ENGINE

TABLE OF CONTENTS

page

ENGINE - ELECTRICAL DIAGNOSTICS - 3.7L/4.7L/5.7L 1
ENGINE - ELECTRICAL DIAGNOSTICS - DIESEL 1045
ENGINE - ELECTRICAL DIAGNOSTICS - SRT-10 1486
ENGINE - 3.7L - SERVICE INFORMATION 2037
ENGINE - 4.7L - SERVICE INFORMATION 2161
ENGINE - 5.7L - SERVICE INFORMATION 2285
ENGINE - 8.3L - SERVICE INFORMATION 2420
ENGINE - 5.9L DIESEL - SERVICE INFORMATION 2527

ENGINE - ELECTRICAL DIAGNOSTICS - 3.7L/4.7L/5.7L

TABLE OF CONTENTS

page

ENGINE - ELECTRICAL DIAGNOSTICS - 3.7L/4.7L/5.7L
DIAGNOSIS AND TESTING
PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE 5
INTERMITTENT CONDITION 7
P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT 8
P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW 14
P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH 18
P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW 23
P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH 27
P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW 32
P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH 36
P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW 41
P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH 45
P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION 50
P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE 60
P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW 66
P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH 69
P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW 73
P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH 78
P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY 83
P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW 88
P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH 91
P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE 95
P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW 101
P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH 105
P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE 110
P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L) 119
P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L) 124
P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L) 129
P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L) 134
P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL 139
P0128-THERMOSTAT RATIONALITY 142
P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW 152
P0131-O2 SENSOR 1/1 CIRCUIT LOW 158

P0132-O2 SENSOR 1/1 CIRCUIT HIGH 163
P0133-O2 SENSOR 1/1 SLOW RESPONSE . 168
P0135-O2 SENSOR 1/1 HEATER PERFORMANCE 171
P0137-O2 SENSOR 1/2 CIRCUIT LOW 175
P0138-O2 SENSOR 1/2 CIRCUIT HIGH 180
P0139-O2 SENSOR 1/2 SLOW RESPONSE . 185
P0141-O2 SENSOR 1/2 HEATER PERFORMANCE 189
P0151-O2 SENSOR 2/1 CIRCUIT LOW 193
P0152-O2 SENSOR 2/1 CIRCUIT HIGH 198
P0153-O2 SENSOR 2/1 SLOW RESPONSE . 203
P0155-O2 SENSOR 2/1 HEATER PERFORMANCE 206
P0157-O2 SENSOR 2/2 CIRCUIT LOW 210
P0158-O2 SENSOR 2/2 CIRCUIT HIGH 215
P0159-O2 SENSOR 2/2 SLOW RESPONSE . 220
P0161-O2 SENSOR 2/2 HEATER PERFORMANCE 224
P0171-FUEL SYSTEM 1/1 LEAN 228
P0172-FUEL SYSTEM 1/1 RICH 235
P0174-FUEL SYSTEM 2/1 LEAN 242
P0175-FUEL SYSTEM 2/1 RICH 249
P0201-FUEL INJECTOR 1 CIRCUIT 256
P0202-FUEL INJECTOR 2 CIRCUIT 260
P0203-FUEL INJECTOR 3 CIRCUIT 264
P0204-FUEL INJECTOR 4 CIRCUIT 268
P0205-FUEL INJECTOR 5 CIRCUIT 272
P0206-FUEL INJECTOR 6 CIRCUIT 276
P0207-FUEL INJECTOR 7 CIRCUIT 280
P0208-FUEL INJECTOR 8 CIRCUIT 284
P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE 288
P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW 297
P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH 303
P0300-MULTIPLE CYLINDER MISFIRE 307
P0301-CYLINDER 1 MISFIRE 314
P0302-CYLINDER 2 MISFIRE 323
P0303-CYLINDER 3 MISFIRE 333
P0304-CYLINDER 4 MISFIRE 343
P0305-CYLINDER 5 MISFIRE 353
P0306-CYLINDER 6 MISFIRE 363
P0307-CYLINDER 7 MISFIRE 373
P0308-CYLINDER 8 MISFIRE 383
P0315-NO CRANK SENSOR LEARNED 393
P0325-KNOCK SENSOR 1 CIRCUIT 396
P0330-KNOCK SENSOR 2 CIRCUIT 401
P0335-CRANKSHAFT POSITION SENSOR CIRCUIT 406
P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT 415
P0340-CAMSHAFT POSITION SENSOR CIRCUIT 422
P0344-CAMSHAFT POSITION SENSOR INTERMITTENT 430
P0401-EGR SYSTEM PERFORMANCE 436
P0403-EGR SOLENOID CIRCUIT 442
P0404-EGR POSITION SENSOR PERFORMANCE 447
P0405-EGR POSITION SENSOR CIRCUIT LOW 453
P0406-EGR POSITION SENSOR CIRCUIT HIGH 458
P0420-CATALYST 1/1 EFFICIENCY 463
P0430-CATALYST 2/1 EFFICIENCY 466
P0440-GENERAL EVAP SYSTEM FAILURE . 469
P0441-EVAP PURGE SYSTEM PERFORMANCE 478
P0442-EVAP PURGE SYSTEM MEDIUM LEAK 482
P0443-EVAP PURGE SOLENOID CIRCUIT . 489
P0452-NVLD PRESSURE SWITCH STUCK CLOSED 494
P0453-NVLD PRESSURE SWITCH STUCK OPEN 499
P0455-EVAP PURGE SYSTEM LARGE LEAK . 504
P0456-EVAP PURGE SYSTEM SMALL LEAK . 504G
P0457-LOOSE FUEL CAP 505
P0461-FUEL LEVEL SENSOR 1 PERFORMANCE 510
P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW 514
P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH 517
P0480-COOLING FAN 1 CONTROL CIRCUIT 522
P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW 526
P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH 529
P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE 533
P0503-VEHICLE SPEED SENSOR 1 ERRATIC 538
P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED 543
P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED 545
P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW 547
P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH 552
P0513-INVALID SKIM KEY 556
P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW 558
P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH 561
P0522-OIL PRESSURE TOO LOW 565
P0532-A/C PRESSURE SENSOR CIRCUIT LOW 570
P0533-A/C PRESSURE SENSOR CIRCUIT HIGH 575
P0551-POWER STEERING PRESSURE SWITCH PERFORMANCE 580

P0562-BATTERY VOLTAGE LOW 584
P0563-BATTERY VOLTAGE HIGH 589
P0571-BRAKE SWITCH 1 PERFORMANCE . 592
P0572-BRAKE SWITCH 1 STUCK ON 597
P0573-BRAKE SWITCH 1 STUCK OFF 601
P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) 605
P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (3.7L,4.7L) 613
P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) 617
P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) 623
P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) 629
P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT 635
P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) 641
P0586-SPEED CONTROL VENT CONTROL CIRCUIT 653
P0591-SPEED CONTROL SWITCH 2 PERFORMANCE 659
P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW 667
P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH 672
P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT 677
P0600-SERIAL COMMUNICATION LINK 683
P0601-INTERNAL MEMORY CHECKSUM INVALID 684
P0606-INTERNAL ECM PROCESSOR 685
P060B-ETC A/D GROUND PERFORMANCE . 686
P060D-ETC LEVEL 2 APP PERFORMANCE . 687
P060E-ETC LEVEL 2 TPS PERFORMANCE . 688
P060F-ETC LEVEL 2 ECT PERFORMANCE . 689
P061A-ETC LEVEL 2 TORQUE PERFORMANCE 690
P061C-ETC LEVEL 2 RPM PERFORMANCE . 691
P0622-GENERATOR FIELD CONTROL CIRCUIT 692
P0627-FUEL PUMP RELAY CIRCUIT 696
P062C-ETC LEVEL 2 MPH PERFORMANCE 700
P0630-VIN NOT PROGRAMMED IN PCM . . . 701
P0632-ODOMETER NOT PROGRAMMED IN PCM 702
P0633-SKIM KEY NOT PROGRAMMED IN PCM 703
P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW 704
P0643-PRIMARY 5-VOLT SUPPLY CIRCUIT HIGH 708
P0645-A/C CLUTCH RELAY CIRCUIT 711
P0652-SENSOR REFERENCE VOLTAGE 2 CIRCUIT LOW 715
P0653-SENSOR REFERENCE VOLTAGE 2 CIRCUIT HIGH 718
P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT 721
P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW 725
P0700-TRANSMISSION CONTROL SYSTEM (MIL REQUEST) 730
P0703-BRAKE SWITCH 2 PERFORMANCE . 731
P0850-PARK/NEUTRAL SWITCH PERFORMANCE 737
P1115-GENERAL TEMPERATURE RATIONALITY 741
P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS 745
P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS 750
P1572-BRAKE PEDAL STUCK ON 755
P1573-BRAKE PEDAL STUCK OFF 759
P1593-SPEED CONTROL SWITCH 1/2 STUCK 763
P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L) 773
P1602–PCM NOT PROGRAMMED 778
P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE 779
P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE 781
P1607-PCM INTERNAL SHUTDOWN TIMER RATIONALITY 783
P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC 784
P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC 789
P1696-EEPROM MEMORY WRITE DENIED/ INVALID 794
P1697-EMR (SRI) MILEAGE NOT STORED . 796
P2072-ELECTRONIC THROTTLE CONTROL SYSTEM - ICE BLOCKAGE 798
P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED 799
P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN 809
P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH 816
P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN 823
P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH 830
P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT 837
P2101-ELECTRONIC THROTTLE CONTROL MOTOR PERFORMANCE 843
P2107-ELECTRONIC THROTTLE CONTROL MODULE PROCESSOR 845
P2108-ELECTRONIC THROTTLE CONTROL MODULE PERFORMANCE 846
P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM 847
P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE 852

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN 857
P2115-ACCELERATOR PEDAL POSITION SENSOR 1 MINIMUM STOP PERFORMANCE 862
P2116-ACCELERATOR PEDAL POSITION SENSOR 2 MINIMUM STOP PERFORMANCE 863
P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT 864
P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW 870
P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH 876
P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW 881
P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH 888
P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION 893
P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION 901
P2161-VEHICLE SPEED SENSOR 2 ERRATIC 907
P2166-ACCELERATOR PEDAL POSITION SENSOR 1 MAXIMUM STOP PERFORMANCE 911
P2167-ACCELERATOR PEDAL POSITION SENSOR 2 MAXIMUM STOP PERFORMANCE 912
P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) 913
P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) 924
P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) 935
P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) 946
P2181-COOLING SYSTEM PERFORMANCE . 957
P2299-BRAKE PEDAL POSITION / ACCELERATOR PEDAL POSITION INCOMPATIBLE 964
P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 967
P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 971
P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 975
P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 979
P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 983
P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 987
P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 991
P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION 995
P2503-CHARGING SYSTEM OUTPUT LOW . 999
U0101-LOST COMMUNICATION WITH TCM 1004
U0155-NO CLUSTER BUS MESSAGE 1006
U0168-NO SKIM BUS MESSAGE 1008
*5.7L INTERMITTENT NO CRANK CONDITION 1010
*CHECKING THE FUEL DELIVERY SYSTEM 1011
*HARD START FUEL SYSTEM 1014
*ENGINE CRANKS BUT DOES NOT START 1017
*FUEL PRESSURE LEAK DOWN 1021
*NO CRANK CONDITION 1023
*NO RESPONSE WITH A NO START CONDITION 1028
*START AND STALL CONDITION 1035
STANDARD PROCEDURE
POWERTRAIN VERIFICATION TEST 1038
SCHEMATICS AND DIAGRAMS 1042

ENGINE - ELECTRICAL DIAGNOSTICS - 3.7L/4.7L/5.7L

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

Are you currently experiencing a NO RESPONSE condition?

Yes >> The NO RESPONSE condition must be properly diagnosed before continuing.
Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No >> Go To 2

---

2. NO START

Is the customer complaint a NO START condition?

Yes >> Check the vehicle for any NO START related PCM DTC(s) or Vehicle Theft Security related DTC(s).
If no Theft related DTC(s) are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No >> Go To 3

---

3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTC(s) and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customers complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inpect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSB(s) related to the customer's complaint or DTC(s).

If a TSB applies, follow the instructions per the TSB.

Choose the following scenario that best applies.

The TSB repaired the customers complaint.
Testing complete.

A DTC is present, no TSB applies, or the TSB didn't repair the customers complaint.
Go To 4

No DTC(s) are present.
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE (CONTINUED)

4. WIRE HARNESS INSPECTION

Clear the DTC(s).

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTC(s) that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTC(s) are fuel or air related, check the fuel level and quality.

Were any repairs made that fixed the customer's complaint?

Yes >> Testing complete.

No >> Refer to the diagnostic test procedure related to the DTC.

INTERMITTENT CONDITION

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

POSSIBLE CAUSES
INTERMITTENT CONDITION

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected faulty component and the PCM.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTC's check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

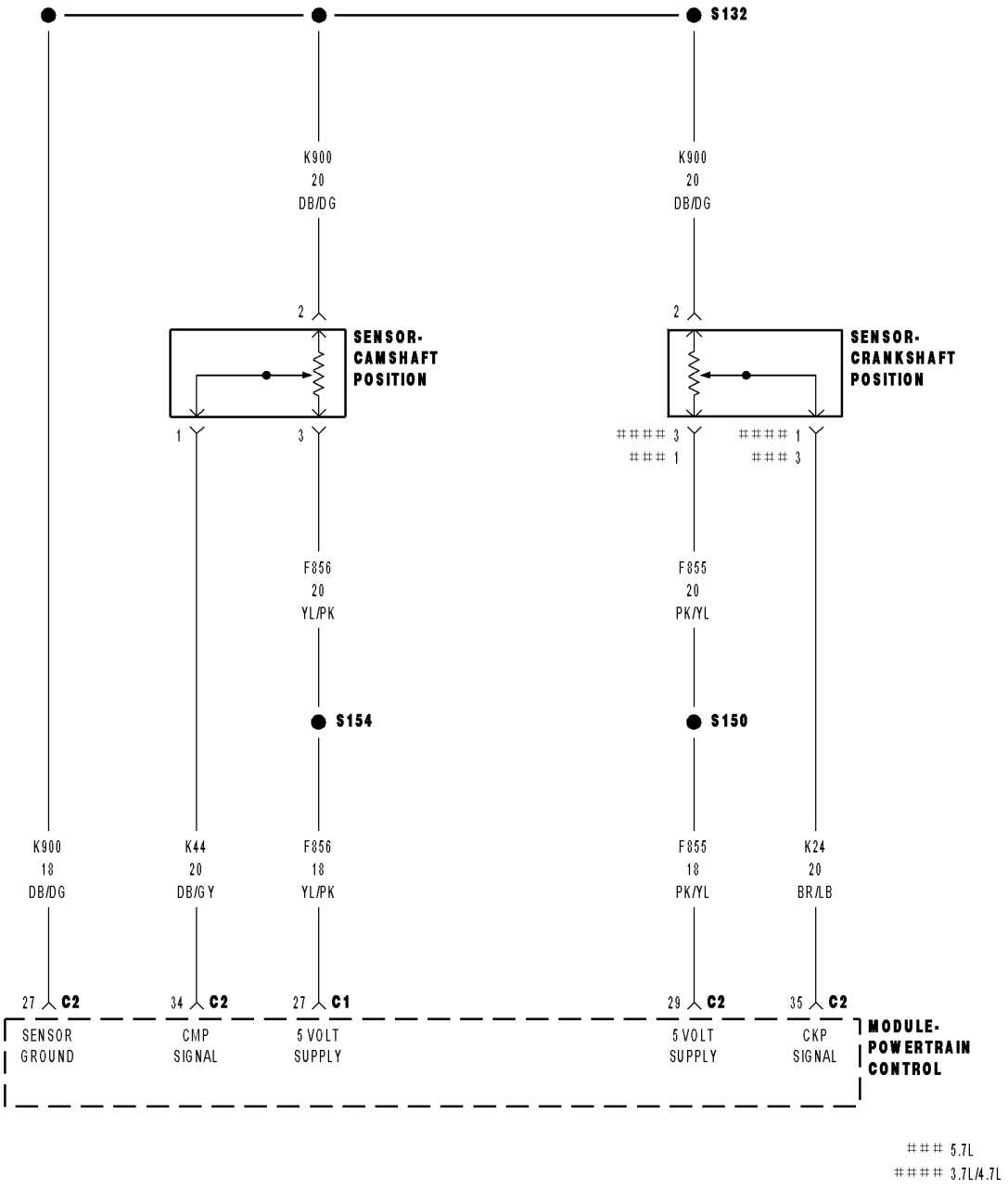
A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

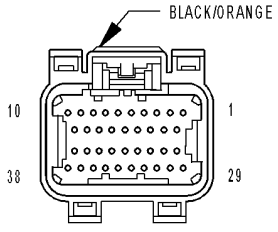
Were any problems found during the above inspections?

Yes >> Perform the necessary repairs.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

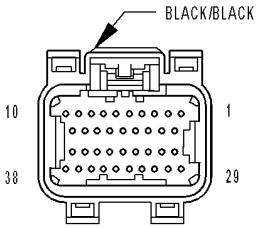
No >> Test Complete.

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT

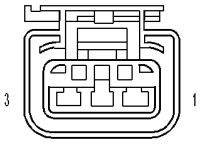




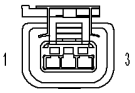
MODULE-
POWERTRAIN
CONTROL C2
(NGC)



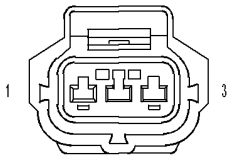
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



SENSOR-
CRANKSHAFT
POSITION
(5.7L/SRT)



CRANKSHAFT
POSITION
SENSOR
(4.7L)



SENSOR-
CRANKSHAFT
POSITION
(3.7L)

81456016

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking and Engine running
- **Set Condition:**
  Powertrain Control Module detects an error when the camshaft position is out of phase with the crankshaft position. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
ERRATIC CAM POSITION SENSOR SIGNAL
CAMSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
ERRATIC CRANKSHAFT POSITION SENSOR SIGNAL
CRANKSHAFT POSITION SENSOR TONE WHEEL/PULSE RING
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

With the scan tool clear the DTC(s).

Start the engine and run until operating temp is reached. (Closed Loop)

If the DTC does not reset it may be necessary to test drive the vehicle.

Does the P0016 return?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING THE CMP SIGNAL WITH A LAB SCOPE

With a lab scope, backprobe the (K44) CMP Signal circuit at the CMP Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 6

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

3. CMP WIRE HARNESS INSPECTION

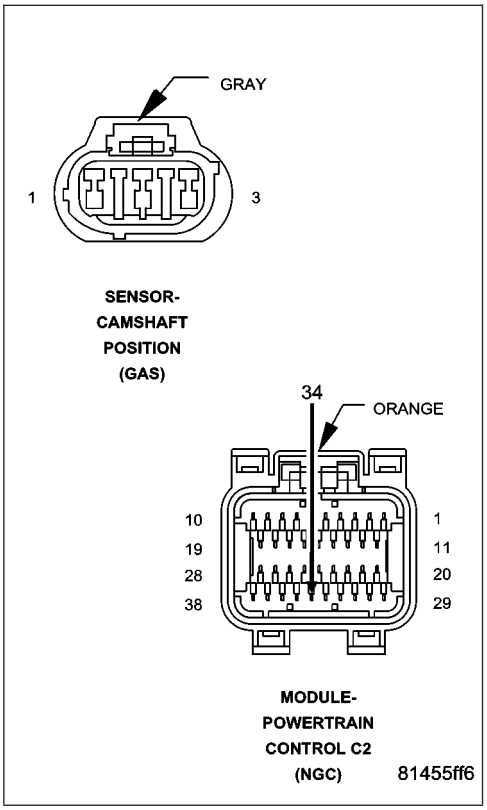
Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. TONE WHEEL/PULSE RING INSPECTION

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

6. ERRATIC CMP SIGNAL

Turn the ignition off.

Remove the lab scope probe.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

With scan tool, erase DTCs.

Start the engine.

Gently tap on and wiggle the Cam Position Sensor.

Ignition on, engine not running.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

Inspect the related wire harness and the splices in the CMP circuit.

Does the P0016 return?

Yes >> Repair the wiring/connector concerns as needed or replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. CHECKING THE CKP SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope, backprobe the (K24) CKP Signal circuit at the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 8

No >> Go To 10

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

8. CKP WIRE HARNESS INSPECTION

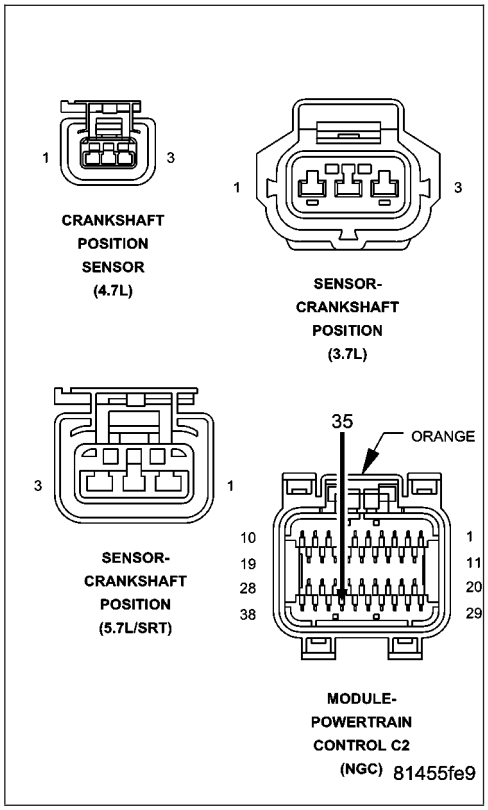
Turn the ignition off.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to their proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0016–CRANKSHAFT / CAMSHAFT TIMING MISALIGNMENT (CONTINUED)

10. **ERRATIC CKP SIGNAL**

NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Gently tap on and wiggle the Crank Position Sensor.

Turn the ignition off.

Inspect the Sensor connector and harness connector, and inspect the PCM connector and harness connector for loose, bent, corroded, or pushed out pins/terminals.

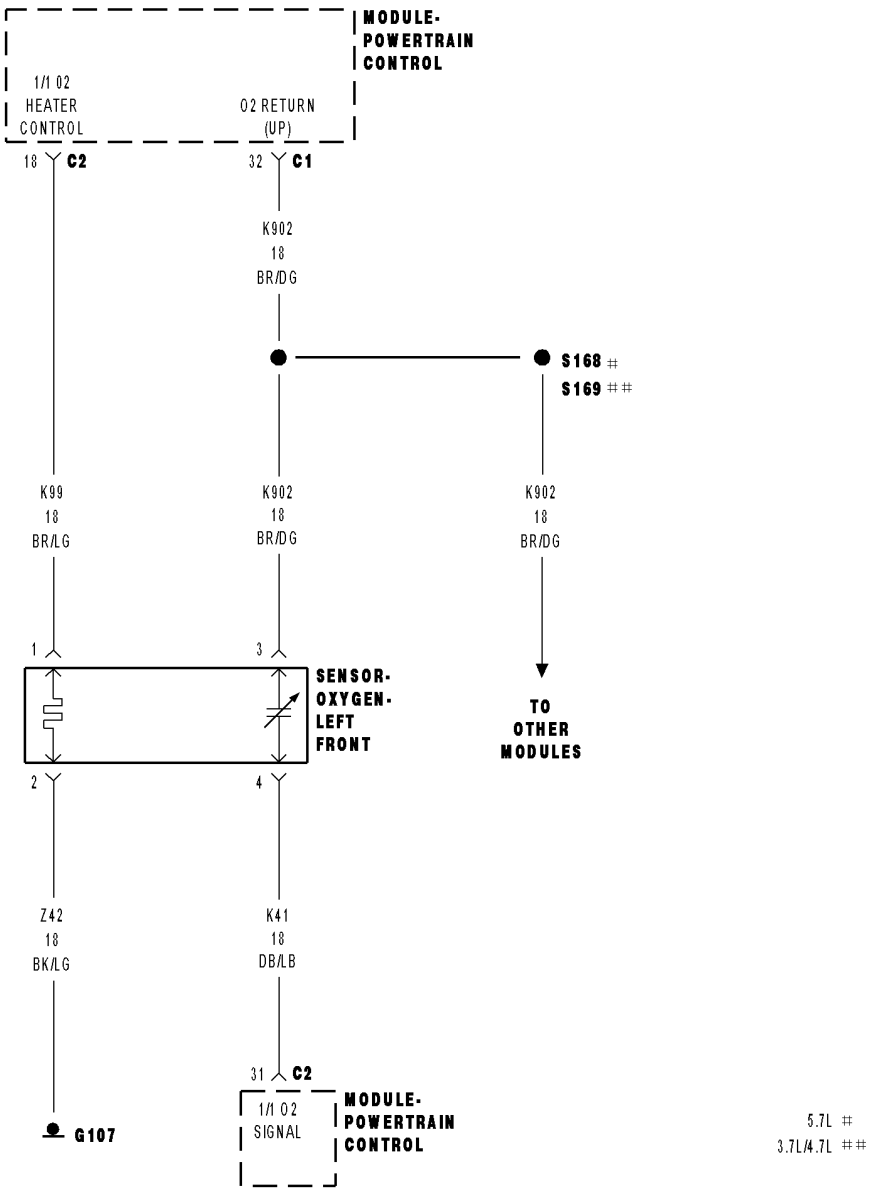
Inspect the related wire harness and the splices in the CKP circuits.

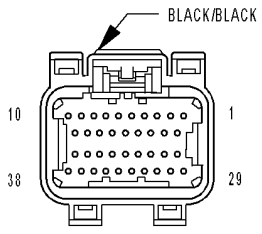
Were any problems found?

Yes >> Repair the wiring/connector concerns as needed or replace the Crankshaft Position Sensor. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

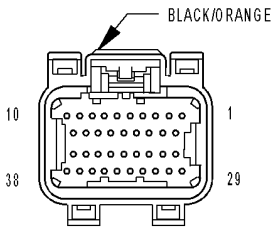
No >> Test Complete.

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW

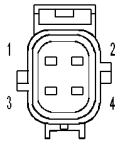




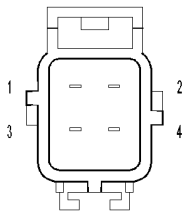
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
LEFT
FRONT
(3.7L/5.7L)



SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)

81452b01

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is powered.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

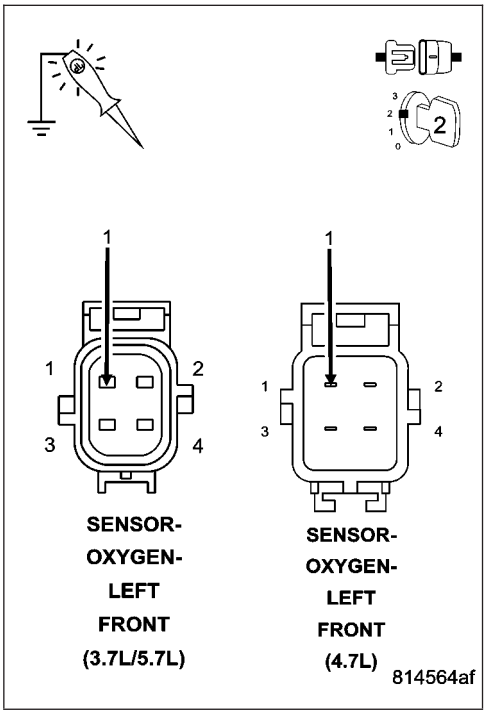
With a scan tool, actuate the O2 1/1 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

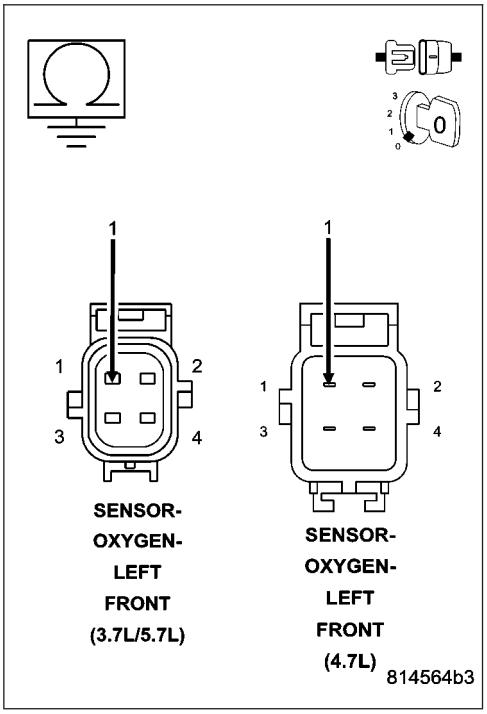
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

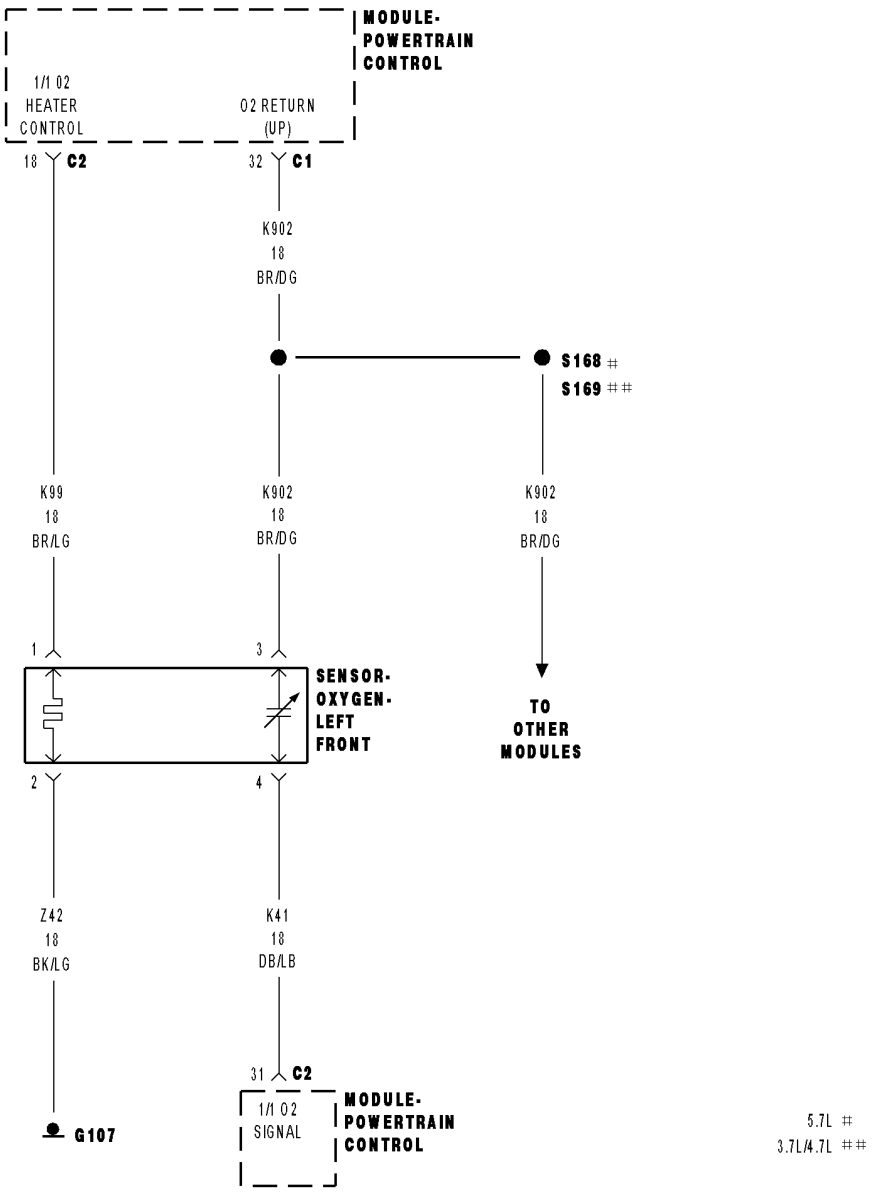
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

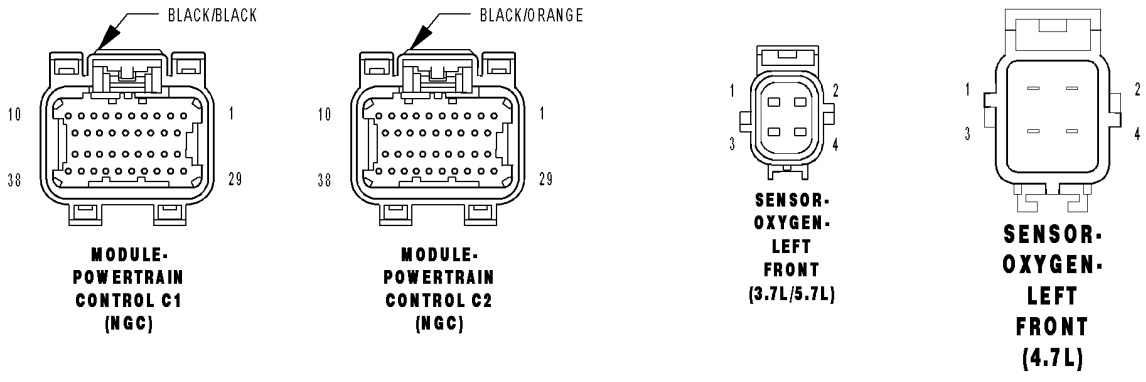
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH





P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN
(K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

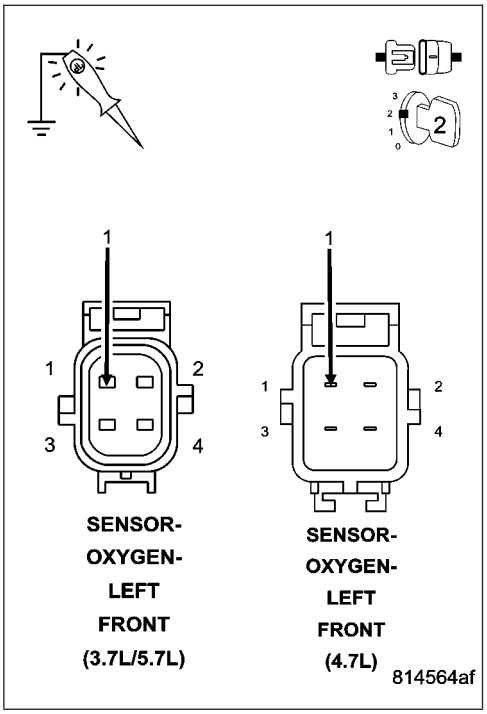
With a scan tool, actuate the O2 1/1 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z42) O2 HEATER GROUND CIRCUIT OPEN

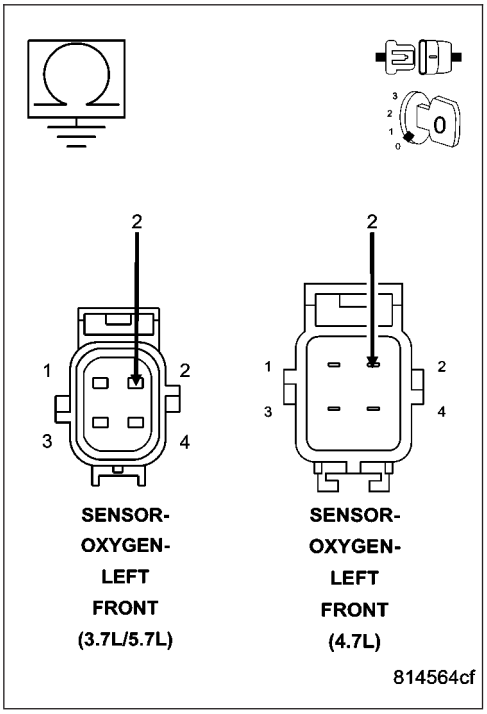
Turn the ignition off.

Measure the resistance between an engine ground and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z42) O2 1/1 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

5. (K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

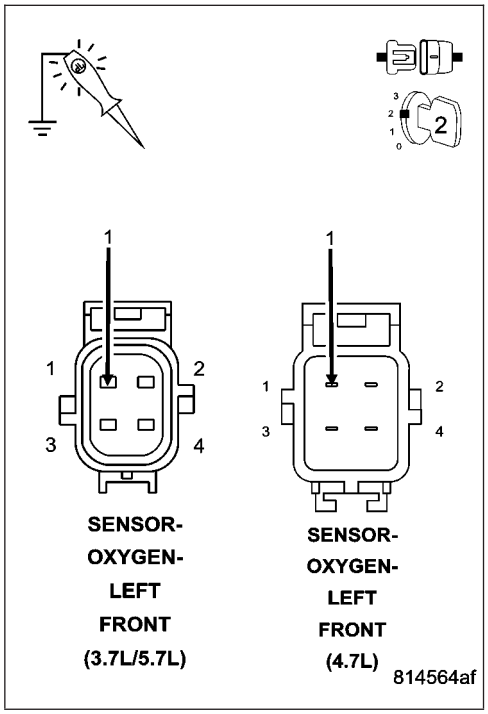
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K99) O2 1/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

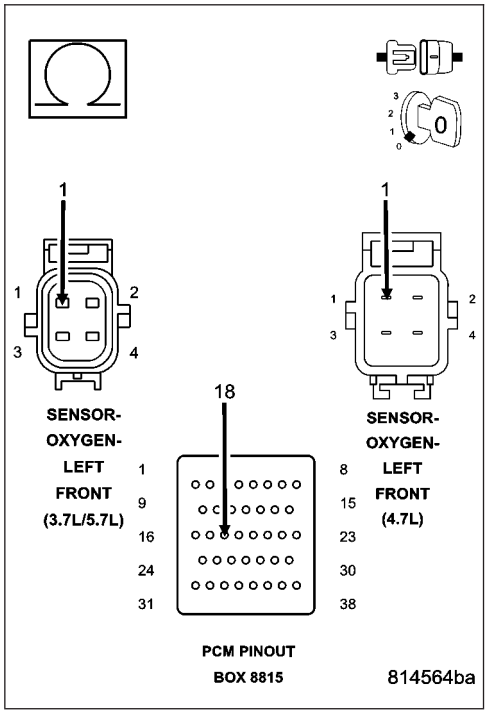
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

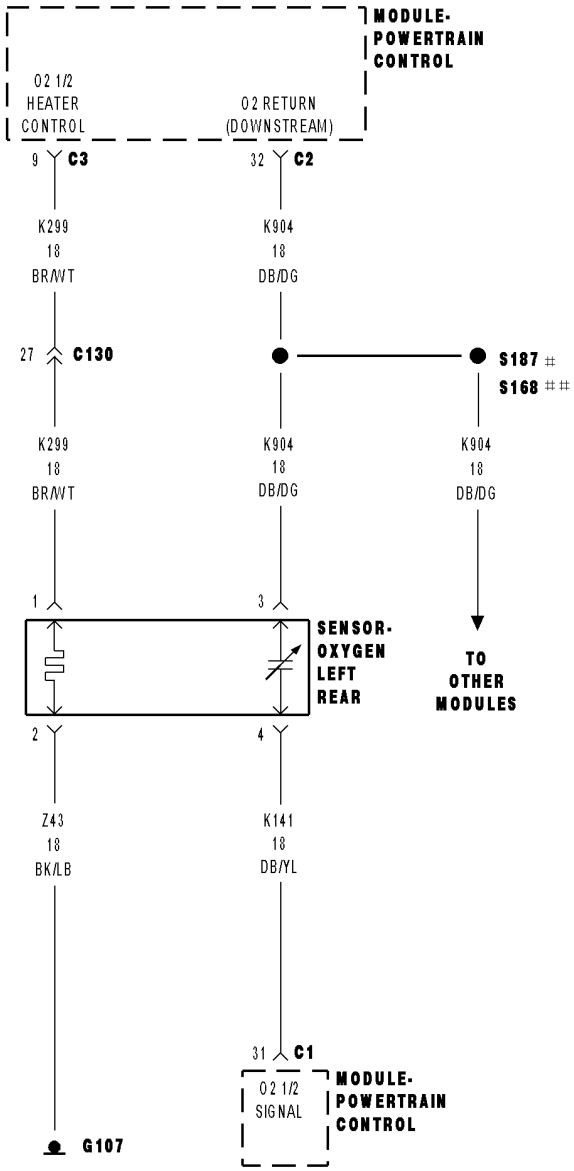
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

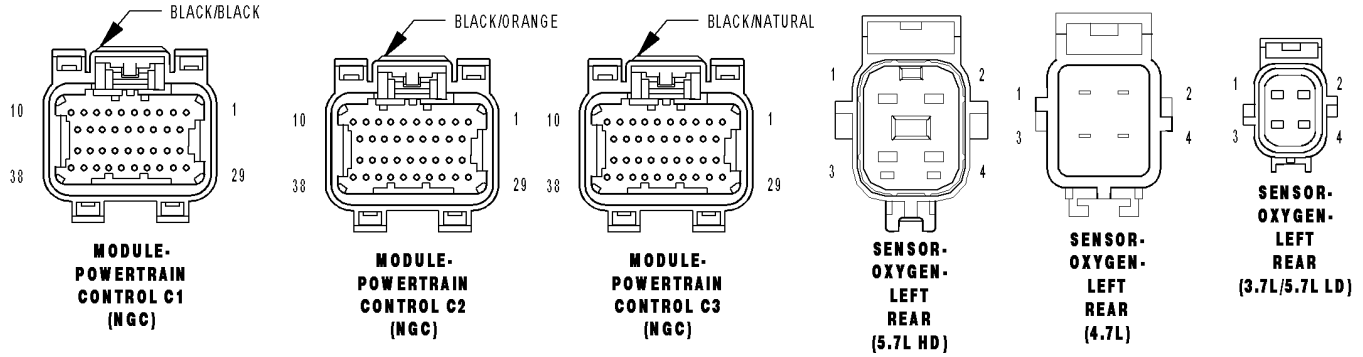
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW





81452b26

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 1/2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

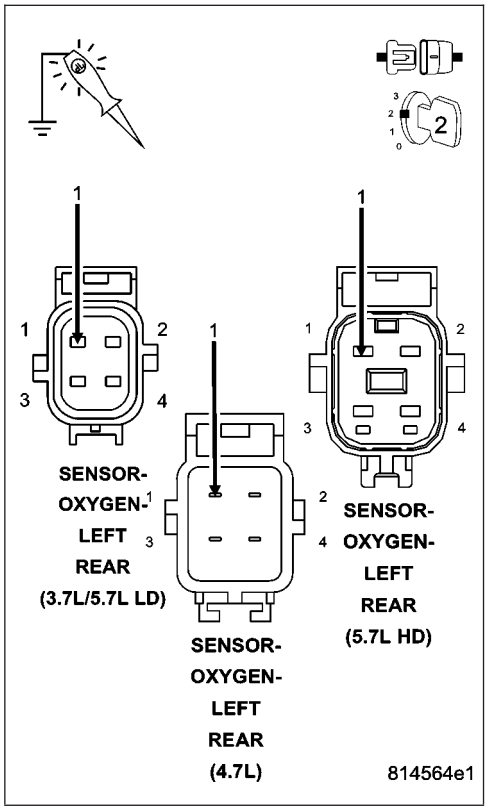
With a scan tool, actuate the O2 Heater Test with the 1/2 O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

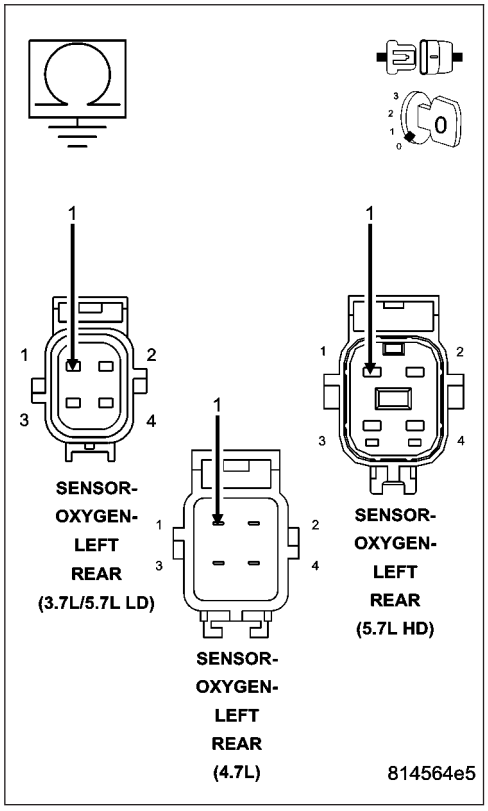
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K299) O2 1/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0037-O2 SENSOR 1/2 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

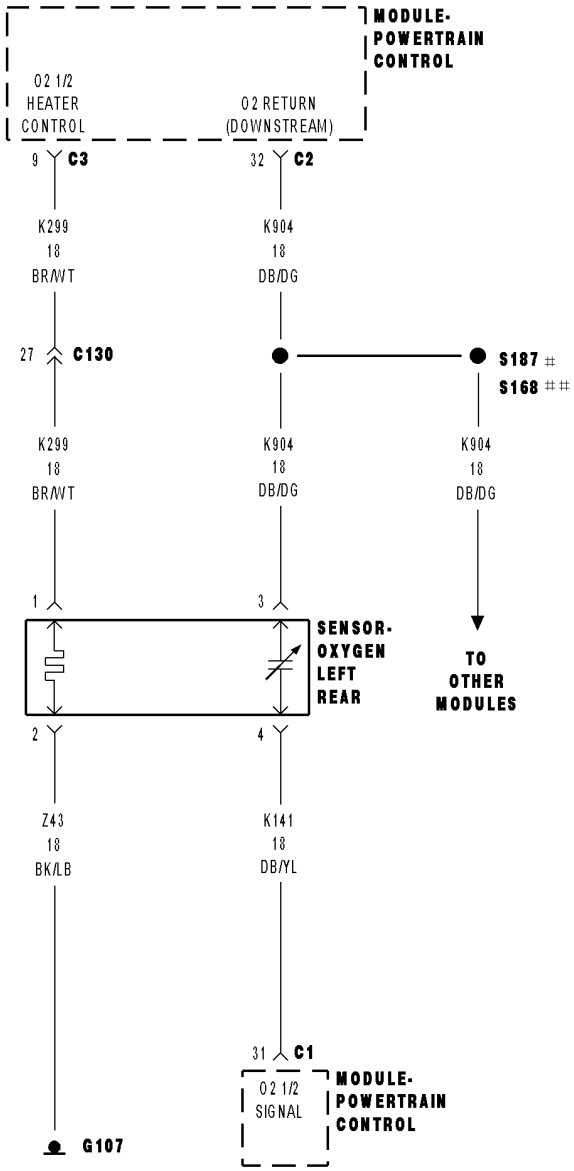
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

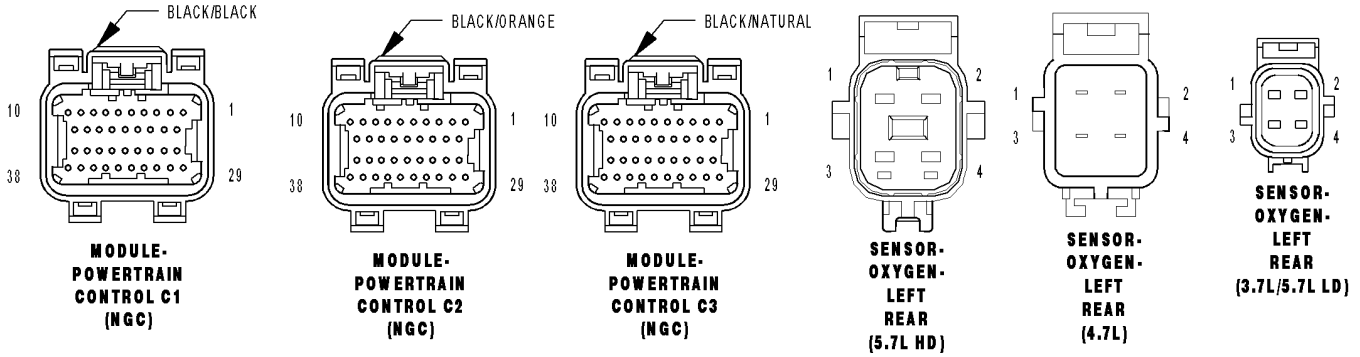
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH





81452b26

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z43) O2 1/2 HEATER GROUND CIRCUIT OPEN
(K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 1/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

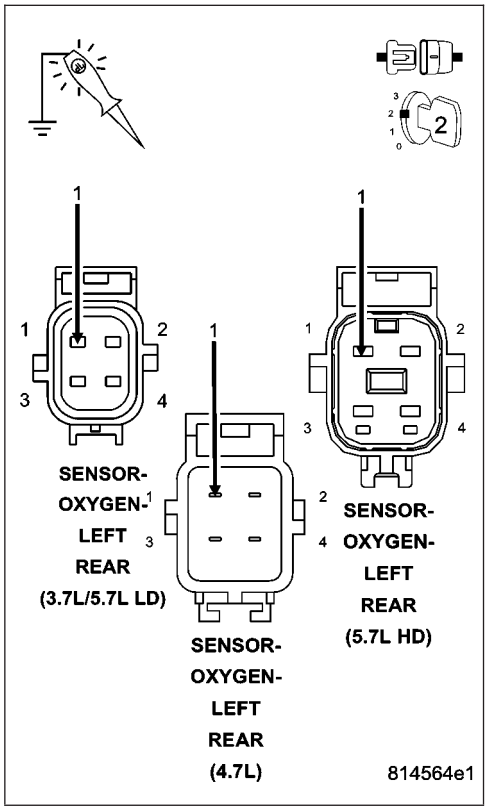
With a scan tool, actuate the O2 1/2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z43) O2 HEATER GROUND CIRCUIT OPEN

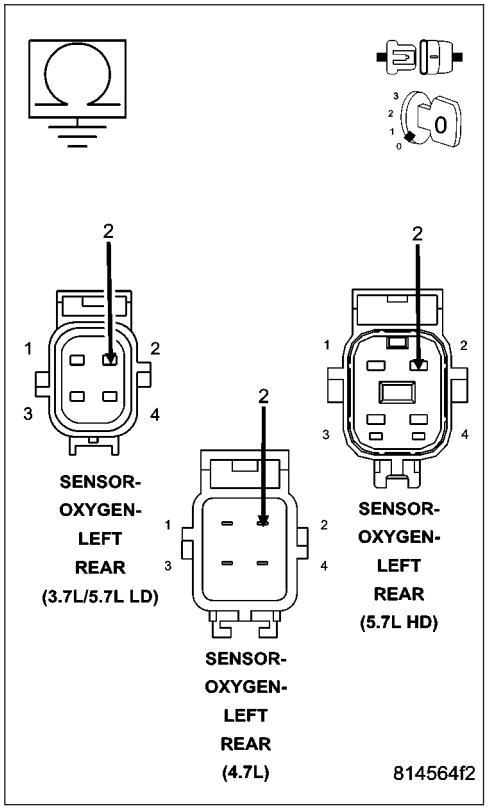
Turn the ignition off.

Measure the resistance between an engine ground and the (Z43) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z43) O2 1/2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

5. (K299) O2 1/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

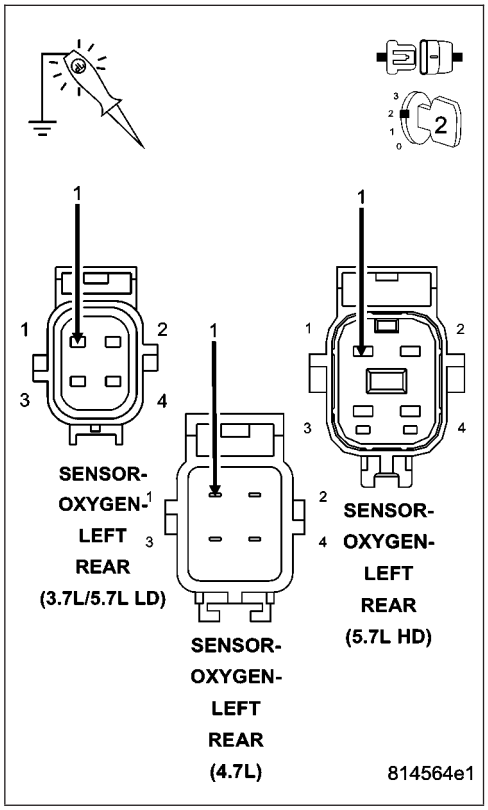
Using a 12-volt test light connect to ground, probe the (K299) O2 1/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K299) O2 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

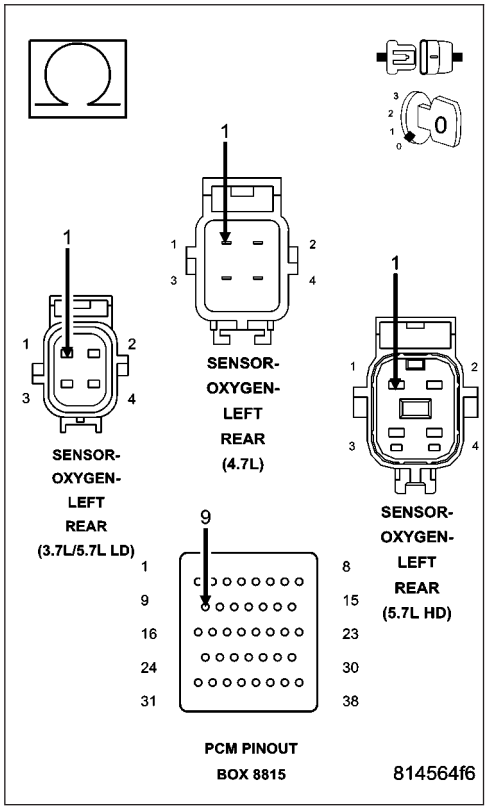
Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K299) O2 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0038-O2 SENSOR 1/2 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

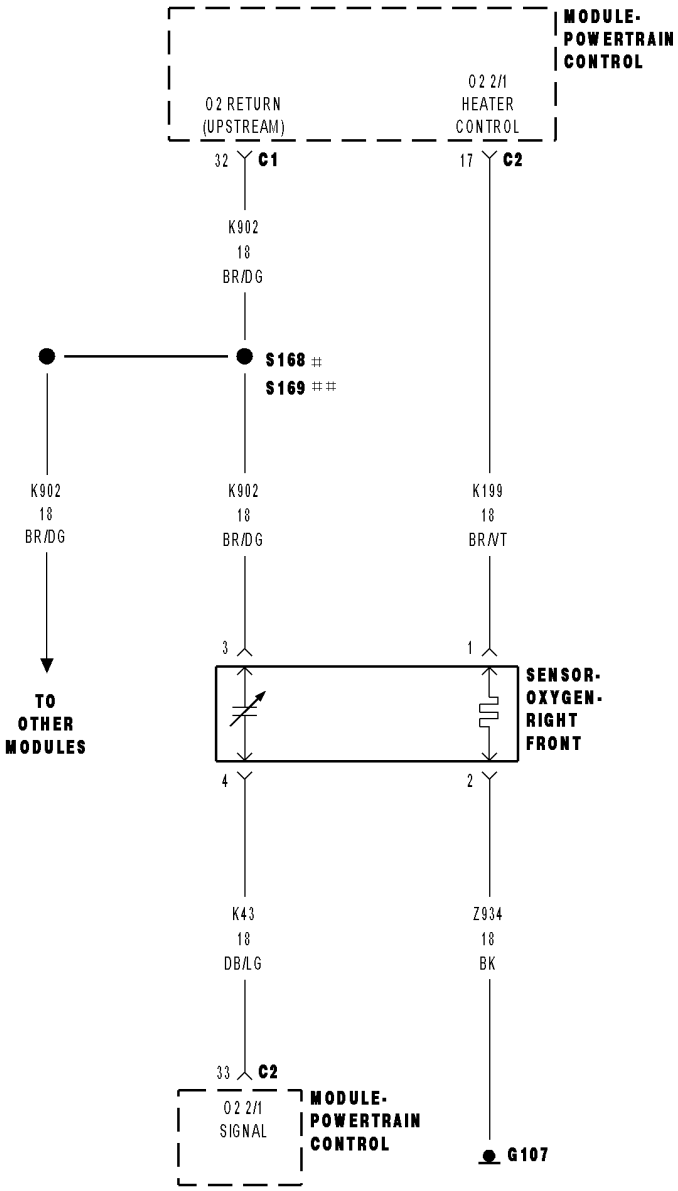
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

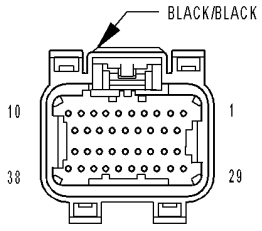
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

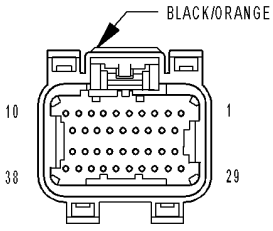
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW

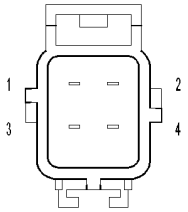




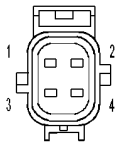
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the Heater Control terminal and the Heater ground terminal at the component.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

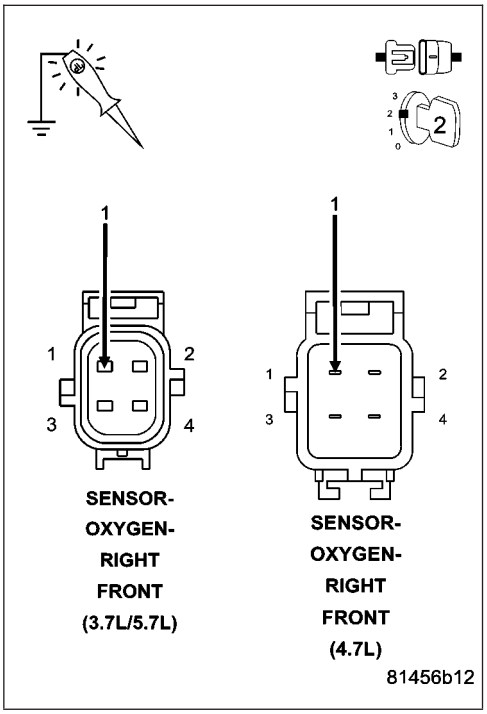
With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

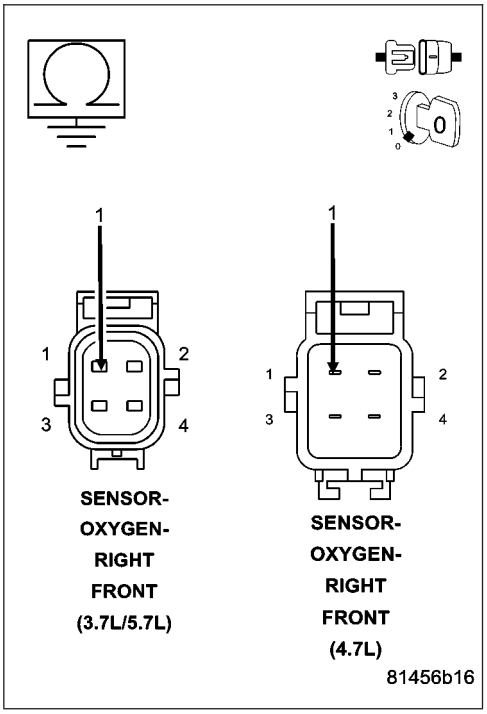
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K199) O2 2/1 Sensor Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

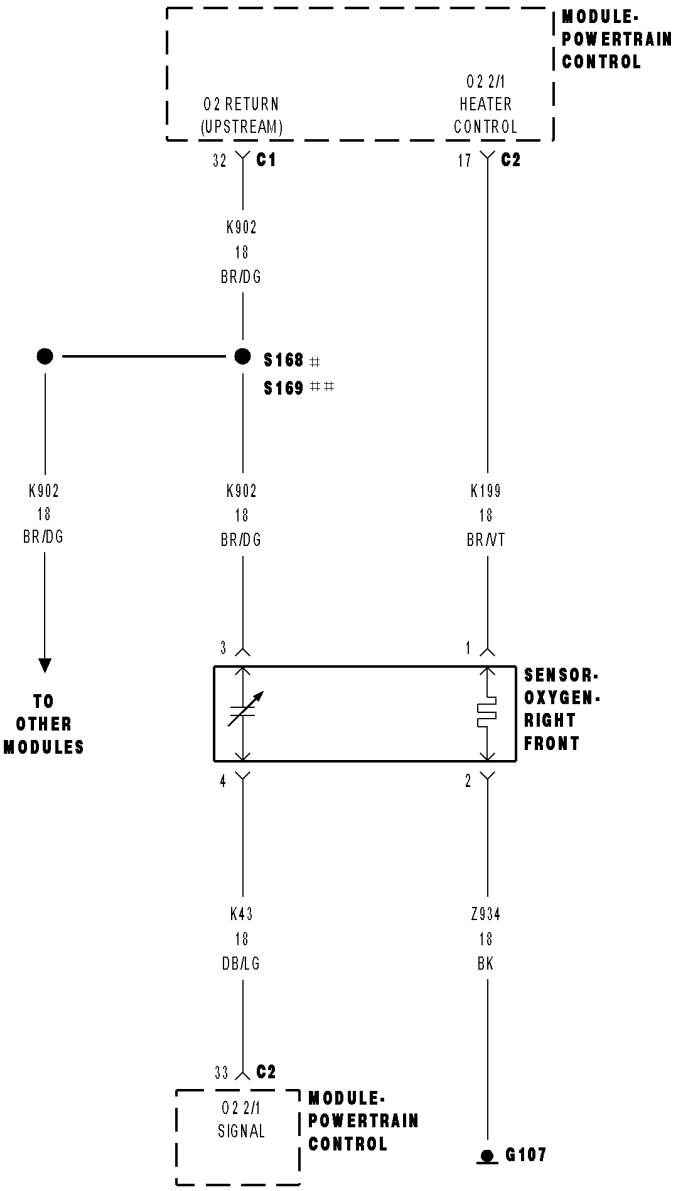
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

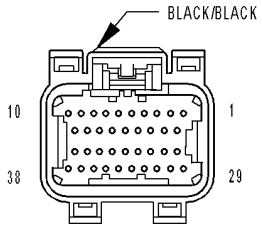
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

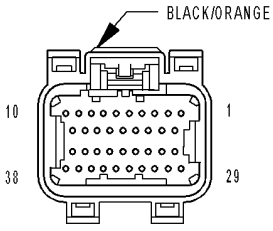
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH

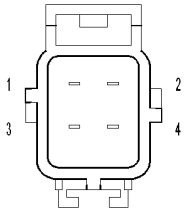




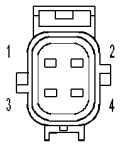
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z934) O2 2/1 HEATER GROUND CIRCUIT OPEN
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the Heater ground terminal at the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

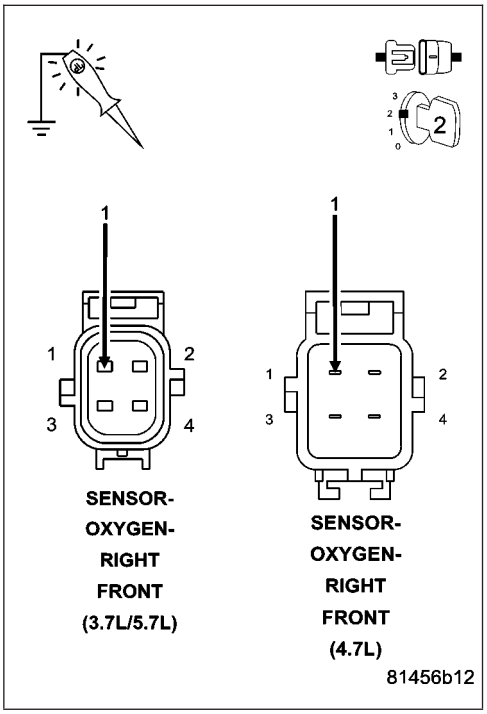
With the scan tool, actuate the O2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z934) O2 2/1 HEATER GROUND CIRCUIT OPEN

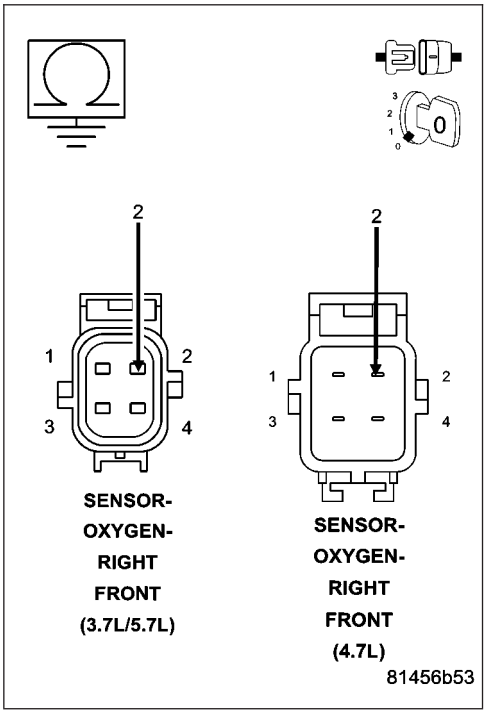
Turn the ignition off.

Measure the resistance between an engine ground and the (Z934) O2 2/1 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z934) O2 2/1 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

5. (K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

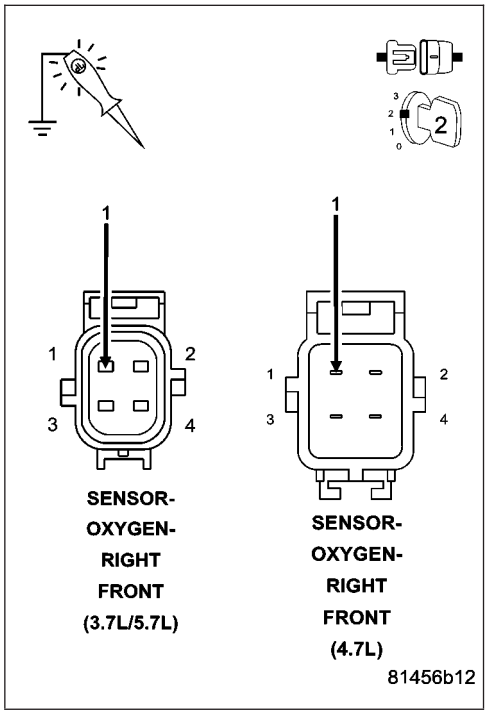
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K199) O2 2/1 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate?

Yes >> Repair the short to battery voltage in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

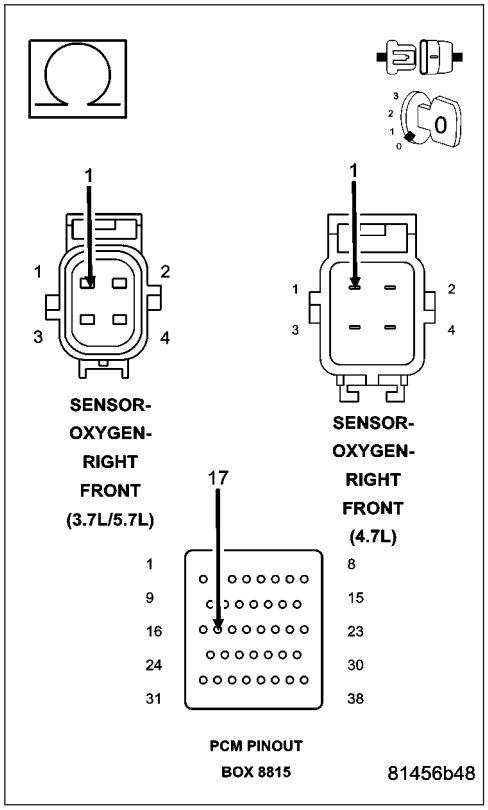
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

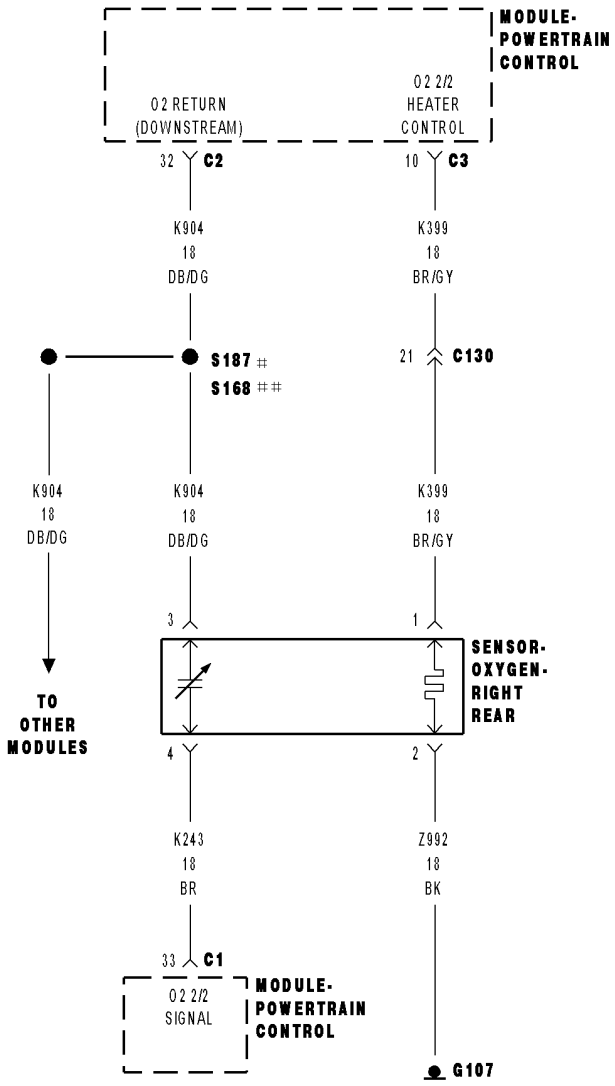
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

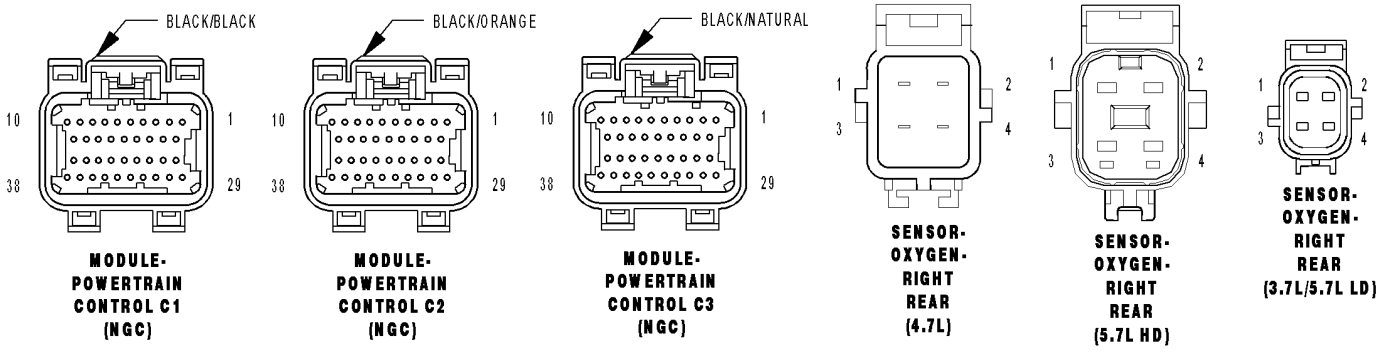
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW





81452bb4

P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

Does the O2 Sensor voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Ignition on, engine not running.

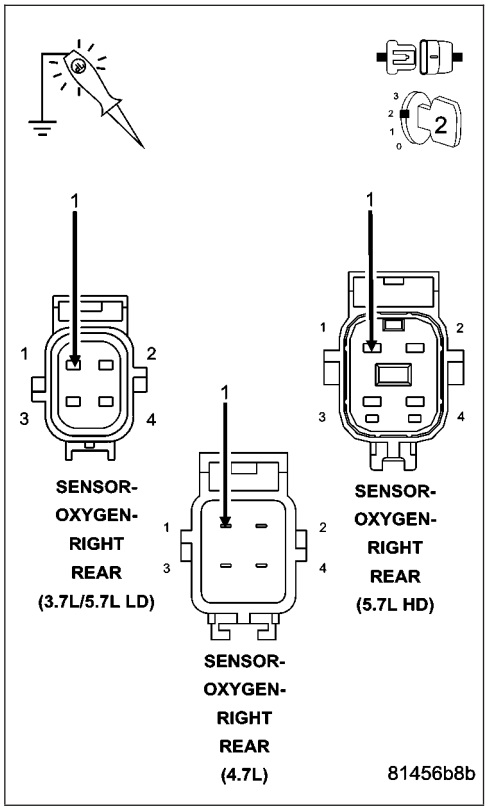
With a scan tool, actuate the O2 Heater Test with the O2 Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

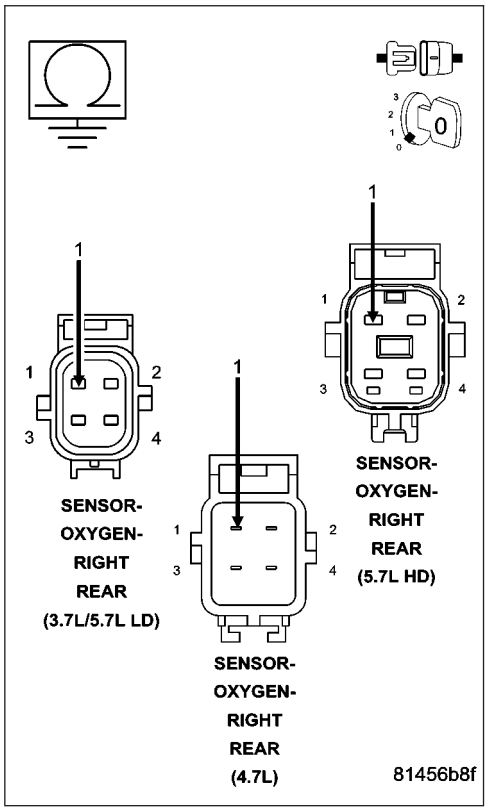
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K399) O2 2/2 Sensor Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0057-O2 SENSOR 2/2 HEATER CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

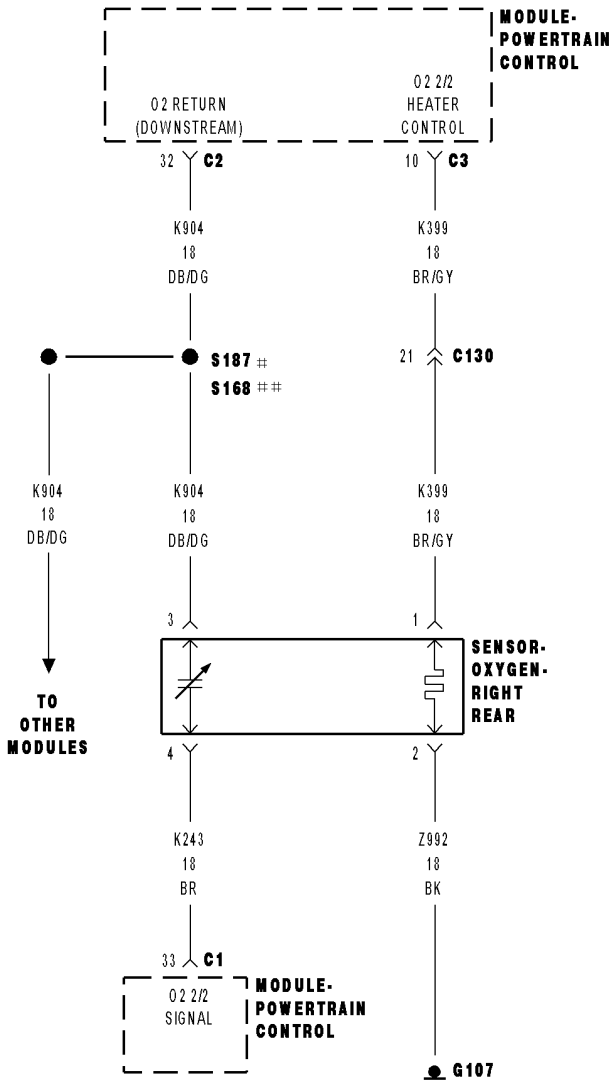
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

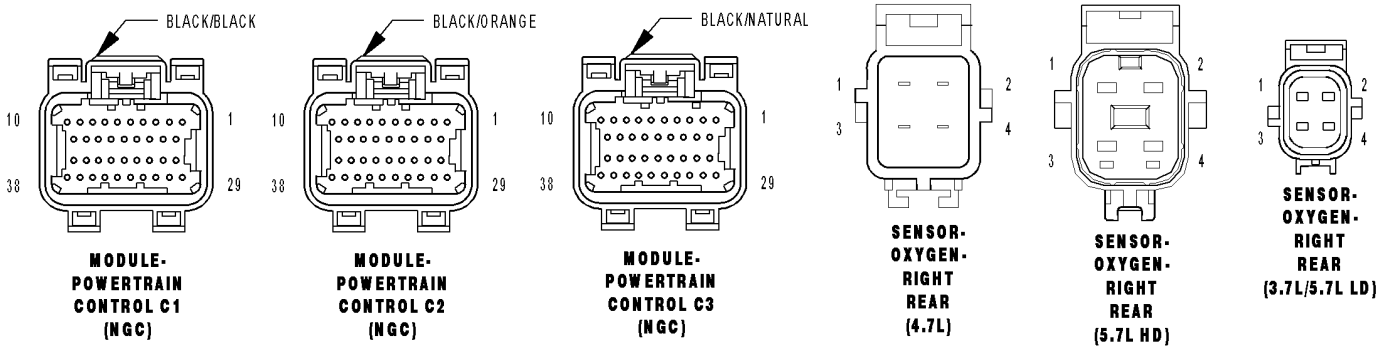
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH





81452bb4

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is off.
- **Set Condition:**
  Desired state does not equal Actual state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z992) O2 2/2 HEATER GROUND CIRCUIT OPEN
(K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC's.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool down to room temperature.

Disconnect the 2/2 O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the component connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the O2 Sensor Heater Element resistance between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT

Ignition on, engine not running.

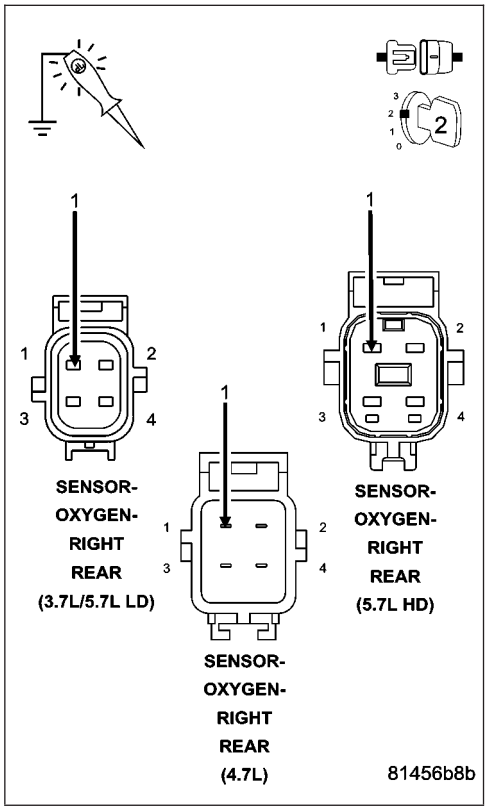
With a scan tool, actuate the O2 2/2 Heater Test with the Sensor harness connector still disconnected.

Using a 12-volt test light connected to ground, probe the (K399) O2 2/2 Heater Control circuit in the O2 Sensor harness connector.

Does the test light illuminate brightly and flash on and off during the actuation?

Yes >> Go To 4

No >> Go To 5



4. (Z992) O2 HEATER GROUND CIRCUIT OPEN

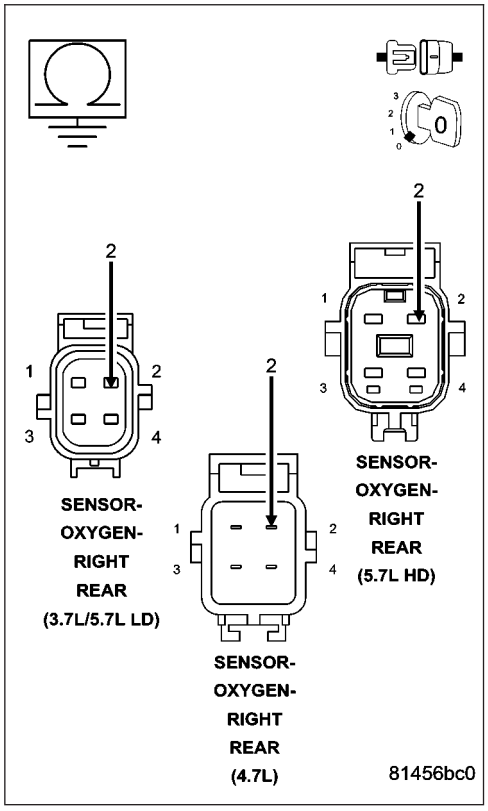
Turn the ignition off.

Measure the resistance between an engine ground and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (Z992) O2 2/2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

5. (K399) O2 2/2 HEATER CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

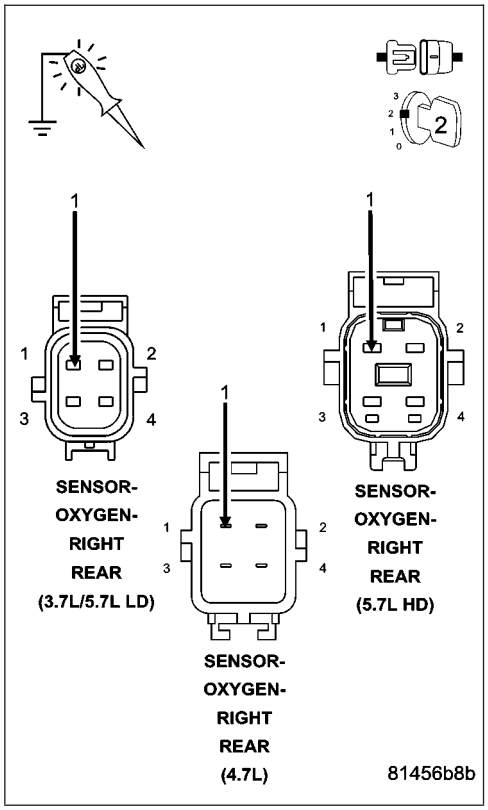
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K399) O2 Heater 2/2 Control circuit in the O2 Sensor harness connector.

Does the test light illuminate?

Yes >> Repair the short to battery voltage in the (K399) O2 2/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

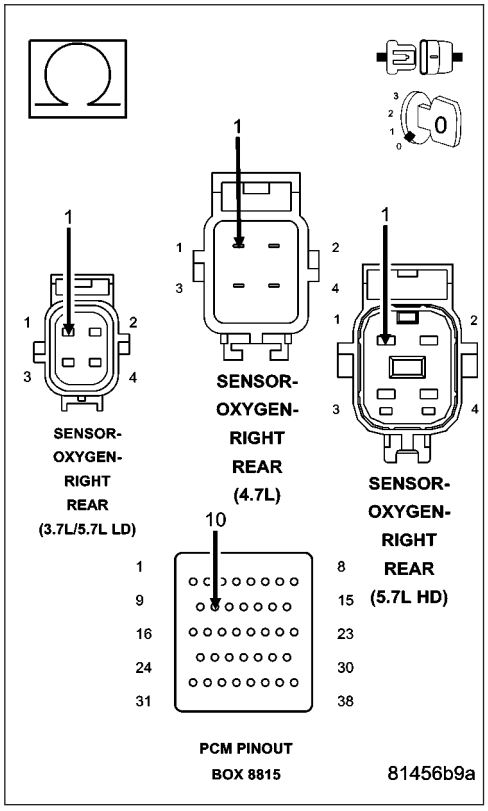
CAUTION: Do not probe the PCM harness connectors. Probing the PCM hanrness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K399) O2 2/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0058-O2 SENSOR 2/2 HEATER CIRCUIT HIGH (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

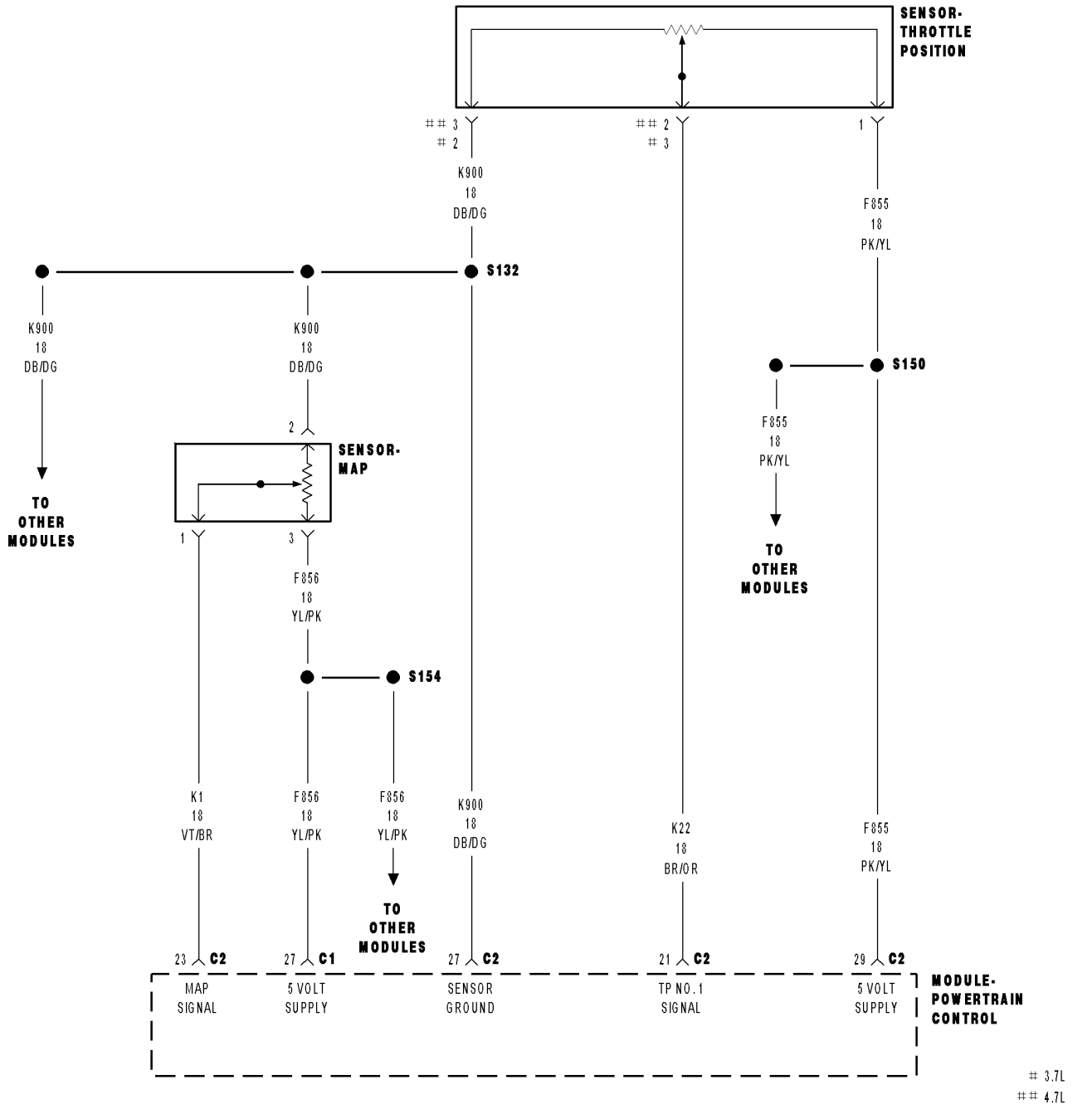
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

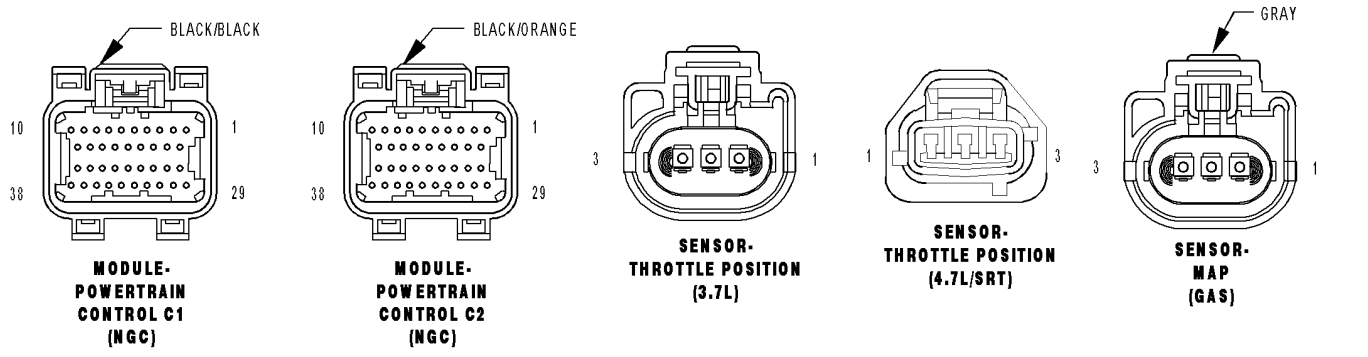
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION





81452c0a

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This DTC sets when an unexpected high intake manifold air flow condition exists that can lead to increased engine speed and puts the NGC into a High Air flow Protection limiting mode. The High Air flow Protection feature includes RPM limits for when a Throttle and/or MAP sensor limp-in fault is present.

- **When Monitored:**
  During all drive modes.
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.

NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

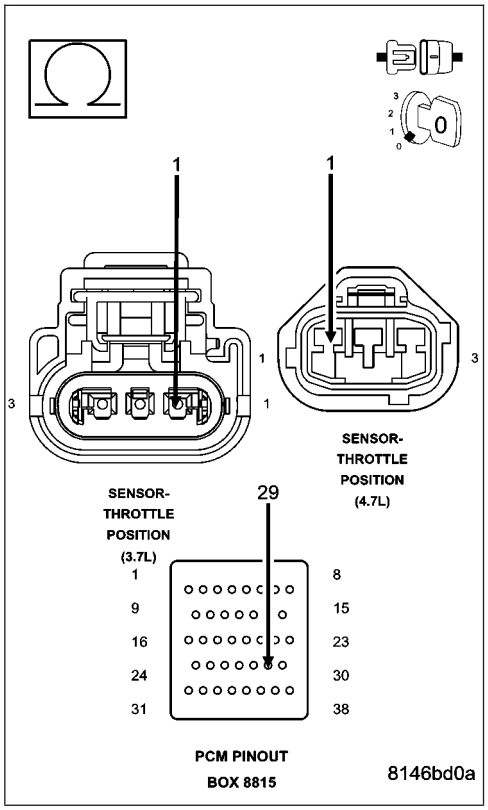
Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

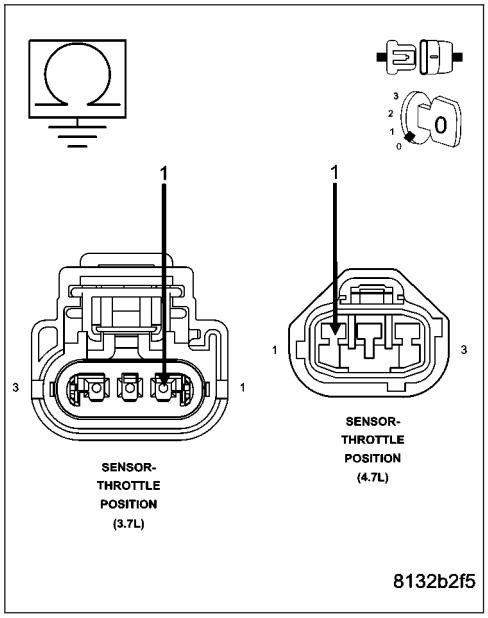
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

7. THROTTLE POSITION SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

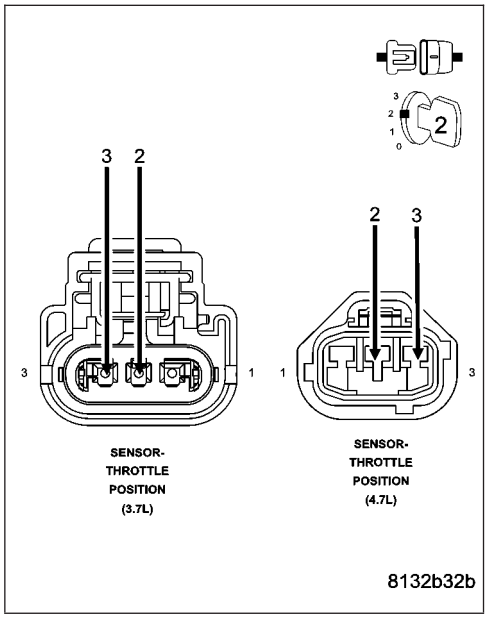
Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

NOTE: Remove the jumper wire before continuing.



8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

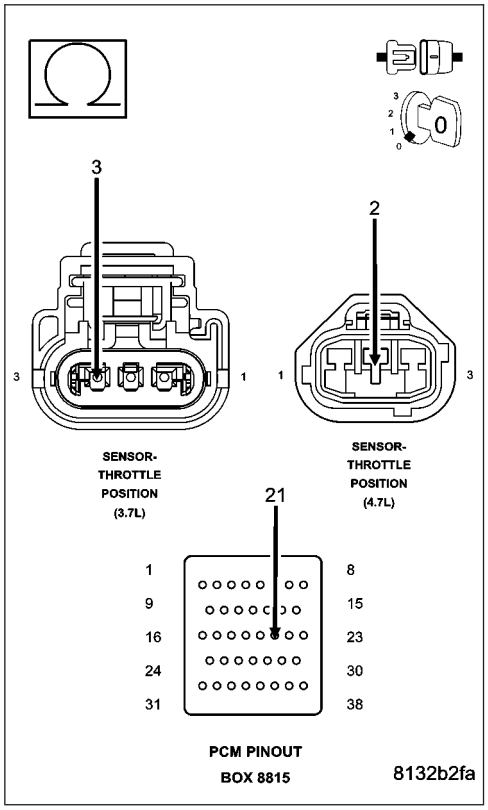
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

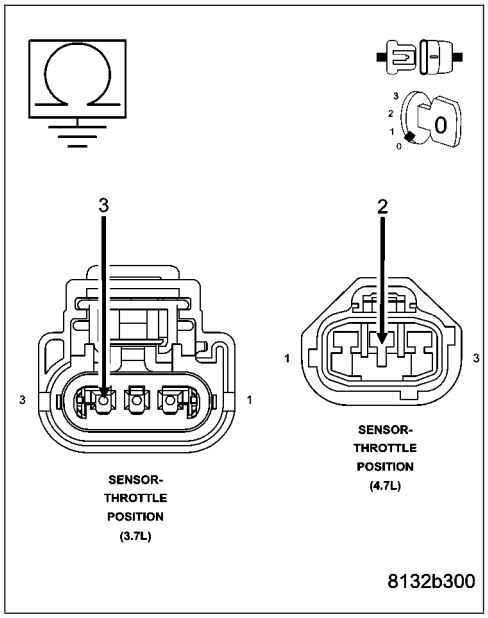
9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



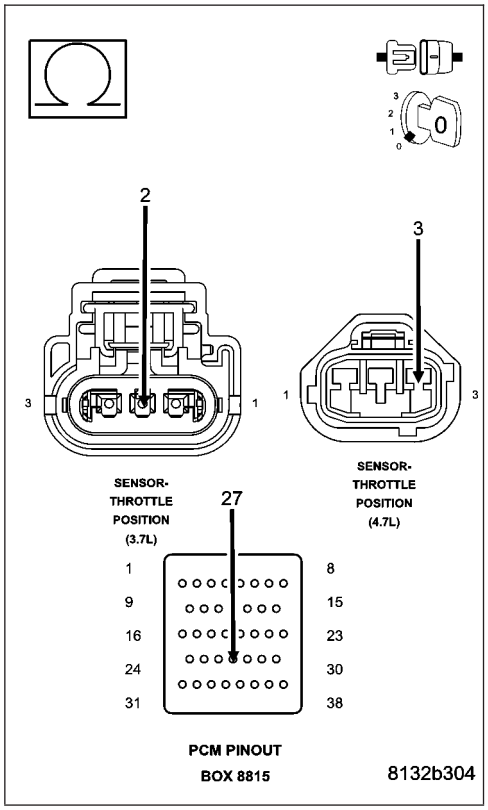
10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

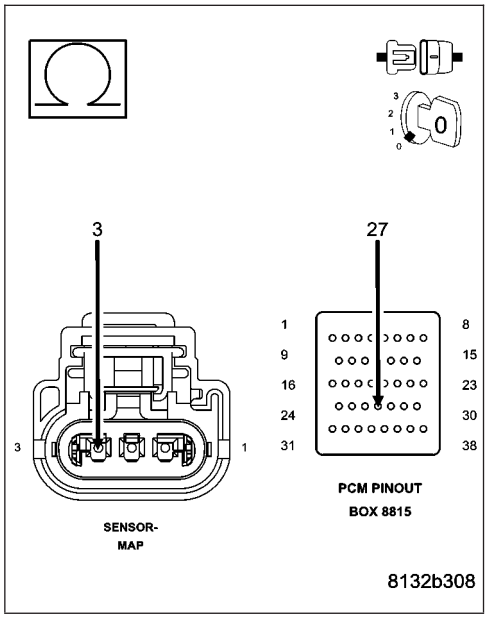
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

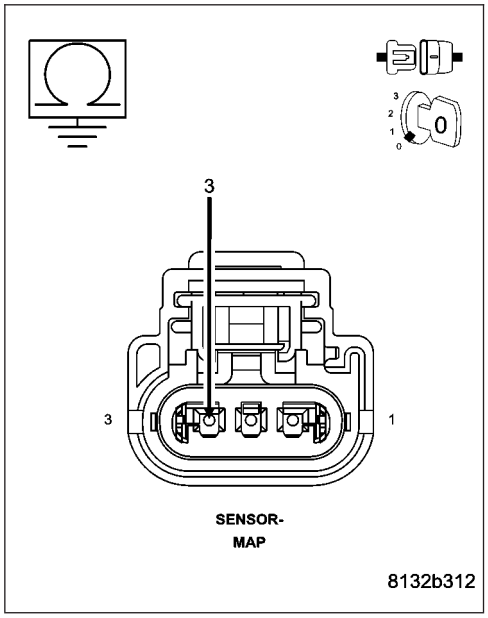
Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

13. MAP SENSOR

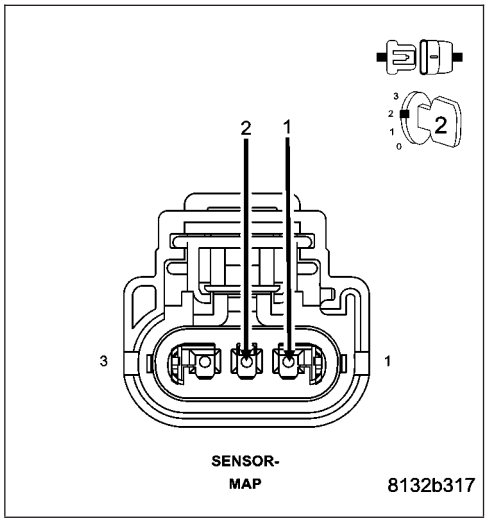
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.



Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.

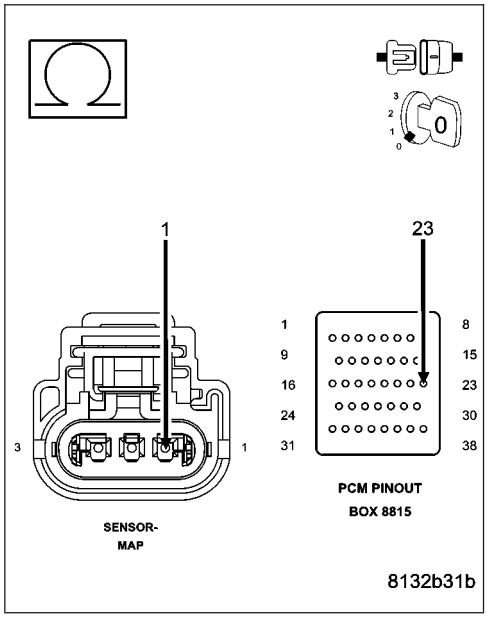
14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

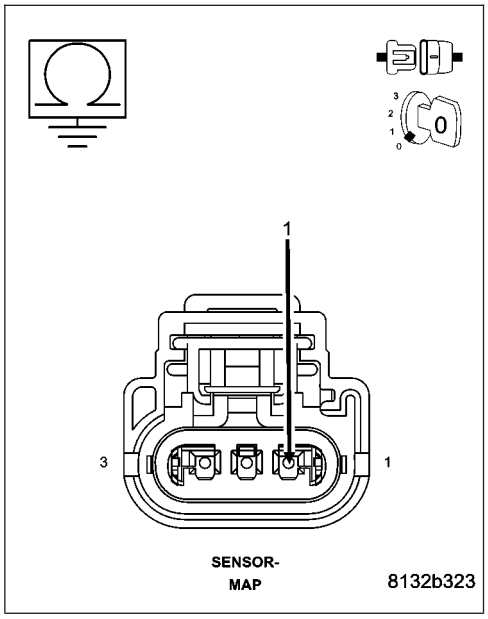
15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

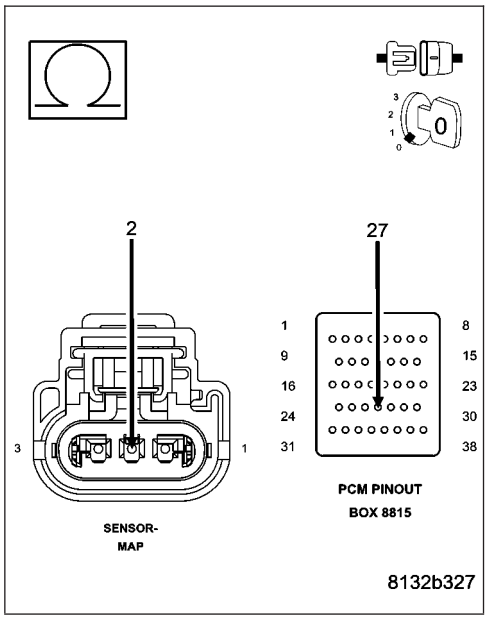
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0068-MANIFOLD PRESSURE/THROTTLE POSITION CORRELATION (CONTINUED)

17. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

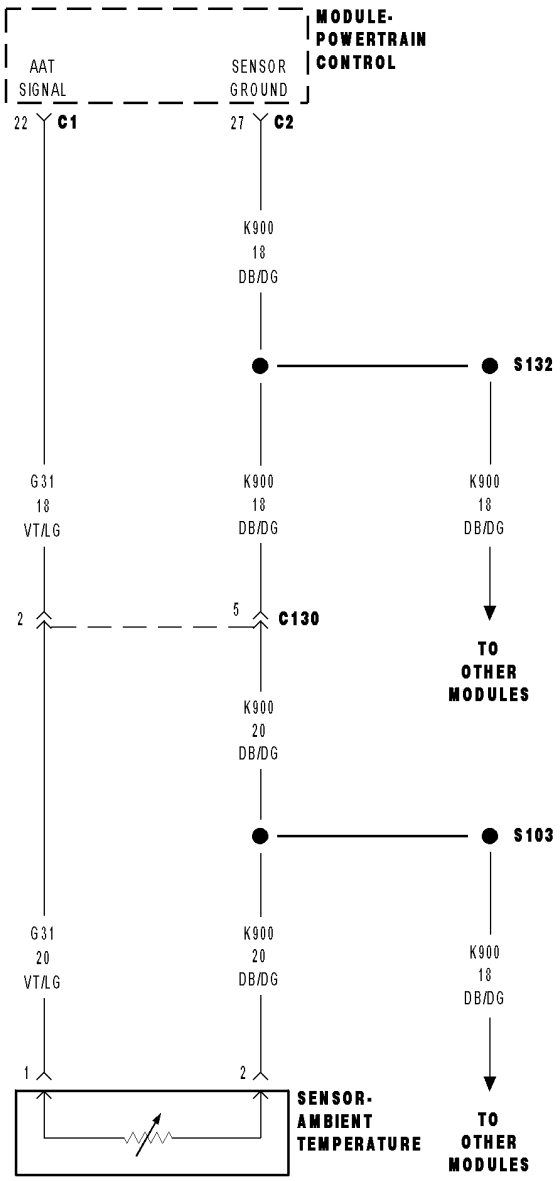
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

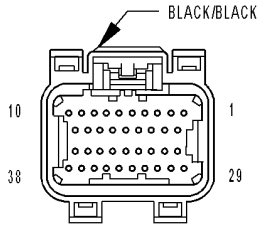
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

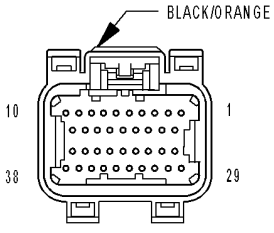
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE

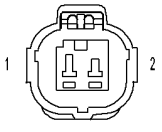




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
AMBIENT AIR
TEMPERATURE

81452c47

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within –10 deg C (18 deg F) of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
AMBIENT AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

2. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the AAT Sensor harness connector.

NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

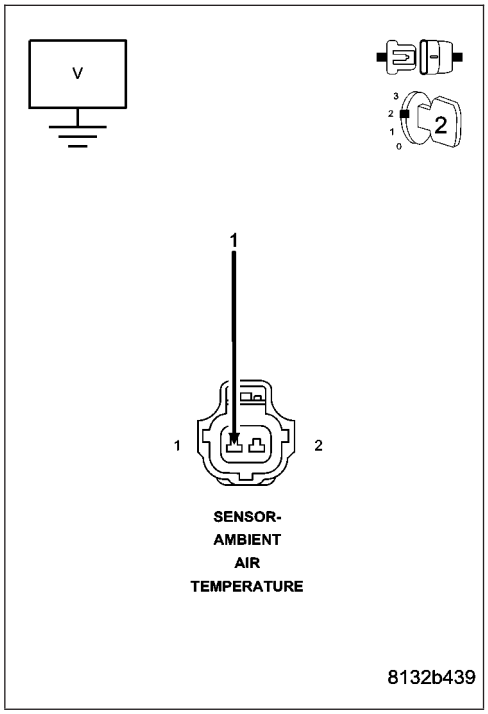
Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to voltage in the (G31) AAT Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. AAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the AAT voltage.

Is the voltage above 4.6 volts?

Yes >> Go To 4

No >> Go To 7

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

4. AAT SENSOR

Connect a jumper wire between the (G31) AAT Signal circuit and the (K900) Sensor ground circuit in the AAT Sensor harness connector.

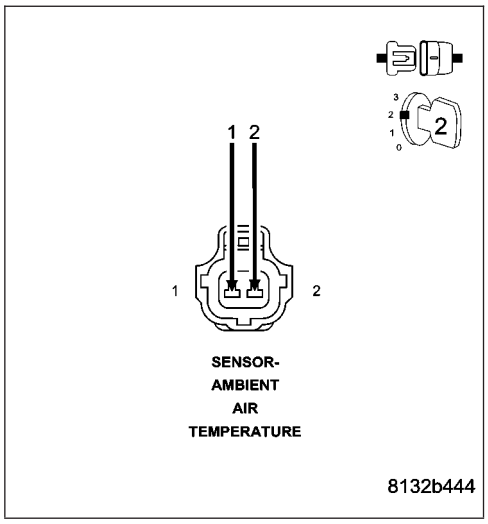
With a scan tool, read the AAT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the AAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

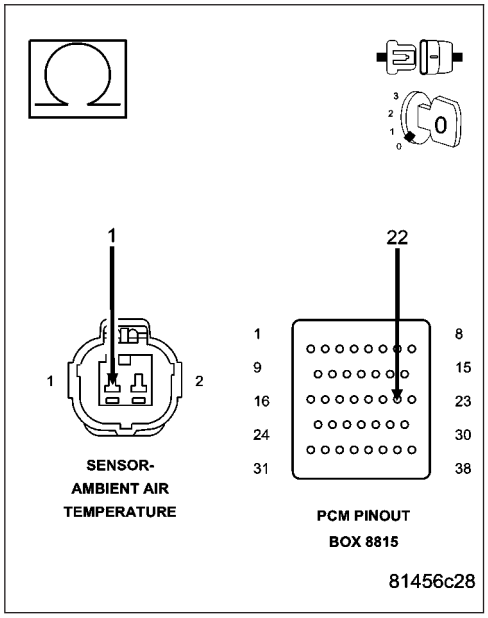
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

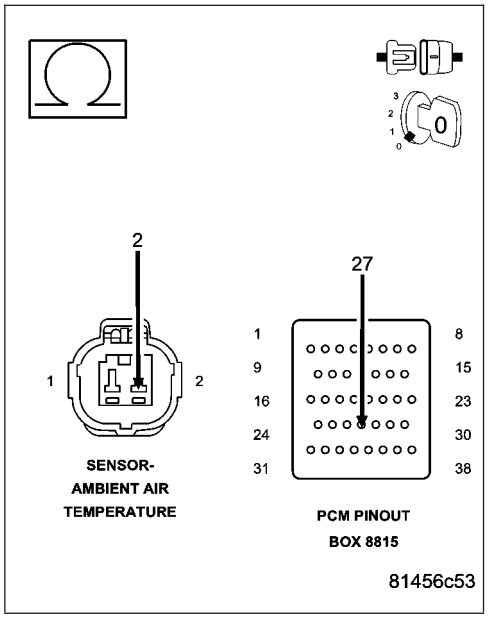
No >> Repair the open in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 9

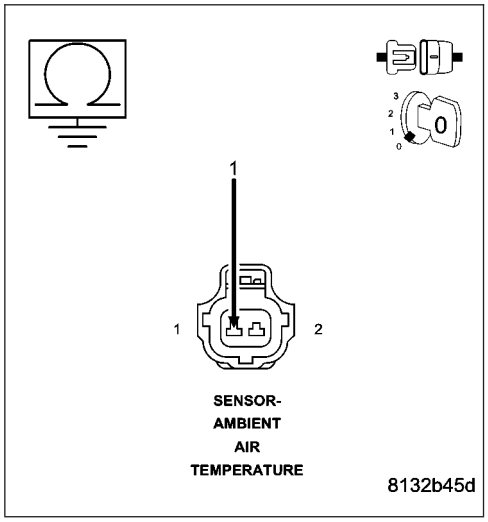
No >> Repair the open in the (K900) Sensor ground circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.



Is the resistance below 100 ohms?

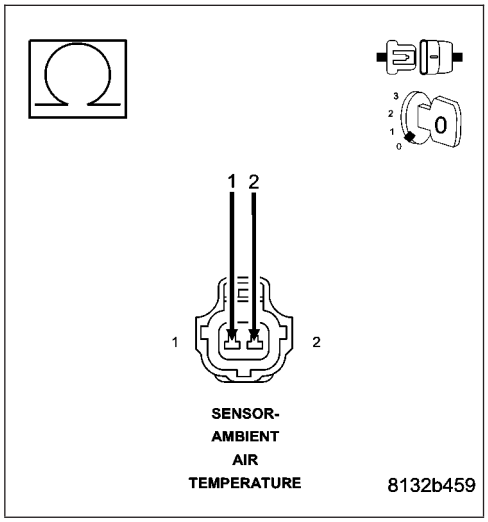
Yes >> Repair the short to ground in the (G31) AAT Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0071-AMBIENT AIR TEMPERATURE SENSOR PERFORMANCE (CONTINUED)

8. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (G31) AAT Signal circuit and the (K900) Sensor ground circuit in the AAT Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. PCM

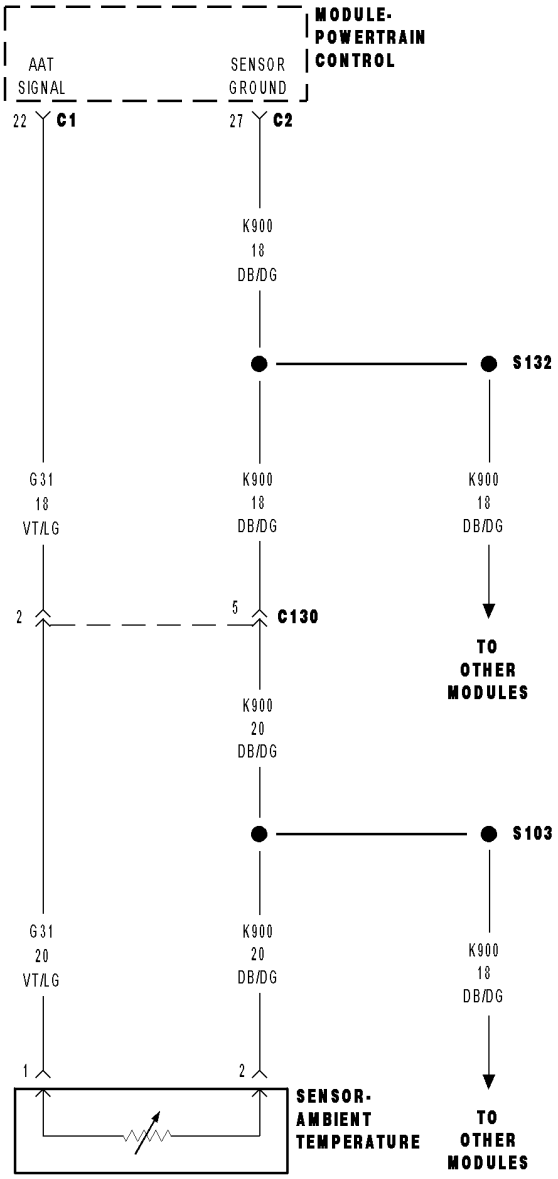
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

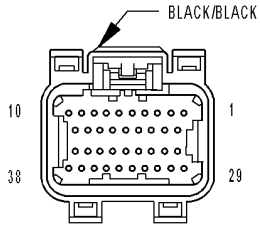
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

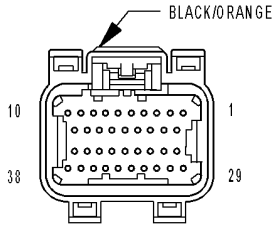
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW

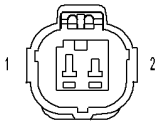




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
AMBIENT AIR
TEMPERATURE

81452c47

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition key on.
- **Set Condition:**
  Ambient Temperature Sensor is less than 0.078 of a volt at the PCM for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND
(G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
AMBIENT AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the Ambient Air Temperature Sensor voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING AAT SENSOR

Turn the ignition off.
Disconnect the Ambient Air Temperature Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read the AAT Sensor voltage.

Is the voltage above 4.6 volts?

Yes >> Replace the Ambient Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0072-AMBIENT AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

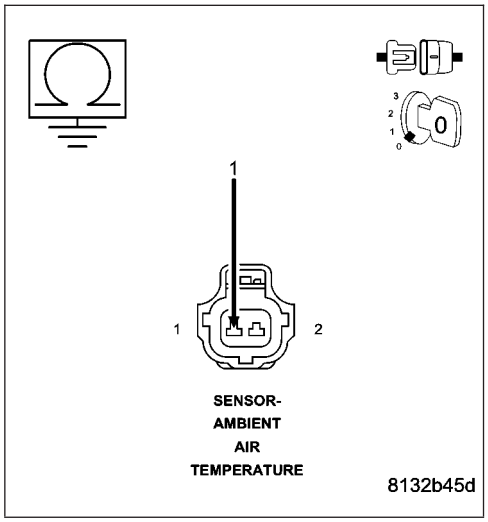
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



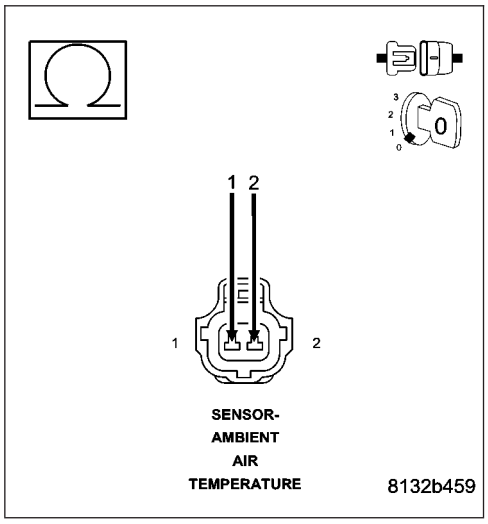
4. (G31) AAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

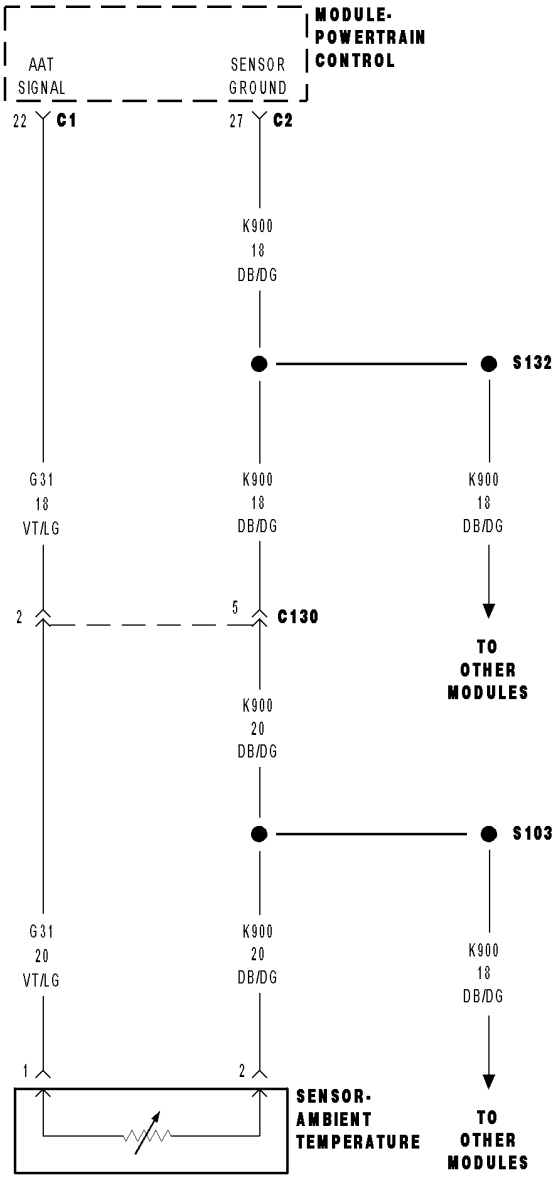
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

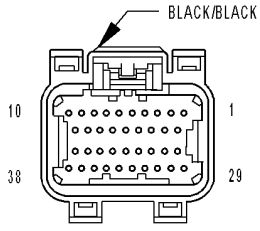
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

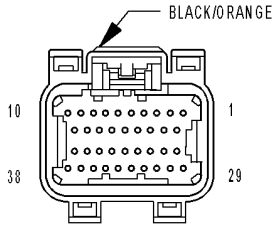
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH

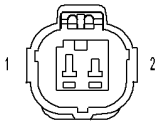




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
AMBIENT AIR
TEMPERATURE

81452c47

P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  The Ambient Temperature Sensor voltage is greater than 4.98 volts at the PCM for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G31) AAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
AMBIENT AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. AAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Ambient Air Temperature Sensor voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. AAT SENSOR

Turn the ignition off.

Disconnect the Ambient Air Temperature Sensor harness connector.

Connect a jumper wire between the (G31) AAT Signal circuit and the (K900) Sensor ground circuit in the AAT Sensor harness connector.

Ignition on, engine not running.

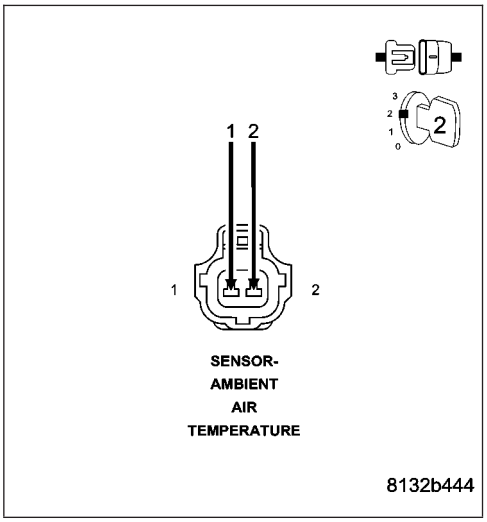
With a scan tool, read AAT Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the Ambient Air Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (G31) AAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

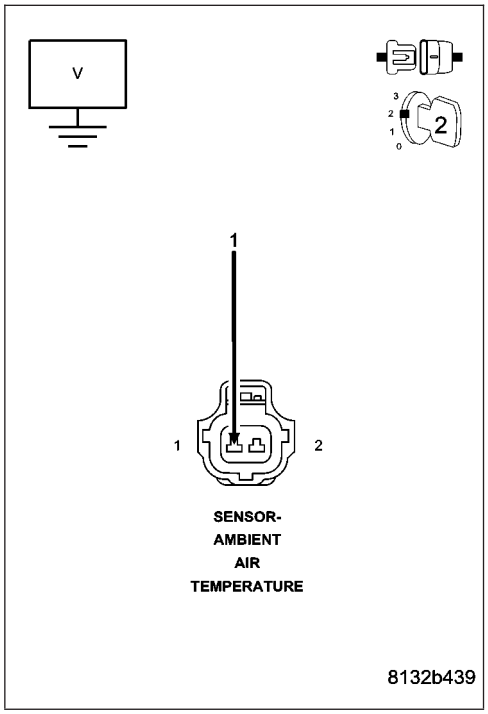
Ignition on, engine not running.

Measure the voltage on the (G31) AAT Signal circuit in the AAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (G31) AAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

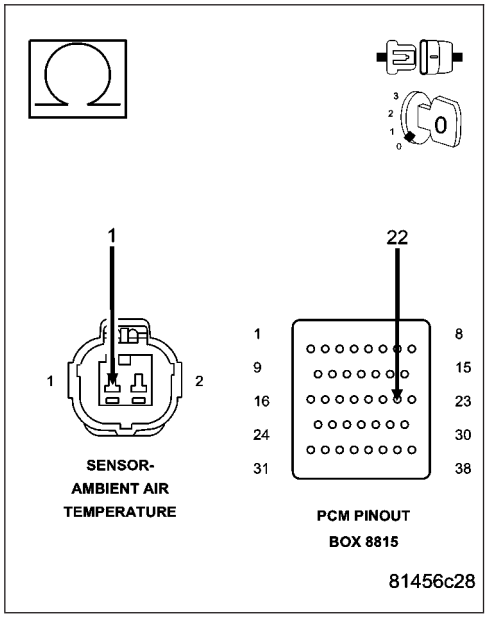
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (G31) AAT Signal circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

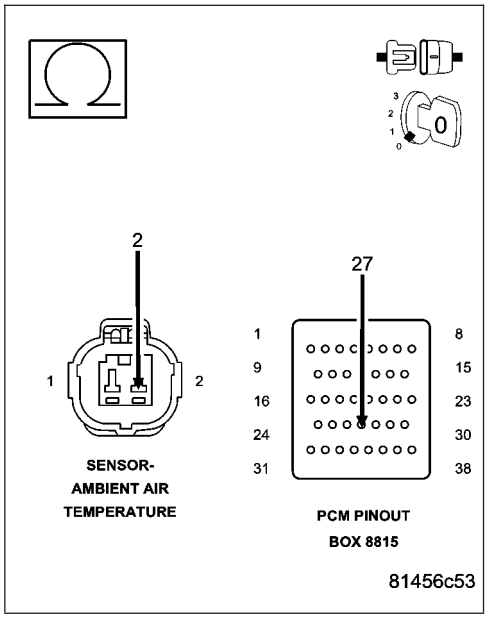
No >> Repair the open in the (G31) AAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0073–AMBIENT AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

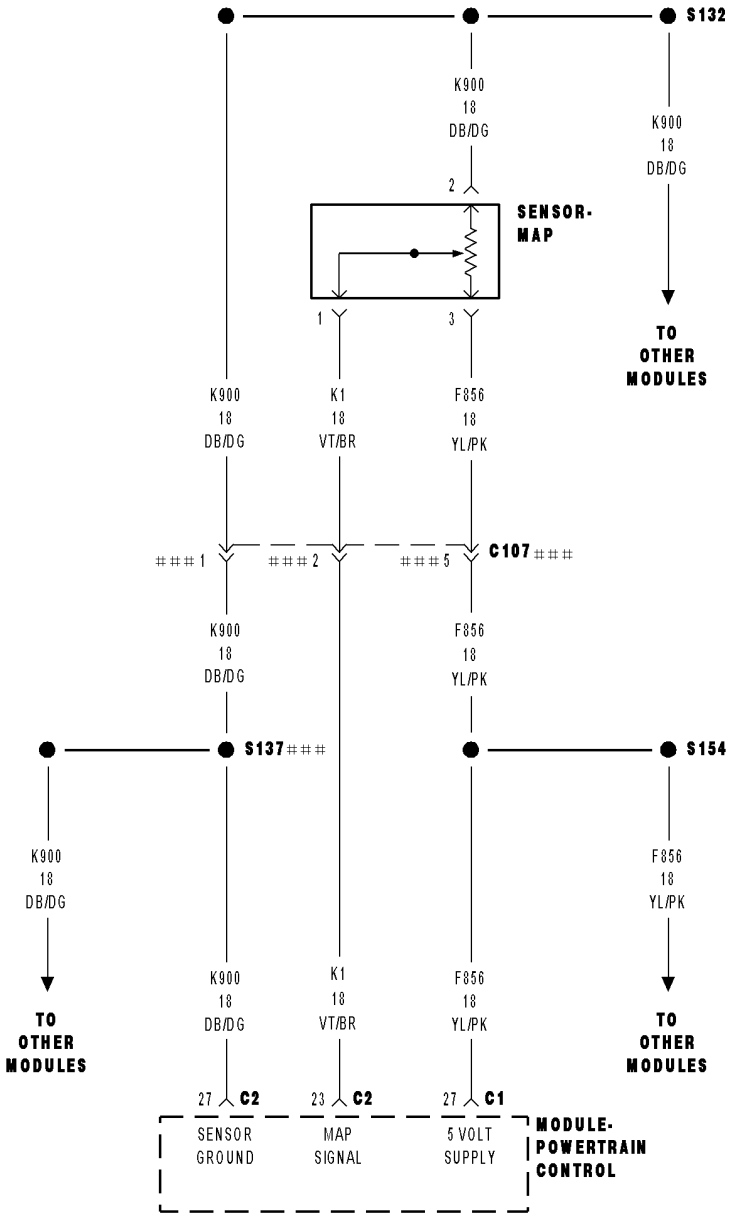
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

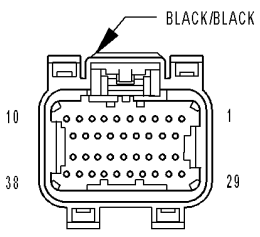
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

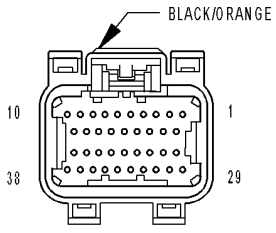
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW

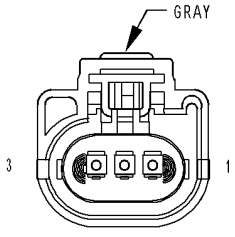




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
MAP
(GAS)

81452cc9

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 to 3500 RPM. Battery voltage greater than 10 volts.
- **Set Condition:**
  The MAP sensor signal voltage is below 0.08 of a volt for 3.0 seconds. One Trip Fault. Three good trips to turn off the MIL, (5.7L ETC light will flash.)

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE BELOW 0.08 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the MAP Sensor voltage.

Is the voltage below 0.08 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

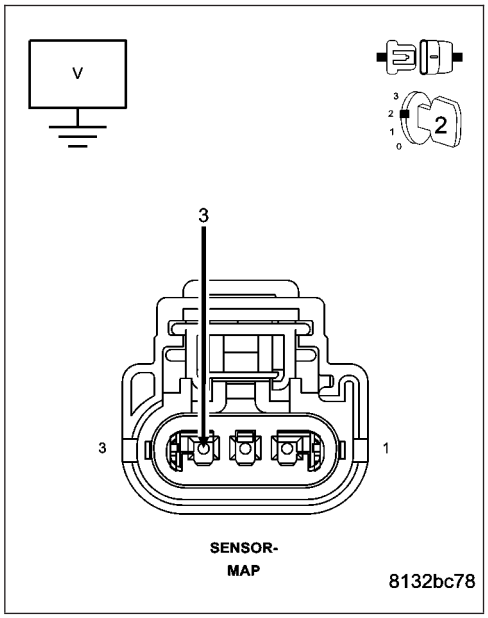
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

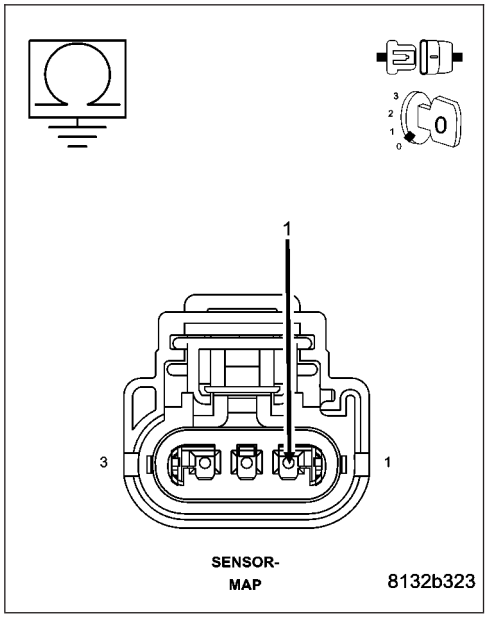
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



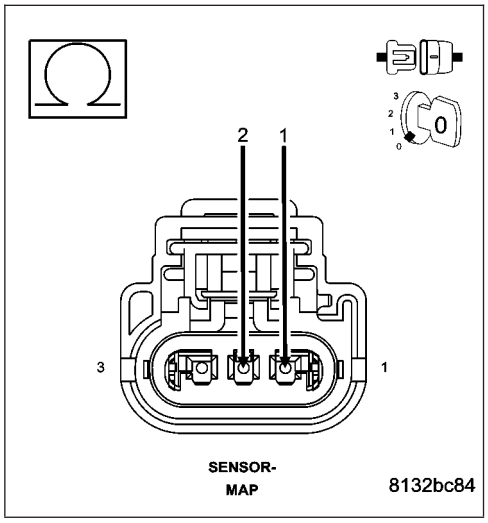
5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

6. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

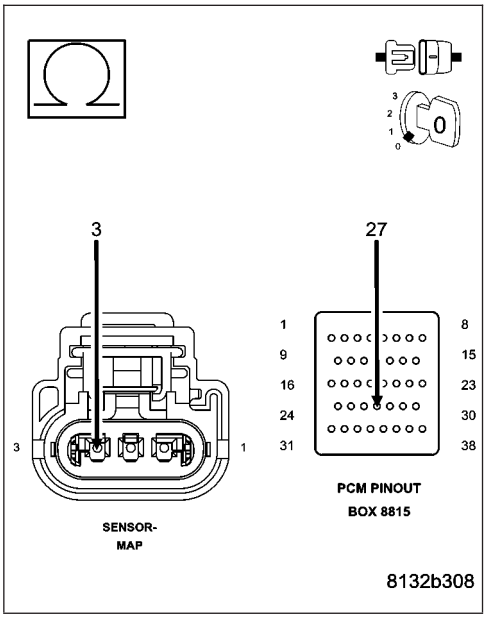
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



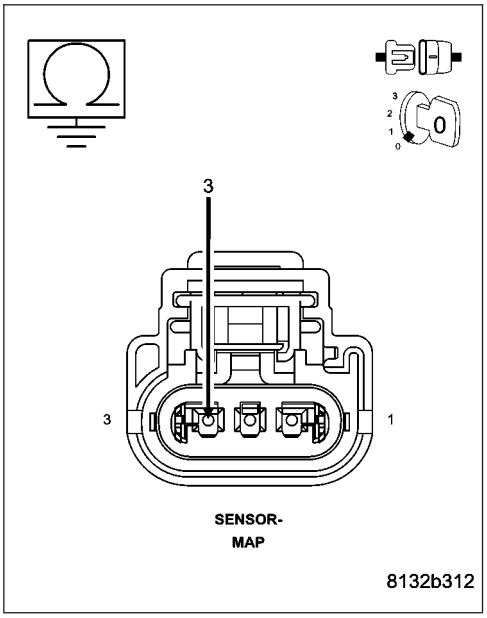
7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0107-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

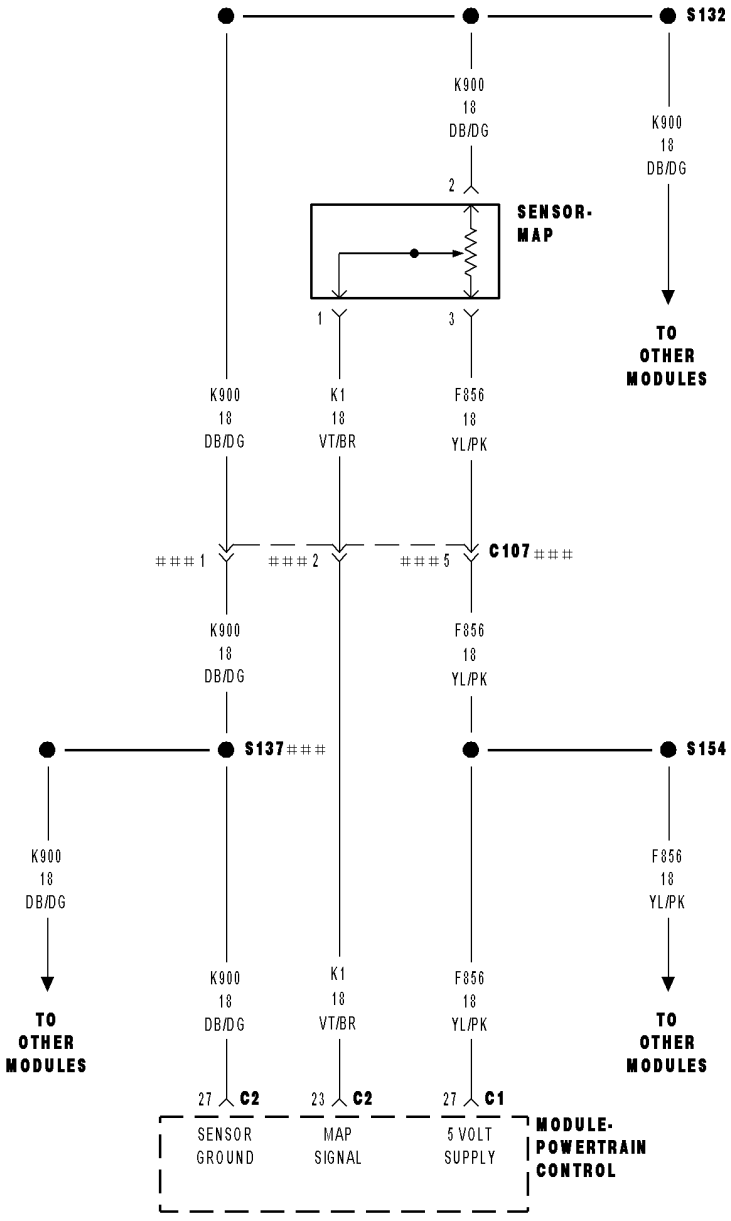
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

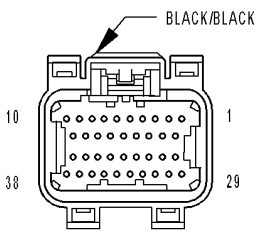
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

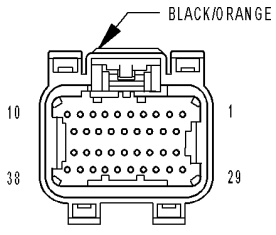
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH

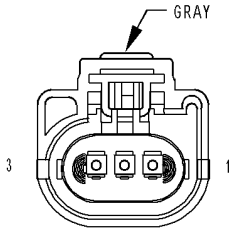




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
MAP
(GAS)

81452cc9

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine speed between 600 to 3500 RPM. Battery voltage greater than 10.37 volts.
- **Set Condition:**
  The MAP sensor signal voltage is greater than 4.92 volts for 3.0 seconds. One trip fault. Three good trips to turn off the MIL. (5.7L ETC light will flash).

Possible Causes
(K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE ABOVE 4.92 VOLTS

Start the engine.

With a scan tool, read the MAP Sensor voltage.

Is the voltage above 4.92 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. MAP SENSOR

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

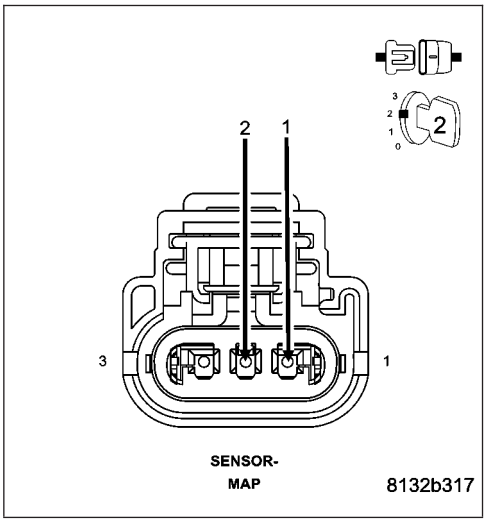
With a scan tool, monitor the MAP Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

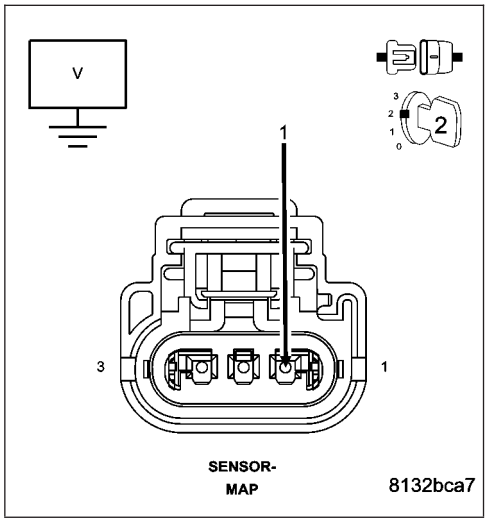
3. (K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

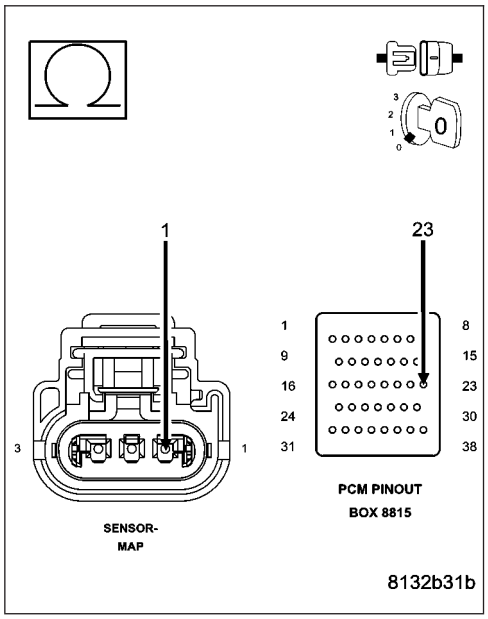
No >> Go To 4

4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

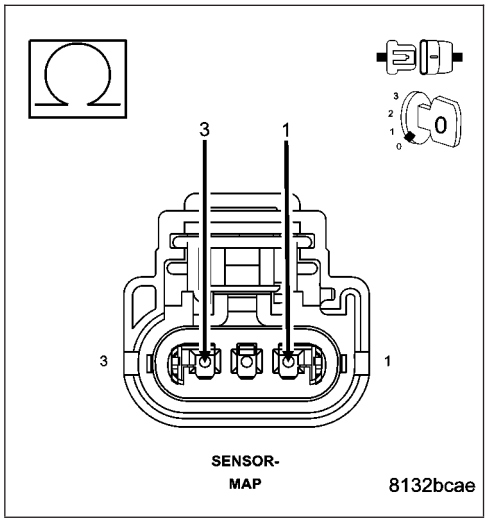
Yes >> Go To 5

No >> Repair the open in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



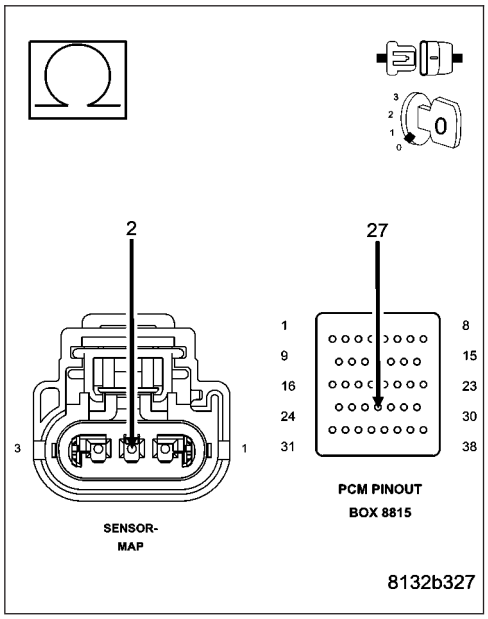
Is the resistance below 100 ohms?

Yes >> Repair the short between the (F856) 5-volt Supply circuit and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108-MANIFOLD ABSOLUTE PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

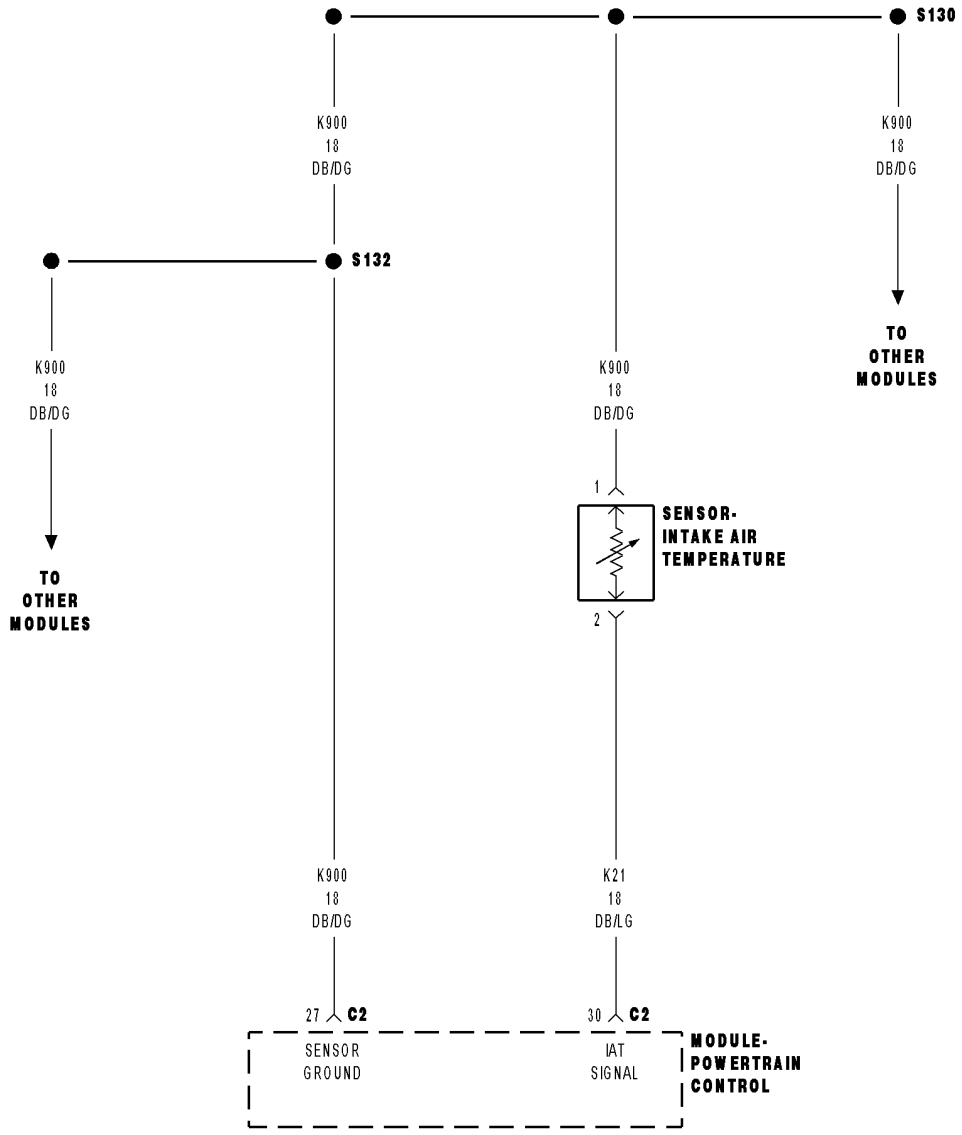
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

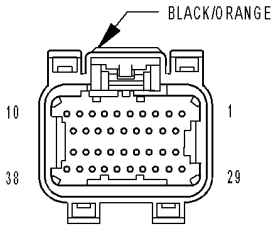
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

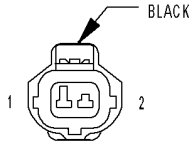
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-INTAKE
AIR TEMPERATURE
(EXCEPT SRT)

81452d0d

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Intake Air Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the engine coolant and ambient air temperature sensors agree and the intake air temperature does not agree, the intake air temperature sensor is declared as irrational.

- **When Monitored:**
  The engine off time is greater than 480 minutes. Ambient Temperature if greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the IAT Sensor value is not within 10 deg C of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

2. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

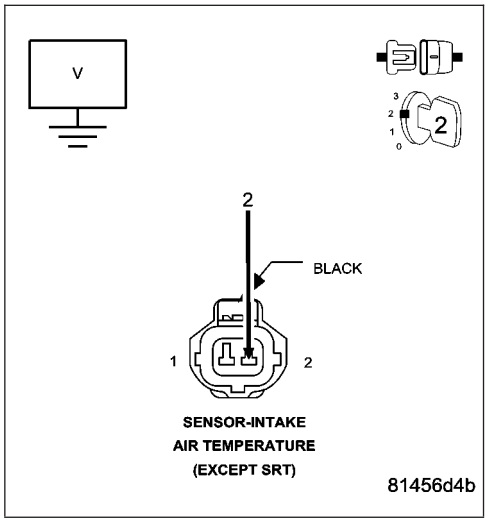
Disconnect the C2 PCM harness connector.

Disconnect the IAT Sensor harness connector.

NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

3. IAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the IAT voltage.

Is the voltage above 4.6 volts?

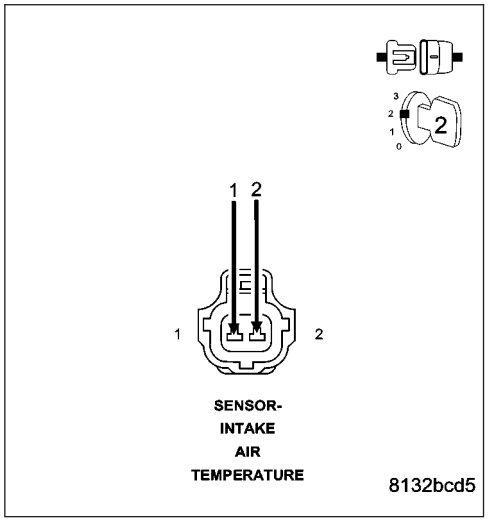
Yes >> Go To 4

No >> Go To 7

4. IAT SENSOR

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

With a scan tool, read the IAT voltage.



Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the IAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.

P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

5. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

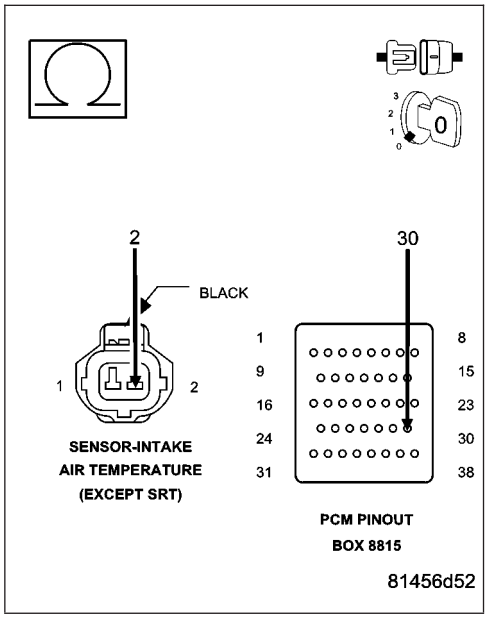
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



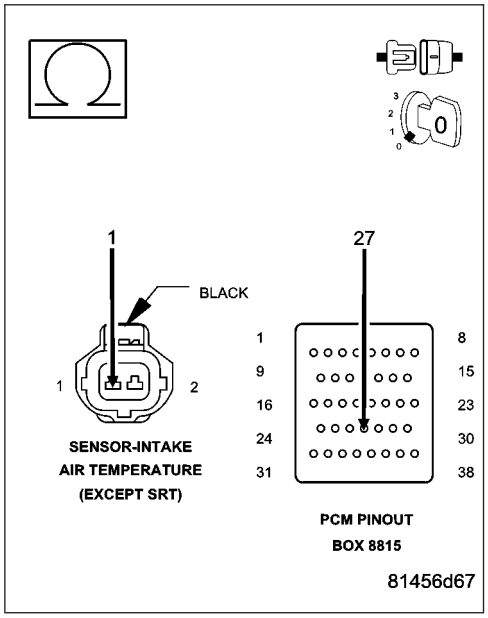
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



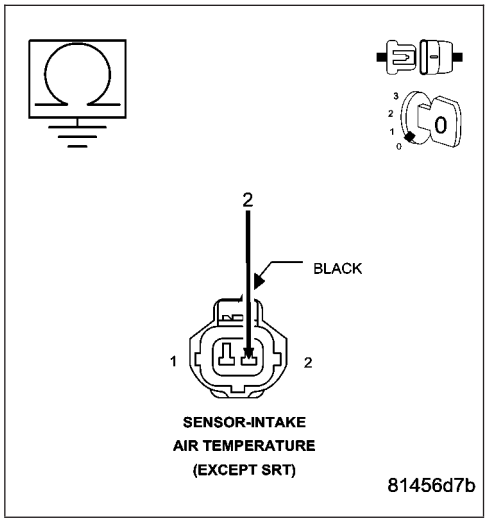
P0111-INTAKE AIR TEMPERATURE SENSOR RATIONALITY (CONTINUED)

7. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.



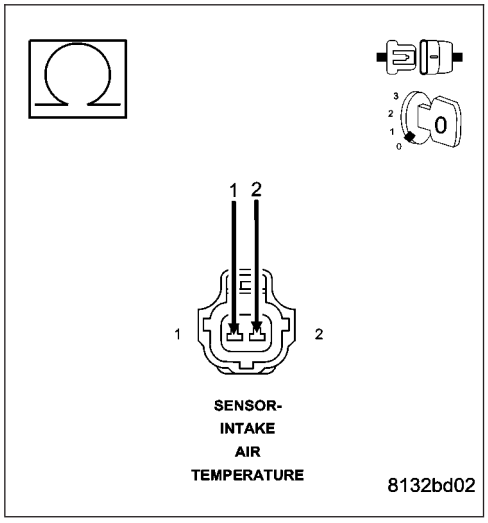
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

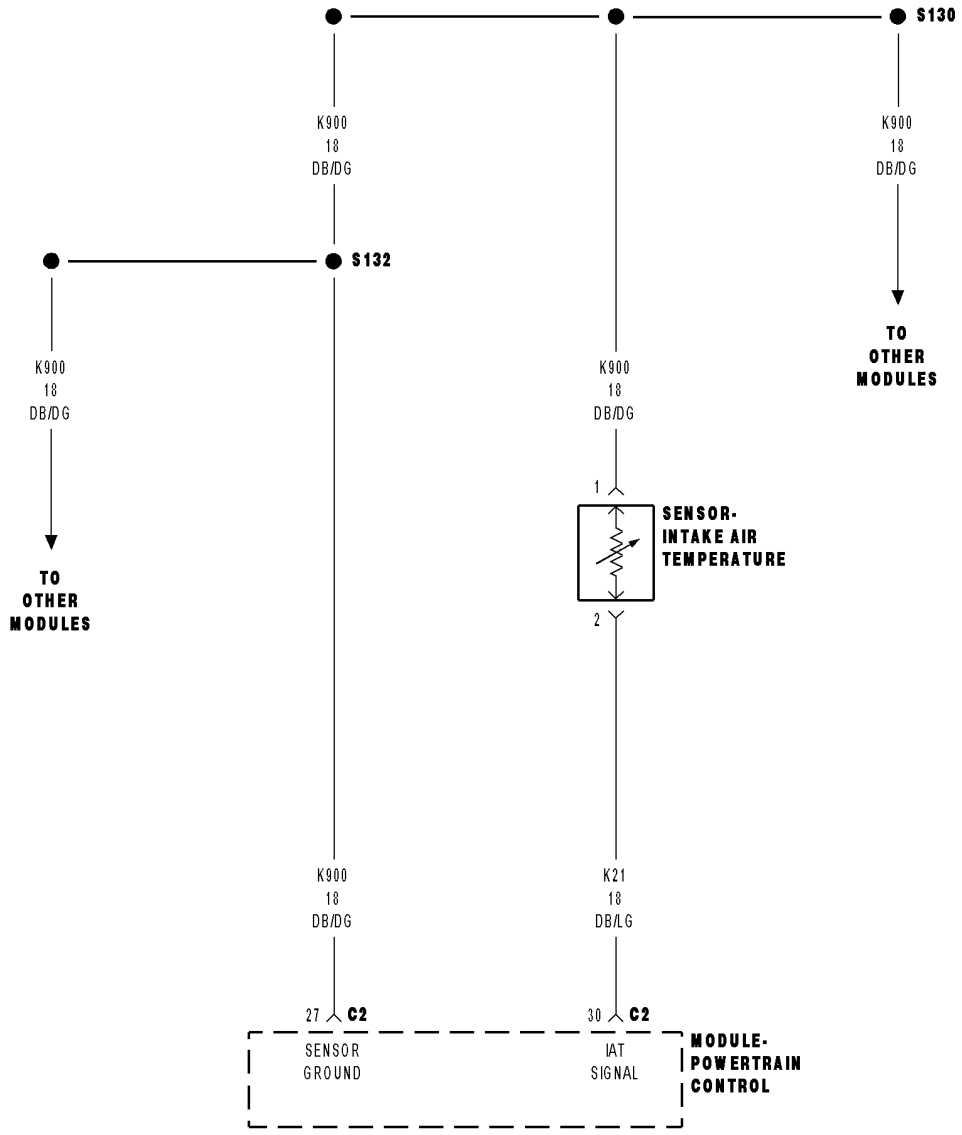
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

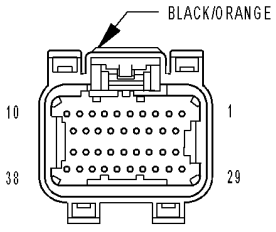
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

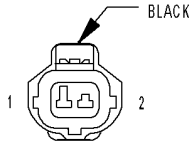
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-INTAKE
AIR TEMPERATURE
(EXCEPT SRT)

81452d0d

P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  When the Inlet Air Temp Sensor Signal circuit voltage is less than .078 volt for more than 2.8 seconds. One trip failure. Three good trips to clear the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the IAT voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. IAT SENSOR

Turn the ignition off.
Disconnect the IAT Sensor harness connector.
Ignition on, engine not running.
With a scan tool, read IAT voltage.

Is the voltage above 0.05 of a volt?

Yes >> Replace the Intake Air Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

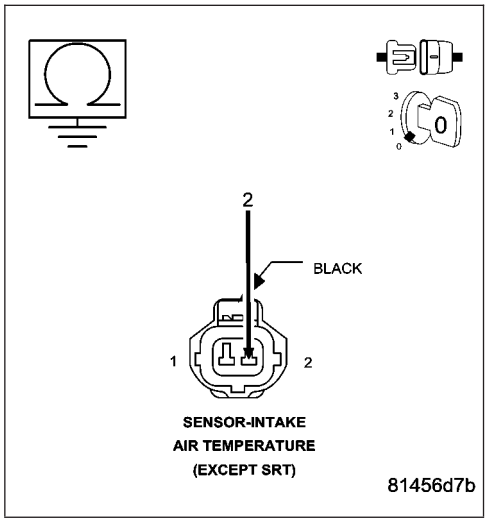
P0112-INTAKE AIR TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.



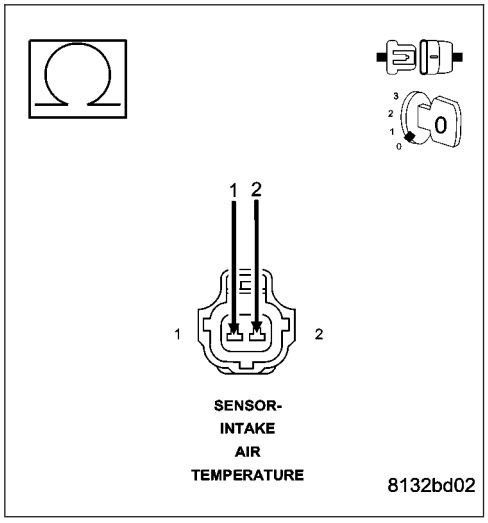
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

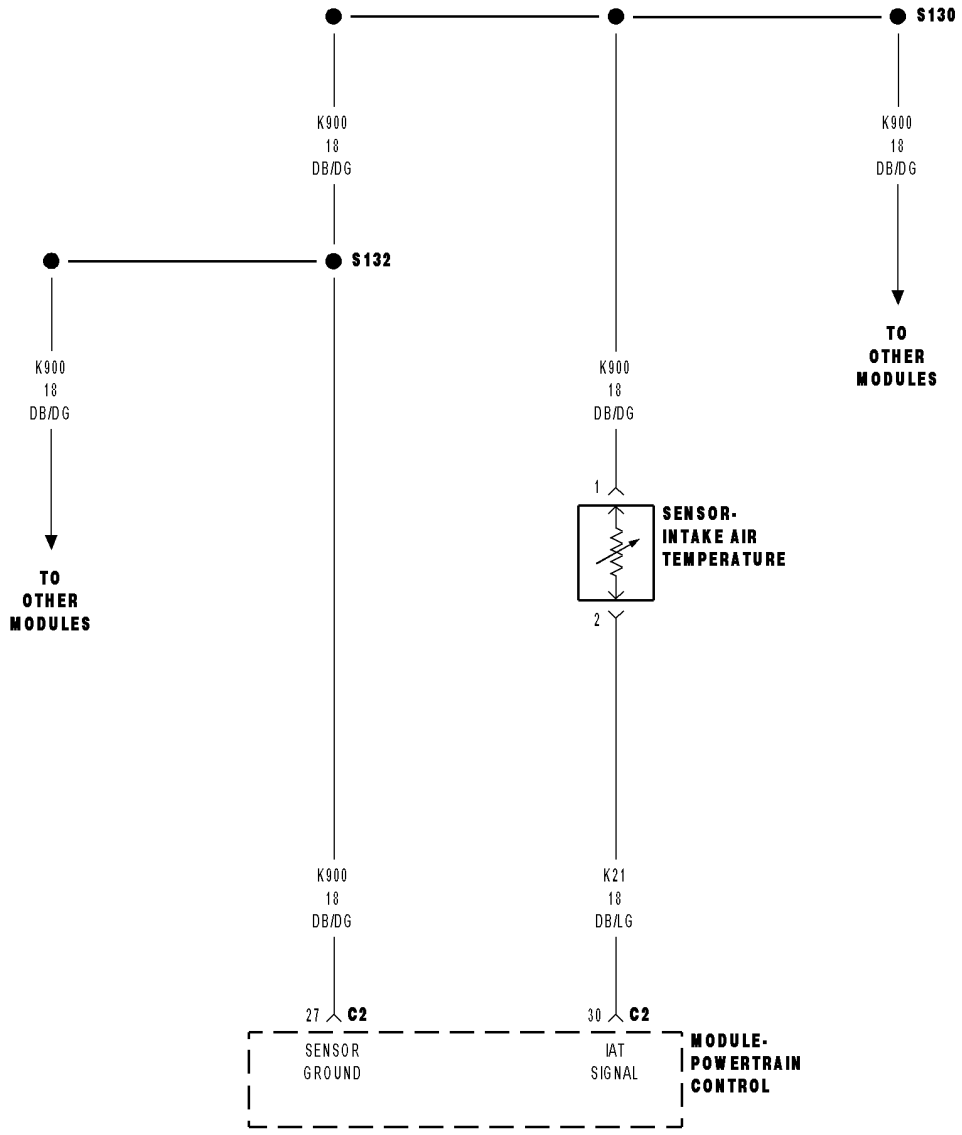
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

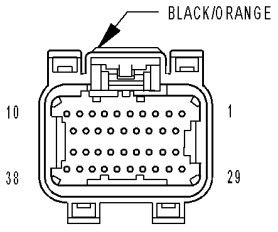
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

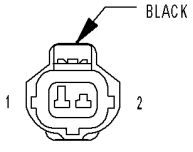
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-INTAKE
AIR TEMPERATURE
(EXCEPT SRT)

81452d0d

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Intake Air Temperature (IAT) sensor circuit voltage at the PCM goes above 4.98 volts for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
IAT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Intake Air Temperature Sensor voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. IAT SENSOR

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Ignition on, engine not running.

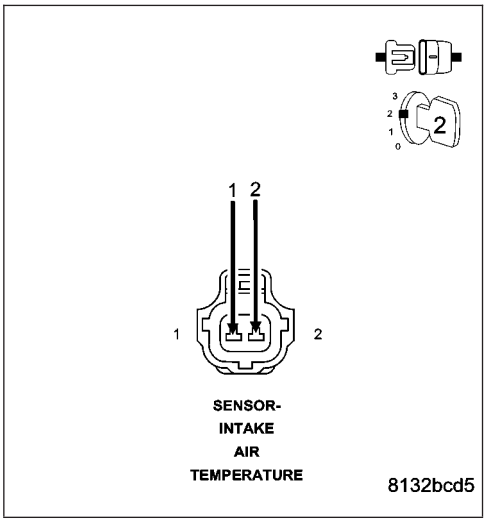
With a scan tool, read the IAT Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the IAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C2 PCM harness connector.

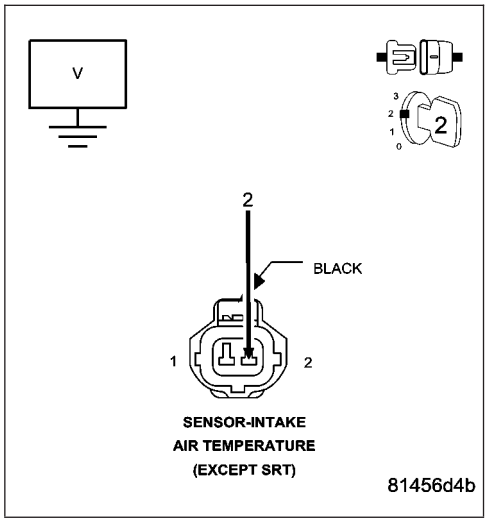
Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

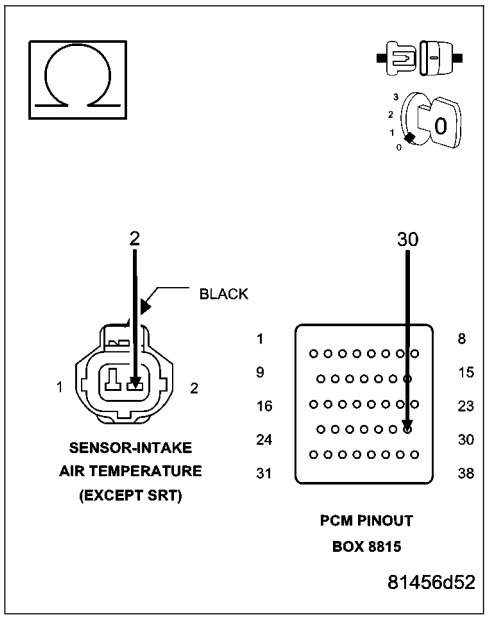
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

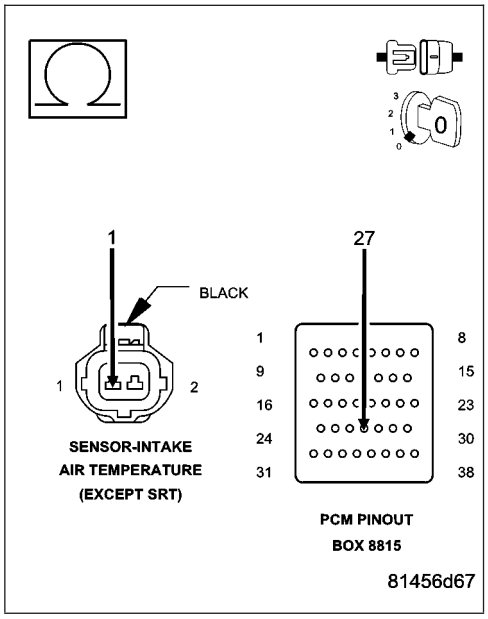
No >> Repair the open in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

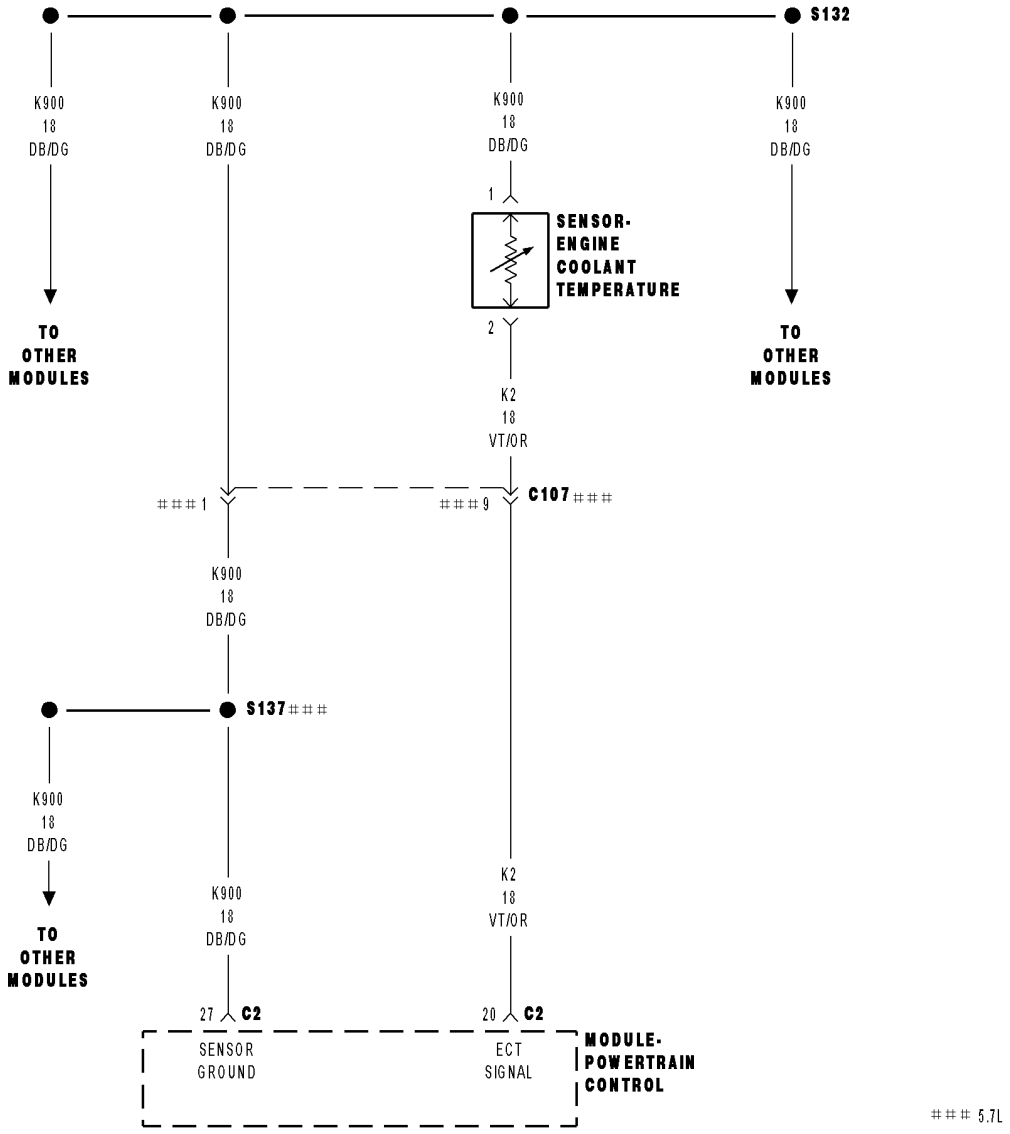
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

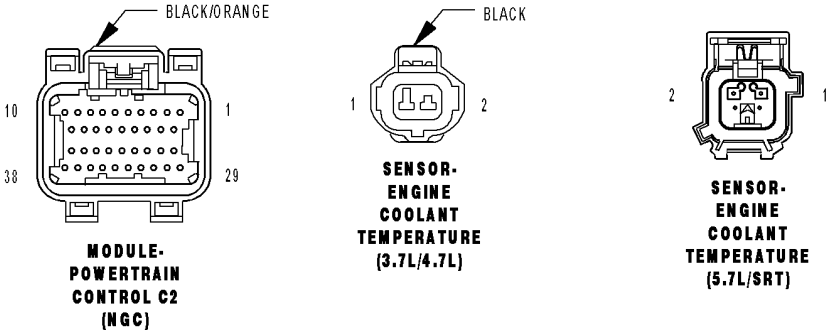
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE





81452d65

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

For the Engine System Schematic circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Engine Coolant Temperature Sensor performance looks at the outputs of three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If the intake air and ambient air temperature sensors agree and the engine coolant temperature does not agree, the engine coolant temperature sensor is declared as irrational.

- **When Monitored:**
  Engine off time is greater than 480 minutes. Ambient temperature is greater than 4 deg C (38 deg F).
- **Set Condition:**
  After a calibrated amount of cool down time the PCM compares the ECT Sensor, IAT Sensor, and the Ambient Air Temp Sensor values. If the ECT Sensor value is not within 10 deg C of the other two temperature sensors. Two Trip Fault. Three good trips to turn off the MIL. (5.7L ETC lamp will illuminate with the MIL.)

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

2. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

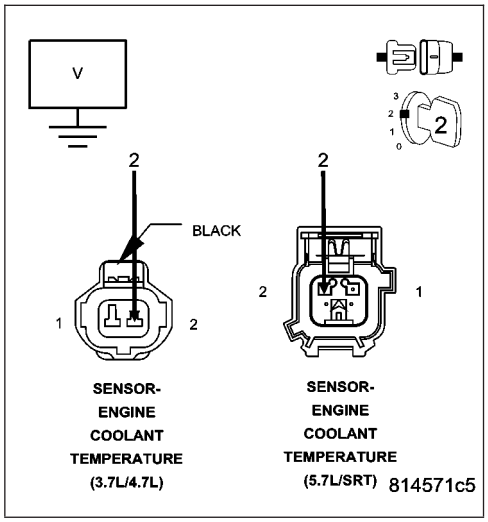
Disconnect the C2 PCM harness connector.

Disconnect the ECT Sensor harness connector.

NOTE: Visually inspect both the component and the PCM connectors. Look for damaged, partially broken wires, and backed out or corroded terminals.

Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

3. ECT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage above 4.6 volts?

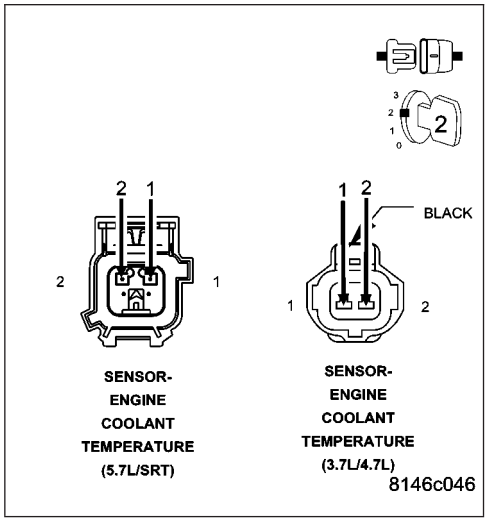
Yes >> Go To 4

No >> Go To 7

4. ECT SENSOR

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.



Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.

P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

5. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

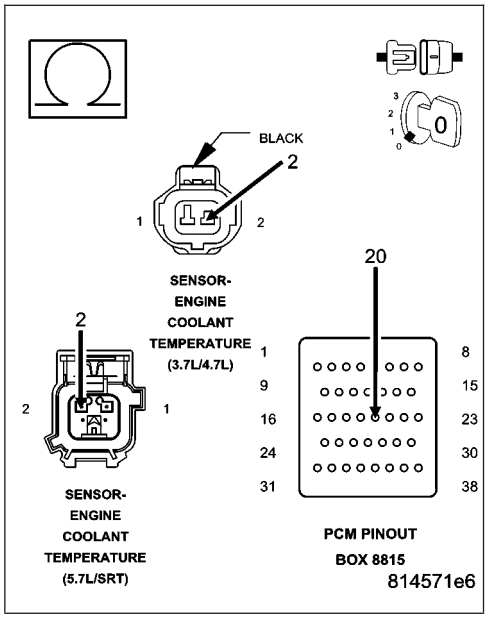
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



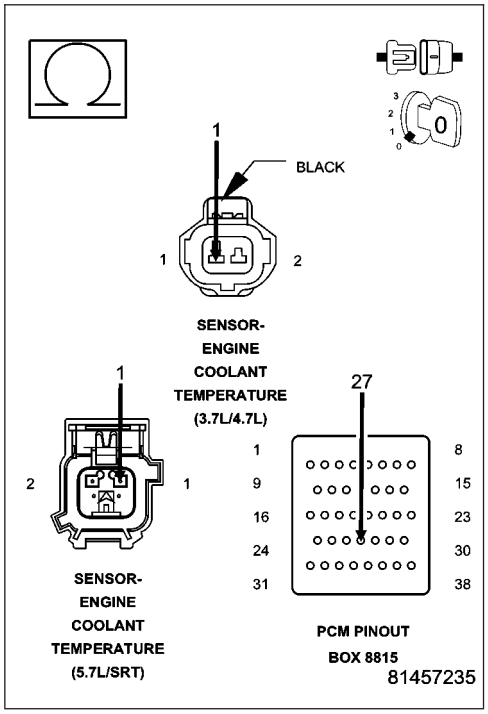
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

7. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

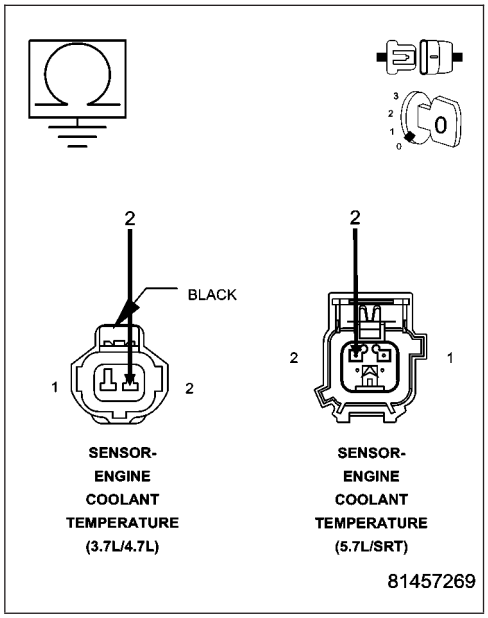
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



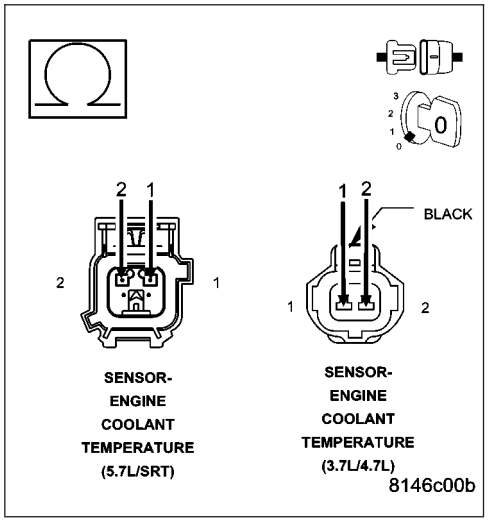
8. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



P0116–ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT PERFORMANCE (CONTINUED)

9. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

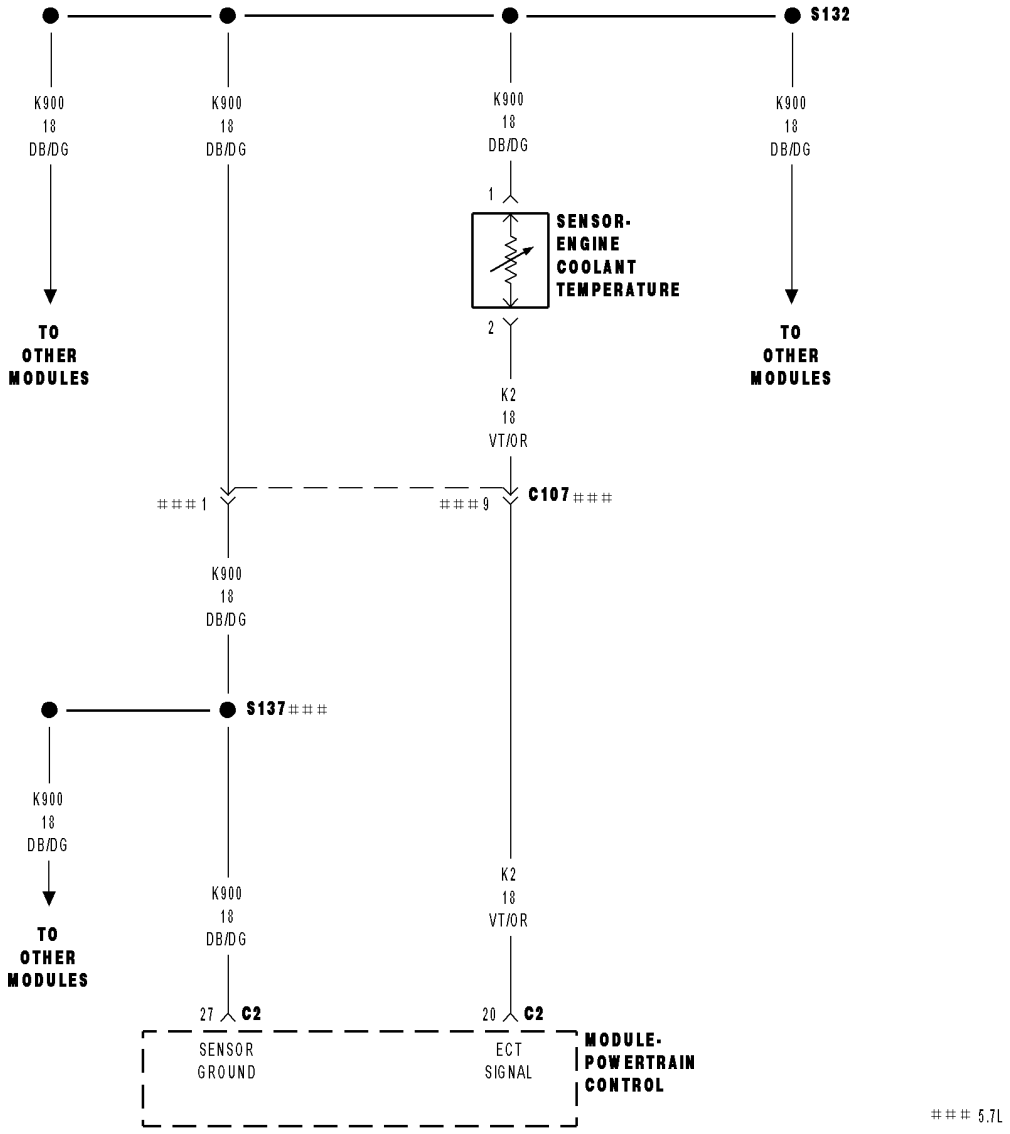
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

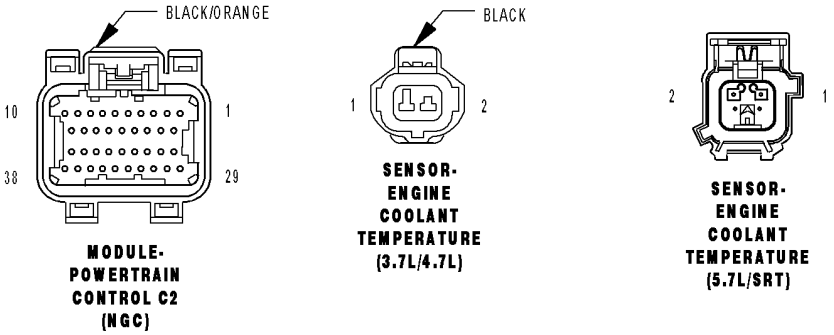
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW





81452d65

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is less than 0.078 of a volt for more than 2.8 seconds. One Trip Fault. Three good trips to clear the MIL.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.
With a scan tool, read the ECT voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ECT SENSOR

Turn the ignition off.
Disconnect the ECT harness connector.
Ignition on, engine not running.
With a scan tool, read ECT voltage.

Is the voltage above 1.0 volt?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

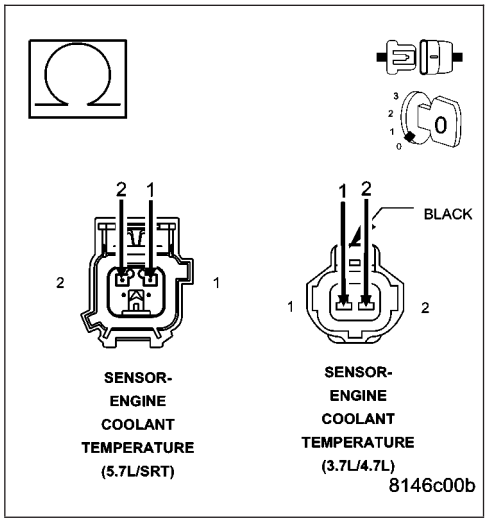
Disconnect the C2 PCM harness connector.

Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



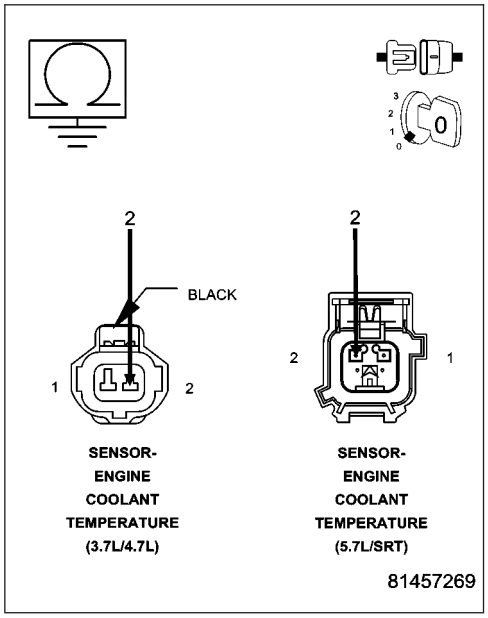
4. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

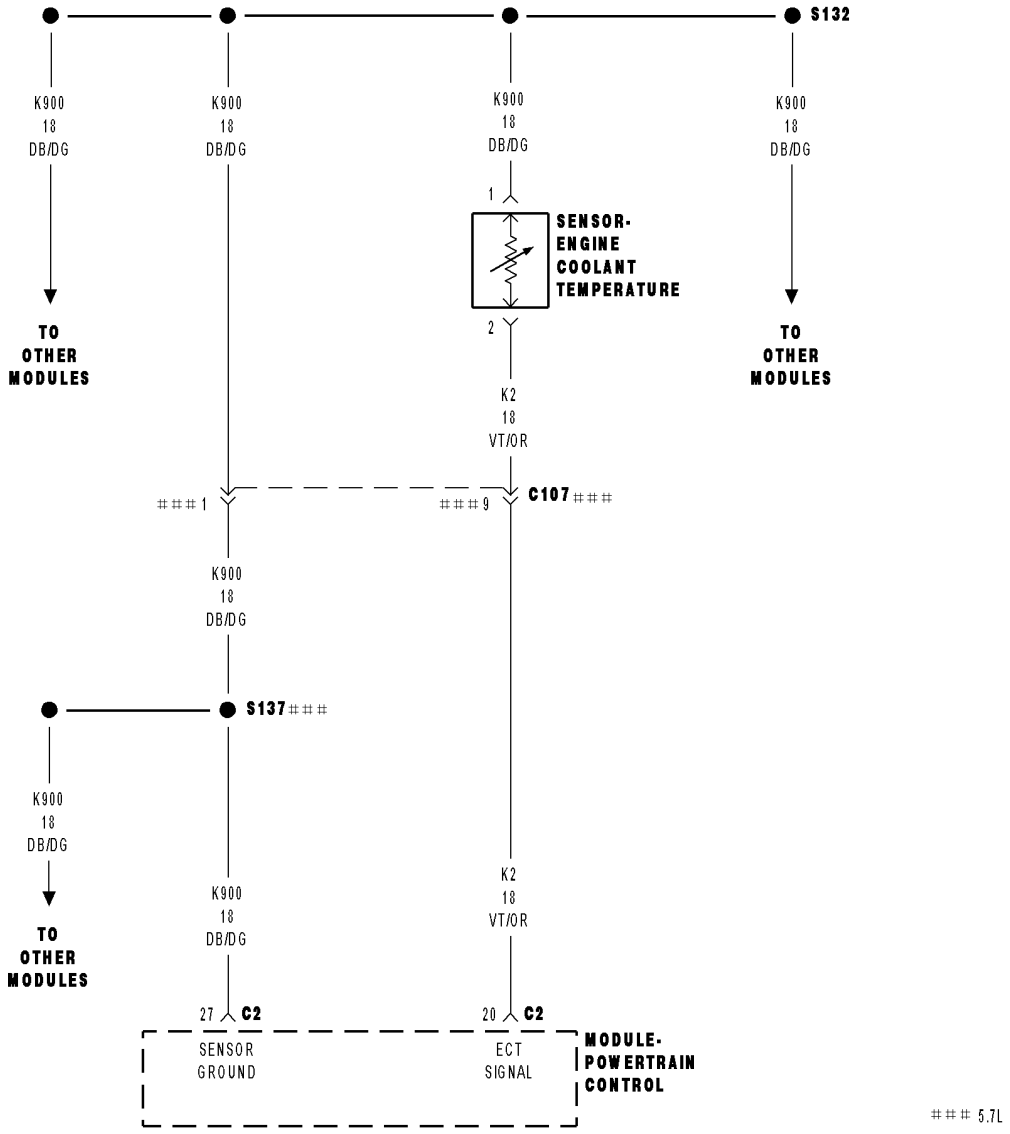
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

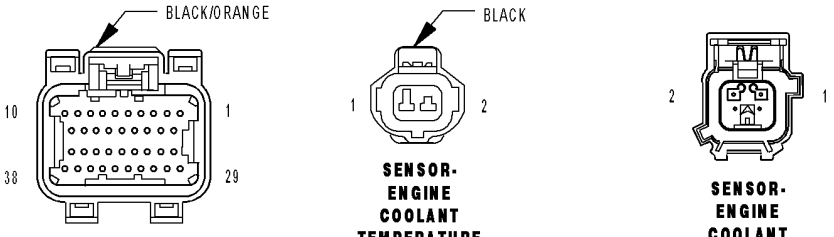
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH





81452d65

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is greater than 4.98 volts for more than 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL. (5.7L ETC lamp will illuminate with the MIL.)

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT harness connector.

Ignition on, engine not running.

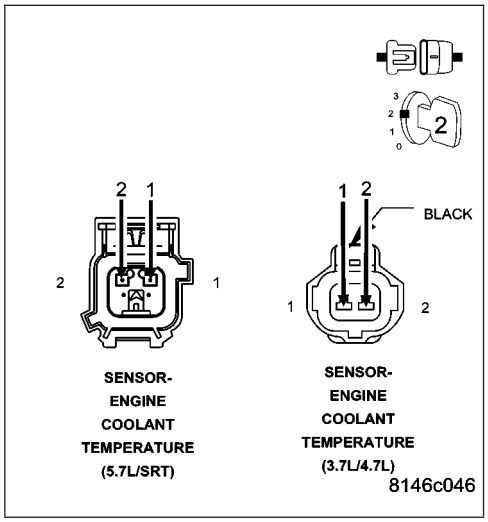
With a scan tool, read ECT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

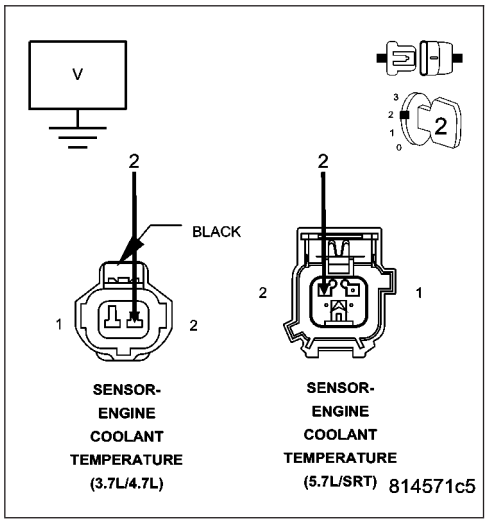
Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

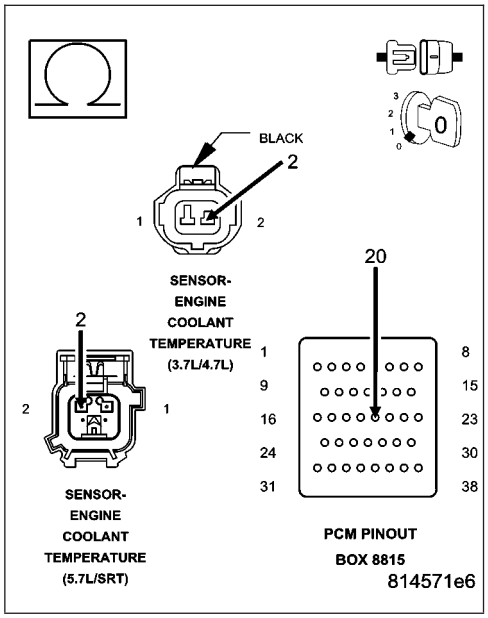
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



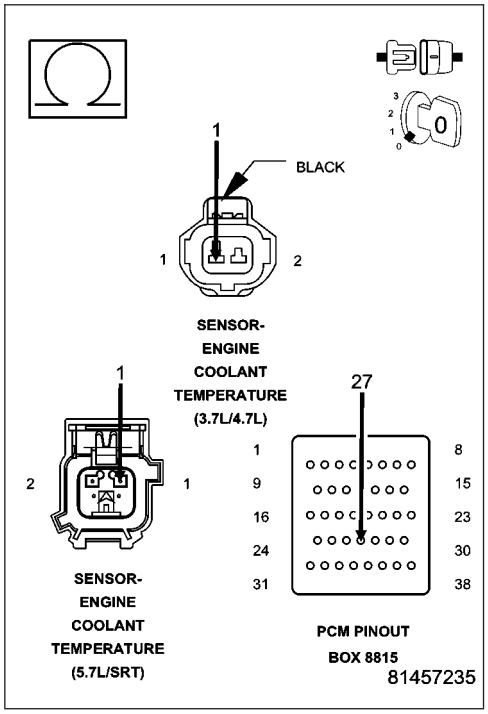
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0118-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

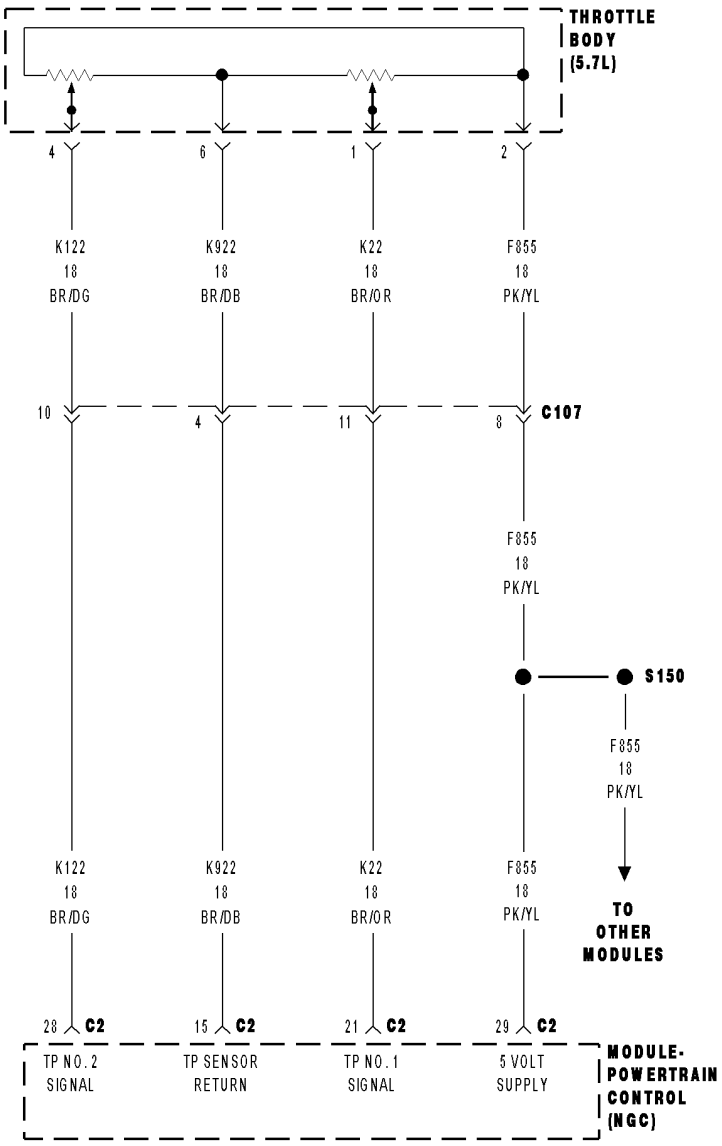
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

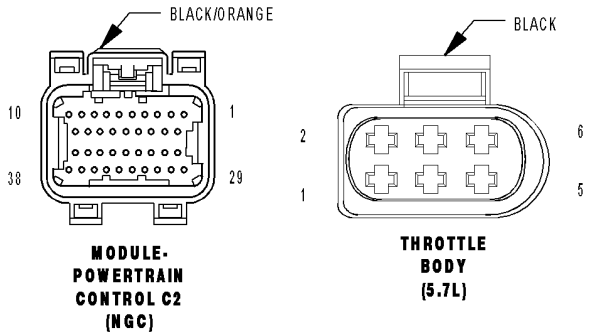
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE





81452d8c

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and No MAP Sensor DTCs set.
- **Set Condition:**
  TP Sensor signals do not correlate to the MAP Sensor signal. One Trip Fault. ETC light will illuminate. P2135 should set with this code also.

Possible Causes
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
RESISTANCE IN THE (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any other TP Sensor DTC(s) before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.
Ignition on, engine not running.

NOTE: Inspect the engine for vacuum leaks.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 11

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

2. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OR THE (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the Throttle Body harness connector.

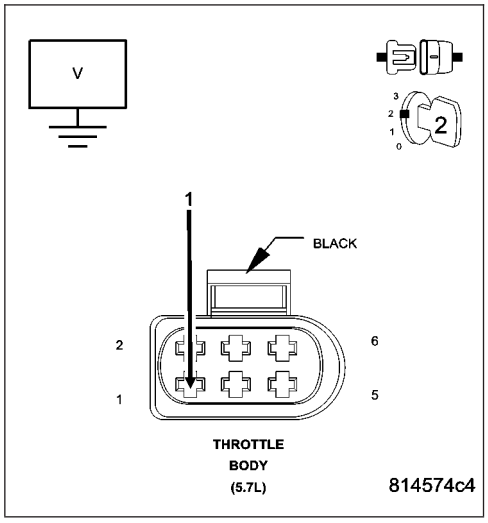
Ignition on, engine not running.

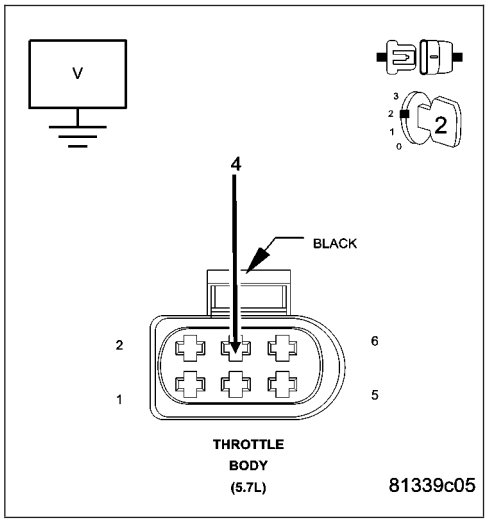
Measure the voltage on the (K22) TP No.1 Signal and the (K122) TP No.2 Signal circuits in the Throttle Body harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor No.1 or (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3





P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

3. THROTTLE POSITION SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor No.1 and No.2 voltage.

Connect a jumper wire between the (K922) Sensor Return circuit and the (K22) TP Sensor No.1 Signal circuit.

NOTE: TP Sensor No.1 voltage should change from approximately 4.5 volts to less than 0.5 of a volt.

For TP Sensor No.2, connect a jumper wire between (F855) 5-volt supply circuit and the (K122) TP Sensor No.2 signal circuit.

NOTE: TP Sensor No.2 voltage should change from approximately 0 volts to 5.0 volts?

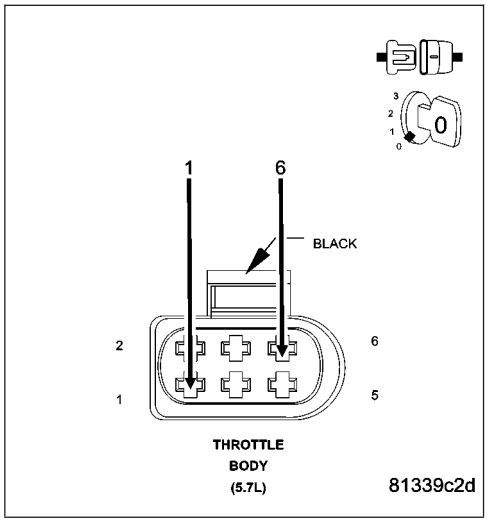
Is the voltage reading within the listed specification when the jumper wire is installed?

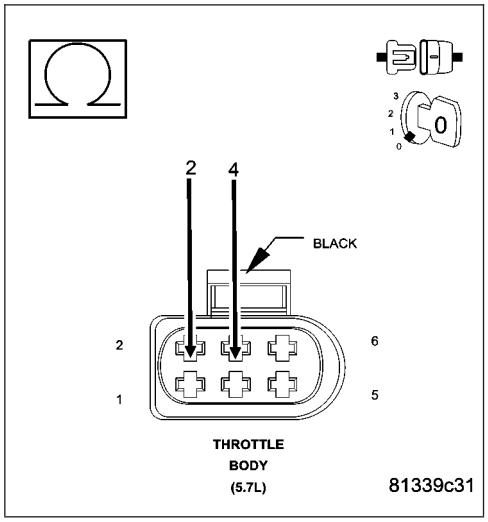
Yes >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.





P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

4. EXCESSIVE RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT AND (K122) TP SENSOR NO.2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

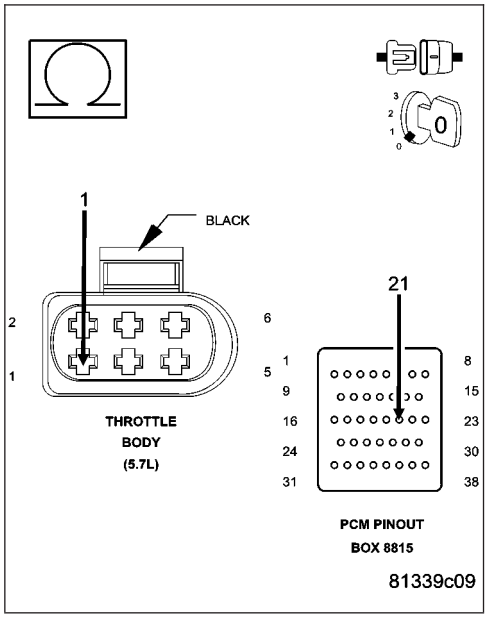
Measure the resistance of the (K122) TP Sensor No.2 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

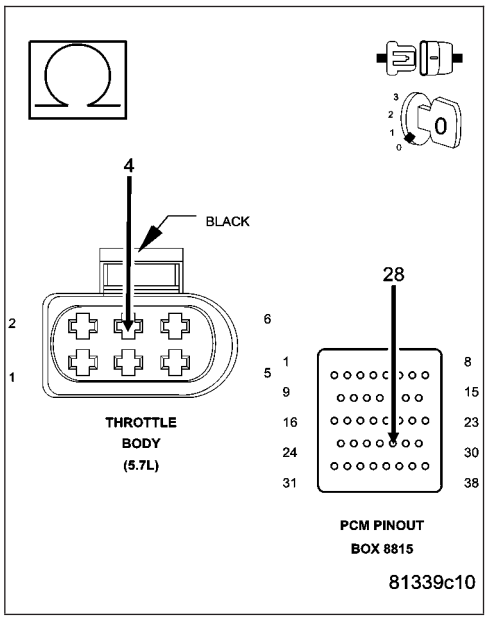
Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit or the (K122) TP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

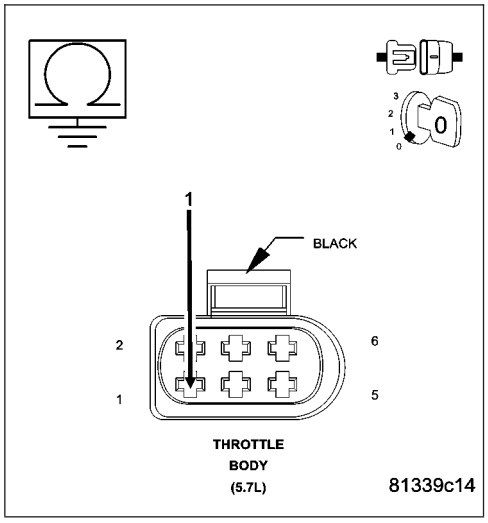




P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

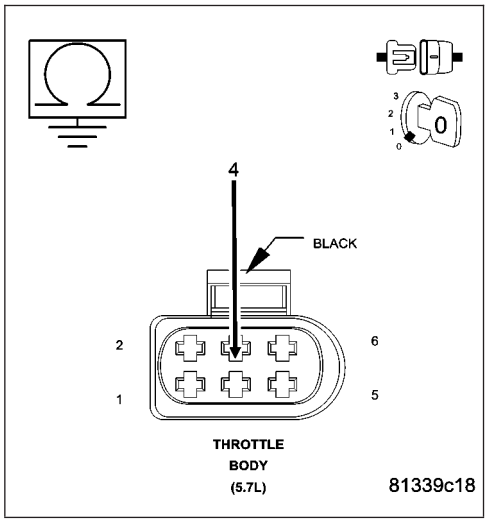
Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit and the (K122) TP Sensor No.2 Signal circuit in Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit or the (K122) TP Sensor No.2 Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

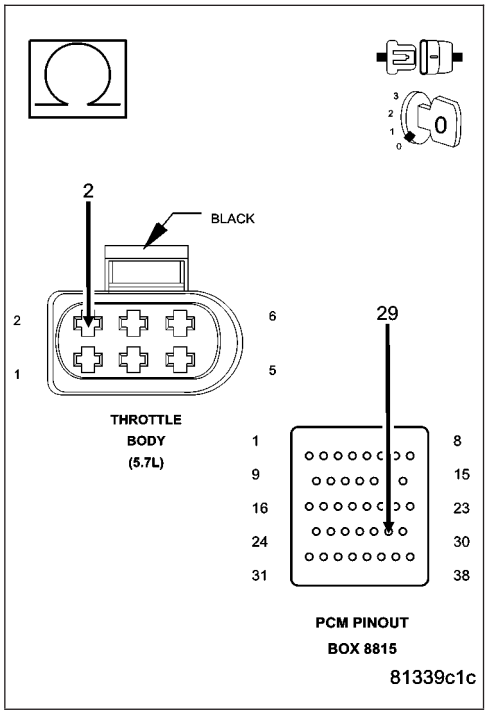
No >> Go To 6



P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

6. EXCESSIVE RESISTANCE IN THE (F855) 5–VOLT SUPPLY CIRCUIT

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

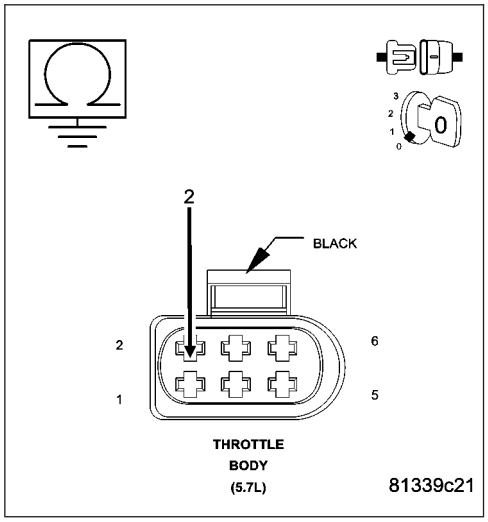
Yes >> Go To 7

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (F855) 5-VOLT SUPPLY SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

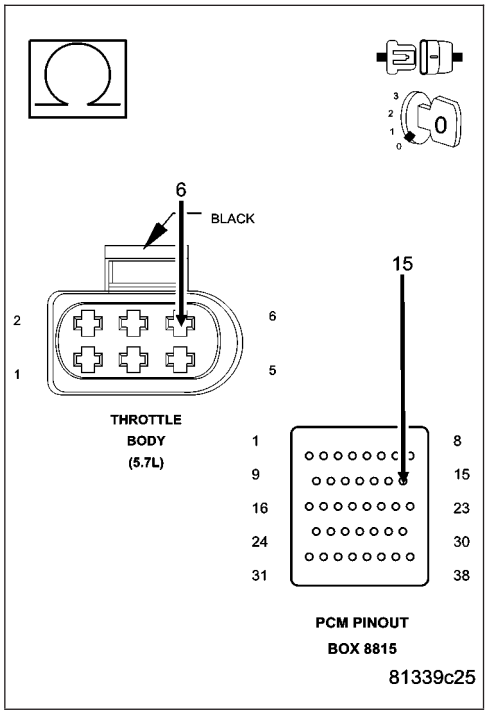
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

8. EXCESSIVE RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



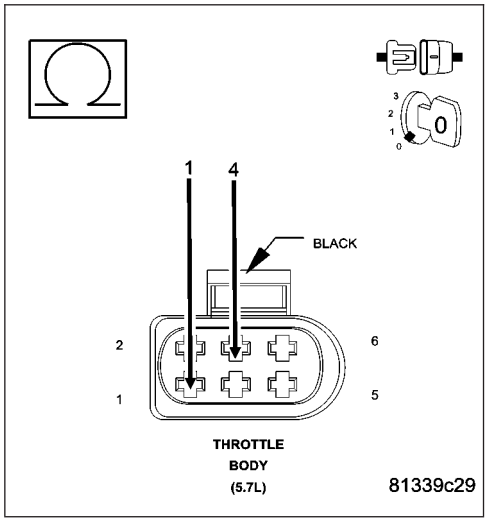
Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K122) TP SENSOR NO.2 SIGNAL CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K122) TP Sensor No.2 Signal circuit in the Throttle Body harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K122) TP Sensor No.2 Signal circuit and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P0121-THROTTLE POSITION SENSOR 1 PERFORMANCE (CONTINUED)

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With a scan tool, perform the Throttle Follower Test and monitor the TP Sensor No.1 or No.2 voltage.

Slowly press the throttle pedal down.

The voltage for TP Sensor No.1 should start at approximately 0.3 of a volt and increase to above 4.7 volts.

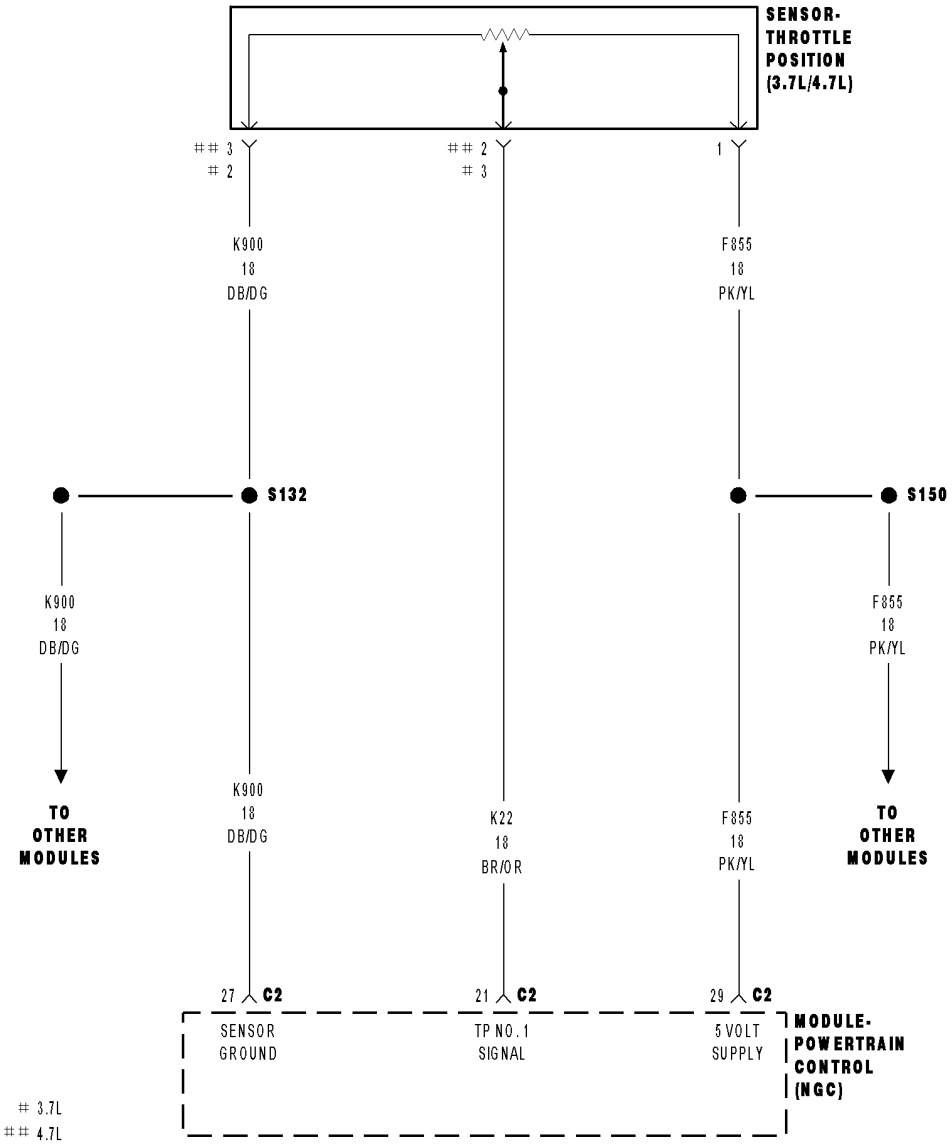
The voltage for TP Sensor No.2 should start at approximately 4.7 volts and decrease to approximately 0.3 of a volt.

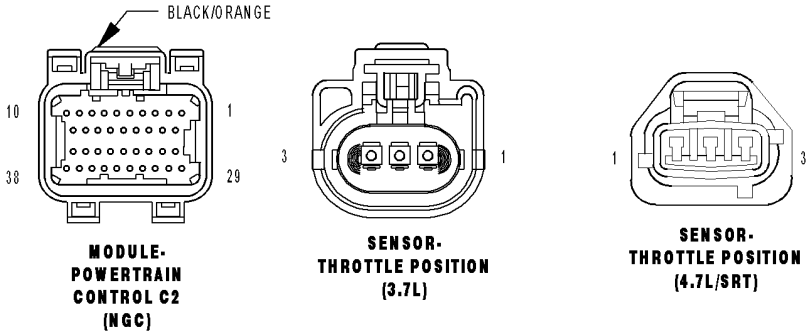
Is the voltage within the range of the listed specification for the appropriate Sensor?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L)





81452da7

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L) (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.0978 of a volt for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. THROTTLE POSITION SENSOR VOLTAGE BELOW 0.098 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the TP Sensor voltage.

Is the voltage below 0.098 of a volt?

Yes >> Go To 2

No >> Go To 9

---

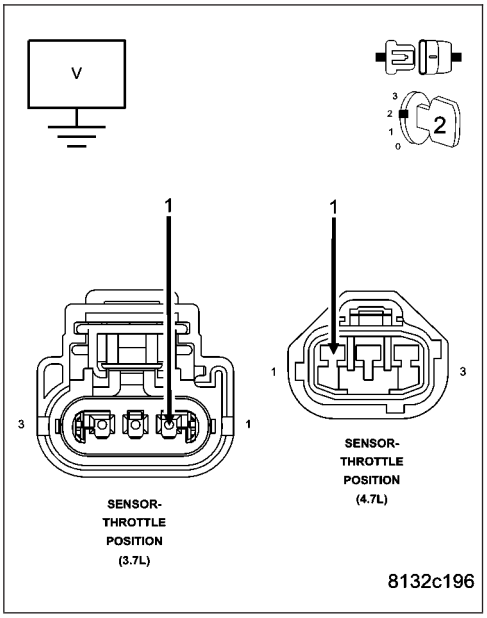
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L) (CONTINUED)

3. THROTTLE POSITION SENSOR

With the a scan tool, monitor the TP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

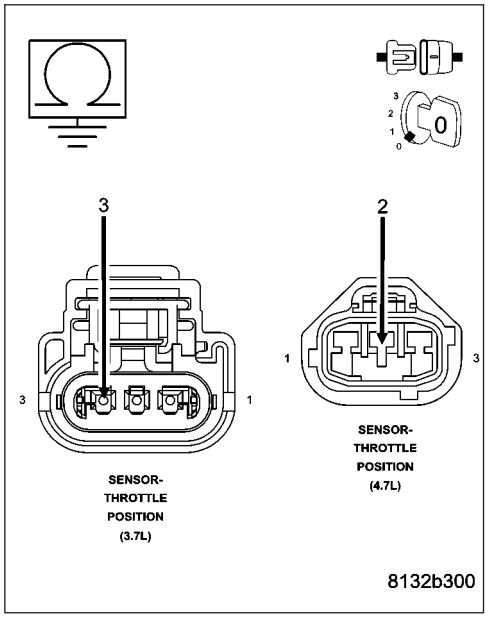
---

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

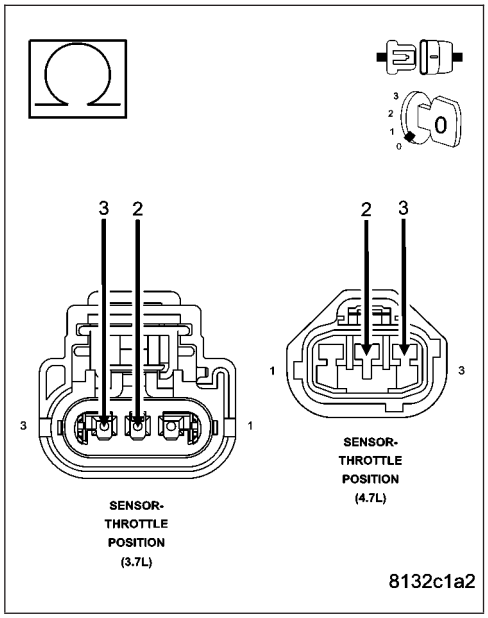
Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L) (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

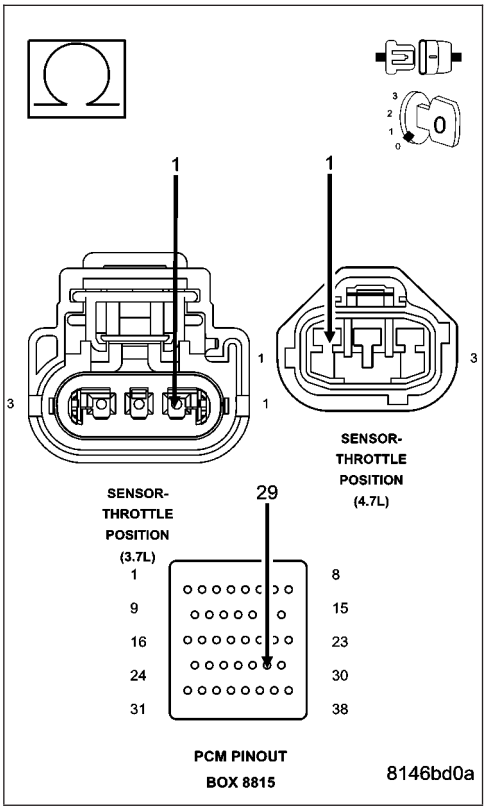
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



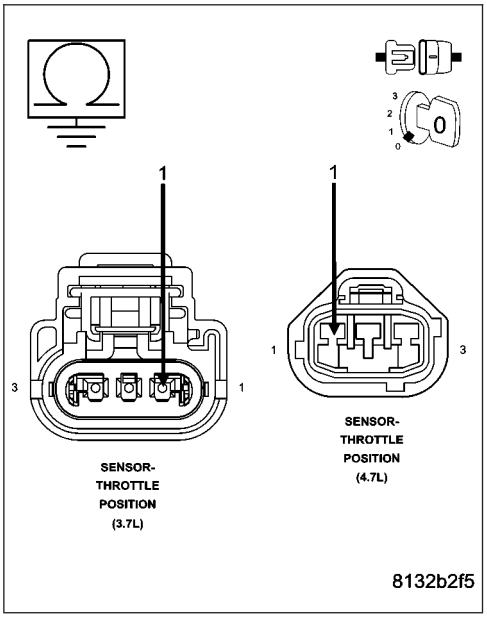
7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (3.7L, 4.7L) (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

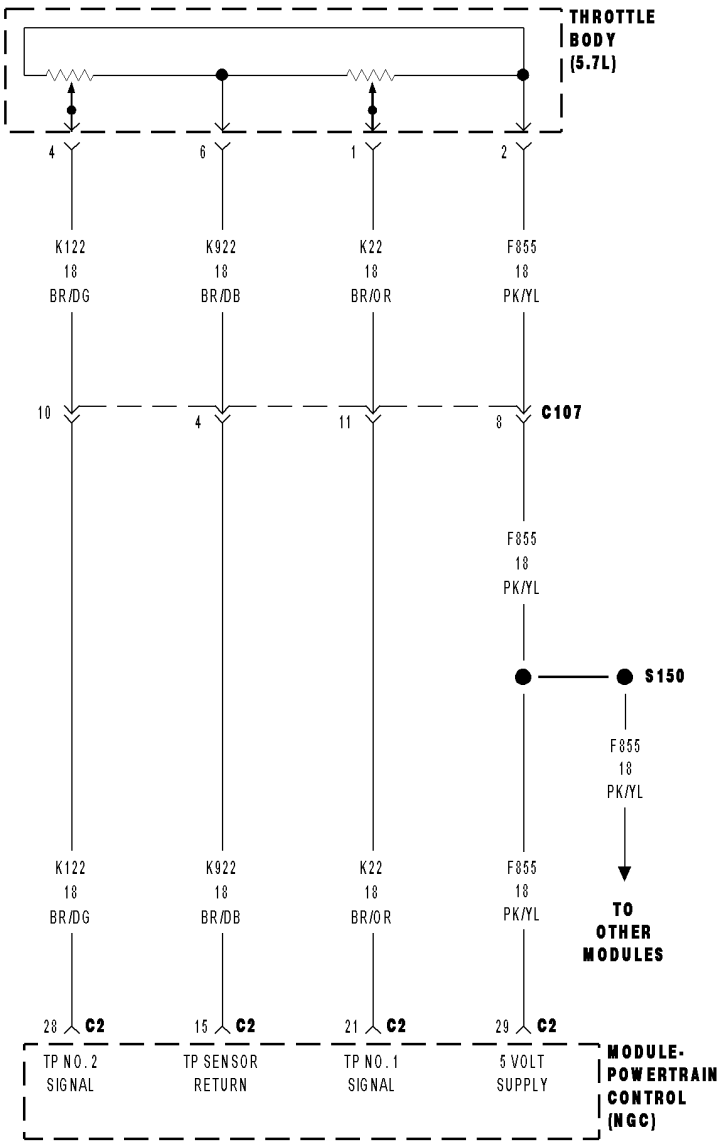
Slowly open the throttle from the idle position to the wide open throttle position.

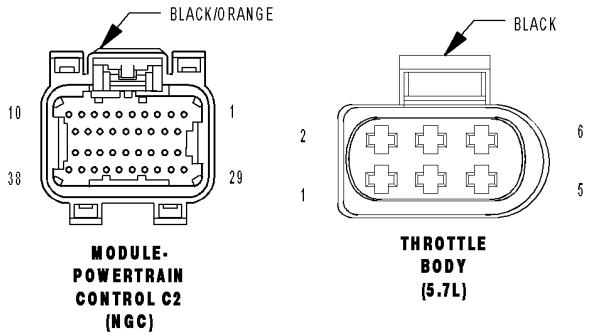
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L)





81452d8c

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L) (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.16 of a volt for 0.7 of a second. One Trip Fault. Three good trips to turn off the MIL. ETC light will illuminate.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K922) SENSOR RETURN CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If a 5-Volt Supply DTC has also set, diagnose the 5-Volt DTC before continuing.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2
No >> Go To 10

---

2. P0222 ALSO SET

Was the P0222-TP SENSOR NO.2 VOLTAGE LOW DTC set along with the P0122?

Yes >> Go To 3
No >> Go To 4

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L) (CONTINUED)

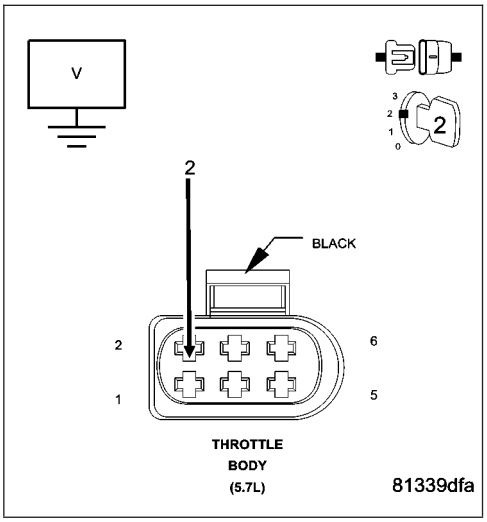
3. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Throttle Body harness connector.



Is the voltage between 4.8 to 5.2 volts?

Yes >> Go To 4

No >> Go To 7

---

4. THROTTLE POSITION SENSOR

With a scan tool, monitor the TP Sensor No.1 voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

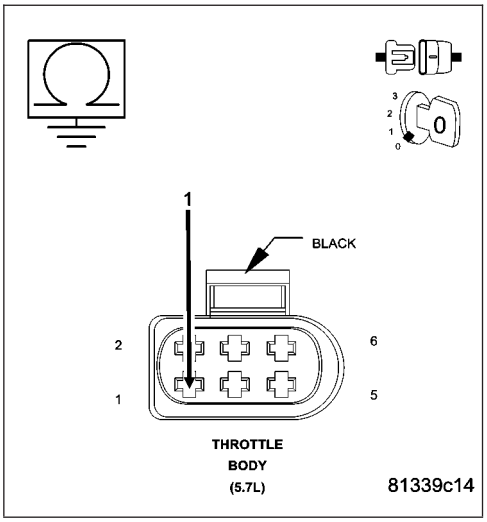
---

5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.

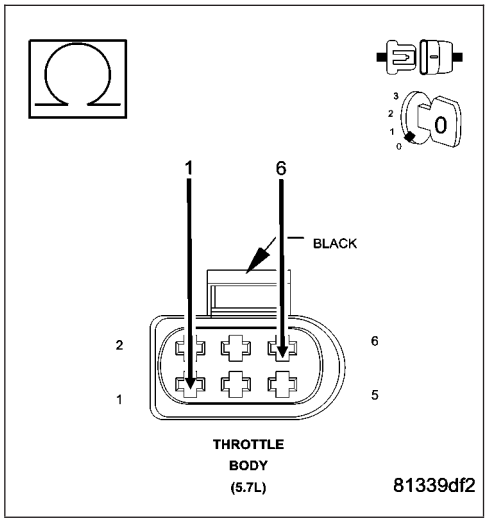
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L) (CONTINUED)

6. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K922) Sensor Return circuit and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

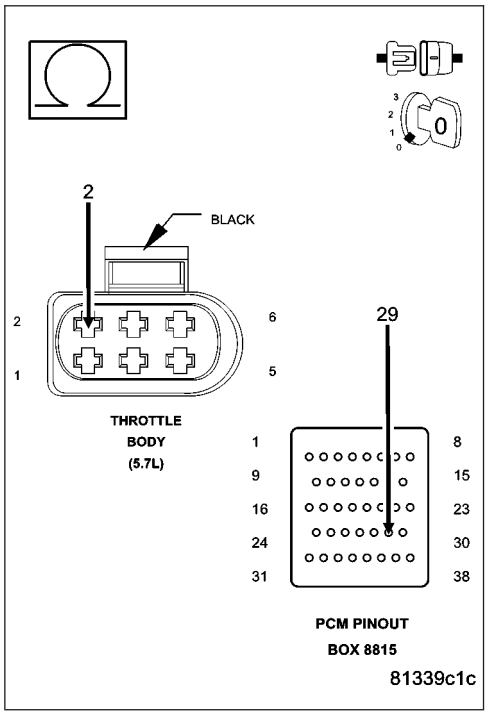
7. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnostics.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

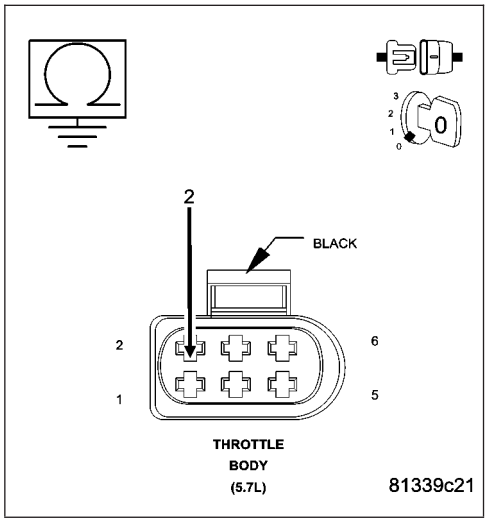
Yes >> Go To 8

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0122-THROTTLE POSITION SENSOR 1 CIRCUIT LOW (5.7L) (CONTINUED)

8. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. THROTTLE FOLLOWER TEST

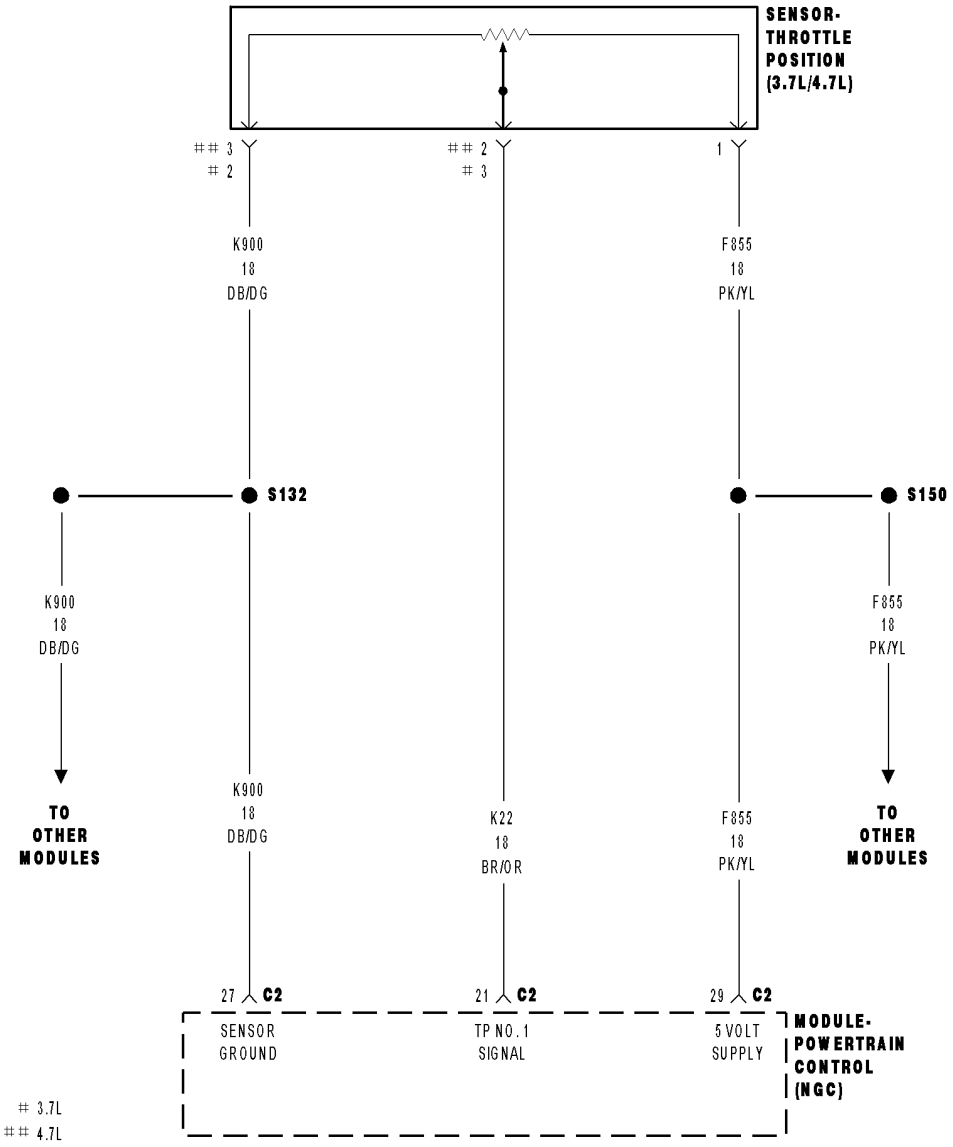
With a scan tool, perform the Throttle Follower Test.
Monitor the TP Sensor No.1 voltage.

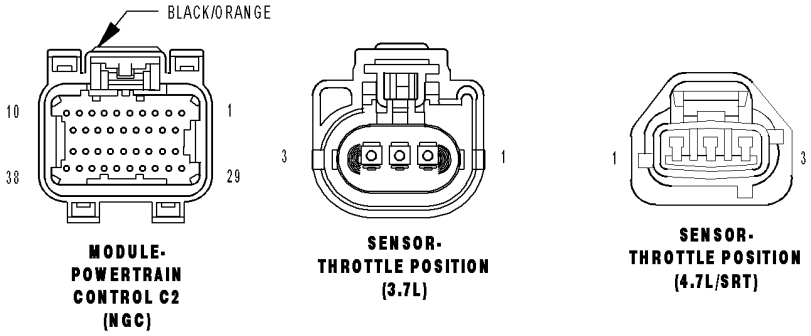
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool select ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L)





81452da7

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L) (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is greater than 4.47 volts for 1.3 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. TP SENSOR VOLTAGE ABOVE 4.5 VOLTS

NOTE: Make sure the throttle is fully closed and free from binding or carbon build up.

Start the engine.

With a scan tool, read the TP Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Go To 2

No >> Go To 8

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L) (CONTINUED)

2. THROTTLE POSITION SENSOR

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

With a scan tool, monitor the TP Sensor voltage.

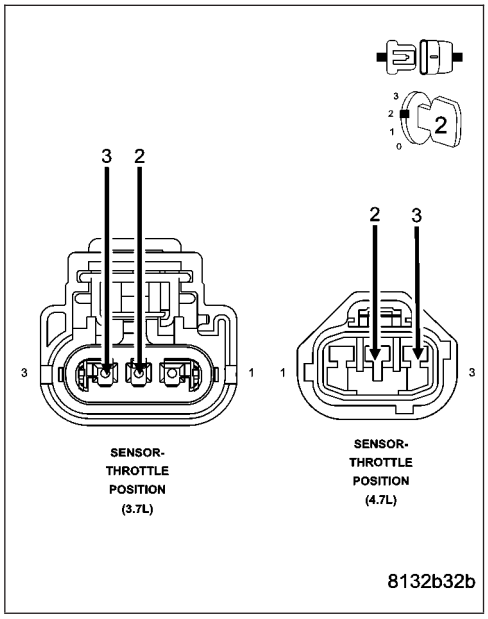
Ignition on, engine not running.

Is the voltage below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

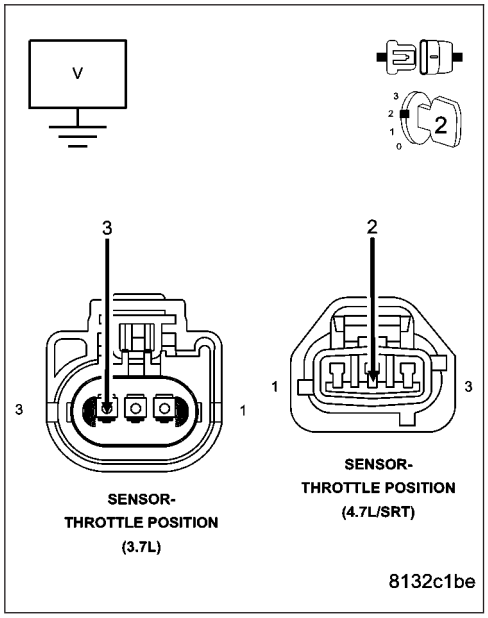
Ignition on, engine not running.

Measure the voltage on the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L) (CONTINUED)

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

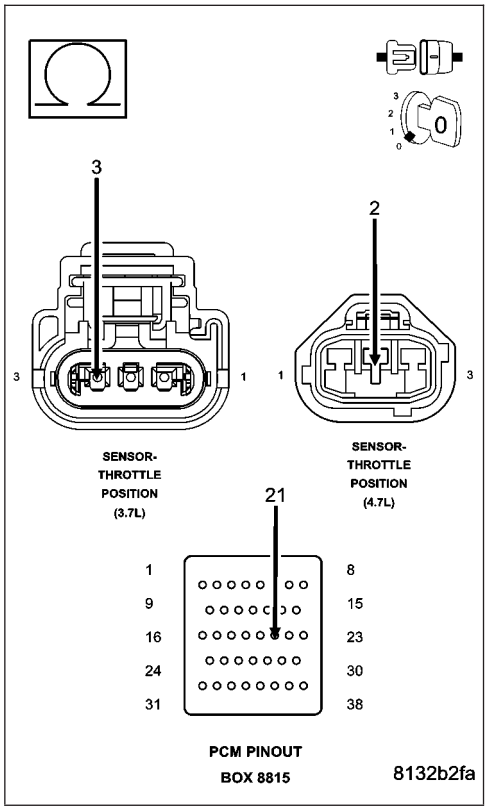
Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

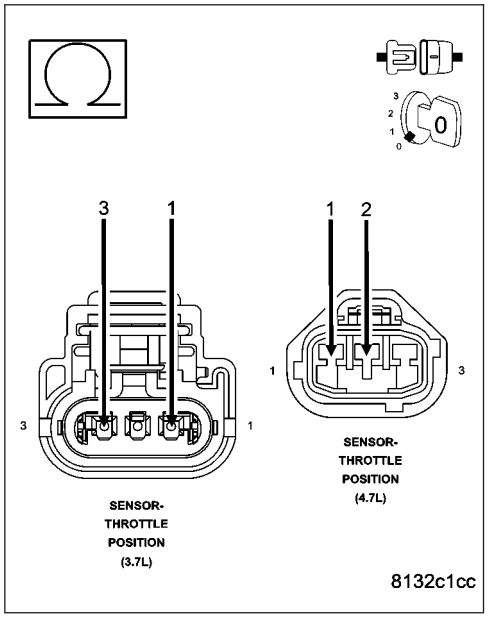
Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

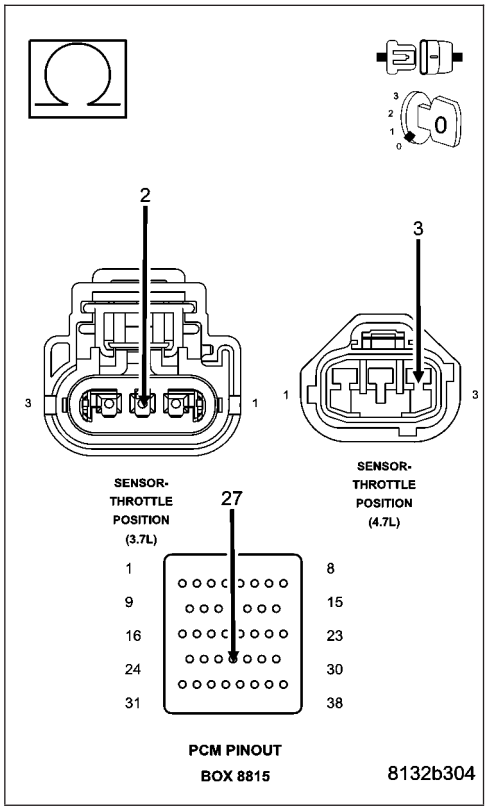
No >> Go To 6



P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (3.7L, 4.7L) (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

8. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

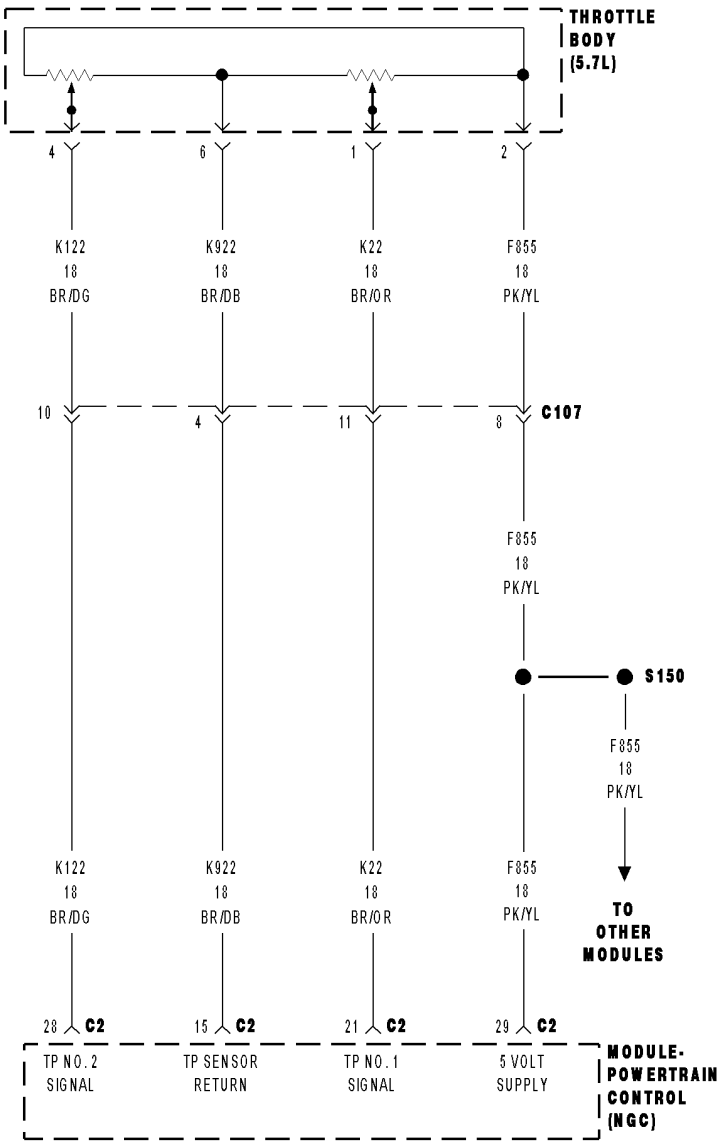
Slowly open the throttle from the idle position to the wide open throttle position.

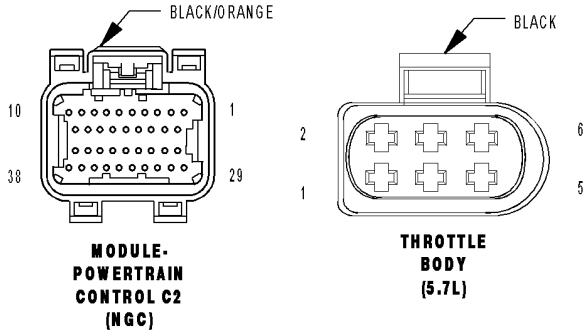
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L)





81452d8c

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L) (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  Throttle Position Sensor No.1 voltage is greater than 4.8 volts for 25 ms. One Trip Fault. 5.7L ETC light will illuminate.

Possible Causes
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K922) SENSOR RETURN CIRCUIT OPEN
THROTTLE POSITION SENSOR/THROTTLE BODY
THROTTLE PLATE JAMMED AGAINST THE MAXIMUM STOP
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. TP SENSOR NO.1 VOLTAGE ABOVE 4.8 VOLTS

NOTE: Make sure the throttle is fully closed and free from binding or carbon build up.

NOTE: If a 5-Volt Supply DTC has also set, diagnose the 5-Volt DTC before continuing.

NOTE: If P2101 is also set, then make sure that the blade moves freely and does not hang up near Wide Open Throttle before trying to repair P0123.

Start the engine.

With a scan tool, read the TP Sensor No.1 voltage.

Is the voltage above 4.8 volts?

Yes >> Go To 2

No >> Go To 8

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L) (CONTINUED)

2. THROTTLE POSITION SENSOR

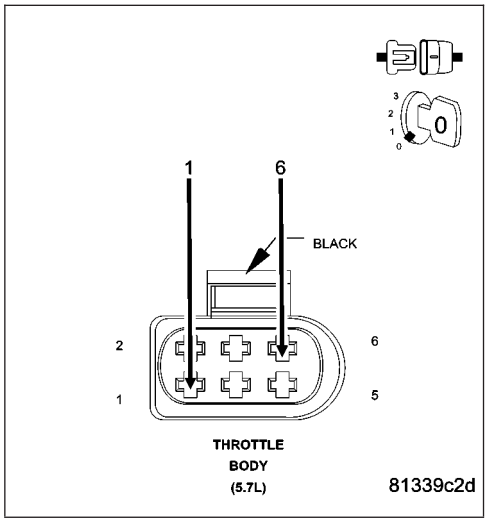
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.

With a scan tool, monitor the TP Sensor No.1 voltage.

Ignition on, engine not running.



Is the voltage below 0.5 of a volt with the jumper wire installed?

Yes >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool, select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

---

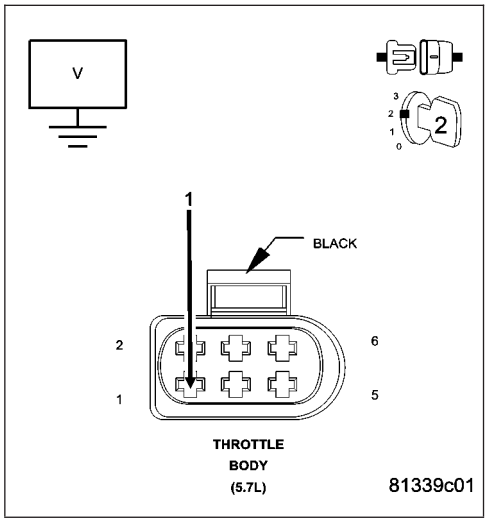
3. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K22) TP Sensor No.1 Signal circuit in the Throttle Body harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L) (CONTINUED)

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

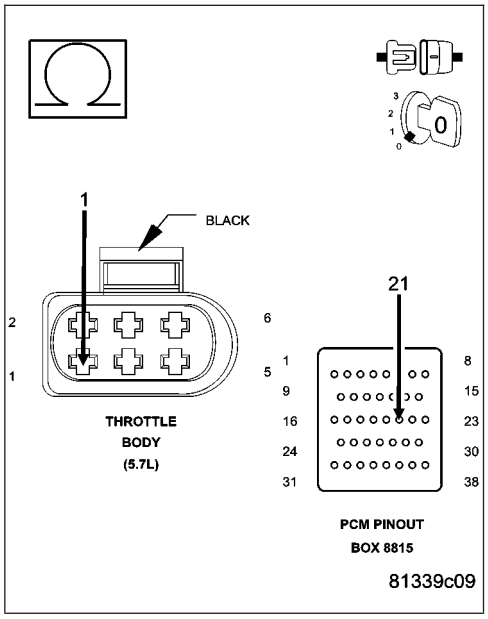
Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

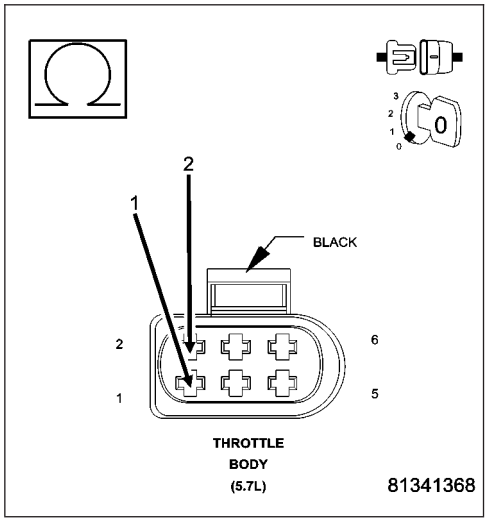
Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

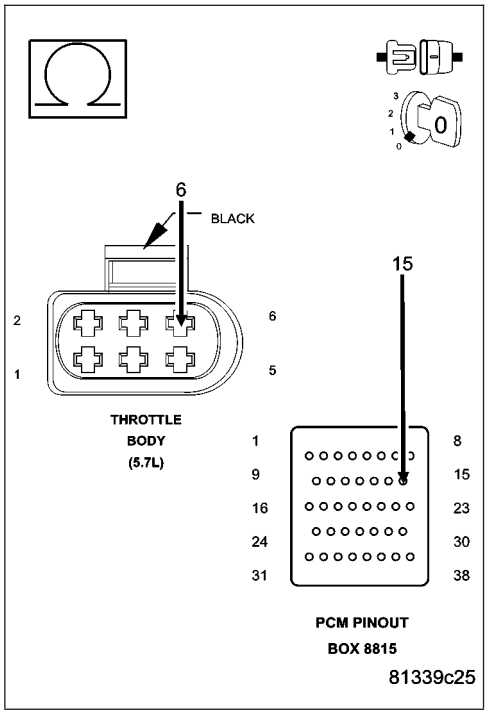
No >> Go To 6



P0123-THROTTLE POSITION SENSOR 1 CIRCUIT HIGH (5.7L) (CONTINUED)

6. (K922) SENSOR RETURN CIRCUIT OPEN

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. THROTTLE FOLLOWER TEST

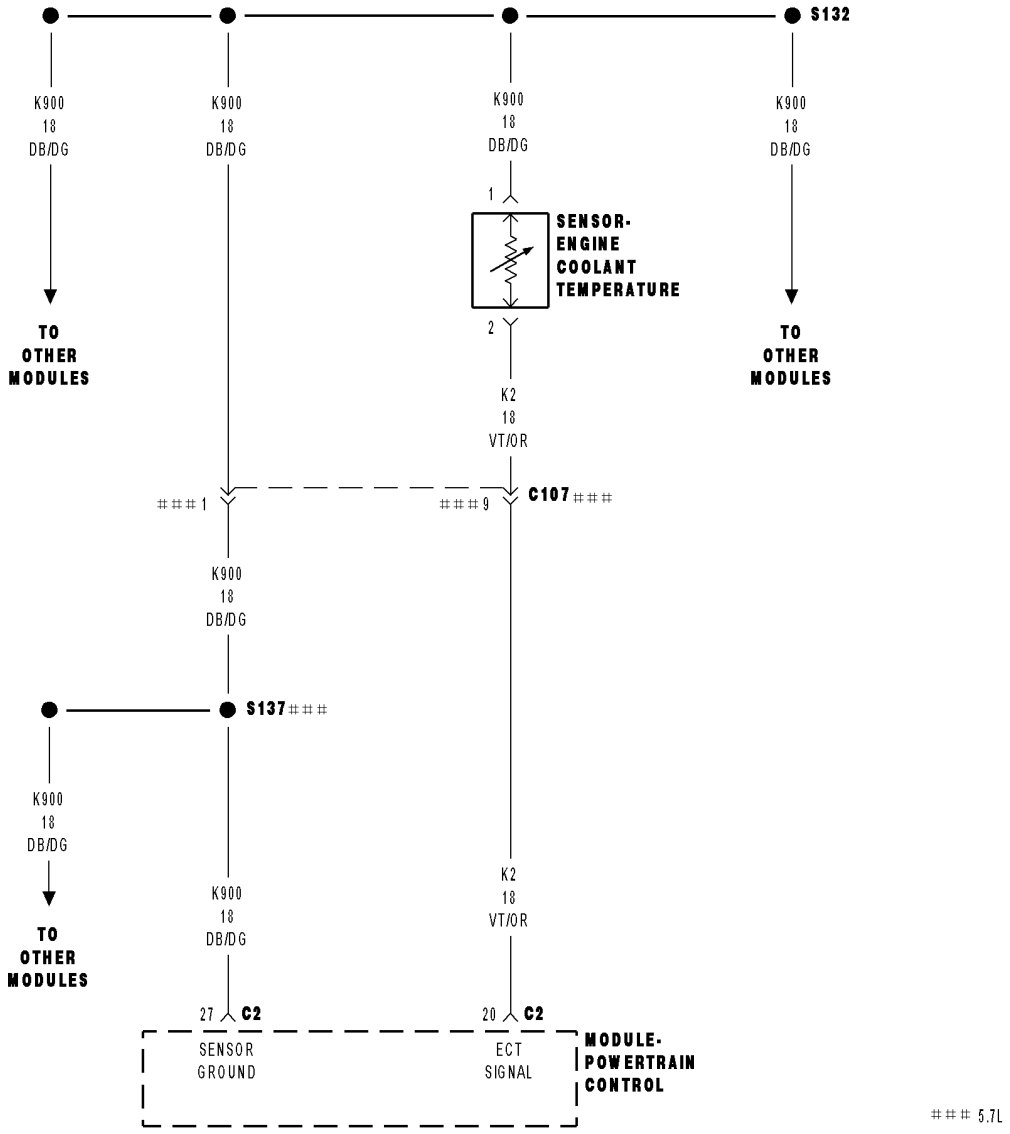
With a scan tool, perform the Throttle Follower Test.
Monitor the TP Sensor No.1 voltage.

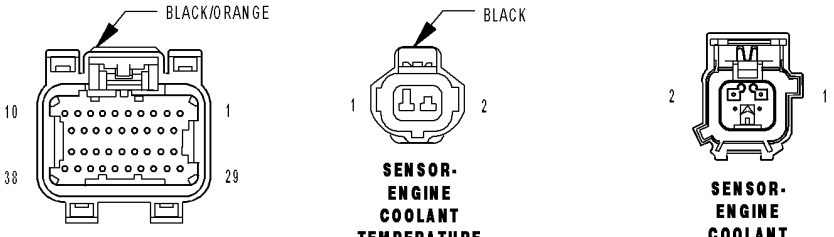
Does voltage start at approximately 0.3 of a volt and go above 4.7 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL





81452d65

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

For the Engine System circuit diagrams Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low. The INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL determines if the engine coolant temperature will reach the closed loop fueling control temperature limit in a regulated time after start.

- **When Monitored:**
  With battery voltage greater than 10.4 volts and after engine is started.
- **Set Condition:**
  The engine temperature does not go above -10°C (15°F). Failure time depends on start-up coolant temperature and ambient temperature. (i.e. 2 minutes for a start temp of -10°C (15°F) or up to 10 minutes for a vehicle with a start-up temp of -28°C (5°F). Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT
ECT SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CHECKING COOLANT LEVEL AND CONDITION

Ignition on, engine not running.

With a scan tool, read DTCs.

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes >> Go To 2

No >> Inspect the vehicle for a coolant leak, make the appropriate repairs, and add the correct amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

2. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool Eng Coolant Tmp Deg values should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 3

No >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ECT SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

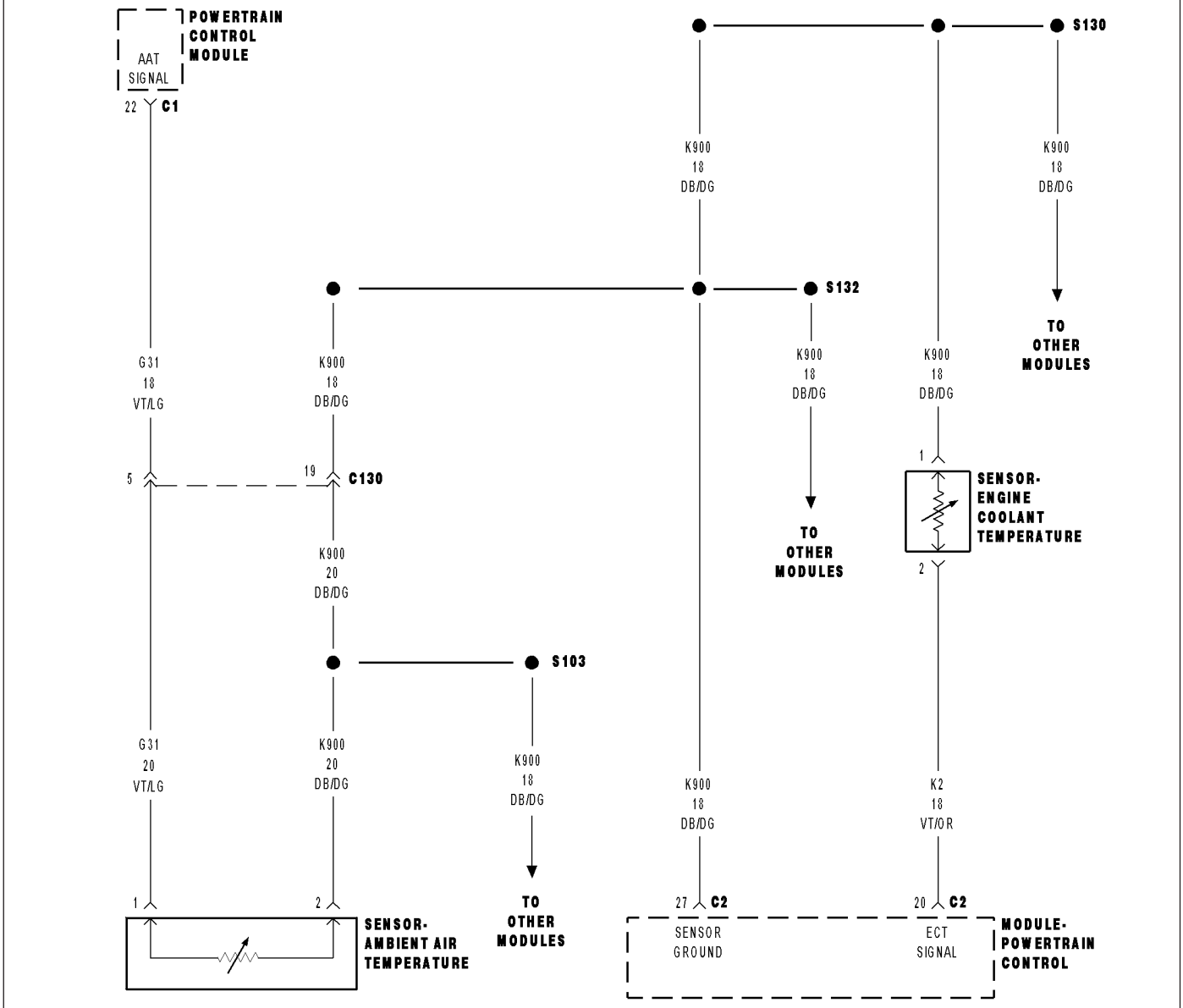
NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tools Eng Coolant Tmp Deg value should stay relatively close to each other.

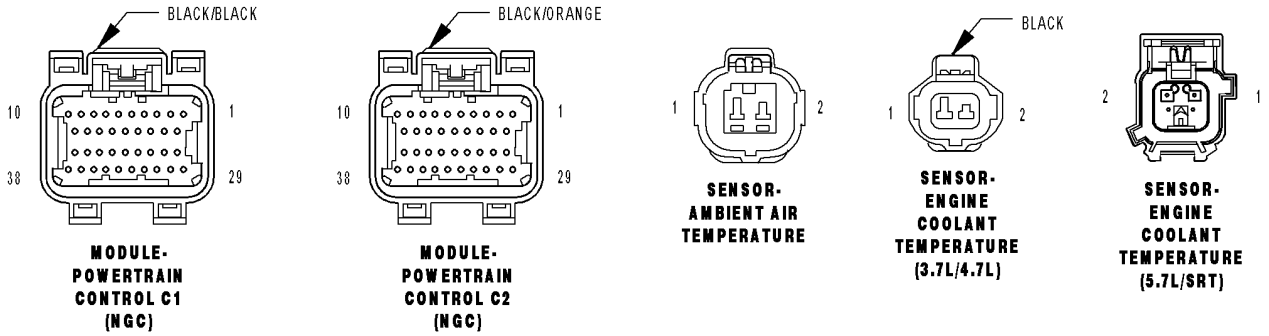
Is the thermometer reading relatively close to the scan tool ECT reading?

Yes >> Test Complete.

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0128-THERMOSTAT RATIONALITY





81452dd2

P0128-THERMOSTAT RATIONALITY (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM predicts a coolant temperature value that it will compare to the actual coolant temperature. A significant difference results in an error. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT OPERATION
SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
TEMPERATURE SENSOR
SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
SIGNAL CIRCUIT SHORTED TO GROUND
SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
OTHER POSSIBLE CAUSES
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any ECT, AAT, CMP or CKP sensor DTCs have set along with P0128, diagnose them before continuing.

NOTE: Make sure that the Pinion Factor has been programmed correctly into the PCM.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0128-THERMOSTAT RATIONALITY (CONTINUED)

2. LOW COOLANT LEVEL

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death. Allow the engine to cool before opening the cooling system.

Check the coolant system to make sure that the coolant is in good condition and at the proper level.

Is the coolant level and condition OK?

Yes >> Go To 3

No >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the ECT Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool, ECT Temperature value should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 4

No >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. AMBIENT AIR TEMP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read and record the AAT Sensor Temperature value.

Using the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the ambient air temperature near the AAT Sensor.

Is the AAT Sensor value with -15°C (5°F) of the temperature probe reading?

Yes >> Go To 5

No >> Go To 7

P0128-THERMOSTAT RATIONALITY (CONTINUED)

5. ECT SENSOR OPERATION

WARNING: Make sure the engine cooling system is cool before removing the pressure cap or any hose. The cooling system is pressurized when hot. Failure to follow these instructions can result in personal injury including extreme burns, scalding, or death.

With a scan tool, read and record the ECT Sensor Temperature value.

Use the DRB Temperature Probe #CH7050, or an equivalent temperature measuring tool, measure the engine coolant temperature.

Is the ECT Sensor value with -15°C (5°F) of the temperature probe reading?

Yes >> Go To 6

No >> Go To 7

---

6. OTHER POSSIBLE CAUSES

Inspect the Temperature Sensors for any physical damage.

Inspect the engine coolant. Make sure the coolant is at the proper level. Refer to the Service Information COOLING.

Make sure the Temperature Sensors are properly installed.

Make sure the CMP and CKP sensors are installed properly. Check the connectors for any signs of damage.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

With the engine running at normal operating temperature, monitor the Temperature sensor parameters while wiggling the wire harness. Look for parameter values to change.

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Inspect and clean all PCM, engine, and chassis grounds.

Were any problems found during the above inspections?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0128-THERMOSTAT RATIONALITY (CONTINUED)

7. SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

NOTE: Visually inspect both the component and the PCM connectors. Look for damage, partially broken wires and backed out or corroded terminals

Turn the ignition off.

Disconnect the applicable Temperature Sensor harness connector.

Disconnect the C2 PCM harness connector.

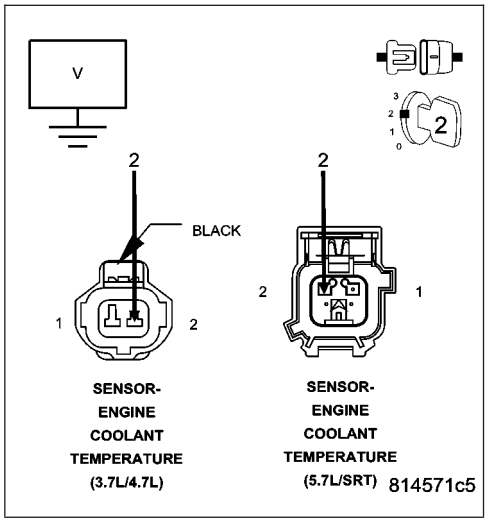
Ignition on, engine not running.

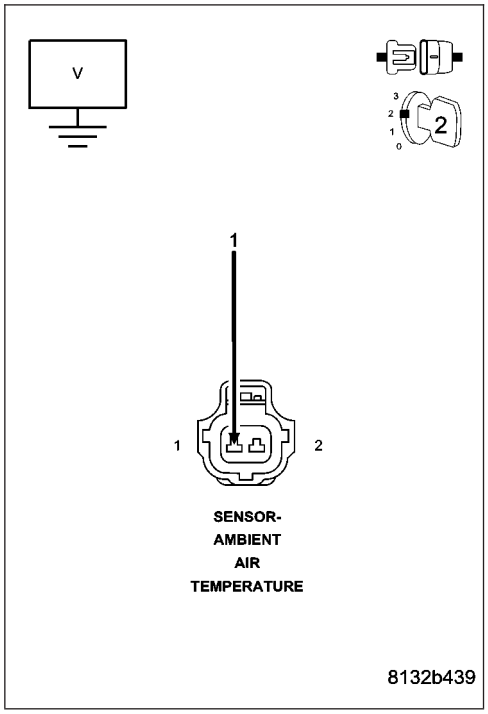
Measure the voltage on the (K2) ECT Signal circuit and the (G31) AAT Signal circuit at the appropriate Temperature Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8





P0128-THERMOSTAT RATIONALITY (CONTINUED)

8. TEMPERATURE SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire across the ECT and AAT Sensor harness connectors.

Ignition on, engine not running.

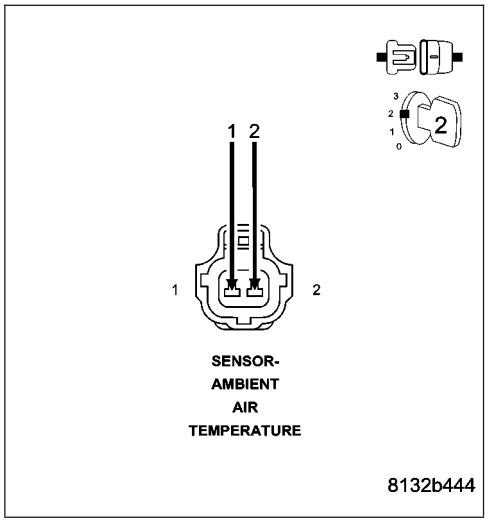
With a scan tool, read the Temperature Sensor voltage.

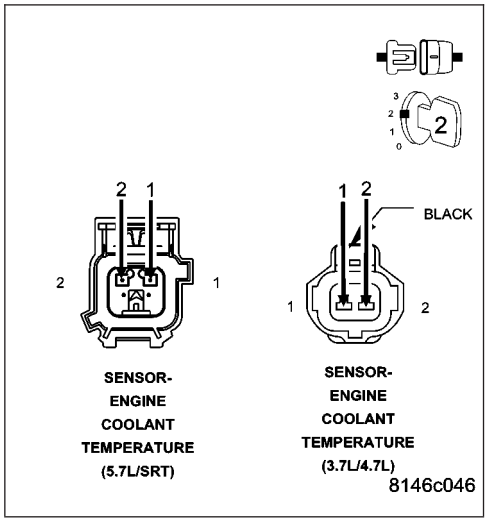
Does the voltage start at 5.0 volts and drop below 1.0 volt when the jumper wire is installed?

Yes >> Replace the appropriate Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Disconnect the jumper wire before continuing.





P0128-THERMOSTAT RATIONALITY (CONTINUED)

9. SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

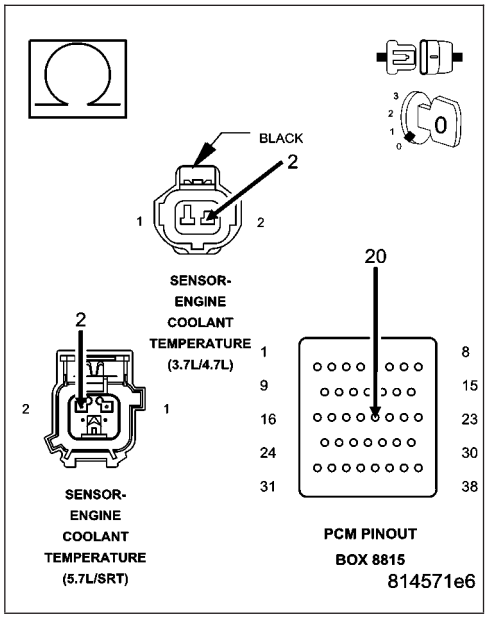
Measure the resistance of the (K2) ECT Sensor Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

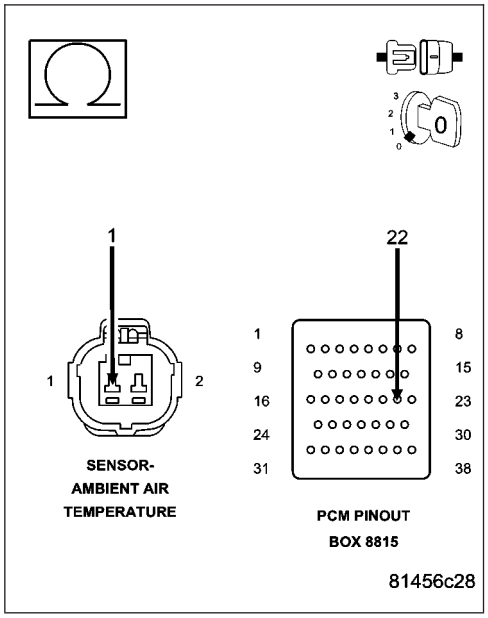
Measure the resistance of the (G31) AAT Sensor Signal circuit from the AAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))





P0128-THERMOSTAT RATIONALITY (CONTINUED)

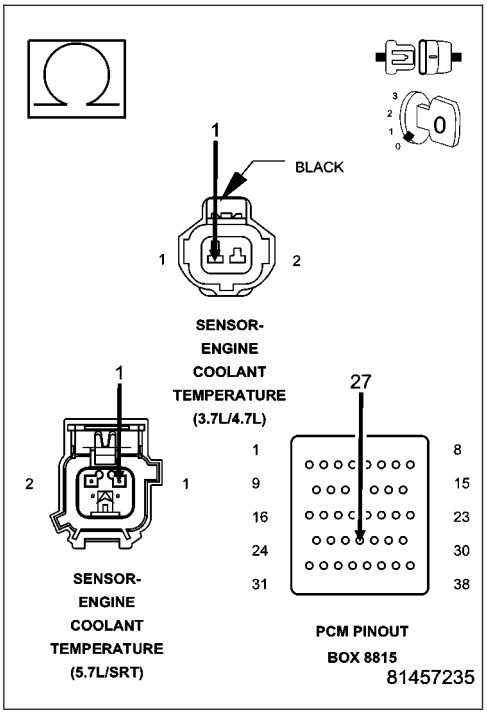
10. SENSOR GROUND CIRCUIT OPEN

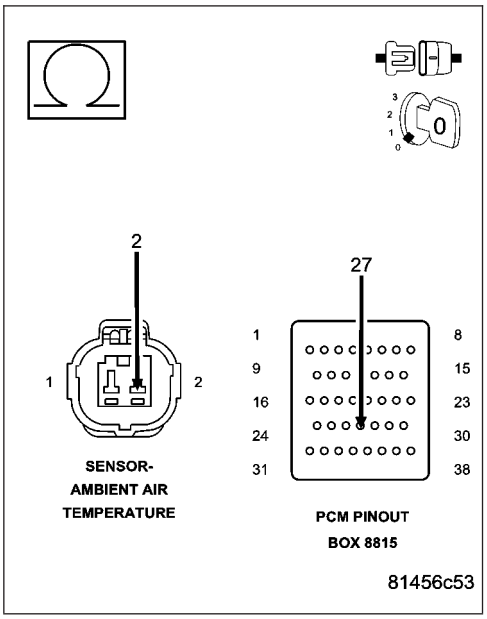
Measure the resistance of the (K900) Sensor ground circuit from the appropriate Temperature Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 11

No >> Repair the open in the Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P0128-THERMOSTAT RATIONALITY (CONTINUED)

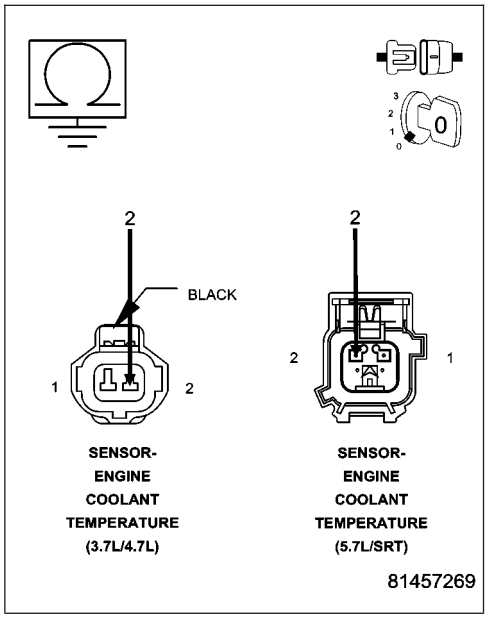
11. SIGNAL CIRCUIT SHORTED TO GROUND

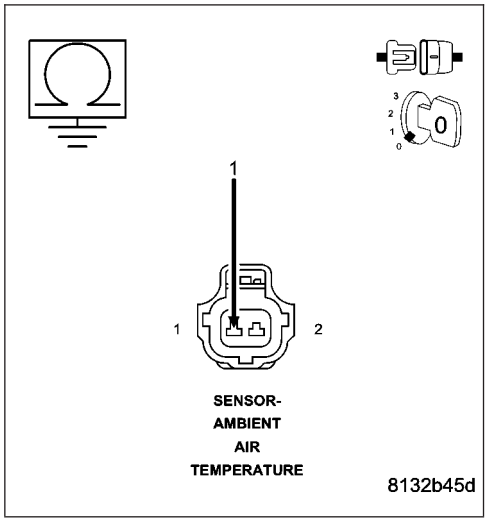
Measure the resistance between ground and the Sensor Signal circuit in the Temperature Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12





P0128-THERMOSTAT RATIONALITY (CONTINUED)

12. SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

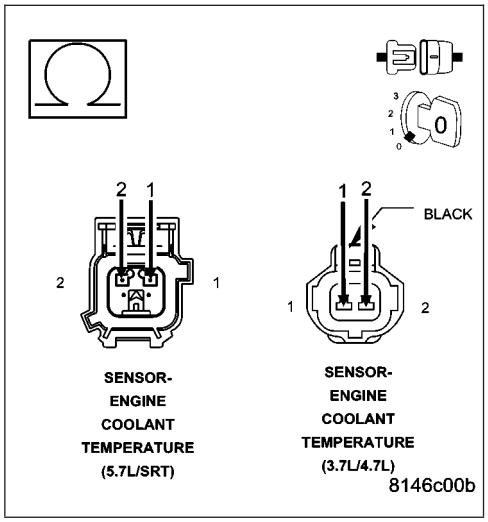
Measure the resistance between the Signal circuit and the (K900) Sensor ground circuit in the (K2) ECT Sensor harness connector.

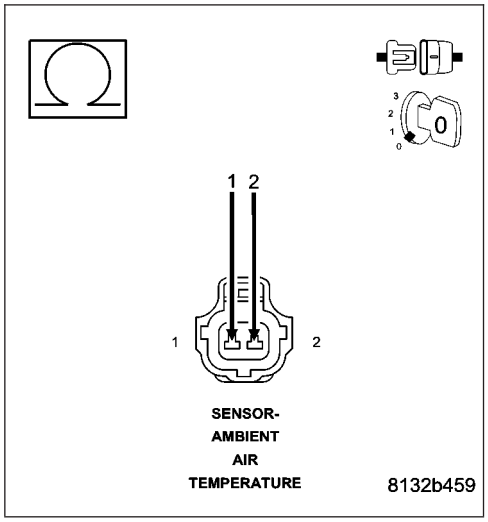
Measure the resistance between the Signal circuit and the (K900) Sensor ground circuit in the (G31) AAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the appropriate Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13





13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

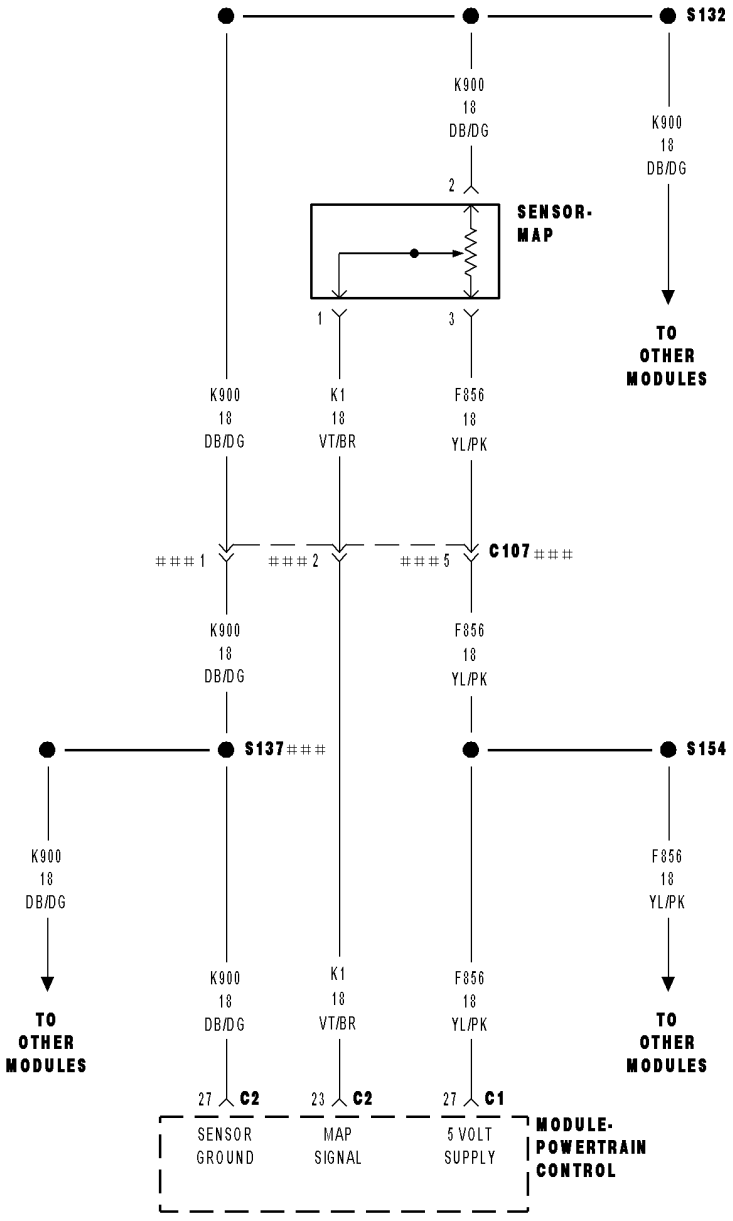
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

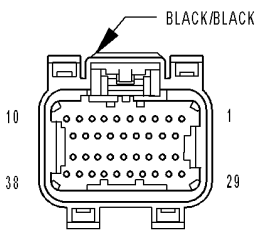
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

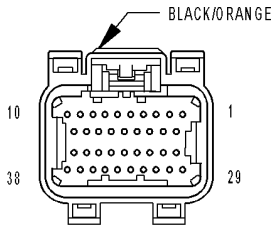
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW

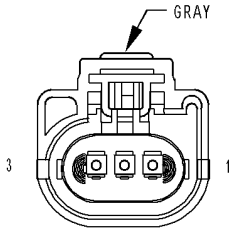




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
MAP
(GAS)

81452cc9

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. No Cam or Crank signal within 75 ms. Engine speed less than 250 RPM.
- **Set Condition:**
  The PCM senses the voltage from the MAP sensor to be less than 2.2 volts but above 0.04 of a volt for 300 milliseconds. One Trip Fault. Three good trips to turn off the MIL. (5.7L ETC lamp will flash)

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time.

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

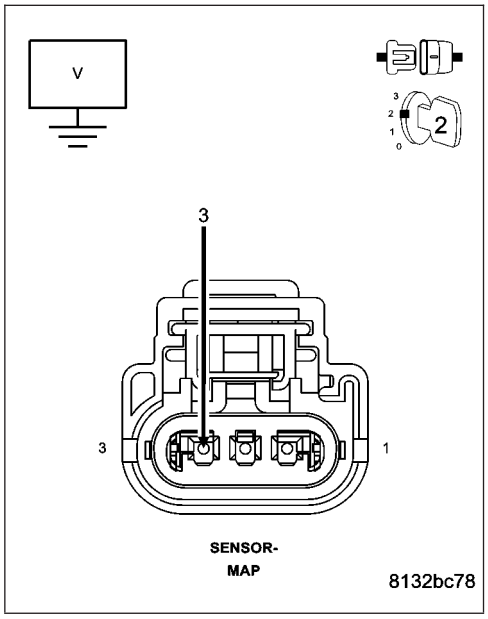
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 7

3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 2.2 volts?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

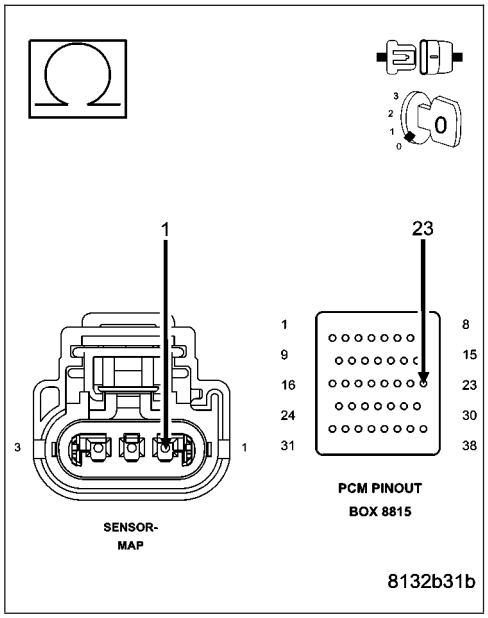
4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

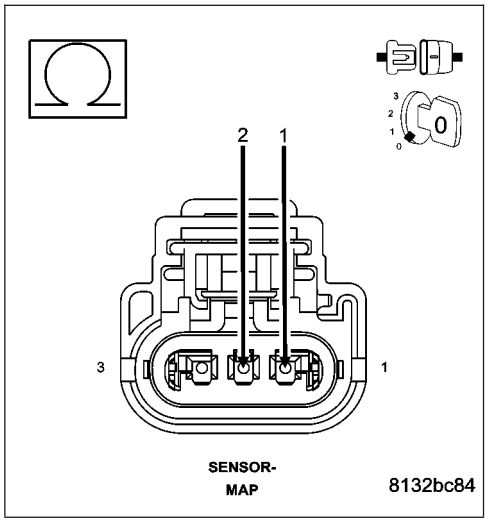
Yes >> Go To 5

No >> Repair the open in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



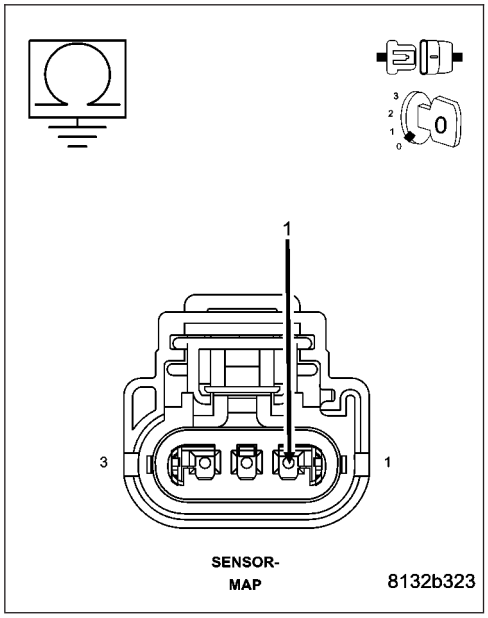
Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

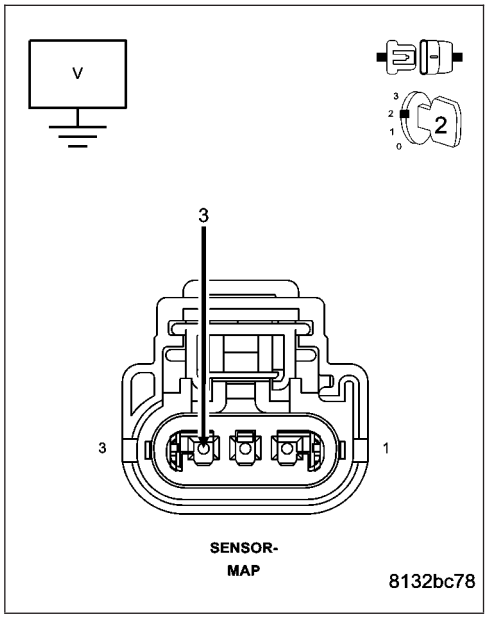
7. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

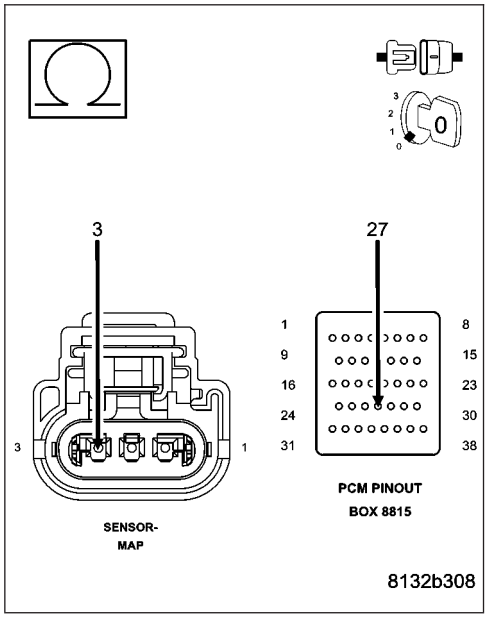
---

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

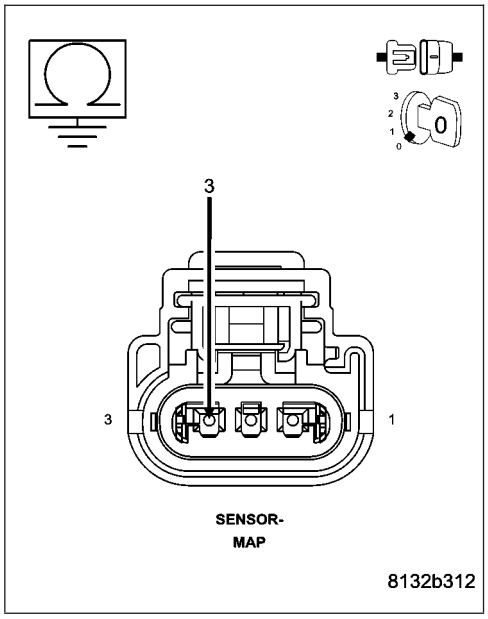
Yes >> Go To 9

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0129-BAROMETRIC PRESSURE OUT-OF-RANGE LOW (CONTINUED)

9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

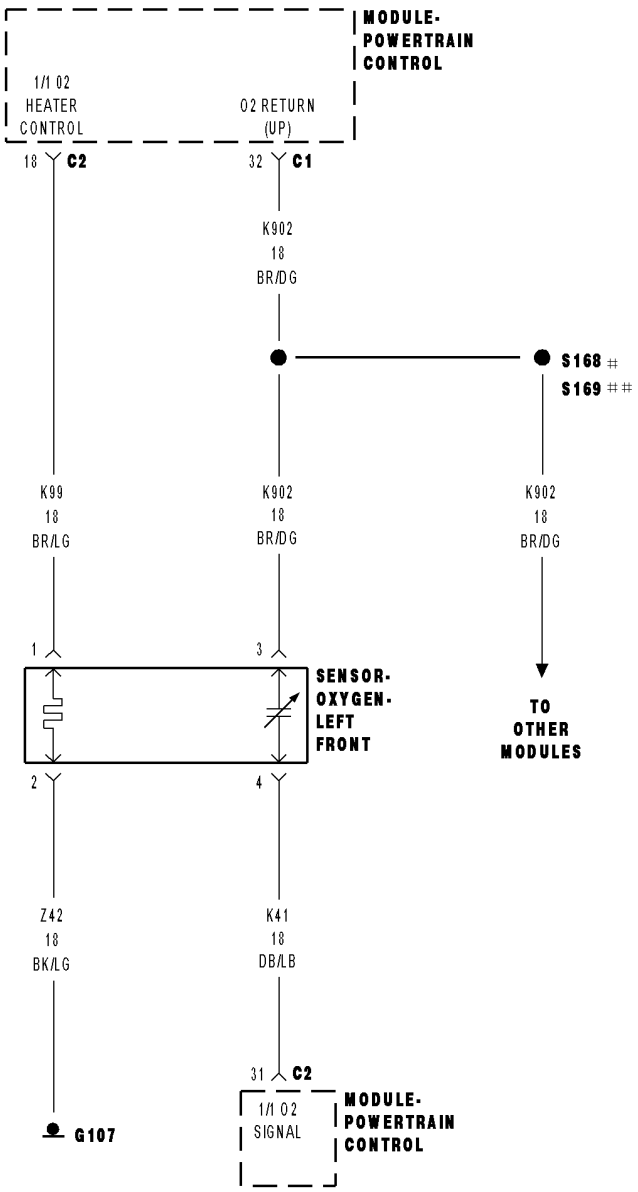
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

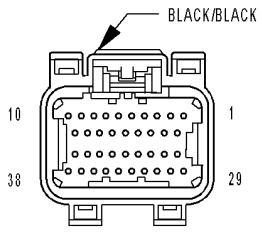
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

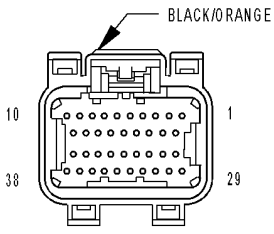
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0131-O2 SENSOR 1/1 CIRCUIT LOW

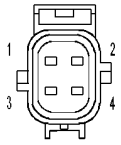




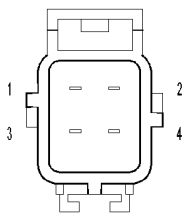
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
LEFT
FRONT
(3.7L/5.7L)



SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)

81452b01

P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.4 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 6 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/1 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 1/1 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 1/1 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the O2 Sensor voltage.

Is the 1/1 O2 Sensor voltage above 4.8 volts?

Yes >> Go To 3

No >> Go To 5

P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

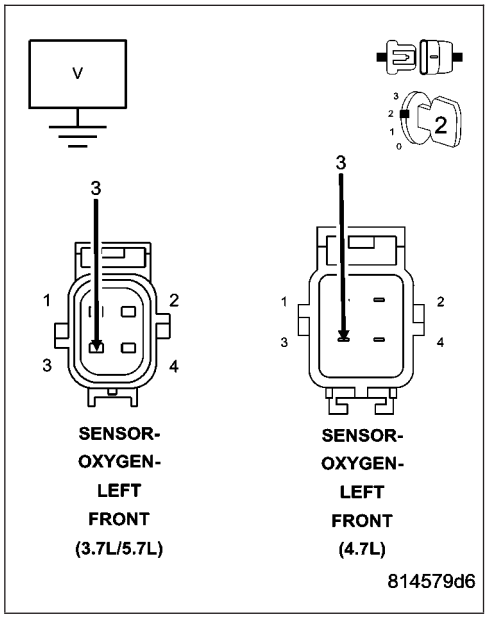
3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

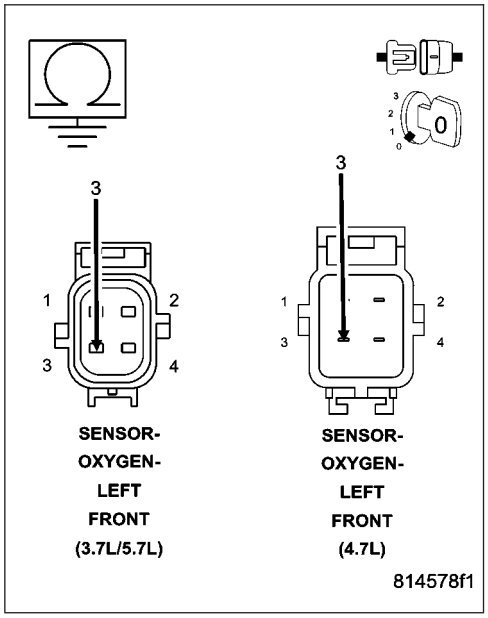
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K902) O2 Return Upstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

5. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

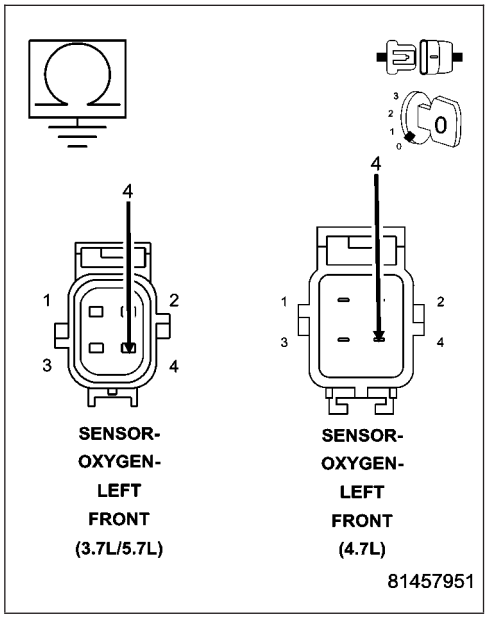
Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K41) O2 Sensor 1/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

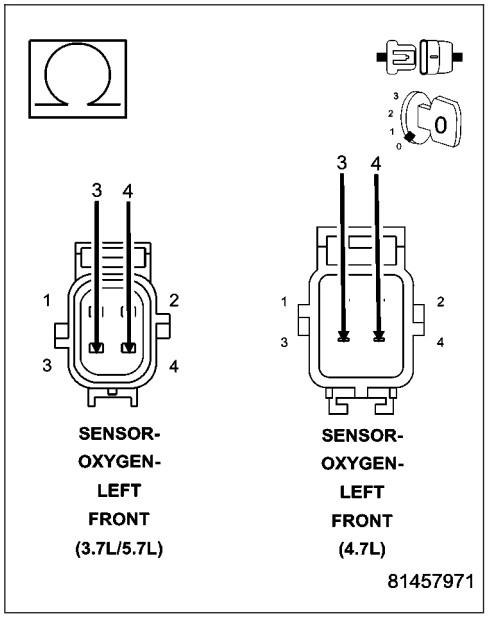
Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K902) O2 Return Upstream circuit and the (K41) O2 Sensor 1/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

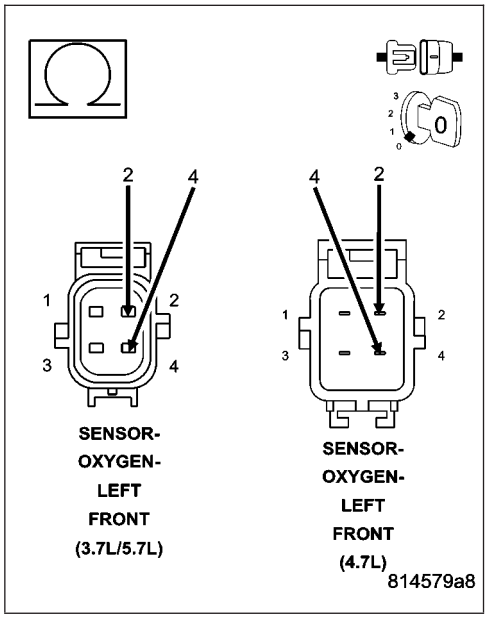
No >> Go To 7



P0131-O2 SENSOR 1/1 CIRCUIT LOW (CONTINUED)

7. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (Z42) O2 1/1 HEATER GROUND CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z42) O2 1/1 Heater ground circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

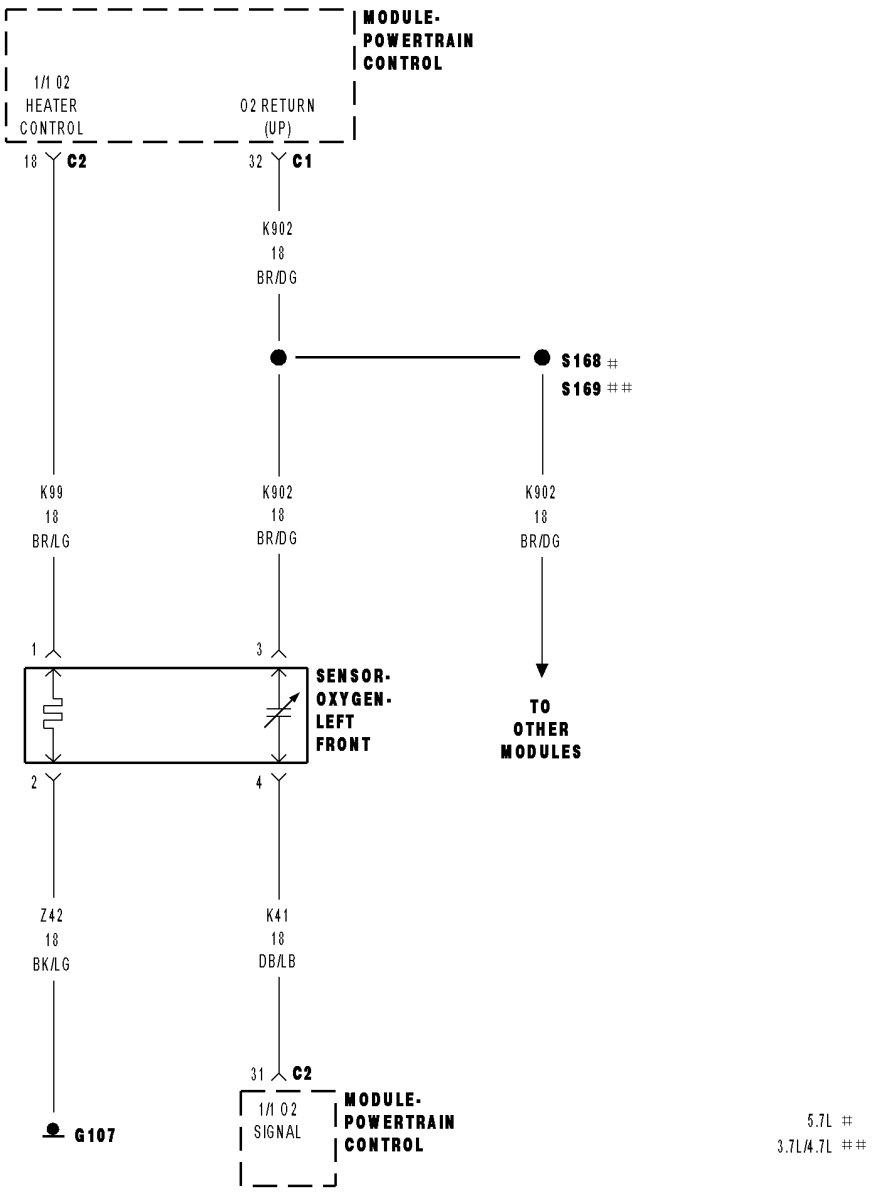
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

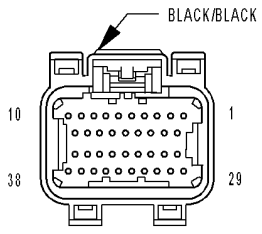
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

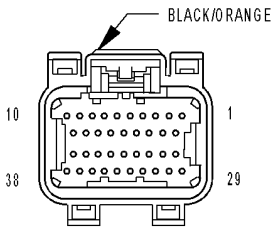
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT HIGH

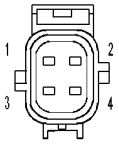




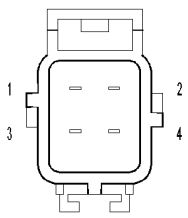
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
LEFT
FRONT
(3.7L/5.7L)



SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)

81452b01

P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 40 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K41) O2 1/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/1 O2 Sensor voltage.

Is the voltage above 3.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

2. (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/1 O2 Sensor harness connector.

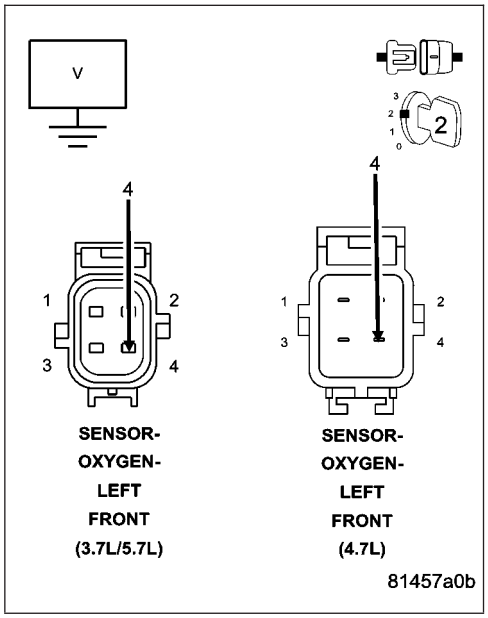
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the 1/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

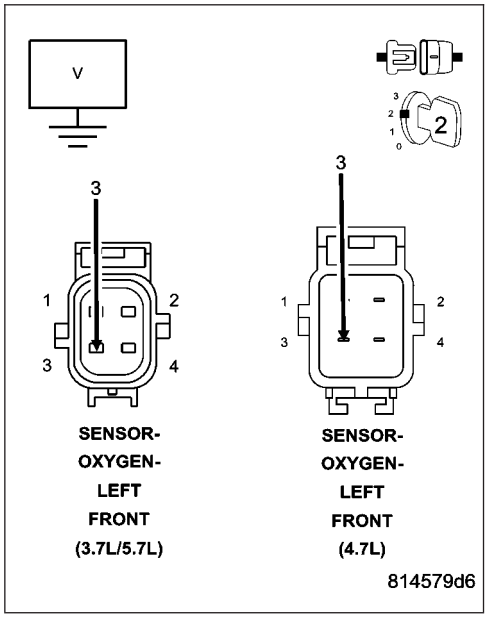
Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K902) O2 Return Upstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

4. 1/1 O2 SENSOR

Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K41) O2 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

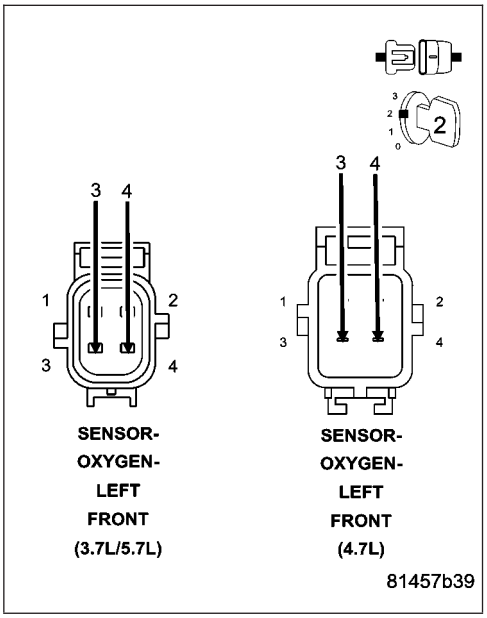
With a scan tool, monitor the 1/1 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K41) O2 1/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

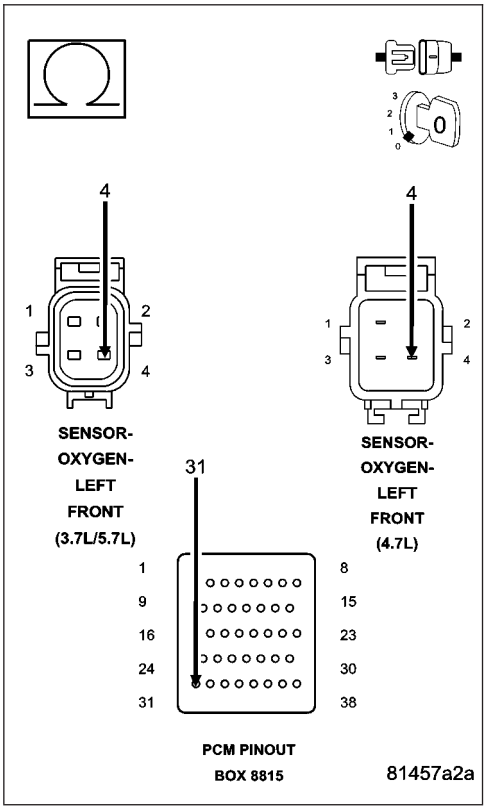
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K41) O2 1/1 Signal circuit from the 1/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

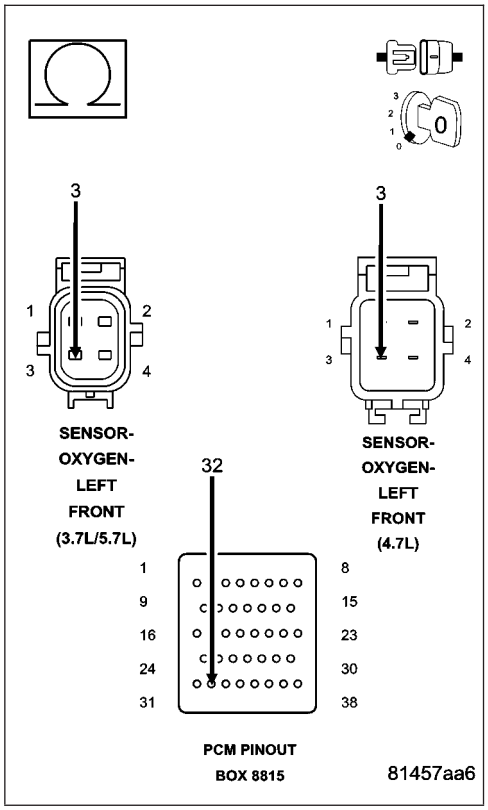
No >> Repair the open in the (K41) O2 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0132-O2 SENSOR 1/1 CIRCUIT HIGH (CONTINUED)

6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K902) O2 Return Upstream circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

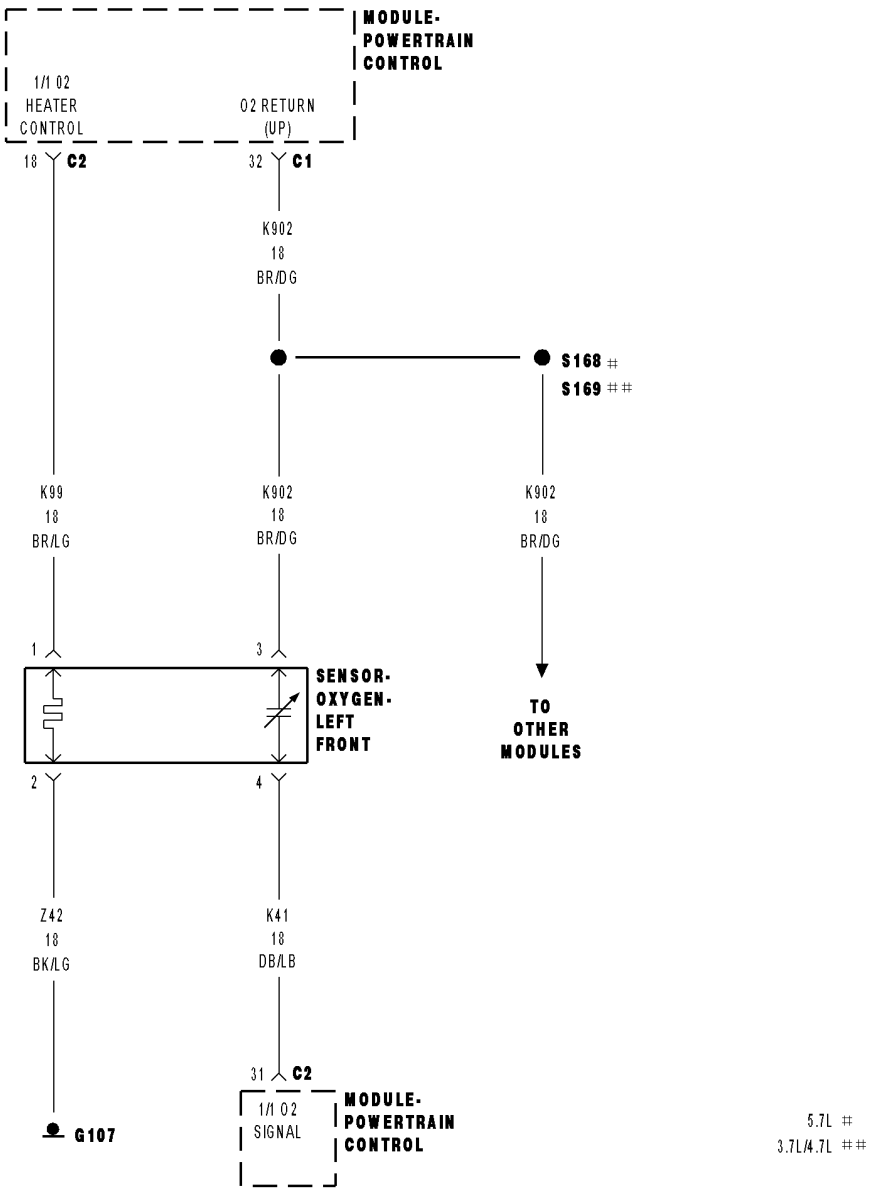
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

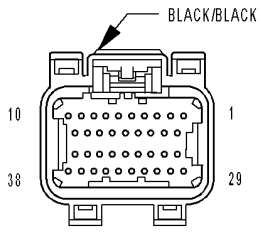
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

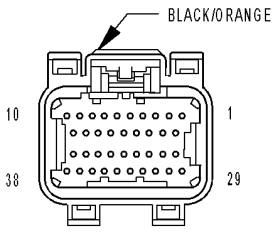
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0133-O2 SENSOR 1/1 SLOW RESPONSE

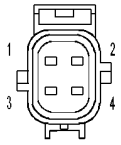




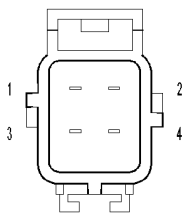
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
LEFT
FRONT
(3.7L/5.7L)



SENSOR-
OXYGEN-
LEFT
FRONT
(4.7L)

81452b01

P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K41) O2 1/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

3. (K41) O2 1/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/1 O2 Sensor harness connector.

Ignition on, engine not running.

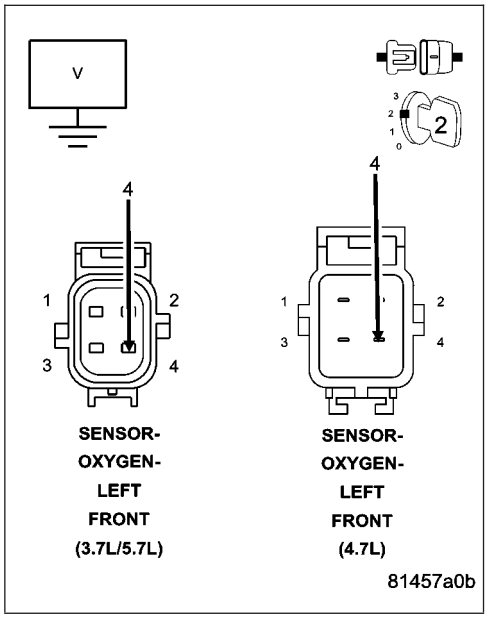
Measure the voltage on the (K41) O2 1/1 Signal circuit in the O2 Sensor harness connector.

Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Check the (K41) O2 1/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K902) O2 RETURN UPSTREAM CIRCUIT

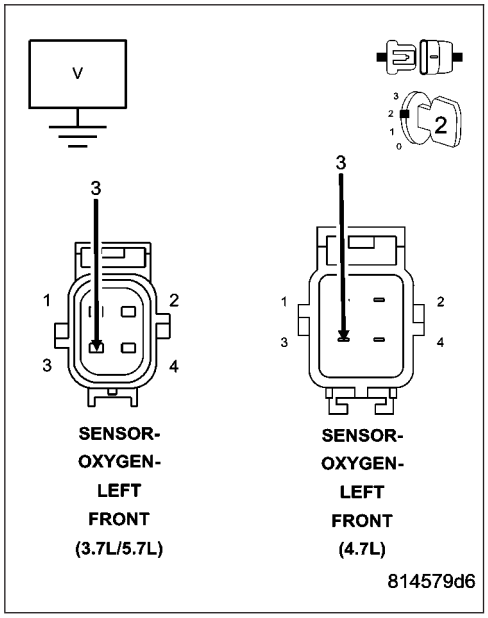
Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)



5. O2 SENSOR

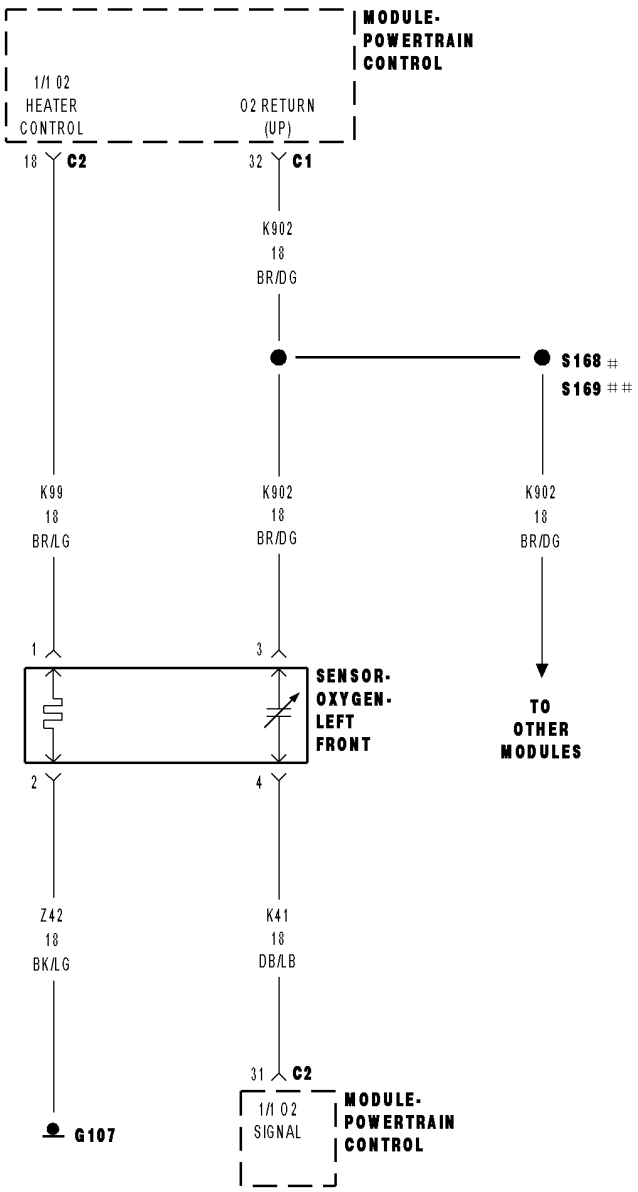
If there are no possible causes remaining, view repair.

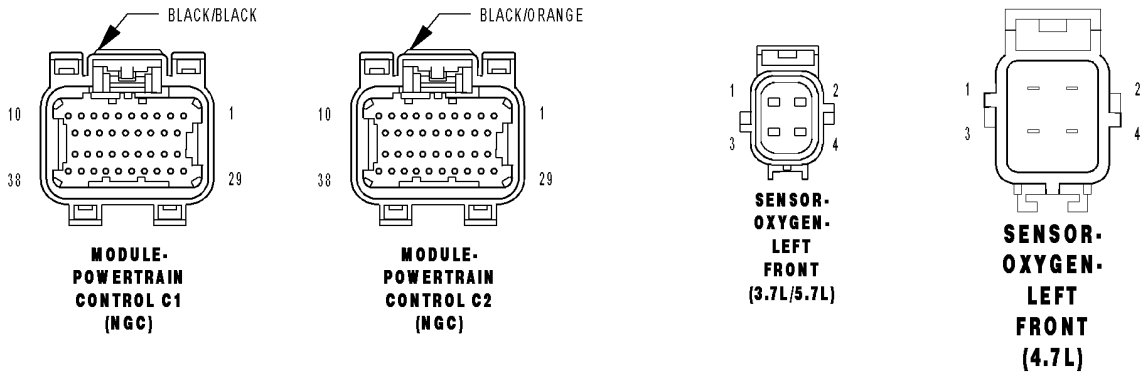
Repair

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE





P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 1/1 O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

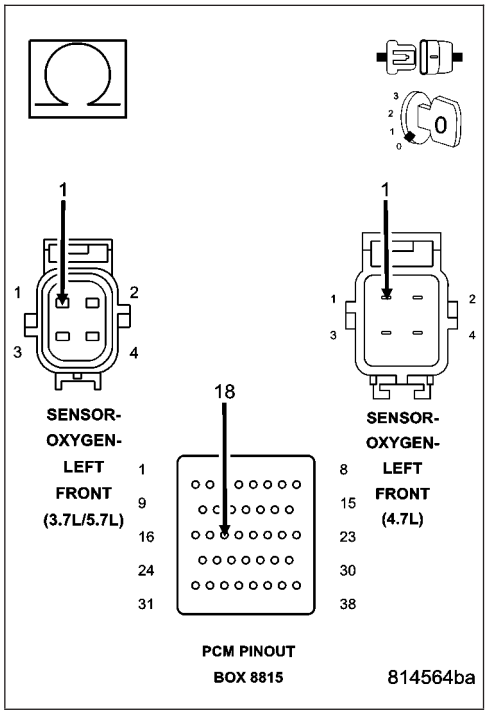
No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

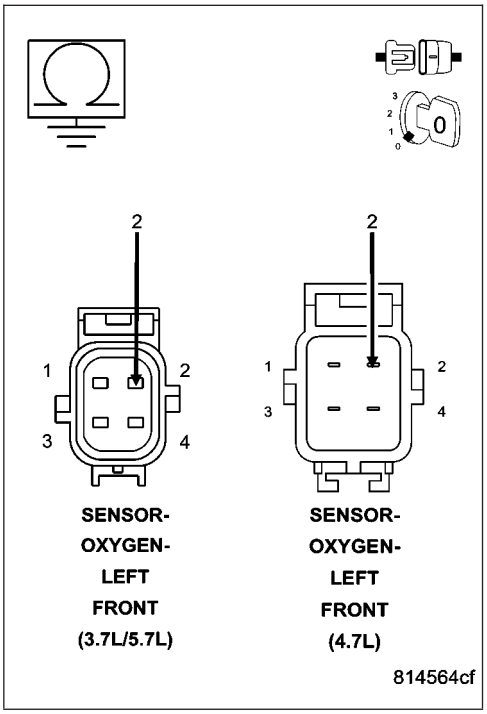
Yes >> Go To 4

No >> Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

4. (Z42) O2 1/1 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z42) O2 1/1 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z42) O2 1/1 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

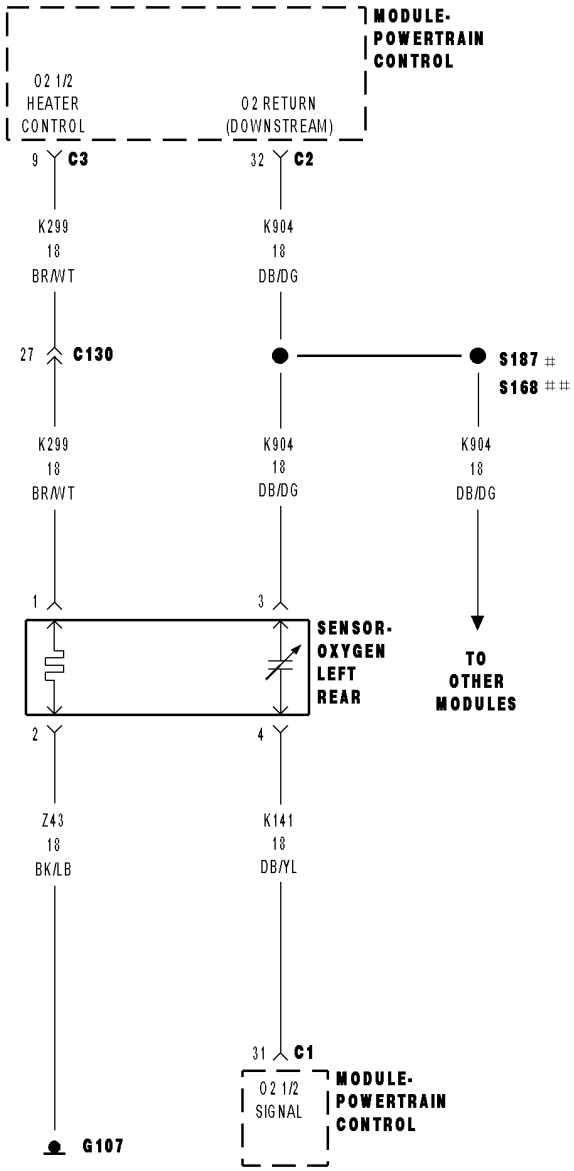
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

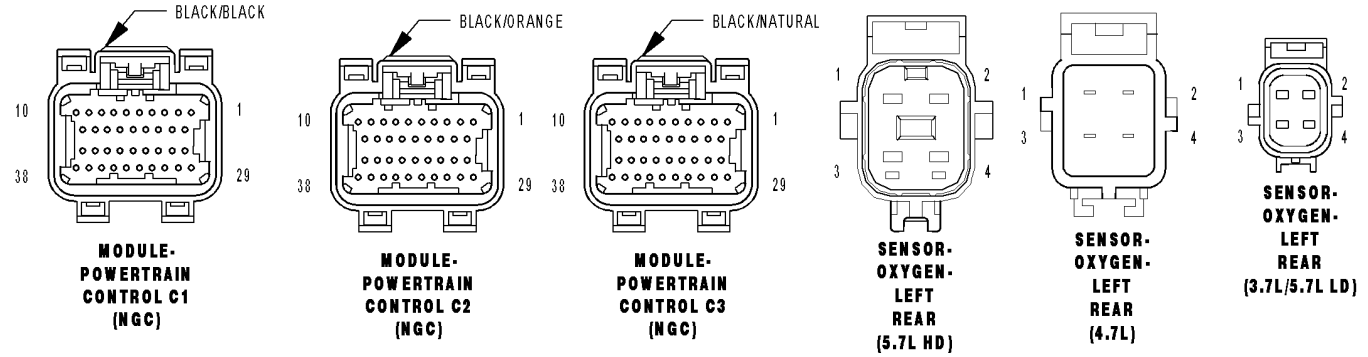
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0137-O2 SENSOR 1/2 CIRCUIT LOW





81452b26

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z43) O2 1/2 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 1/2 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 1/2 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 1/2 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

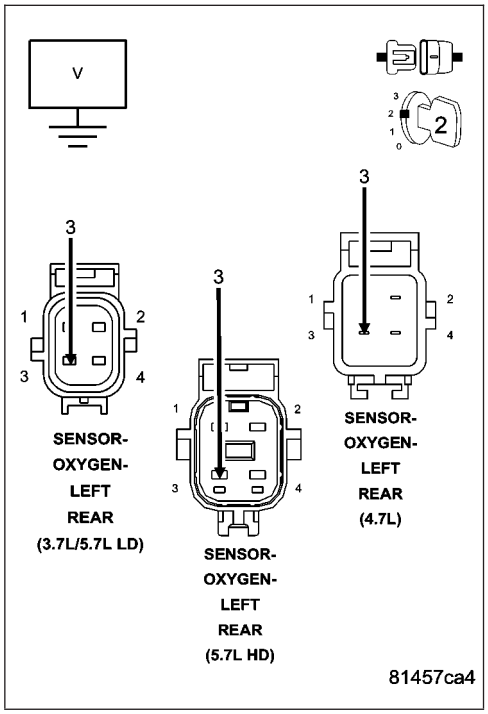
Yes >> Go To 3

No >> Go To 5

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

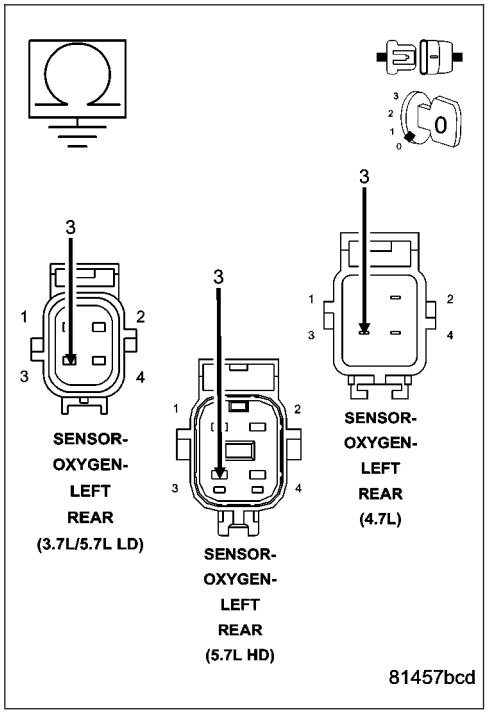
No >> Go To 4

4. (K904) O2 RETURN DOWNSTREAMCIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

5. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

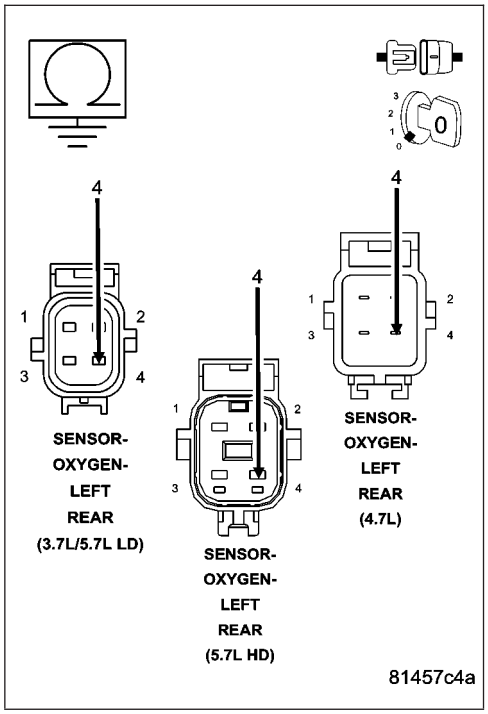
Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



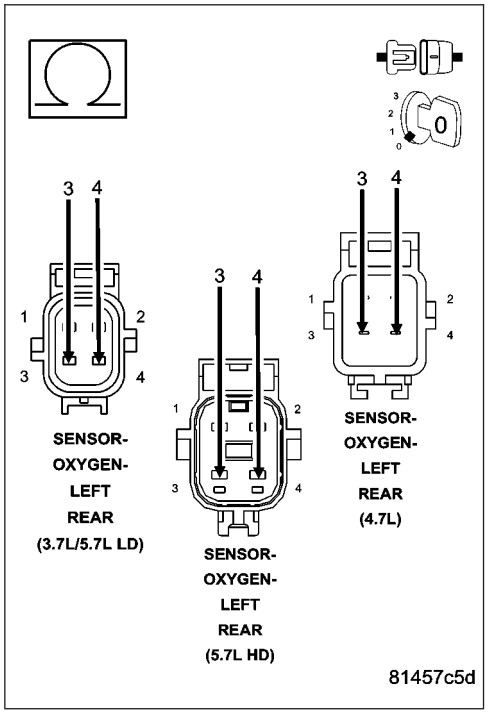
6. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K904) O2 Return Downstream circuit and the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

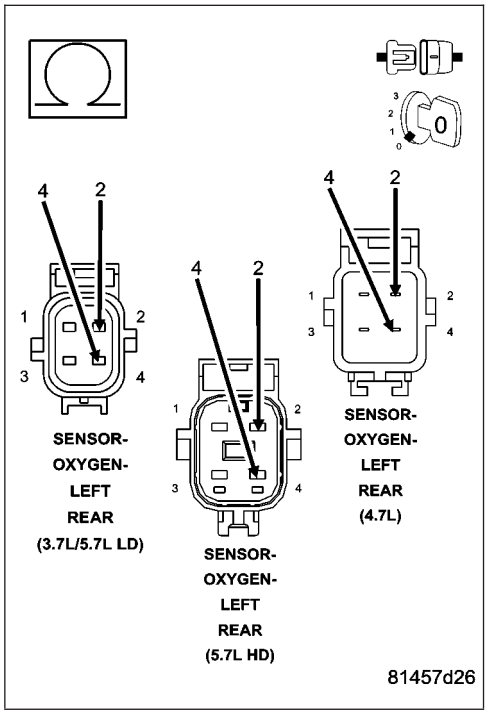
No >> Go To 7



P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

7. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO THE (Z43) O2 1/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K141) O2 1/2 Signal circuit and the (Z43) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z43) O2 1/2 Heater ground circuit and the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

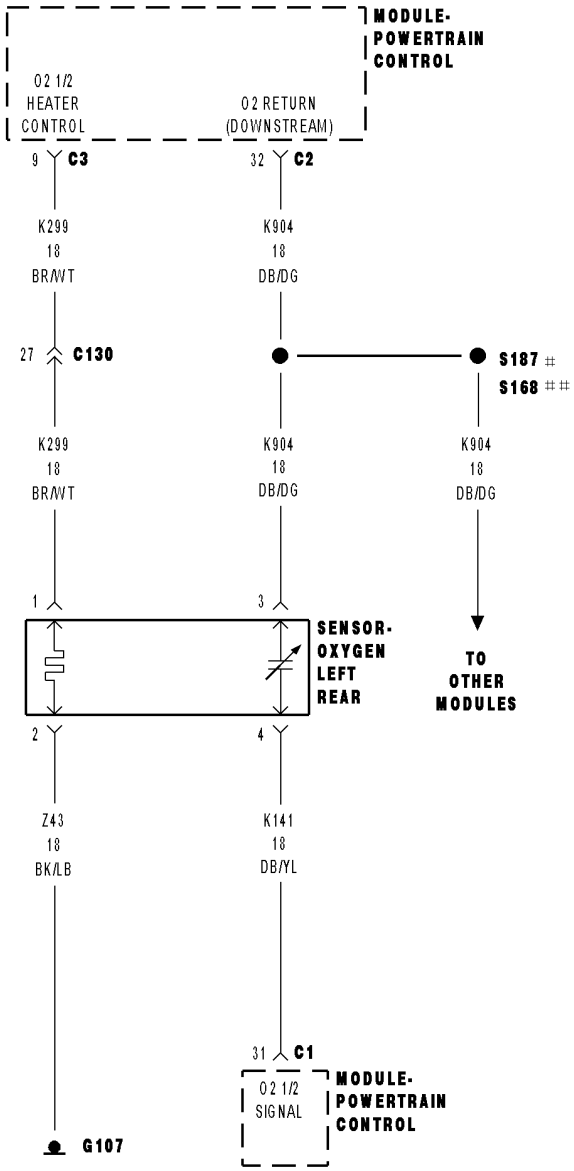
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

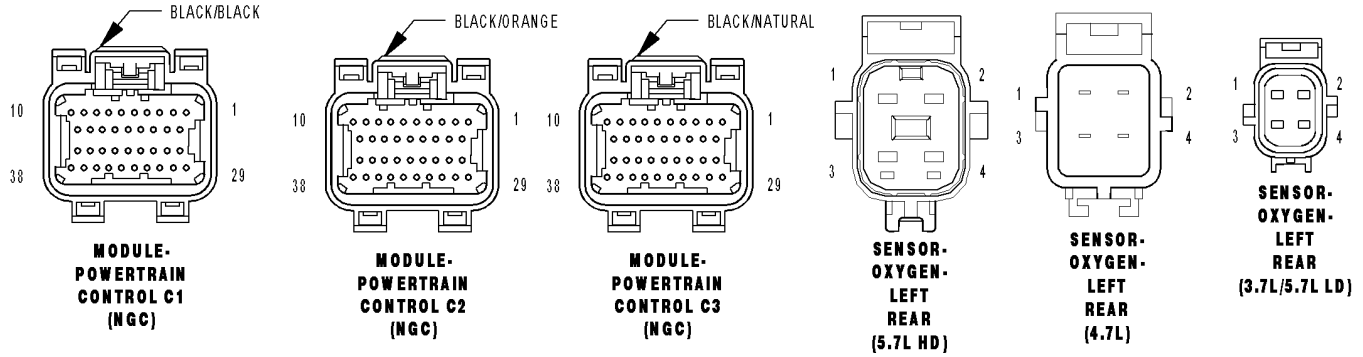
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0138-O2 SENSOR 1/2 CIRCUIT HIGH





81452b26

P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K141) O2 1/2 SENSOR SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.7 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 1/2 O2 Sensor voltage.

Is the voltage above 3.7 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

2. (K141) O2 1/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 1/2 O2 Sensor harness connector.

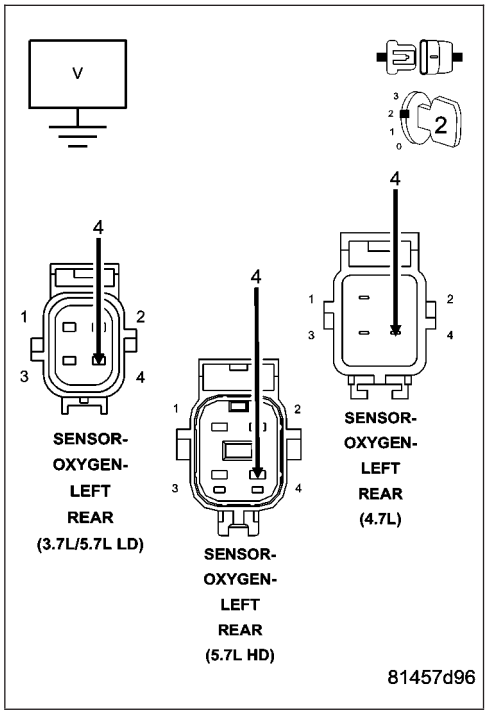
Measure the voltage on the (K141) O2 Sensor 1/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K141) O2 Sensor 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

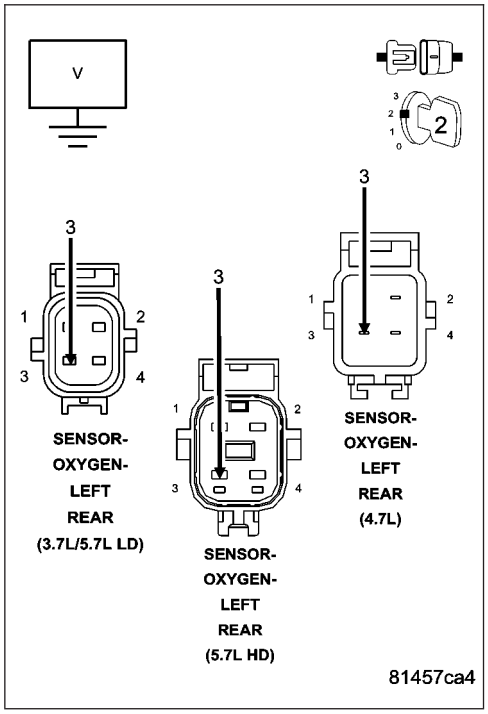
Ignition on, engine not running.

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K141) O2 1/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

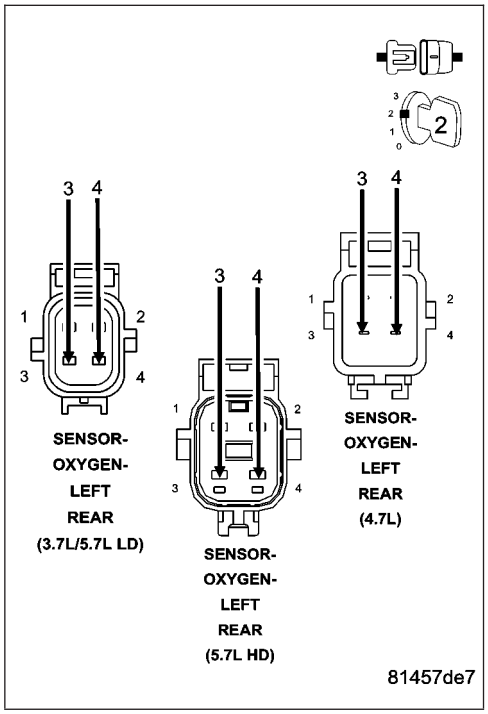
With a scan tool, monitor the 1/2 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K141) O2 1/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1and C2 PCM harness connectors.

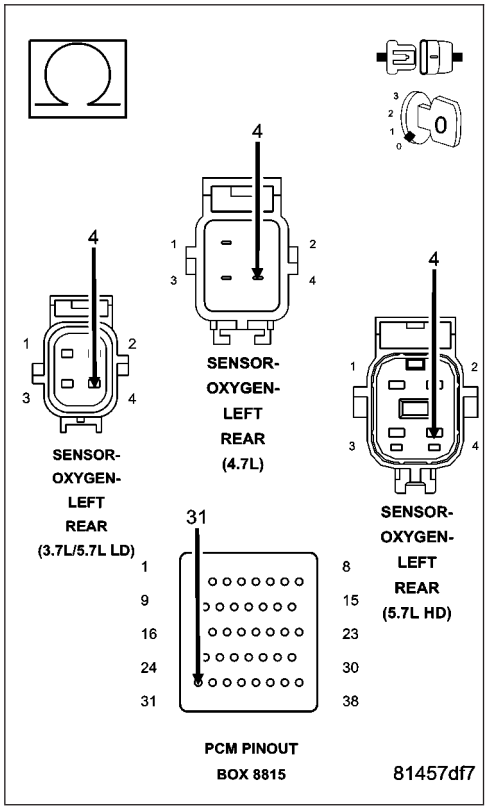
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K141) O2 1/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

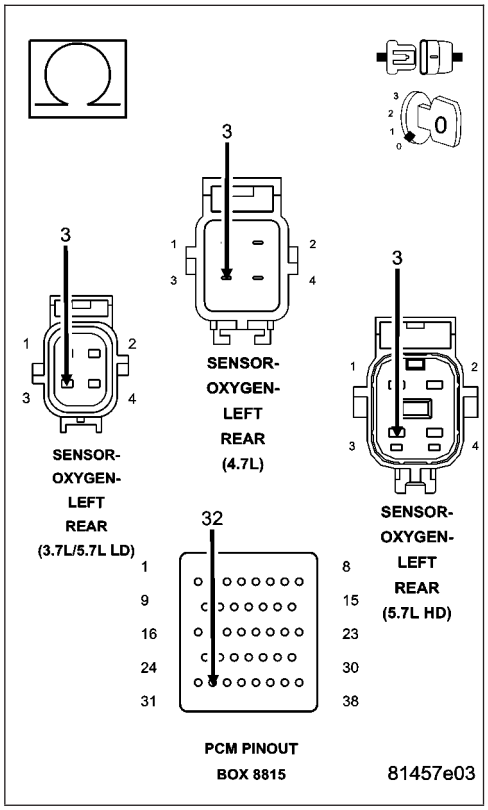
No >> Repair the open in the (K141) O2 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

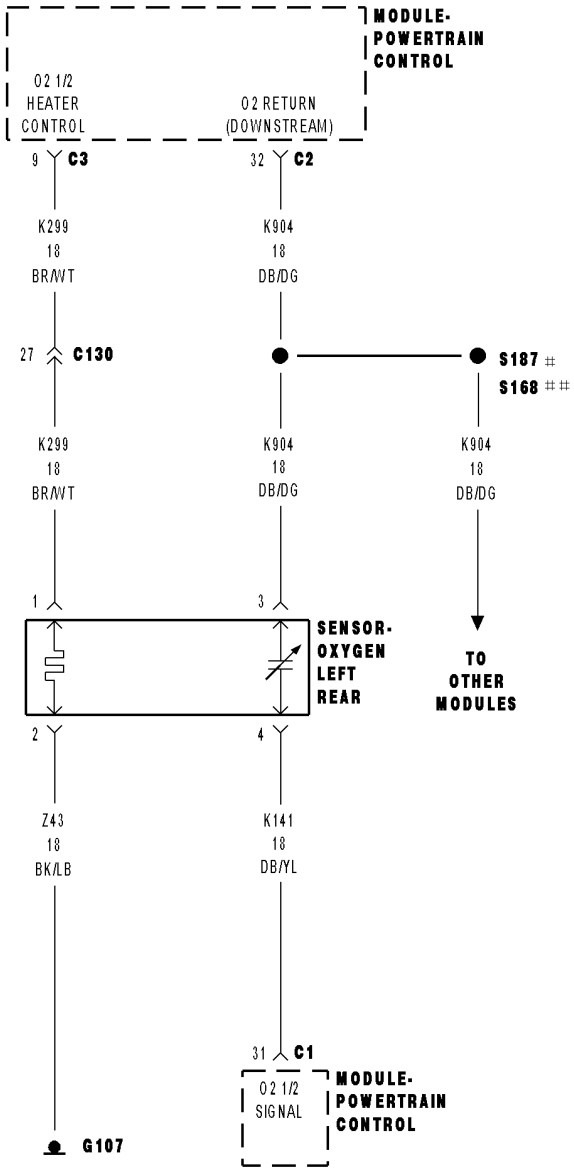
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

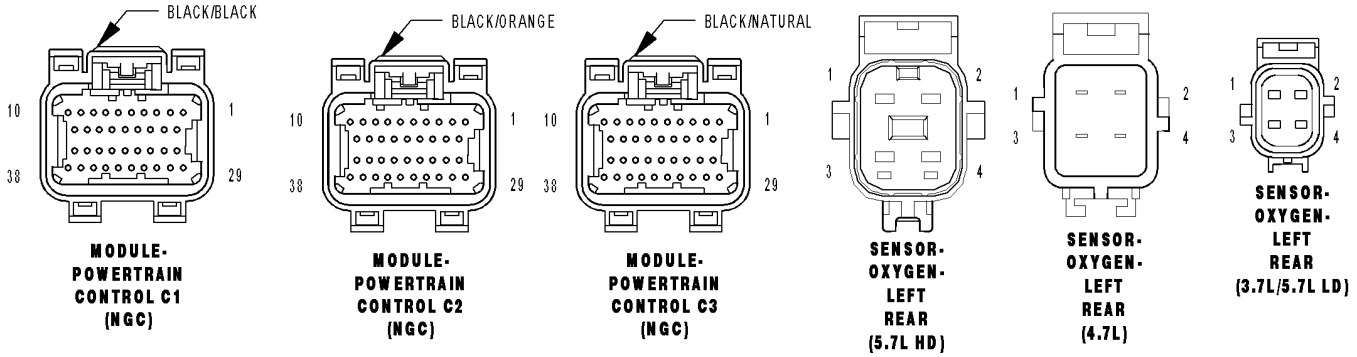
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0139-O2 SENSOR 1/2 SLOW RESPONSE





81452b26

P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K141) O2 1/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

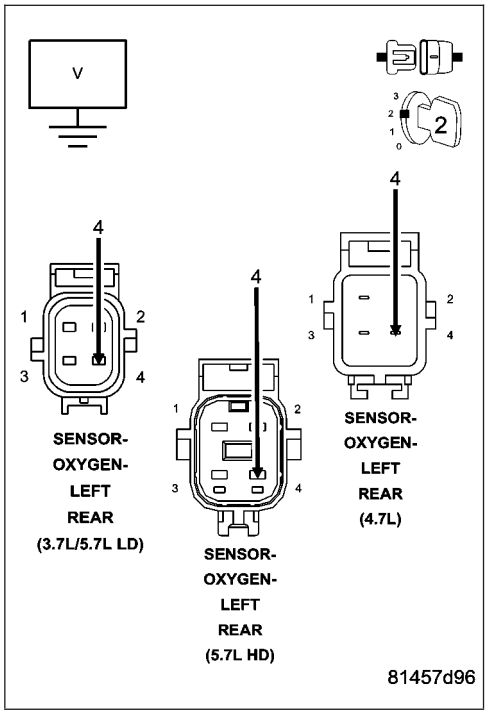
3. (K141) O2 1/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 1/2 O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K141) O2 1/2 Signal circuit in the O2 Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

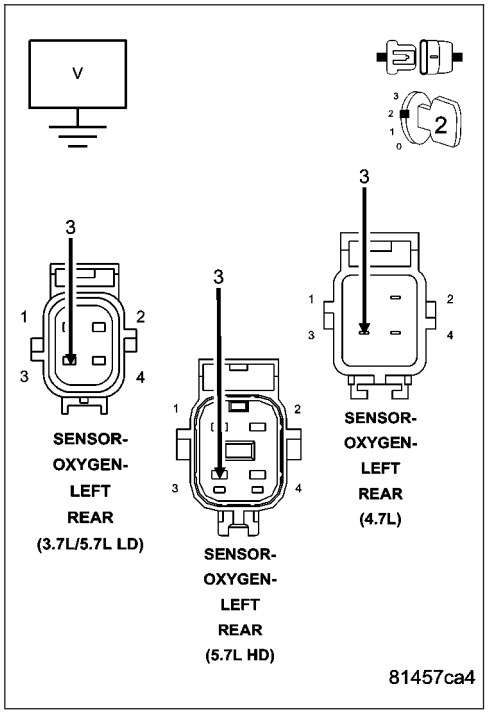
Yes >> Go To 4

No >> Check the (K141) O2 1/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

Measure the voltage on the (K904) O2 Return Downstream circuit in the 1/2 O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

5. **O2 SENSOR**

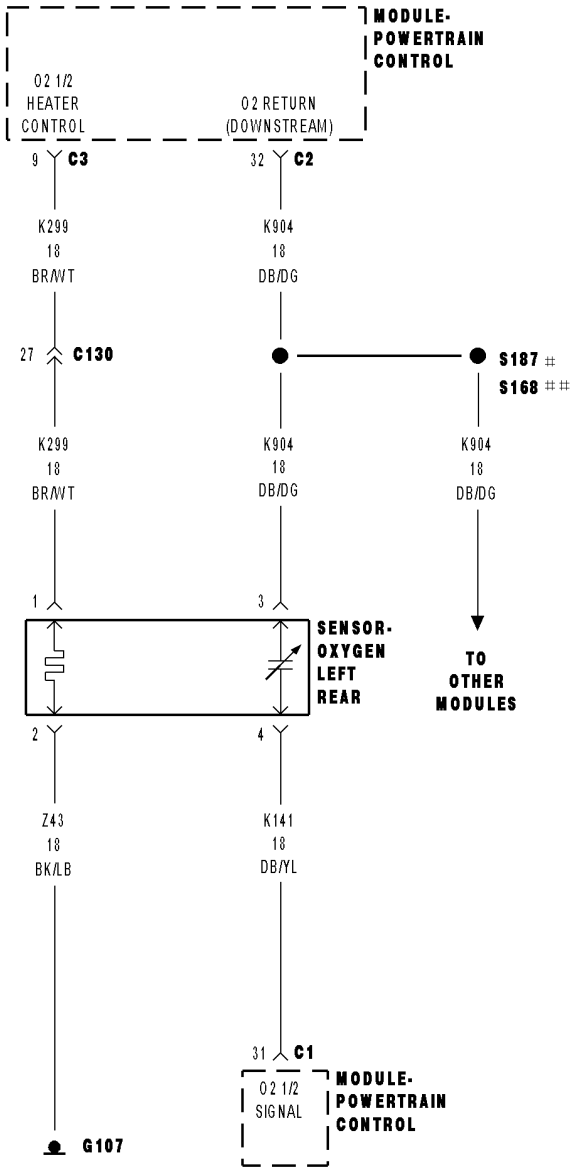
If there are no possible causes remaining, view repair.

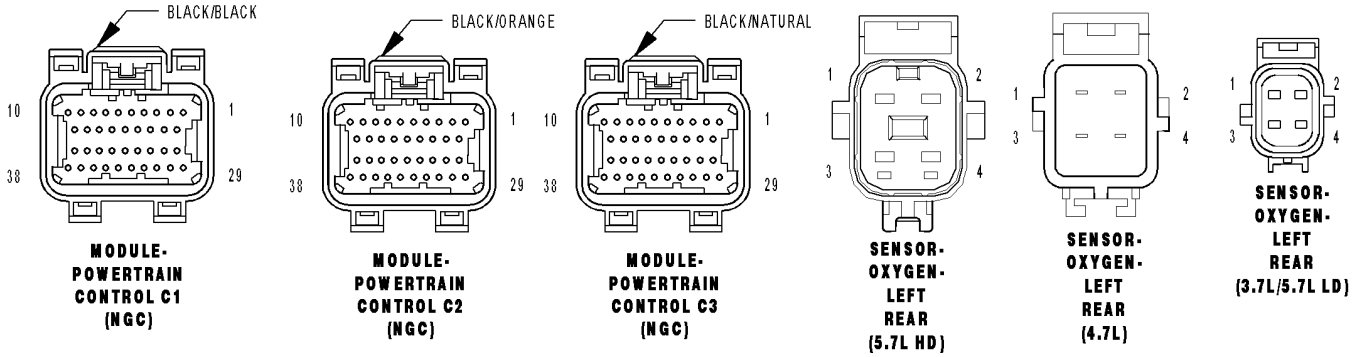
Repair

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE





81452b26

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN
(Z43) O2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

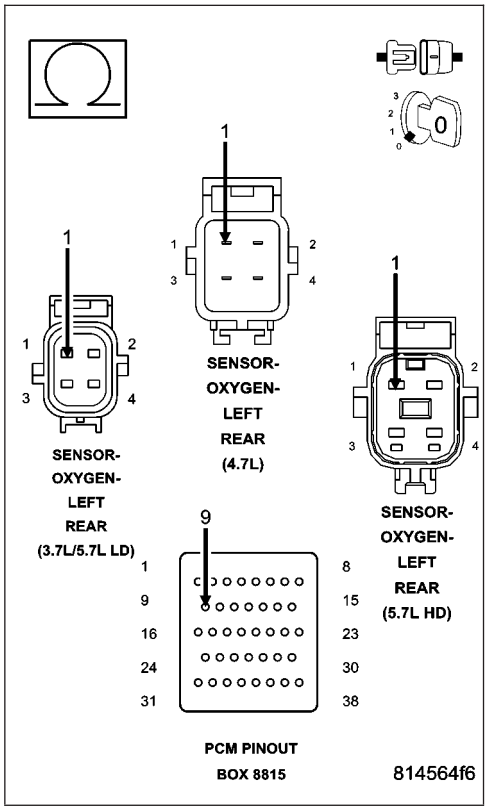
No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. (K299) O2 1/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K299) O2 1/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

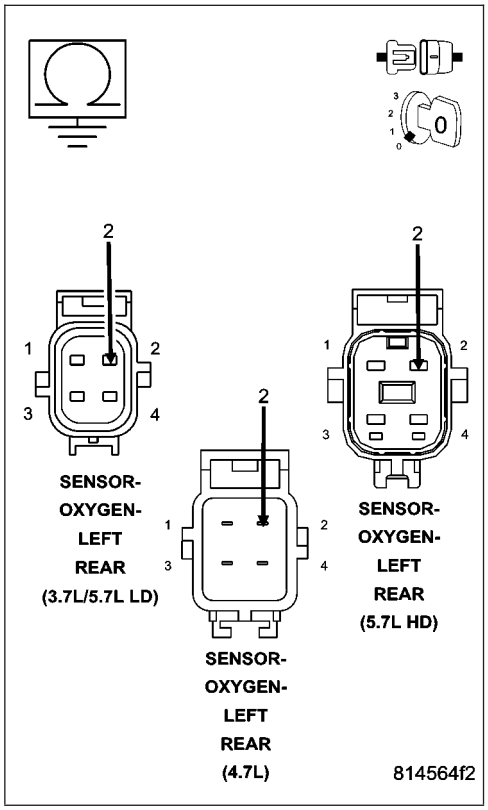
Yes >> Go To 4

No >> Repair the excessive resistance in the (K299) O2 1/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

4. (Z43) O2 1/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z43) O2 1/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z43) O2 1/2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

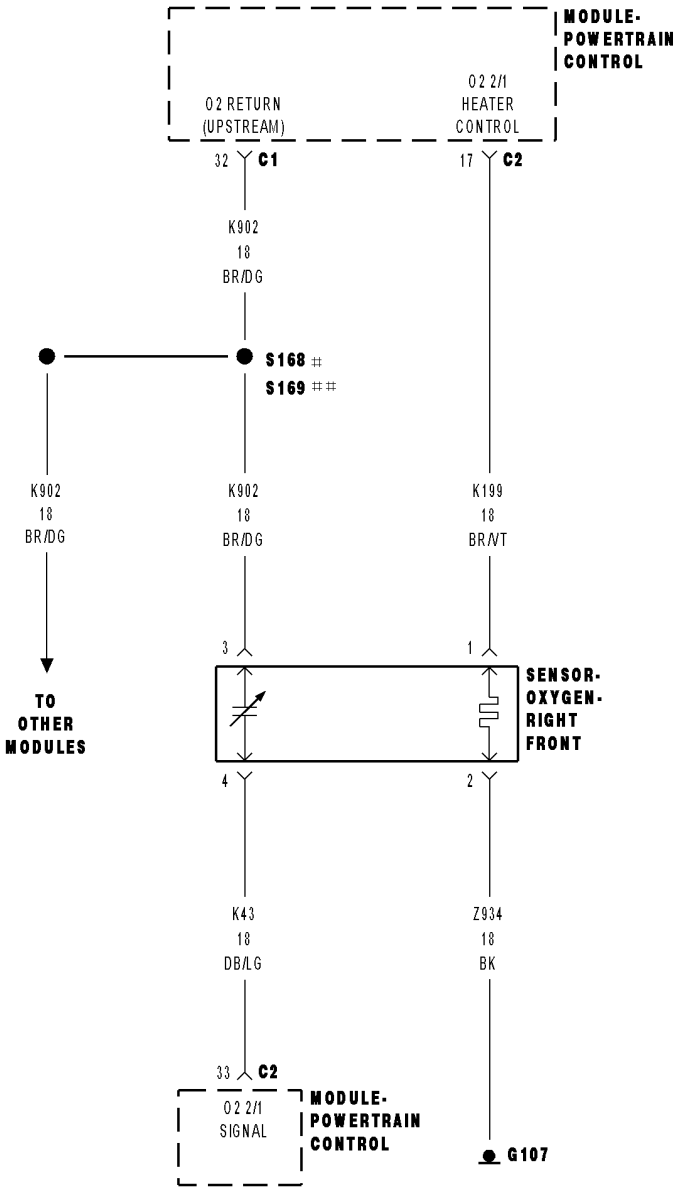
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

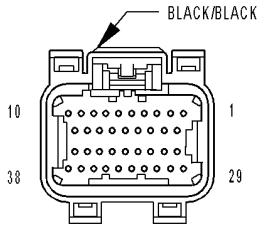
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

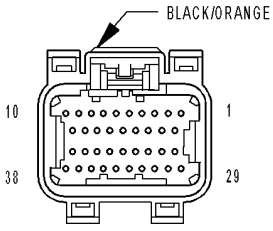
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0151-O2 SENSOR 2/1 CIRCUIT LOW

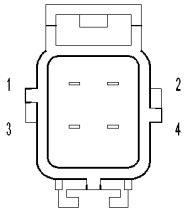




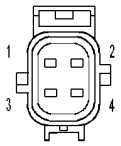
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z934) HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 2/1 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 2/1 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 2/1 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

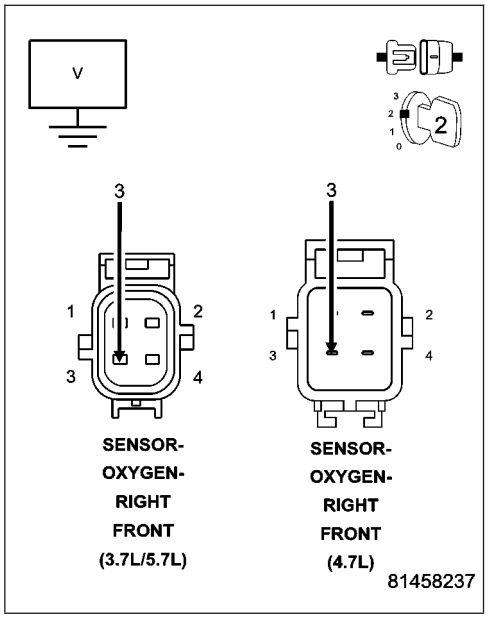
Yes >> Go To 3

No >> Go To 5

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the 2/1 O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

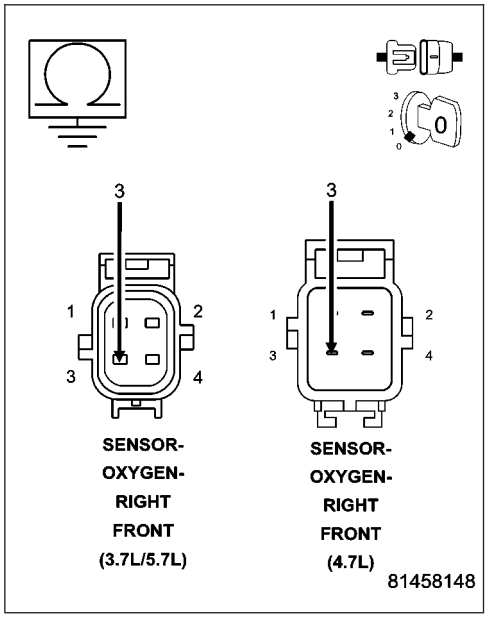
No >> Go To 4

4. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K902) O2 Return Upstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

5. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

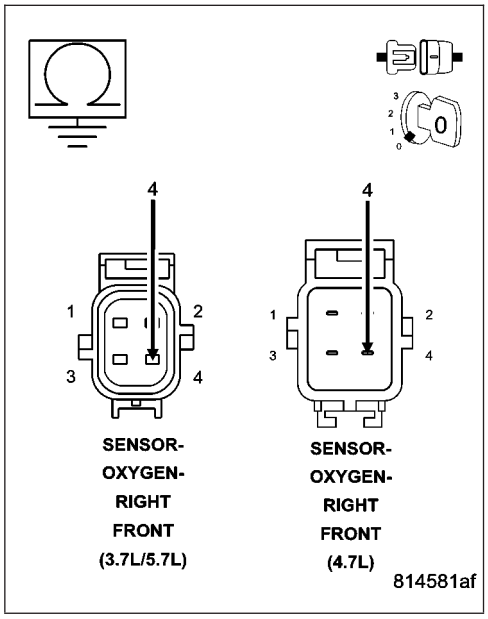
Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between ground and the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



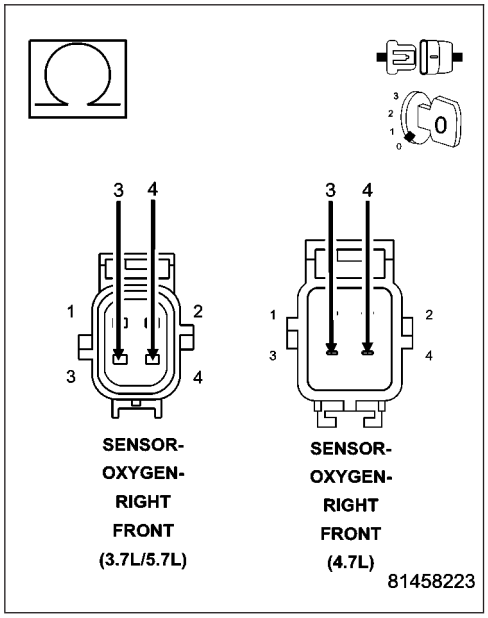
6. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K902) O2 Return Upstream circuit and the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

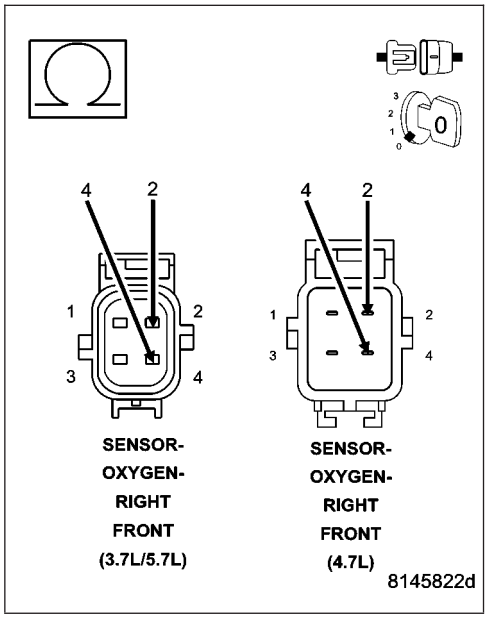
No >> Go To 7



P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

7. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (Z934) HEATER GROUND CIRCUIT

Measure the resistance between the (K43) O2 2/1 Signal circuit and the (Z934) O2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z934) O2 Heater ground circuit and the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

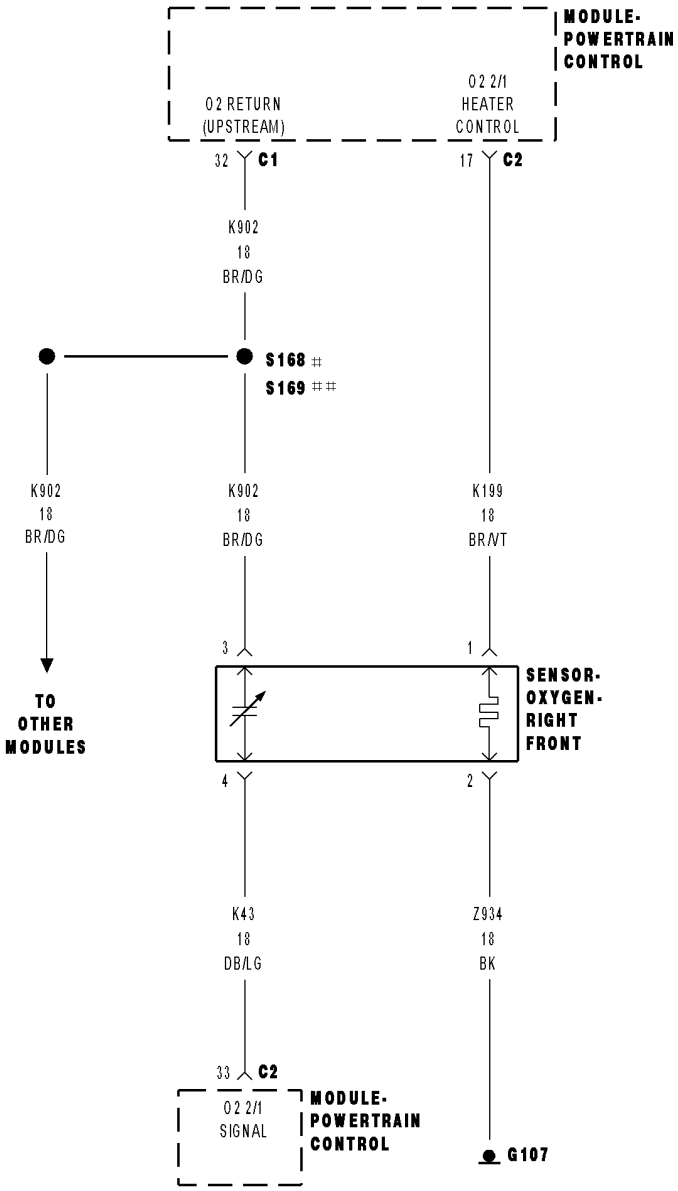
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

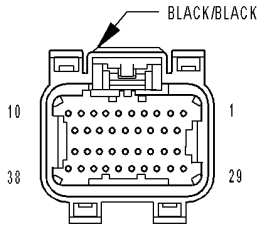
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

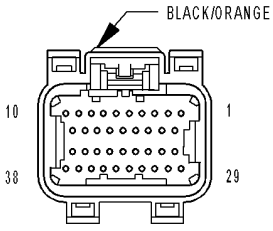
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH

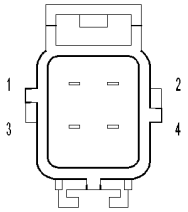




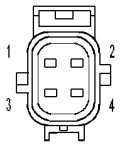
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K43) O2 2/1 SIGNAL CIRCUIT OPEN
(K902) O2 RETURN UPSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/1 O2 Sensor voltage.

Is the voltage above 3.99 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

2. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/1 O2 Sensor harness connector.

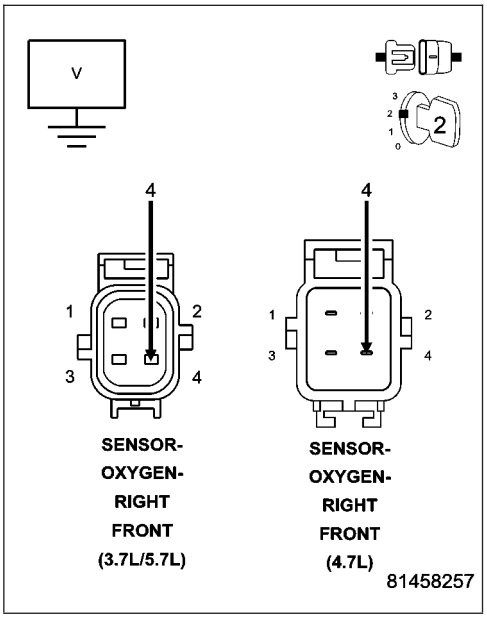
Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the 2/1 O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K902) O2 Return Upstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K902) O2 RETURN UPSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

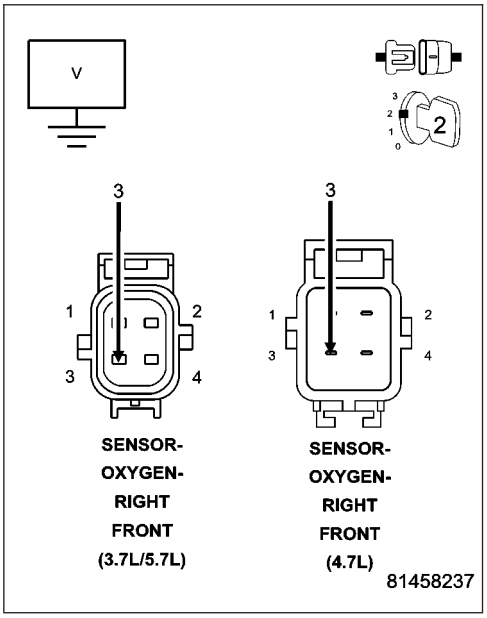
Ignition on, engine not running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 2/1 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K902) O2 Return Upstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C1 PCM harness connector.

Connect a jumper wire between the (K43) O2 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Ignition on, engine not running.

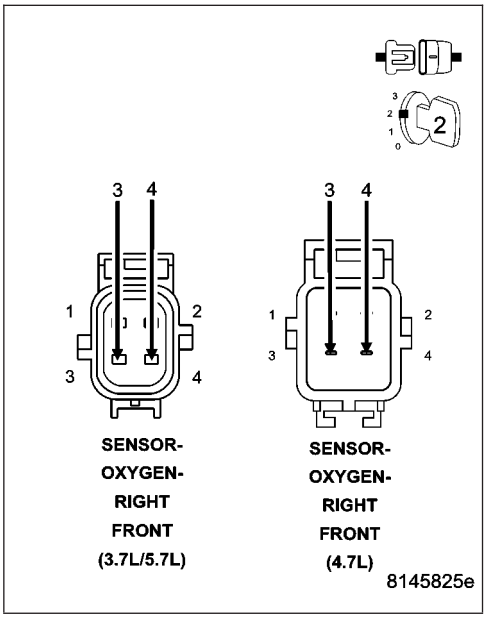
With a scan tool, monitor the 2/1 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire in place?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K43) O2 2/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

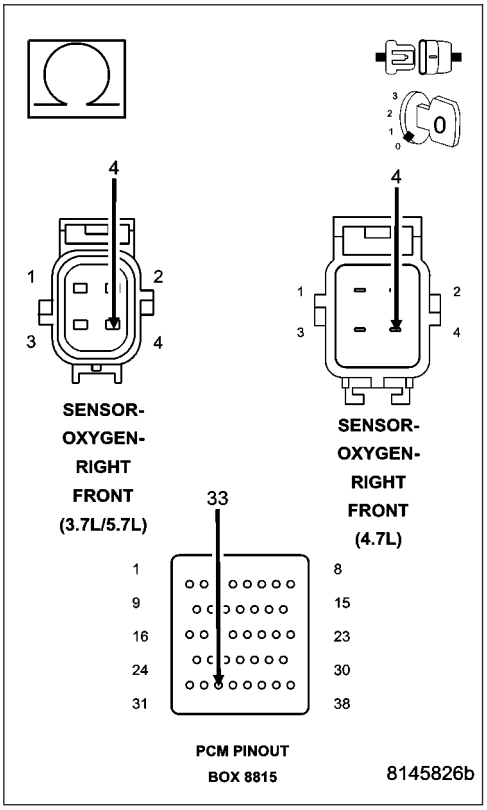
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K43) O2 2/1 Signal circuit from the 2/1 O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

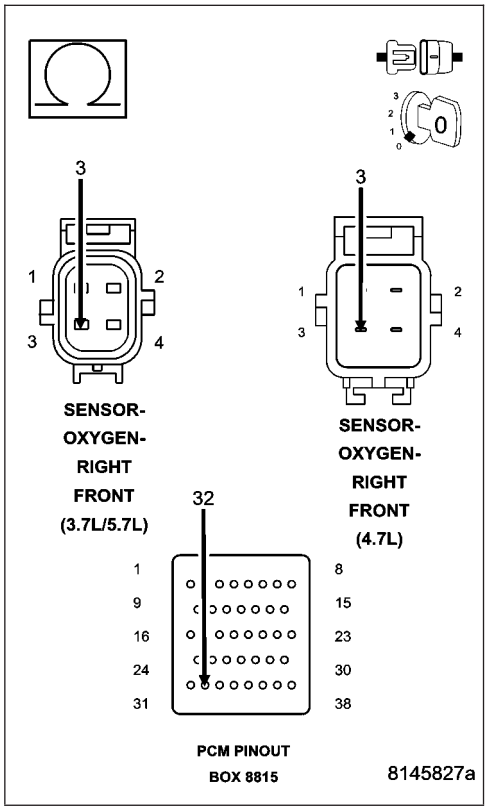
No >> Repair the open in the (K43) O2 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

6. (K902) O2 RETURN UPSTREAM CIRCUIT OPEN

Measure the resistance of the (K902) O2 Return Upstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K902) O2 Return Upstream circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

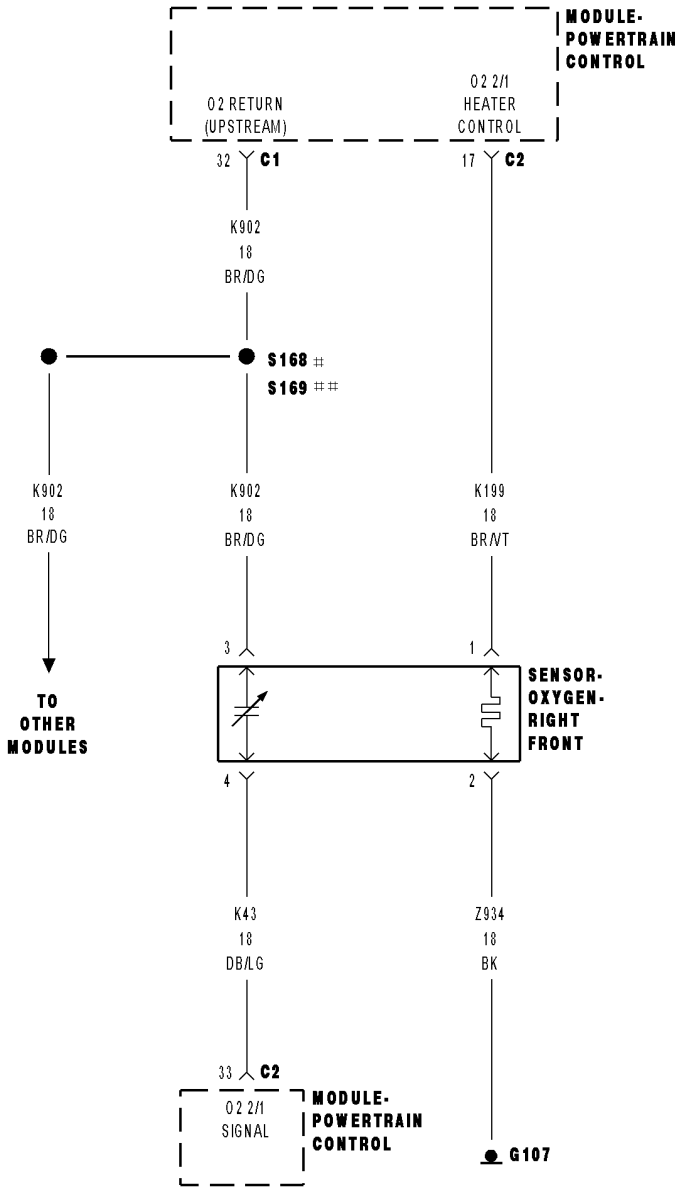
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

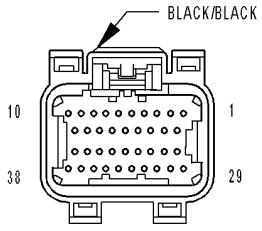
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

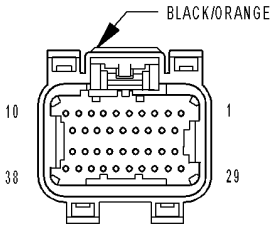
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0153-O2 SENSOR 2/1 SLOW RESPONSE

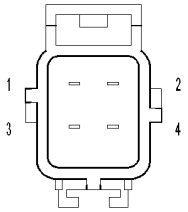




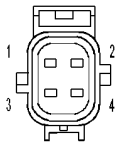
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K43) O2 2/1 SIGNAL CIRCUIT
(K902) O2 RETURN UPSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.
Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

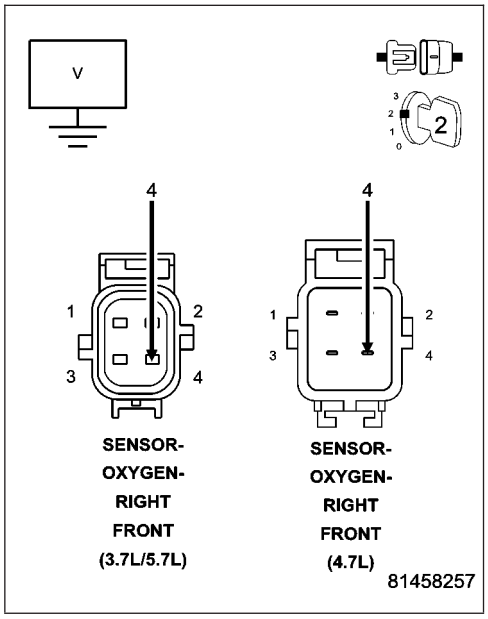
3. (K43) O2 2/1 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the O2 Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K43) O2 2/1 Signal circuit in the O2 Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

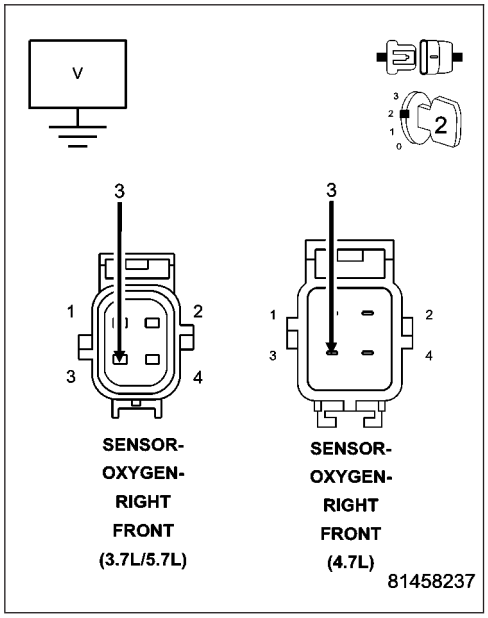
Yes >> Go To 4

No >> Check the (K43) O2 2/1 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K902) O2 RETURN UPSTREAM CIRCUIT

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

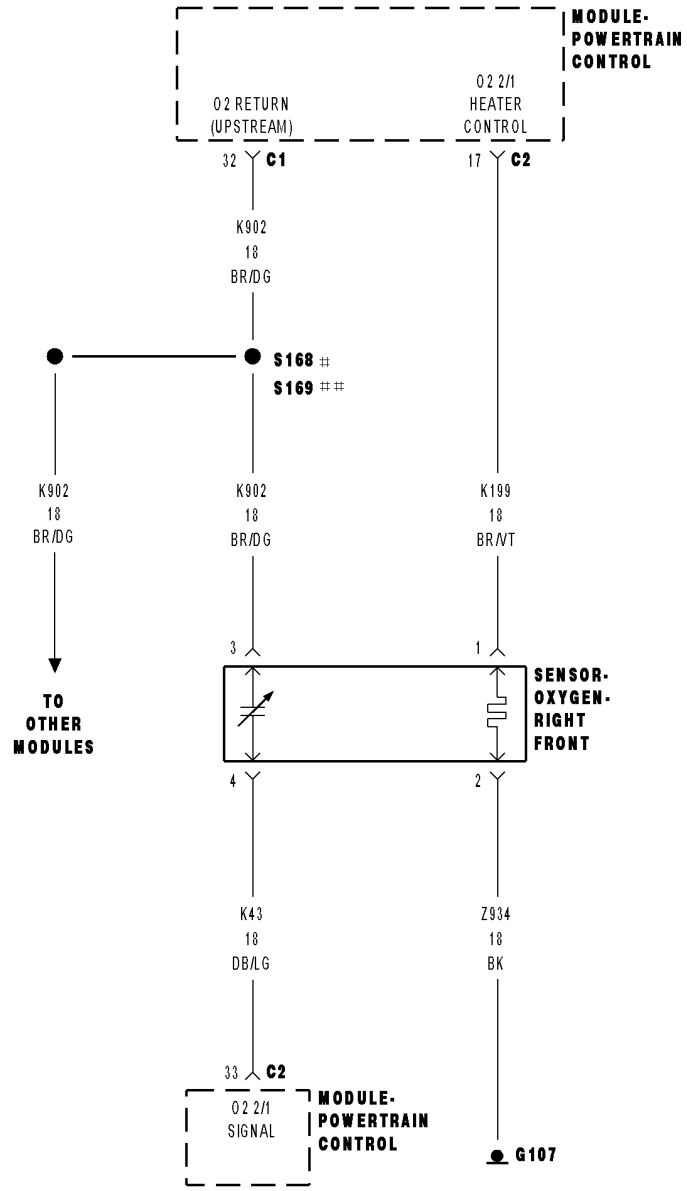
If there are no possible causes remaining, view repair.

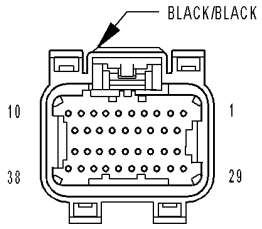
Repair

Replace the O2 Sensor

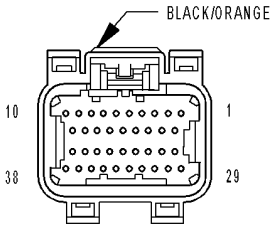
Perform (NGC) POWERTRAIN VERIFICATION TEST VER - 5. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/POWERTRAIN CONTROL MODULE - DIAGNOSIS AND TESTING)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE

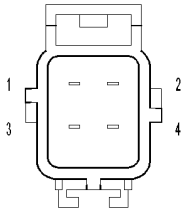




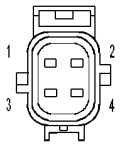
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(Z934) O2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the 2/1 O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the O2 Sensor connector between the O2 Heater Control terminal and the O2 Heater ground terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

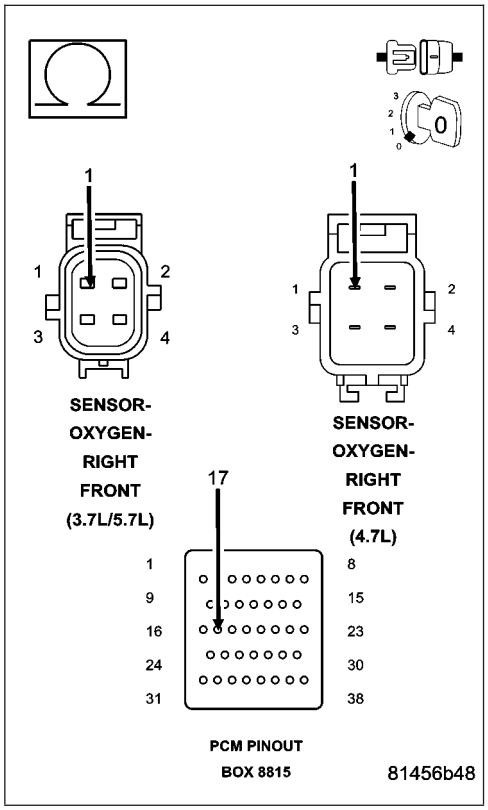
---

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

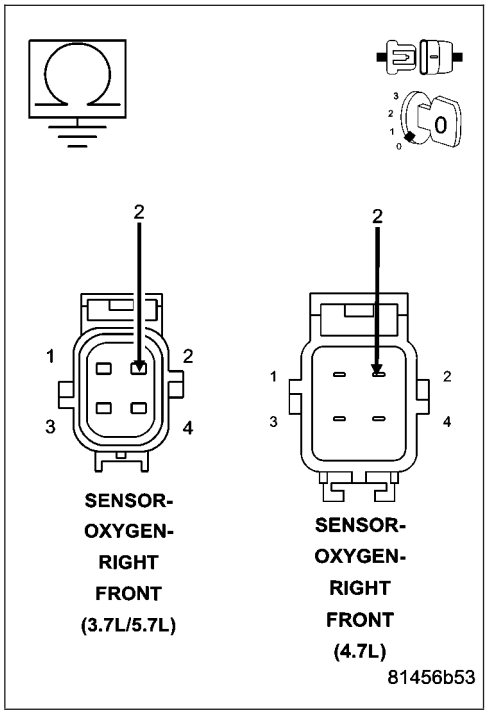
Yes >> Go To 4

No >> Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

4. (Z934) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z934) O2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z934) O2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

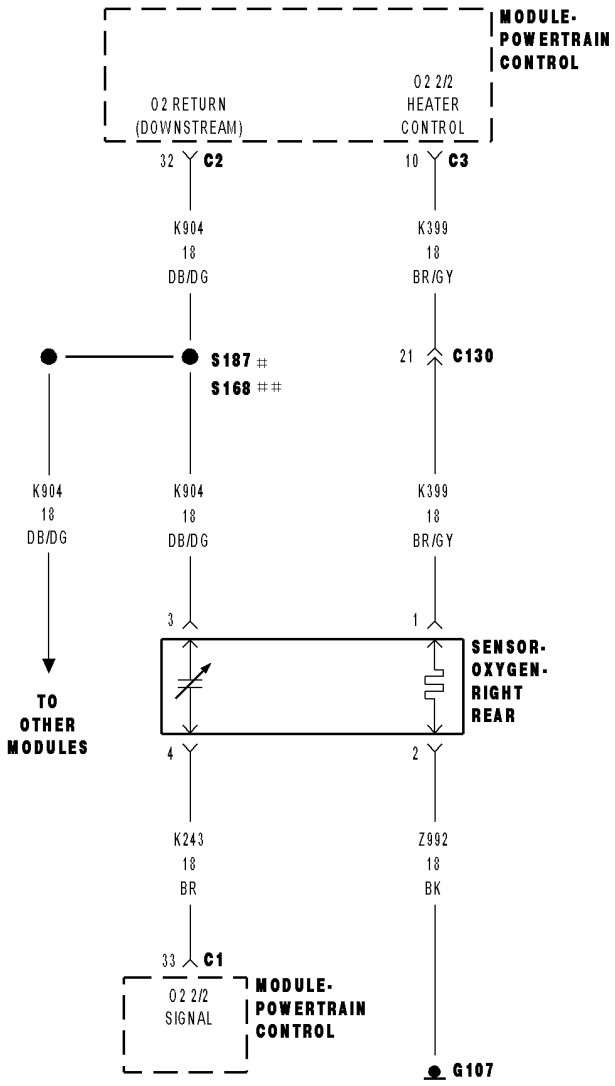
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

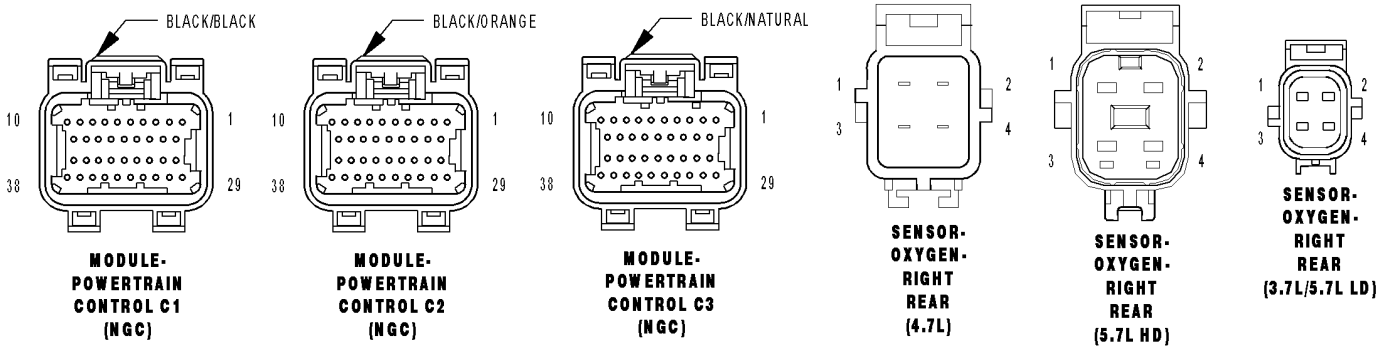
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0157-O2 SENSOR 2/2 CIRCUIT LOW





81452bb4

P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running for less than 30 seconds and the O2 Sensor Heater Temperature is less than 251°C (484°F) with battery voltage greater 10.99 volts.
- **Set Condition:**
  The oxygen sensor signal voltage is below 2.5196 volts for 3 seconds after starting engine. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT
(K243) O2 SIGNAL CIRCUIT SHORTED TO THE (Z992) O2 2/2 HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 2.52 VOLTS

Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read the 2/2 O2 Sensor voltage.

Is the voltage below 2.52 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the 2/2 O2 Sensor harness connector.
Ignition on, engine not running.
With a scan tool, monitor the 2/2 O2 Sensor voltage.

Is the O2 Sensor voltage above 4.8 volts?

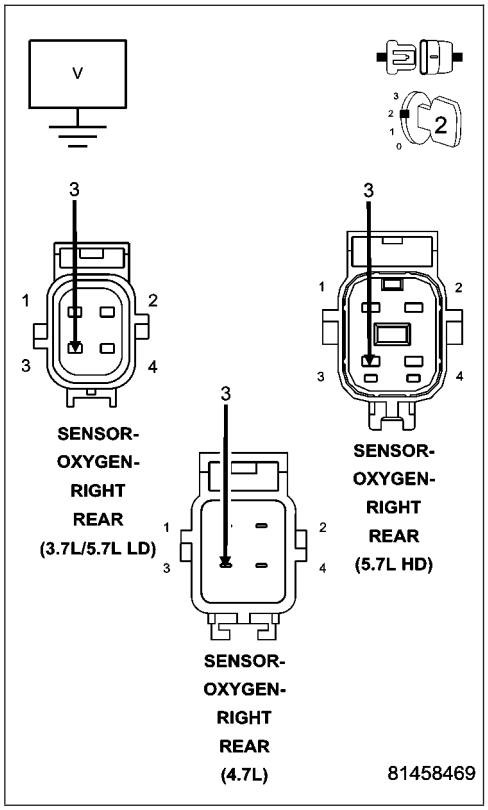
Yes >> Go To 3

No >> Go To 5

P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

3. O2 SENSOR

Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the voltage at 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

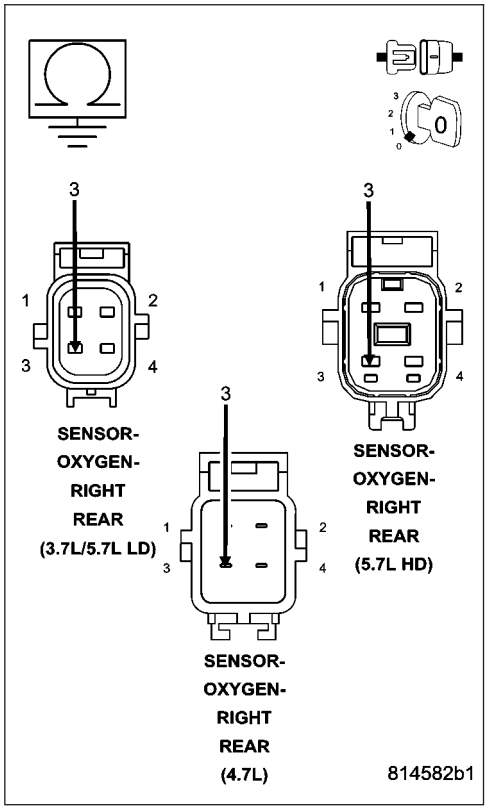
No >> Go To 4

4. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

5. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

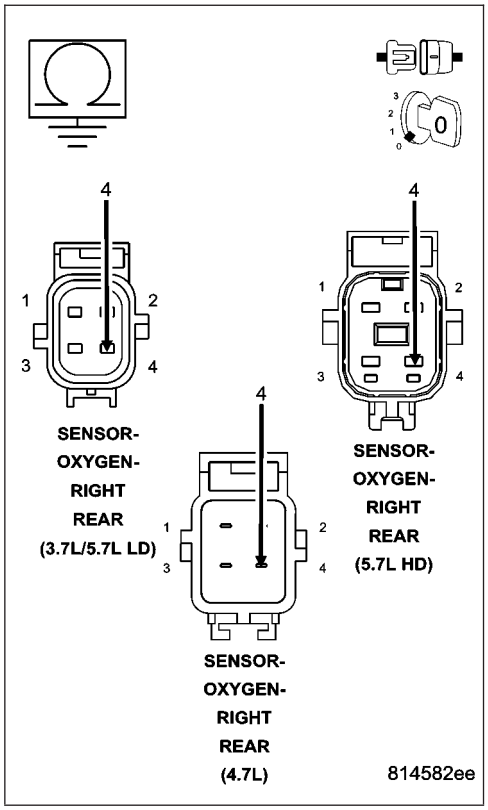
Measure the resistance between ground and the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K243) O2 2/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (K904) O2 RETURN DOWNSTREAM CIRCUIT

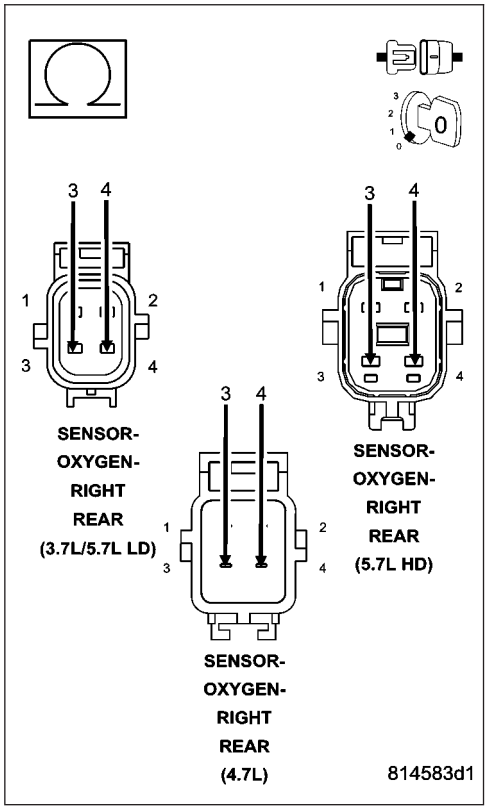
Measure the resistance between the (K243) O2 2/2 Signal circuit and the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K904) O2 Return Downstream circuit and the (K243) O2 2/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

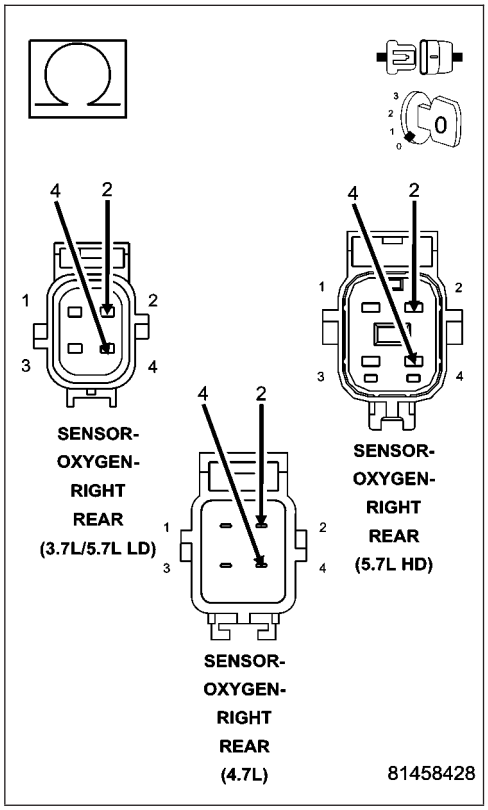
No >> Go To 7



P0157-O2 SENSOR 2/2 CIRCUIT LOW (CONTINUED)

7. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO THE (Z992) O2 2/2 HEATER GROUND CIRCUIT

Measure the resistance between the (K243) O2 2/2 Signal circuit and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z992) O2 2/2 Heater ground circuit and the (K243) O2 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

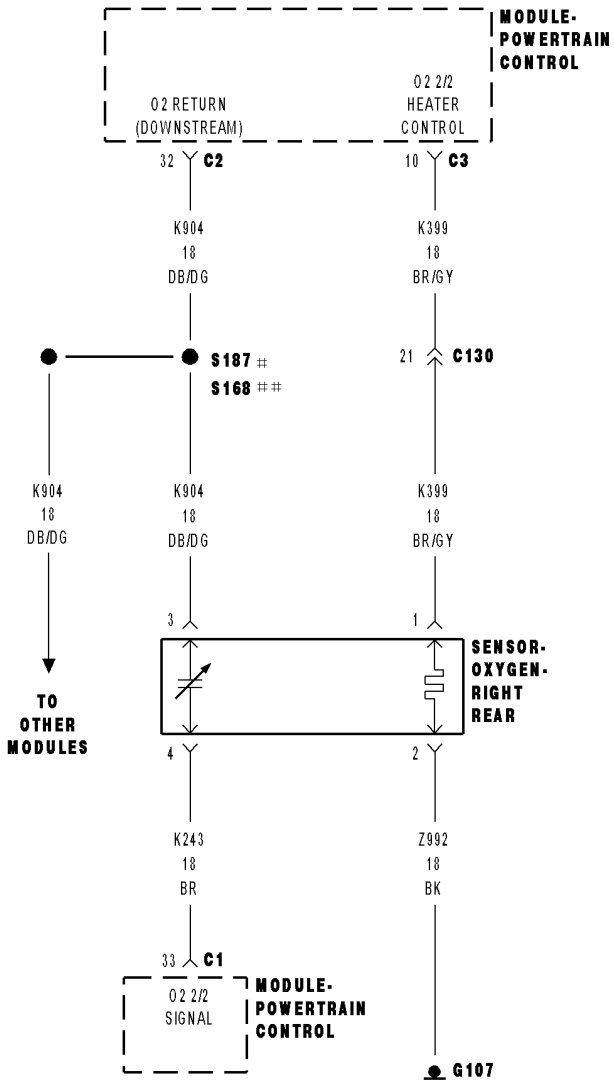
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

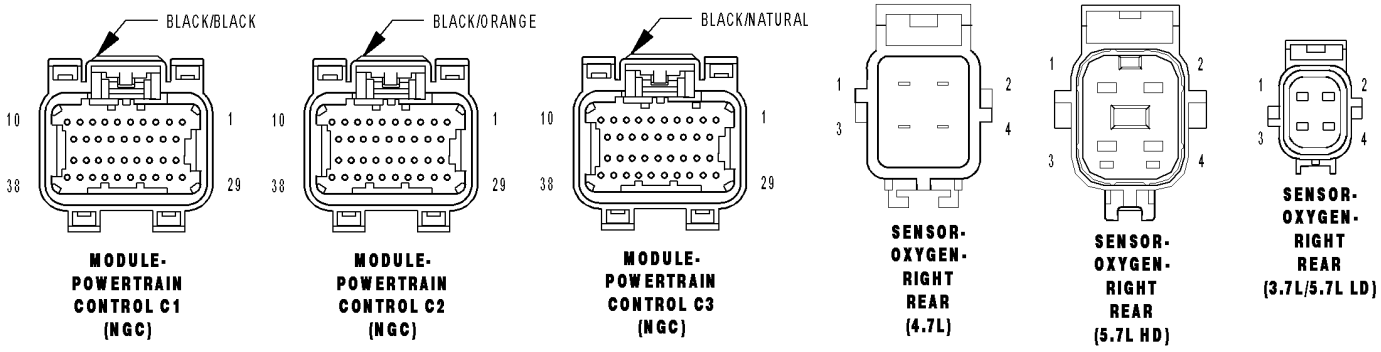
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT HIGH





81452bb4

P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  O2 Sensor Heater Temperature is greater than 496°C (925°F) and battery voltage greater than 10.99 volts.
- **Set Condition:**
  The Oxygen Sensor voltage is above 3.99 volts for 30 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE
(K243) O2 2/2 SIGNAL CIRCUIT OPEN
(K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 3.99 VOLTS

NOTE: When only one O2 Sensor is shorted to voltage, the scan tool will display all O2 Sensor voltage readings at approximately 5.0 volts. When diagnosing this DTC, only diagnose the O2 Sensor that set the DTC.

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, read the 2/2 O2 Sensor voltage.

Is the voltage above 3.99 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

2. (K243) O2 2/2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Start the engine and allow the engine to idle.

Disconnect the 2/2 O2 Sensor harness connector.

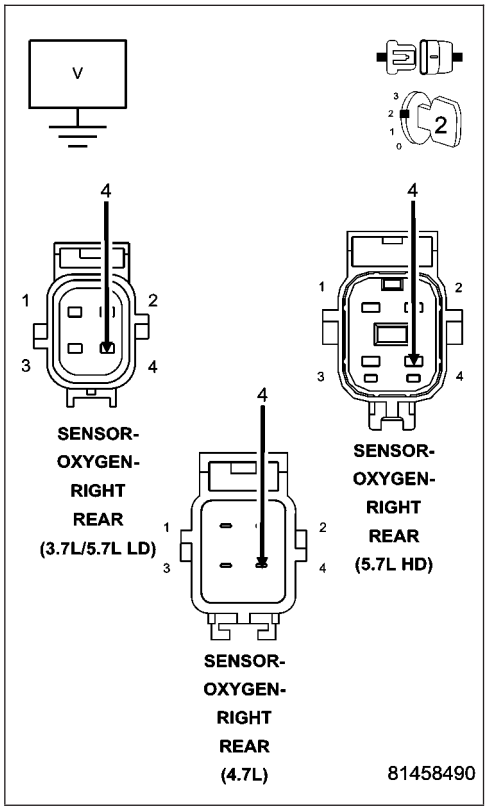
Measure the voltage on the (K243) O2 Sensor 2/2 Signal circuit in the O2 Sensor harness connector.

NOTE: Measure the voltage in reference to ground, not the (K904) O2 Return Downstream circuit.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K243) O2 Sensor 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K904) O2 RETURN DOWNSTREAM CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

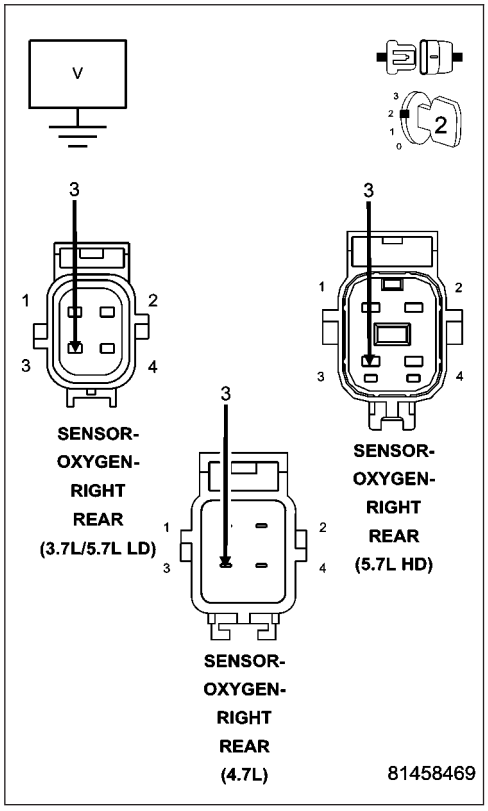
Ignition on, engine not running.

Measure the voltage on the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Is there any voltage present?

Yes >> Repair the short to battery voltage in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

4. O2 SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Connect a jumper wire between the (K243) O2 2/2 Signal circuit and the (K904) O2 Return Downstream circuit in the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

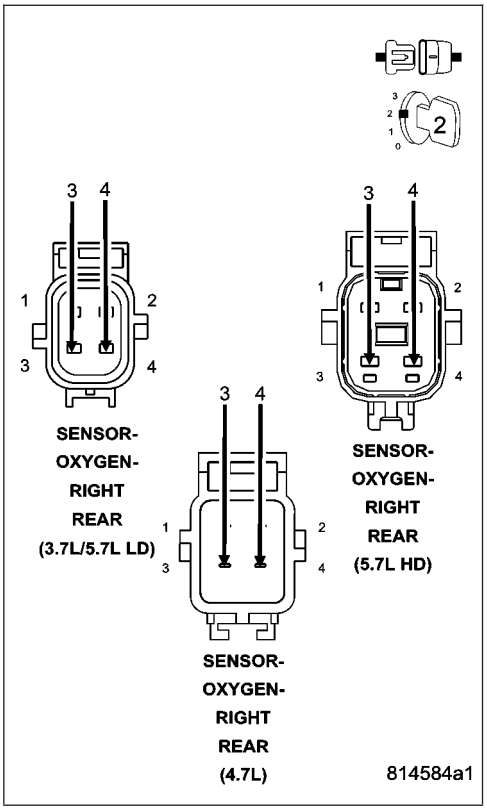
With a scan tool, monitor the 2/2 O2 Sensor voltage.

Is the voltage between 2.3 and 2.7 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



5. (K243) O2 2/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

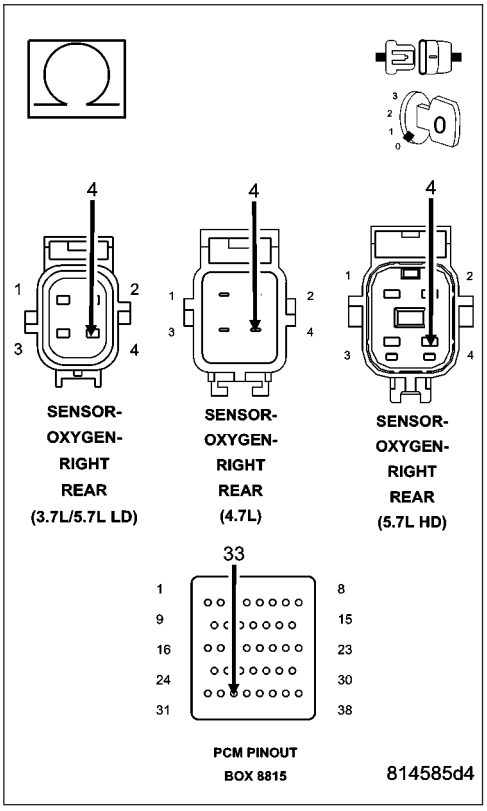
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K243) O2 2/2 Signal circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

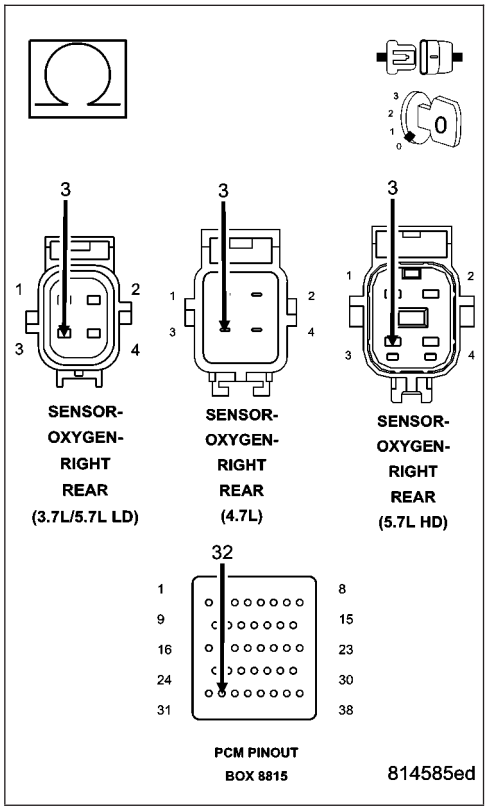
No >> Repair the open in the (K243) O2 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0158-O2 SENSOR 2/2 CIRCUIT HIGH (CONTINUED)

6. (K904) O2 RETURN DOWNSTREAM CIRCUIT OPEN

Measure the resistance of the (K904) O2 Return Downstream circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K904) O2 Return Downstream circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

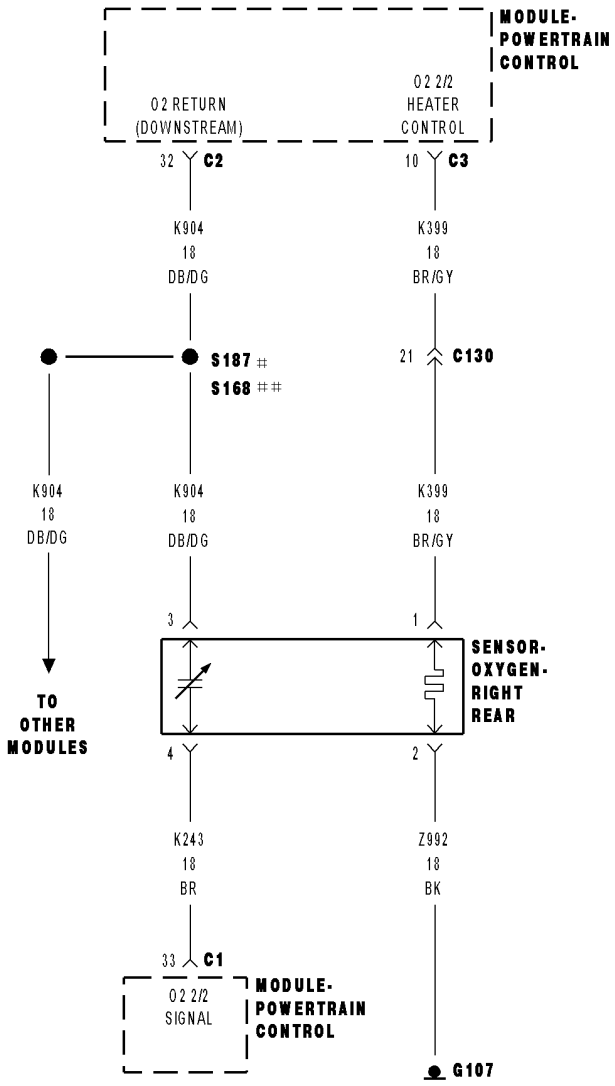
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

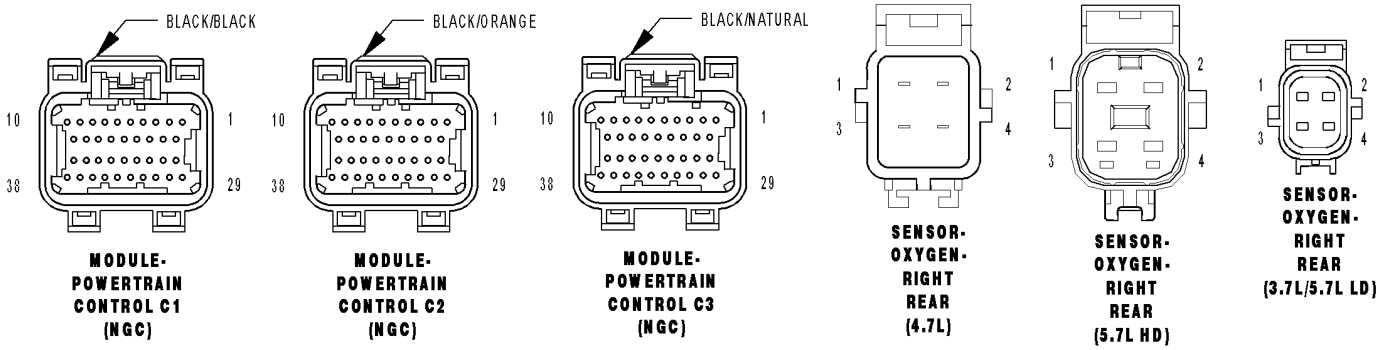
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0159-O2 SENSOR 2/2 SLOW RESPONSE





81452bb4

P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Vehicle is started and driven between 20 and 55 MPH with the Throttle open for a minimum of 120 seconds. Coolant greater than 70°C (158°F). Catalytic Converter Temp greater than 600°C (1112°F) and EVAP Purge is active.
- **Set Condition:**
  The oxygen sensor signal voltage switches less than 16 times from lean to rich within 20 seconds during monitoring. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
(K243) O2 2/2 SIGNAL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

3. (K243) O2 2/2 SIGNAL CIRCUIT

Turn the ignition off

Disconnect the 2/2 O2 Sensor harness connector.

Ignition on, engine not running.

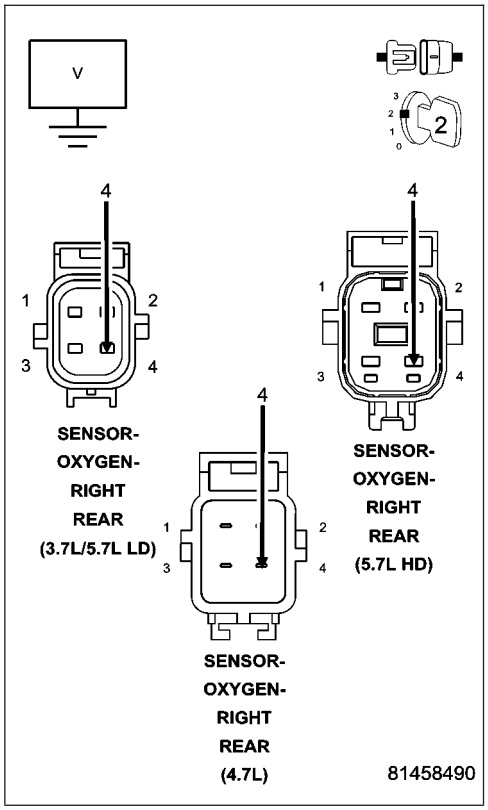
Measure the voltage on the (K243) O2 2/2 Signal circuit in the O2 Sensor harness connector.

Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Check the (K243) O2 2/2 Signal circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K904) O2 RETURN DOWNSTREAM CIRCUIT

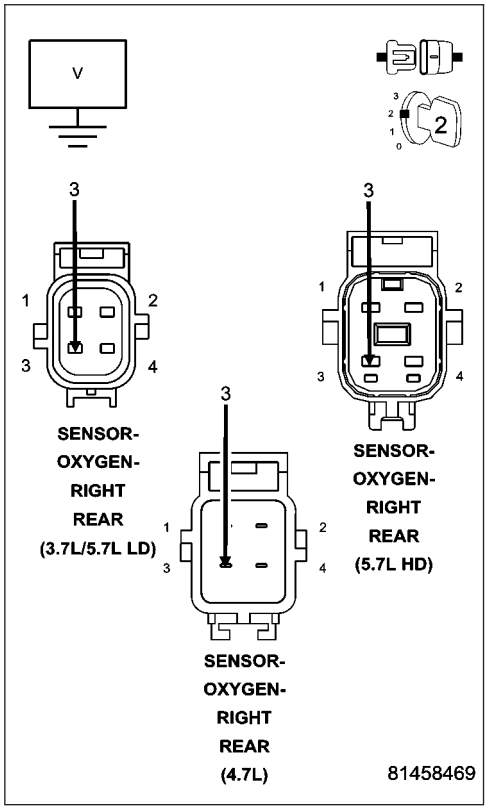
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Go To 5

No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

5. **O2 SENSOR**

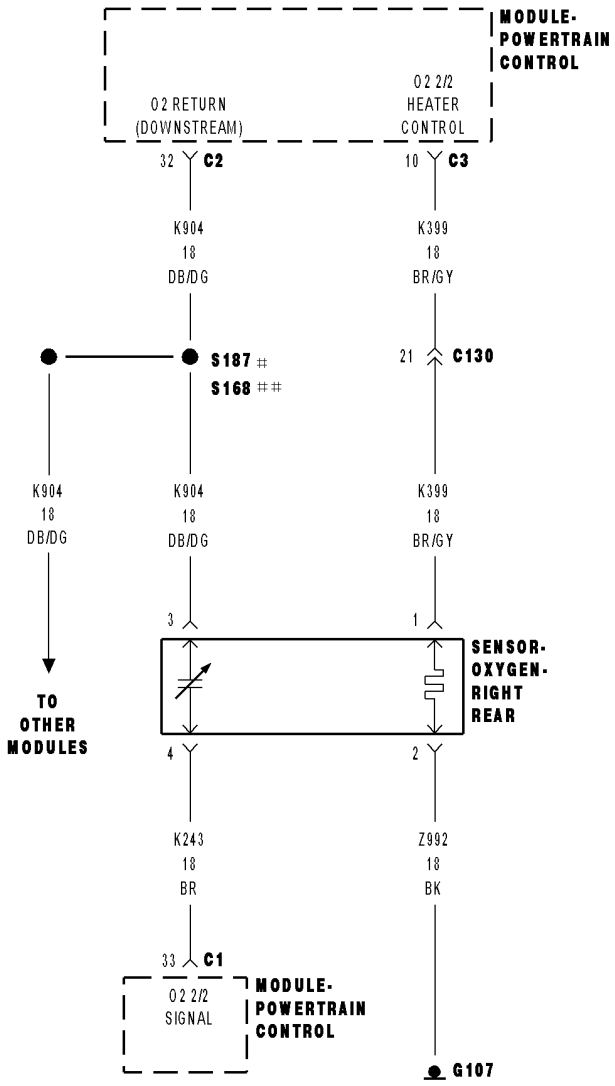
If there are no possible causes remaining, view repair.

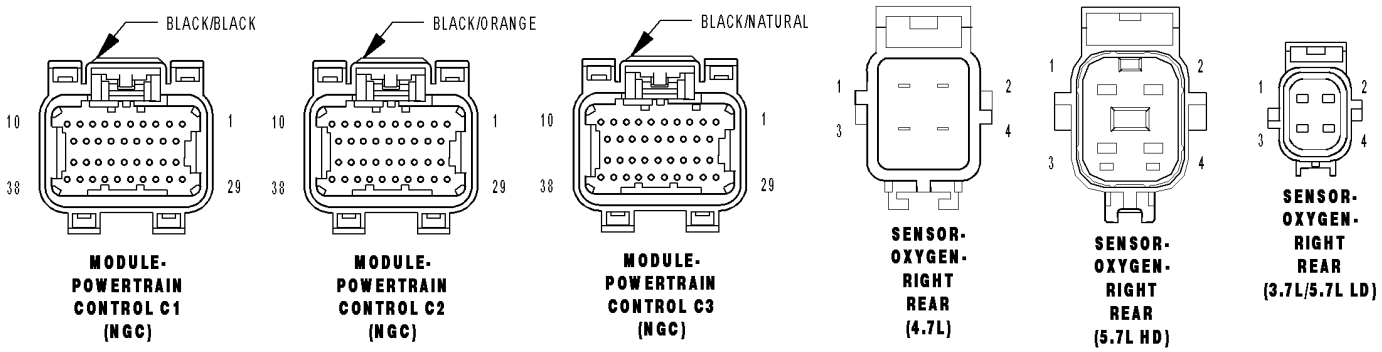
Repair

Replace the O2 Sensor

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE





81452bb4

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  Engine running and heater duty cycle greater than 0%. Battery voltage greater than 11.0 volts.
- **Set Condition:**
  No sensor output is received when the PCM powers up the sensor heater. Two trip fault. Three good trips to turn off the MIL.

Possible Causes
(K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN
(Z922) O2 2/2 HEATER GROUND CIRCUIT OPEN
O2 SENSOR HEATER ELEMENT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING.

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With a scan tool, monitor 2/2 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the 2/2 O2 Heater Element, between the O2 Heater Control terminal and the O2 Heater ground terminal in the O2 Sensor connector.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 2.0 and 30.0 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

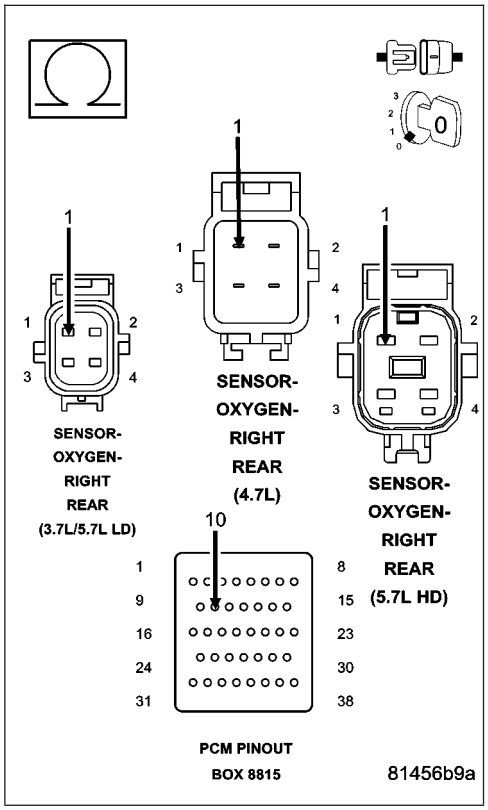
---

3. (K399) O2 2/2 HEATER CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K399) O2 2/2 Heater Control circuit from the O2 harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 0.5 of an ohm?

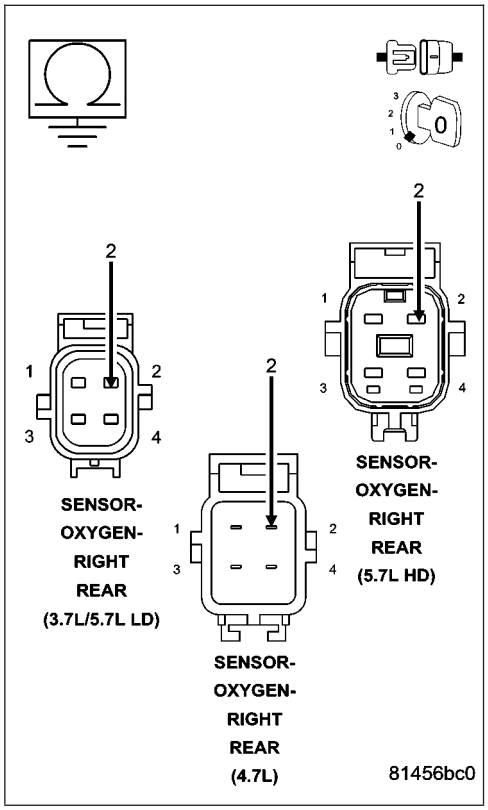
Yes >> Go To 4

No >> Repair the excessive resistance in the (K399) O2 2/2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

4. (Z992) O2 2/2 HEATER GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z992) O2 2/2 Heater ground circuit in the O2 Sensor harness connector.



Is the resistance below 0.5 of an ohm?

Yes >> Go To 5

No >> Repair the excessive resistance in the (Z992) O2 2/2 Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

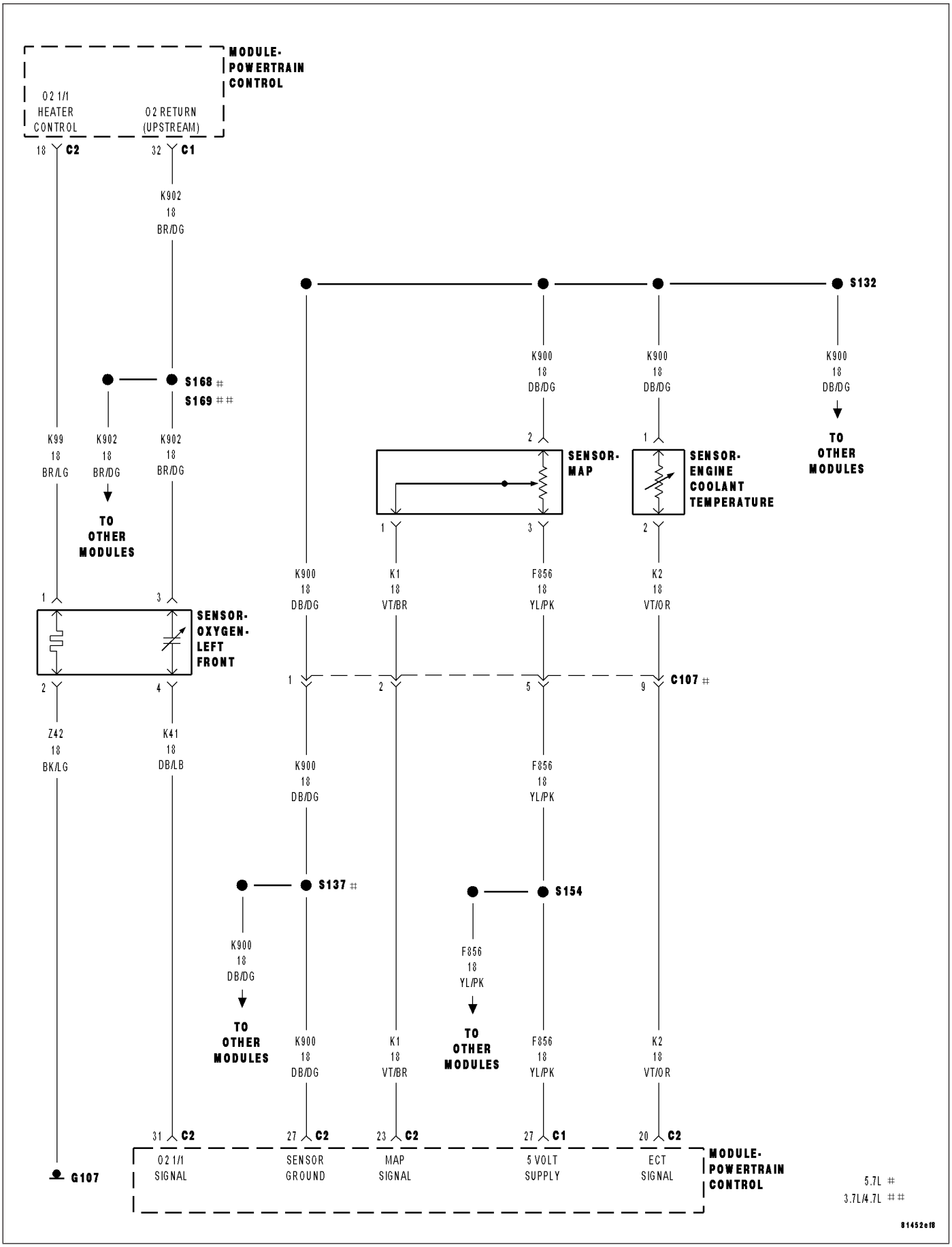
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN



P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR HEATER OPERATION
O2 SENSOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Below Specification

Go To 12

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With a scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage switching between 2.5 and 3.4 volts for all the O2 Sensors?

Yes >> Go To 4

No >> Go To 8

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the 1/1 O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the 1/1 O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

7. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

8. 1/1 O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/1 O2 Sensor harness connector.

With a scan tool, monitor the 1/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K41) Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

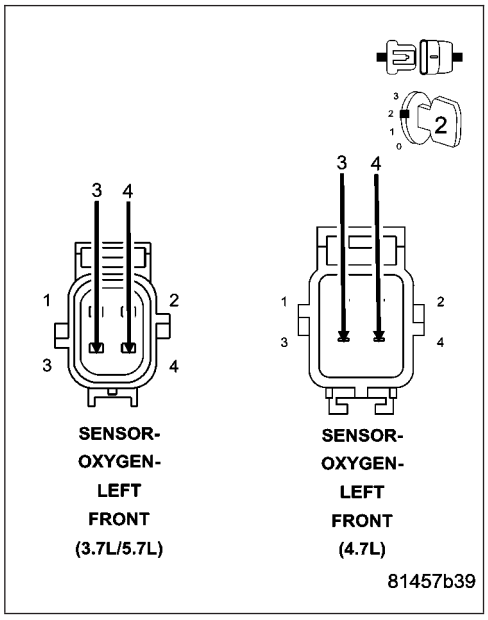
NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts with the jumper wire installed?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Remove the jumper wire before continuing.



P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

9. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

With a scan tool, monitor the 1/1 O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage above 4.8 volts?

Yes >> Go To 10

No >> Check the (K41) O2 Sensor 1/1 Signal circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. (K902) O2 RETURN UPSTREAM CIRCUIT

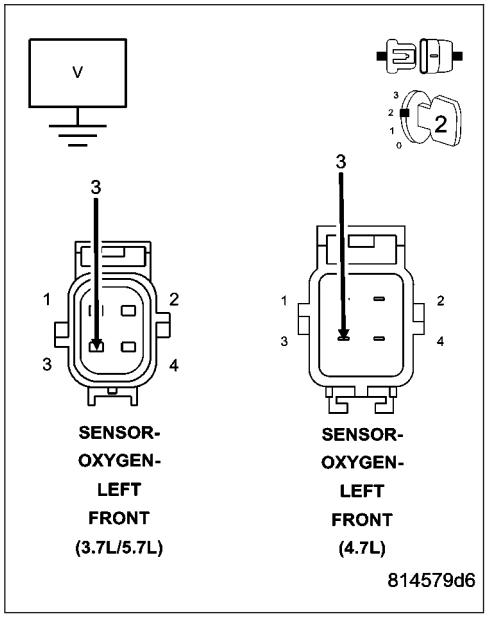
Disconnect the 1/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Go To 11

No >> Check the O2 Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertriain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



---

11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

---

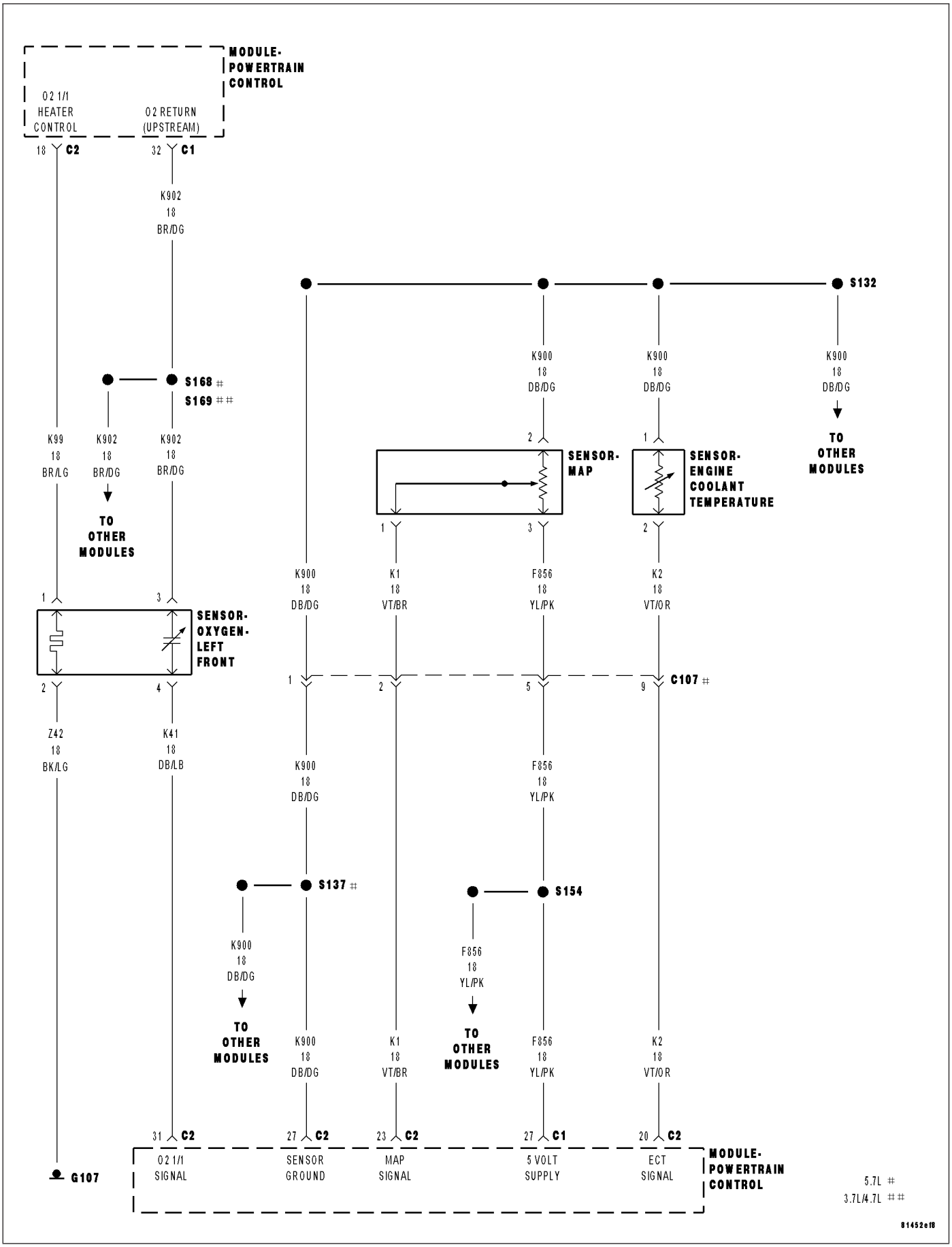
14. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL PROBLEM
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 1/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 9

---

4. 1/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 1/1 O2 Heater Test.

With the scan tool, monitor the O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts during the Heater test?

Yes >> Replace the O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With a scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes >> Go To 8

No >> Replace the EVAP Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Connect the vacuum hoses before continuing.

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

---

9. 1/1 O2 SENSOR

NOTE: Perform the following test on the O2 Sensors whose voltage was not switching properly in the previous step.
Ignition on, engine not running.
Disconnect the 1/1 O2 Sensor harness connector.
With a scan tool, monitor the 1/1 O2 Sensor voltage.
O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.
Connect a jumper wire between the (K41) O2 Sensor 1/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

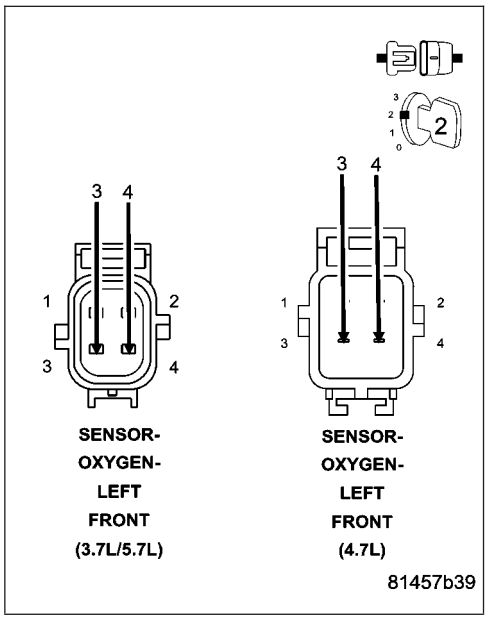
NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.

Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the 1/1 O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

NOTE: Remove the jumper wire before continuing.



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

10. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

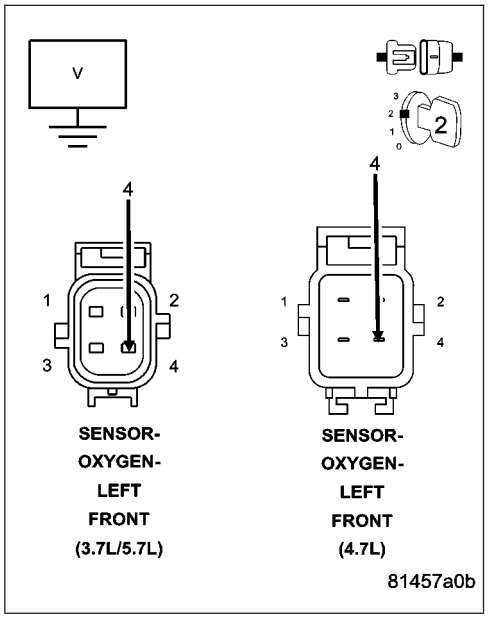
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit in the O2 Sensor harness connector.

Is the voltage above 4.8 volts?

Yes >> Check the (K41) O2 Sensor 1/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Engine still running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the 1/1 O2 Sensor harness connector.

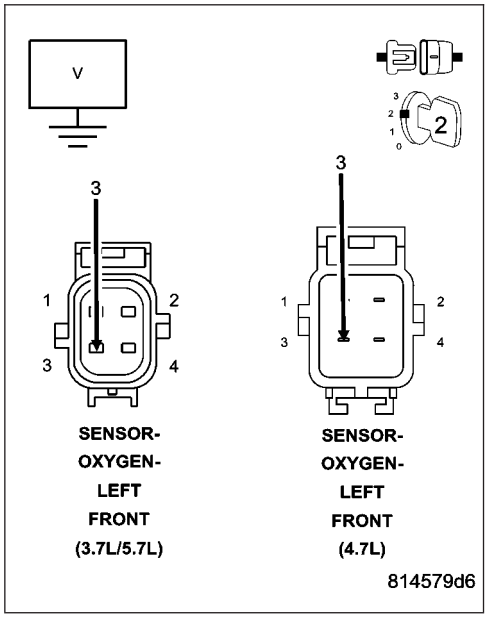
Is the voltage at 2.5 volts?

Yes >> Go To 12

No >> Check the (K902) O2 Return Upstream circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

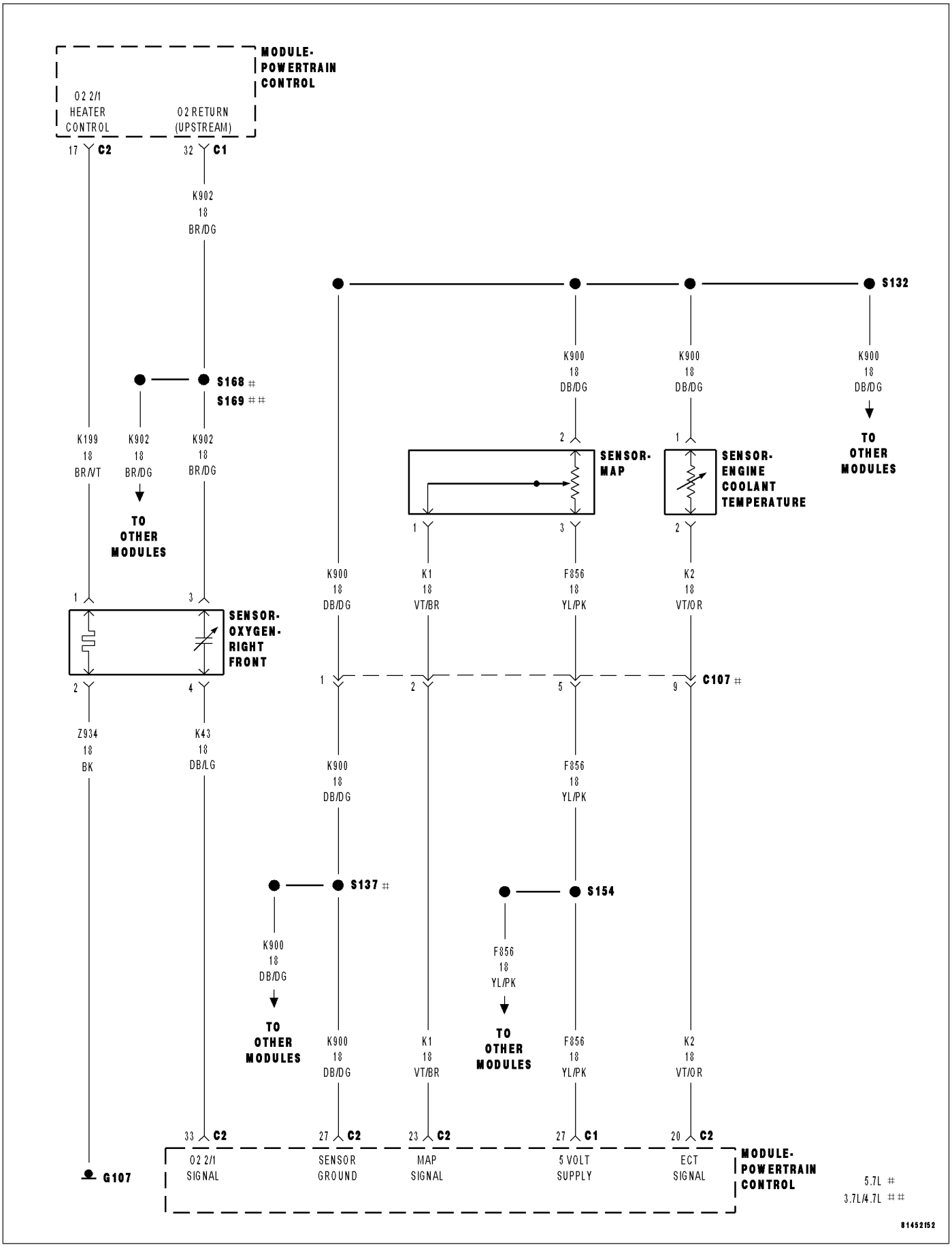
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN



P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR HEATER OPERATION
O2 SENSOR
MAP SENSOR OPERATION
ECT SENSOR OPERATION
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Diagnose all other trouble codes before continuing.

NOTE: Check for contaminants that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Below Specification

Go To 12

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensor's Signal or Return circuit is shorted to ground the scan tool will display all O2 Sensor voltage readings low. The O2 Sensor that is shorted to ground will display a voltage reading near or at 0 volts.

NOTE: If one of the O2 Sensor Signal or Return circuits are shorted to voltage, the scan tool will display all O2 Sensor voltage readings high.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 8

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

NOTE: Perform the following test on all O2 Sensors.

Ignition on, engine not running.

With a scan tool, actuate the 2/1 O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the 2/1 O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature (ECT) Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the ECT Sensor value. The temperature value change should be a smooth transition from start up to normal operating temperature 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and did it reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

7. ENGINE MECHANICAL

Turn the ignition off.

Check for any of the following conditions/mechanical problems.

AIR INDUCTION SYSTEM - must be free from leaks.

ENGINE VACUUM - must be at least 13 inches in neutral

ENGINE VALVE TIMING - must be within specifications

ENGINE COMPRESSION - must be within specifications

ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

ENGINE PCV SYSTEM - must flow freely

TORQUE CONVERTER STALL SPEED - must be within specifications

POWER BRAKE BOOSTER - no internal vacuum leaks

FUEL - must be free of contamination

FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

8. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/1 O2 Sensor harness connector.

With the scan tool, monitor the 2/1 O2 Sensor voltage.

O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

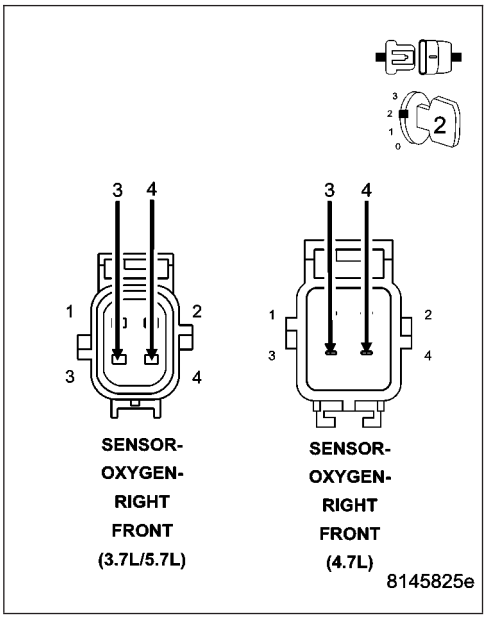
NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor voltage change from 5.0 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the 2/1 O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

NOTE: Remove the jumper wire before continuing.



P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

9. O2 SENSOR SIGNAL CIRCUIT

With the scan tool, monitor all the O2 Sensor voltage reading with the jumper wire removed.

NOTE: The scan tool will display all O2 Sensor voltage readings approximately 5.0 volts when only one O2 Sensor's Signal circuit is shorted to voltage.

NOTE: The scan tool will display one O2 Sensor voltage close to zero and the others will read lower than normal when one O2 Sensor Signal circuit contains excessive resistance.

Is the voltage above 4.8 volts?

Yes >> Go To 10

No >> Check all the O2 Signal circuits for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. (K902) O2 RETURN UPSTREAM CIRCUIT

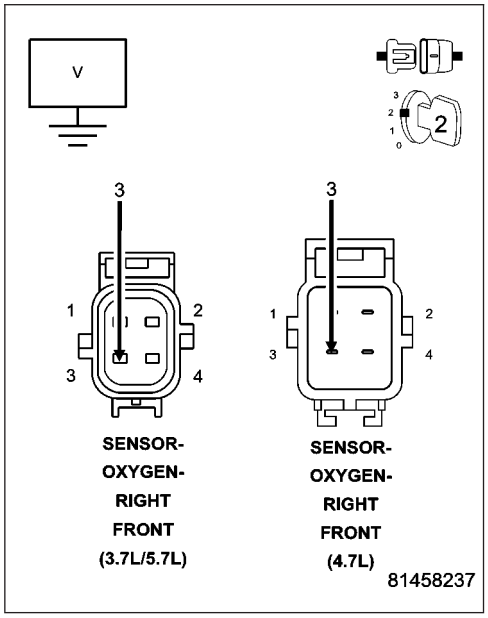
Disconnect the 2/1 O2 Sensor harness connector.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

Yes >> Go To 11

No >> Check the (K902) O2 Return Upstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



---

11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

12. RESTRICTED FUEL SUPPLY LINE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 between disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

---

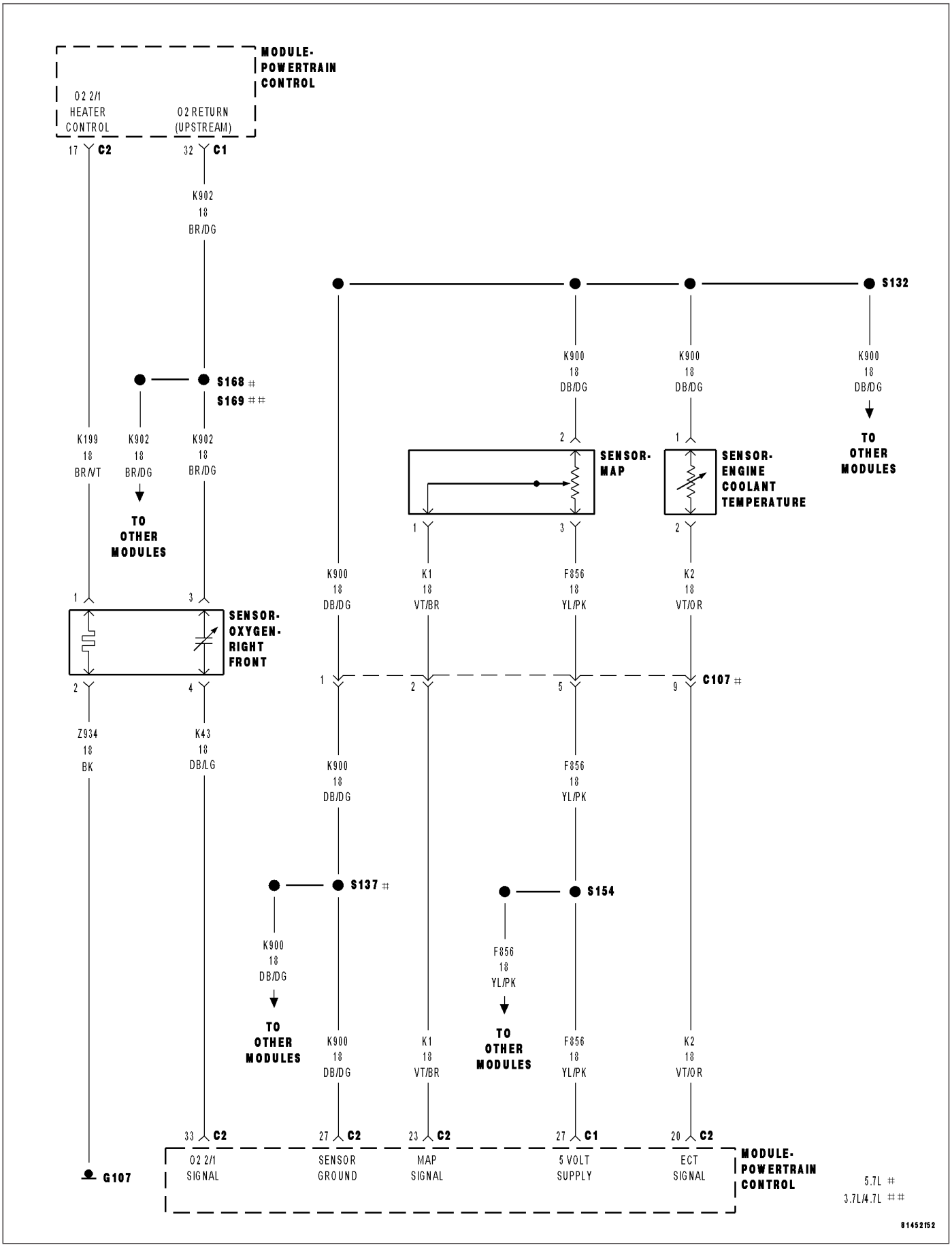
14. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR HEATER OPERATION
EVAP PURGE SOLENOID OPERATION
O2 SIGNAL CIRCUIT
O2 RETURN CIRCUIT
O2 SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL
FUEL FILTER/PRESSURE REGULATOR (HIGH)
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminates that may have damaged an O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. O2 SENSOR OPERATION

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: If one of the O2 Sensors Signal or Return circuit is shorted to ground or voltage, all the other O2 Sensor voltage readings will be affected.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.

With the scan tool, monitor the 2/1 O2 Sensor voltage reading.

Is the voltage switching between 2.5 and 3.4 volts?

Yes >> Go To 4

No >> Go To 9

---

4. 2/1 O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize at 5.0 volts.

Ignition on, engine not running.

With the scan tool, perform the 2/1 O2 Heater Test for each O2 Sensor.

With the scan tool, monitor the 2/1 O2 Sensor voltage while performing the Heater test for at least 2 minutes.

Does the voltage stay above 4.5 volts for each Sensor?

Yes >> Replace the 2/1 O2 Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

5. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 6

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

6. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the ECT value increase smoothly and reach at least 180°F (82°C)?

Yes >> Go To 7

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port on the component side.

Did the Evap Purge Solenoid hold vacuum?

Yes >> Go To 8

No >> Replace the EVAP Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Connect the vacuum hoses before continuing.

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

8. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

---

9. 2/1 O2 SENSOR

Ignition on, engine not running.
Disconnect the 2/1 O2 Sensor harness connector.
With the scan tool, monitor the 2/1 O2 Sensor voltage.
O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.
Connect a jumper wire between the (K43) O2 Sensor 2/1 Signal circuit and the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

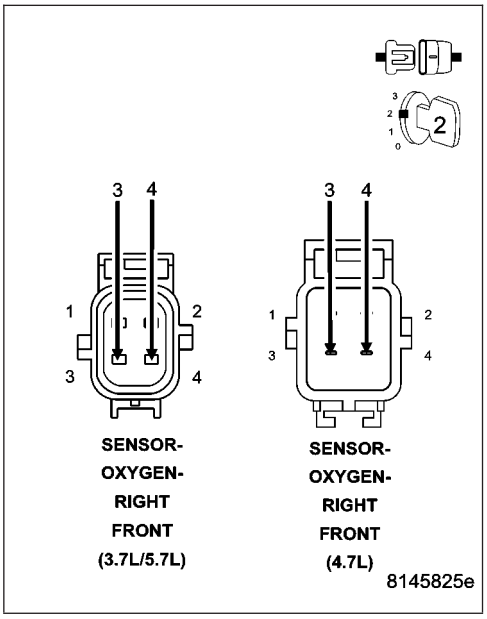
NOTE: The voltage should drop from 5.0 volts down to 2.5 volts with the jumper wire connected.

Did the O2 Sensor voltage drop from 5 volts to 2.5 volts when the jumper wire was installed?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

NOTE: Remove the jumper wire before continuing.



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

10. O2 SENSOR SIGNAL CIRCUIT

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

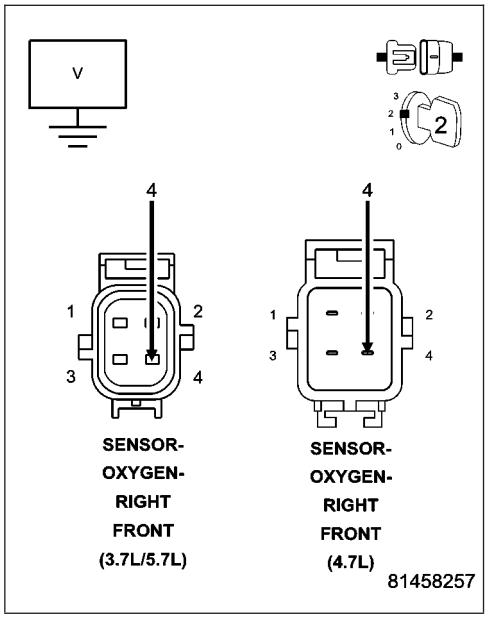
Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit in the O2 Sensor harness connector.

Is the voltage above 4.8 volts?

Yes >> Check the (K43) O2 Sensor 2/1 Signal circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K902) O2 SENSOR RETURN UPSTREAM CIRCUIT

Engine still running.

Measure the voltage on the (K902) O2 Return Upstream circuit in the O2 Sensor harness connector.

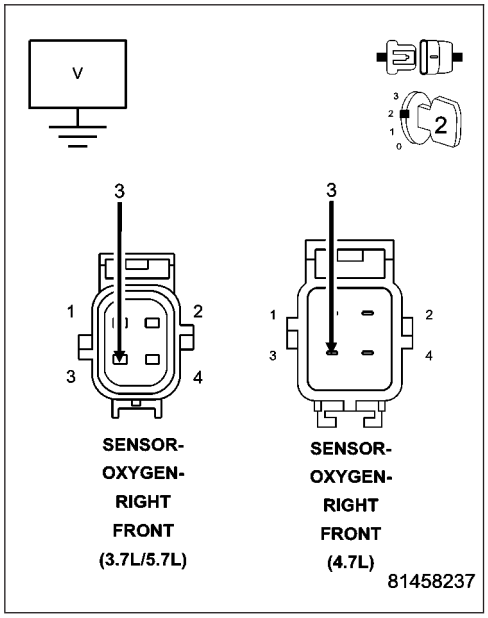
Is the voltage at 2.5 volts?

Yes >> Go To 12

No >> Check the (K902) O2 Return Upstream circuit for damage, short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

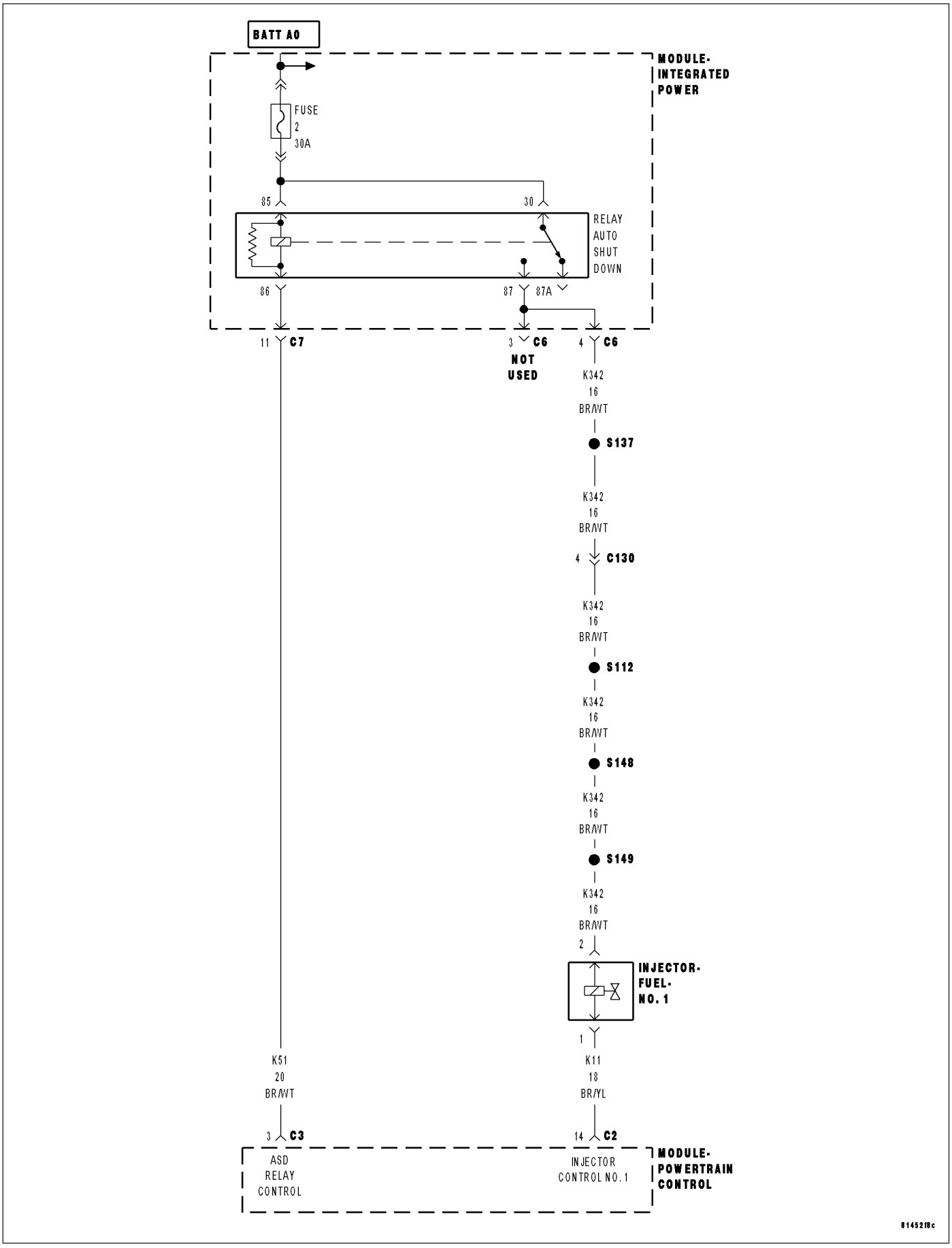
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT



P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN
(K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

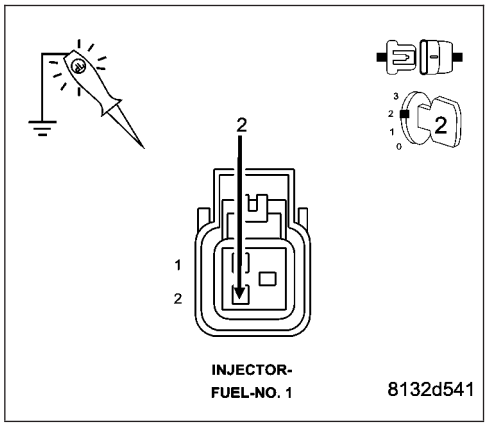
Turn the ignition off.

Disconnect the No.1 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Fuel Injector harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.

With the scan tool, actuate the Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

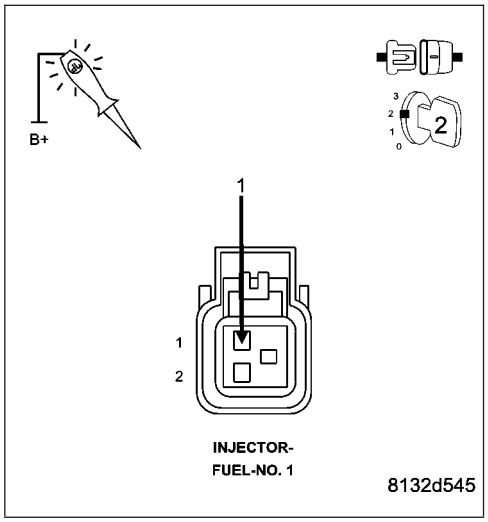
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

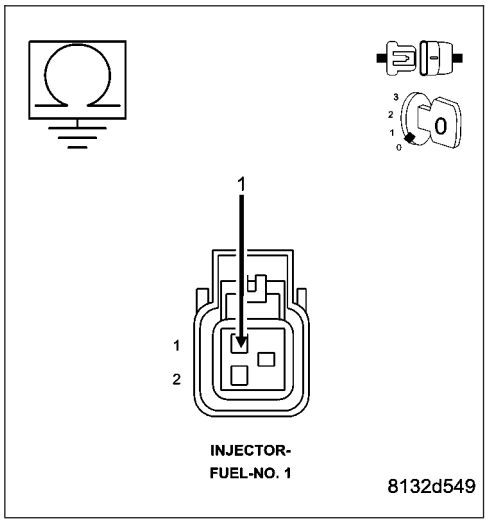
Measure the resistance between ground and the (K11) Injector Control No.1 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K11) Injector Control No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

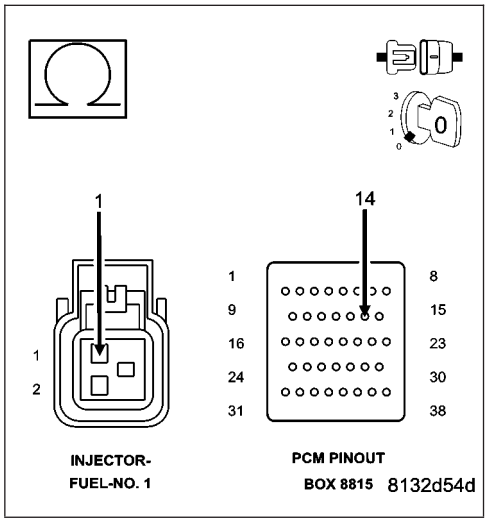
5. (K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K11) Injector Control No.1 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K11) Injector Control No.1 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

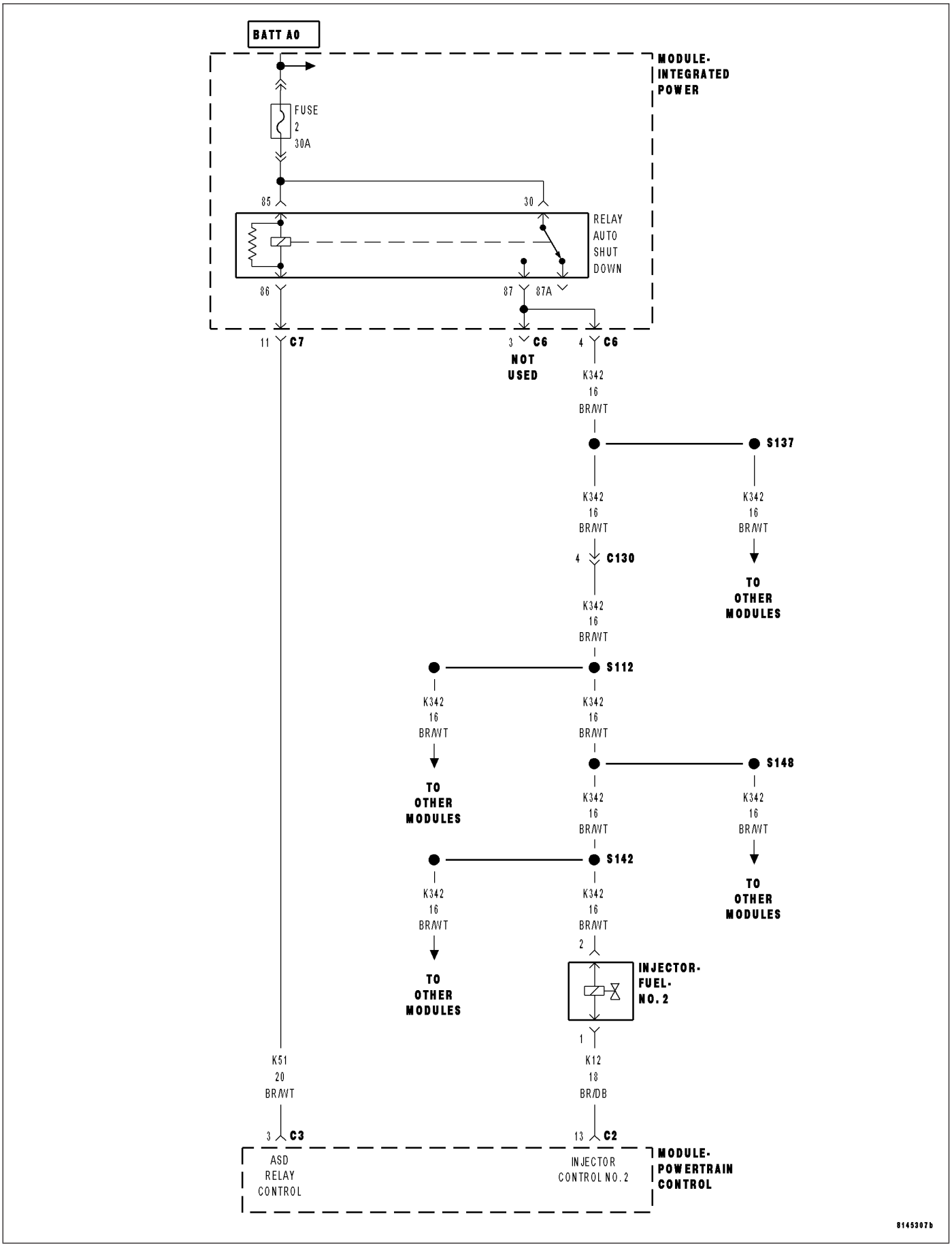
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0202-FUEL INJECTOR 2 CIRCUIT



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN
(K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.2 Fuel Injector harness connector.

Ignition on, engine not running.

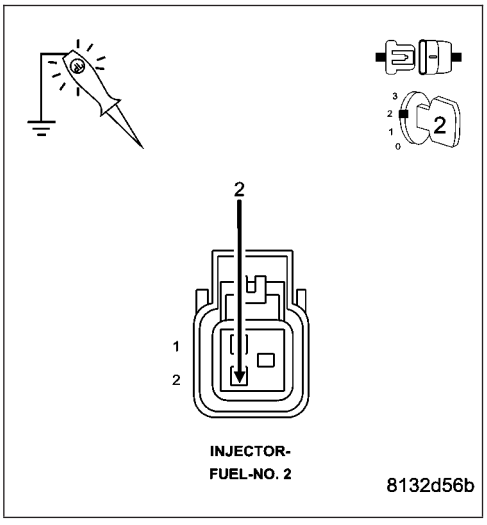
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.2 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.

With the scan tool, actuate the No.2 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

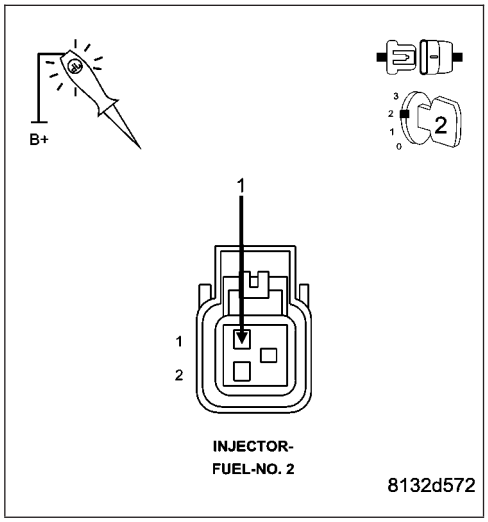
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

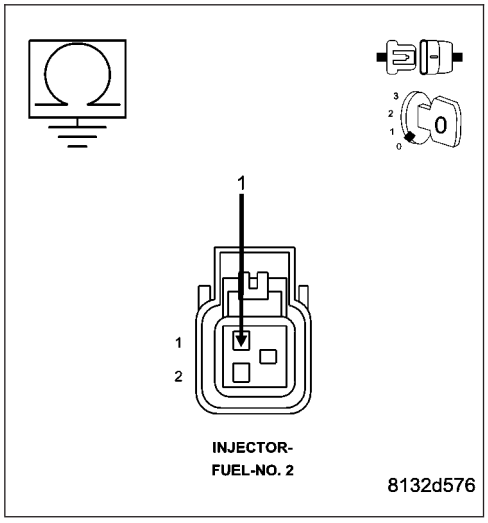
Measure the resistance between ground and the (K12) Injector Control No.2 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K12) Injector Control No.2 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

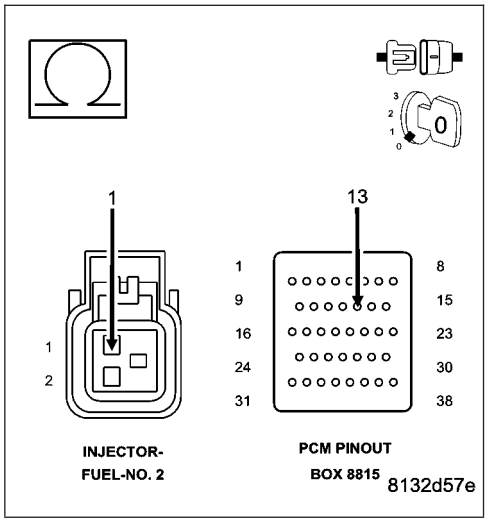
5. (K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K12) Injector Control No.2 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K12) Injector Control No.2 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

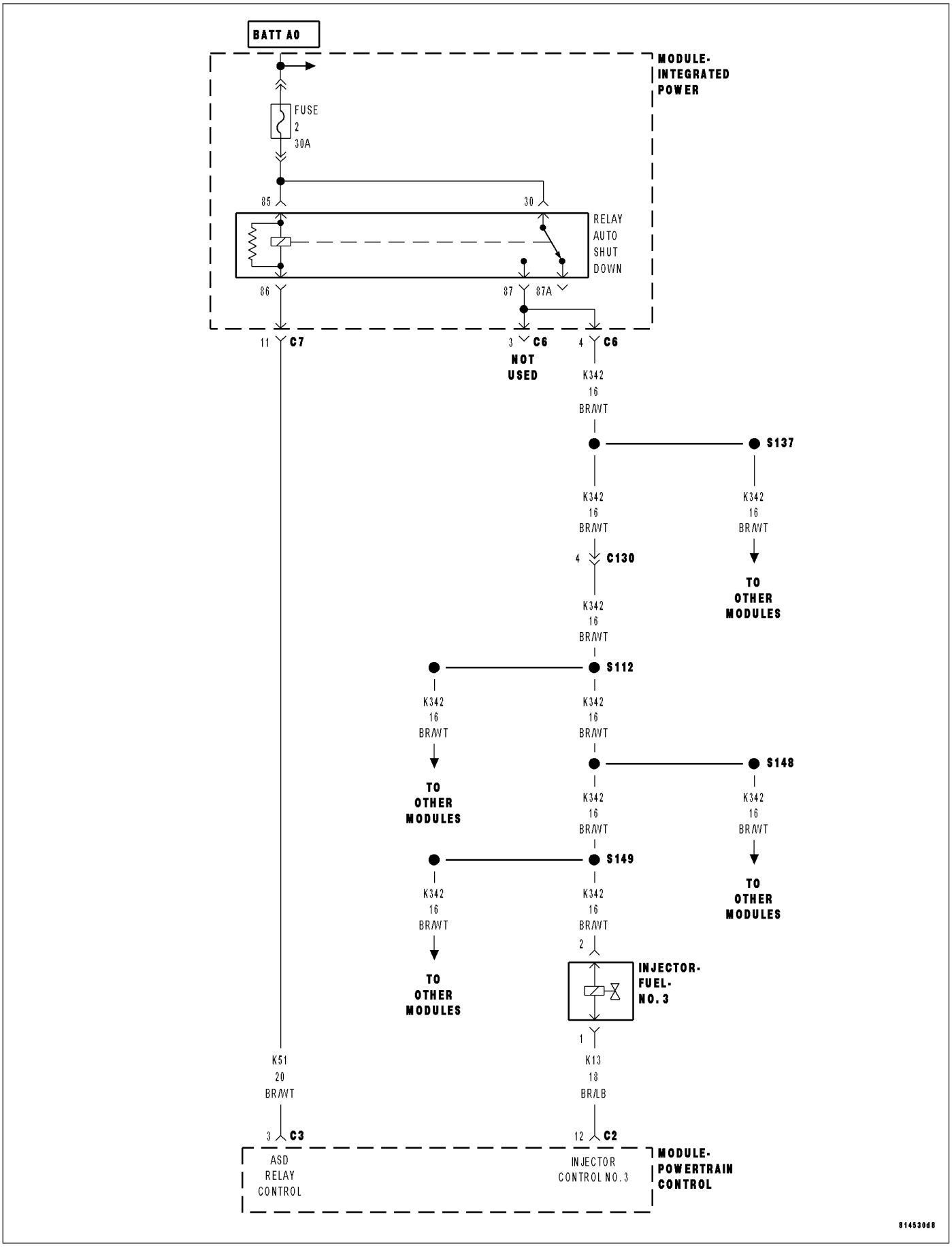
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0203-FUEL INJECTOR 3 CIRCUIT



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN
(K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

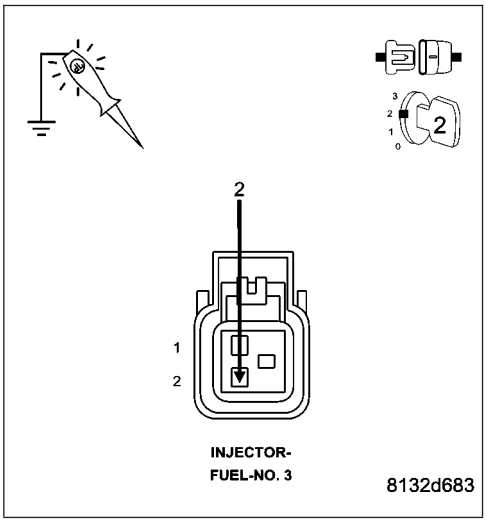
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.3 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.

With the scan tool, actuate the No.3 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

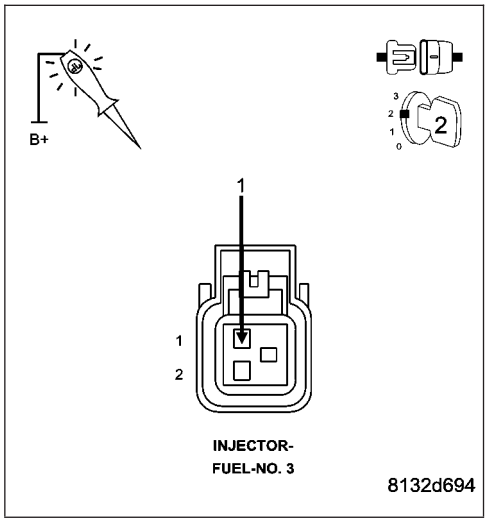
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

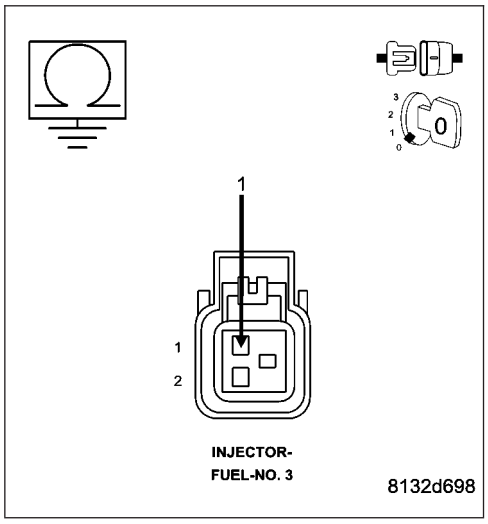
Measure the resistance between ground and the (K13) Injector Control No.3 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K13) Injector Control No.3 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

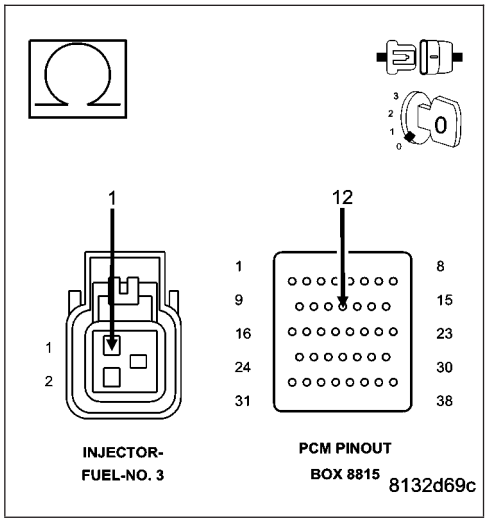
5. (K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K13) Injector Control No.3 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K13) Injector Control No.3 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

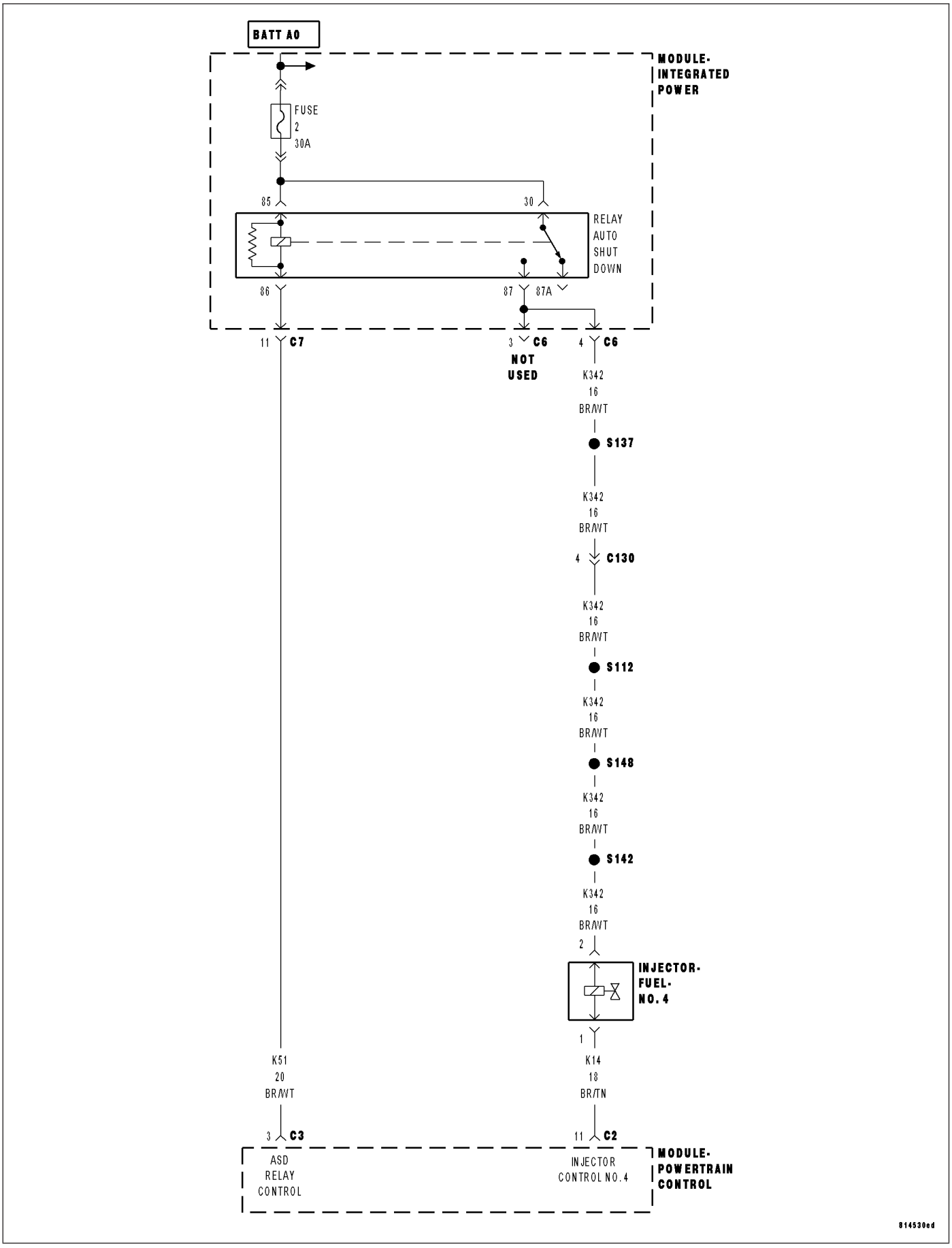
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0204-FUEL INJECTOR 4 CIRCUIT



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN
(K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

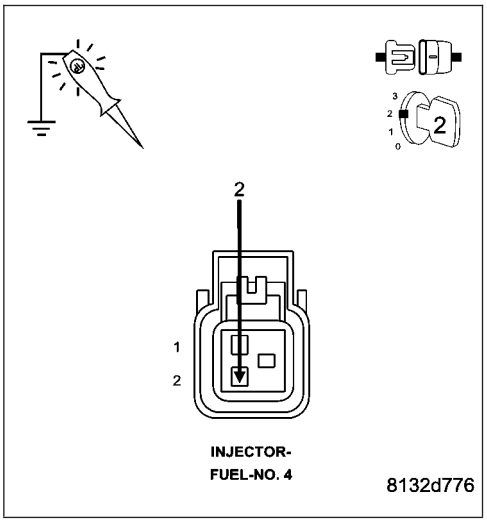
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.4 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.

With the scan tool, actuate the No.4 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

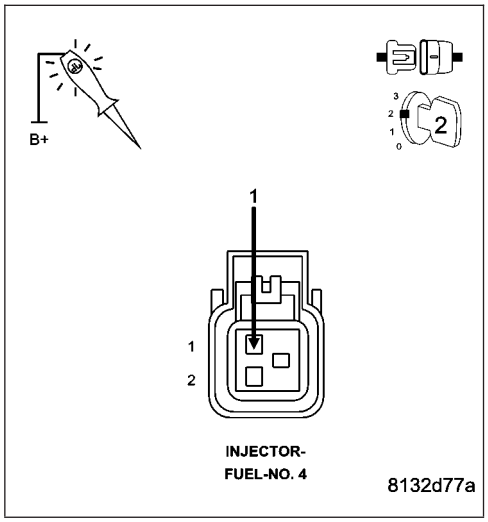
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

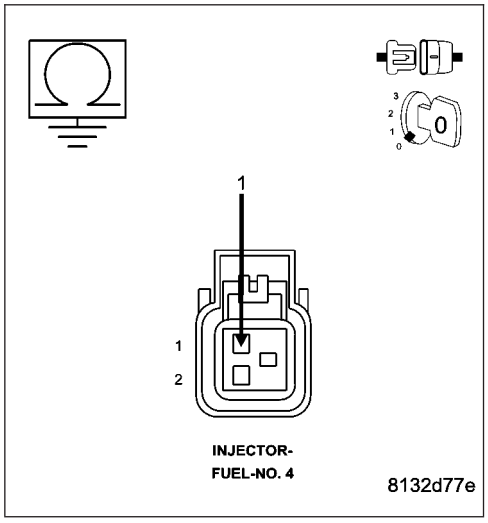
Measure the resistance between ground and the (K14) Injector Control No.4 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K14) Injector Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

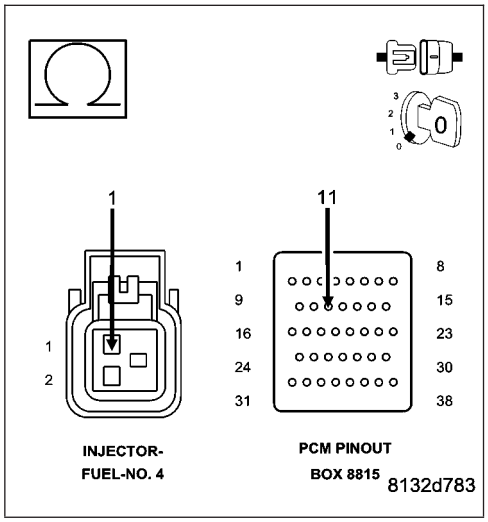
5. (K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K14) Injector Control No.4 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K14) Injector Control No.4 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

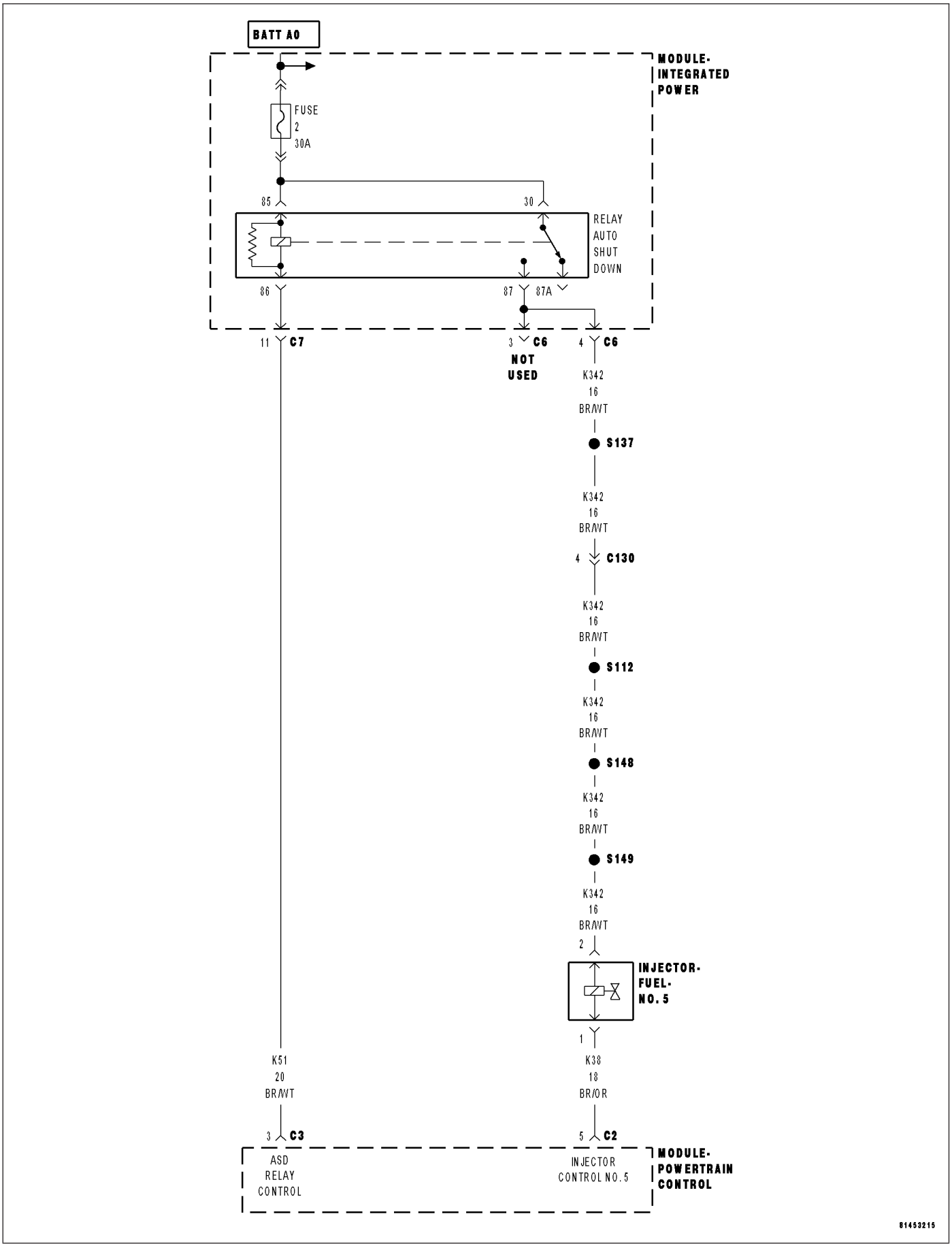
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0205-FUEL INJECTOR 5 CIRCUIT



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN
(K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.5 Fuel Injector harness connector.

Ignition on, engine not running.

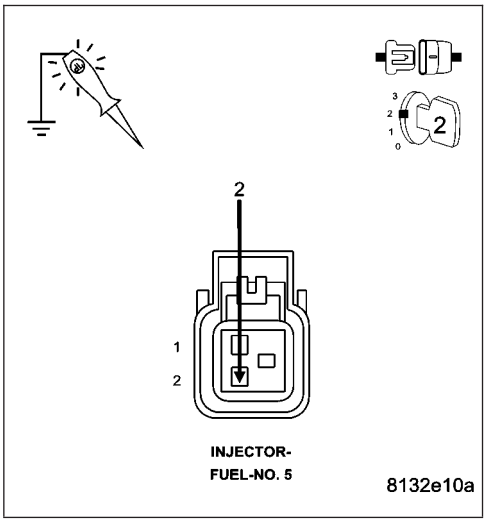
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.5 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.

With the scan tool, actuate the No.5 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

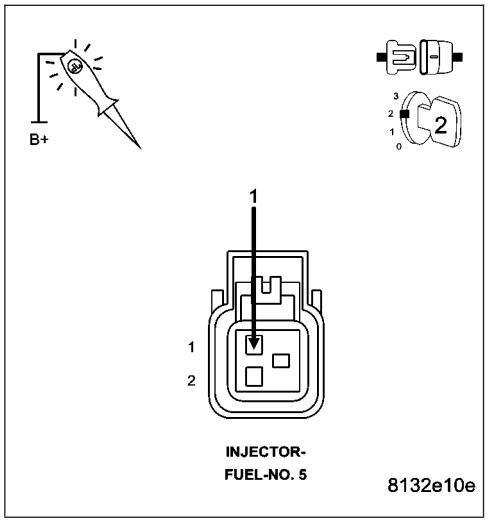
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

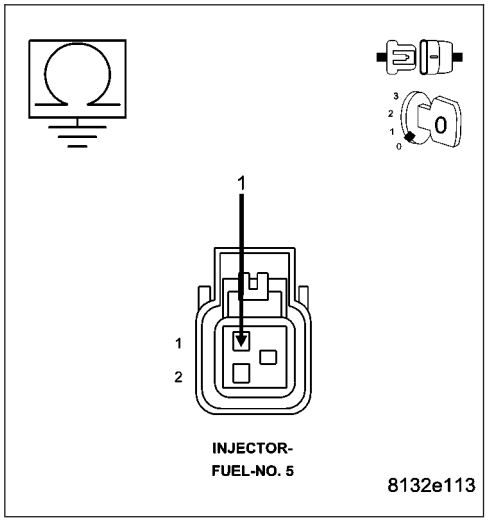
Measure the resistance between ground and the (K38) Injector Control No.5 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K38) Injector Control No.5 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

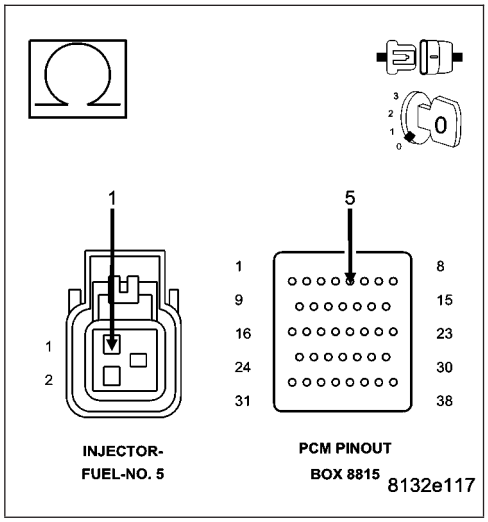
5. (K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K38) Injector Control No.5 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K38) Injector Control No.5 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

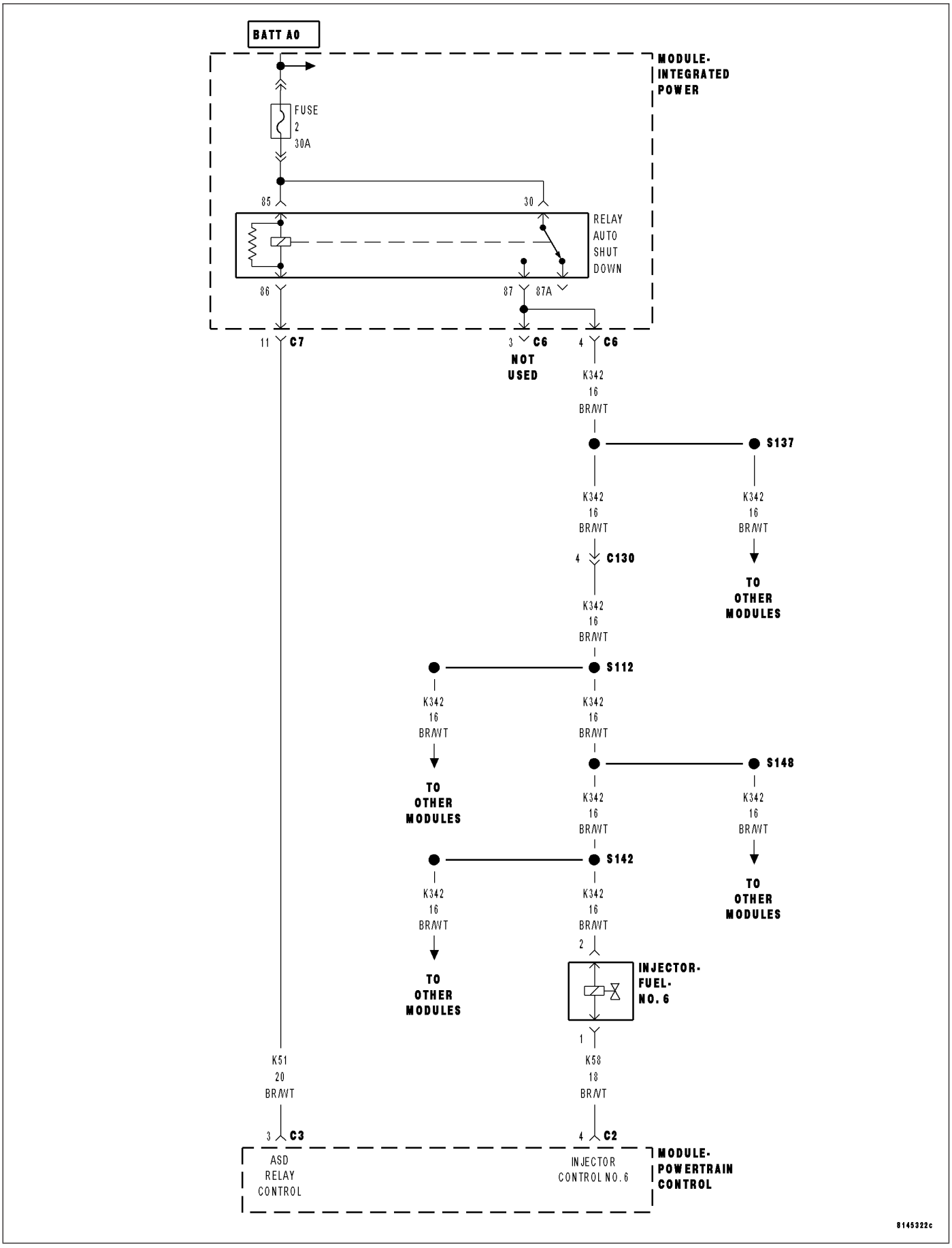
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0206-FUEL INJECTOR 6 CIRCUIT



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN
(K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

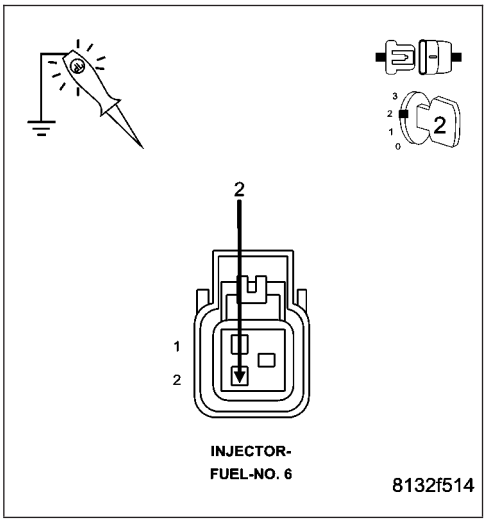
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.6 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.

With the scan tool, actuate the No.6 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

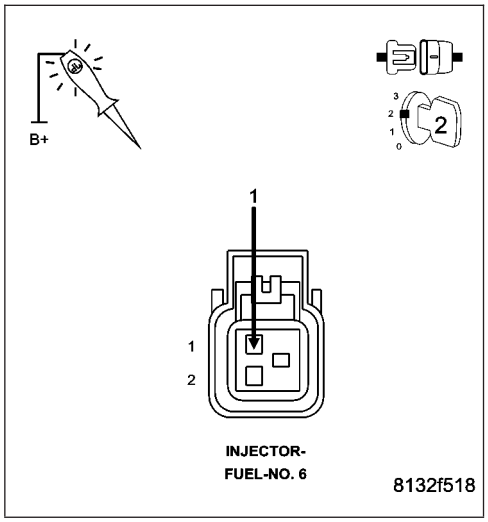
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

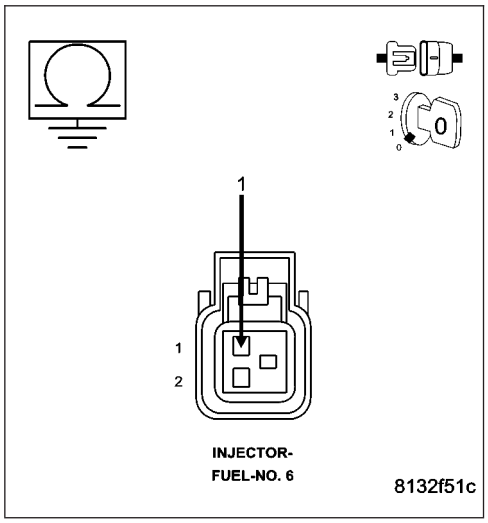
Measure the resistance between ground and the (K58) Injector Control No.6 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K58) Injector Control No.6 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

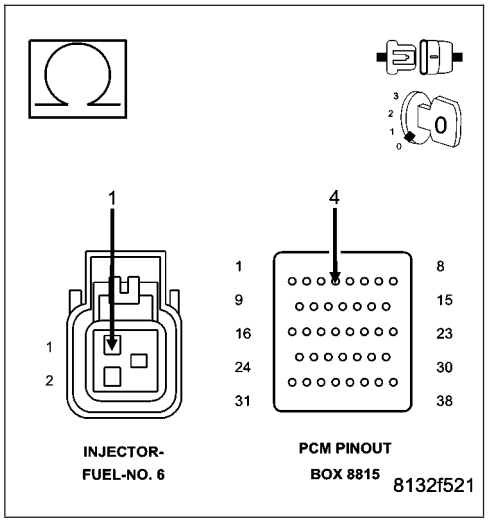
5. (K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K58) Injector Control No.6 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K58) Injector Control No.6 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

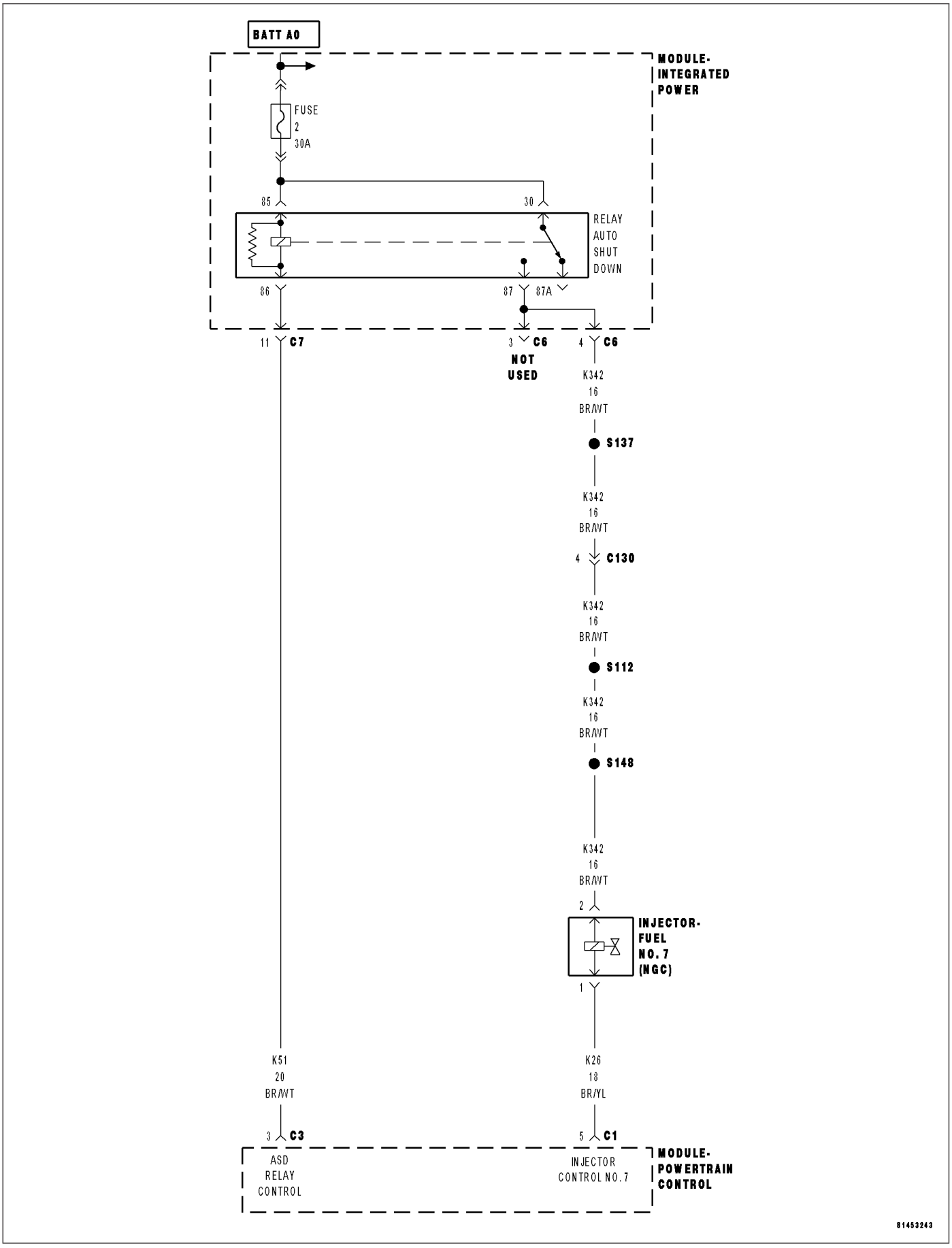
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0207-FUEL INJECTOR 7 CIRCUIT



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN
(K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.7 Fuel Injector harness connector.

Ignition on, engine not running.

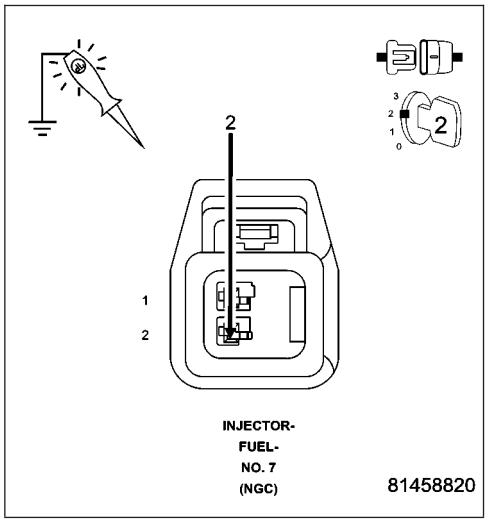
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.7 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K26) Injector Control No.7 circuit.

With the scan tool, actuate the No.7 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

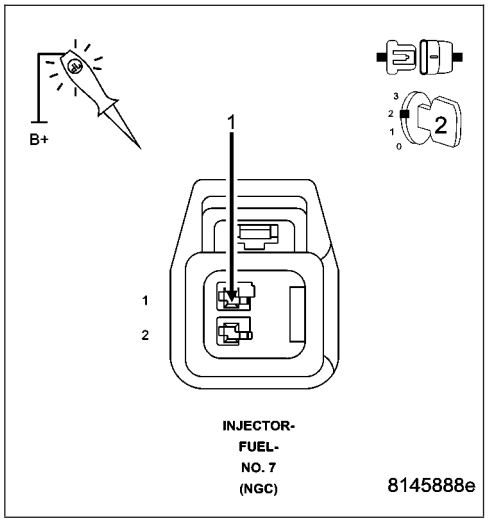
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

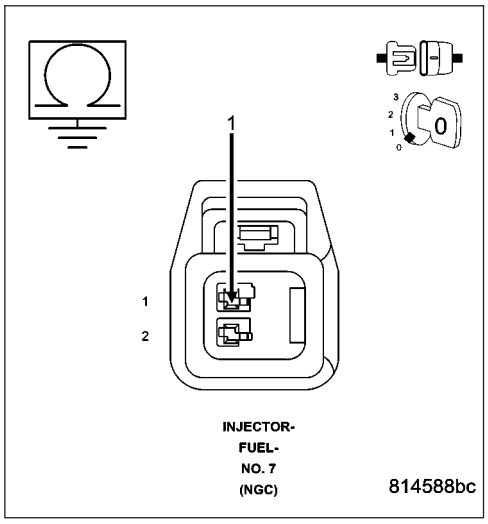
Measure the resistance between ground and the (K26) Injector Control No.7 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K26) Injector Control No.7 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

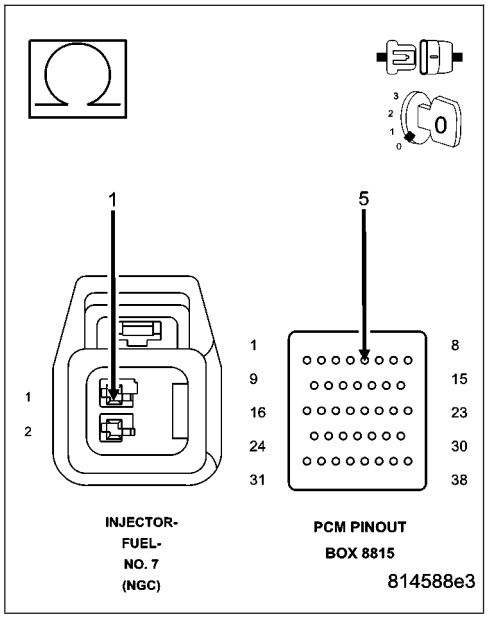
5. (K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K26) Injector Control No.7 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K26) Injector Control No.7 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

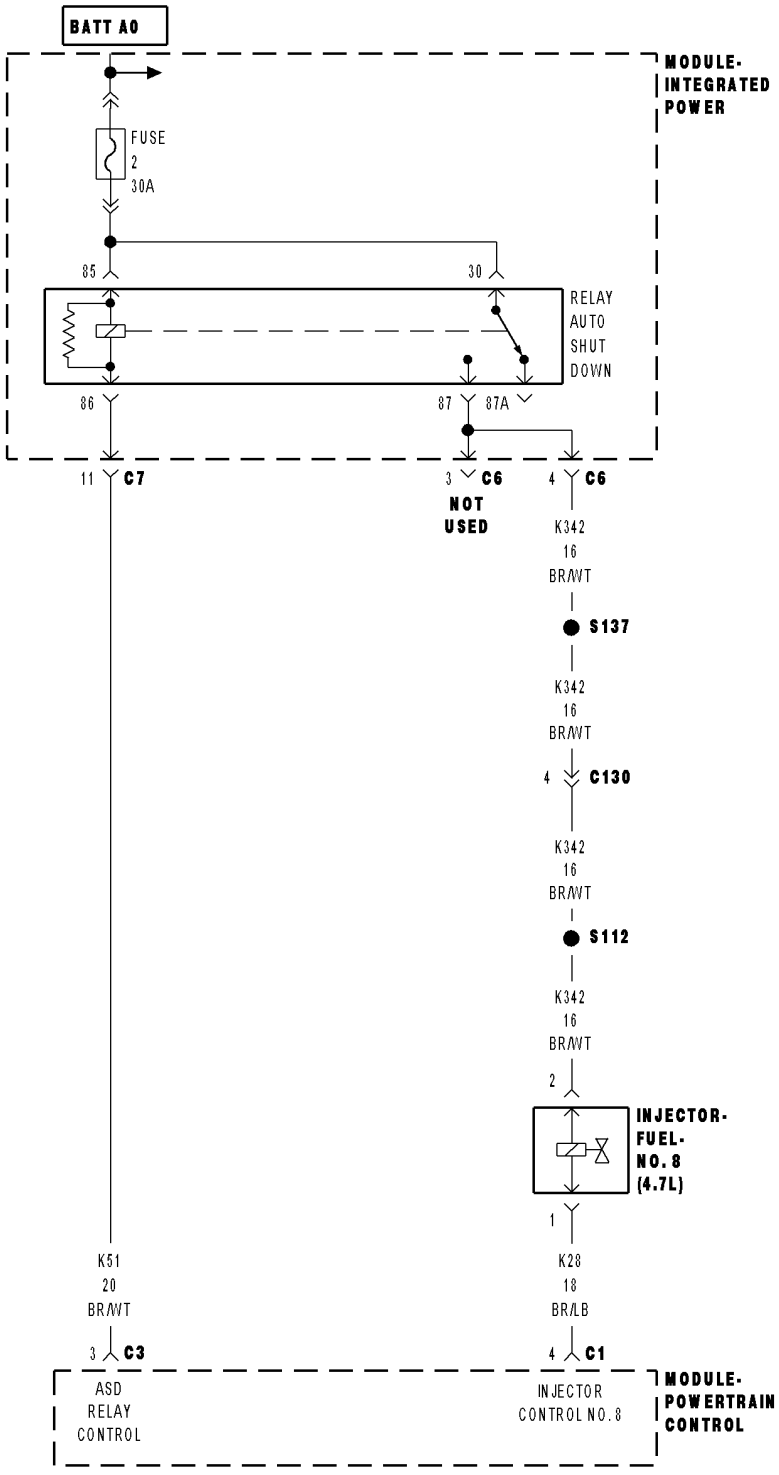
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0208-FUEL INJECTOR 8 CIRCUIT



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10 volts. Auto Shutdown Relay energized. Engine speed less than 3000 rpm.
- **Set Condition:**
  No inductive spike is detected after injector turn off.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN
(K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

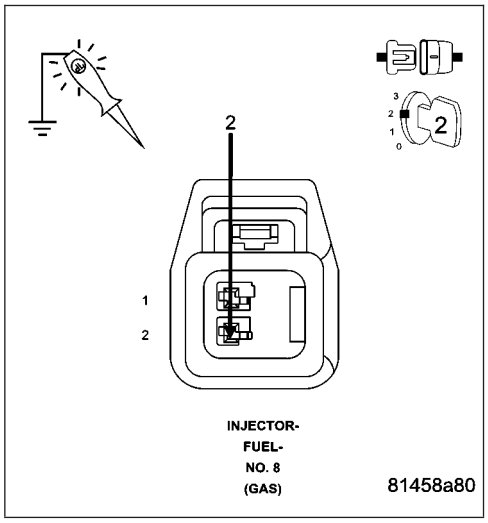
Turn the ignition off.

Disconnect the No.8 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.8 Fuel Injector harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control No.8 circuit.

With the scan tool, actuate the No.8 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

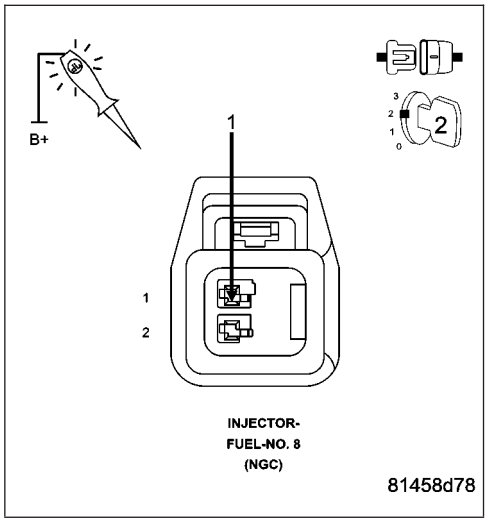
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

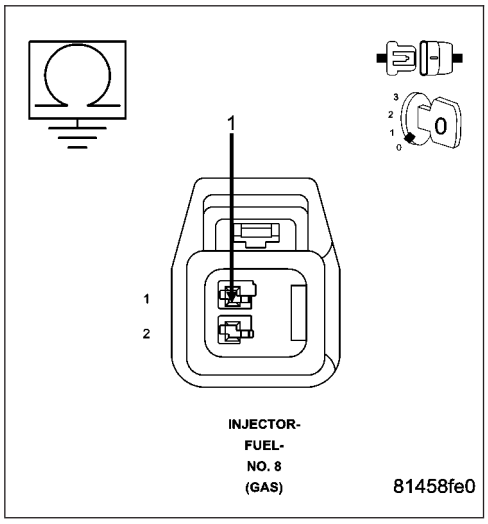
Measure the resistance between ground and the (K28) Injector Control No.8 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K28) Injector Control No.8 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

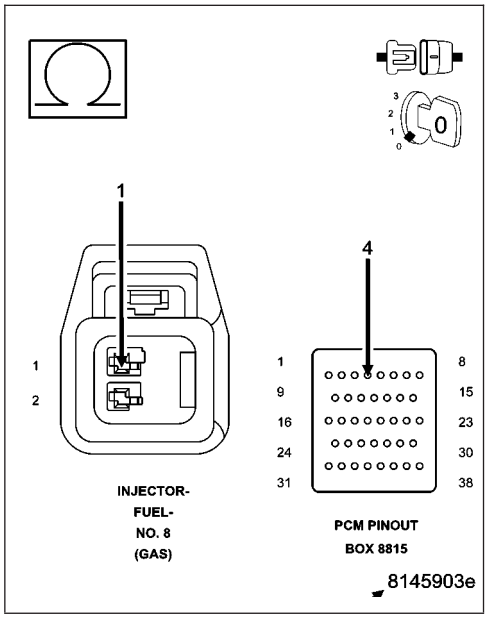
5. (K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K28) Injector Control No.8 circuit from the Fuel Injector harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K28) Injector Control No.8 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

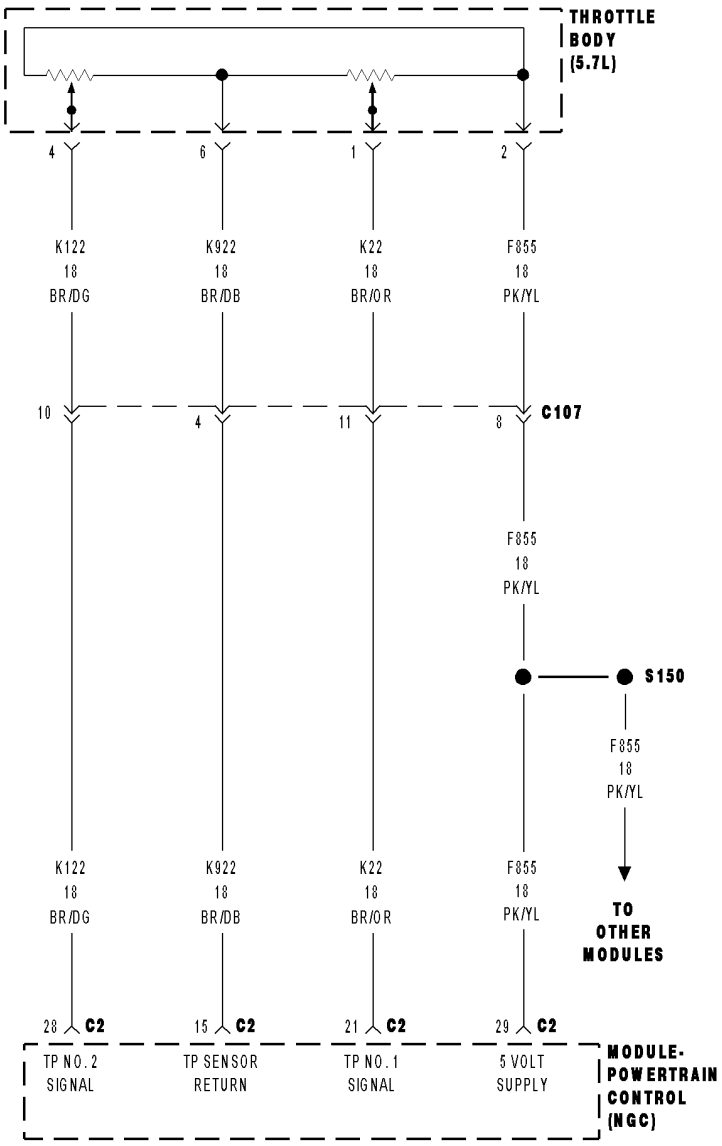
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

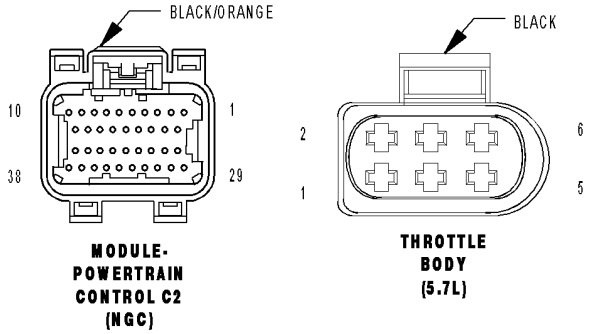
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE





81452d8c

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and No MAP Sensor DTCs set.
- **Set Condition:**
  TP Sensor signals do not correlate to the MAP Sensor signal. One Trip Fault. ETC light will illuminate. P2135 should set with this code also.

Possible Causes
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT OR (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
RESISTANCE IN THE (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT OR (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any other TP Sensor DTC(s) before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.
Ignition on, engine not running.

NOTE: Inspect the engine for vacuum leaks.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 11

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

2. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT OR (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (K122) TP No.2 Signal circuit in the Throttle Body harness connector.

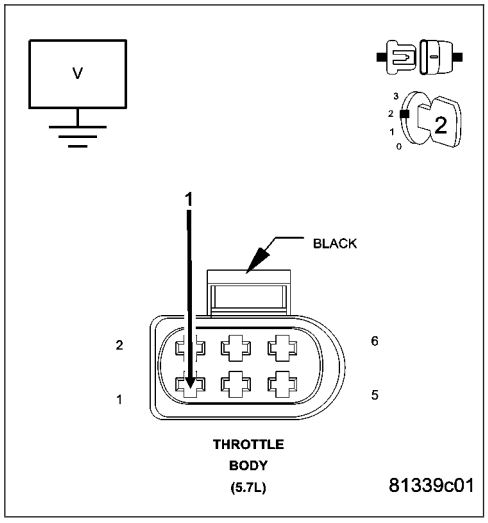
Measure the voltage on the (K22) TP No.1 Signal circuit in the Throttle Body harness connector.

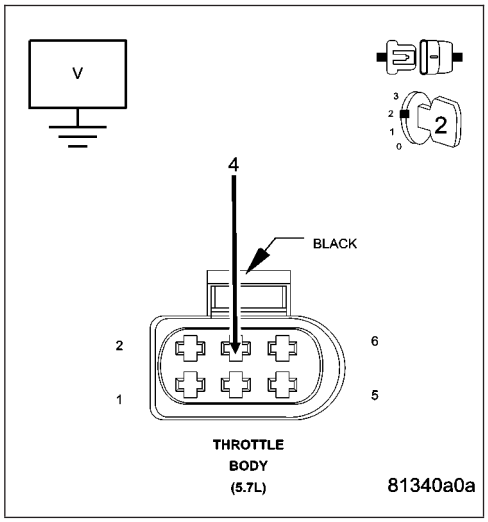
Is the voltage above 5.2 volts for each reading?

Yes >> Repair the short to battery voltage in the (K122) TP Sensor No.2 Signal circuit or the (K22) TP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3





P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

3. THROTTLE POSITION SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With the scan tool, monitor the TP Sensor No.1 and No.2 voltage.

Connect a jumper wire between the (K922) Sensor Return circuit and the (K22) TP Sensor No.1 Signal circuit.

NOTE: TP Sensor No.1 voltage should change from approximately 4.7 volts to 0.3 of a volt.

For TP Sensor No.2, connect a jumper wire between (F855) 5-volt supply circuit and the (K122) TP Sensor No.2 Signal circuit.

NOTE: TP Sensor No.2 voltage should change from approximately 0 volts to 5.0 volts.

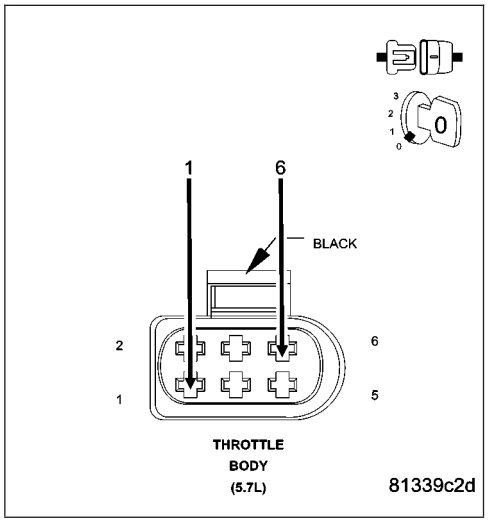
Is the voltage reading within the listed specification with the jumper wire installed?

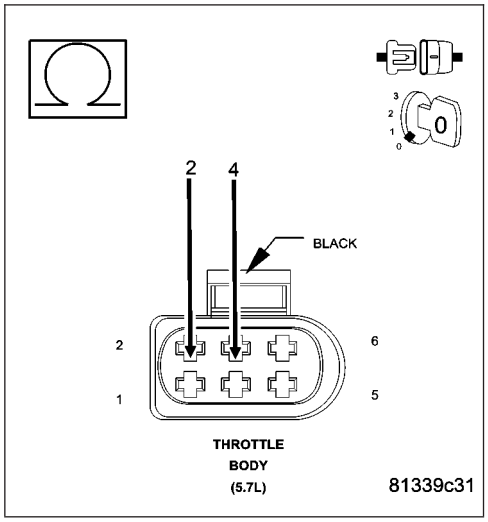
Yes >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool, select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.





P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

4. EXCESSIVE RESISTANCE IN THE (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

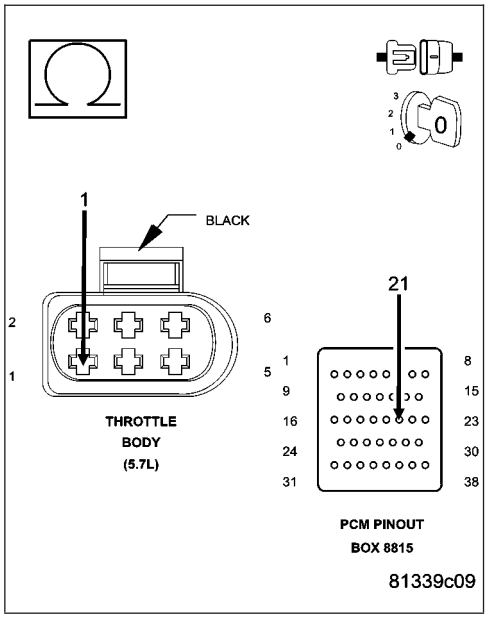
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

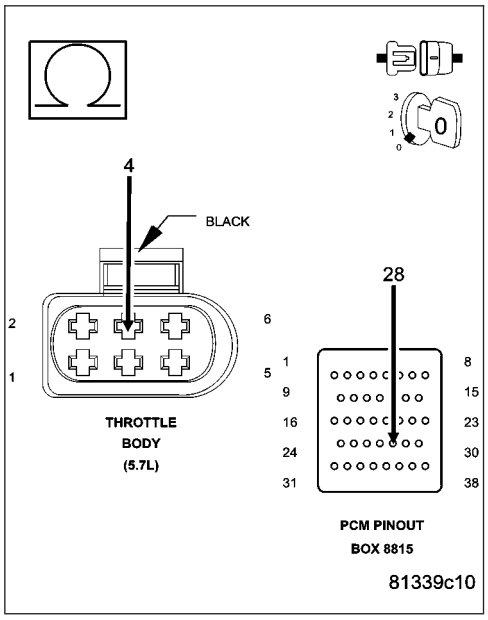
Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815. Measure the resistance of the (K122) TP Sensor No.2 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 or (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

5. (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Sensor No.2 Signal circuit at the Throttle Body harness connector.

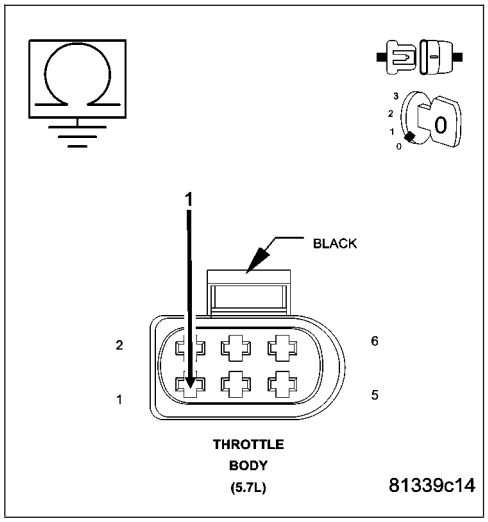
Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit at the Throttle Body harness connector.

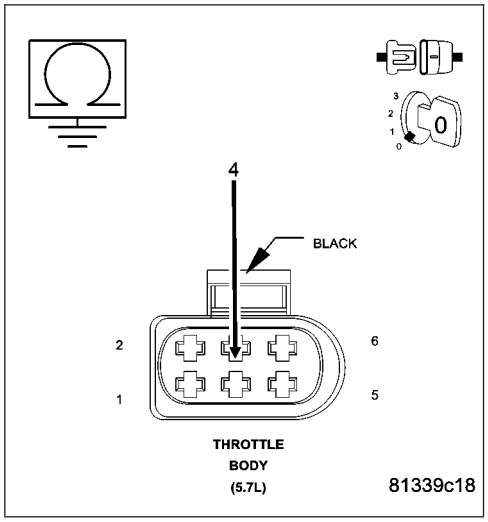
Is the resistance below 100 ohms for each circuit?

Yes >> Go To 6

No >> Repair the short to ground in the (K122), (K22) TP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

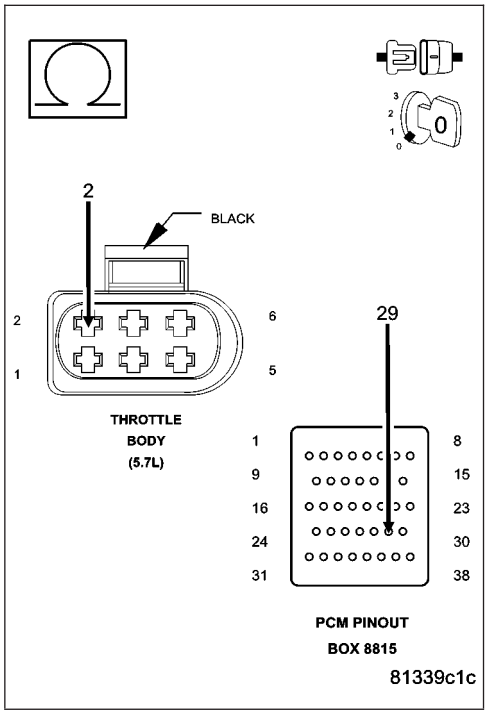




P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

6. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

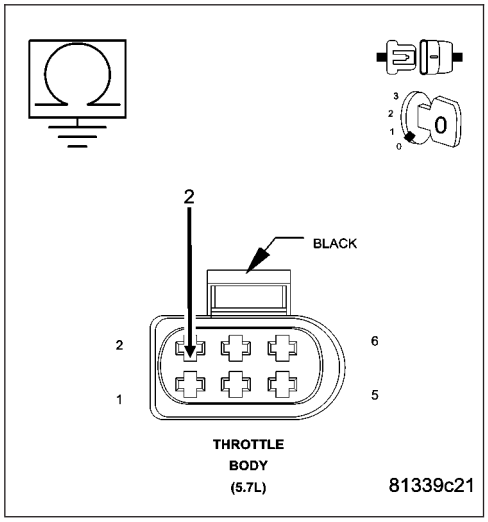
Yes >> Go To 7

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (F855) 5-VOLT SUPPLY SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

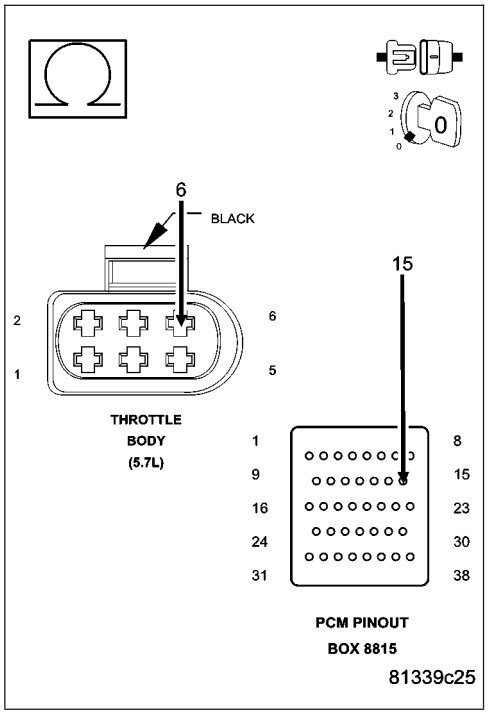
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

8. EXCESSIVE RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



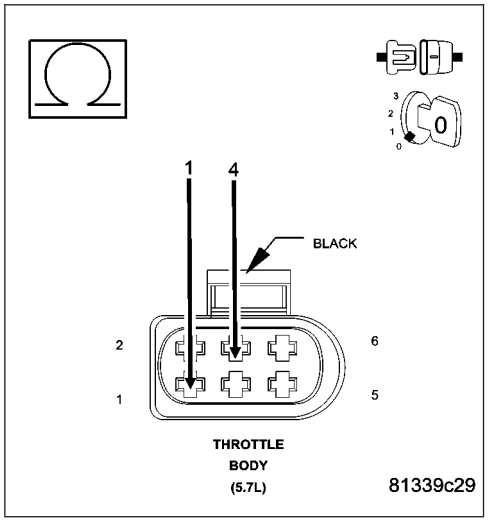
Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (K22) TP SENSOR NO.1 SIGNAL SHORTED TO THE (K122) TP SENSOR NO.2 SIGNAL

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K122) TP Sensor No.2 Signal circuit at the Throttle Body harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K122) TP Sensor No.2 Signal circuit and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P0221-THROTTLE POSITION SENSOR 2 PERFORMANCE (CONTINUED)

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. THROTTLE FOLLOWER TEST

Ignition on, engine not running.

With the scan tool, perform the Throttle Follower Test and monitor the TP Sensor No.1 or No.2 voltage.

Slowly press the throttle pedal down.

The voltage for TP Sensor No.1 should start at approximately 0.3 of a volt and increase to above 4.3 volts.

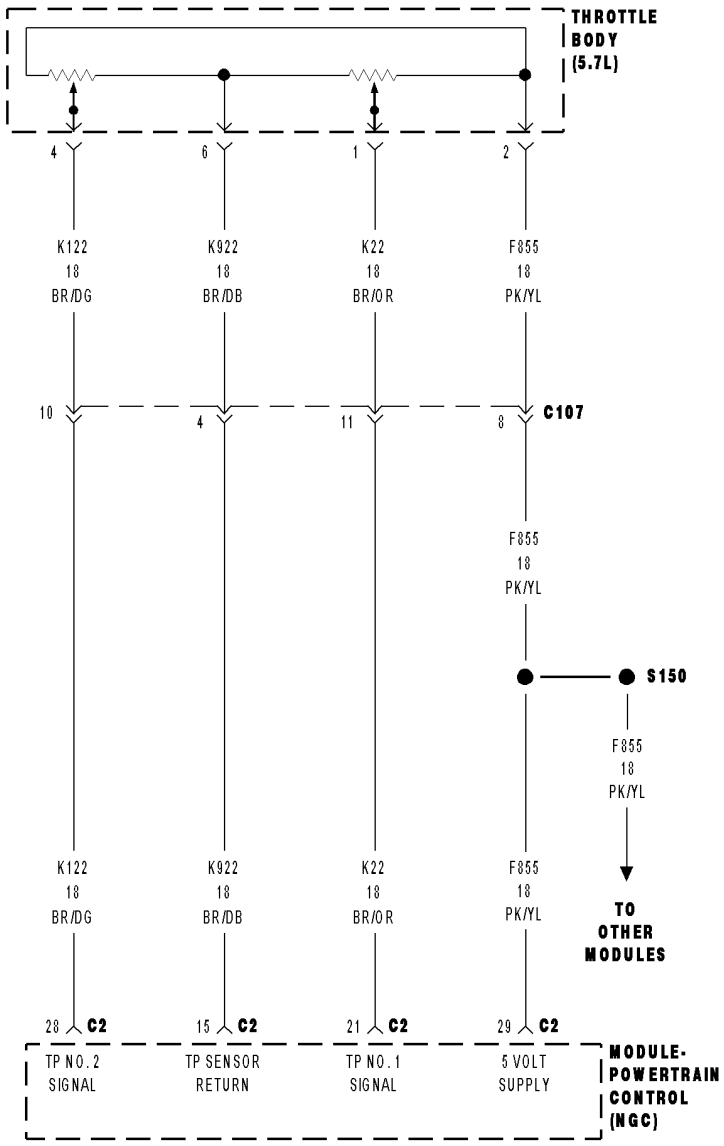
The voltage for TP Sensor No.2 should start at approximately 4.3 volts and decrease to approximately 0.3 of a volt.

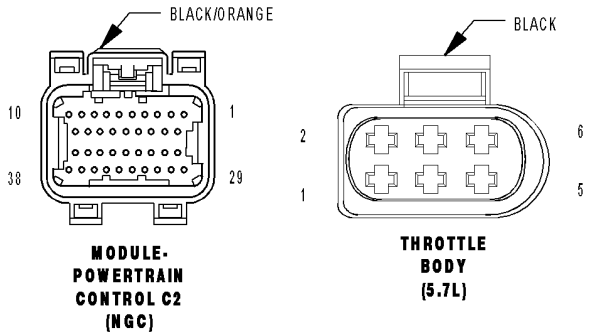
Is the voltage within the range of the listed specification for the appropriate Sensor?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, using a scan tool select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW





81452d8c

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete Engine wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.16 of a volt for 0.7 of a second. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K922) SENSOR RETURN CIRCUIT
THROTTLE POSITION SENSOR/THROTTLE BODY
THROTTLE PLATE JAMMED AGAINST THE MAXIMUM STOP
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. TP SENSOR NO.2 BELOW 0.35 OF A VOLT

NOTE: If a 5-Volt supply DTC has also set, diagnose the 5-Volt DTC before continuing.

NOTE: Make sure the throttle moves freely and does not hang up at Wide Open Throttle, by performing the Throttle Follower Test

NOTE: If P2101 is also set, then make sure that the blade moves freely and does not hang up near Wide Open Throttle before trying to repair P0222.

Ignition on, engine not running.

With the scan tool, read the TP Sensor voltage.

Is the voltage below 0.35 of a volt?

Yes >> Go To 2

No >> Go To 11

---

2. P0122 ALSO SET

Was the P0122-TP SENSOR NO.1 VOLTAGE LOW DTC set along with the P0222?

Yes >> Go To 3

No >> Go To 4

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

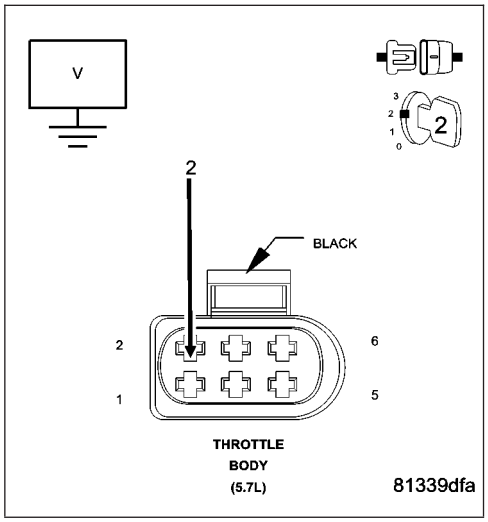
3. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Throttle Body harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Throttle Body harness connector.



Is the voltage between 4.5 to 5.2 volts?

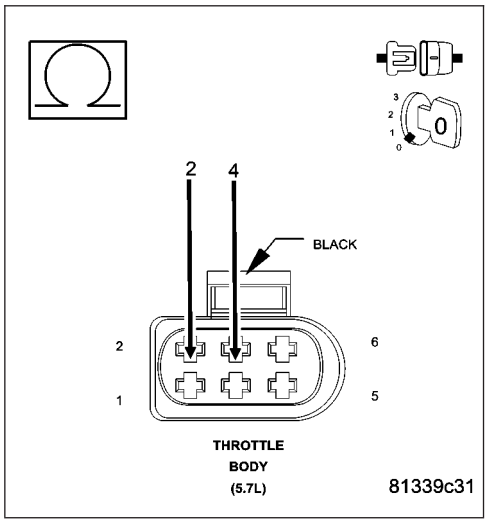
Yes >> Go To 4

No >> Go To 8

4. THROTTLE POSITION SENSOR

Connect a jumper wire between the (F855) 5-volt Supply circuit and the (K122) TP Sensor No.2 Signal circuit in the Throttle Body harness connector.

With the scan tool, monitor the TP Sensor No.2 voltage.



Is the voltage between 4.8 and 5.2 volts with the jumper wire installed?

Yes >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, with a scan tool select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

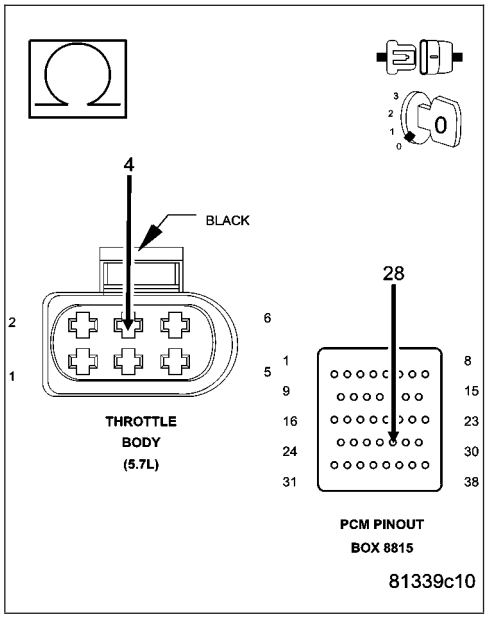
5. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K122) TP Sensor No.2 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

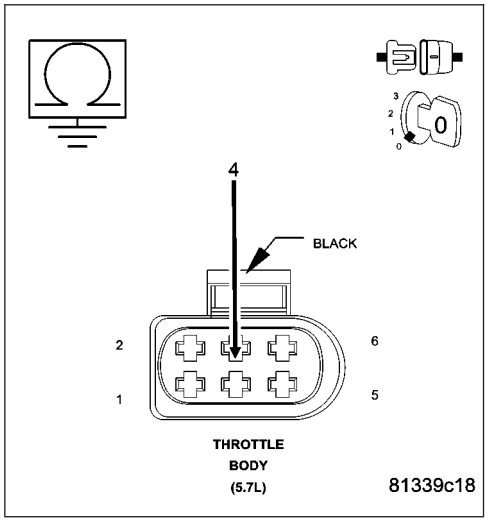
Yes >> Go To 6

No >> Repair the open in the (K122) TP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K122) TP Sensor No.2 Signal circuit at the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K122) TP Sensor No.2 Signal.

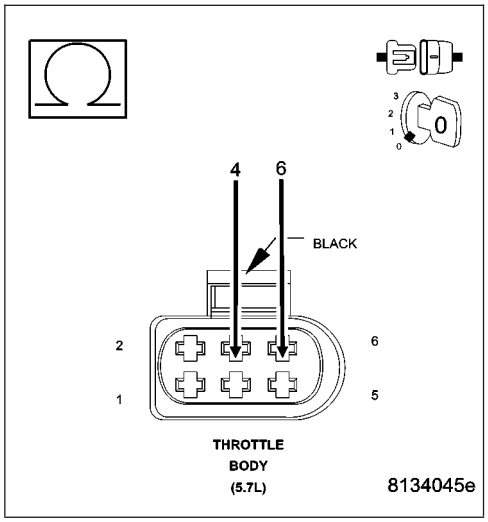
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

7. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO (K922) SENSOR RETURN CIRCUIT

Measure the resistance between the (K122) TP Sensor No.2 Signal circuit and the (K922) TP Sensor Return circuit at the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K922) Sensor Return circuit and the (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

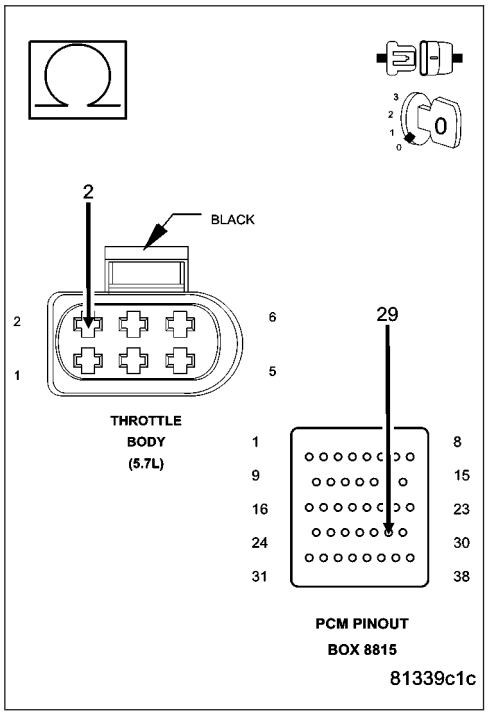
8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

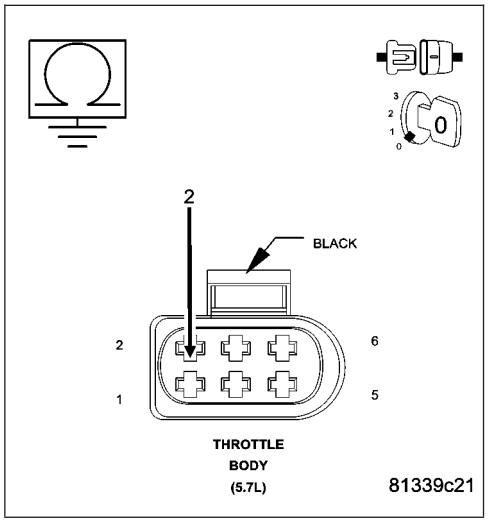
Yes >> Go To 9

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0222-THROTTLE POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. THROTTLE FOLLOWER TEST

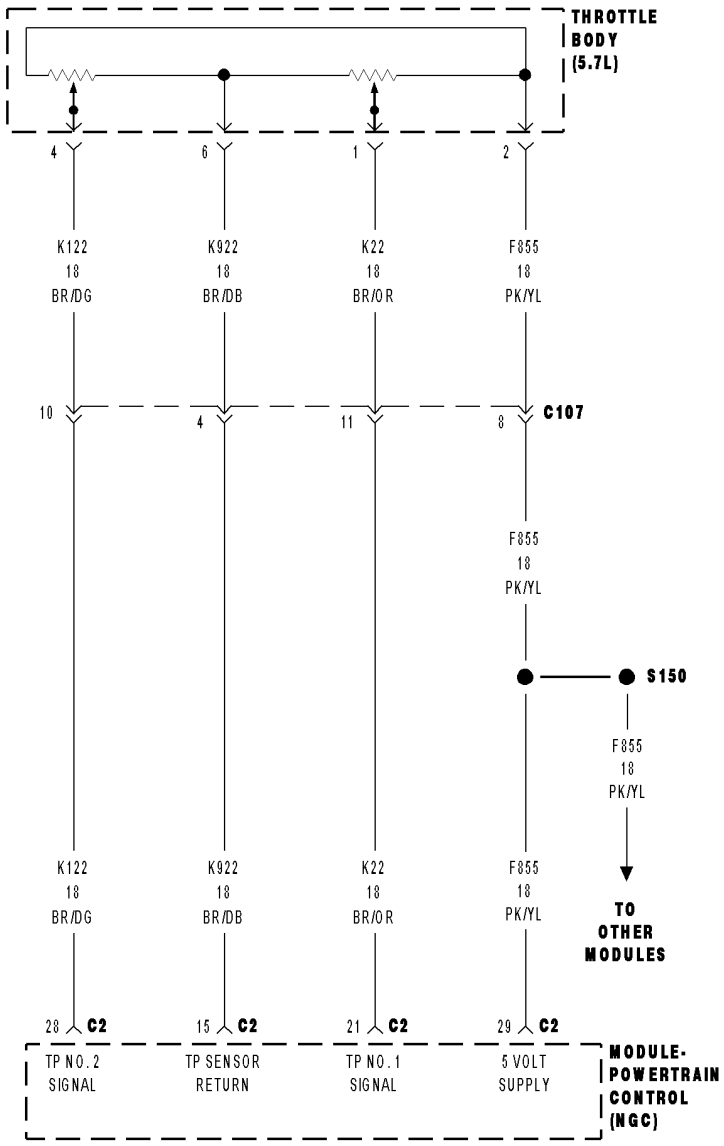
Ignition on, engine not running.
With the scan tool, perform the Throttle Follower Test.
Monitor the TP Sensor No.2 voltage while slowly pressing the Throttle pedal down.

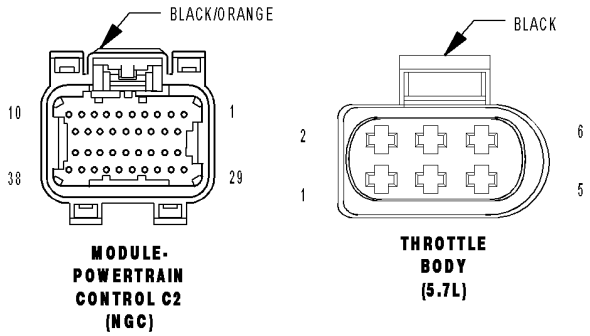
Is there a smooth voltage change from high to low?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, with a scan tool select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH





81452d8c

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Throttle Position Sensor No.2 Signal circuit voltage is greater than 4.9 volts for 25 ms. One Trip Fault. ETC light will illuminate.

Possible Causes
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K922) SENSOR RETURN CIRCUIT OPEN
THROTTLE POSITION SENSOR/THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If a 5-Volt supply DTC has also set, diagnose the 5-Volt DTC before continuing.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 7

---

2. THROTTLE POSITION SENSOR

Turn the ignition off.
Disconnect the Throttle Body Assembly harness connector.
Ignition on, engine not running.
With the scan tool monitor the TP Sensor No.2 voltage.

Is the voltage below 0.5 volt?

Yes >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, with the scan tool select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

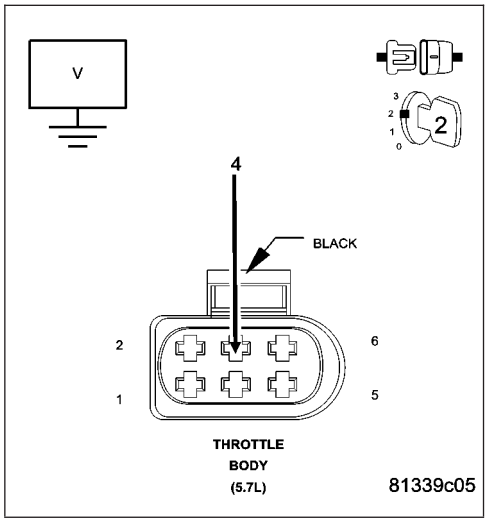
3. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K122) TP Sensor No.2 Signal circuit at the Throttle Body harness connector.



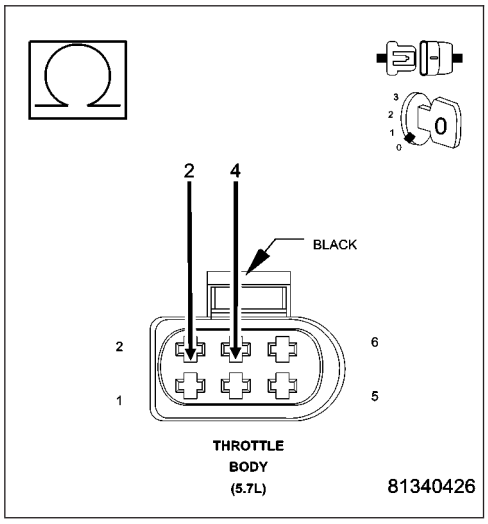
Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit at the Throttle Body harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

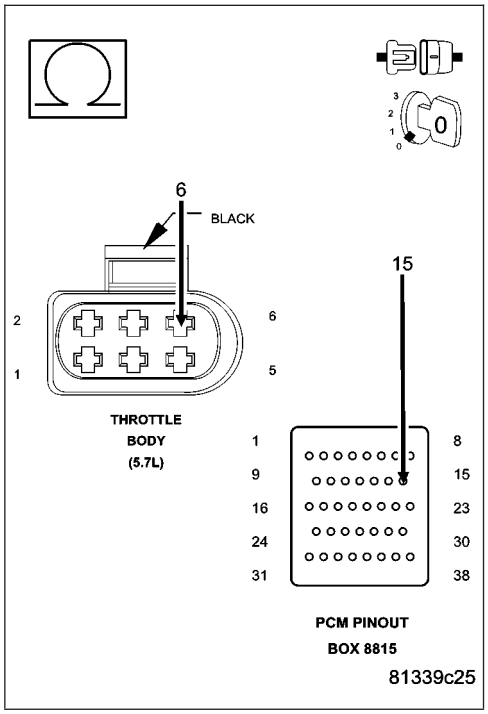
No >> Go To 5

P0223-THROTTLE POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

5. (K922) SENSOR RETURN CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. THROTTLE FOLLOWER TEST

With the scan tool, perform the Throttle Follower Test.

Monitor the TP Sensor No.2 voltage while slowly pressing the Throttle pedal down.

Is there a smooth voltage change from high to low?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, with the scan tool select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 2% (2.5% LEV) misfire rate is measured during two trips. Above 3000 RPM 1 trip less than 3000 RPM 2 trip. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
INJECTOR CONTROL CIRCUIT
COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

NOTE: Check for any TSB's that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.

Star the engine.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector of the misfiring cylinders.

Disconnect the Fuel Injector harness connector of the misfiring cylinders.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connectors.
Remove the Ignition Coils.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Does the Spark Plug have any problems?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector of the misfiring cylinder.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Check the Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay or ASD Relay.

Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm and the resistance of a 5.7L Ignition coil is 0.558 to 0.682 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

16. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the Coil Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

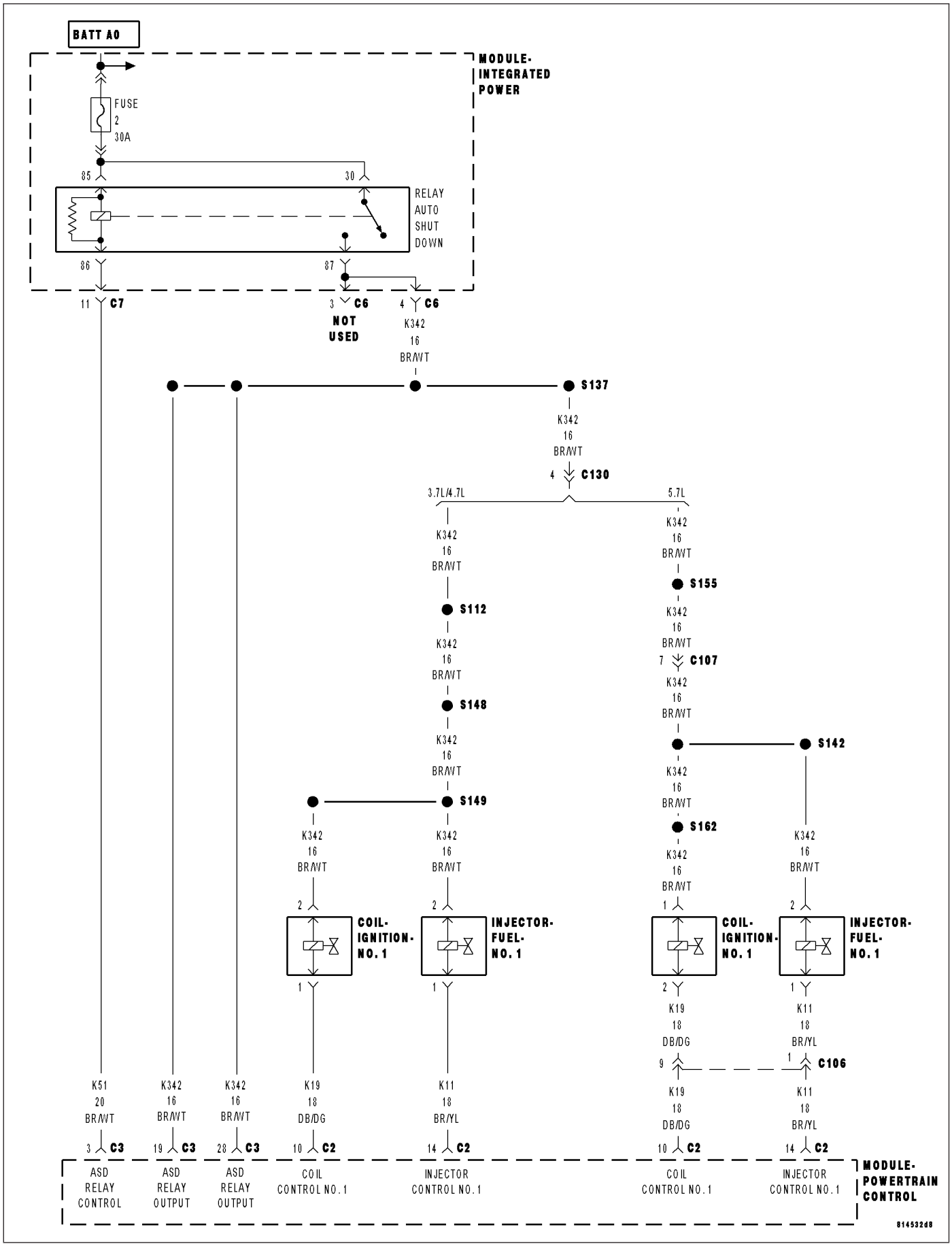
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE



P0301-CYLINDER 1 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL NO.1 CIRCUIT
(K19) COIL CONTROL NO.1 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

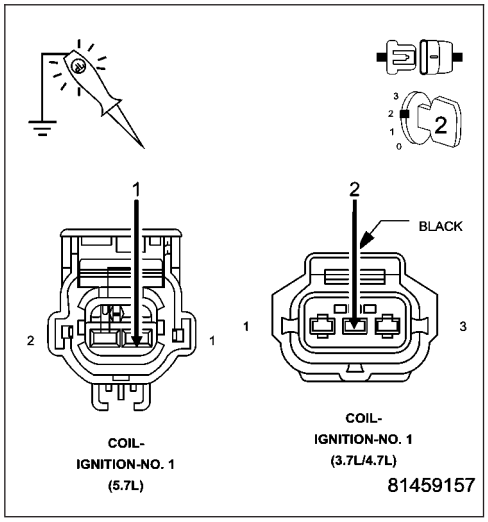
Disconnect the Ignition Coil No.1 harness connector.

Disconnect the Fuel Injector No.1 harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

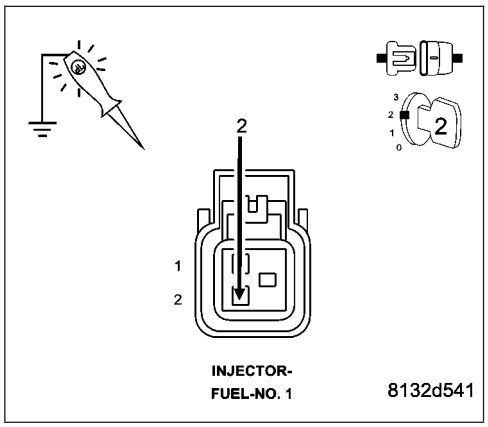
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0301-CYLINDER 1 MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.1 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER 1 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.1 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0301-CYLINDER 1 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

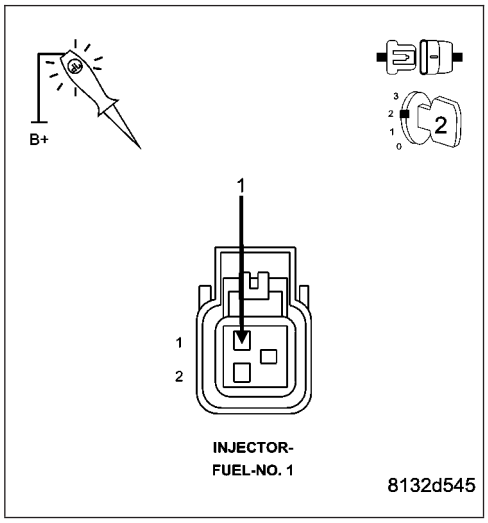
Turn the ignition off.
Disconnect the No.1 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0301-CYLINDER 1 MISFIRE (CONTINUED)

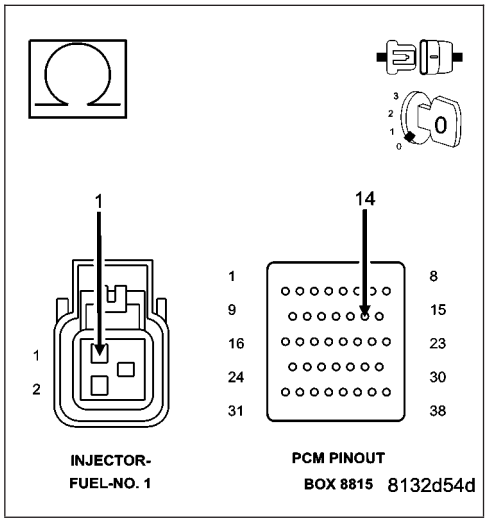
11. (K11) INJECTOR CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K11) Injector Control No.1 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K11) Injector Control No.1 circuit?

Yes >> Repair the excessive resistance or short in the (K11) Injector Control No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0301-CYLINDER 1 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K19) Coil Control No.1 circuit.

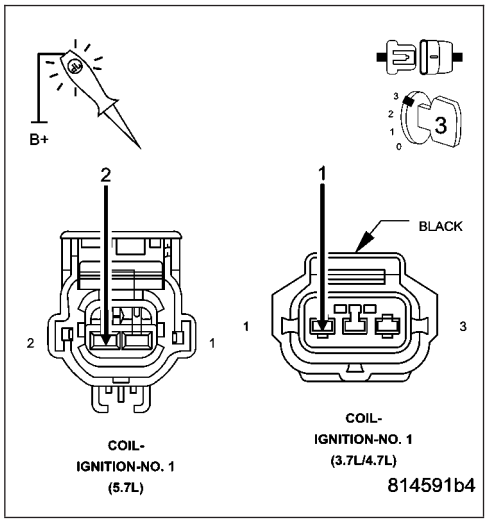
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0301-CYLINDER 1 MISFIRE (CONTINUED)

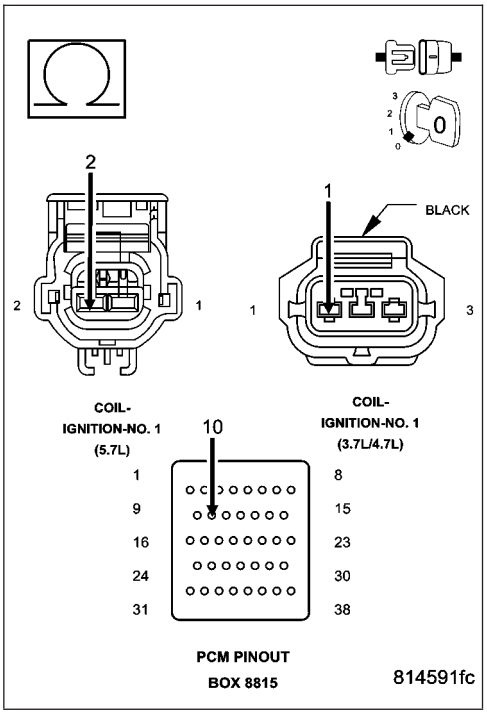
16. (K19) COIL CONTROL NO.1 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K19) Coil Control No.1 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K19) Coil Control No.1 circuit?

Yes >> Repair the (K19) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

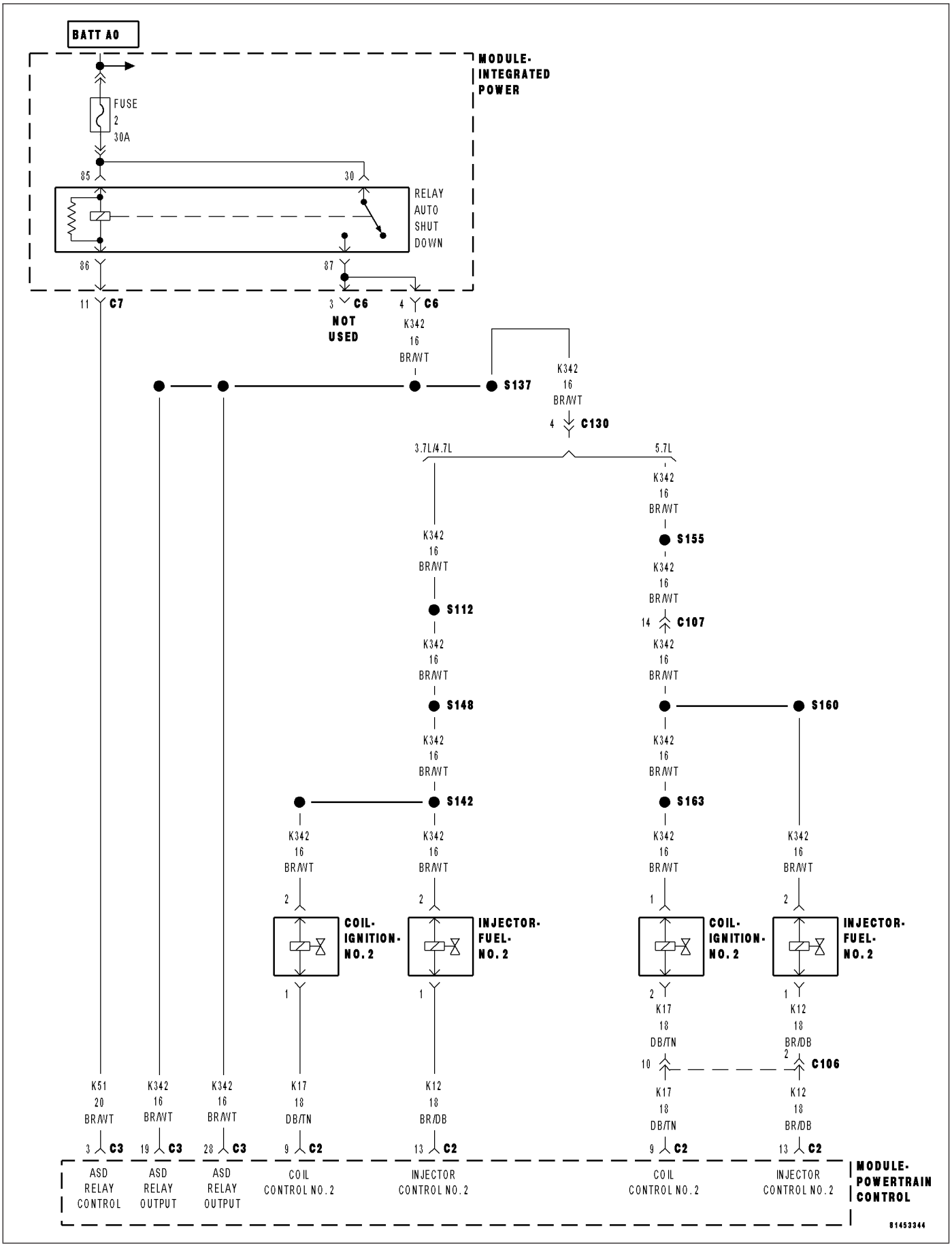
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE



P0302-CYLINDER 2 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10 % to 30 % misfire rate during one trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL NO.2 CIRCUIT
(K17) COIL CONTROL NO.2 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

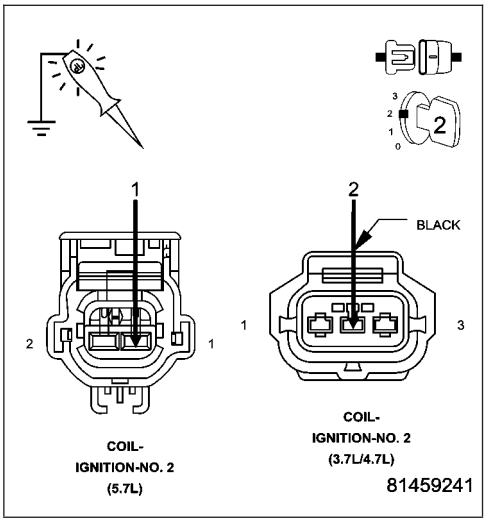
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0302-CYLINDER 2 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

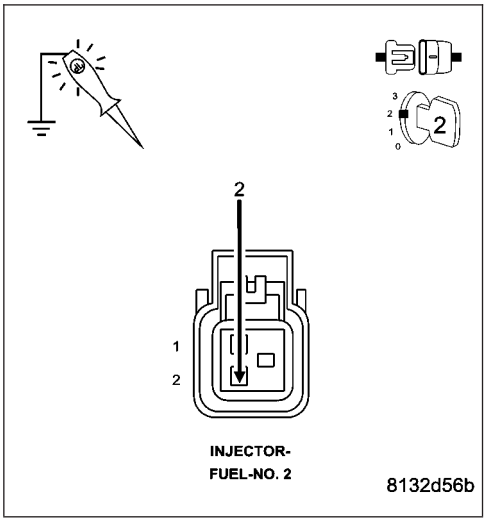
Turn the ignition off.
Disconnect the Ignition Coil No.2 harness connector.
Disconnect the Fuel Injector No.2 harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.2 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0302-CYLINDER 2 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER 2 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using scan tool, actuate the No.2 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0302-CYLINDER 2 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

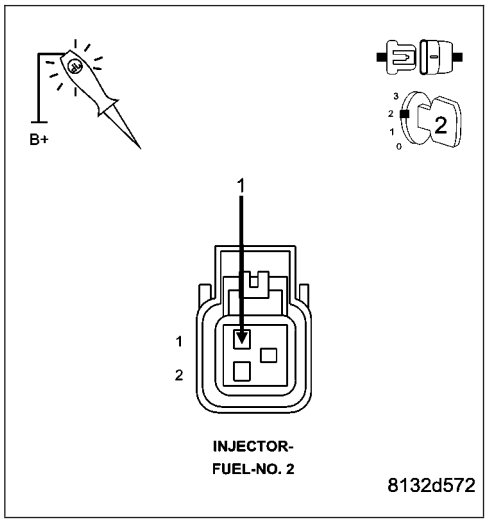
Turn the ignition off.
Disconnect the No.2 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0302-CYLINDER 2 MISFIRE (CONTINUED)

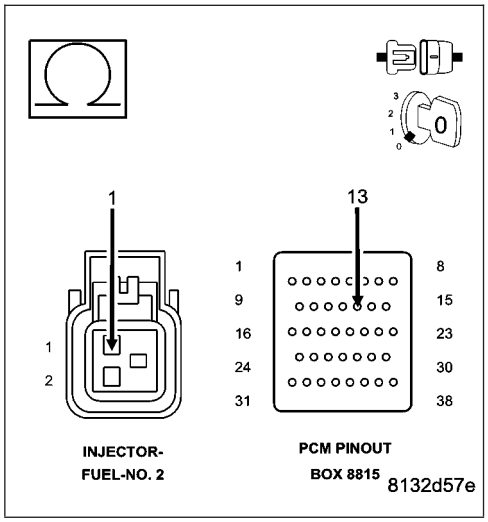
11. (K12) INJECTOR CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K12) Injector Control No.2 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K12) Injector Control No.2 circuit?

Yes >> Repair the excessive resistance or short in the (K12) Injector Control No.2 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0302-CYLINDER 2 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control No.2 circuit.

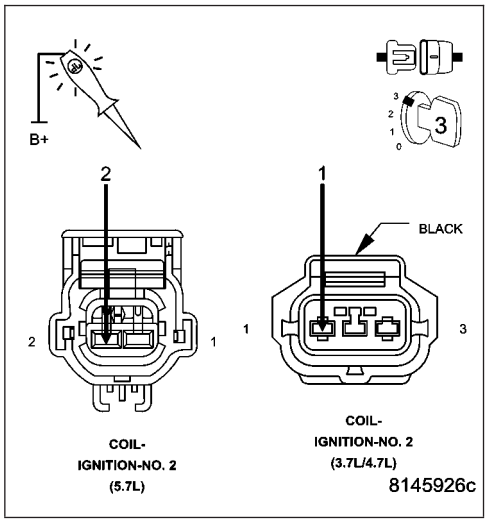
Crank the engine for 5 secondc while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0302-CYLINDER 2 MISFIRE (CONTINUED)

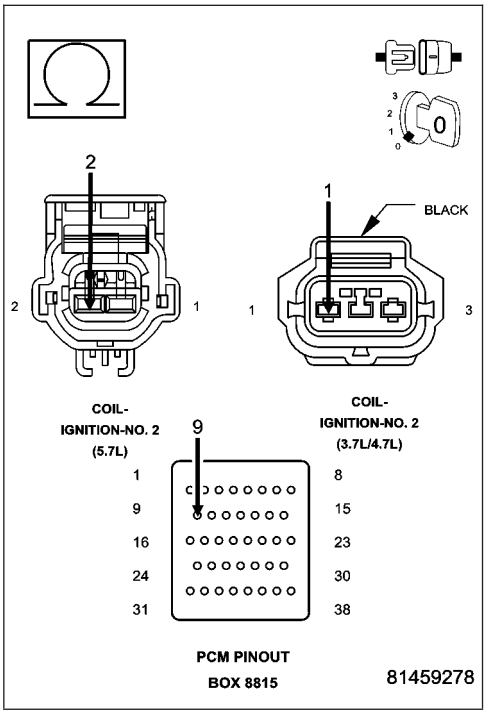
16. (K17) COIL CONTROL NO.2 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K17) Coil Control No.2 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K17) Coil Control No.2 circuit?

Yes >> Repair the (K17) Coil Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

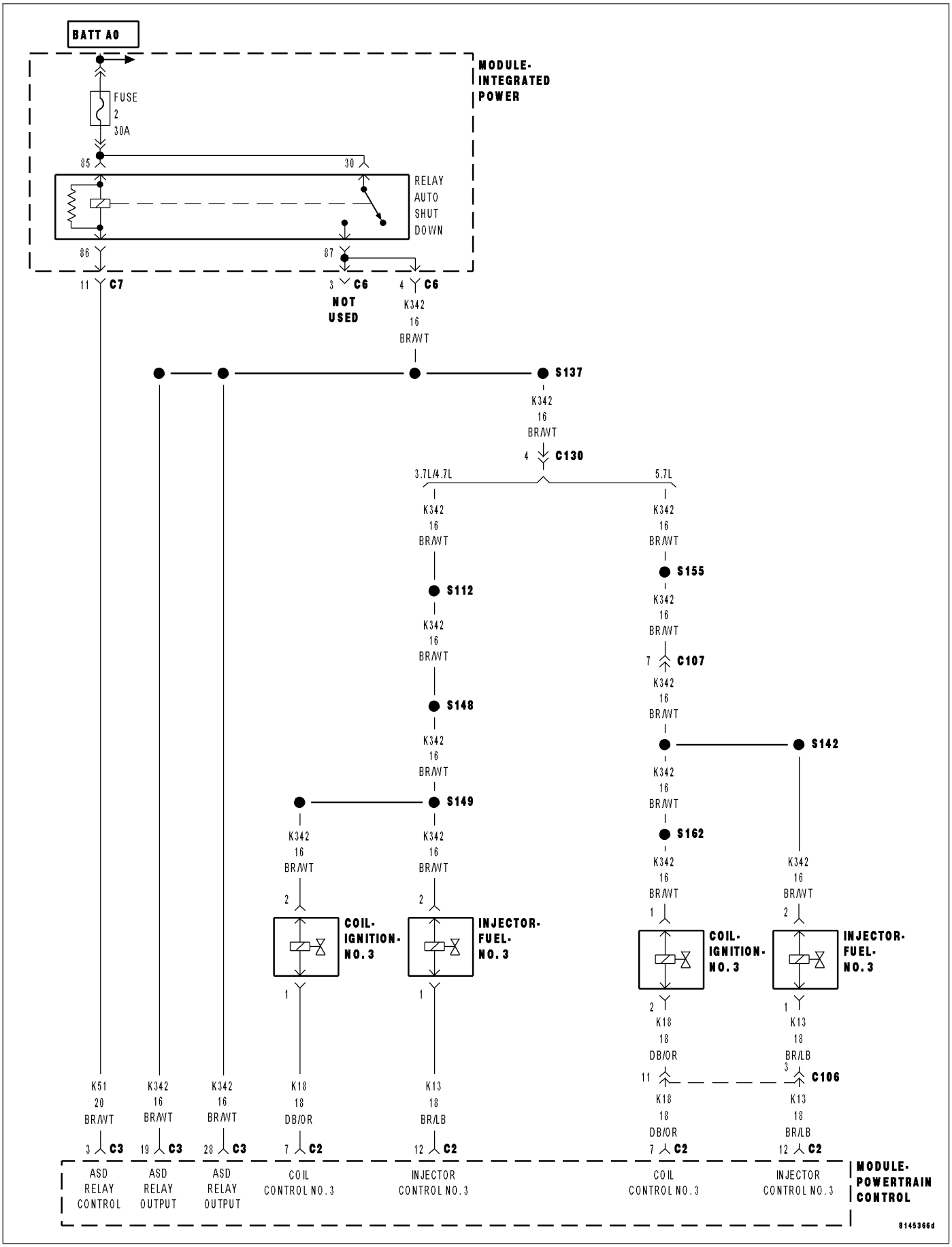
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE



P0303-CYLINDER 3 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT
(K18) COIL CONTROL NO.3 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

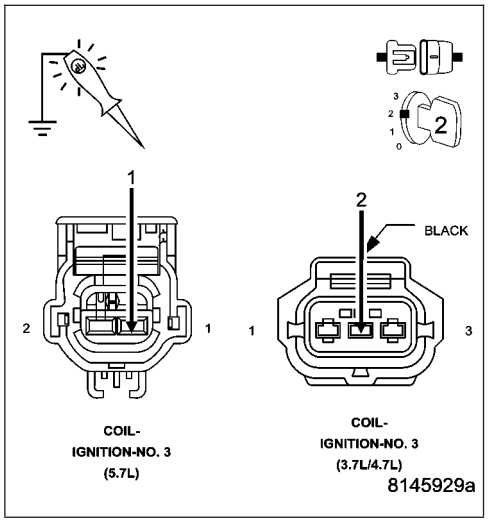
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0303-CYLINDER 3 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

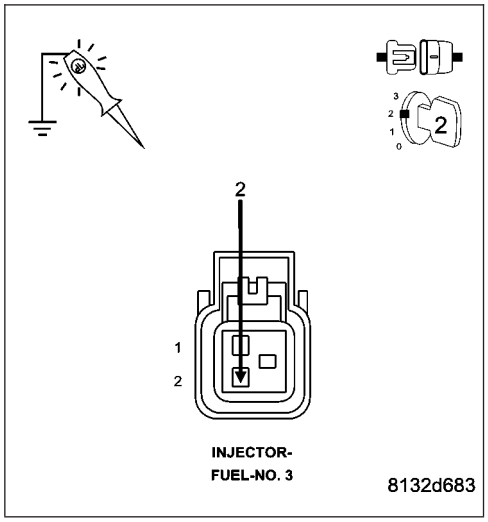
Turn the ignition off.
Disconnect the No.3 Ignition Coil harness connector.
Disconnect the No.3 Fuel Injector harness connector.
Ignition on, engine not running.
With a scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.3 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0303-CYLINDER 3 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER 3 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using a scan tool, actuate the No.3 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0303-CYLINDER 3 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

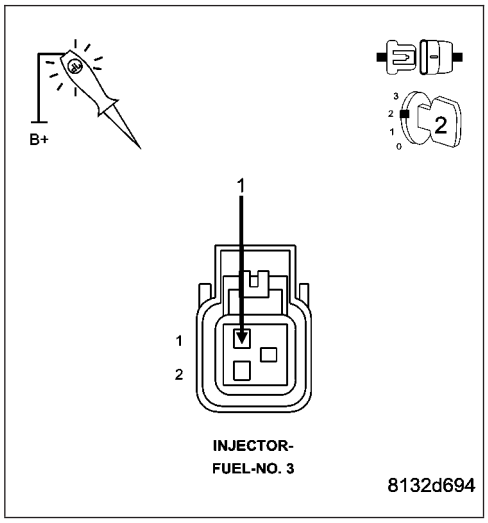
Turn the ignition off.
Disconnect the No.3 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0303-CYLINDER 3 MISFIRE (CONTINUED)

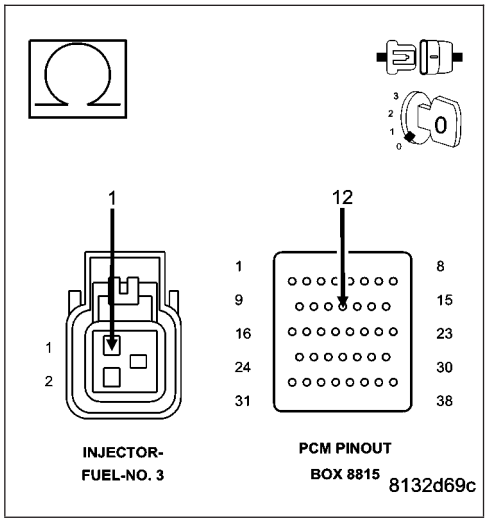
11. (K13) INJECTOR CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K13) Injector Control No.3 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K13) Injector Control No.3 circuit?

Yes >> Repair the excessive resistance or short in the (K13) Injector Control No.3 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0303-CYLINDER 3 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.3 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control No.3 circuit.

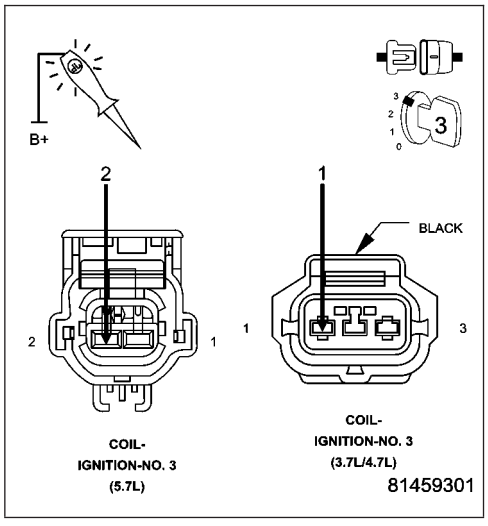
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0303-CYLINDER 3 MISFIRE (CONTINUED)

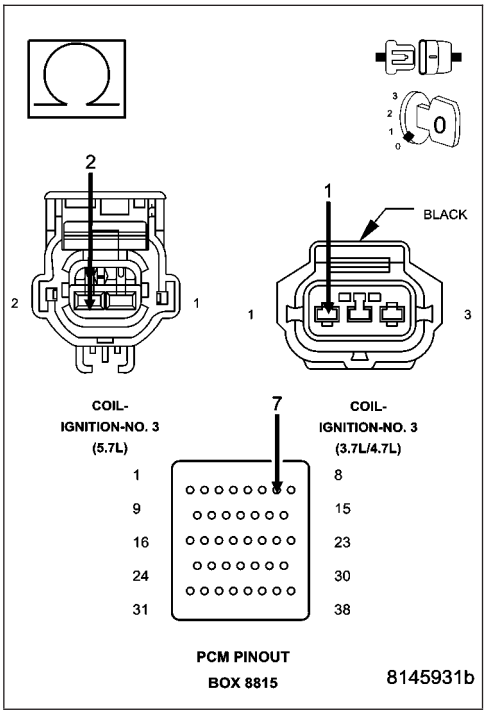
16. (K18) COIL CONTROL NO.3 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K18) Coil Control No.3 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K18) Coil Control No.3 circuit?

Yes >> Repair the (K18) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

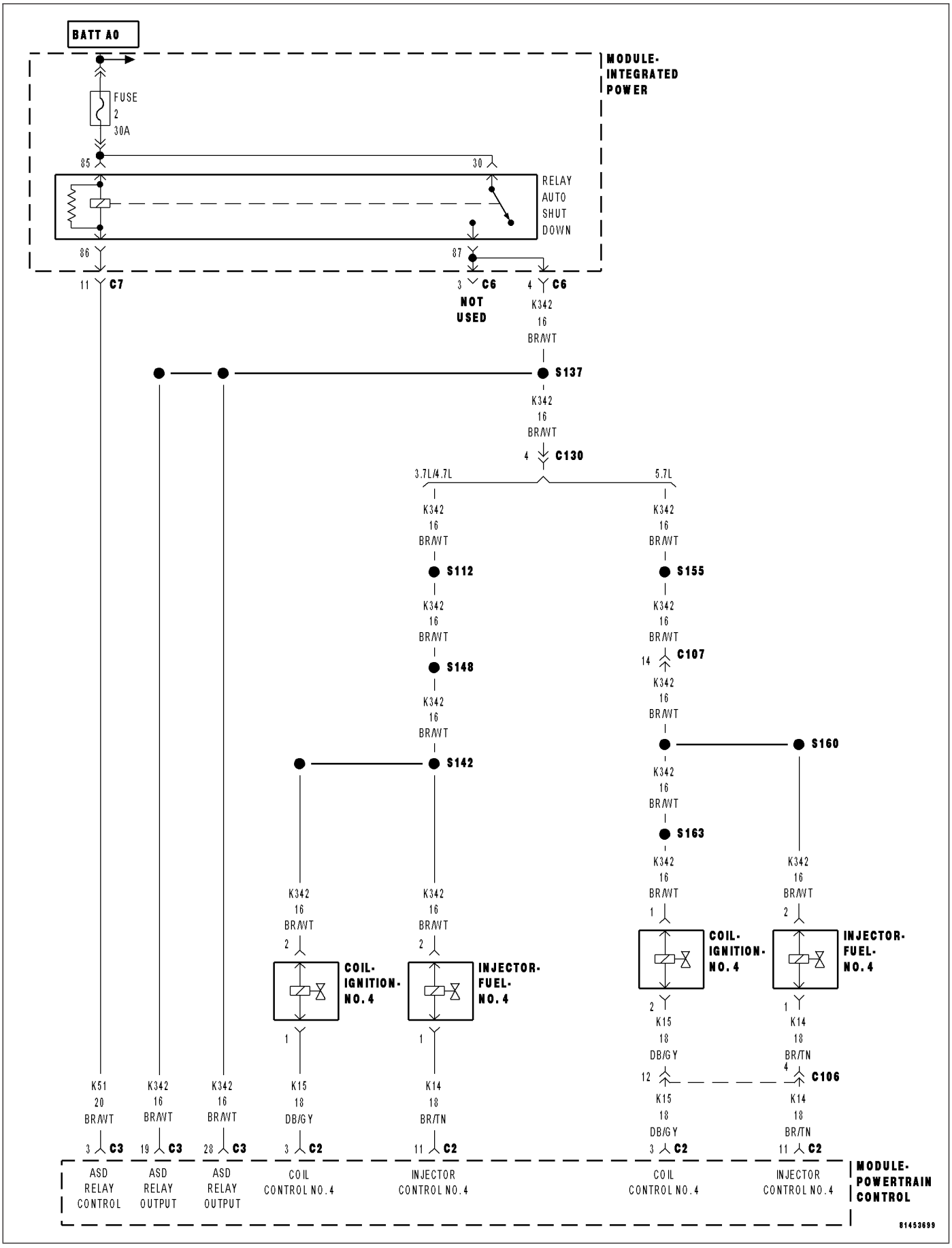
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE



P0304-CYLINDER 4 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL NO.4 CIRCUIT
(K15) COIL CONTROL NO.4 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

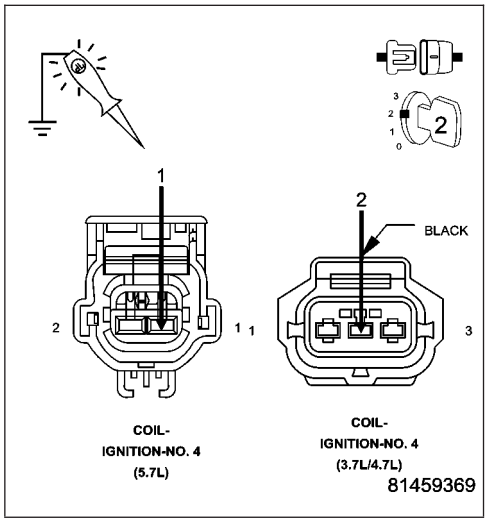
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0304-CYLINDER 4 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

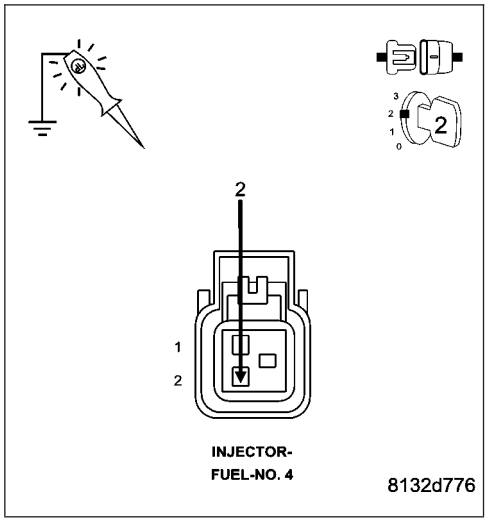
Turn the ignition off.
Disconnect the No.4 Ignition Coil harness connector.
Disconnect the No.4 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the No.4 Ignition Coil harness connector.
Remove the No.4 Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0304-CYLINDER 4 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER 4 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.4 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0304-CYLINDER 4 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

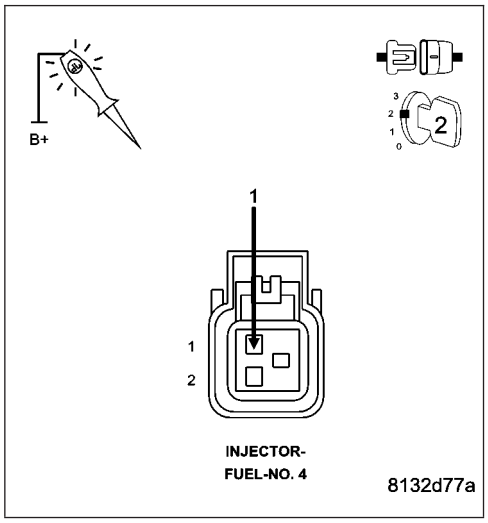
Turn the ignition off.
Disconnect the No.4 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0304-CYLINDER 4 MISFIRE (CONTINUED)

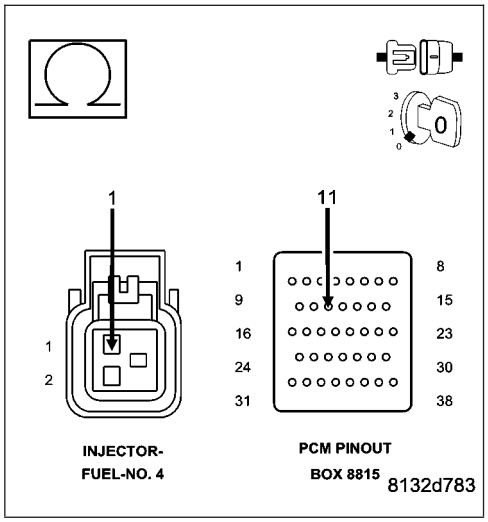
11. (K14) INJECTOR CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K14) Injector Control No.4 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K14) Injector Control No.4 circuit?

Yes >> Repair the excessive resistance or short in the (K14) Injector Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0304-CYLINDER 4 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.4 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K15) Coil Control No.4 circuit.

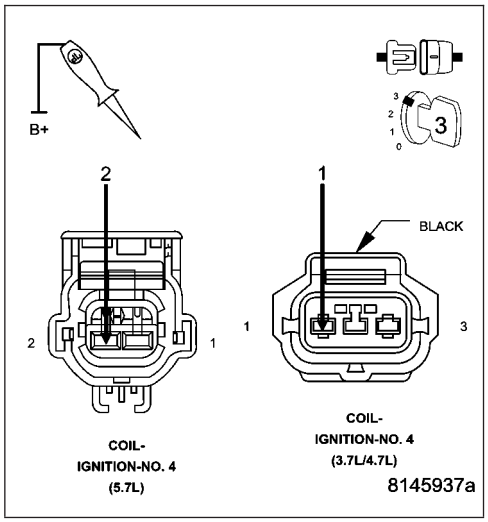
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0304-CYLINDER 4 MISFIRE (CONTINUED)

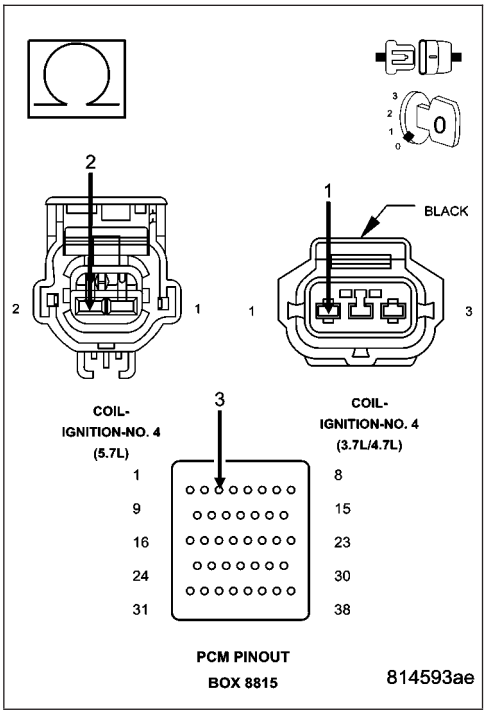
16. (K15) COIL CONTROL NO.4 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K15) Coil Control No.4 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K15) Coil Control No.4 circuit?

Yes >> Repair the (K15) Coil Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

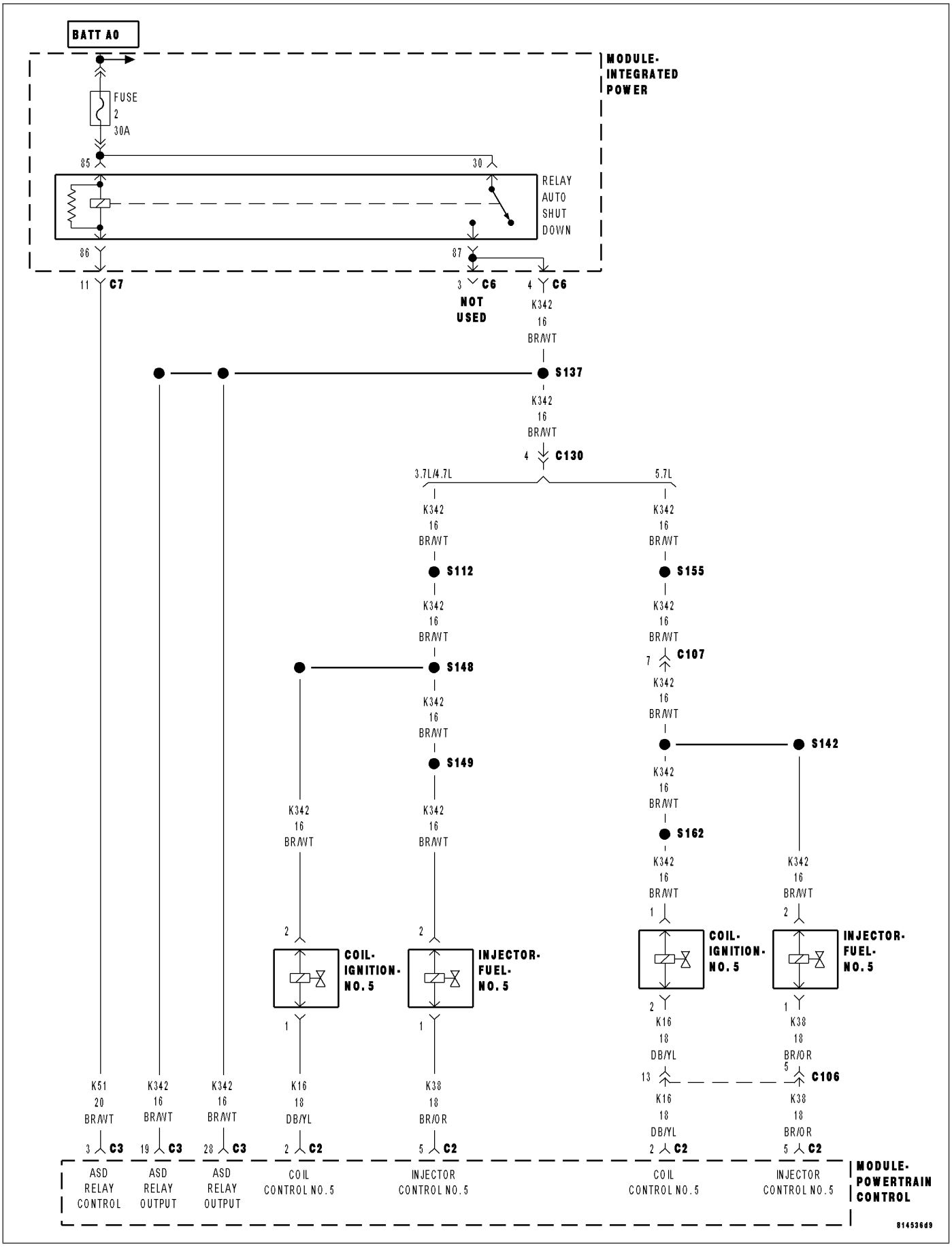
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE



P0305-CYLINDER 5 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL NO.5 CIRCUIT
(K16) COIL CONTROL NO.5 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

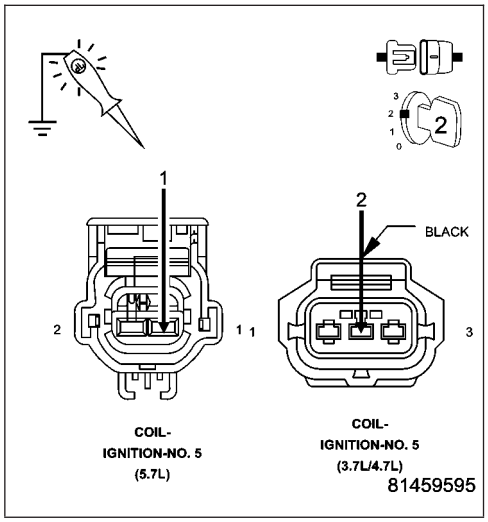
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0305-CYLINDER 5 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

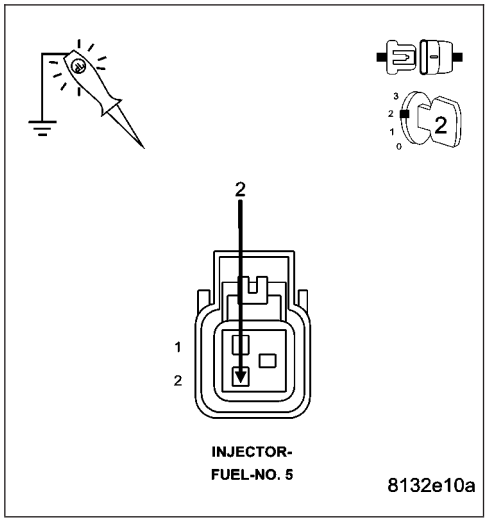
Turn the ignition off.
Disconnect the No.5 Ignition Coil harness connector.
Disconnect the No.5 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.5 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0305-CYLINDER 5 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER 5 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.5 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0305-CYLINDER 5 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

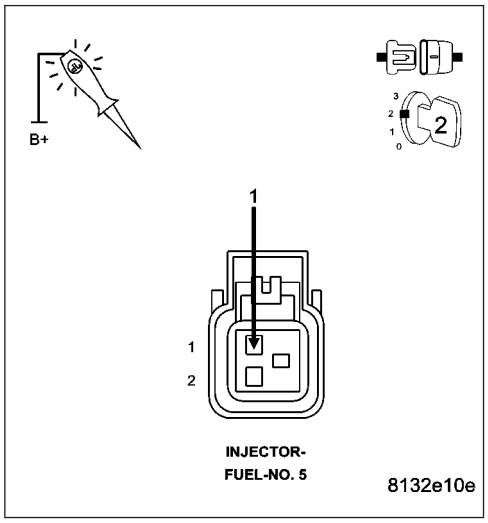
Turn the ignition off.
Disconnect the No.5 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0305-CYLINDER 5 MISFIRE (CONTINUED)

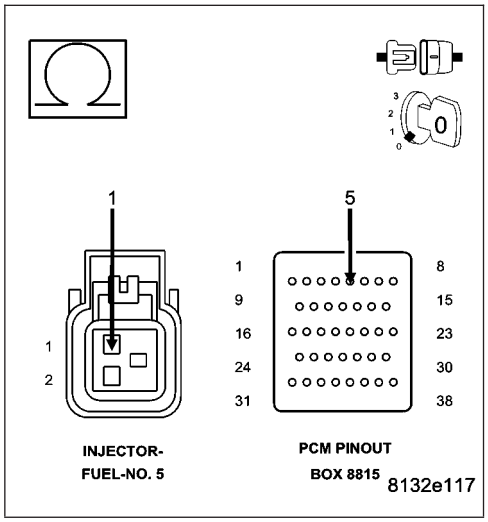
11. (K38) INJECTOR CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K38) Injector Control No.5 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K38) Injector Control No.5 circuit?

Yes >> Repair the excessive resistance or short in the (K38) Injector Control No.5 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0305-CYLINDER 5 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.5 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K16) Coil Control No.5 circuit.

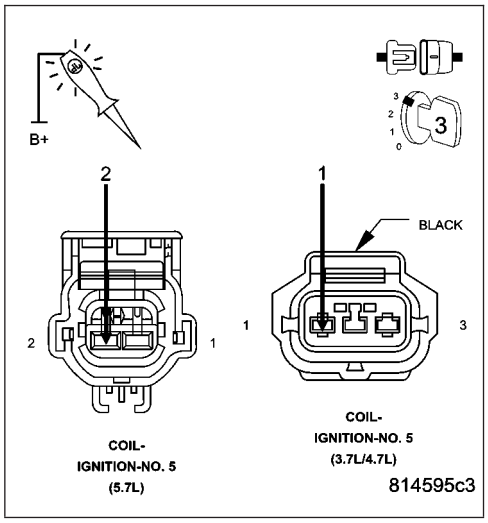
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0305-CYLINDER 5 MISFIRE (CONTINUED)

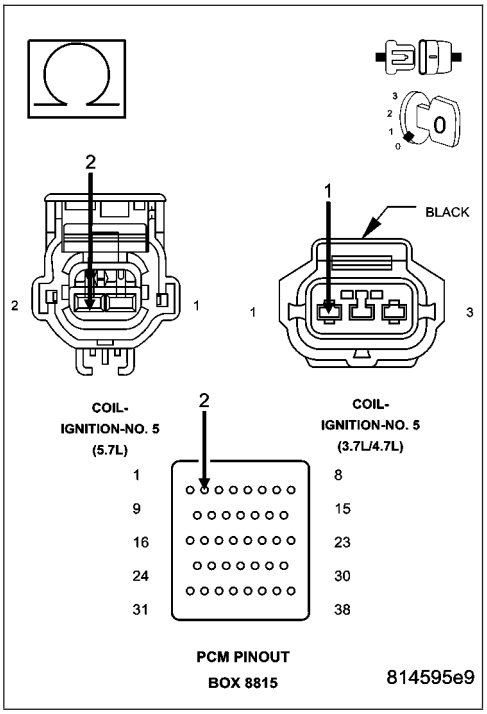
16. (K16) COIL CONTROL NO.5 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K16) Coil Control No.5 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K16) Coil Control No.5 circuit?

Yes >> Repair the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

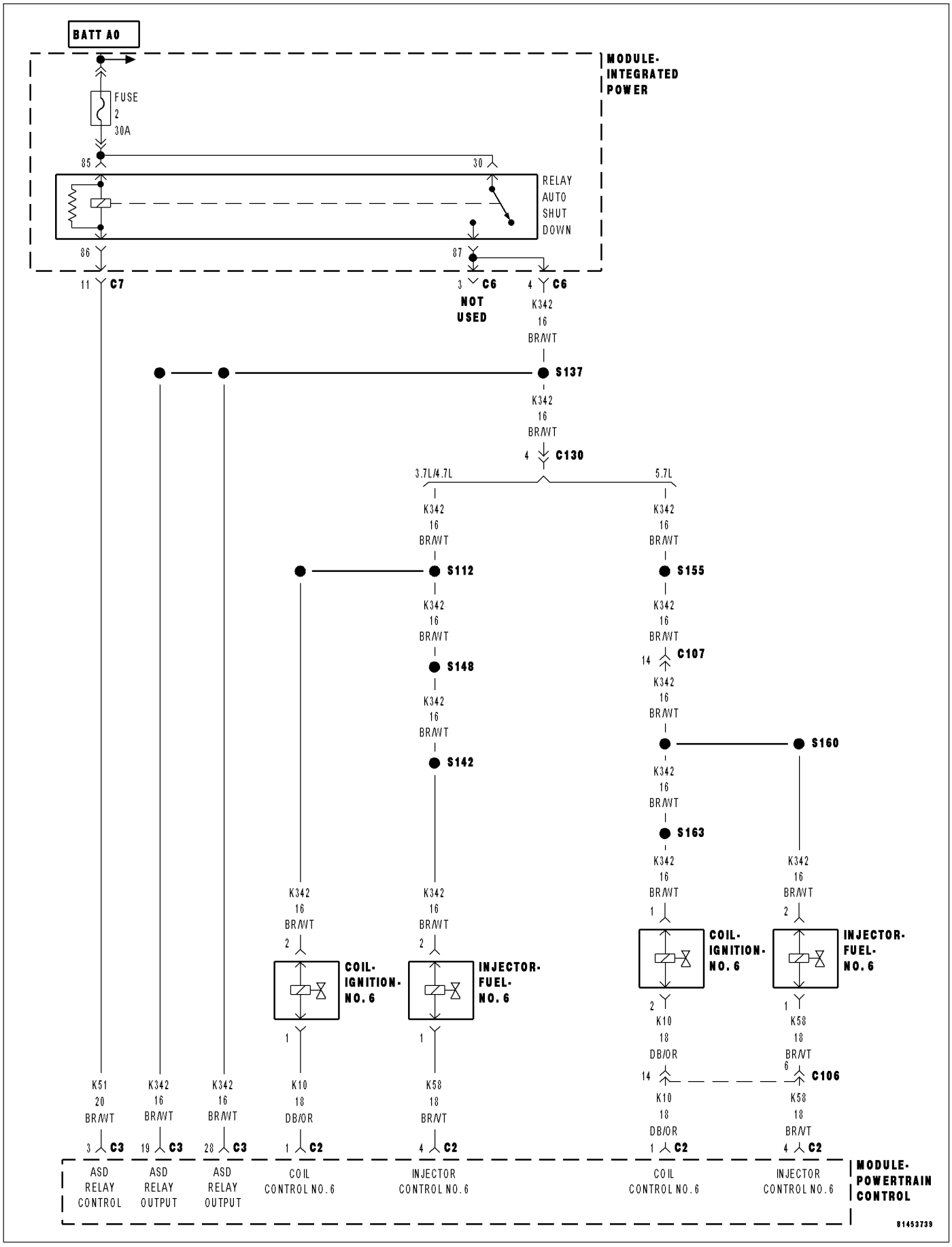
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)
d

P0306-CYLINDER 6 MISFIRE



P0306-CYLINDER 6 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL NO.6 CIRCUIT
(K10) COIL CONTROL NO.6 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER 6 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

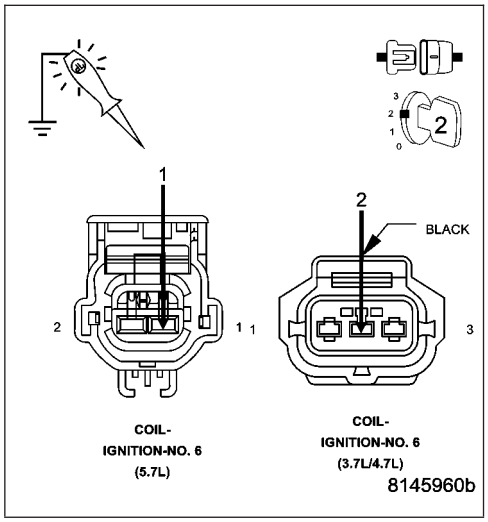
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0306-CYLINDER 6 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

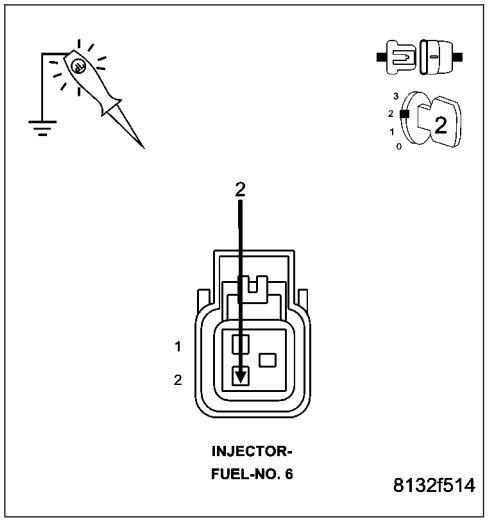
Turn the ignition off.
Disconnect the No.6 Ignition Coil harness connector.
Disconnect the No.6 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.6 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0306-CYLINDER 6 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

P0306-CYLINDER 6 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.6 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0306-CYLINDER 6 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

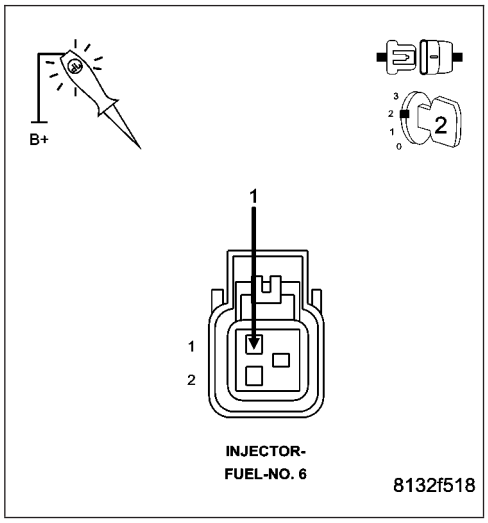
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the No.6 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0306-CYLINDER 6 MISFIRE (CONTINUED)

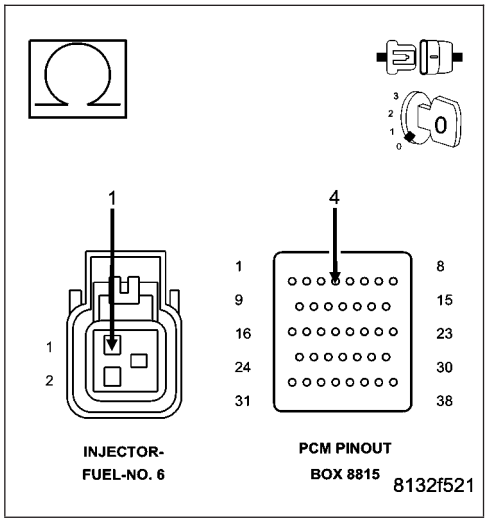
11. (K58) INJECTOR CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K58) Injector Control No.6 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K58) Injector Control No.6 circuit?

Yes >> Repair the excessive resistance or short in the (K58) Injector Control No.6 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0306-CYLINDER 6 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.6 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K10) Coil Control No.6 circuit.

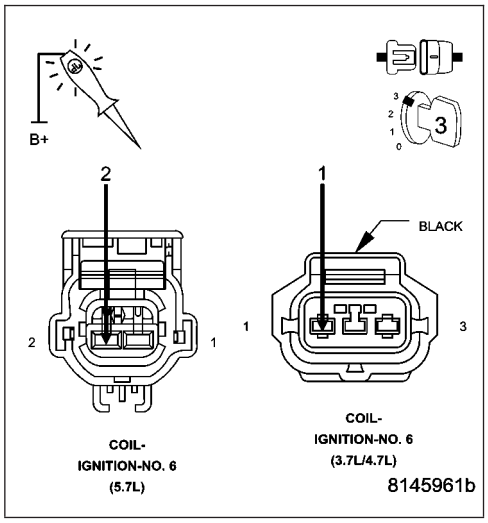
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



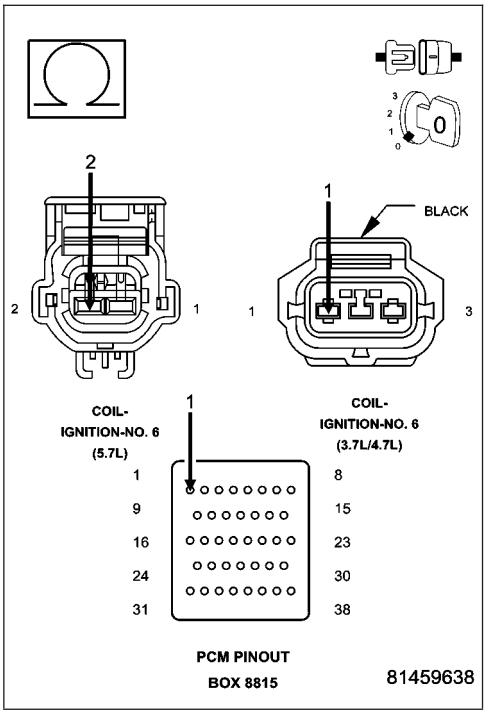
P0306-CYLINDER 6 MISFIRE (CONTINUED)

16. (K10) COIL CONTROL NO.6 CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connector.

Check the (K10) Coil Control No.6 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K10) Coil Control No.6 circuit?

Yes >> Repair the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

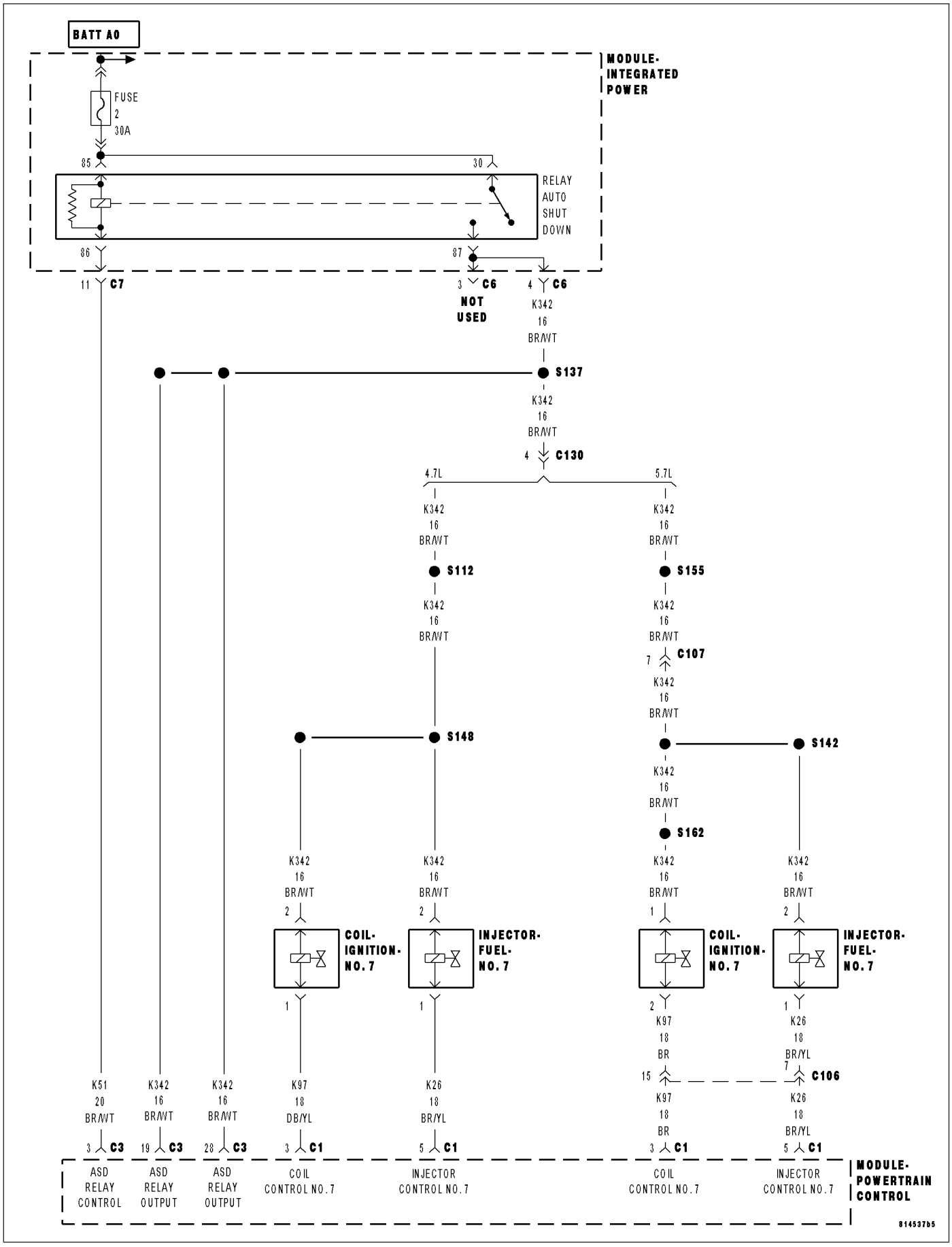
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE



P0307-CYLINDER 7 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL NO.7 CIRCUIT
(K97) COIL CONTROL NO.7 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

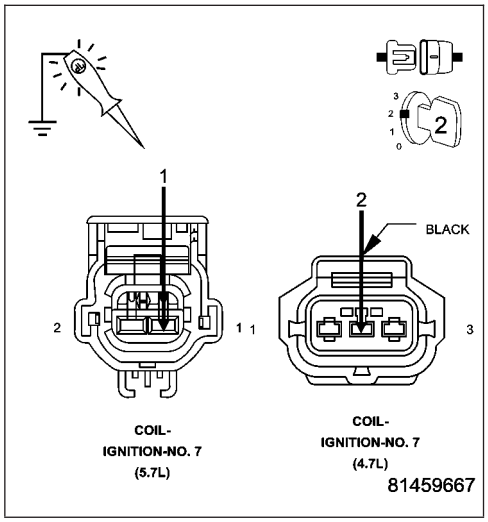
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0307-CYLINDER 7 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

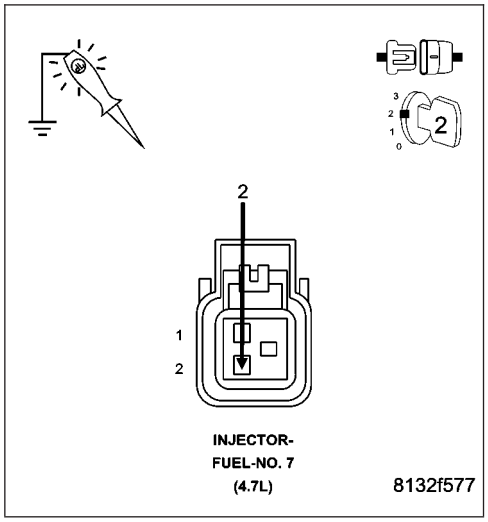
Turn the ignition off.
Disconnect the No.7 Ignition Coil harness connector.
Disconnect the No.7 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.7 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0307-CYLINDER 7 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER 7 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.7 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0307-CYLINDER 7 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

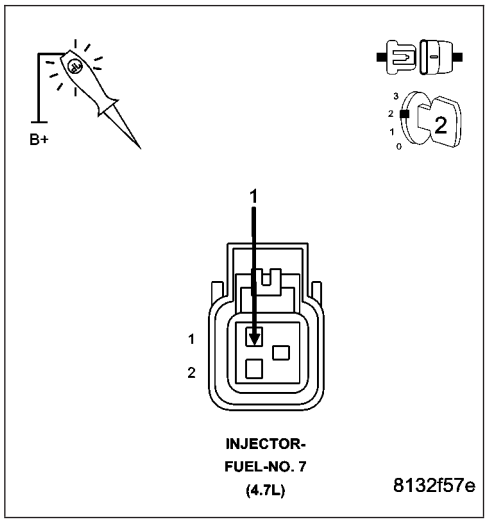
Turn the ignition off.
Disconnect the No.7 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K26) Injector Control No.7 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0307-CYLINDER 7 MISFIRE (CONTINUED)

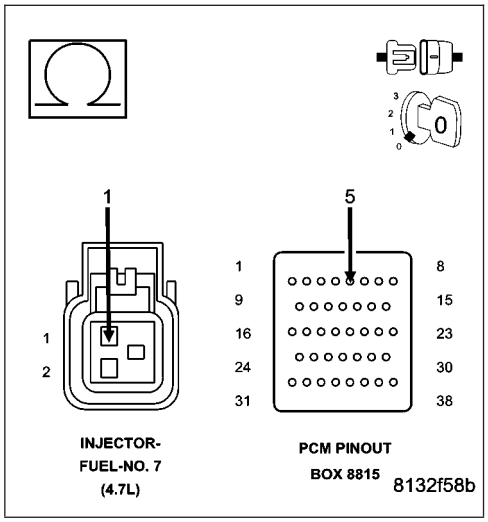
11. (K26) INJECTOR CONTROL NO.7 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K26) Injector Control No.7 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K26) Injector Control No.7 circuit?

Yes >> Repair the excessive resistance or short in the (K26) Injector Control No.7 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0307-CYLINDER 7 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.7 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K97) Coil Control No.7 circuit.

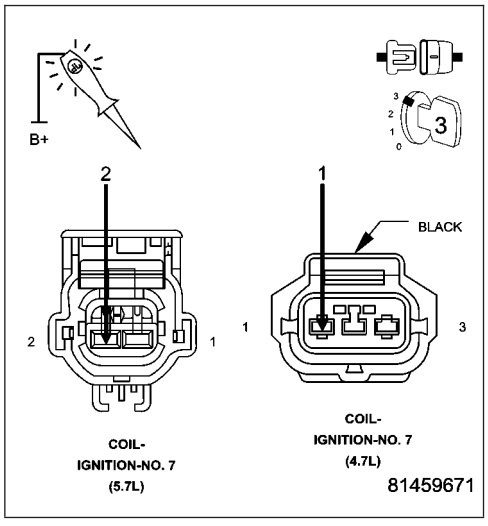
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0307-CYLINDER 7 MISFIRE (CONTINUED)

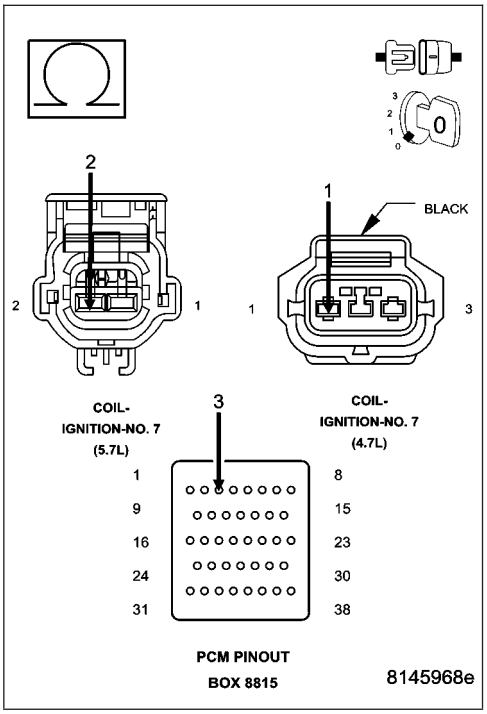
16. (K97) COIL CONTROL NO.7 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K97) Coil Control No.7 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K97) Coil Control No.7 circuit?

Yes >> Repair the (K97) Coil Control No.7 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

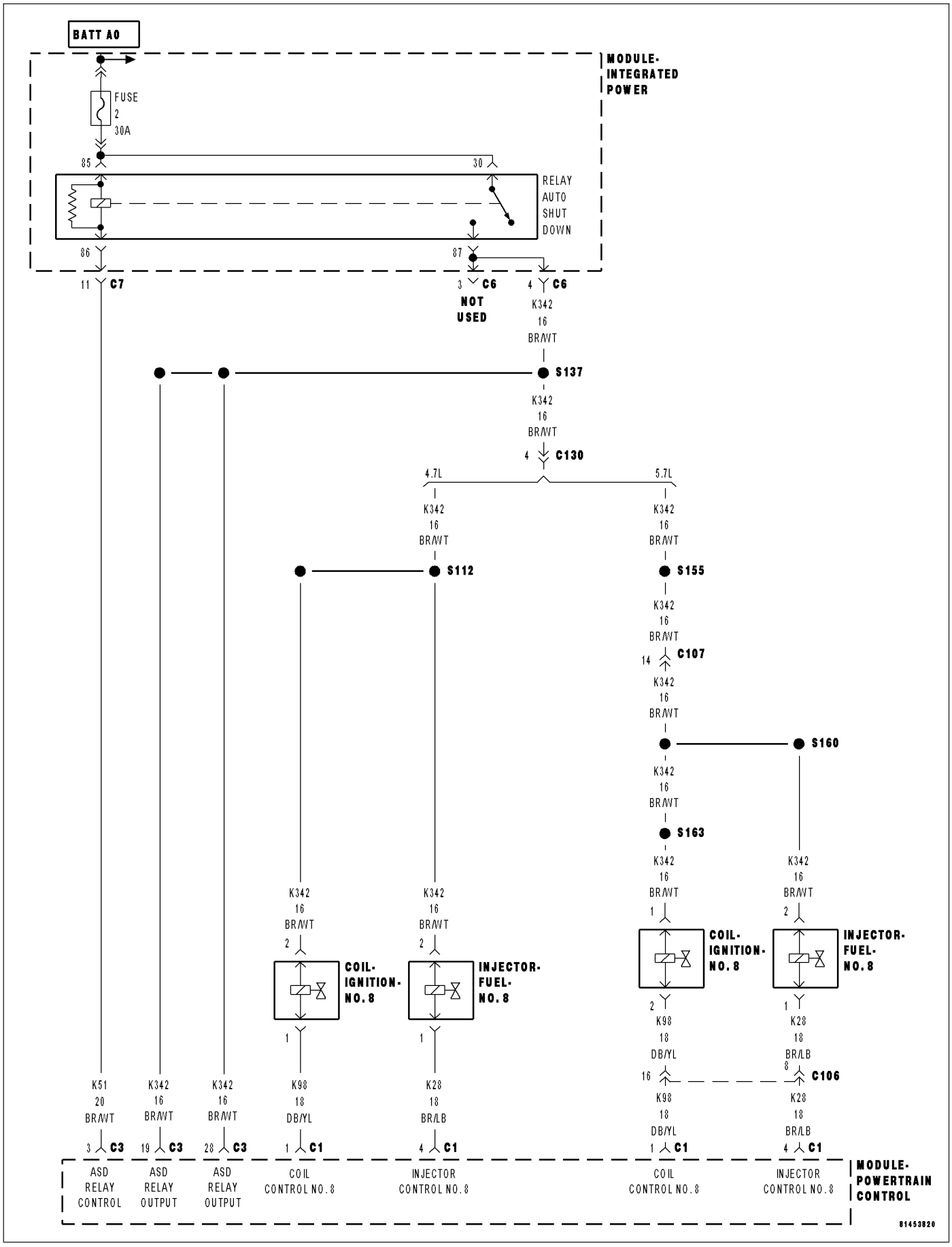
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE



P0308-CYLINDER 8 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than 2% (2.5% LEV) misfire rate is measured during two trips, or with 10% to 30% misfire rate during on trip. Three good trips to clear the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL NO.8 CIRCUIT
(K98) COIL CONTROL NO.8 CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute with a scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

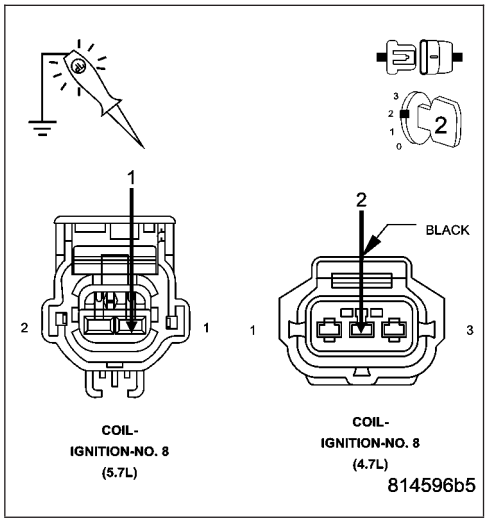
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0308-CYLINDER 8 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

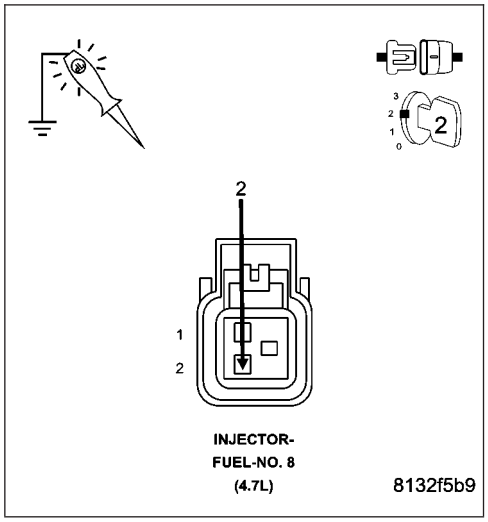
Turn the ignition off.
Disconnect the No.8 Ignition Coil harness connector.
Disconnect the No.8 Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil No.8 harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0308-CYLINDER 8 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER 8 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the No.8 Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0308-CYLINDER 8 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

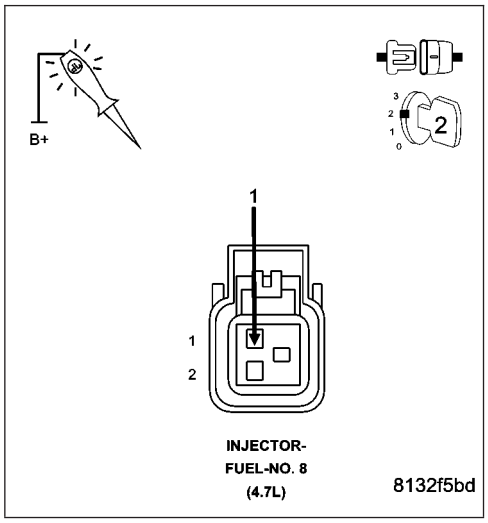
Turn the ignition off.
Disconnect the No.8 Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control No.8 circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0308-CYLINDER 8 MISFIRE (CONTINUED)

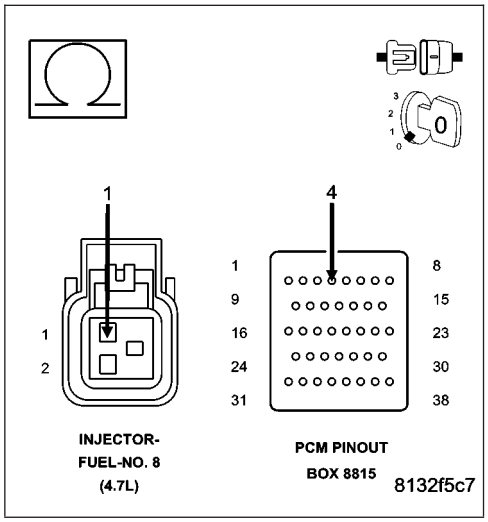
11. (K28) INJECTOR CONTROL NO.8 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K28) Injector Control No.8 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K28) Injector Control No.8 circuit?

Yes >> Repair the excessive resistance or short in the (K28) Injector Control No.8 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0308-CYLINDER 8 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the No.8 Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K98) Coil Control No.8 circuit.

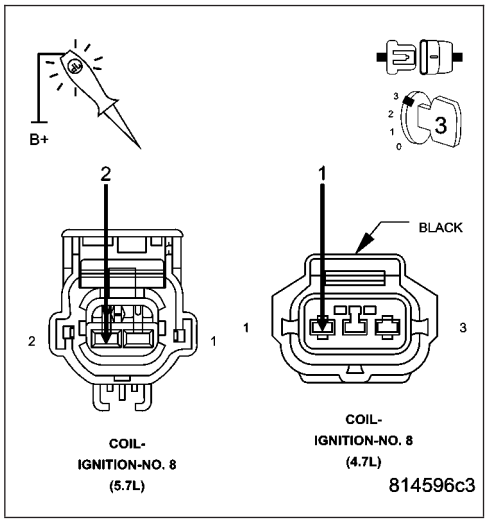
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 4.7L Ignition coil is 0.6 to 0.9 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0308-CYLINDER 8 MISFIRE (CONTINUED)

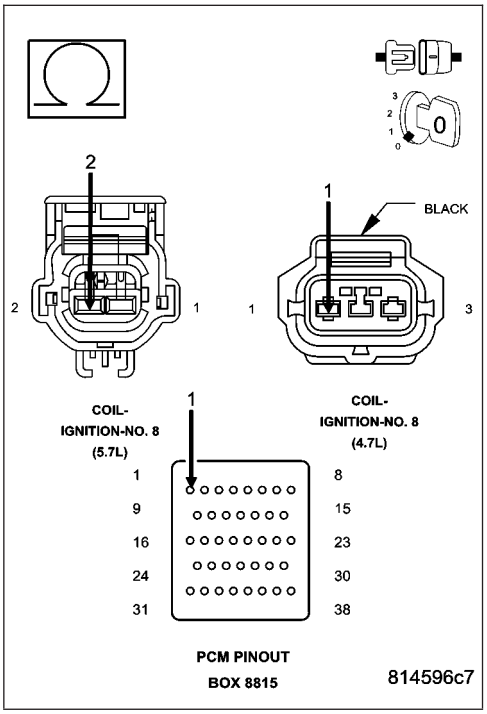
16. (K98) COIL CONTROL NO.8 CIRCUIT

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the (K98) Coil Control No.8 circuit for an open, short to ground, and short to voltage.



Was a problem found with the (K98) Coil Control No.8 circuit?

Yes >> Repair the (K98) Coil Control No.8 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

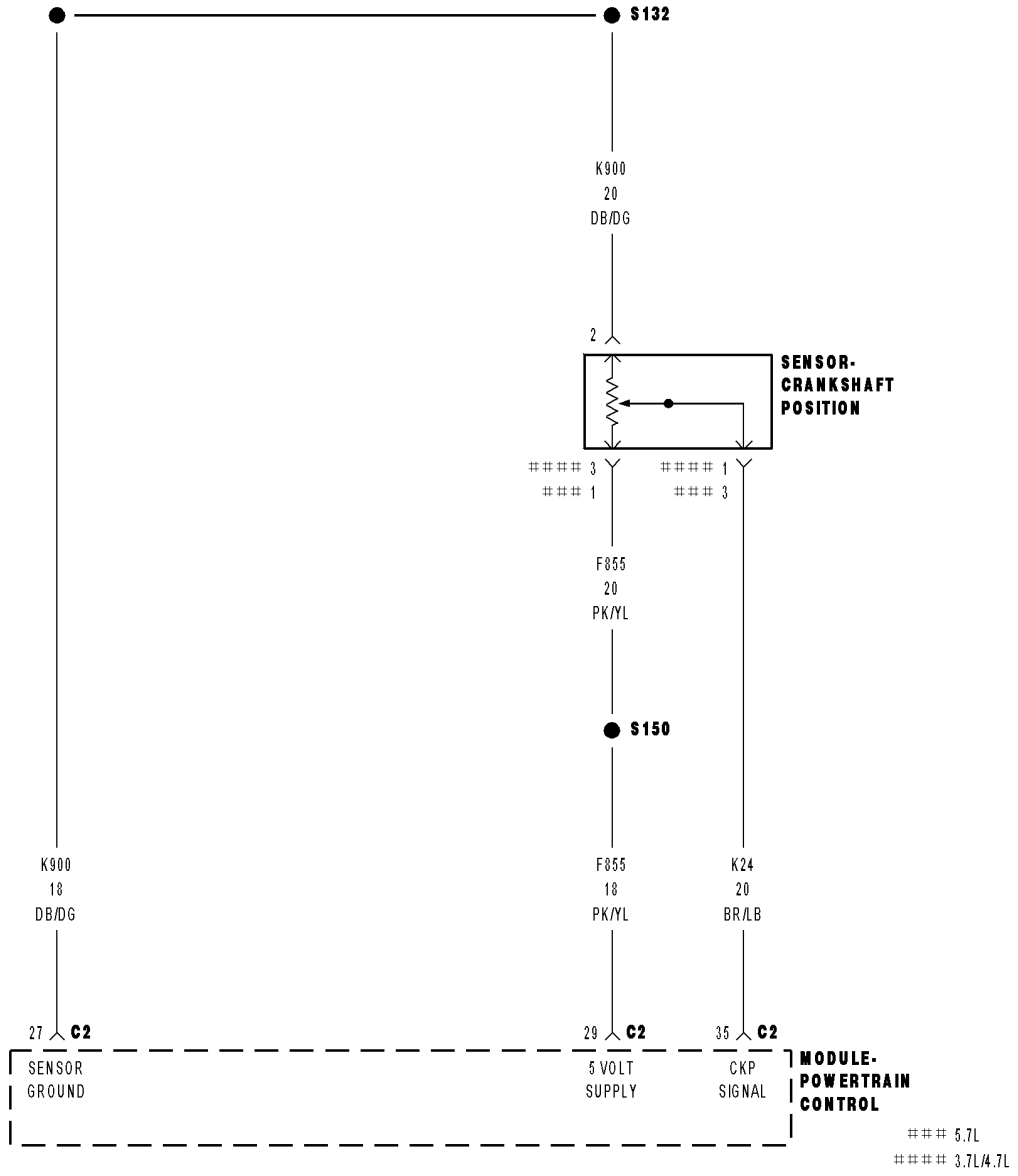
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

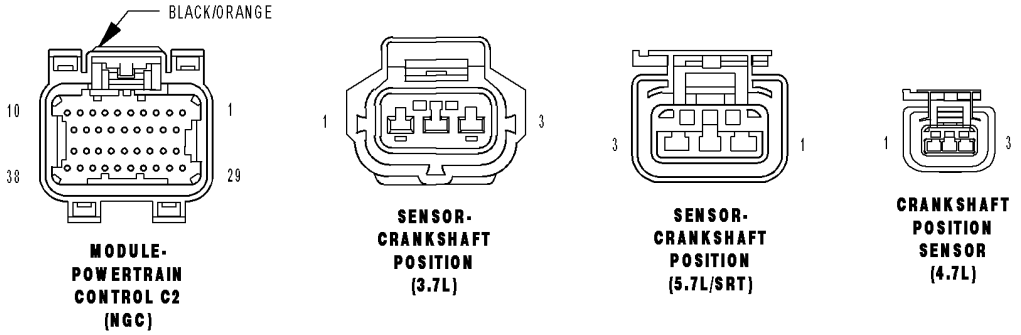
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0315-NO CRANK SENSOR LEARNED





814538ec

P0315-NO CRANK SENSOR LEARNED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Under closed throttle decel and A/C off. ECT above 75°C (167°F). Engine start time is greater than 50 seconds.
- **Set Condition:**
  One of the CKP sensor target windows has more than 2.86% variance from the reference. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
TONE WHEEL/PULSE RING
WIRE HARNESS
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, clear DTCs, PCM battery disconnect to reset the PCM.

Start the engine.

If the MIL has not yet illuminated, test drive the vehicle to try to get the code to reset.

Does the code reset while cranking or during the test drive?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0315-NO CRANK SENSOR LEARNED (CONTINUED)

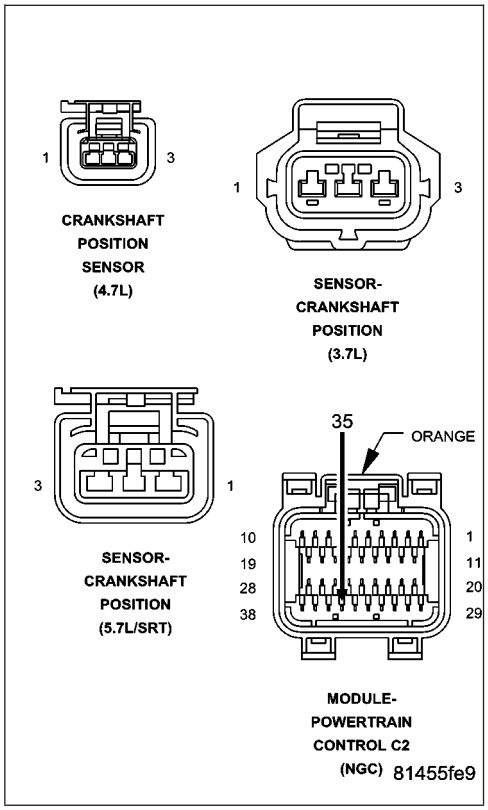
2. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the CKP wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the CKP wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor is properly installed and the mounting bolt(s) are torqued to the proper specification.



Were any of the above conditions present?

Yes >> Repair as necessary
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

3. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

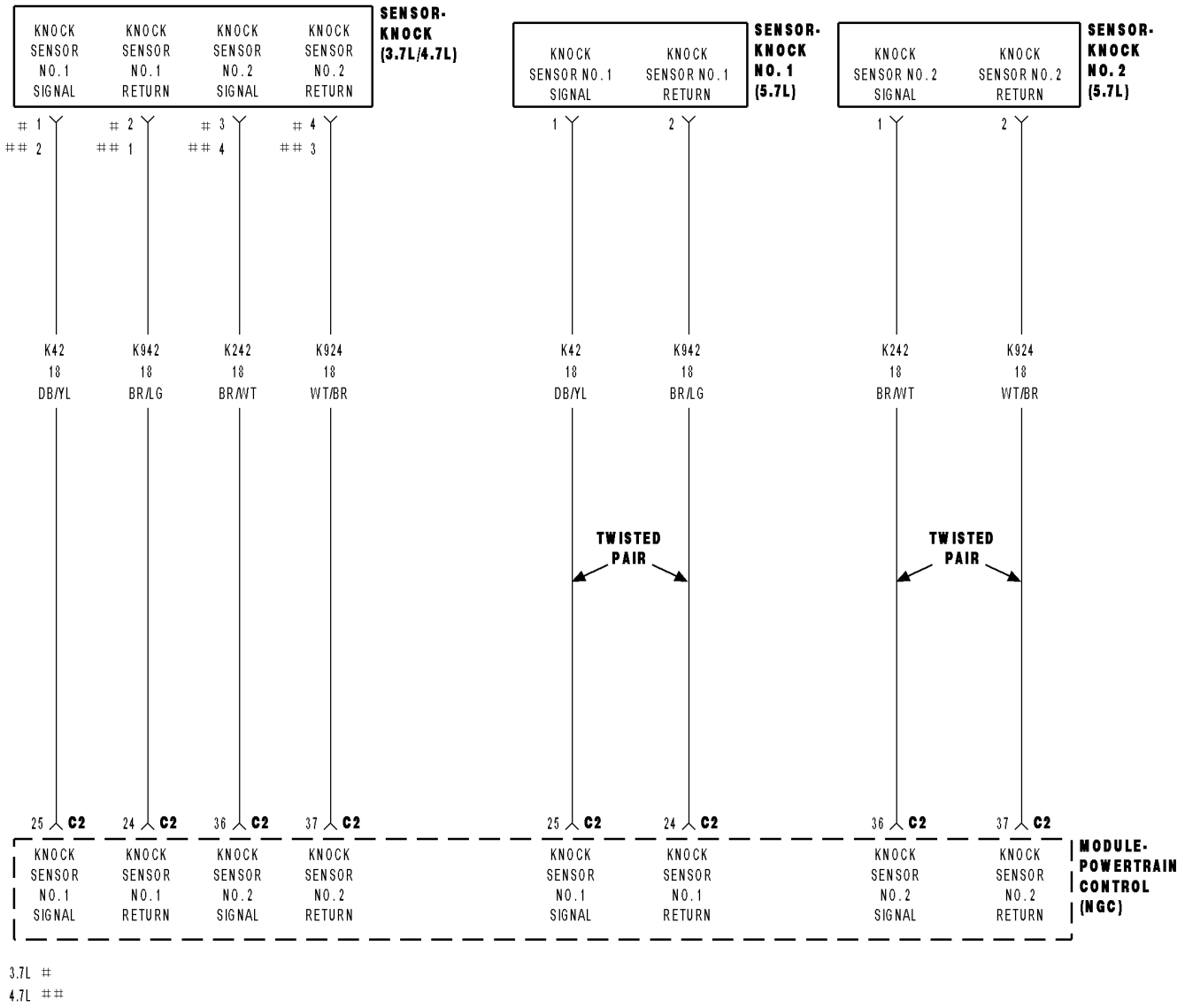
4. CRANKSHAFT POSITION SENSOR

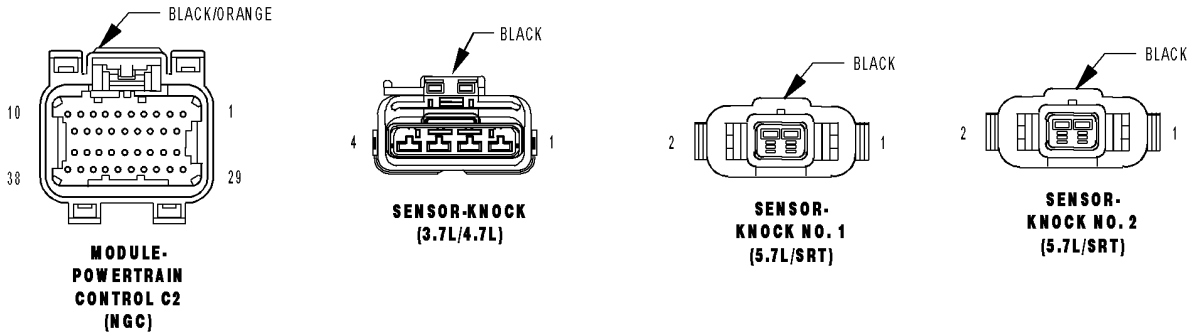
If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT





81453951

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC will also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

2. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO BATTERY VOLTAGE

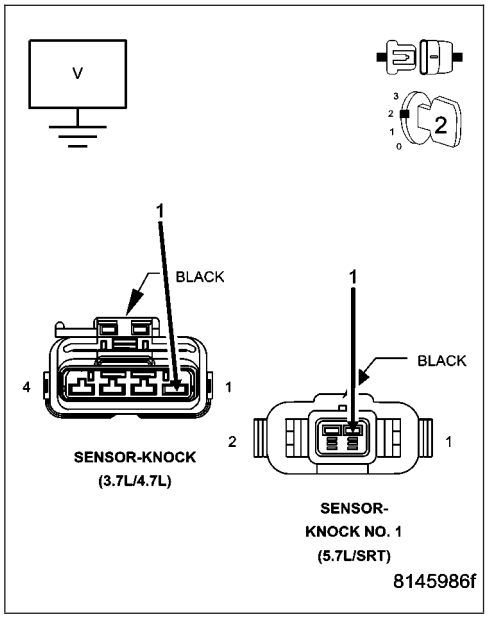
Turn the ignition off.

Disconnect the Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.



Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

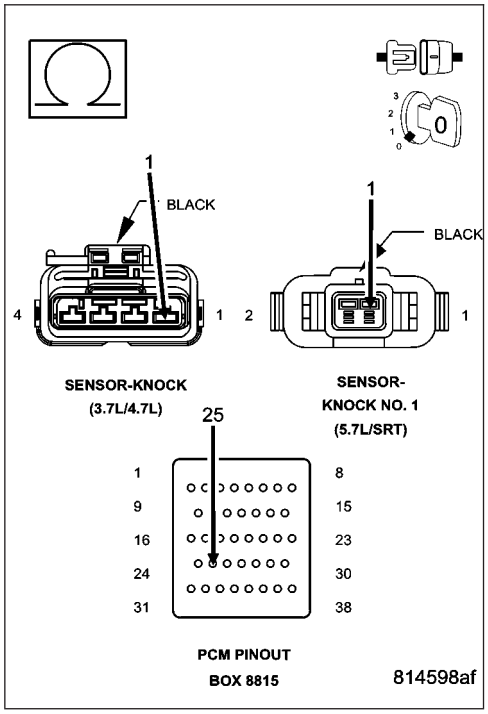
No >> Go To 3

3. (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K42) Knock Sensor No.1 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

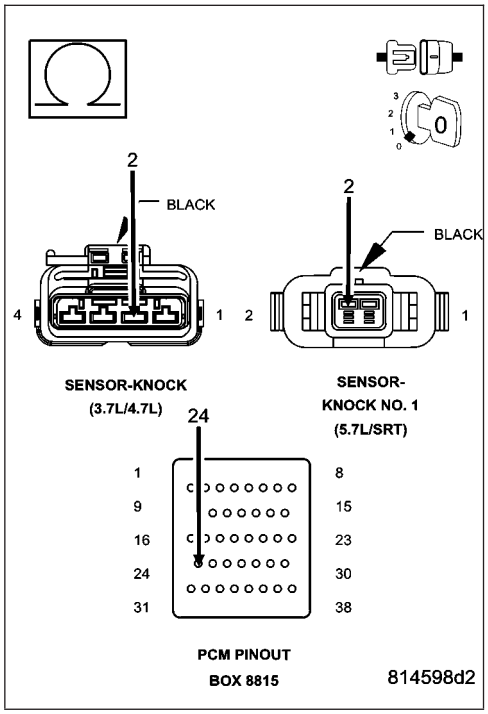
Yes >> Go To 4

No >> Repair the open in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

4. (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT OPEN

Measure the resistance of the (K942) Knock Sensor No.1 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

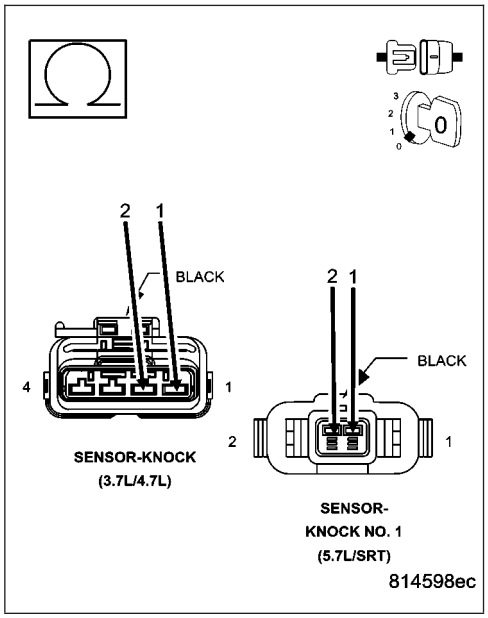
Yes >> Go To 5

No >> Repair the open in the (K942) Knock Sensor No.1 Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO THE (K942) KNOCK SENSOR NO.1 RETURN CIRCUIT

Measure the resistance between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K42) Knock Sensor No.1 Signal circuit and the (K942) Knock Sensor No.1 Return circuit.

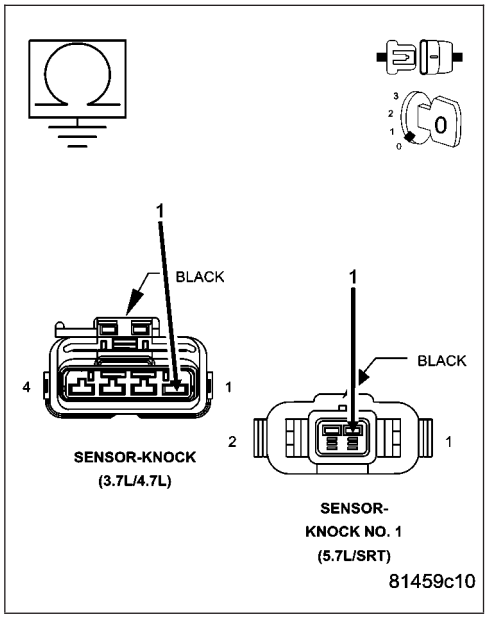
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

6. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. KNOCK SENSOR

Replace the Knock Sensor.
Ignition on, engine not running.
With the scan tool, erase DTC.
Attempt to operate the vehicle using the information noted in the Freeze Frame.
With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

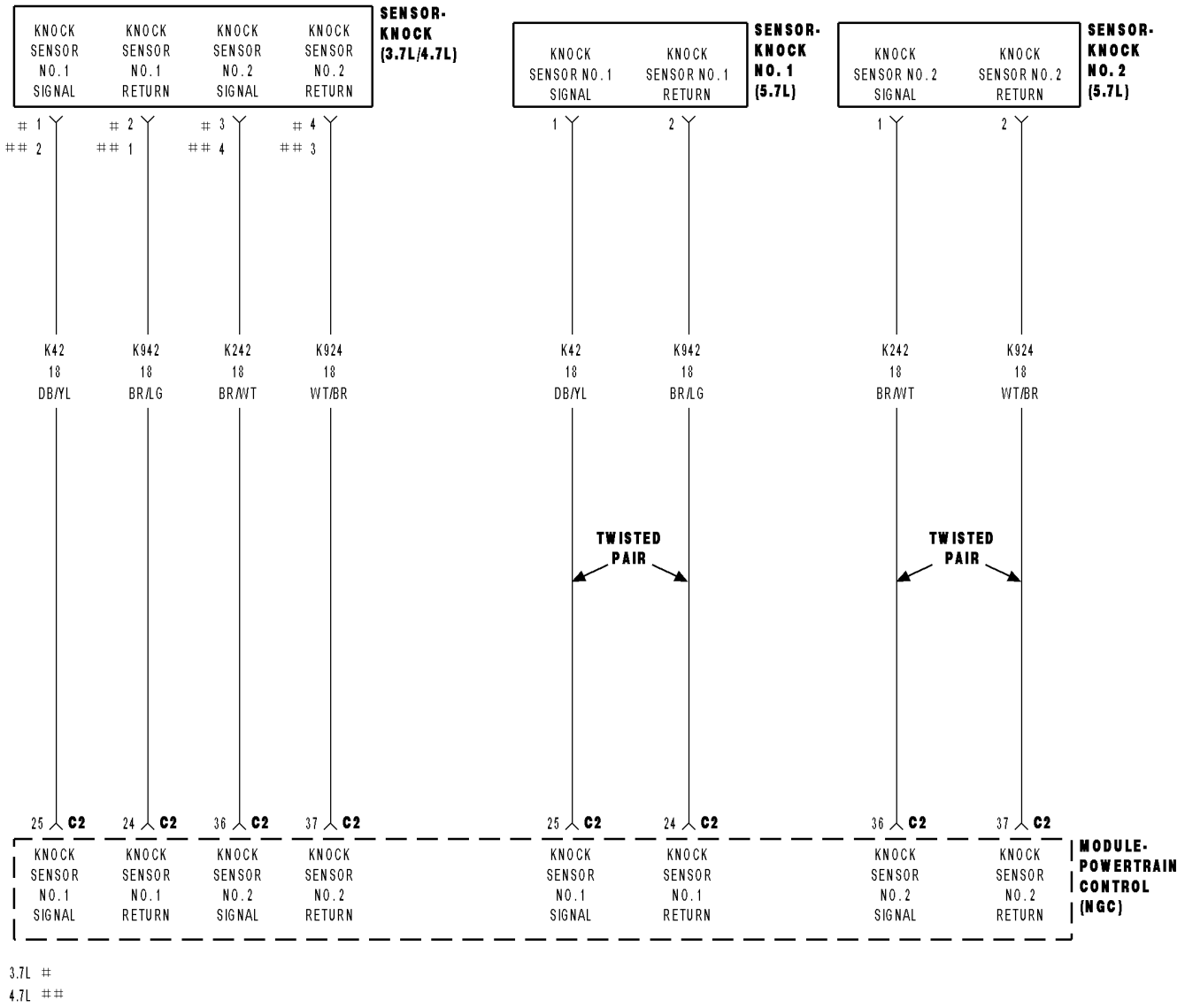
Yes >>

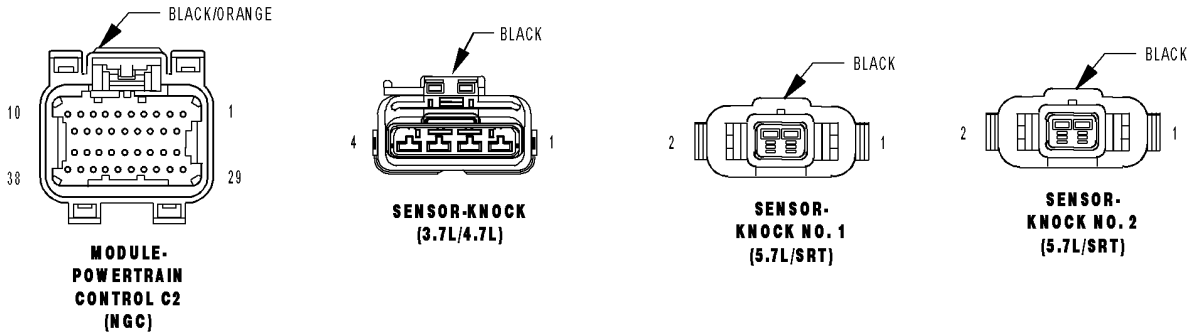
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0330-KNOCK SENSOR 2 CIRCUIT





81453951

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC well also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN
(K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

2. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the No.2 Knock Sensor harness connector.

Disconnect the C2 PCM harness connector.

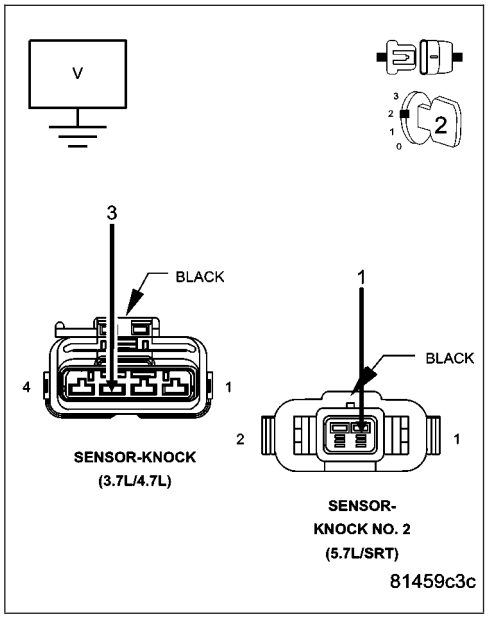
Ignition on, engine not running.

Measure the voltage on the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.

Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K242) Knock Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

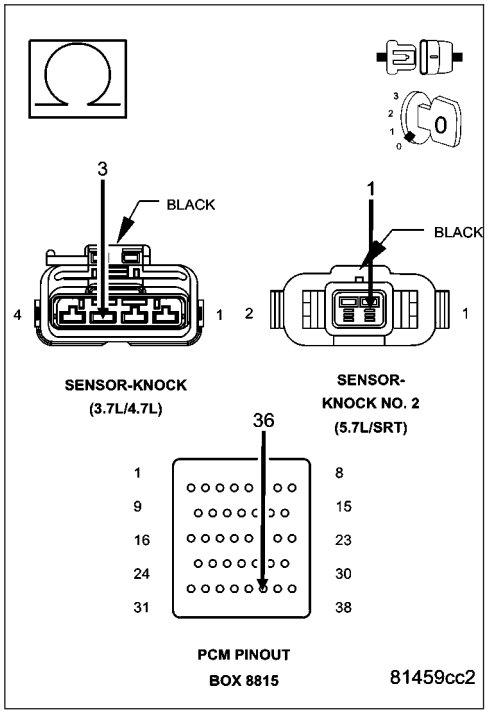
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K242) Knock Sensor No.2 Signal circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

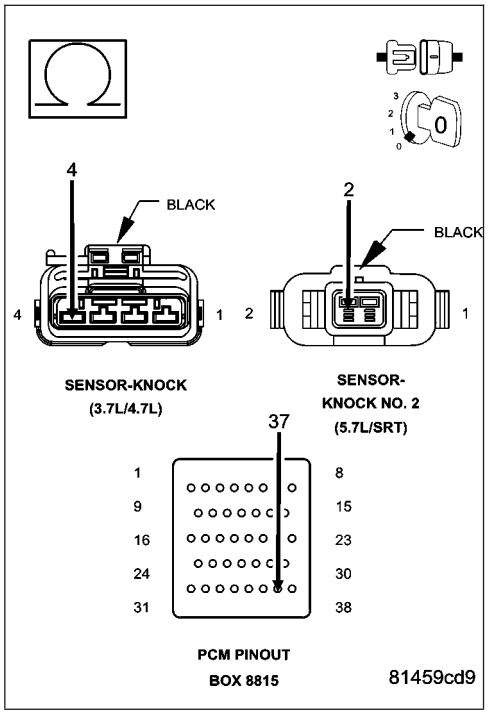
No >> Repair the open in the (K242) Knock Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

4. (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT OPEN

Measure the resistance of the (K924) Knock Sensor No.2 Return circuit from the Knock Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

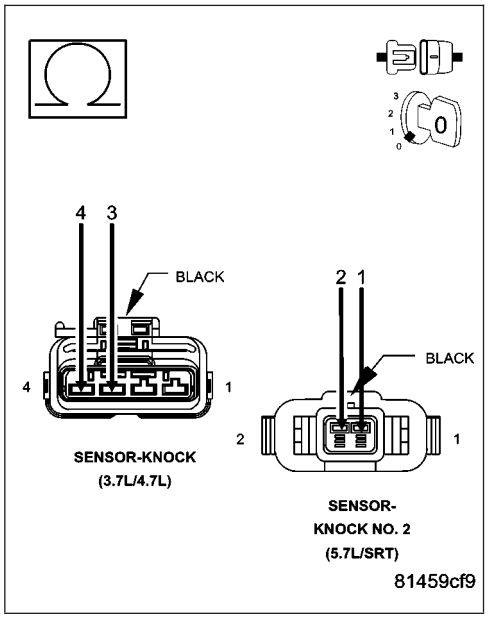
Yes >> Go To 5

No >> Repair the open in the (K924) Knock Sensor No.2 Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO THE (K924) KNOCK SENSOR NO.2 RETURN CIRCUIT

Measure the resistance between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K242) Knock Sensor No.2 Signal circuit and the (K924) Knock Sensor No.2 Return circuit.

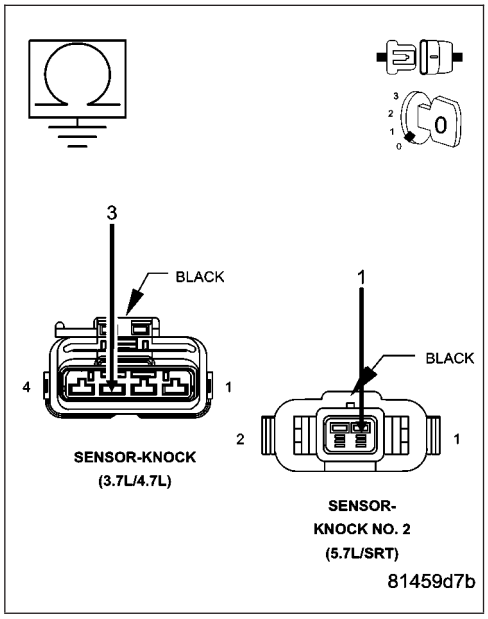
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

6. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K242) Knock Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. KNOCK SENSOR

Replace the Knock Sensor.

Ignition on, engine not running.

With the scan tool, erase DTC.

Attempt to operate the vehicle using the information noted in the Freeze Frame.

With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

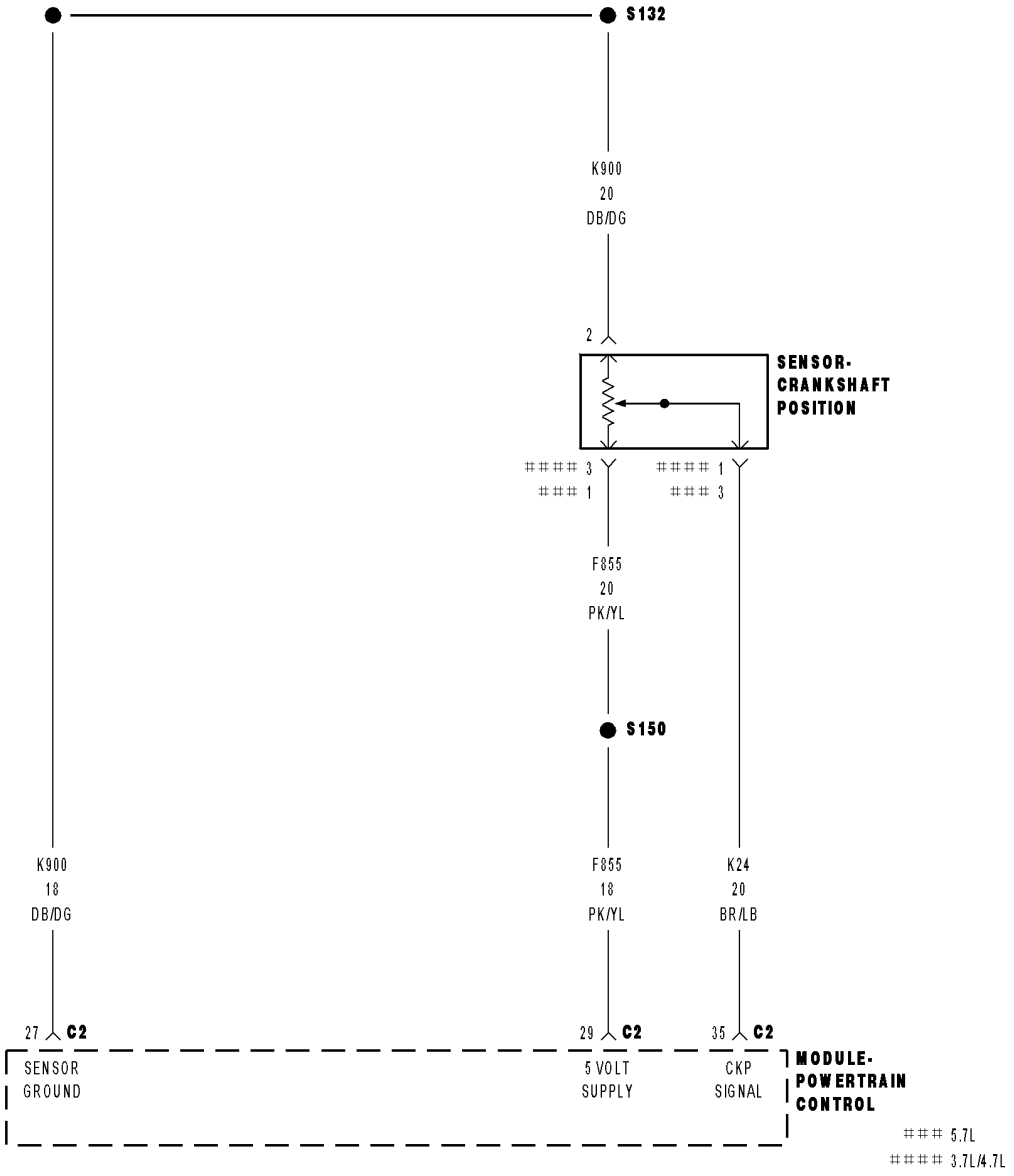
Yes >>

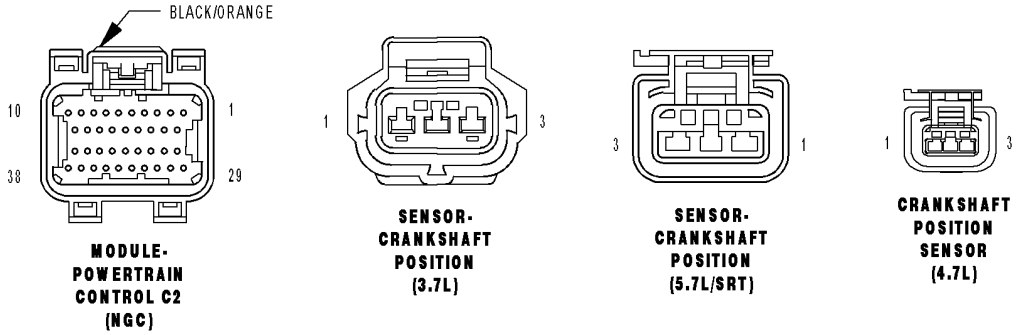
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT





814538ec

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking.
- **Set Condition:**
  No CKP signal is present during engine cranking, and at least 8 camshaft position sensor signals have occurred. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K24) CKP SIGNAL CIRCUIT SHORTED GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CRANKSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

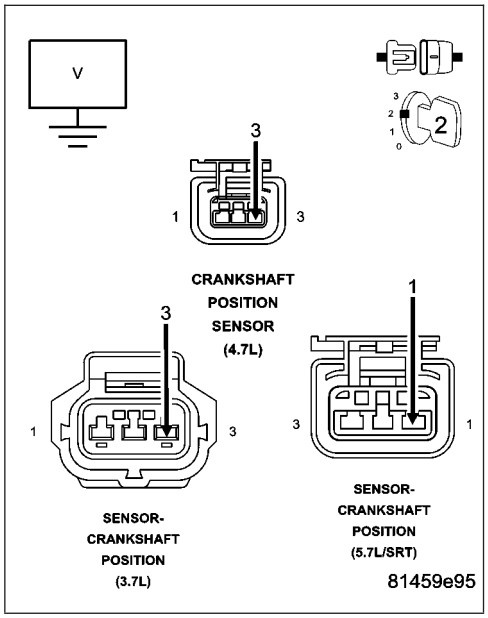
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



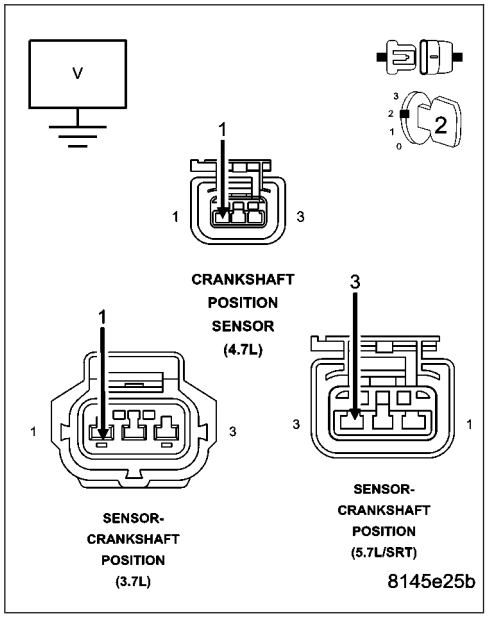
Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10

3. (K24) CKP SIGNAL CIRCUIT

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

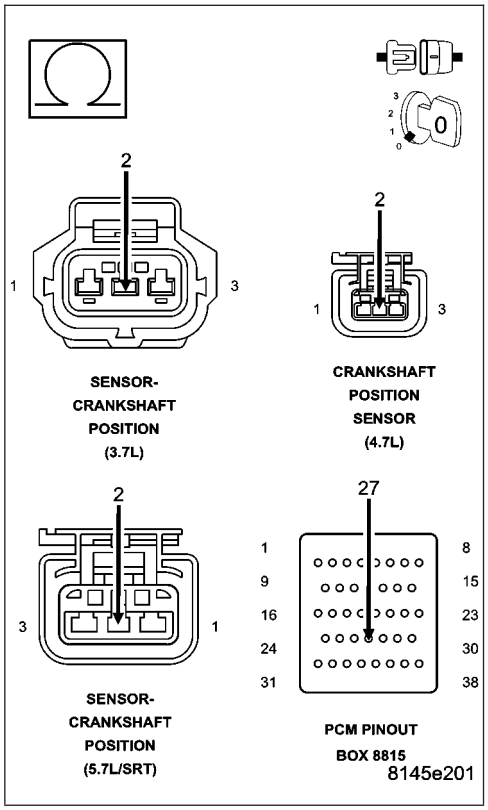
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



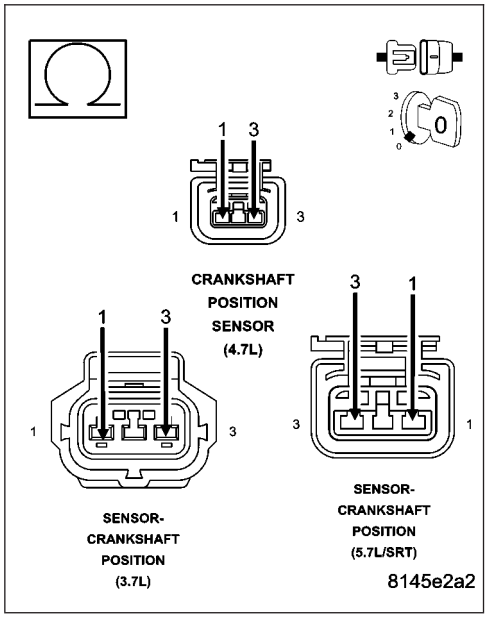
5. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

6. CRANKSHAFT POSITION SENSOR

NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

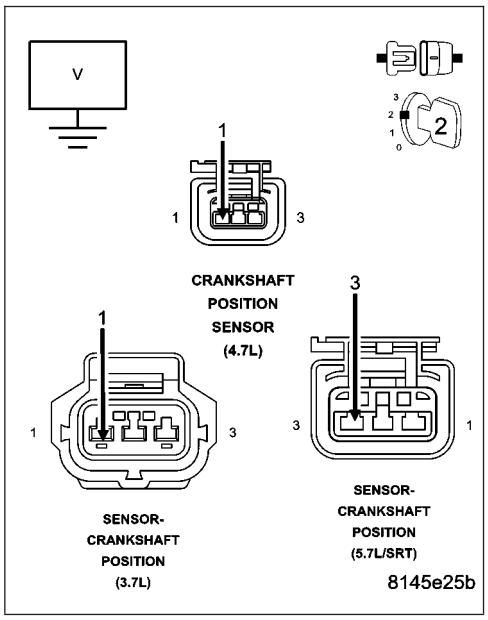
7. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

8. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

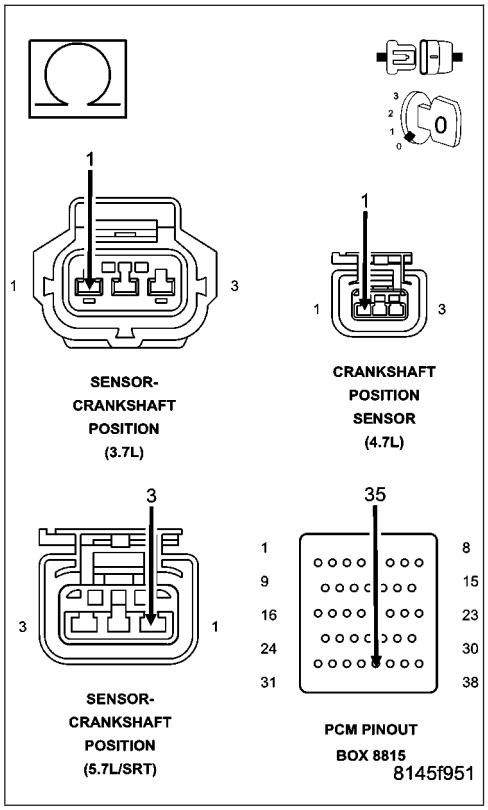
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K24) CKP Signal circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K24) CKP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



---

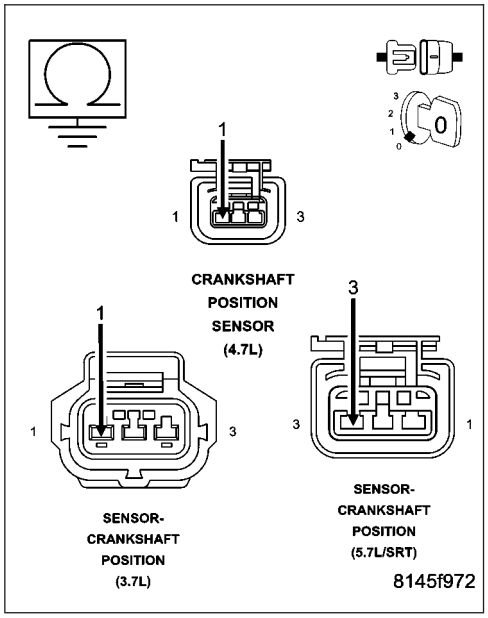
9. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K24) CKP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

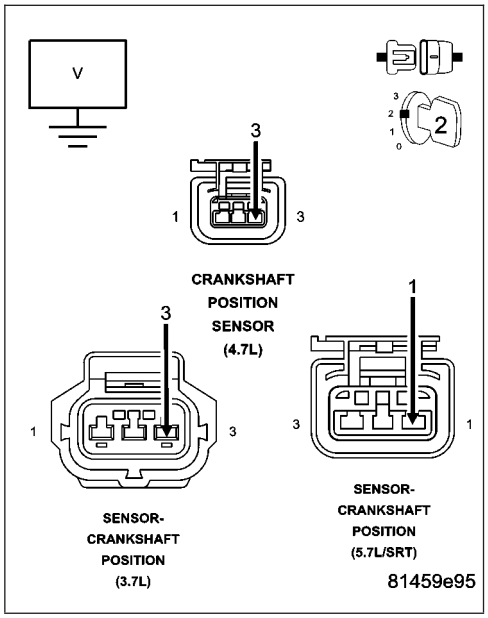
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

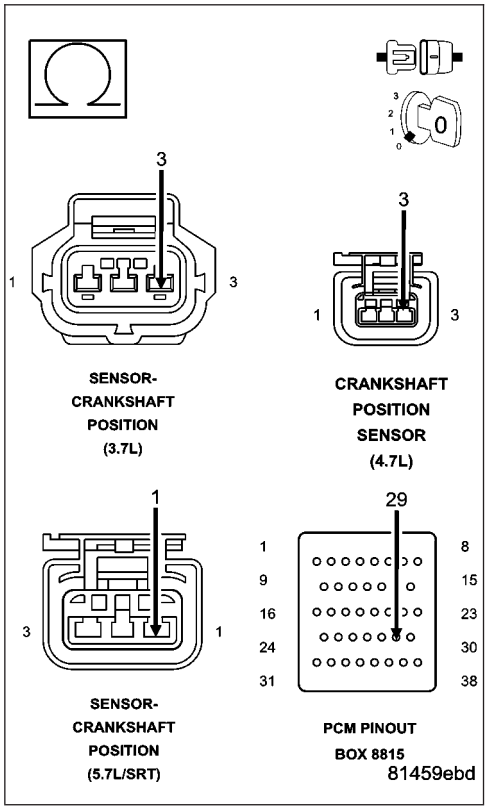
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the CKP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

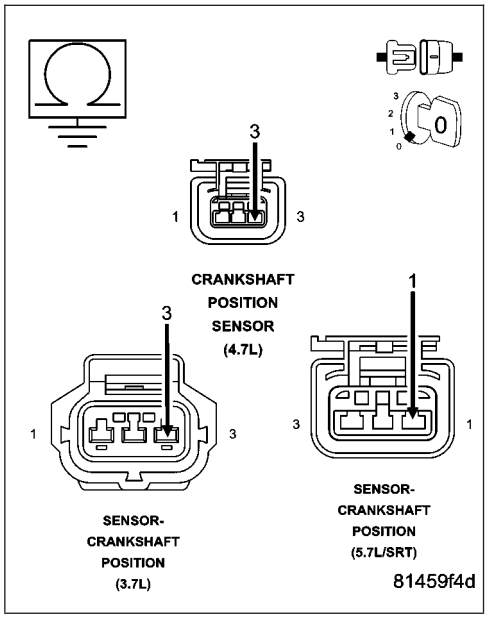
No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0335-CRANKSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

14. ERRATIC CKP SENSOR SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CKP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

Did the CKP Sensor generate any erratic pulses?

Yes >> Inspect the related wire harness and replace the Crankshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

---

15. ERRATIC CMP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CMP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

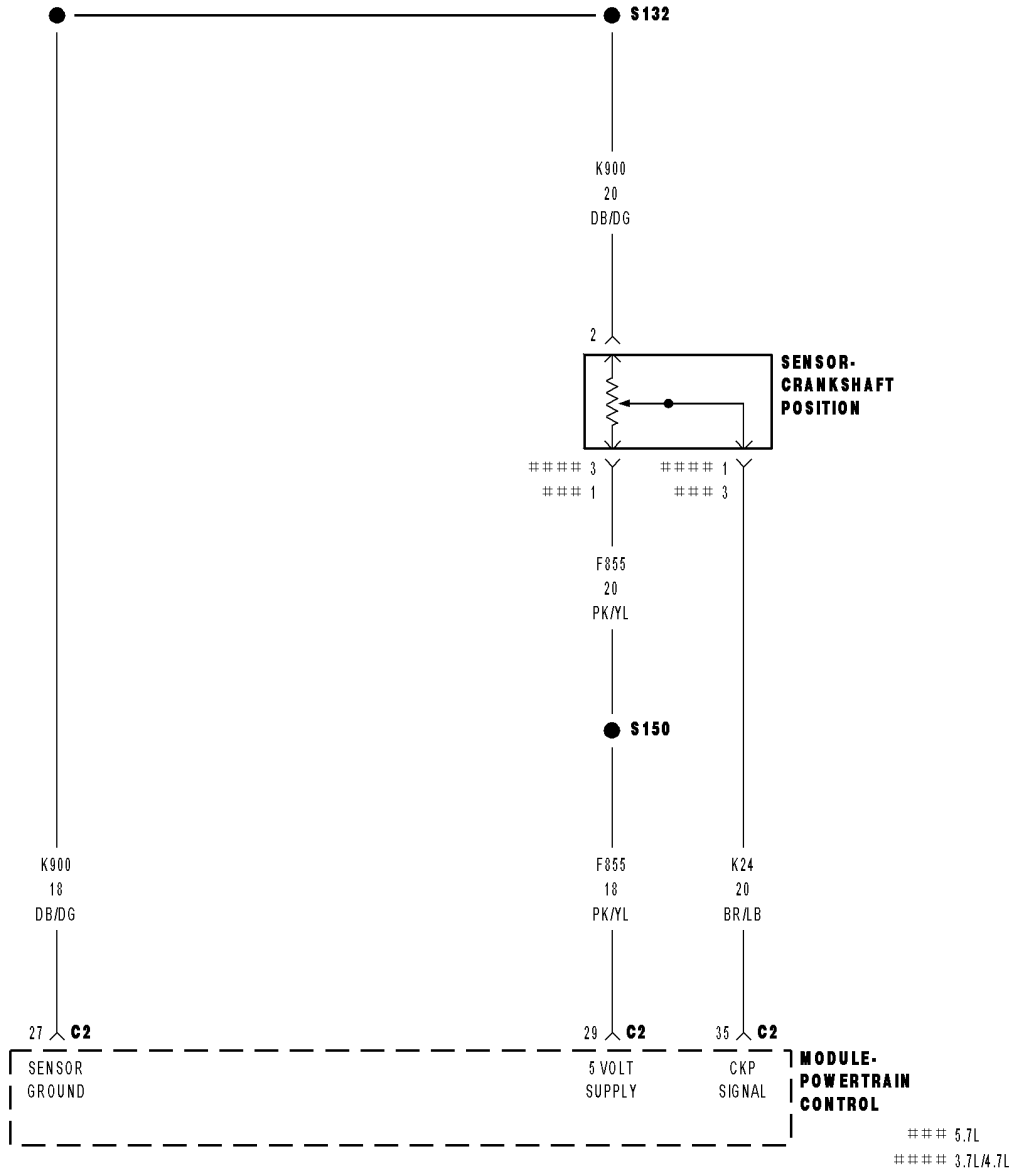
Did the CMP Sensor generate any pulses?

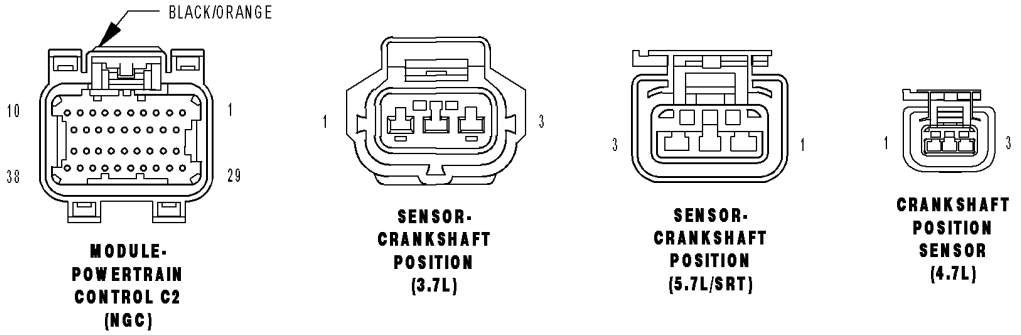
Yes >> Inspect the related wire harness and replace the Camshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test complete, the conditions that set this DTC are not present at this time.

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT





814538ec

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and with the engine running.
- **Set Condition:**
  When the CKP Sensor failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
CRANKSHAFT POSITION SENSOR
TONE WHEEL/PULSE RING
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 8

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

3. WIRE HARNESS INSPECTION

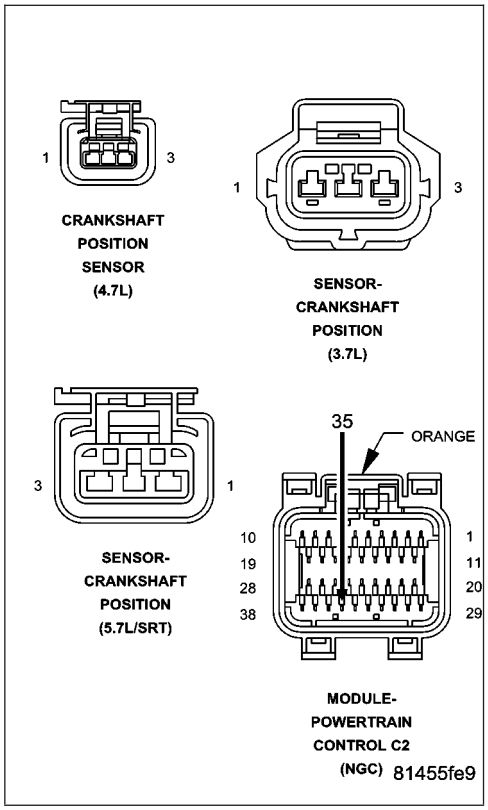
Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.



Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

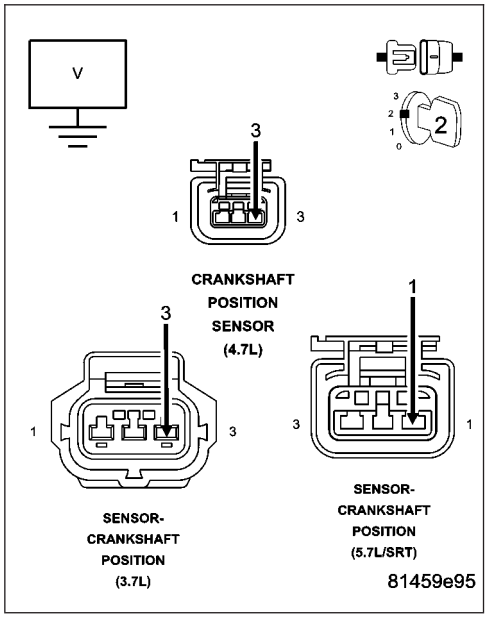
No >> Go To 4

4. (F855) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CKP Sensor connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Sensor harness connector.



Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Repair the open or short to ground in the (F855) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

5. TONE WHEEL/FLEX PLATE INSPECTION

Turn the ignition off.

Carefully disconnect the Negative Battery (Ground) cable.

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Install the CKP Sensor and connect the battery cable.

NOTE: An intermittent condition in the Cam Position Sensor can cause the P0339 to set.
With the a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the Sensor harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Replace the Cam Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. CRANKSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

8. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

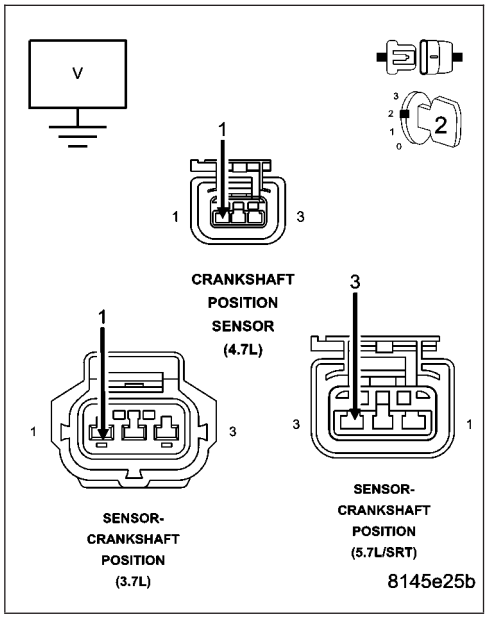
Disconnect the C2 PCM harness connector.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the Sensor harness connector.

Wiggle the related wire harness while taking this measurement.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

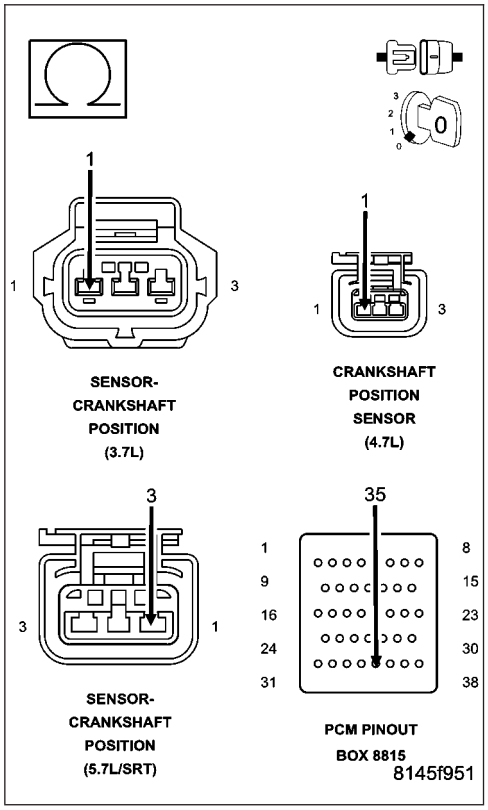
9. (K24) CKP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (K24) CKP Signal circuit from the CKP harness connector to the appropriate terminal of special tool #8815.

Wiggle the wire harness while taking this measurement.



Is the resistance below 1.0 ohm?

Yes >> Go To 10

No >> Repair the excessive resistance in the (K24) CKP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

10. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

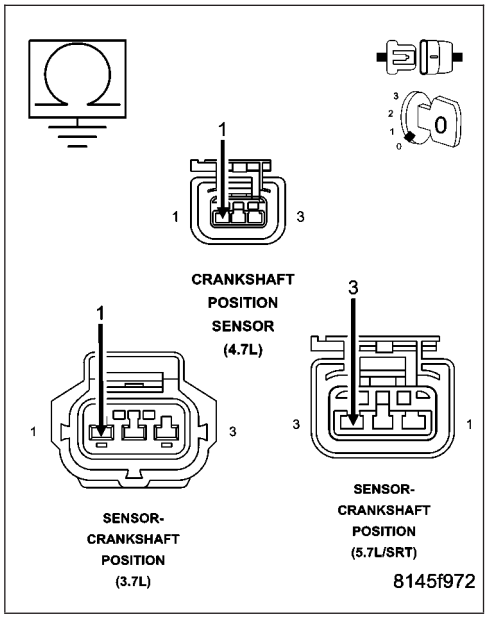
Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Wiggle the related wire harness while monitoring the resistance value.

Does the resistance ever go below 100 ohms?

Yes >> Repair the short to ground in the (K24) Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



11. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

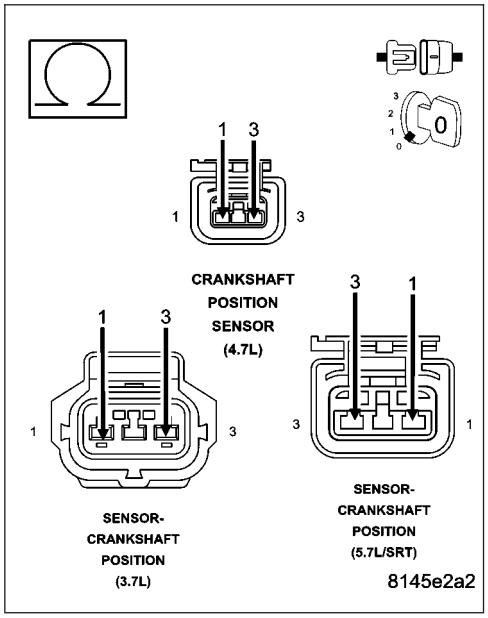
Measure the resistance between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit in the CKP harness connector.

Wiggle the related wire harness while taking this measurement.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12



P0339-CRANKSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

12. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

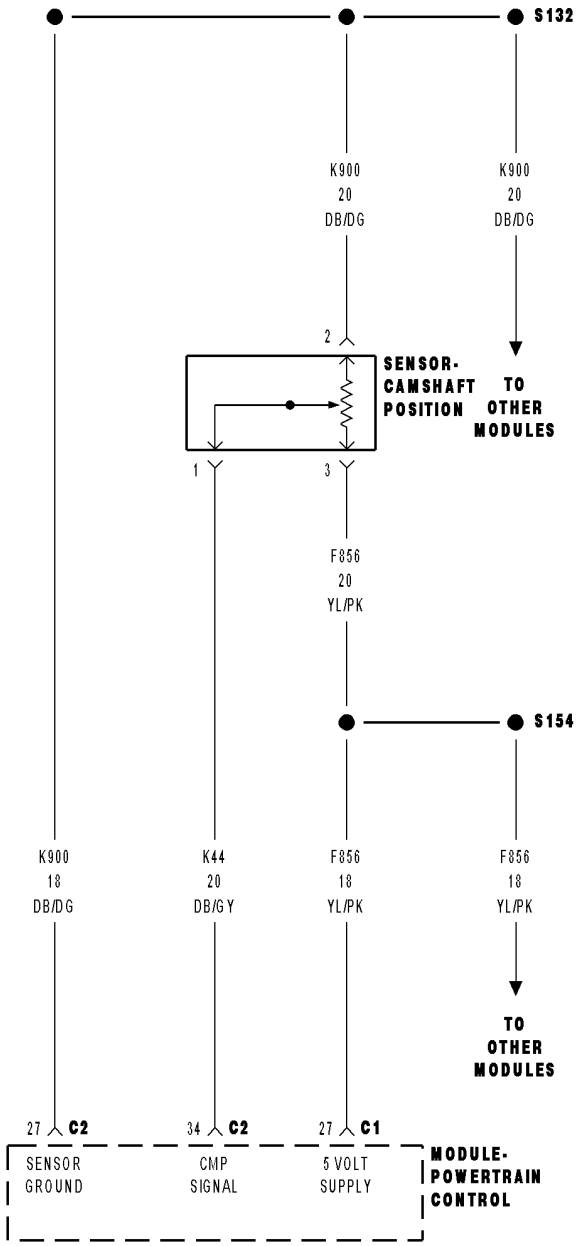
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

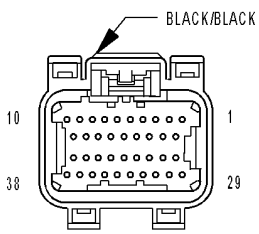
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

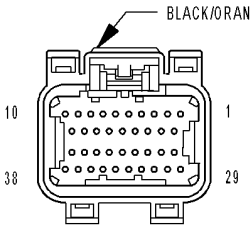
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT

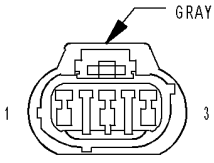




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

8145398c

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During engine cranking and with the engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  At least 5 seconds or 2.5 engine revolutions have elapsed with crankshaft position sensor signals present but no camshaft position sensor signal. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED GROUND
(K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool read the DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

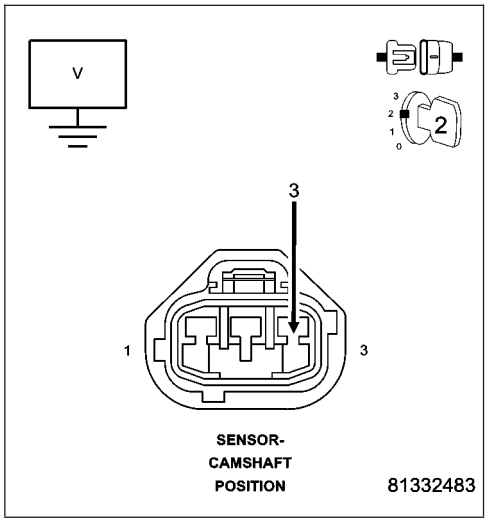
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



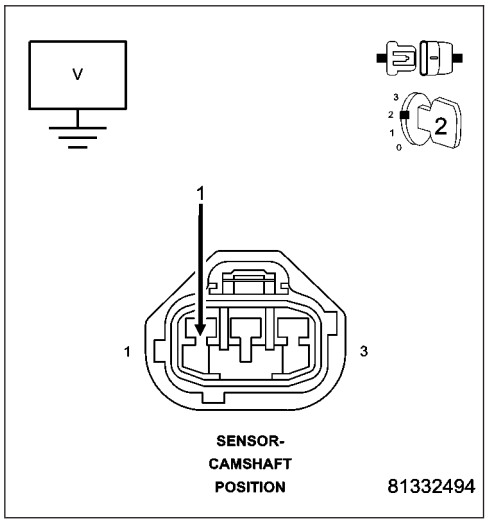
Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10

3. (K44) CMP SIGNAL CIRCUIT

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

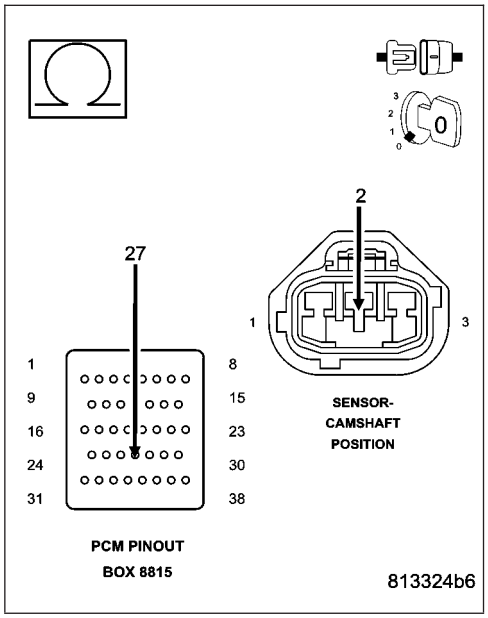
4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.



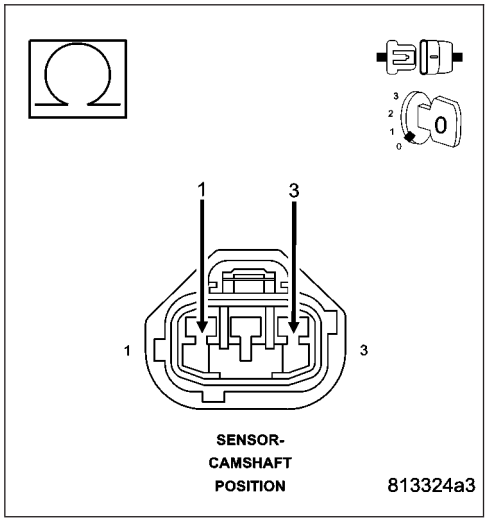
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K44) CMP SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K44) CMP Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. CAMSHAFT POSITION SENSOR

NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

7. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

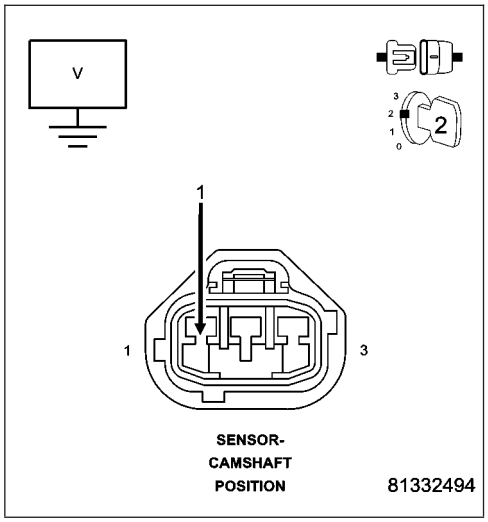
Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



8. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

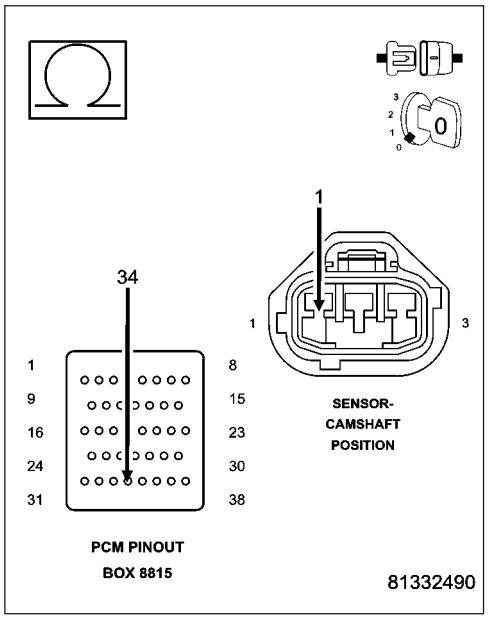
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K44) CMP Signal circuit from the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

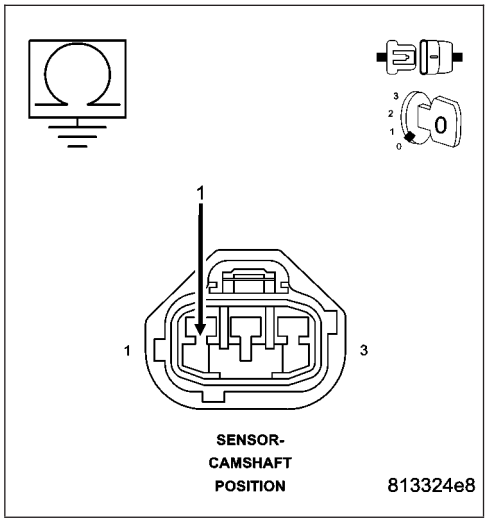
No >> Repair the open in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

9. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K44) CMP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

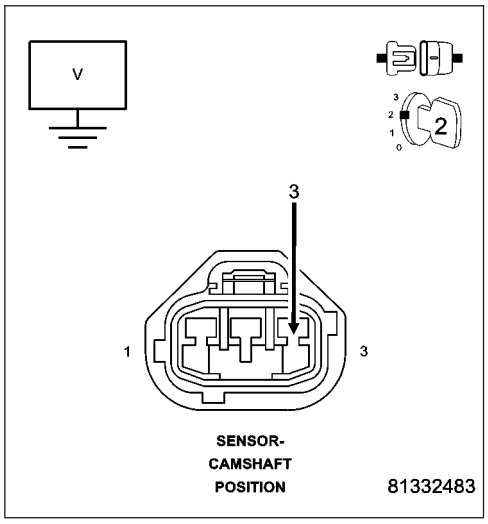
10. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

11. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

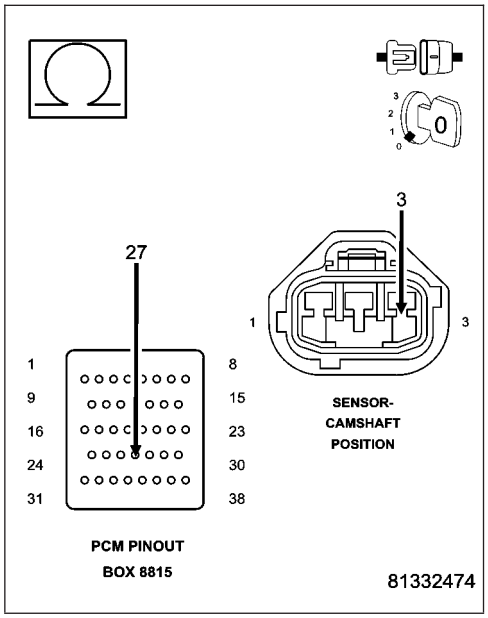
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit between the CMP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



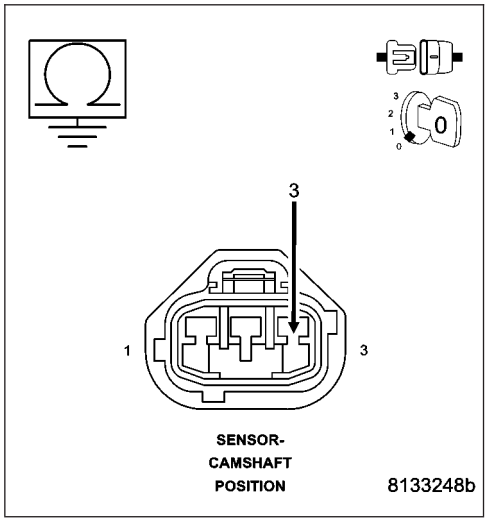
12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the CMP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13



P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. ERRATIC CMP SIGNAL

With a lab scope probe and the Miller special tool #6801, back probe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap the Camshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

Did the CMP Sensor generate any erratic pulses?

Yes >> Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

---

15. ERRATIC CKP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

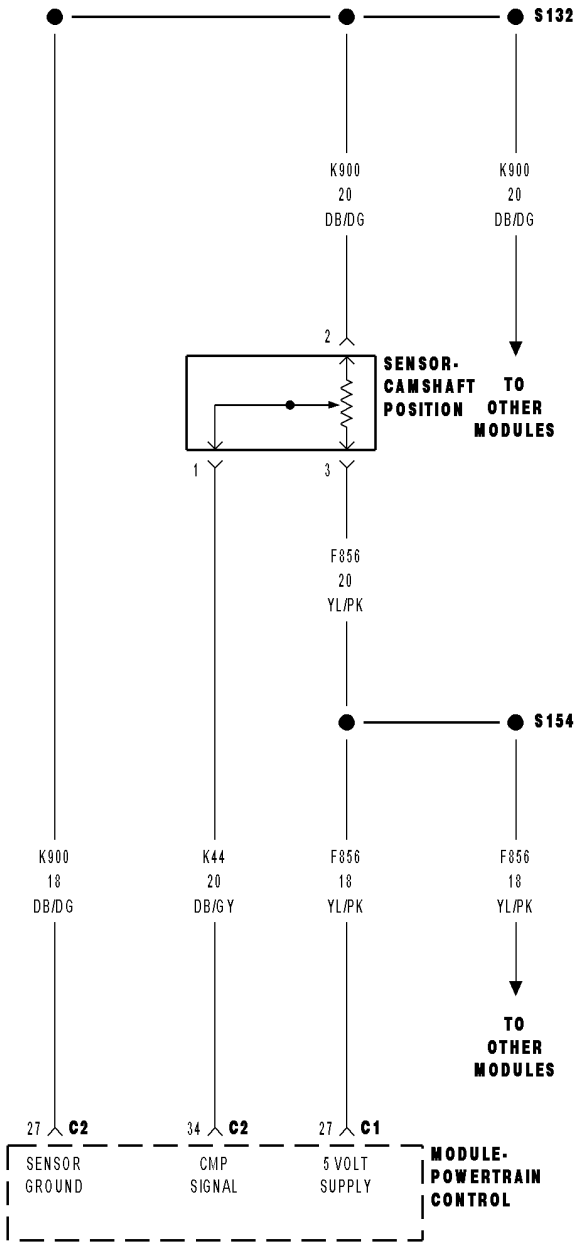
Did the CKP Sensor generate any erratic pulses?

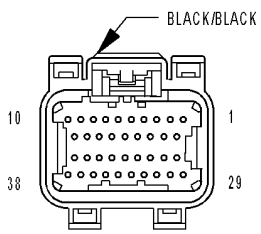
Yes >> Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test complete, the conditions that set this DTC are not present at this time

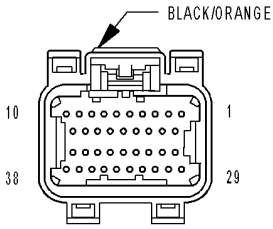
---

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT

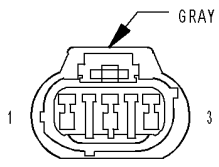




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

8145398c

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While cranking the engine and engine running.
- **Set Condition:**
  When the failure counter reaches 20. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY
TONE WHEEL/PULSE RING
CAMSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING CAMSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 8

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

3. WIRE HARNESS INSPECTION

Turn the ignition off.

Visually inspect the related wire harness including the ground circuit. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

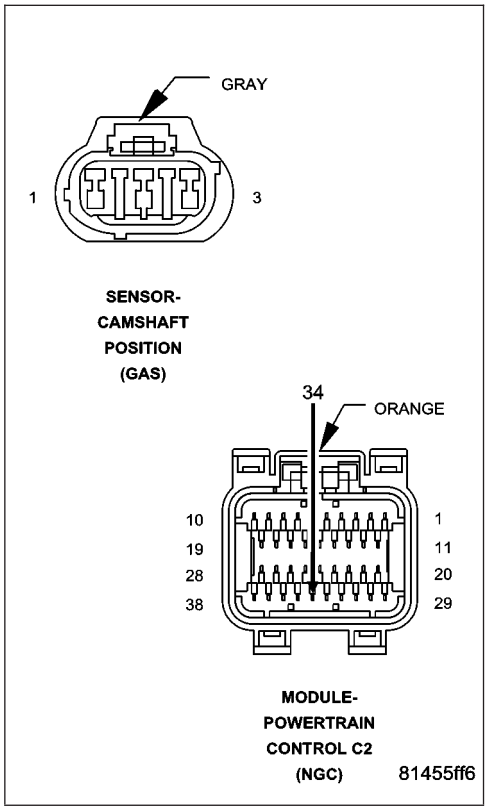
Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to the proper specification.

Refer to any TSBs that may apply.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (F856) 5-VOLT SUPPLY CIRCUIT OPEN OR SHORTED TO GROUND

Disconnect the CMP Sensor connector.

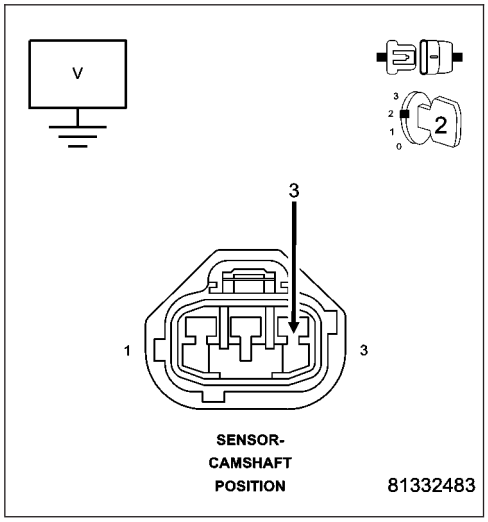
Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the CMP harness connector.

Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Repair the open or short to ground in the (F856) 5-volt Supply circuit. Use Miller special tool #8815 when checking for an open circuit to prevent PCM harness connector terminal damage.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

5. TONE WHEEL/PULSE RING INSPECTION

Turn the ignition off.

Carefully disconnect the Battery Ground cable.

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. CHECKING CRANKSHAFT POSITION SENSOR SIGNAL WITH A LAB SCOPE

NOTE: An intermittent condition in the Crank Position Sensor can cause the P0344 to set.

Install the CMP Sensor and connect the Battery cable.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Replace the Crank Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

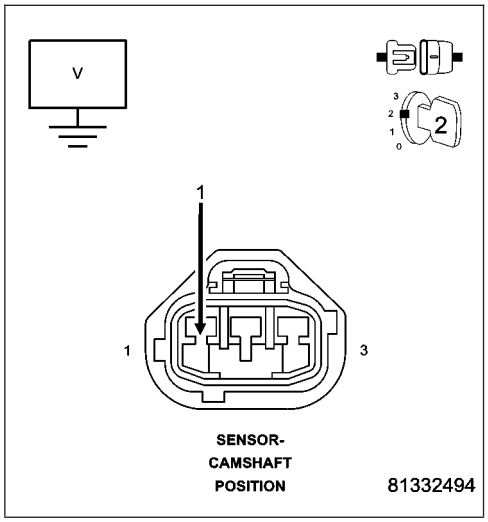
Repair

Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

8. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.
Disconnect the CMP Sensor connector.
Disconnect the C2 PCM harness connector.
Ignition on, engine not running.
Measure the voltage on the (K44) CMP Signal circuit.
Wiggle the related wire harness while taking this measurement.



Does the voltage ever increase above 0 volts?

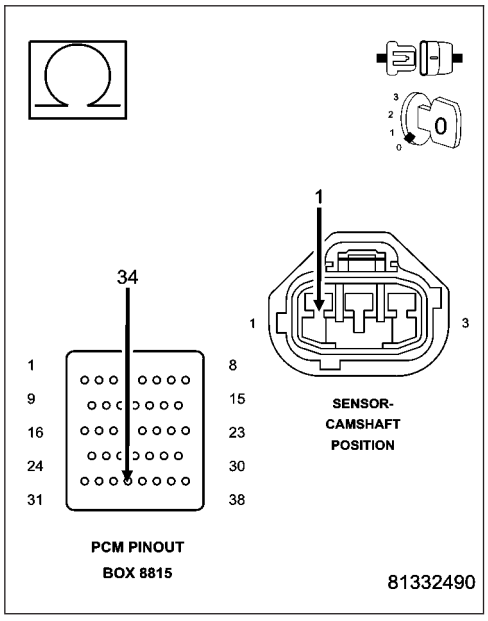
Yes >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. (K44) CMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance in the (K44) CMP Signal circuit from the CMP harness connector to the appropriate terminal of special tool #8815.
Wiggle the related wire harness while taking this measurement.



Is the resistance below 5.0 ohms?

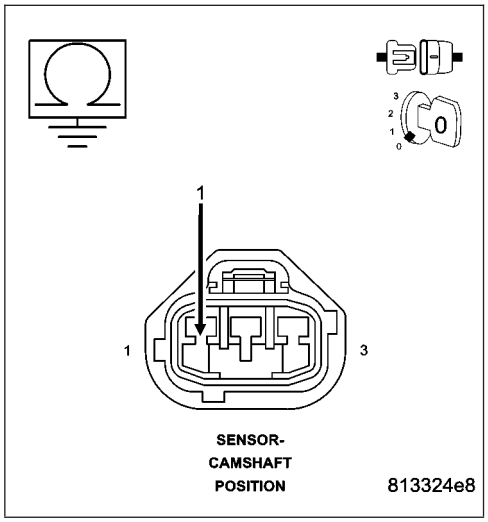
Yes >> Go To 10

No >> Repair the excessive resistance in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0344-CAMSHAFT POSITION SENSOR INTERMITTENT (CONTINUED)

10. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.
Wiggle the related wire harness while monitoring the resistance value.



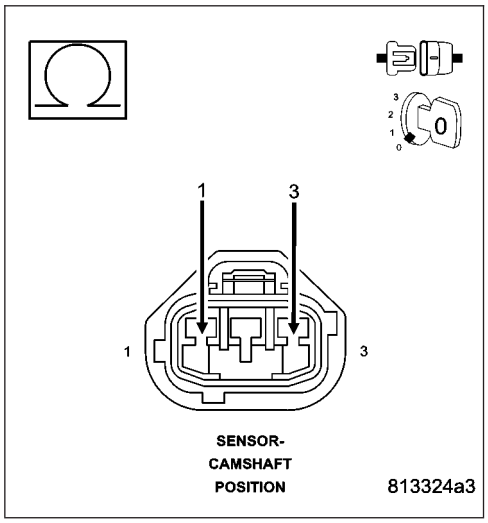
Does the resistance ever go below 100 ohms?

Yes >> Repair the short to ground in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

11. (K44) CMP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit in the CMP harness connector.
Wiggle the related wire harness while taking this measurement.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F856) 5-volt Supply circuit and the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

12. PCM

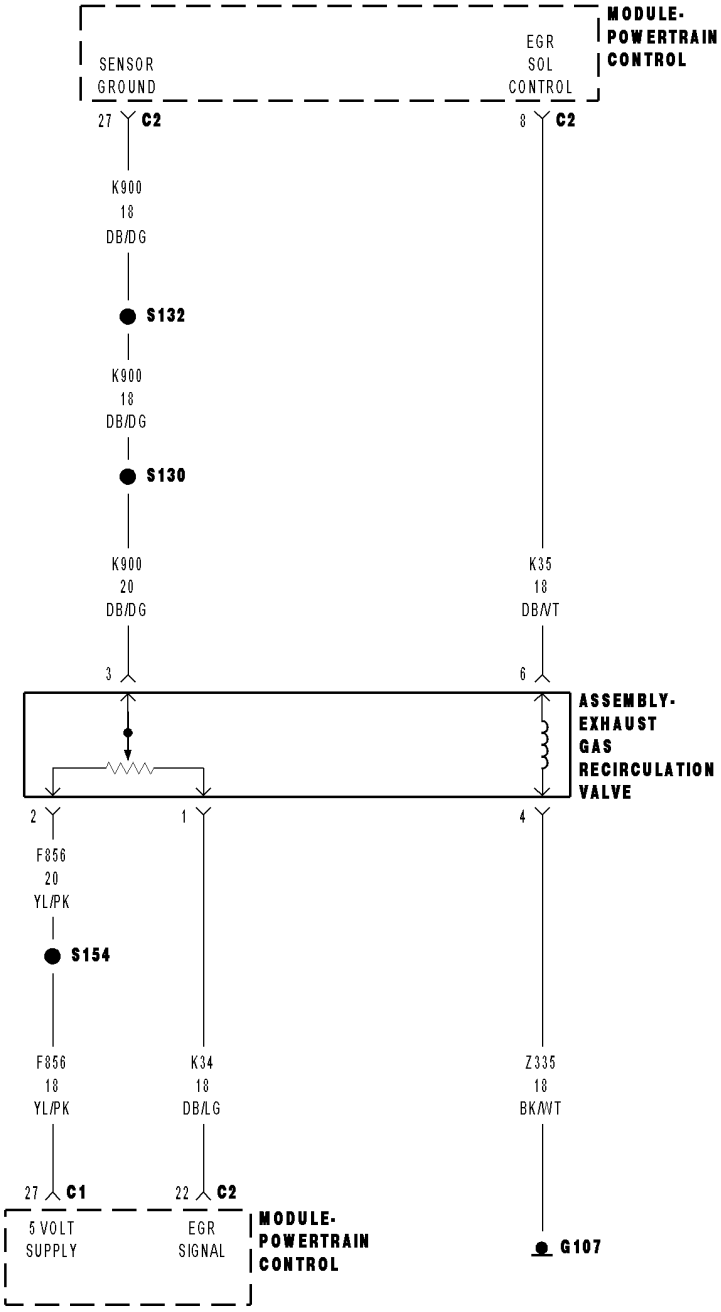
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

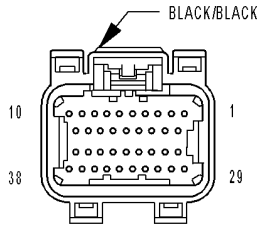
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

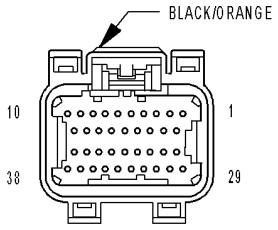
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0401-EGR SYSTEM PERFORMANCE

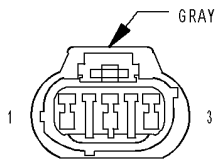




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

814539c3

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Exhaust gas recirculation is a method of reducing emissions of oxides of nitrogen. As the inert exhaust gas is recirculated, the mixture absorbs heat in the combustion chamber without interacting with the fuel/air mixture and reduces the formation of NOx emissions. After the EGR monitor conditions are met, the EGR valve is turned on and off momentarily. The EGR monitor calculated the difference in engine roughness from the EGR off condition to the EGR condition. This engine combustion stability difference as measured by engine roughness is the measure of a functional EGR system.

- **When Monitored:**
  Engine running for greater than two minutes with the Engine Coolant Temp greater than 70°C (158°F). EGR active. Less than 8500 feet. Ambient temperature greater than -6°C (20°F).
- **Set Condition:**The PCM closes the EGR valve while monitoring the O2 Sensor signal. Once a closed EGR fueling sample has been established the PCM then ramps in EGR and additional fueling while monitoring the O2 sensor signal in the open state. A fueling sample is again established. The PCM then compares the different O2 Sensor signal readings (fueling samples). If a larger than expected variation is detected, a soft failure is recorded. Three soft failures set a one trip failure. After two failed trips, a DTC is set and the MIL is illuminated.

Possible Causes
(Z335) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

2. EGR OPERATION

NOTE: If the vehicle is running rough at idle (scan tool not actuating) follow the yes path to continue.
Turn all accessories off.
Start the engine.
Allow the engine to reach normal operating temperature.
With the scan tool, enter Engine System Test, then EGR System Test.
Actuate the FLOW function in the EGR System Test.

Did the engine run rough or stall?

Yes >> Go To 3

No >> Go To 6

---

3. EGR VALVE OPEN AT IDLE

Turn the ignition off.
Disconnect the EGR Solenoid Assembly harness connector.
Start engine. Attempt to allow the engine to idle.

Does the engine run rough or stall?

Yes >> Inspect the EGR tube assembly. If OK, replace the EGR valve.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. EGR VALVE ASSEMBLY INSPECTION

Inspect the EGR Assembly for the following.
Gasket(s) for leaking
Damage and/or holes in the EGR tube(s)
Carbon build up on or near the EGR pintle and passage ways.
Obstruction in the EGR tubes.

Were any problem found?

Yes >> Repair or replace the EGR Assembly as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

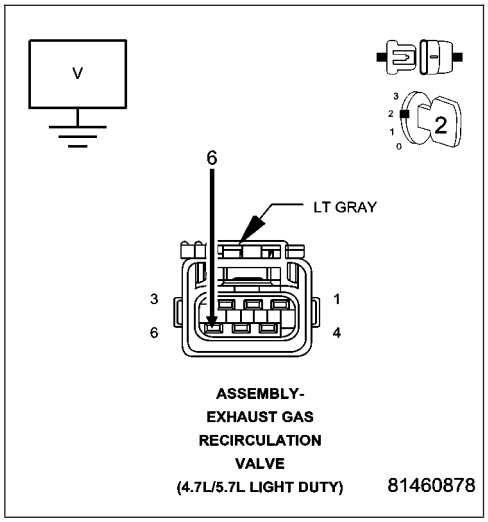
5. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Ignition on, engine not running.

Measure the voltage on the (K35) EGR Solenoid Control circuit in the EGR Solenoid connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K35) EGR Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

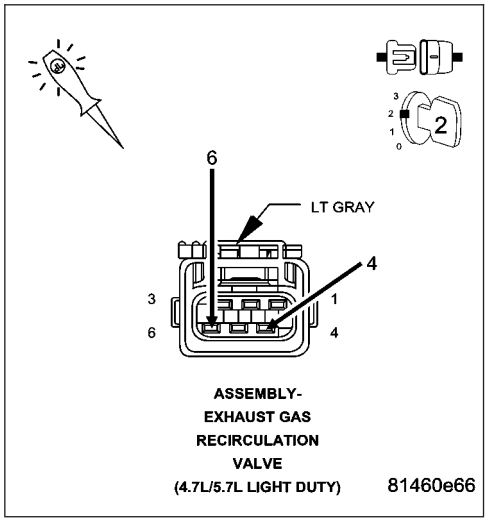
No >> Go To 10

6. EGR SOLENOID ASSEMBLY

Disconnect the EGR Solenoid harness connector.

Using a 12-volt test light, jump across the (K35) EGR Solenoid Control terminal and the (Z335) Ground terminal in the EGR Solenoid harness connector.

With the scan tool, actuate the EGR solenoid.



Does the 12-volt test light flash on and off?

Yes >> Inspect the tube(s) for obstructions and damage, repair as necessary. If OK, replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

7. (Z335) EGR SOLENOID GROUND CIRCUIT OPEN

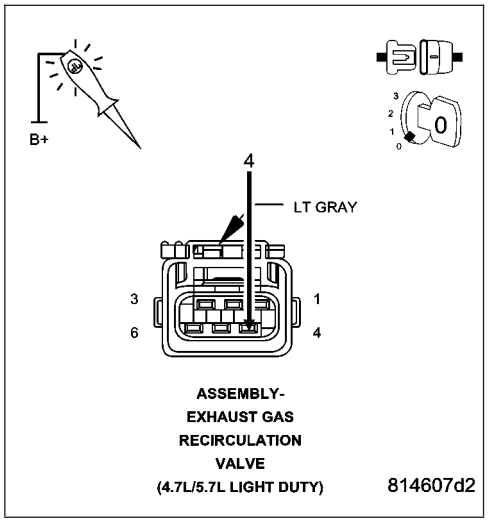
Turn the ignition off.

Using a 12-volt test light connected to battery voltage, probe the (Z335) EGR Solenoid ground circuit in the EGR Solenoid harness connector.

Does the 12-volt test light illuminate brightly?

Yes >> Go To 8

No >> Repair the open in the (Z335) EGR Solenoid ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

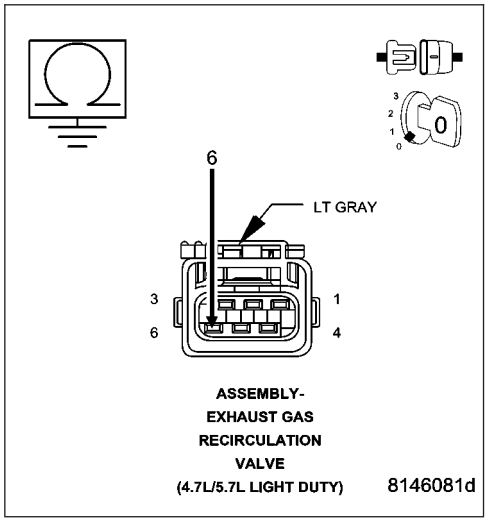
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K35) EGR Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

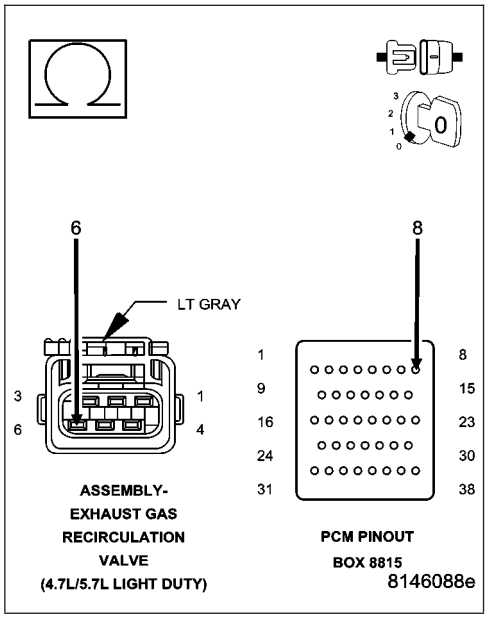


P0401-EGR SYSTEM PERFORMANCE (CONTINUED)

9. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K35) EGR Solenoid Control circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the (K35) EGR Solenoid Control circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

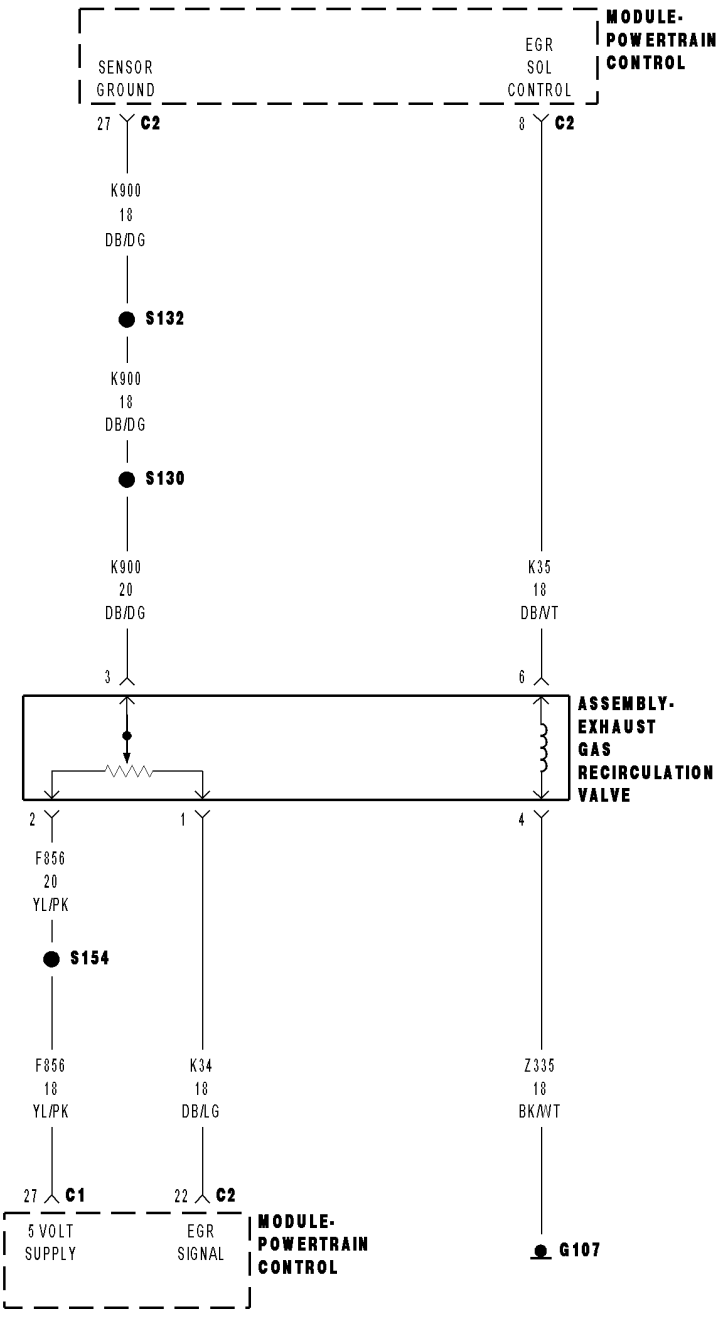
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

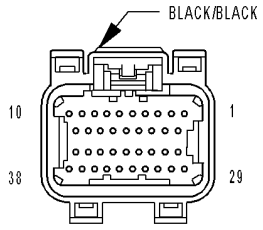
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

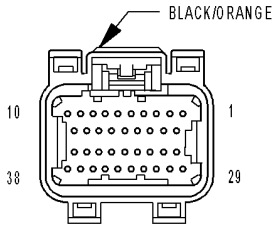
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0403-EGR SOLENOID CIRCUIT

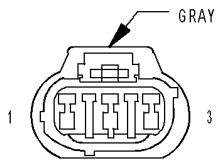




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

814539c3

P0403-EGR SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  The EGR solenoid control circuit is not in the expected state when requested to operate by the PCM. One Trip Fault.

Possible Causes
(Z335) EGR SOLENOID GROUND CIRCUIT OPEN
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

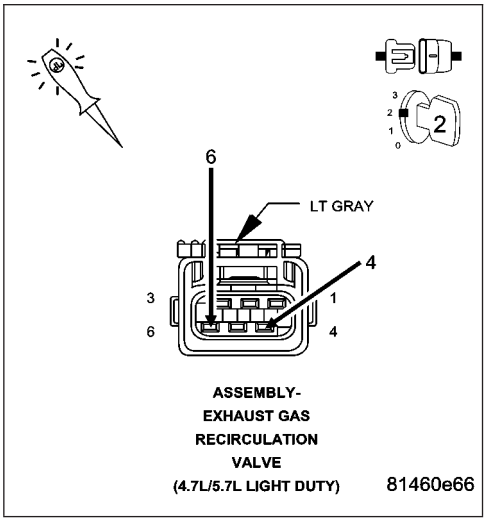
2. EGR SOLENOID ASSEMBLY

Turn the ignition off.
Disconnect the EGR Solenoid harness connector.
Ignition on, engine not running.
Turn off all accessories.
Using a 12-volt test light connected to the (Z335) EGR Solenoid ground circuit, probe the (K34) EGR Solenoid Control circuit.
With a scan tool, actuate the EGR solenoid.

Does the 12-volt test light flash on and off?

Yes >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0403-EGR SOLENOID CIRCUIT (CONTINUED)

3. (Z335) EGR SOLENOID GROUND CIRCUIT OPEN

Turn the ignition off.

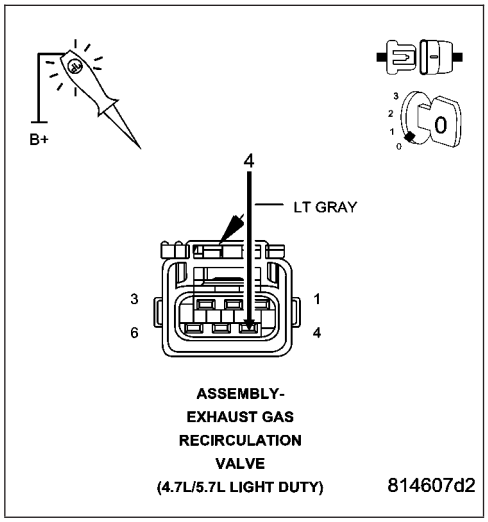
Using a 12-volt test light connected to the 12-volts, probe the (Z335) EGR Solenoid ground circuit in the EGR Solenoid harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open in the (Z335) EGR Solenoid ground circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Ignition on, engine not running.

Disconnect the C2 PCM harness connector.

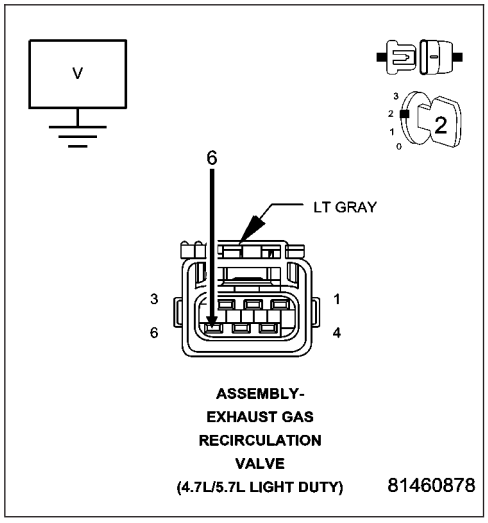
Measure the voltage on the (K35) EGR Solenoid Control circuit in the EGR Solenoid connector.

Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K35) EGR Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0403-EGR SOLENOID CIRCUIT (CONTINUED)

5. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

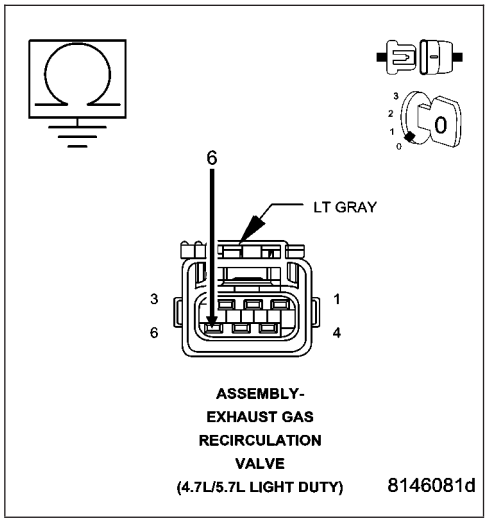
Measure the resistance between ground and the (K35) EGR Solenoid Control circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K35) EGR Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (K35) EGR SOLENOID CONTROL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

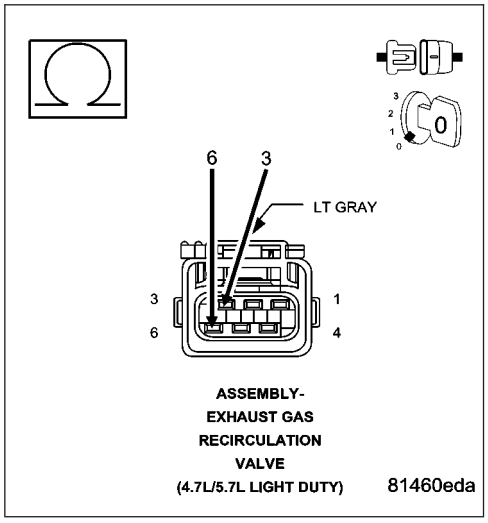
Measure the resistance between the (K35) EGR Solenoid Control circuit and the (K900) Sensor ground circuit in the EGR Solenoid connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K35) EGR Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

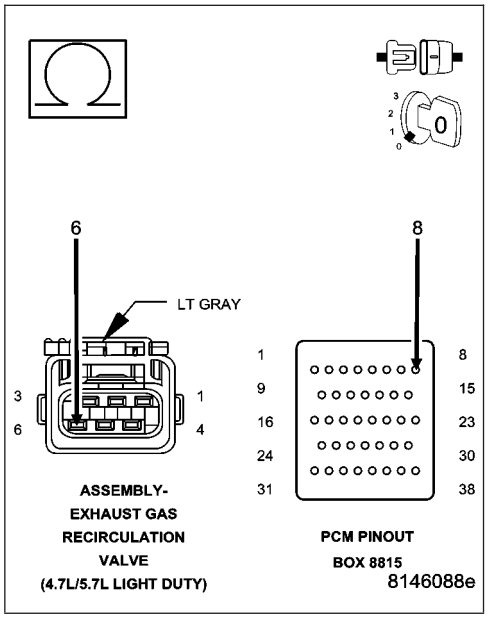
No >> Go To 7



P0403-EGR SOLENOID CIRCUIT (CONTINUED)

7. (K35) EGR SOLENOID CONTROL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K35) EGR Solenoid Control circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K35) EGR Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

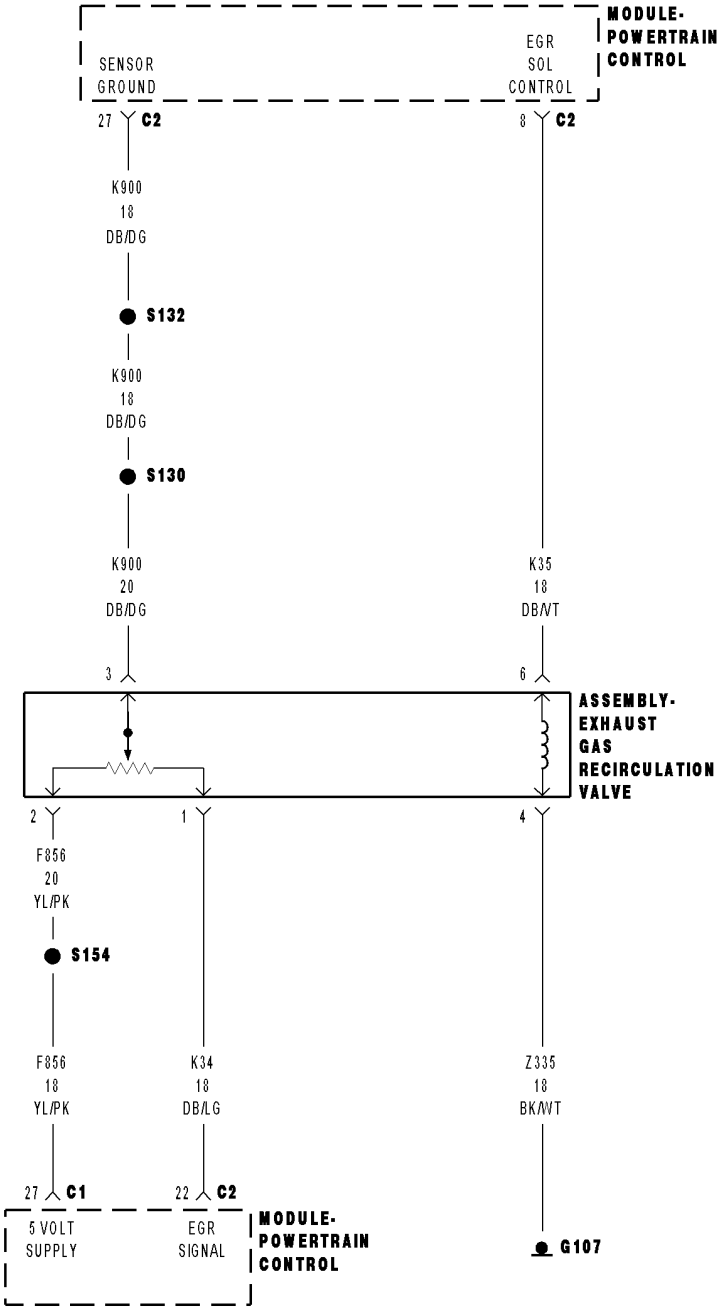
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

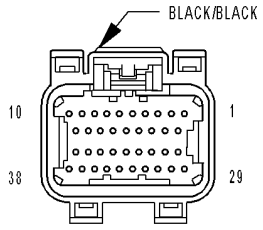
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

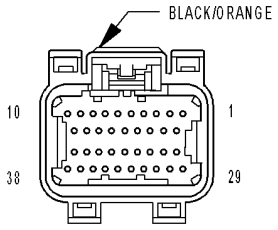
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0404-EGR POSITION SENSOR PERFORMANCE

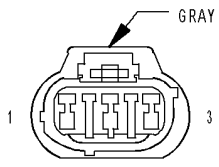




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

814539c3

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The EGR valve has a position sensor and the EGR position rationality is designed to make sure that the valve moves freely within its operating range. Closed valve position reference check verifies that the valve is within its allowable upper and lower limits. The EGR position rationality test looks for a sustained error relative to commanded valve position.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The EGR flow or valve movement is not what is expected.

Possible Causes
EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(K35) EGR SOLENOID CONTROL CIRCUIT
(K34) EGR SENSOR SIGNAL CIRCUIT OPEN
(K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K900) SENSOR GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EGR POSITION VOLTAGE

NOTE: Diagnose all other EGR DTC(s) before continuing.
Start the engine.
With a scan tool, read the EGR Position Sensor voltage.

Choose a conclusion that best matches the EGR voltage reading.

Below 3.5 volts
Go To 3

Between 3.5 volts to 4.3 volts
Go To 5

Above 4.3 volts
Go To 6

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

3. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

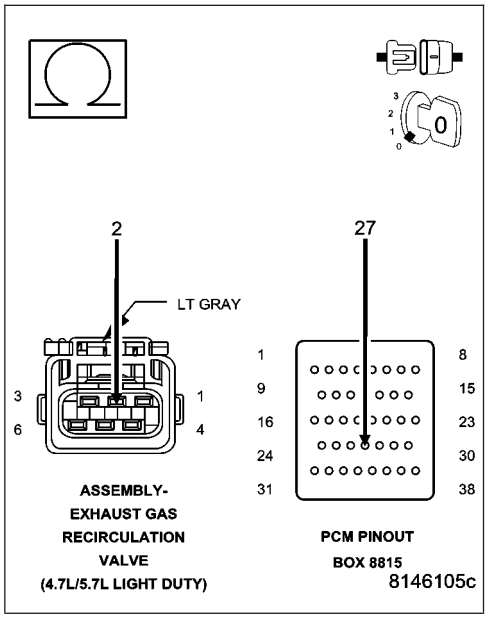
Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Disconnect the C1 and C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

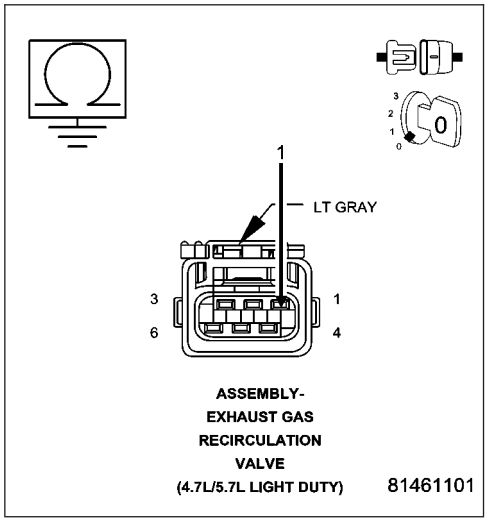
Yes >> Go To 4

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K34) EGR Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the EGR Assembly.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

5. (K35) EGR SOLENOID CONTROL CIRCUIT

Ignition on, engine not running.
With the scan tool, actuate the EGR Solenoid.
Allow the EGR Solenoid to actuate for at least 15 seconds.
Feel the EGR Solenoid for operation.
Stop actuation.

Does EGR Solenoid operate while actuating and then turn off when actuation test is stopped?

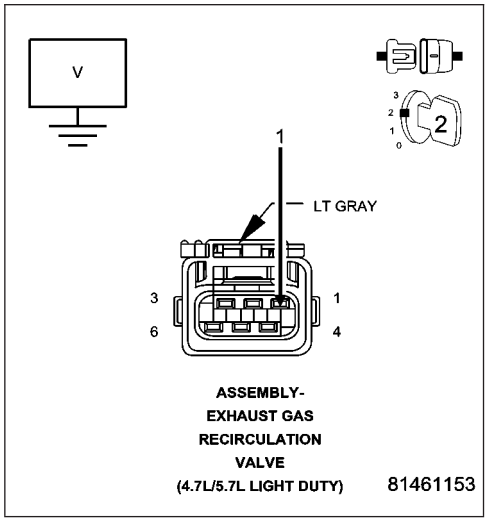
a. Yes
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the P0403-EGR Control Circuit diagnostic procedure and continue.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. (K34) EGR SENSOR SIGNAL CIRCUIT

Turn the ignition off.
Disconnect the EGR Solenoid harness connector.
Ignition on, engine not running.
Measure the voltage of the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the voltage above 4.30 volts?

Yes >> Go To 7

No >> Go To 8

P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

7. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

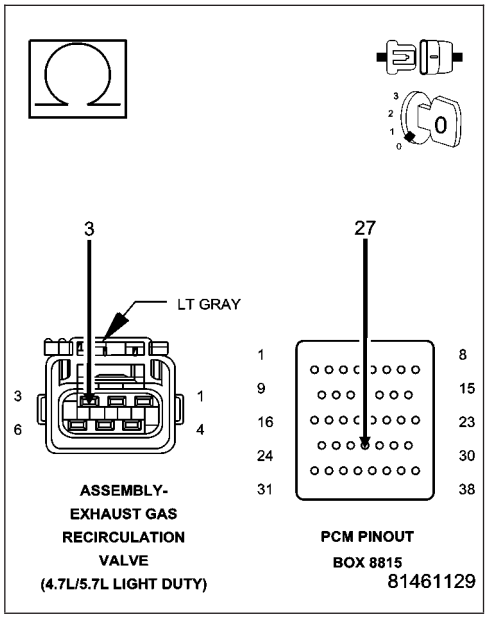
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Replace the EGR Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K34) EGR SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

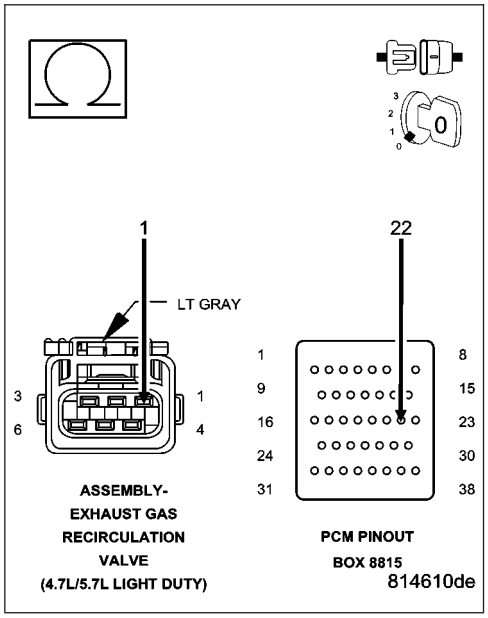
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K34) EGR Sensor Signal circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

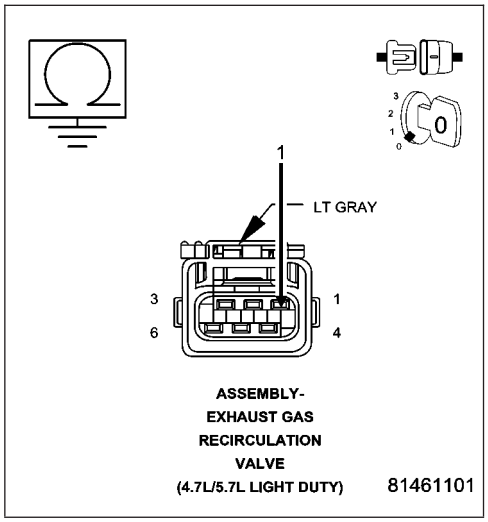
No >> Repair the open in the (K34) EGR Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0404-EGR POSITION SENSOR PERFORMANCE (CONTINUED)

9. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K34) EGR Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

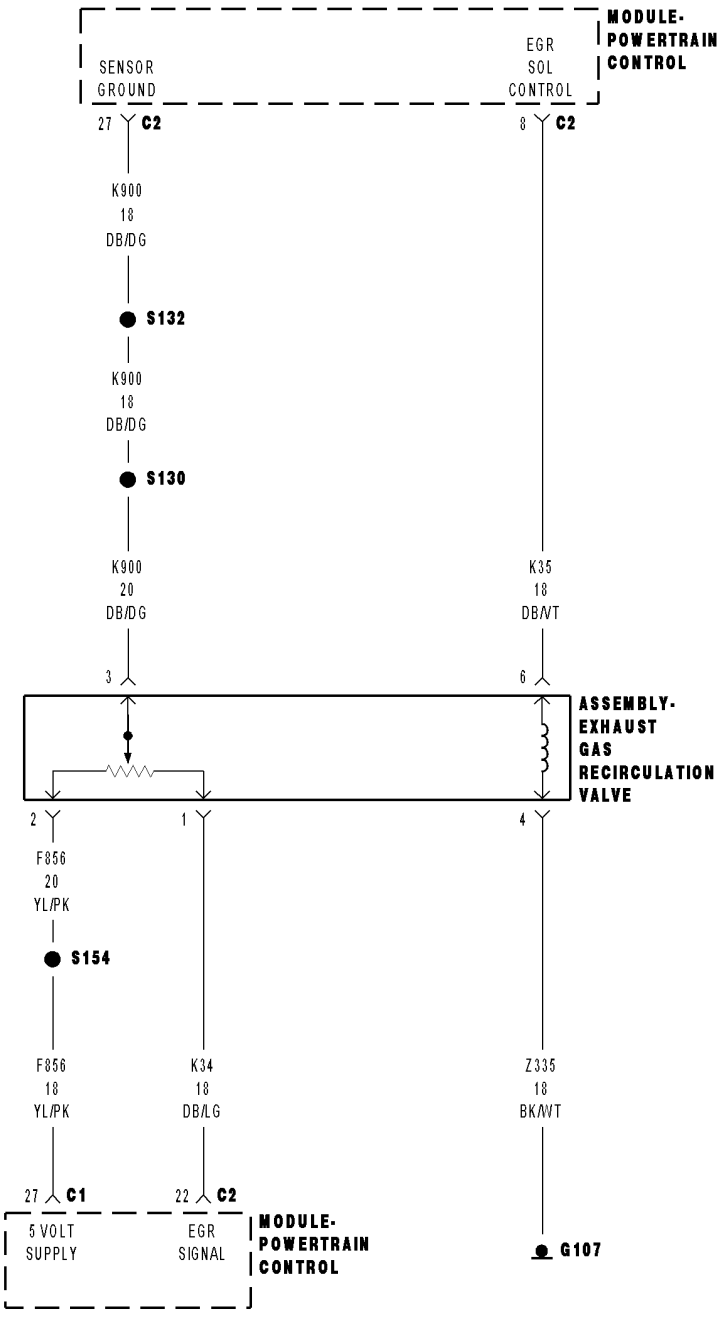
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

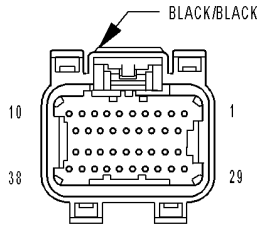
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

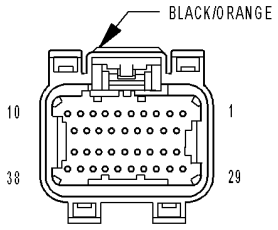
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0405-EGR POSITION SENSOR CIRCUIT LOW

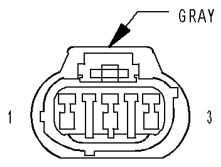




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

814539c3

P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage above 10.0 volts.
- **Set Condition:**
  EGR Position Sensor Signal is less than 0.1 of a volt. One trip Fault.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
EGR POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. EGR POSITION SENSOR BELOW 0.2 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the EGR Position Sensor voltage.

Is the voltage below 0.2 of a volt?

Yes >> Go To 2

No >> Go To 9

---

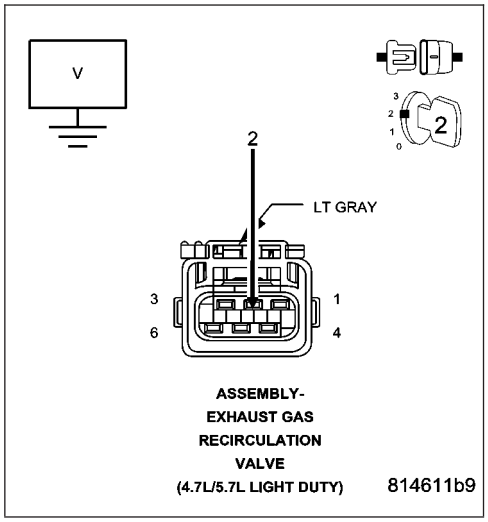
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

Ignition on, engine not running.

Measure the voltage of the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

3. EGR POSITION

With the scan tool, monitor the EGR Position Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

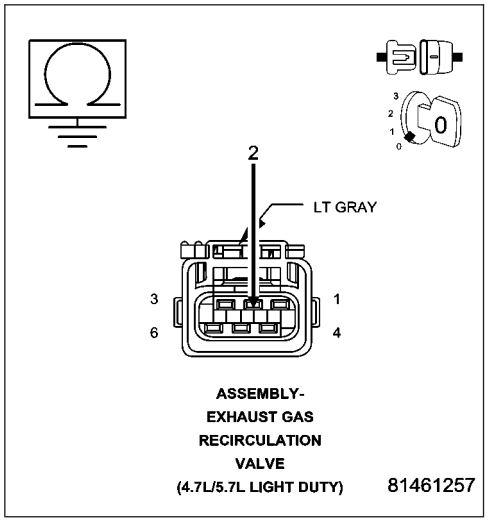
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K34) EGR Position Sensor Signal circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground circuit in the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



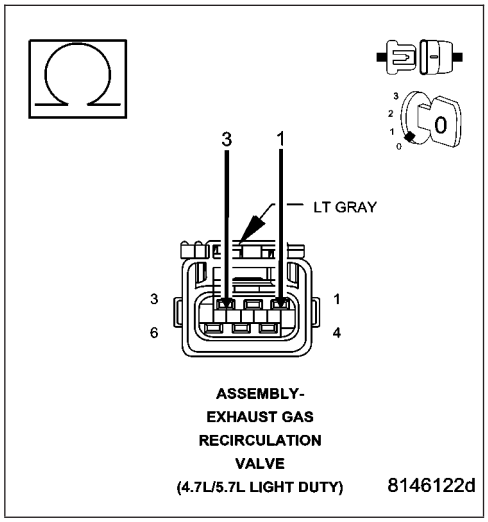
5. (K34) EGR SENSOR SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and (K900) Sensor ground circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

6. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

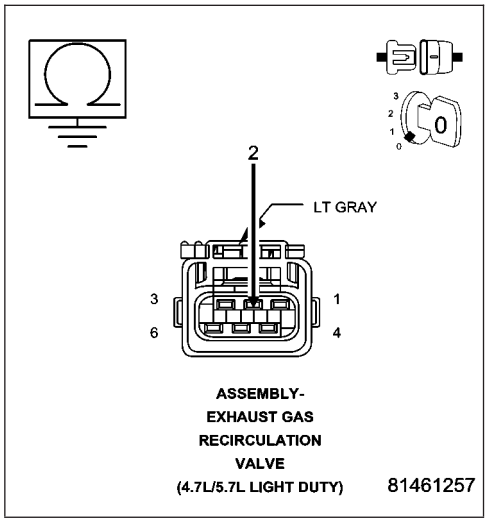
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



7. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

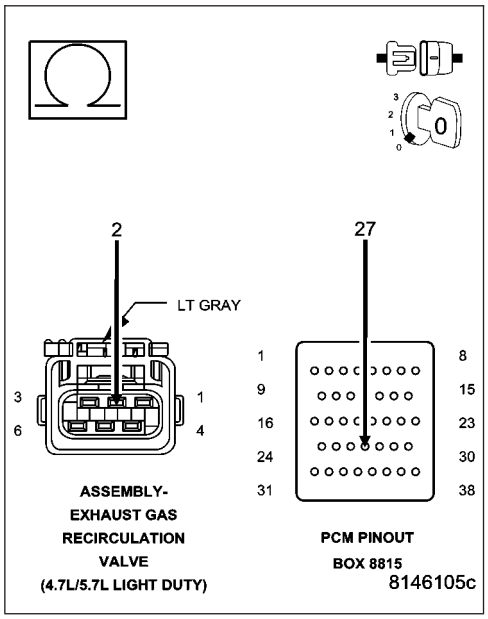
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0405-EGR POSITION SENSOR CIRCUIT LOW (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. EGR POSITION SENSOR SWEEP

NOTE: The engine will run rough and possibly stall in the following test. Feather the accelerator pedal to keep the engine from stalling.

Start the engine.

With the scan tool, enter System Test and then EGR System Test. Push the 4=VARIABLE function.

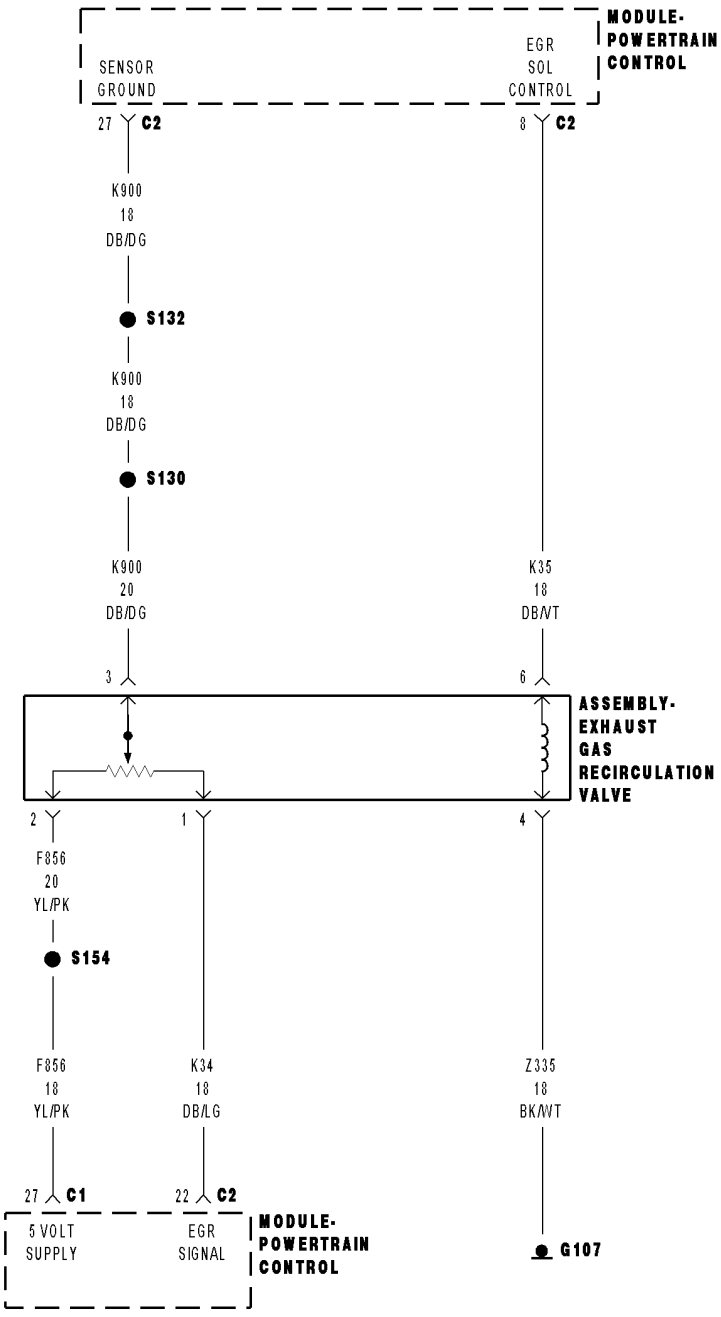
Monitor the EGR voltage while slowly pushing the up arrow.

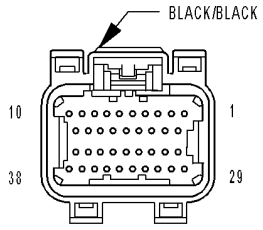
Is the voltage change smooth?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

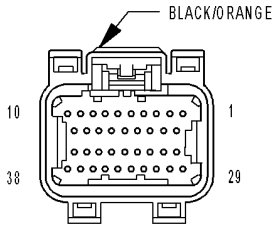
No >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0406-EGR POSITION SENSOR CIRCUIT HIGH

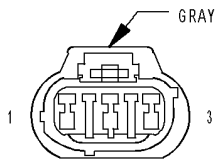




MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)

814539c3

P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  EGR position sensor signal is greater than 4.89. One trip Fault.

Possible Causes
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
EGR SOLENOID ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. EGR POSITION SENSOR VOLTAGE ABOVE 4.5 VOLTS

Start the engine.

With the scan tool, read the EGR Position Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Go To 2

No >> Go To 8

---

2. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the EGR Solenoid harness connector.

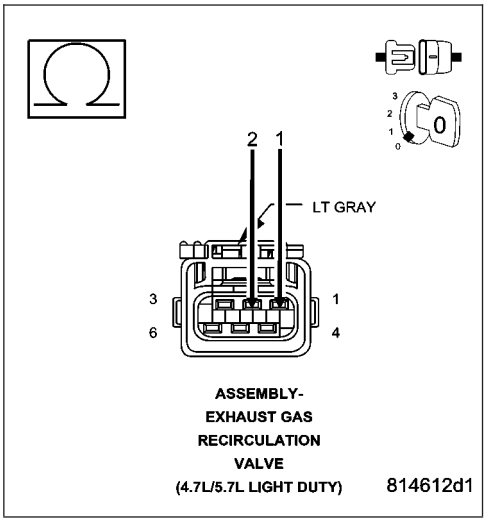
Disconnect the C1 and C2 PCM harness connectors.

Measure the resistance between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit in the EGR Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K34) EGR Position Sensor Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

3. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

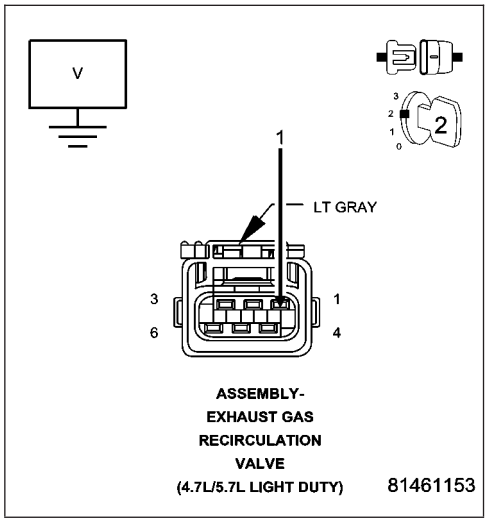
Ignition on, engine not running.

Measure the voltage on the (K34) EGR Sensor Signal circuit in the EGR Solenoid harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. EGR SOLENOID ASSEMBLY

Turn the ignition off.

Connect the PCM harness connectors.

Connect a jumper wire between the (K34) EGR Position Sensor Signal circuit and the (K900) Sensor ground circuit.

With the scan tool, monitor the EGR Position Sensor voltage.

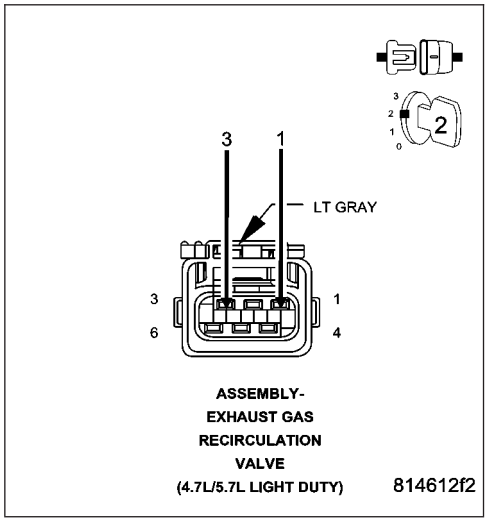
Ignition on, engine not running.

Is the voltage below 0.5 of a volt?

Yes >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.



P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

5. (K34) EGR POSITION SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

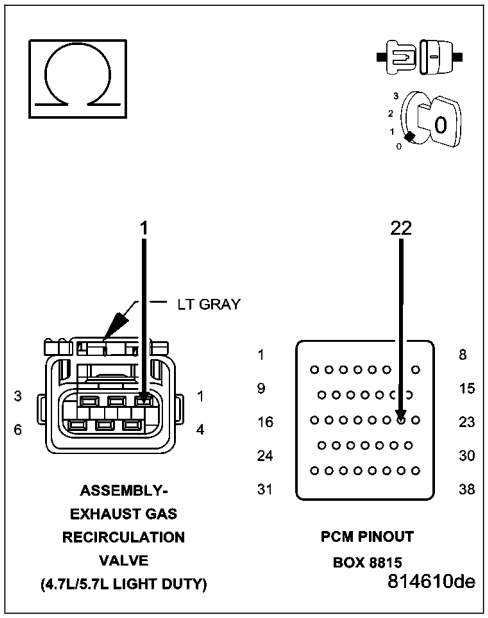
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K34) EGR Position Sensor Signal circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K34) EGR Position Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



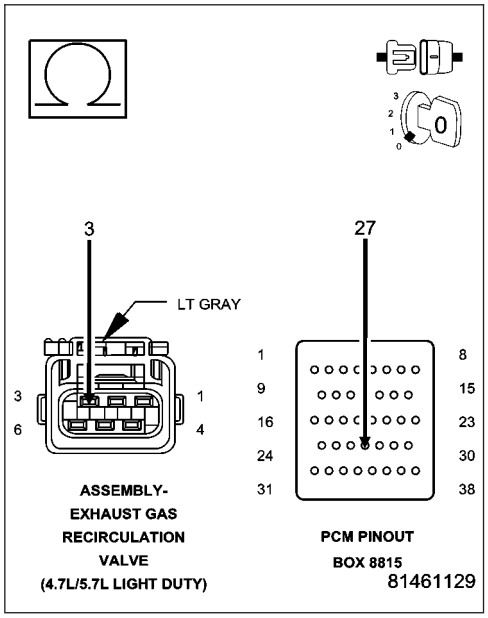
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the EGR Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 30 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0406-EGR POSITION SENSOR CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. EGR POSITION SENSOR SWEEP

NOTE: The engine will run rough and possibly stall in the following test. Feather the accelerator pedal to keep the engine from stalling.

Start the engine.

With the scan tool, enter System Test and then EGR System Test. Push the 4=VARIABLE function.

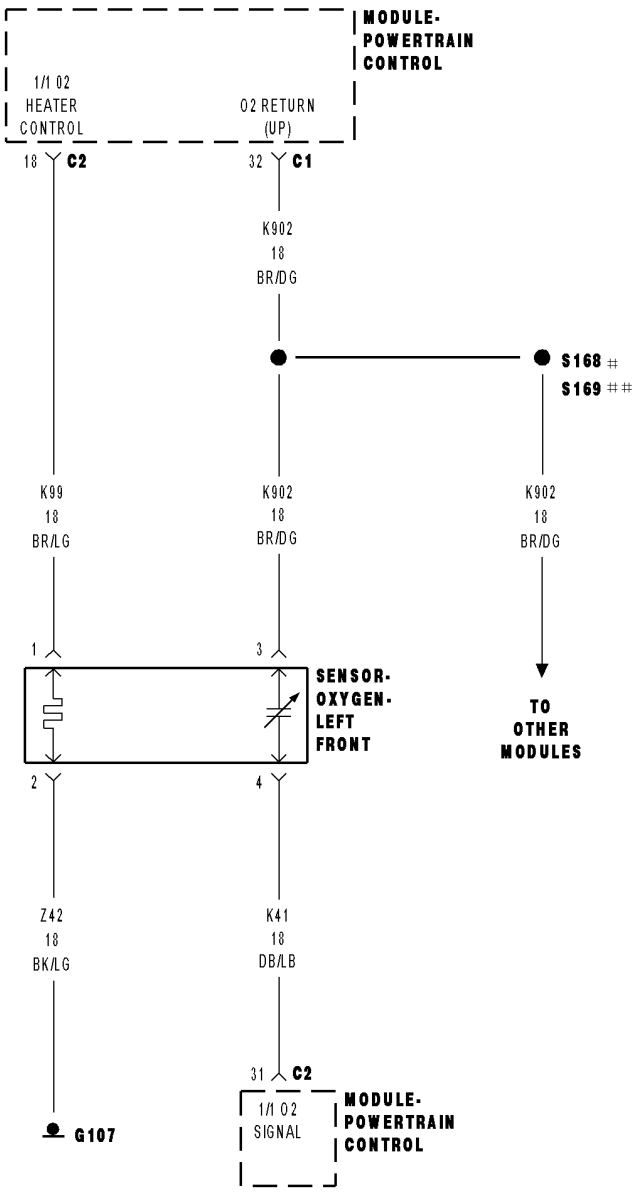
Monitor the EGR voltage while slowly pushing the up arrow.

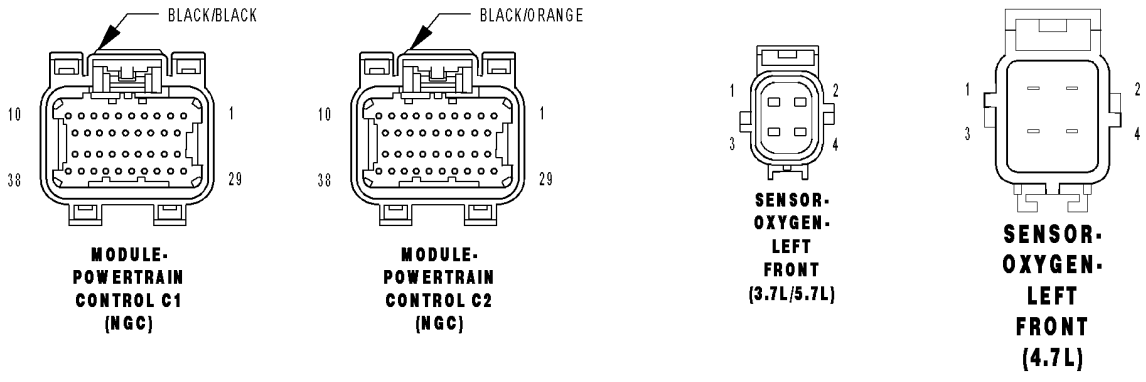
Is the voltage change smooth?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the EGR Solenoid Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-CATALYST 1/1 EFFICIENCY





P0420-CATALYST 1/1 EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 70°C (158°F), 180 seconds of open throttle operation, at a speed greater than 18 mph and less than 55 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-CATALYST 1/1 EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 1/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 1/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the Front O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

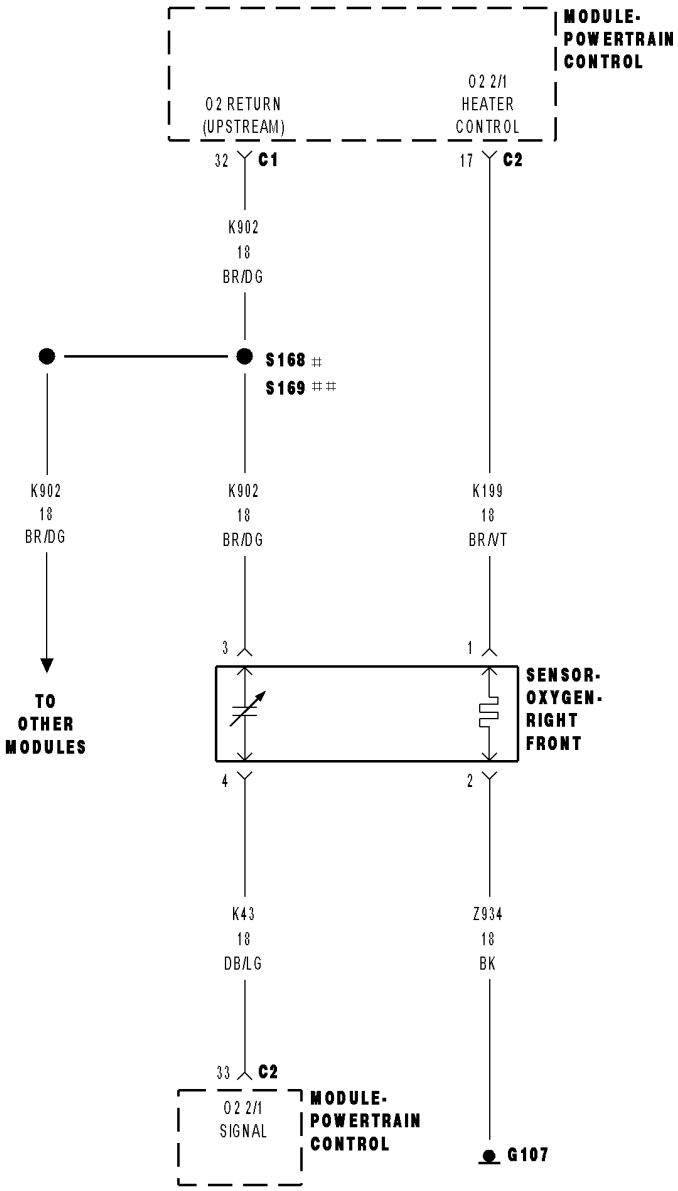
6. CATALYTIC CONVERTER

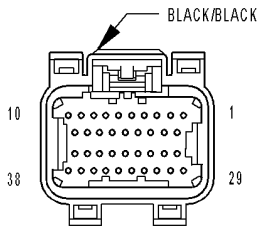
If there are no possible cause remaining, view repair.

Repair

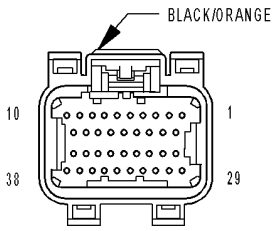
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0430-CATALYST 2/1 EFFICIENCY

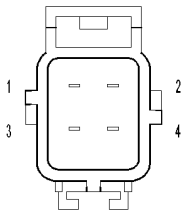




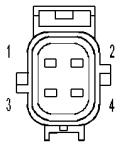
MODULE-
POWERTRAIN
CONTROL C1
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
OXYGEN-
RIGHT
FRONT
(4.7L)



SENSOR-
OXYGEN-
RIGHT
FRONT
(3.7L/5.7L)

81452b7e

P0430-CATALYST 2/1 EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 147 deg. F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0430-CATALYST 2/1 EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 2/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 2/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the 2/1 O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

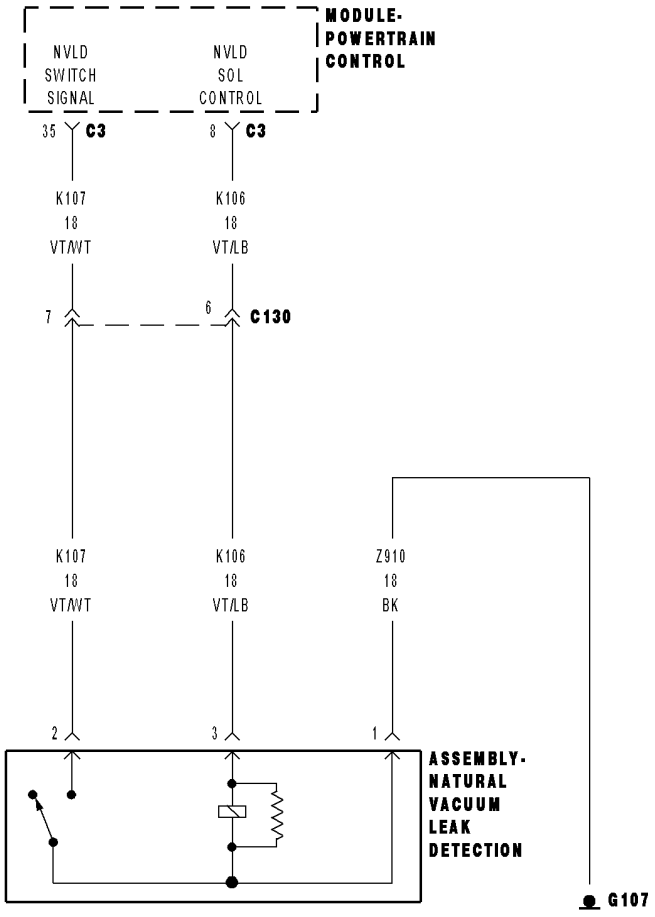
6. CATALYTIC CONVERTER

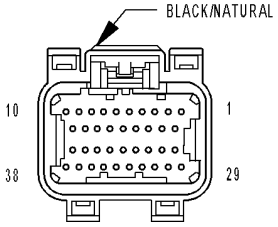
If there are no possible cause remaining, view repair.

Repair

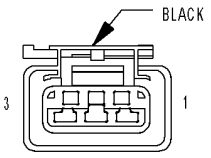
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0440-GENERAL EVAP SYSTEM FAILURE





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F).
- **Set Condition:**
  The PCM does not see the NVLD switch close during the medium/large leak test. The PCM then will increase the vacuum supply to the EVAP system by increasing flow through the EVAP Purge valve. If the switch does not close with an increase in vacuum an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
(Z910) GROUND CIRCUIT OPEN
(K107) NVLD SWITCH SIGNAL CIRCUIT OPEN
EVAPORATIVE EMISSION LEAK DETECTION
NVLD ASSEMBLY
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

2. ACTIVE DTC

NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498, or P0499) diagnose them first before continuing with P0440.

NOTE: A loose gas cap could have caused this DTC to set. Make sure the gas cap is tight and in good condition.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. VISUAL AND PHYSICAL INSPECTION

Turn the ignition off.

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the following conditions:

- Hoses disconnected or left off
- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap left off or bad gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. EVAP VACUUM SUPPLY HOSE INSPECTION

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Make sure the vacuum port at the throttle body or intake manifold is free from any blockage.

Were any problems found?

Yes >> Repair the vacuum supply, hose/tube as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

5. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

NOTE: To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases, Keep the test area well ventilated.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Connect the SMOKE supply tip (black hose) to the “CAN” port on the Evap Purge Solenoid.

Set the smoke/air control switch to SMOKE.

While still holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

Is smoke visible from the EVAP Purge Solenoid?

Yes >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

NOTE: This is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Disconnect the Smoke supply tip from the vacuum supply hoses at the EVAP Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ side of the EVAP Purge Solenoid.

Observe the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Go To 7

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. NVLD SWITCH OPERATION

CAUTION: Do not attempt to probe the NVLD Terminals to diagnose the switch function. This may damage the switch and disable the NVLD component. Follow procedures outlined in the service manual for NVLD switch testing using a scan tool.

Connect the previously disconnected vacuum hose.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete This may take up to 10 minutes.

Did the NVLD Switch operate as described above?

Yes >> Test complete.

No >> Go To 8

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

8. VERIFY NVLD SWITCH OPERATION

Start the engine.
Allow the engine to idle.
Using the scan tool, perform the NVLD FORCED MONITOR TEST for a second time.
While the NVLD FORCED MONITOR TEST is running, open/remove the gas cap.
Monitor the NVLD Switch state.

Did the NVLD Switch go from OPEN to CLOSED?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. VERIFY EVAPORATIVE EMISSION LEAK

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.
Turn the ignition off.
To continue testing you will need Miller Tool #8404 Evaporative Emission Leak Detector (EELD).

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.
Connect the red power lead of EELD to the battery positive terminal and the black ground lead to battery negative terminal.
Block the vent hose of the EVAP Canister.
Connect shop air to the EELD.
Set the smoke/air control switch to AIR.
Insert the tester's AIR supply tip (clear hose) into the .040 orifice on the tester's control panel.
Press the remote smoke/air start button.
Position the red flag on the air flow meter so it is aligned with the indicator ball.
When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute.
Install the service port adapter #8404-14 on the vehicle's service port (if equipped) or install the #8404-ADP into the filter line.
Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.
Press the remote button to activate AIR flow.
Compare the flow meter indicator ball reading to the red flag.
ABOVE the red flag indicates a leak present.
BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 10

No >> Go To 11

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

10. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

Remove the Air supply hose from the service port or the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move at this point.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

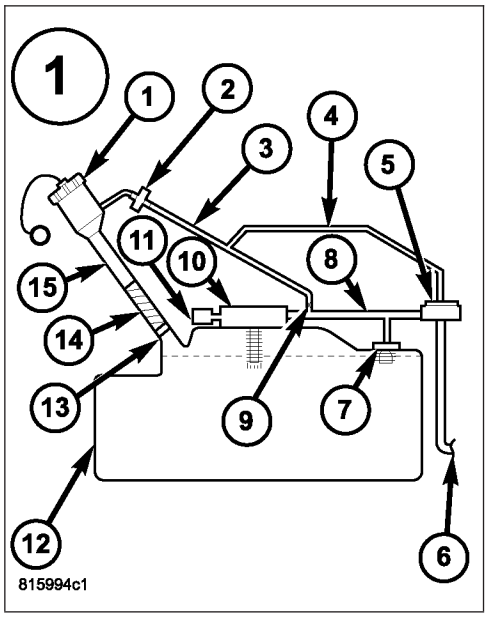
If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that are left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

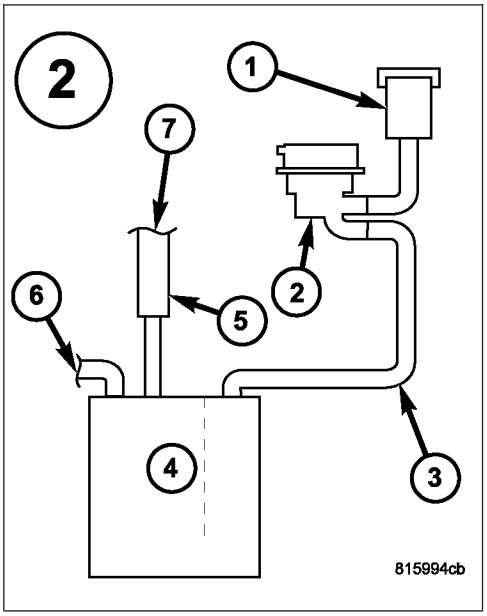
1 Fuel Cap
2 Recirculation Check Valve.
3 Vapor Recirculation Line.
4 Signal Vapor Line for FVM.
5 Flow Management Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Fuel Tank Vent (Check Valve).
8 Vapor Line to Canister.
9 Flow Control Orfice.
10 Control Valve.
11 Liquid Trap.
12 Fuel Tank.
13 Check valve.
14 Fuel Fill Tube to Tank connector.
15 Fuel Fill Tube
Damaged or disconnected EVAP system components.



P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

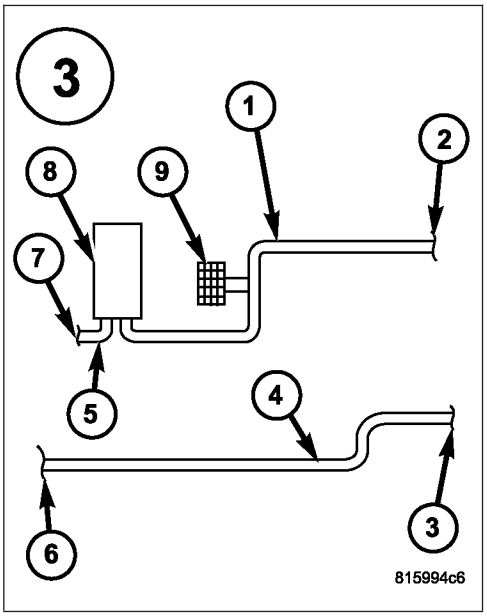
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.



- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.



NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke or dye may or may not be visible. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

11. NVLD ASSEMBLY

Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z910) Ground circuit in the NVLD electrical harness connector.

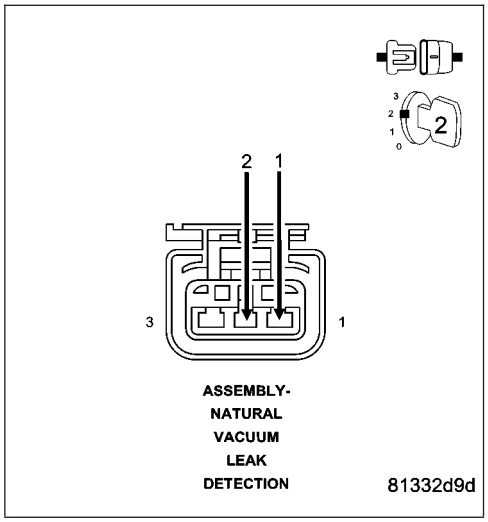
Monitor the NVLD Switch state on the scan tool.

Does the Switch change from OPEN to CLOSED when the jumper wire is installed?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

NOTE: Remove the jumper wire before continuing.



12. (Z910) GROUND CIRCUIT OPEN

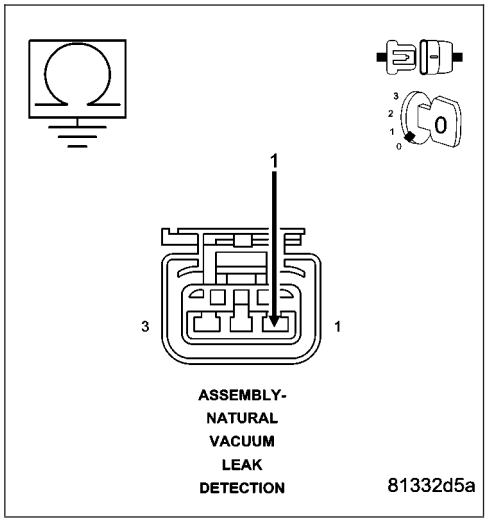
Turn the ignition off.

Measure the resistance between the (Z910) Ground circuit and ground.

Is the resistance below 5.0 ohms?

Yes >> Go To 13

No >> Repair the open in the (Z910) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) .



P0440-GENERAL EVAP SYSTEM FAILURE (CONTINUED)

13. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Disconnect the PCM harness connectors.

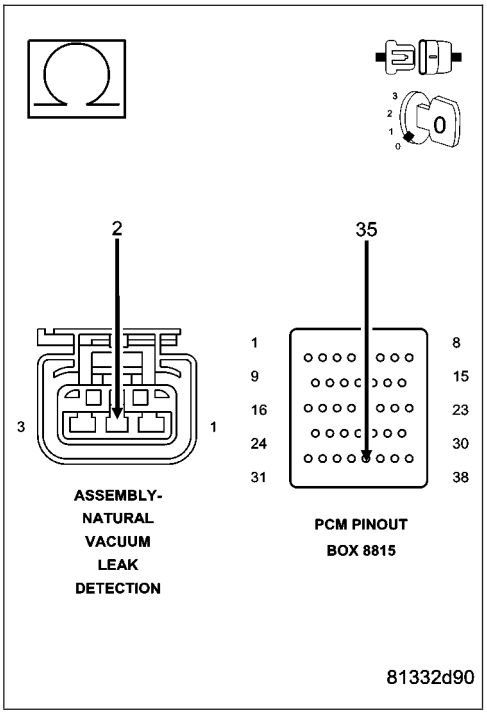
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of the special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 14

No >> Repair the open in the (K107) Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



14. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

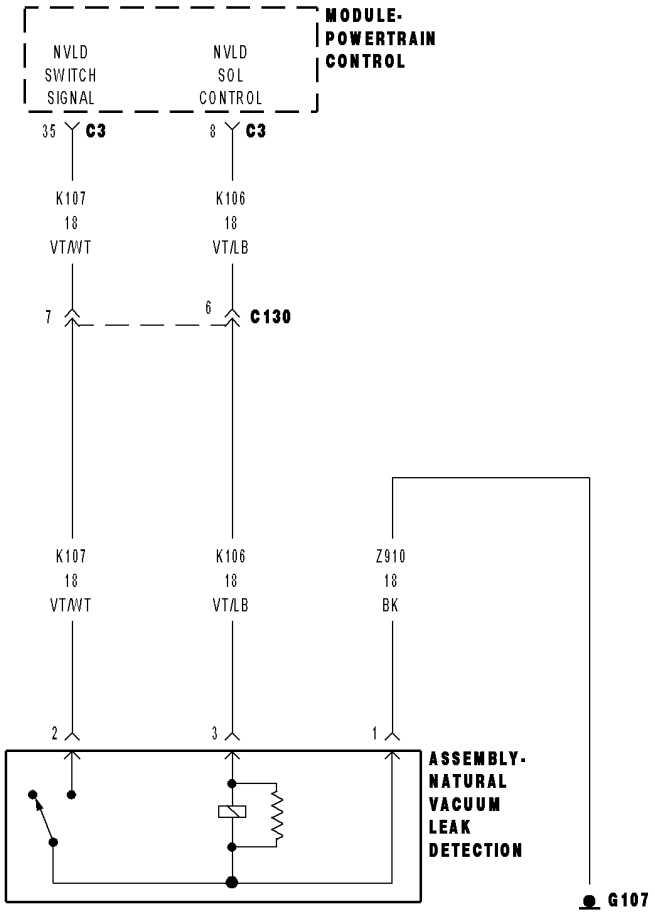
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

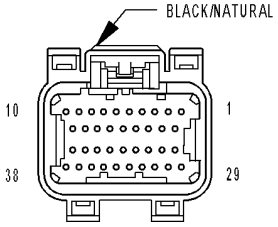
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

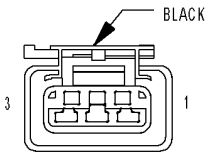
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0441-EVAP PURGE SYSTEM PERFORMANCE





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0441-EVAP PURGE SYSTEM PERFORMANCE (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Cold start test. Engine Running. Small Leak Test Passed.
- **Set Condition:**
  The PCM activates the EVAP Purge solenoid gradually increases to maximum flow. During flow, the PCM looks for the NVLD switch to close. If the PCM does not see the NVLD switch close at maximum flow an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE SOLENOID

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

---

2. ACTIVE DTC

NOTE: If any of the following DTCs are set (P0443, P0452, P0453, P0498, or P0499) diagnose them first before continuing with P0441.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0441-EVAP PURGE SYSTEM PERFORMANCE (CONTINUED)

3. CHECKING EVAP PURGE SOLENOID FUNCTIONALITY

NOTE: After disconnecting the Evap Purge vacuum connections, inspect the lines and solenoid for any signs of contamination or foreign materials.

Using a hand vacuum pump, apply 10 in Hg to ″CAN″ side of the EVAP Purge Solenoid.

Ignition on, engine not running.

Observe the vacuum gauge.

With the scan tool, actuate the EVAP Purge Solenoid.

Does the vacuum drop when the solenoid is actuated?

Yes >> Go To 4

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum pump before continuing.

---

4. EVAP VACUUM SUPPLY HOSE INSPECTION

Turn the ignition off.

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing.

Check for a pinched or plugged hose from the throttle body or intake manifold to the Purge Solenoid.

Inspect the vacuum port at the throttle body or intake manifold for any damage or plugging.

Were any problems found?

Yes >> Repair the vacuum supply hose/tube as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go to 5

---

5. NVLD SWITCH OPERATION

CAUTION: Do not attempt to probe the NVLD Terminals to diagnose the switch function. This may damage the switch and disable the NVLD component. Follow procedures outlined in the service manual for NVLD switch testing using a scan tool.

Connect the previously disconnected vacuum hose.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch state.

NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete This may take up to 10 minutes.

Did the NVLD Switch operate as described above?

Yes >> Test complete.

No >> Go To 6

P0441-EVAP PURGE SYSTEM PERFORMANCE (CONTINUED)

6. VERIFY NVLD SWITCH OPERATION

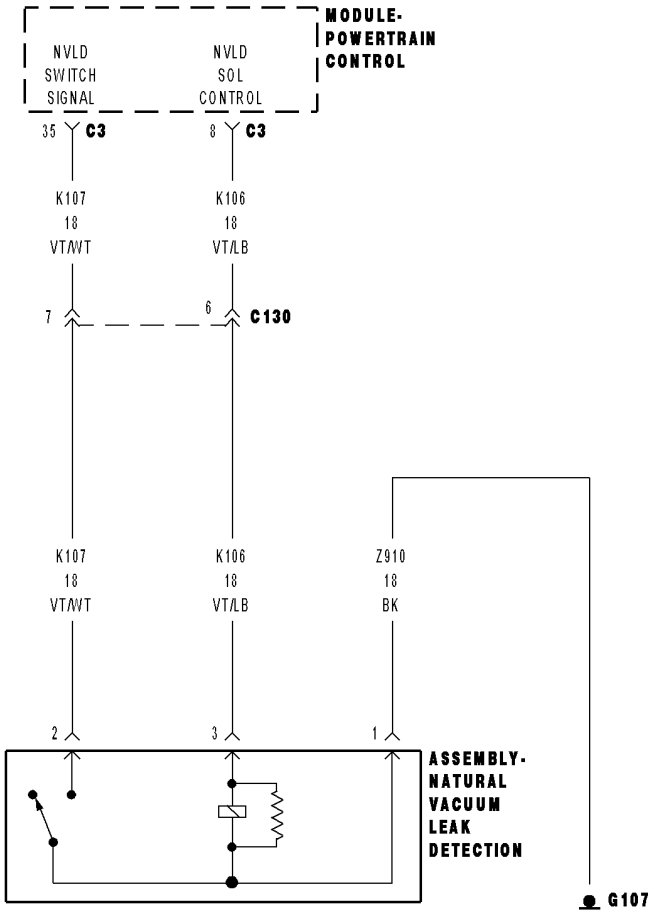
Start the engine.
Allow the engine to idle.
Using the scan tool, perform the NVLD FORCED MONITOR TEST for a second time.
While the NVLD FORCED MONITOR TEST is running, open/remove the gas cap.
Monitor the NVLD Switch state.

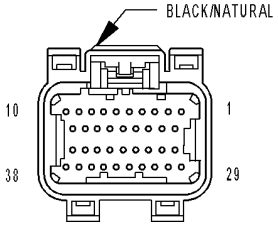
Did the NVLD Switch go from OPEN to CLOSED?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

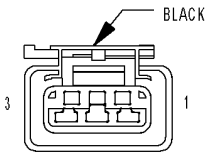
No >> Test complete.

P0442-EVAP PURGE SYSTEM MEDIUM LEAK





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Cold start test. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs when small leak test is maturing.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time for a Medium leak an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
NVLD SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2.

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

2. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3.

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. LOOSE OR MISSING FUEL FILL CAP

Inspect the fuel fill cap.
Inspect the cap for any abnormal defects.

Was the cap off, missing, or broken?

Yes >> Properly install the fuel fill cap and proceed to step.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4.

---

4. NVLD SERVICE TEST

With the scan tool perform the NVLD Service Test.

Does the NVLD Service Test pass?

Yes >> Test complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

5. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 6.

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

6. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

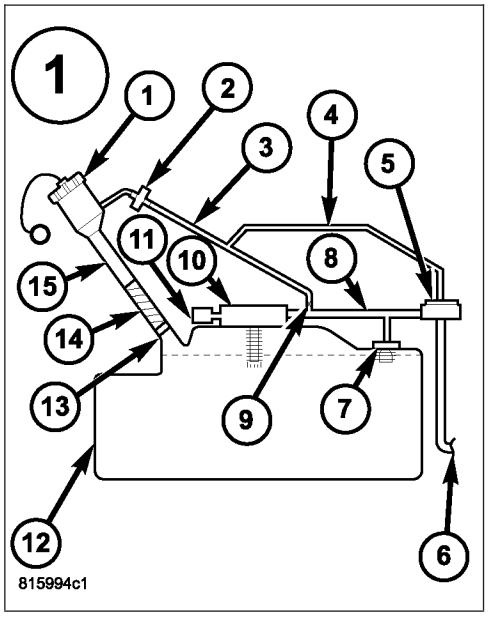
If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

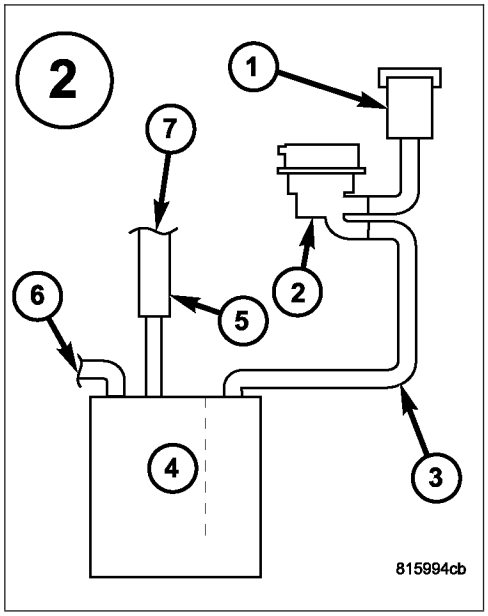
1 Fuel Cap
2 Recirculation Check Valve.
3 Vapor Recirculation Line.
4 Signal Vapor Line for FVM.
5 Flow Management Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Fuel Tank Vent (Check Valve).
8 Vapor Line to Canister.
9 Flow Control Orfice.
10 Control Valve.
11 Liquid Trap.
12 Fuel Tank.
13 Check valve.
14 Fuel Fill Tube to Tank connector.
15 Fuel Fill Tube
Damaged or disconnected EVAP system components.



P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

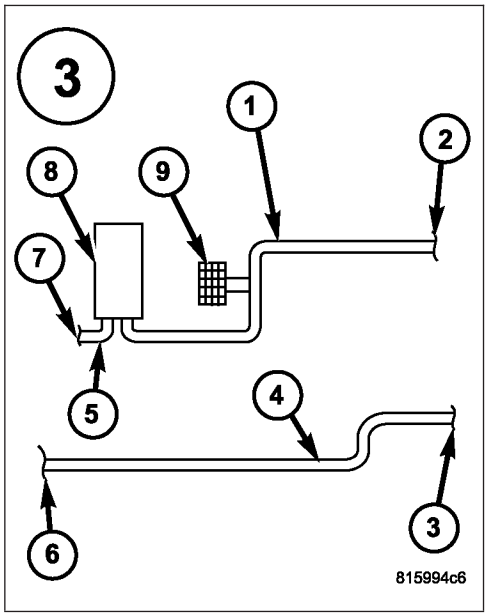
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.



- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.



NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Go To 7.

No >> Go To 8.

7. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.

Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

Was a leak found at the gas cap adapter?

Yes >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP PURGE SYSTEM MEDIUM LEAK (CONTINUED)

8. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?

Yes >> Go To 9.

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. NVLD SWITCH OPERATION

Reconnect all vacuum hoses.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch.

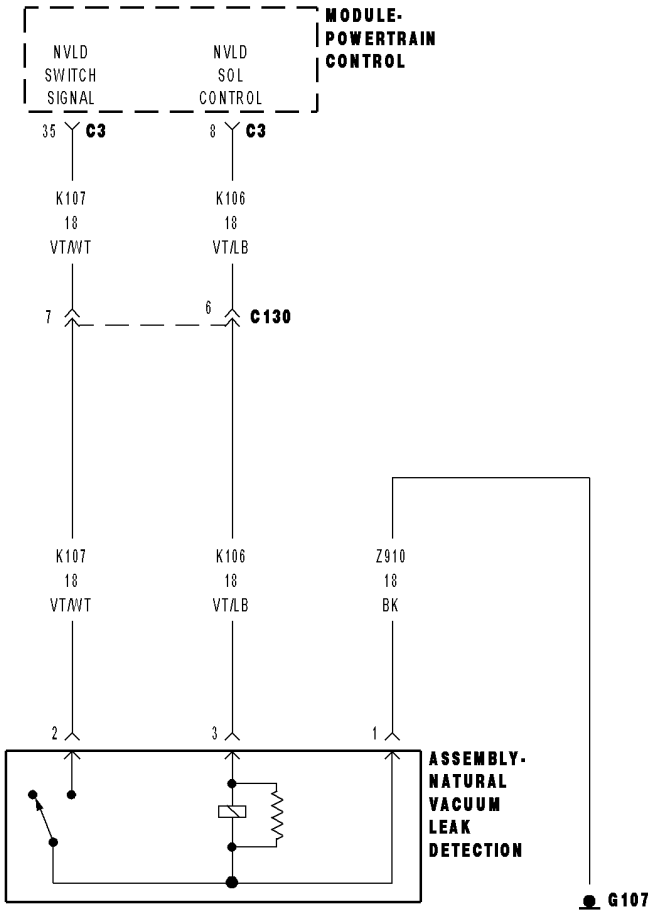
NOTE: As the test runs, the NVLD Switch should go from an OPEN state to CLOSED. After the vacuum is released form the EVAP system the Switch state will return to OPEN.

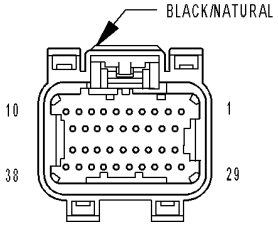
Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

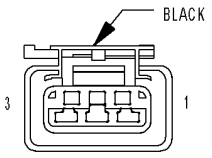
No >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition on or engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  The PCM will set a trouble code if the actual state of the solenoid does not match the intended state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K52) EVAP PURGE CONTROL CIRCUIT OPEN
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN
(K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

---

2. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

3. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.

Disconnect the EVAP Purge Solenoid harness connector.

Ignition on, engine not running.

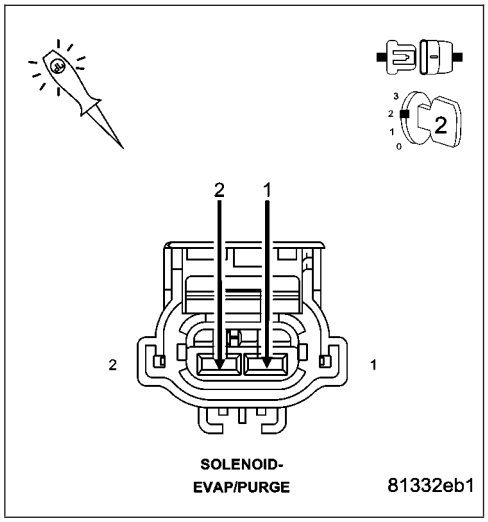
Using a 12-volt test light, jump across the (K52) Evap Purge Solenoid Control circuit and (K70) Evap Purge Solenoid Signal circuit in the EVAP Purge Solenoid harness connector.

With a scan tool, actuate the EVAP Purge Solenoid.

Does the test light flash on and off?

Yes >> Replace the EVAP Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

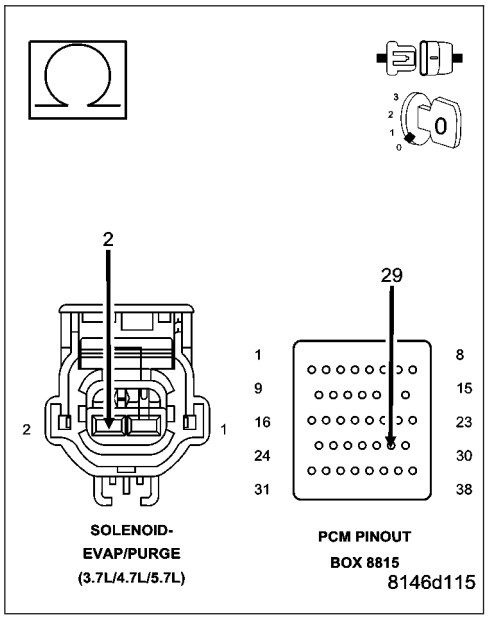
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K52) Evap Purge Solenoid Control circuit from the Evap Purge Solenoid harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

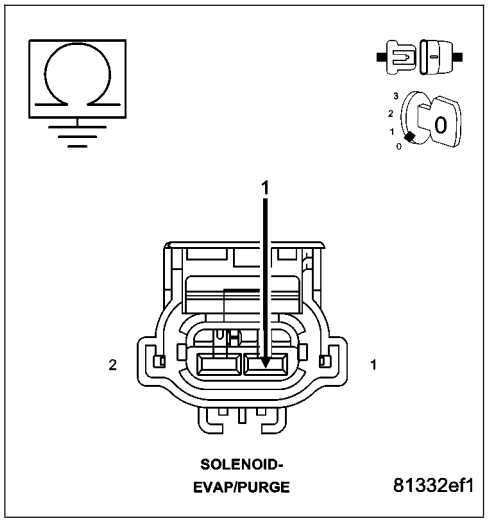
No >> Repair the open in the (K52) EVAP Purge Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

5. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the Evap Purge Solenoid harness connector.



Is the resistance below 100 ohms?

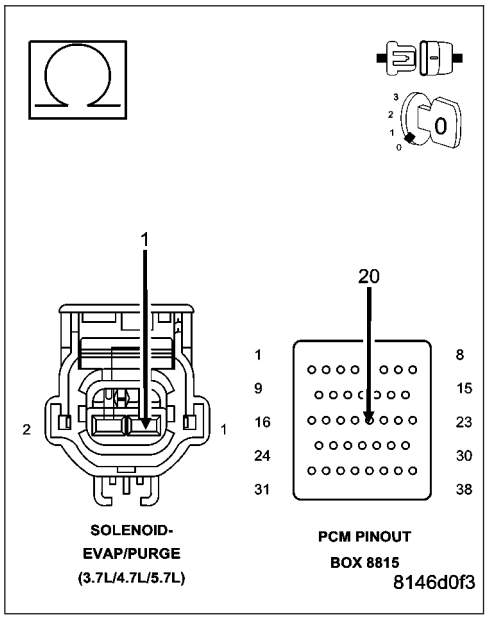
Yes >> Repair the short to ground in the (K52) EVAP Purge Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K70) Evap Purge Solenoid Signal circuit from the EVAP Purge Solenoid harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

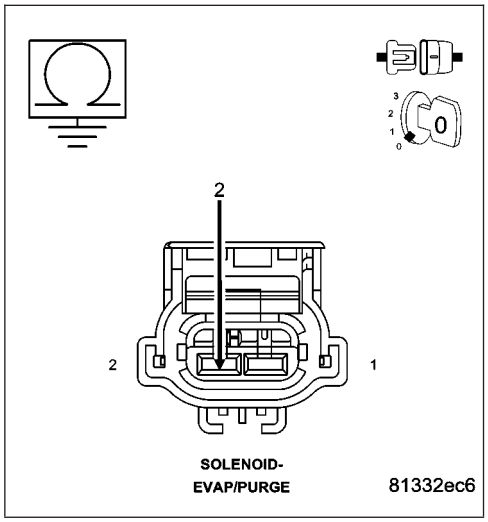
Yes >> Go To 7

No >> Repair the open in the (K70) Evap Purge Solenoid Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

7. (K70) EVAP PURGE SOLENOID SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K70) Evap Purge Solenoid Signal circuit in the Evap Purge Solenoid harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K70) Evap Purge Solenoid Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

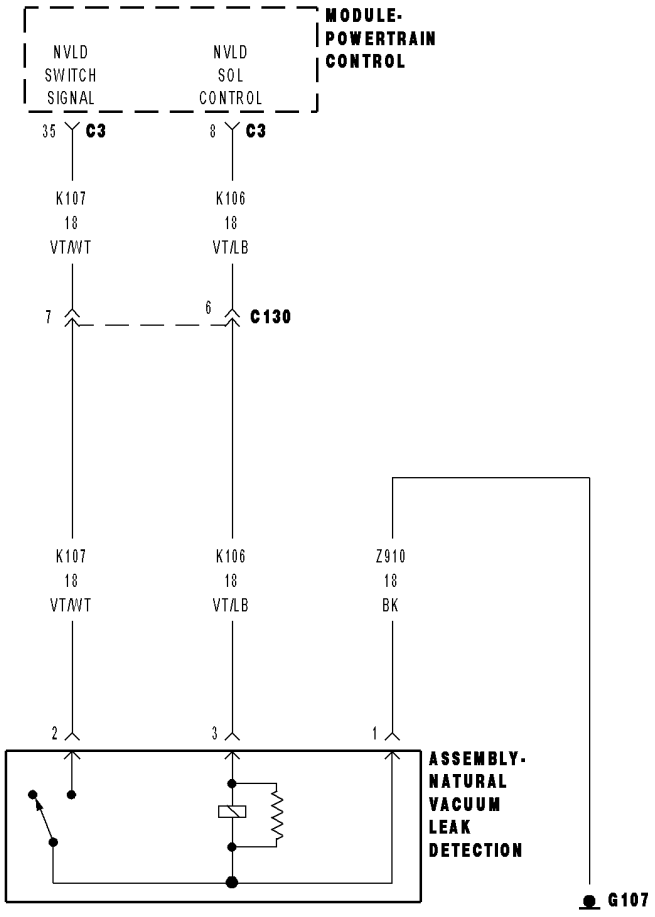
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

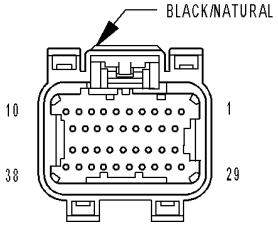
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

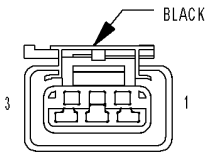
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0452-NVLD PRESSURE SWITCH STUCK CLOSED





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after the engine has been started.
- **Set Condition:**
  The PCM activates the NLVD Solenoid. If PCM does not see NVLD switch open an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
NVLD ASSEMBLY
EVAP PURGE SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

---

2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

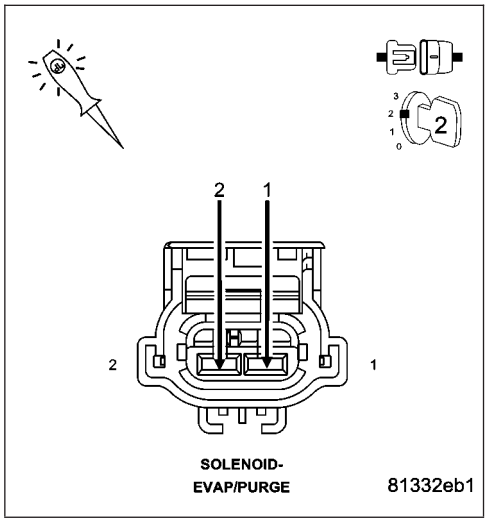
Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

3. EVAP PURGE SOLENOID OPERATION

Turn the ignition off.
Disconnect the EVAP Purge Solenoid harness connector.
Ignition on, engine not running.
Using a 12-volt test light, jump across the Evap Purge Solenoid harness connector.
With the scan tool, actuate the EVAP Purge Solenoid.



Does the test light flash on and off?

Yes >> Go To 4
No >> Go To 8

4. EVAP PURGE SOLENOID LEAKS/STUCK OPEN

Turn the ignition off.
Connect the Evap Purge Solenoid harness connector.
Disconnect the vacuum hoses at the Evap Purge Solenoid.

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.
Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Go To 5
No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. NVLD SWITCH OPERATION

Ignition on, engine not running.
Using the scan tool, monitor the NVLD Switch State with the vacuum pump still installed and holding vacuum.

Does the scan tool display the NVLD state OPEN?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)
No >> Go To 6

NOTE: Remove the vacuum pump and connect the vacuum hose before continuing.

P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

6. NVLD ASSEMBLY

Disconnect the NVLD electrical connector.

Does the Switch change from CLOSED to OPEN?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (K107) SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

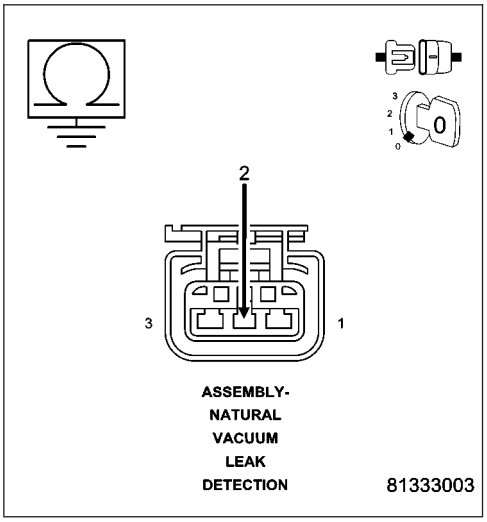
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K107) NVLD Switch Signal circuit in the NVLD Assembly harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K107) NVLD Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



8. (K52) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

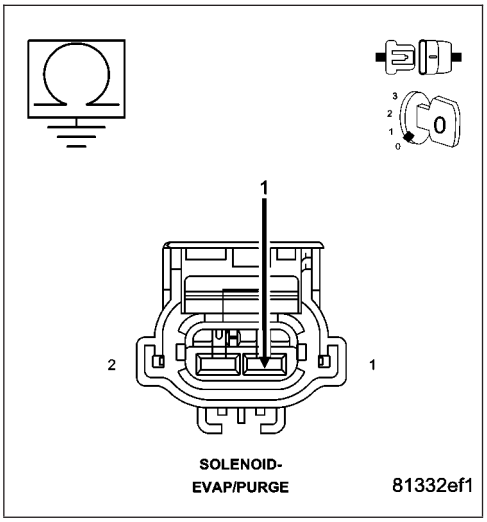
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K52) Evap Purge Solenoid Control circuit in the EVAP Purge Solenoid harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K52) Evap Purge Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



P0452-NVLD PRESSURE SWITCH STUCK CLOSED (CONTINUED)

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

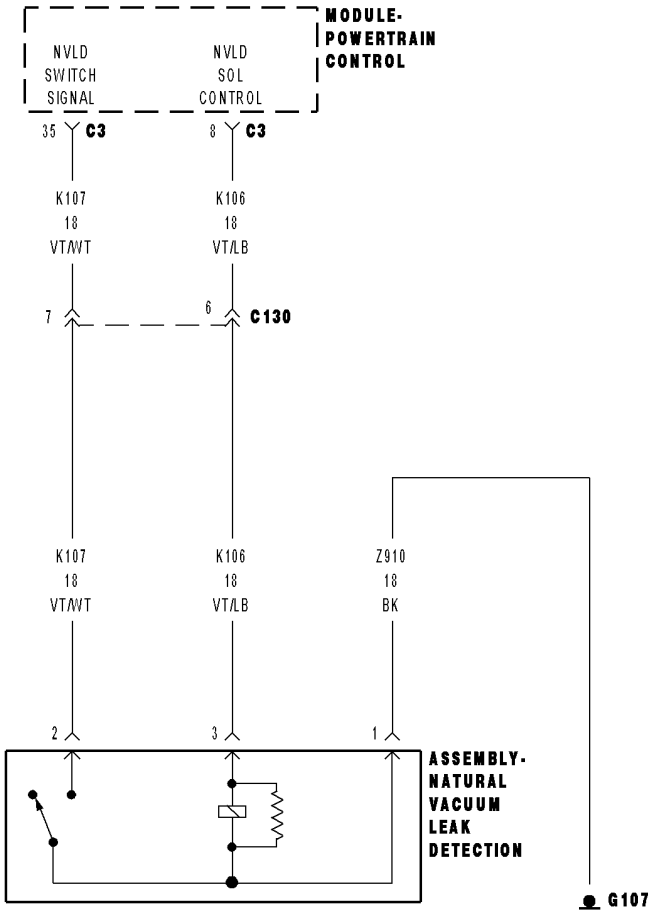
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

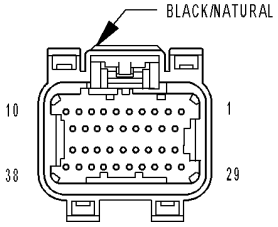
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

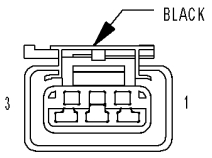
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0453-NVLD PRESSURE SWITCH STUCK OPEN





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  If the PCM does not see the NVLD switch close during test an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K107) NVLD SWITCH SIGNAL CIRCUIT OPEN
(K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT
(Z910) GROUND CIRCUIT OPEN
NVLD ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. NVLD SWITCH OPERATION

Start the engine.
Allow the engine to idle.
Using a scan tool, perform the NVLD FORCED MONITOR TEST.
Monitor the NVLD Switch state.

NOTE: As the test runs, the NVLD Switch should go from an OPEN state to a CLOSED state and then return to OPEN when the test is complete.

Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

2. NVLD ASSEMBLY

Turn the ignition off.

Disconnect the NVLD electrical harness connector.

Ignition on, engine not running.

Monitor the NVLD Switch state on the scan tool.

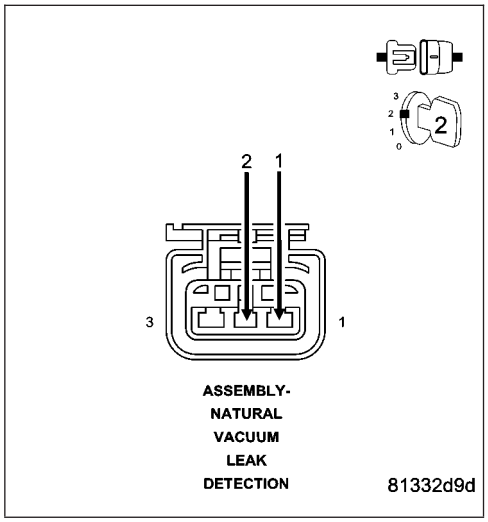
Connect a jumper wire between the (K107) NVLD Switch Signal circuit and the (Z910) Ground circuit in the NVLD harness connector.

Does the Switch change from OPEN to CLOSED with the jumper wire installed?

Yes >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

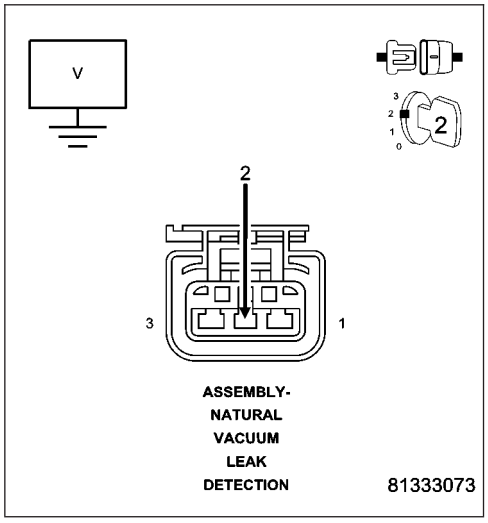
Ignition on, engine not running.

Measure the voltage on the (K107) NVLD Switch Signal circuit in the NVLD electrical harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K107) NVLD Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

4. (K107) NVLD SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

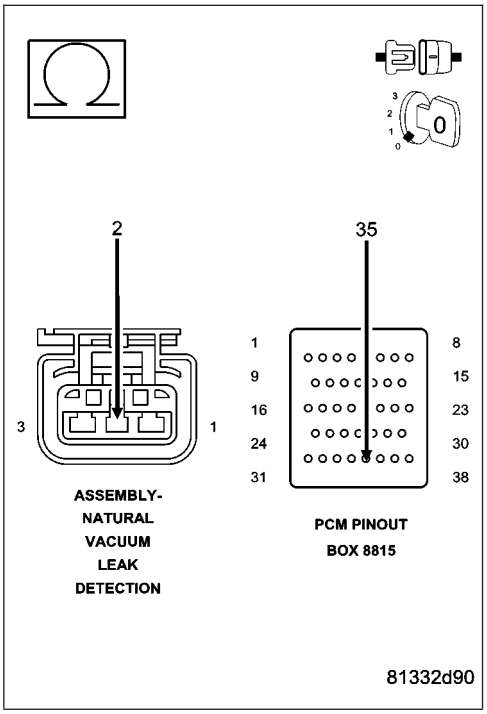
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K107) NVLD Switch Signal circuit from the NVLD electrical harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K107) NVLD Switch Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



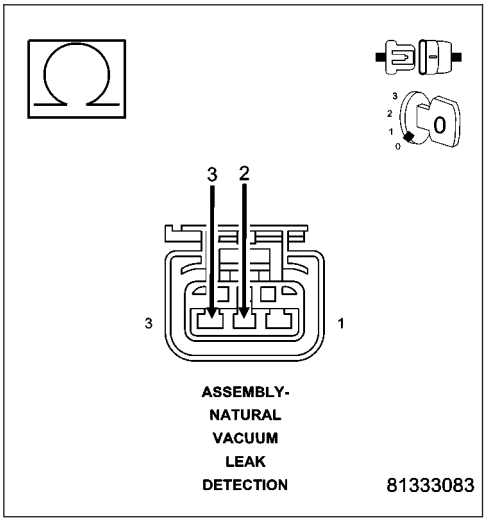
5. (K107) NVLD SWITCH SIGNAL CIRCUIT SHORTED TO THE (K106) NVLD SOLENOID CONTROL CIRCUIT

Measure the resistance between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K107) NVLD Switch Signal circuit and the (K106) NVLD Solenoid Control circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

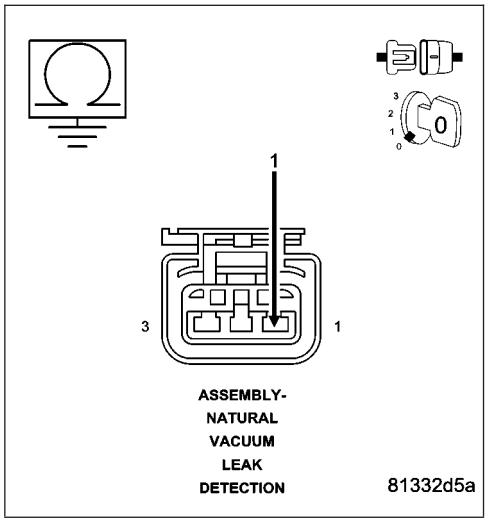
No >> Go To 6



P0453-NVLD PRESSURE SWITCH STUCK OPEN (CONTINUED)

6. (Z910) GROUND CIRCUIT OPEN

Measure the resistance between the (Z910) Ground circuit and ground.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (Z910) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE))

---

7. PCM

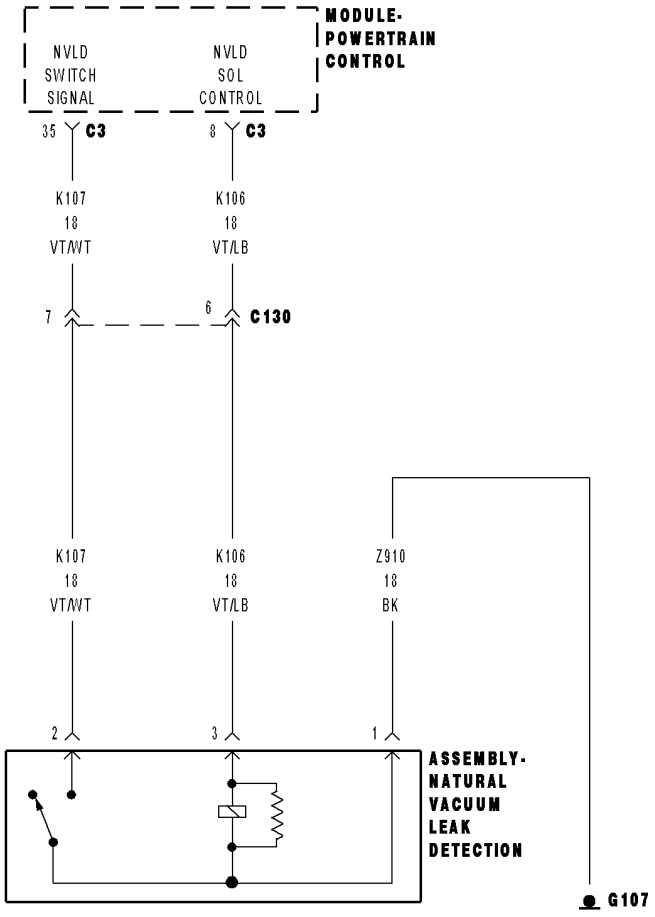
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

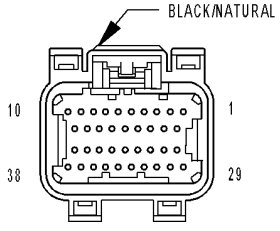
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

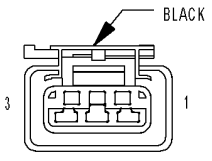
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Engine Running. Cold start test. Fuel Level greater than 12%. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs when small leak test is maturing.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time for a Large leak an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
NVLD SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

2. ACTIVE DTC

Check for any related TSBs before continuing.

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 5

No >> Refer to the Freeze Frame data recorded in step 1. If the data indicates that the vehicle was in motion when the DTC was set, verify that all hoses are properly connected.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may aid diagnosis also.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

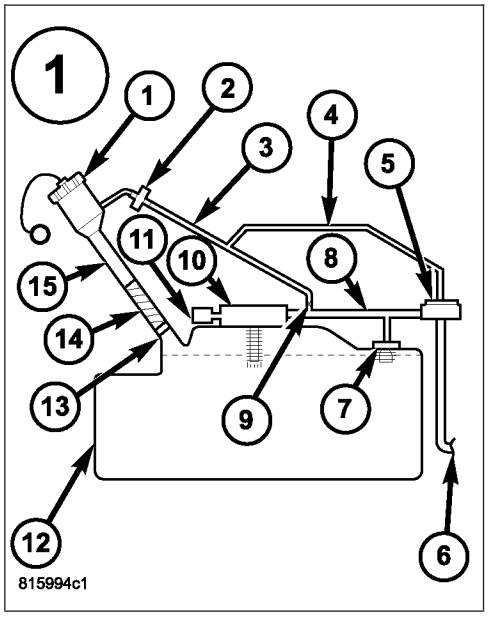
If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

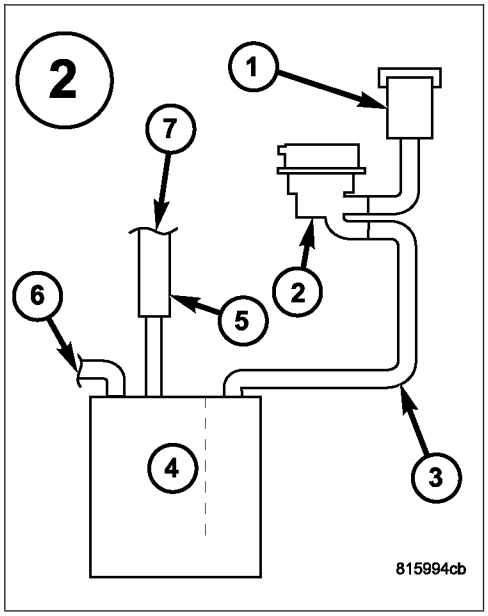
1 Fuel Cap
2 Recirculation Check Valve.
3 Vapor Recirculation Line.
4 Signal Vapor Line for FVM.
5 Flow Management Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Fuel Tank Vent (Check Valve).
8 Vapor Line to Canister.
9 Flow Control Orfice.
10 Control Valve.
11 Liquid Trap.
12 Fuel Tank.
13 Check valve.
14 Fuel Fill Tube to Tank connector.
15 Fuel Fill Tube
Damaged or disconnected EVAP system components.



P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

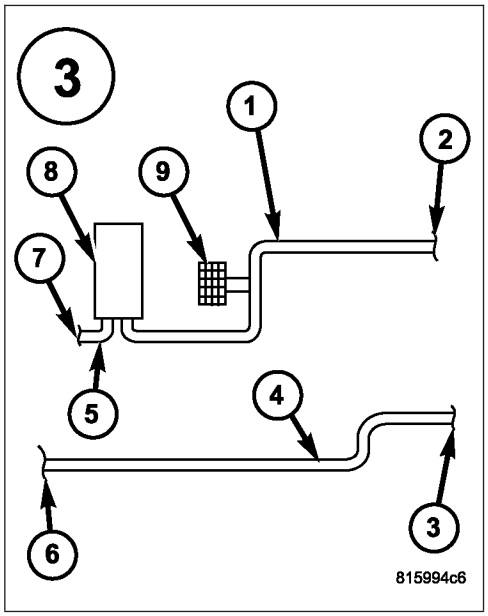
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.



- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.



NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found at the gas cap?

Yes >> Go To 6
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

6. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.
Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

Was a leak found at the gas cap adapter?

Yes >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP PURGE SYSTEM LARGE LEAK (CONTINUED)

7. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

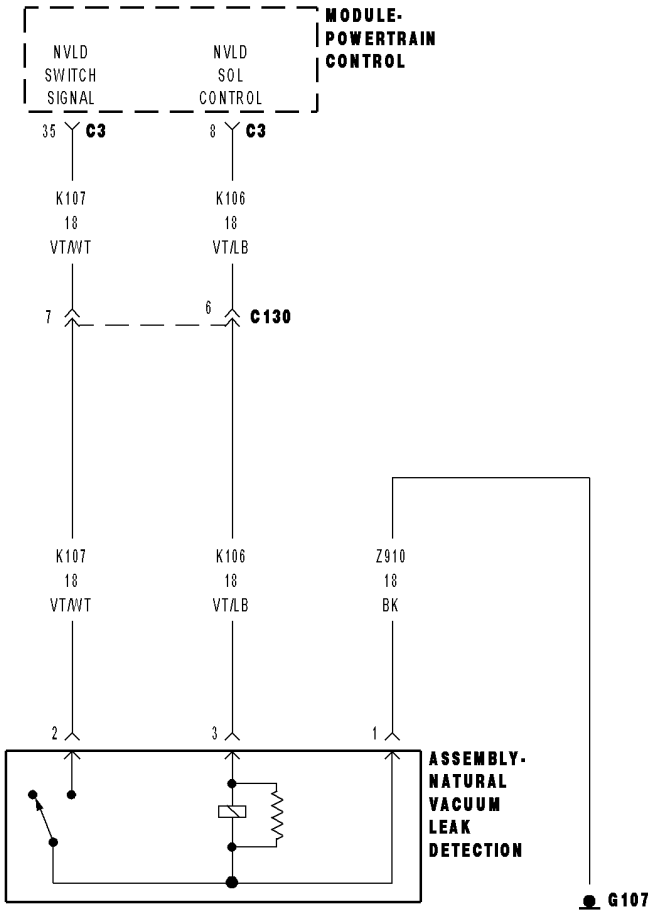
NOTE: Monitor the vacuum gauge for at least 15 seconds.

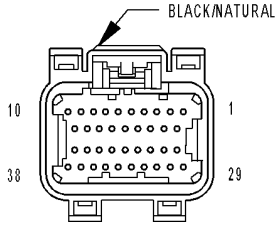
Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?

Yes >> Replace the NVLD.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

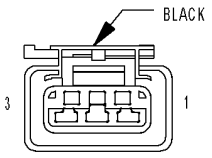
No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The theory behind the Natural Vacuum Leak Detection (NVLD) is adherence to the Ideal Gas Law. Pressure in a sealed vessel will change linearly as a function of the temperature of the gas in the vessel. Even small leaks will allow the pressure in the vessel to come to equilibrium with the atmospheric pressure. After key-off and a calibrated amount of time, cool down from operating temperatures or diurnal ambient temperature the system pressure will force the system to go negative or draw a vacuum if there is no leak. When the vacuum level reaches 1" H2O (0.25 KPA) the NVLD vacuum switch closes. This sends a signal to the NGC freezing a timer and registering a pass. If a switch closure is not detected an assessment of leak size will be made.

- **When Monitored:**
  Ignition off. Fuel Level less than 88%. Ambient Temperature between 4°C and 43°C (39°F and 109°F) Close Loop fuel system.
- **Set Condition:**
  Due to temperature changes, a vacuum is created in the fuel tank and EVAP system. With the EVAP system sealed, the PCM monitors the NVLD switch. If the NVLD switch does not close within a calibrated time allowance, an error is detected by the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

2. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 5

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

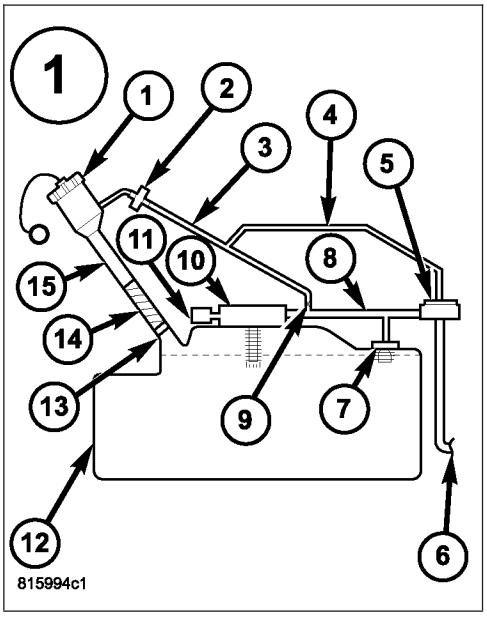
If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: The EVAP System is divided into three zones. A leak from any of these zones can cause this DTC to set. The lists below specify the possible leak points in that specific zone. For further assistance see the Zone Identification Charts below.

- ZONE 1

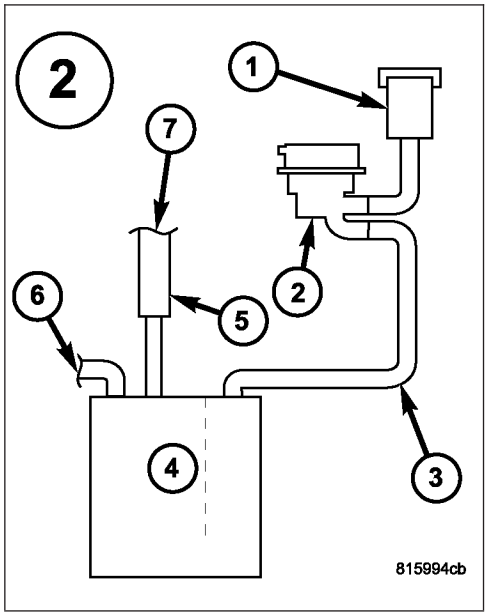
1 Fuel Cap
2 Recirculation Check Valve.
3 Vapor Recirculation Line.
4 Signal Vapor Line for FVM.
5 Flow Management Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Fuel Tank Vent (Check Valve).
8 Vapor Line to Canister.
9 Flow Control Orfice.
10 Control Valve.
11 Liquid Trap.
12 Fuel Tank.
13 Check valve.
14 Fuel Fill Tube to Tank connector.
15 Fuel Fill Tube
Damaged or disconnected EVAP system components.



P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

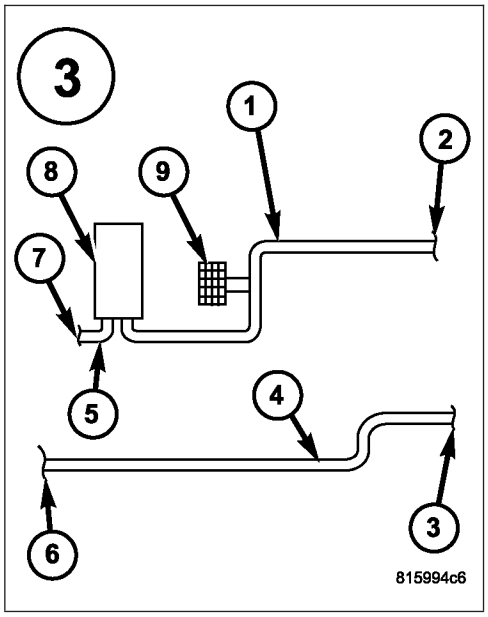
- ZONE 2

1 Filter.
2 NVLD.
3 Canister Vent Line.
4 Evap Canister.
5 Chassis Purge Valve.
6 Fuel Tank to Canister Vapor Line connection.
7 Evap Purge connection.



- ZONE 3

1 Evap Purge Vacuum Line.
2 Connection to Chassis Line.
3 Connection to Canister.
4 Chassis Purge Line.
5 Evap Purge Vacuum Line.
6 Connection to Evap Purge Harness.
7 Chassis Evap Purge Line connection to Engine Vacuum.
8 Evap Purge Valve.
9 Service Port.



NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Go To 6
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

6. LEAK AT GAS CAP

Remove the SMOKE supply tip (black hose) from the service port (if equipped) or to the #8404–ADP adapter.
Install gas cap adapter, Miller Tool #8382 (1/4 turn cap) or #6922 (screw cap) and #8399* (secondary seal depressor) and repeat test 5.

Was a leak found at the gas cap adapter?

Yes >> Replace the Fuel Filler tube assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the gas cap.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0456-EVAP PURGE SYSTEM SMALL LEAK (CONTINUED)

7. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Press the remote smoke/air start button on the EELD.

While holding the remote smoke/air start button, check to see if smoke is exiting the purge valve. This indicates that there is a leak internal to the purge valve.

NOTE: Below is an optional method of checking the purge valve for leaks if the EELD is unavailable.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in HG to the “CAN” of the Evap Purge Solenoid.

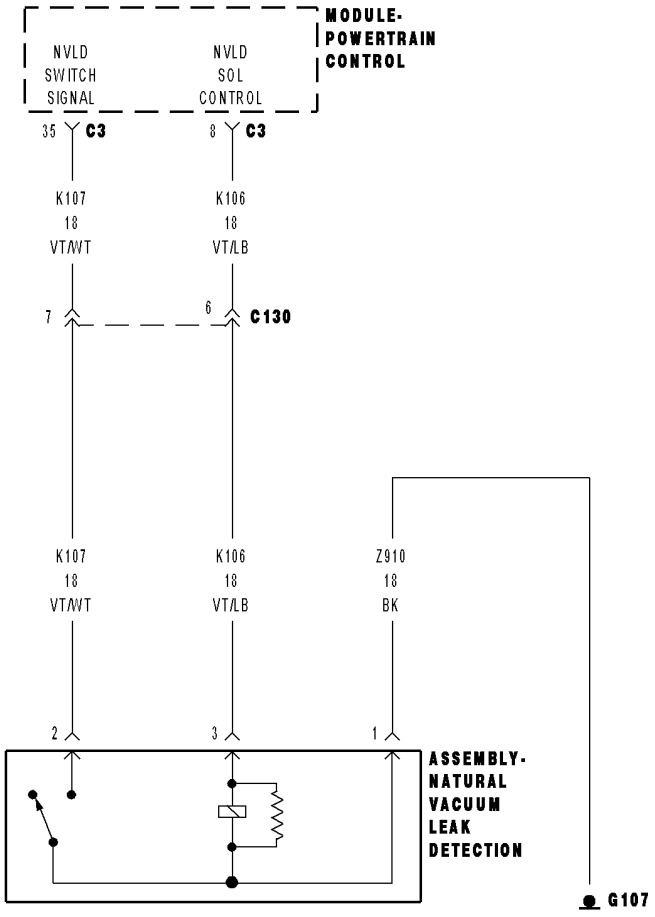
NOTE: Monitor the vacuum gauge for at least 15 seconds.

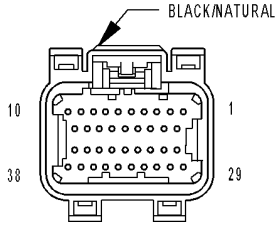
Is smoke visible from the EVAP Purge Solenoid if using the EELD, or not hold a vacuum?

Yes >> Replace the NVLD.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

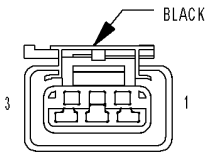
No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0457-LOOSE FUEL CAP (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

Fuel level is recorded when the ignition key is turned off and is compared to the fuel level when the ignition key is turned back on. The PCM recognizes an increase in fuel level and will fail the Medium leak test because the fuel cap is broken or not installed properly. GAS CAP will be displayed in odometer to inform the owner that the cap is off of loose.

- **When Monitored:**
  Engine running. Ambient Temperature between 4°C and 32°C (39°F and 89°F) Close Loop fuel system. Test runs after the medium leak test is inconclusive and the PCM has senses a fuel increase.
- **Set Condition:**
  The PCM activates the EVAP Purge Solenoid to pull the EVAP system into a vacuum to close the NVLD switch. Once the NVLD switch is closed, the PCM turns the EVAP Purge Solenoid off to seal the EVAP system. If the NVLD switch reopens before the calibrated amount of time after a fuel tank fill, an error is detected. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOOSE OR MISSING FUEL CAP
FUEL FILL CAP
NVLD SWITCH
EVAP PURGE SOLENOID
EVAP PURGE SYSTEM MEDIUM LEAK

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. ACTIVE DTC

NOTE: After the PCM has determined the leak test inconclusive and sees an increase in fuel level, the PCM will request the GAS CAP indicator on to inform the customer that the gas fill cap is loose or off.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. LOOSE OR MISSING FUEL FILL CAP

Inspect the fuel fill cap.

Inspect the cap for any abnormal defects.

Was the cap off, missing, or broken?

Yes >> Properly install the fuel fill cap and proceed to step 3.

No >> Go To 4

P0457-LOOSE FUEL CAP (CONTINUED)

3. NVLD SERVICE TEST

With the scan tool perform the NVLD Service Test.

Does the NVLD Service Test pass?

Yes >> Test complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on Medium leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 5

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP (CONTINUED)

5. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Go To 7.

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0457-LOOSE FUEL CAP (CONTINUED)

7. NVLD SWITCH OPERATION

Reconnect all vacuum hoses.

Start the engine.

Allow the engine to idle.

Using the scan tool, perform the NVLD FORCED MONITOR TEST.

Monitor the NVLD Switch.

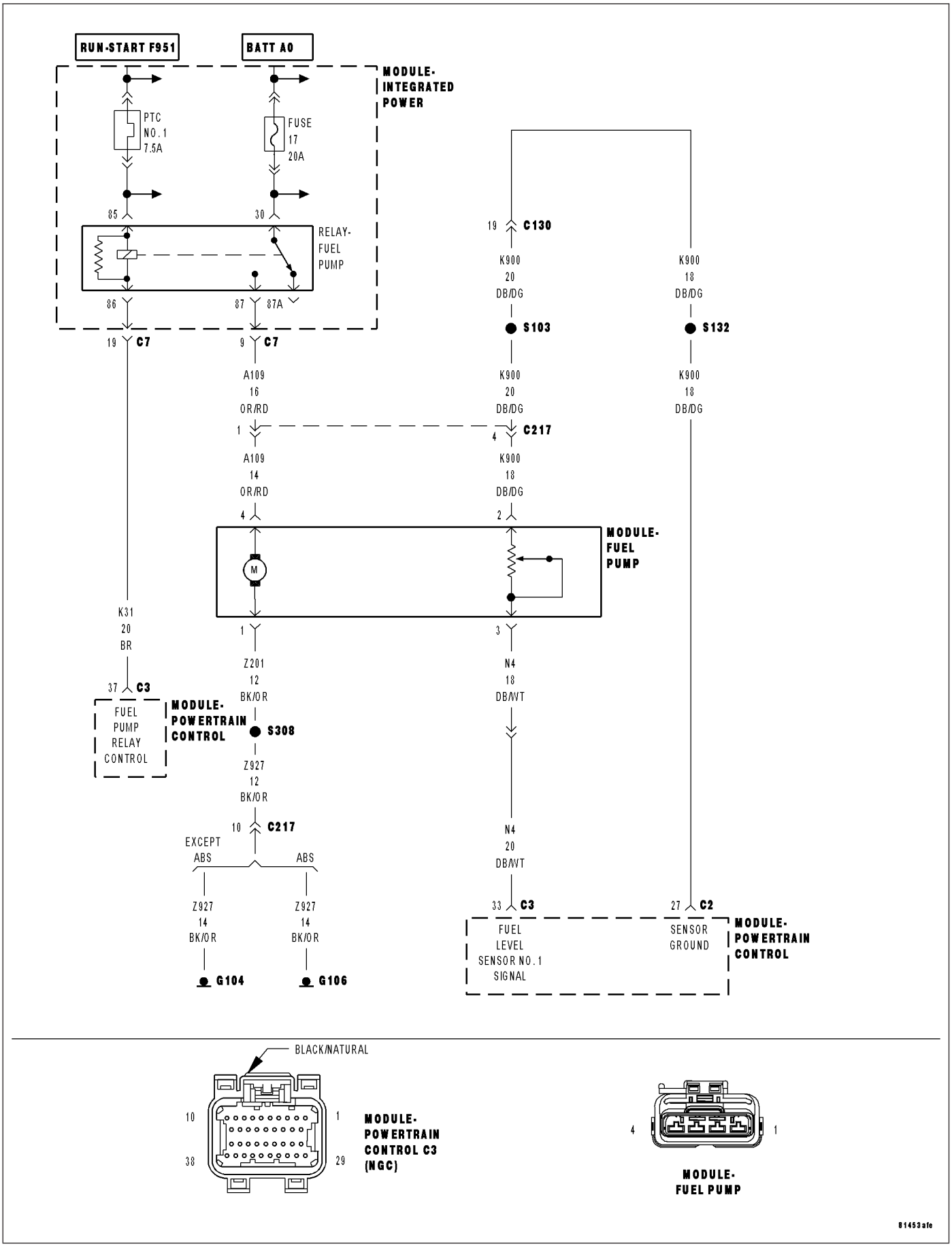
NOTE: As the test runs, the NVLD Switch should go from an OPEN state to CLOSED. After the vacuum is released form the EVAP system the Switch state will return to OPEN.

Did the NVLD Switch operate as described above?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE



P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel level rationality will set a fault for a fuel level reading that does not change over an accumulated mileage threshold to keep stuck high or stuck low fuel levels from disabling OBD monitors. If the vehicle is fitted with a saddle tank fuel system this feature includes diagnostics for both of the sending units and diagnostics for a siphon tube that has become disconnected or plugged. The power up test looks to see a large enough fuel level voltage change from the last key-off to the following engine run. The engine run test looks to see a fuel level voltage change over an accumulated mileage.

- **When Monitored:**
  TEST No.1: With the ignition on, the fuel level is compared to the previous key down after a 20 second delay.
  TEST No.2: The PCM monitors the fuel level at ignition on.
- **Set Condition:**
  TEST No.1: If the PCM does not see a difference in fuel level of greater than 0.1 volt the test will fail. TEST No.2: If the PCM does not see a change in the fuel level of .1765 over a set amount of miles the test will fail. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(K900) SENSOR GROUND CIRCUIT OPEN
FUEL TANK
FUEL LEVEL SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose P0462 or P0463 first, if set along with P0461.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUALLY INSPECT FUEL TANK

Visually inspect the Fuel Tank for damage that may restrict the Fuel Sending Unit float from moving.

Is the Fuel Tank OK?

Yes >> Go To 3

No >> Replace the Fuel Tank as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

3. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

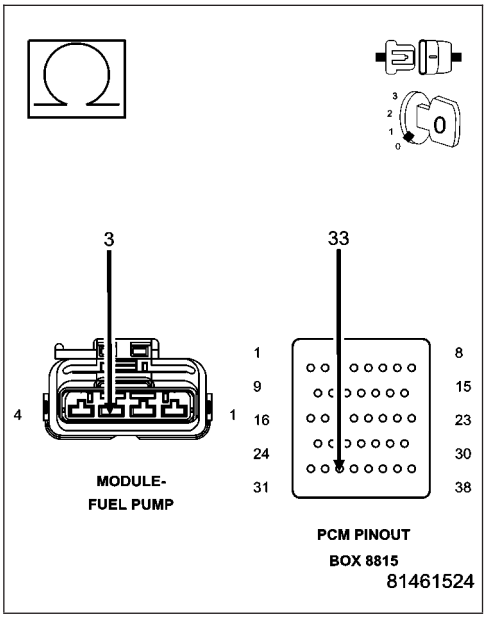
Turn the ignition off.

Disconnect the Fuel Pump Module harness connector.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.



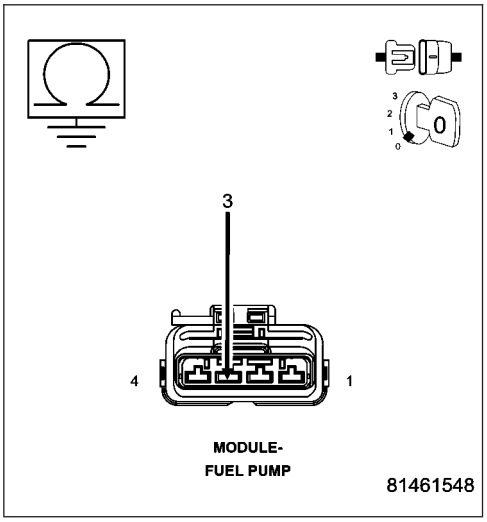
Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the resistance below 100 ohms?

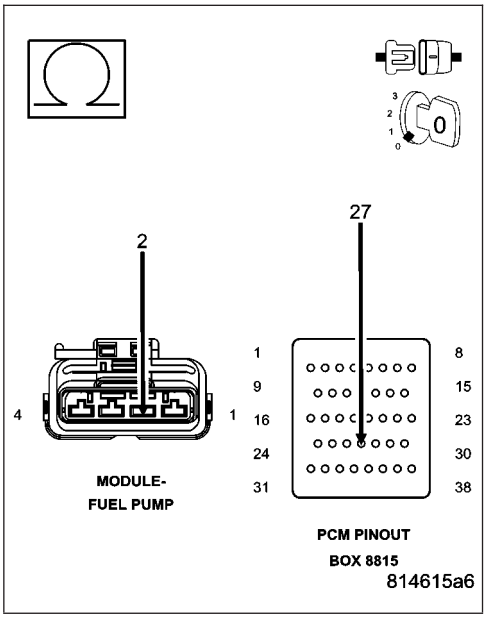
Yes >> Repair the short to ground in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0461-FUEL LEVEL SENSOR 1 PERFORMANCE (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. INTERNAL INSPECTION OF THE FUEL TANK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Tank per Service Information.

Remove the Fuel Pump Module.

Visually inspect the inside of the Fuel Tank for any obstructions or deformities.

Inspect the Fuel Pump Module Float arm for damage.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

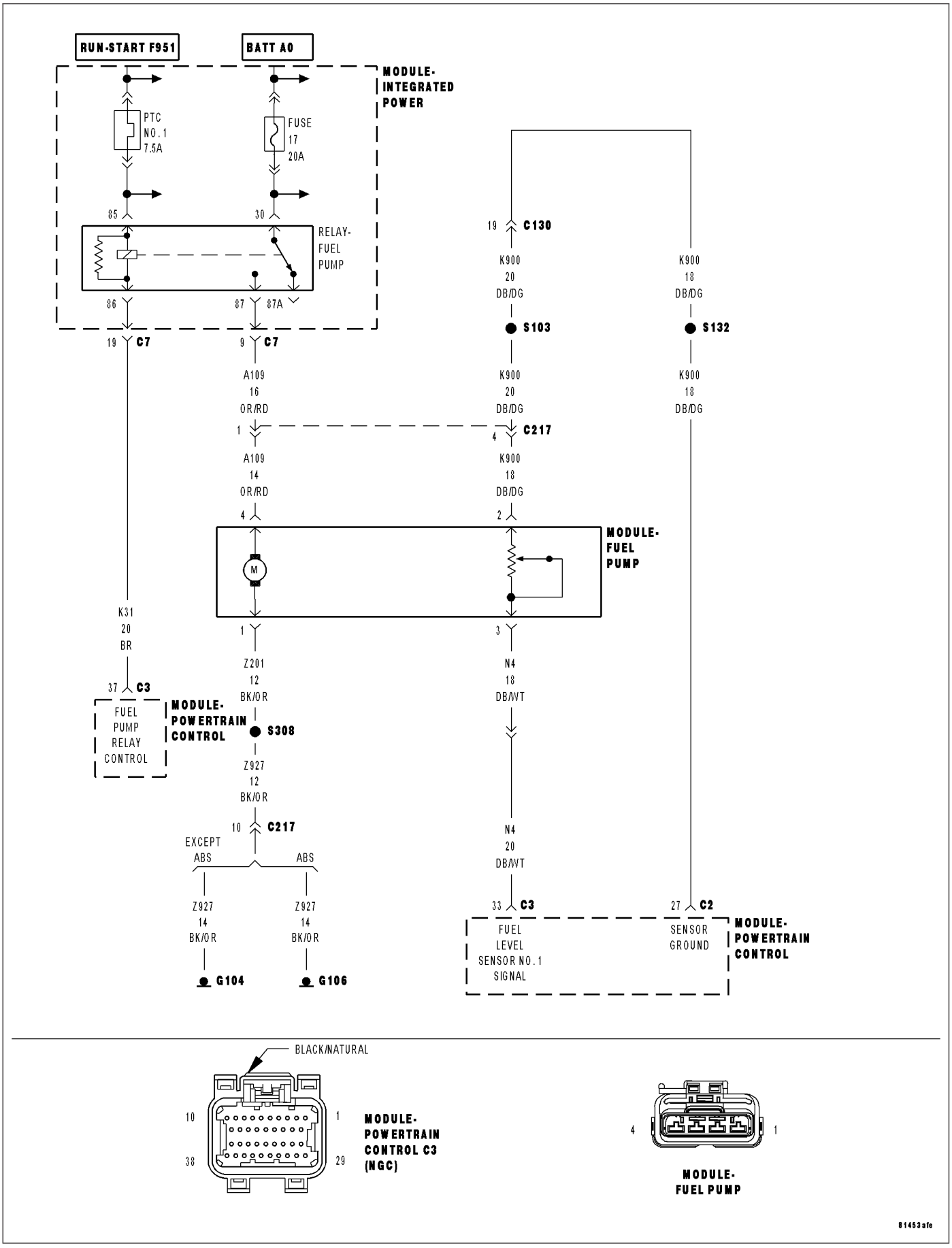
7. FUEL LEVEL SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW



P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage goes below 0.4 of a volt for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
FUEL LEVEL SENSOR
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTAGE BELOW 0.4 OF A VOLT

NOTE: Diagnose any Bus Message failures before continuing.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage below 0.4 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. FUEL LEVEL SENSOR

Turn the ignition off.
Disconnect the Fuel Pump Module harness connector.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Did the Fuel Level Sensor voltage change from below 0.4 of a volt to above 4.0 volts?

Yes >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0462-FUEL LEVEL SENSOR 1 CIRCUIT LOW (CONTINUED)

3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

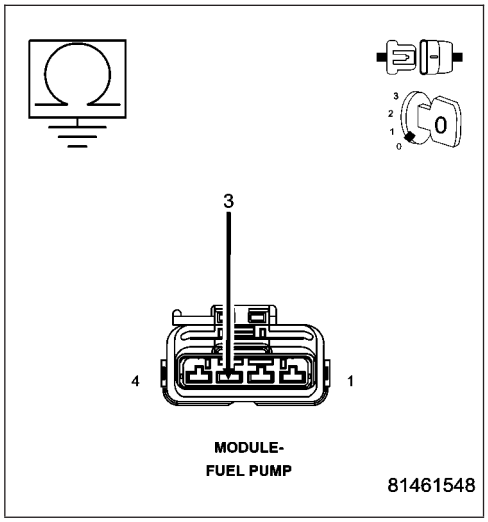
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



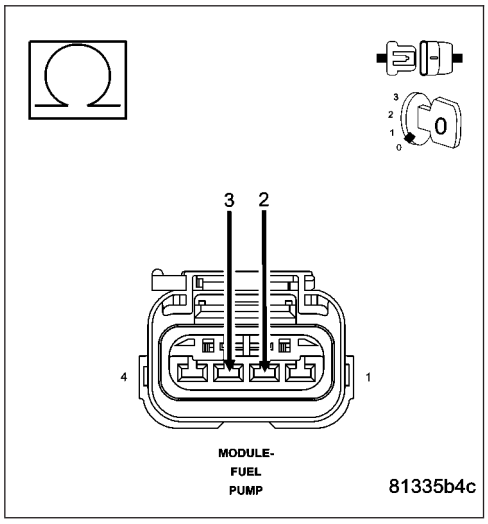
4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit in the Fuel Pump Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor Ground circuit and the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

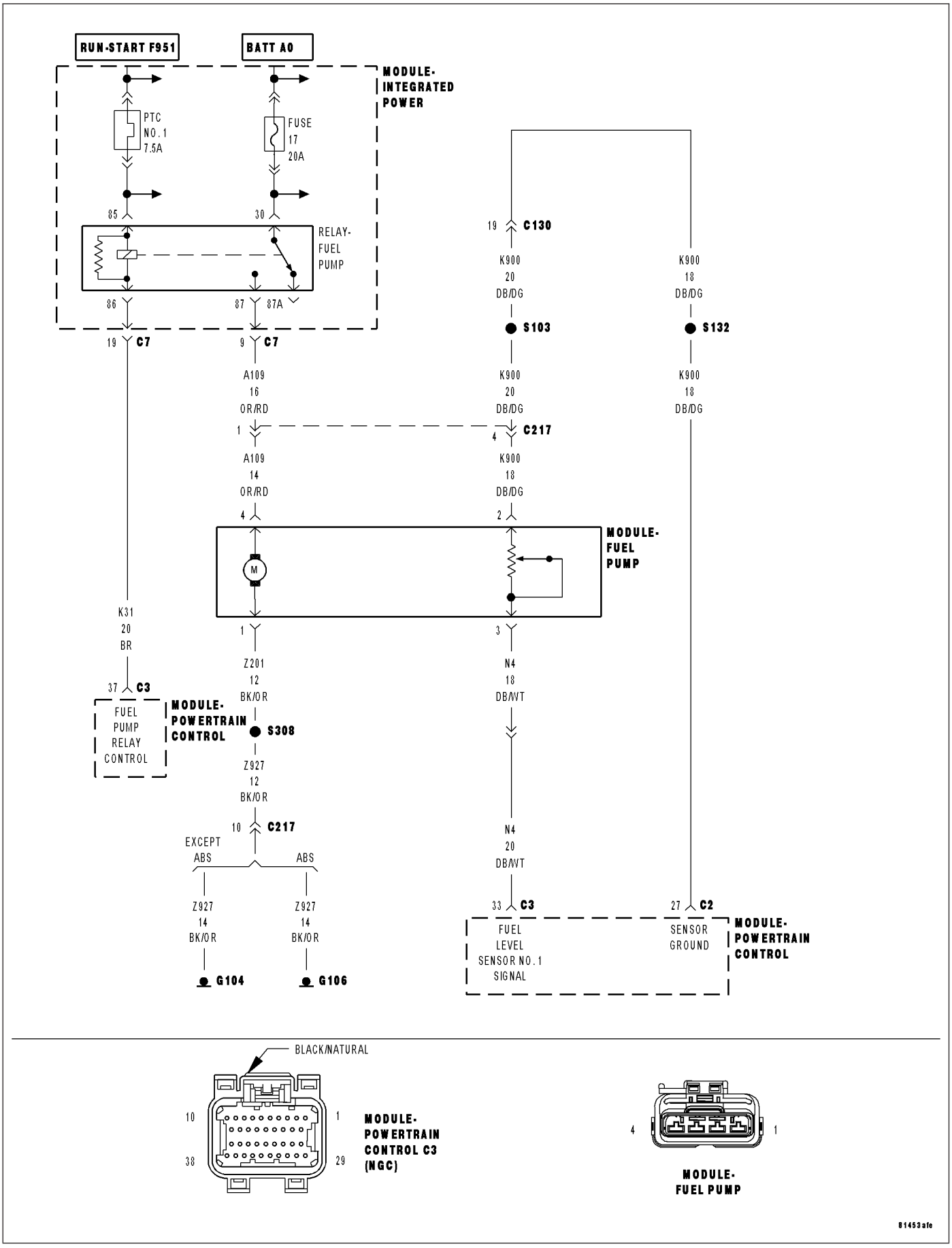
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH



P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage at the PCM goes above 4.9 volts for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
FUEL LEVEL SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTS ABOVE 4.9 VOLTS

NOTE: Diagnose any Bus Message failures before continuing.

Ignition on, engine not running.

With a scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

2. FUEL LEVEL SENSOR

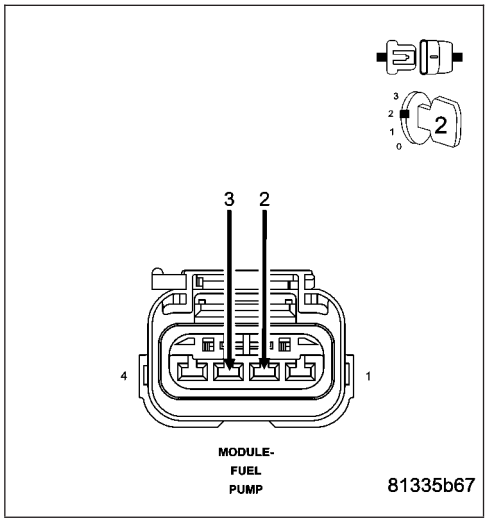
Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit in the Fuel Pump Module harness connector.

With the scan tool, read the Fuel Level Sensor voltage.



Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt with the jumper wire installed?

Yes >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

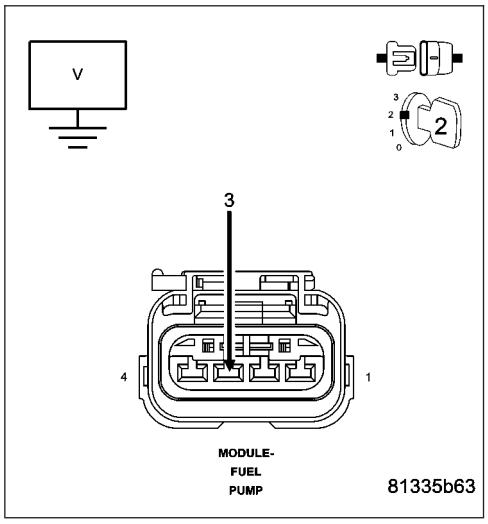
3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

Turn the ignition off.

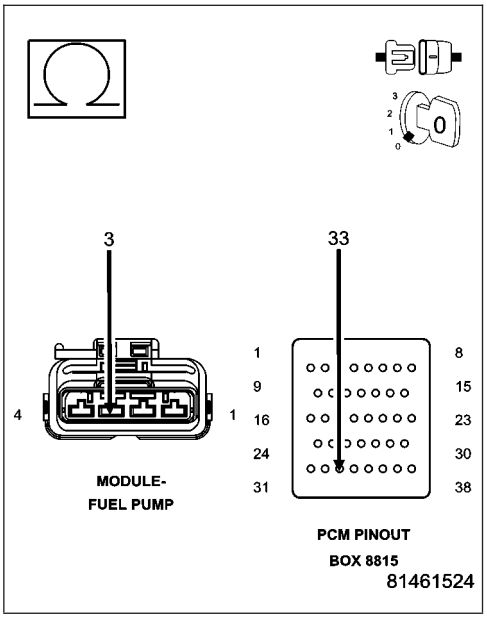
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (N4) Fuel Level Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



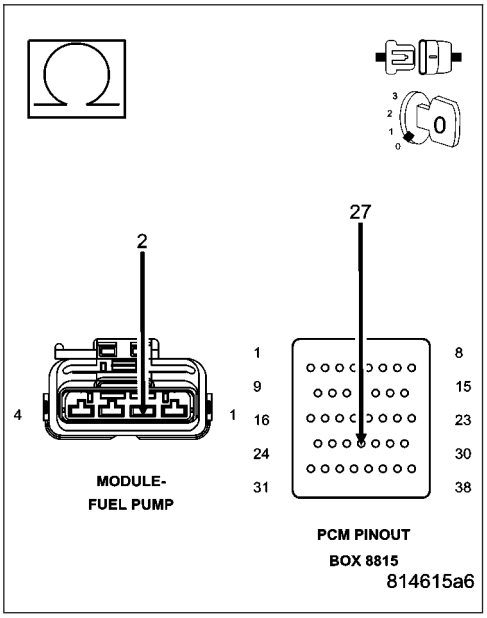
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor Ground circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

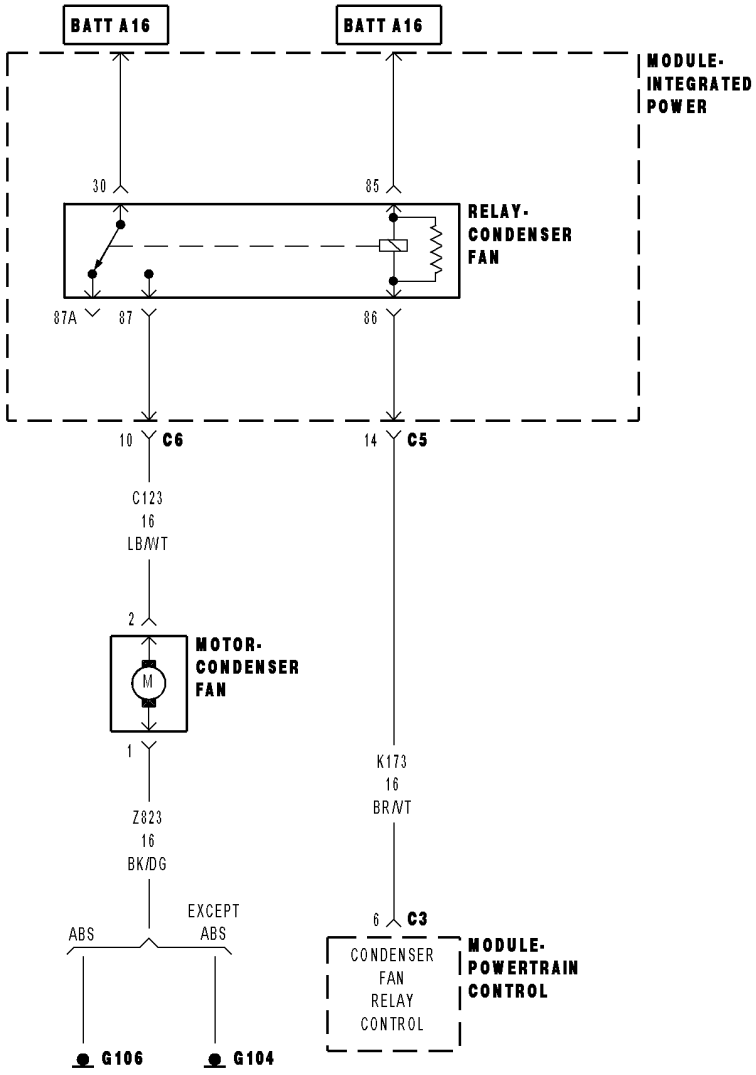
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

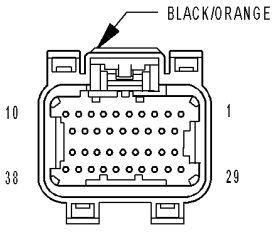
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

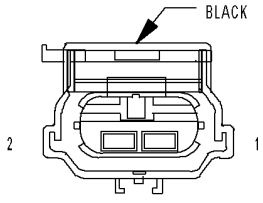
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0480-COOLING FAN 1 CONTROL CIRCUIT





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



MOTOR-
CONDENSER
FAN
(NGC)

81453b55

P0480-COOLING FAN 1 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted circuit is detected in the radiator fan relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(A16) FUSED B+ CIRCUITS
(K173) COOOLING FAN NO.1 RELAY CONTROL CIRCUIT OPEN
(K173) COOOLING FAN NO.1 RELAY CONTROL CIRCUIT SHORTED TO GROUND
LOW SPEED RADIATOR FAN RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. COOLING FAN RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Cooling Fan Relay.

Is the Cooling Fan Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. (A16) FUSED B+ CIRCUITS

Turn the ignition off.

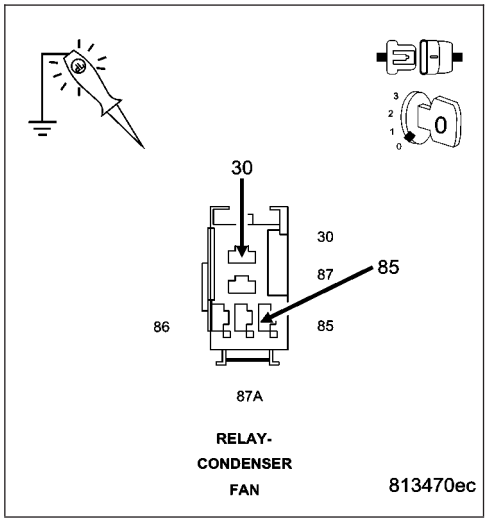
Remove the Cooling Fan Relay.

Using a 12-volt test light connected to ground, probe the (A16) Fused B+ circuits.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A16) Fused B+ circuits. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0480-COOLING FAN 1 CONTROL CIRCUIT (CONTINUED)

3. COOOLING FAN RELAY RESISTANCE

Measure the resistance of the Cooling Fan Relay Coil.

Is the resistance between 60 to 80 ohms?

Yes >> Go To 4

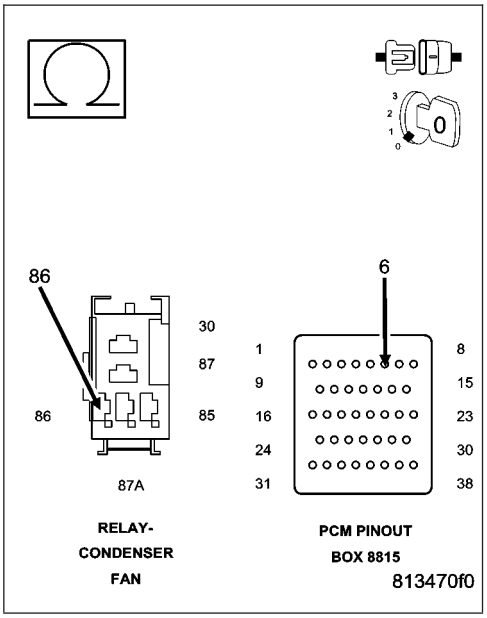
No >> Replace the Cooling Fan Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K173) COOLING FAN NO.1 CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K173) Cooling Fan No.1 Relay Control circuit from the Relay to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

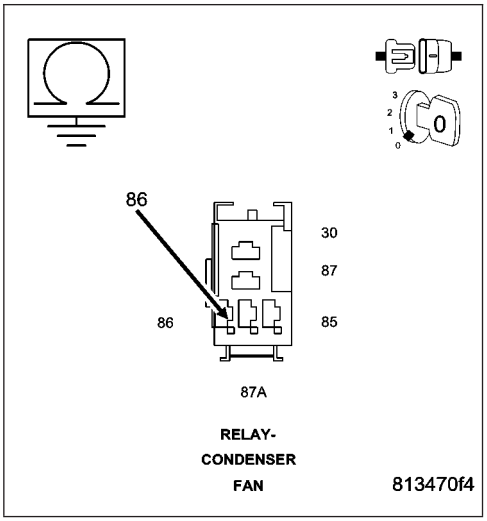
Yes >> Go To 5

No >> Repair the open in the (K173) Cooing Fan No.1 Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K173) COOLING FAN NO.1 CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K173) Cooling Fan No.1 Relay Control circuit at the Relay connection.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K173) Cooling Fan No.1 Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0480-COOLING FAN 1 CONTROL CIRCUIT (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

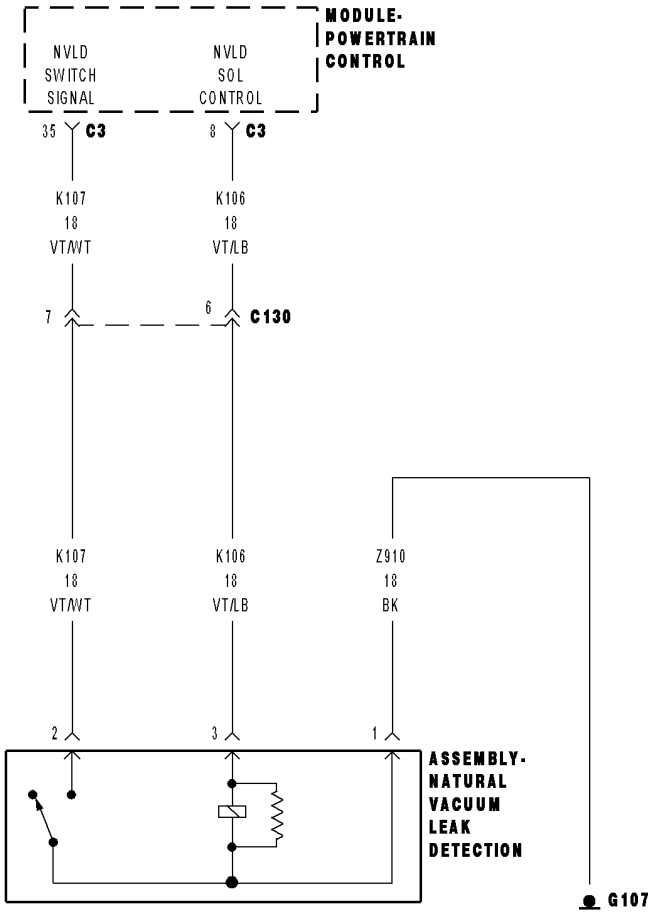
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

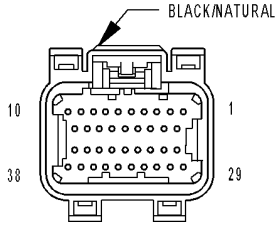
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

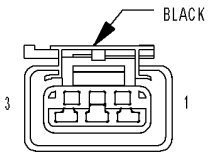
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects a short in the NVLD Canister vent solenoid circuits. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
NVLD ASSEMBLY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2.

---

2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

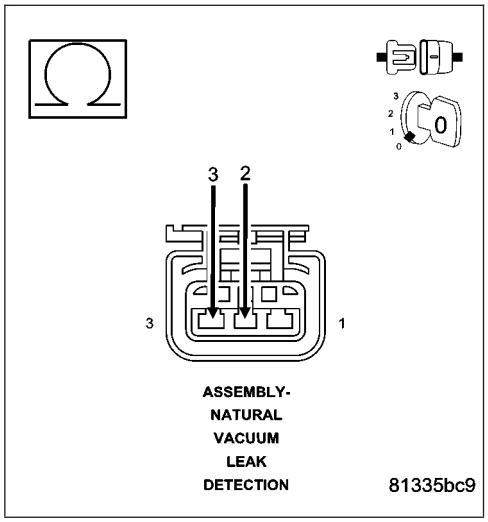
Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0498-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT LOW (CONTINUED)

3. NVLD SOLENOID

Turn the ignition off.
Disconnect the NVLD electrical harness connector.
Measure the resistance of the NVLD Solenoid Coil.



Is the resistance between 7.5 to 8.5 ohms?

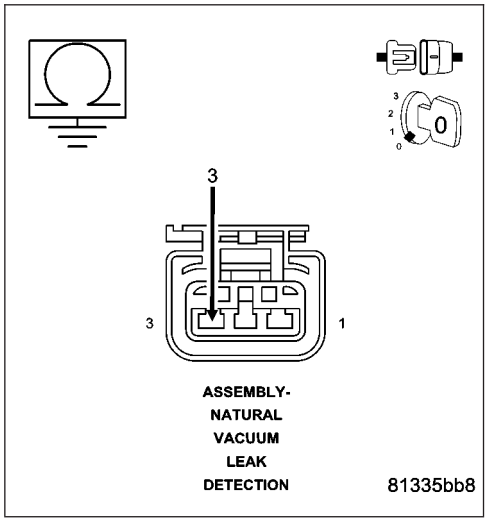
Yes >> Go To 4

No >> Replace the NVLD Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Disconnect the C3 PCM harness connector.
Measure the resistance between ground and the (K106) NVLD Solenoid Control circuit in the NVLD electrical harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K106) NVLD Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. PCM

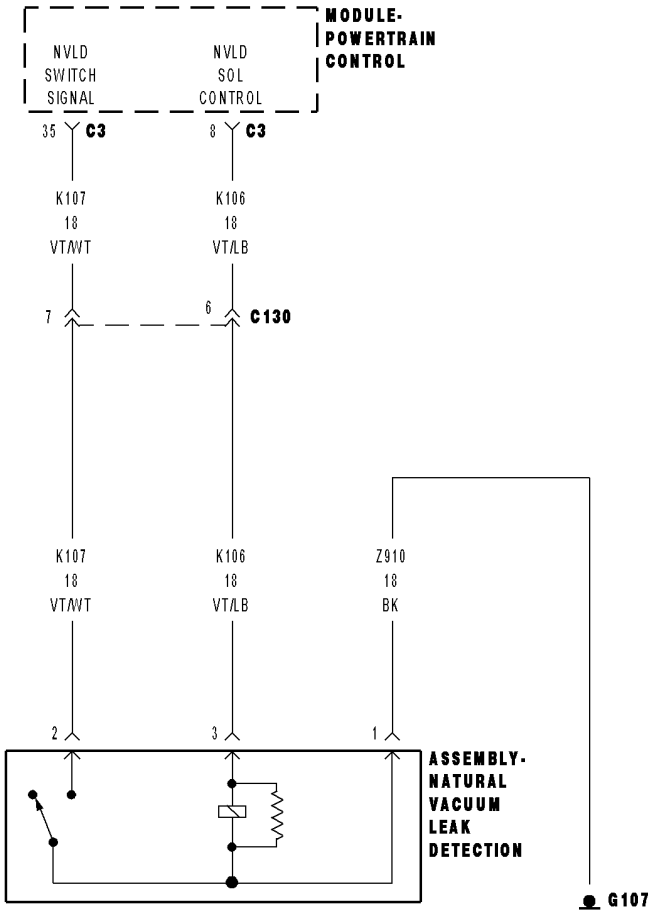
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

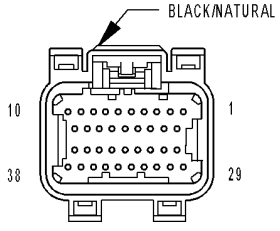
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

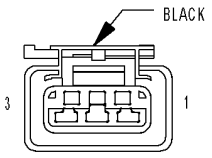
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



ASSEMBLY-
NATURAL VACUUM
LEAK DETECTION
(3.7L/4.7L/5.7L)

81453a02

P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The PCM detects an open in the NVLD Canister vent solenoid circuits for more than 9.375 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K106) NVLD SOLENOID CONTROL CIRCUIT OPEN
(Z910) GROUND CIRCUIT OPEN
NVLD SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VEHICLE HISTORY AND SERVICE BULLETIN INVESTIGATION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customer's complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inspect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any service bulletin(s) related to the customer's complaint or DTC(s).

If a service bulletin applies, follow the instructions per the service bulletin.

Choose the following scenario that best applies.

The service bulletin repaired the customer's complaint.
Testing complete.

A DTC is present, no service bulletins apply, or the service bulletin didn't repair the customer's complaint.
Go To 2.

---

2. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

3. NVLD SOLENOID

Turn the ignition off.

Disconnect the NVLD Assembly harness connector.

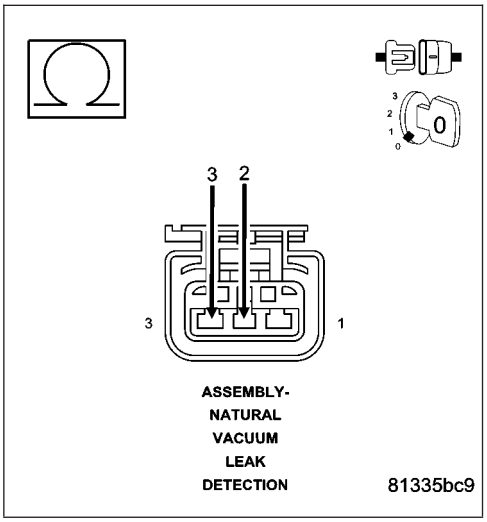
Measure the resistance of the NVLD Solenoid coil.

Is the resistance between 7.5 to 8.5 ohms?

Yes >> Go To 4

No >> Replace the NVLD Assembly.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K106) NVLD SOLENOID CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

Take this measurement with the Ignition in the off (lock) position and in the Ignition on, engine off position.

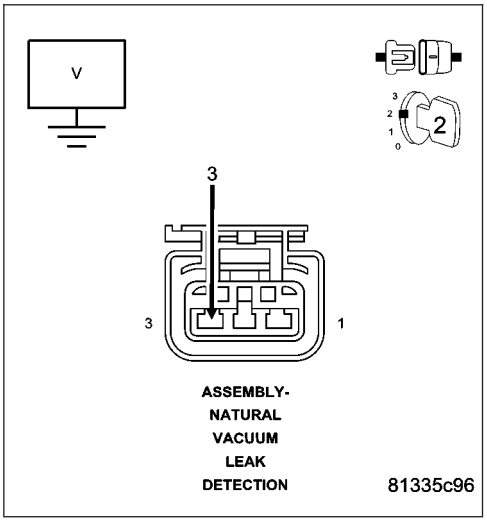
Measure the voltage on the (K106) NVLD Solenoid Control circuit in the NVLD Assembly harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K106) NVLD Solenoid Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



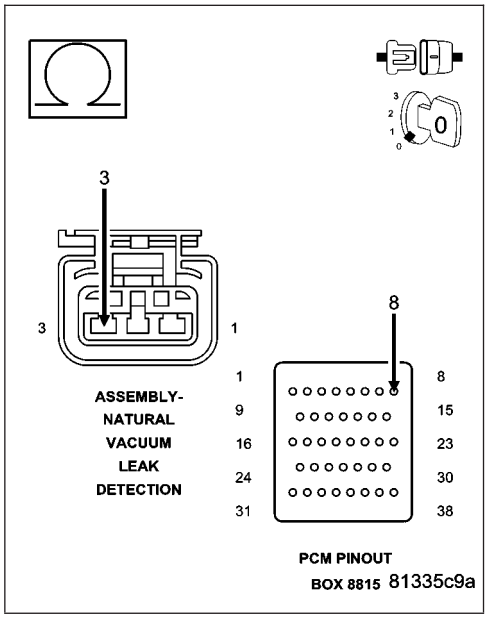
P0499-NVLD CANISTER VENT VALVE SOLENOID CIRCUIT HIGH (CONTINUED)

5. (K106) NVLD SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K106) NVLD Solenoid Control circuit from the NVLD Assembly harness connector to the appropriate terminal of special tool #8815.



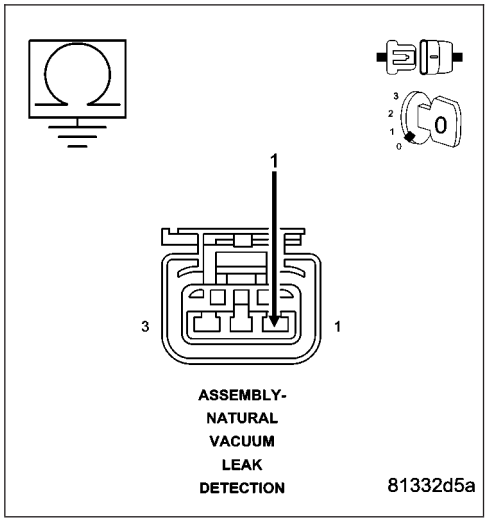
Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K106) NVLD Solenoid Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (Z910) GROUND CIRCUIT OPEN

Measure the resistance between the (Z910) Ground circuit and ground.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (Z910) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

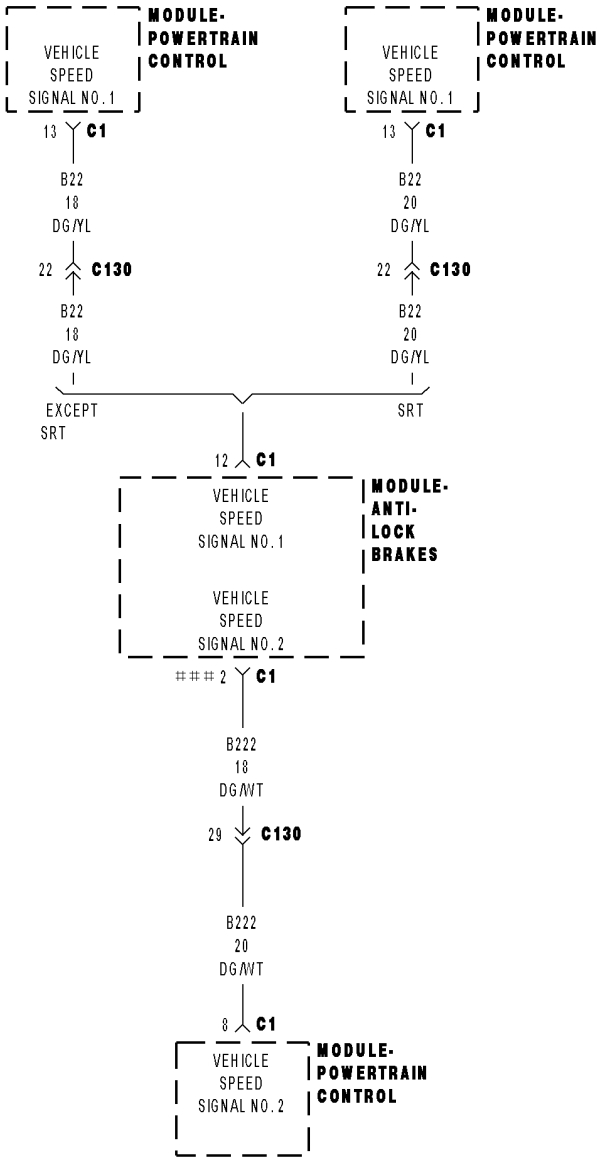
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

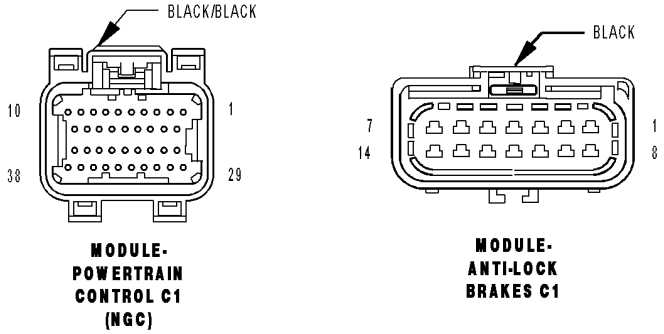
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE





81453b7e

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**
  With the engine running, transmission not in park or neutral, brakes not applied, and engine rpm greater than 1500.
- **Set Condition:**
  This code will set if no vehicle speed signal is received from the ABS Module for more than 11 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT OPEN
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

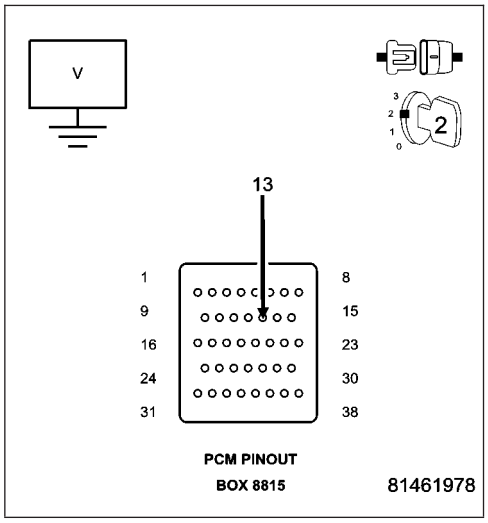
Disconnect the C1 Anti-lock Brake Module harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

Measure the voltage of the (B22) Vehicle Speed No.1 Signal circuit at the appropriate terminal of special tool #8815.



Is the voltage above 6.0 volts?

Yes >> Repair the short to voltage in the (B22) Vehicle Speed No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

4. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

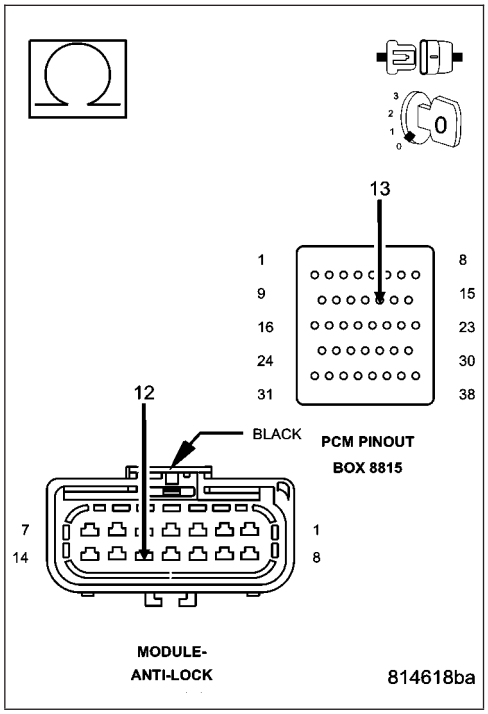
Measure the resistance of the (B22) Vehicle Speed No.1 Signal circuit from the ABS Module harness connector to the appropriate terminal of special tool #8815.

Is the voltage above 6.0 volts?

Yes >> Go To 5

No >> Repair the open in the (B22) Vehicle Speed No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

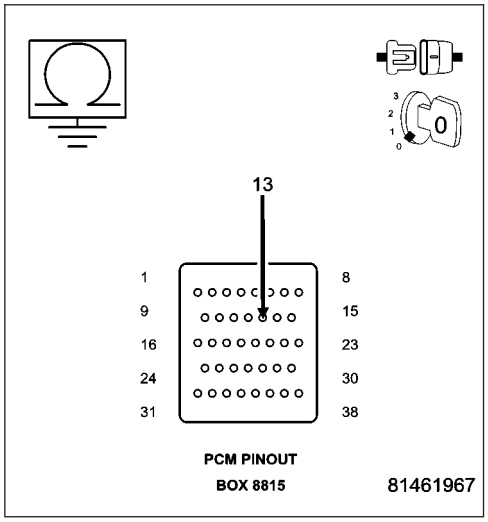
Measure the resistance between ground and the (B22) Vehicle Speed No.1 Signal circuit at the appropriate terminal of special tool #8815.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B22) Vehicle Speed No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0501-VEHICLE SPEED SENSOR 1 PERFORMANCE (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

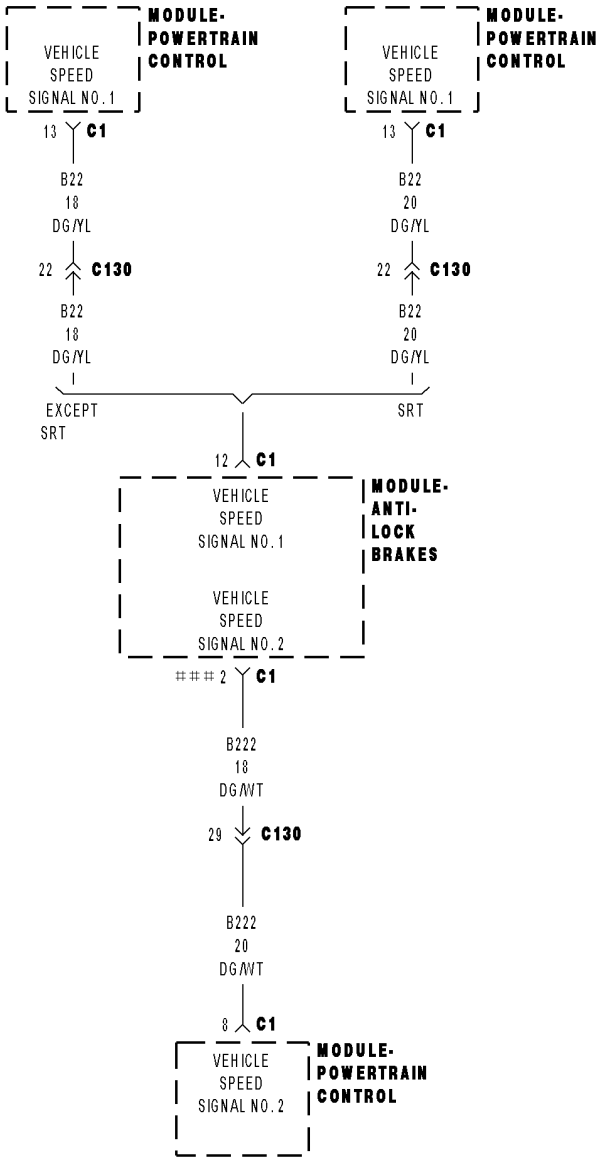
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

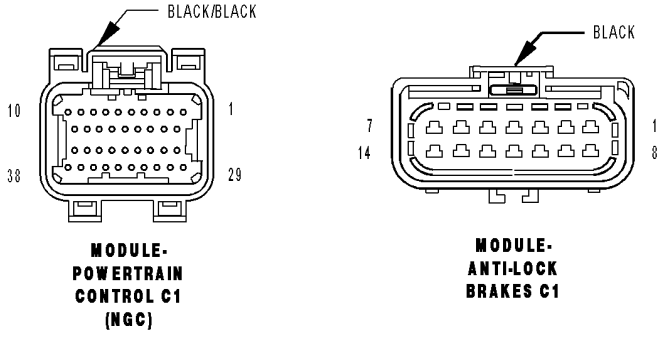
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0503-VEHICLE SPEED SENSOR 1 ERRATIC





81453b7e

P0503-VEHICLE SPEED SENSOR 1 ERRATIC (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The vehicle speed sensor rationality is a continuous test that monitors the vehicle speed sensor for lack of activity. The rationality will not run if a limp-in exists for MAP, Throttle Position, and Engine Coolant Temperature. If vehicle speed sensor is below a minimum threshold for a period of time after the vehicle is operated at a sufficient load, a failure will be indicated.

- **When Monitored:**
  With the engine running, transmission not in park or neutral, brakes not applied, and engine rpm greater than 1500.
- **Set Condition:**
  This code will set if no vehicle speed signal is received from the ABS Module for more than 11 seconds for 2 consecutive trips. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT OPEN
(B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Anti-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Anti-Lock Brake Module must be properly diagnosed before continuing.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0503-VEHICLE SPEED SENSOR 1 ERRATIC (CONTINUED)

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

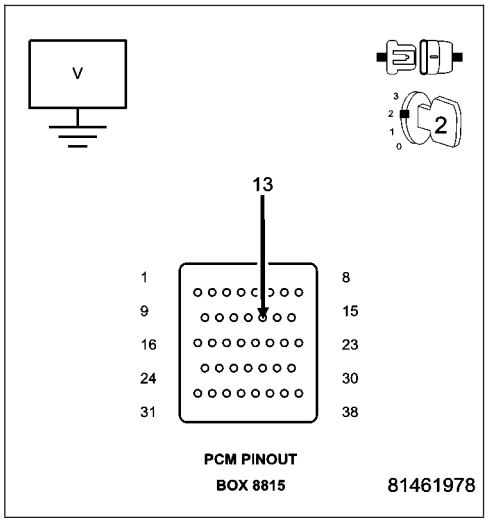
Disconnect the C1 Anti-lock Brake Module harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

Measure the voltage of the (B22) Vehicle Speed No.1 Signal circuit at the appropriate terminal of special tool #8815.



Is the voltage above 6.0 volts?

Yes >> Repair the short to voltage in the (B22) Vehicle Speed No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0503-VEHICLE SPEED SENSOR 1 ERRATIC (CONTINUED)

4. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

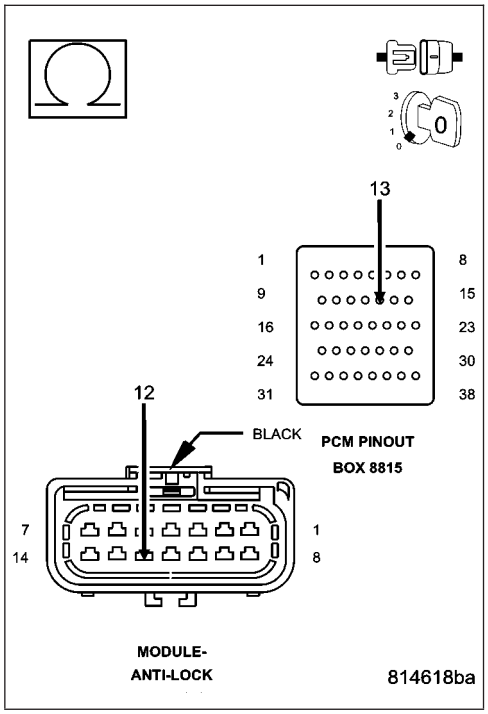
Measure the resistance of the (B22) Vehicle Speed No.1 Signal circuit from the ABS Module harness connector to the appropriate terminal of special tool #8815.

Is the voltage above 6.0 volts?

Yes >> Go To 5

No >> Repair the open in the (B22) Vehicle Speed No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (B22) VEHICLE SPEED NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

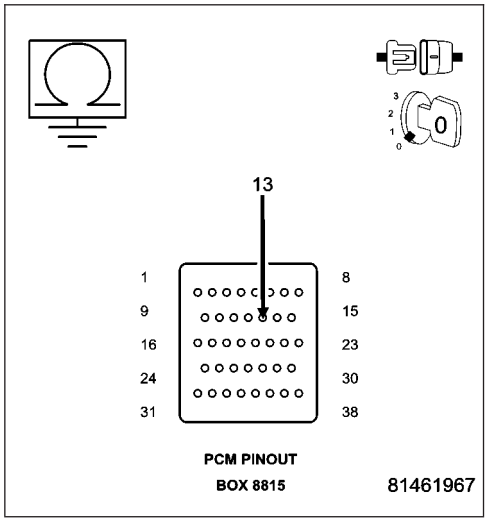
Measure the resistance between ground and the (B22) Vehicle Speed No.1 Signal circuit at the appropriate terminal of special tool #8815.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B22) Vehicle Speed No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0503-VEHICLE SPEED SENSOR 1 ERRATIC (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 100 RPM or more below idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM
THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.
Restrictions: Dirty Air Cleaner, Foreign material trapped in the air intake tube, etc.
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0506-IDLE SPEED PERFORMANCE LOWER THAN EXCEPTED (CONTINUED)

3. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.

If the throttle plate does not close entirely it may be bent and needs to be replaced.

Verify that the throttle cable between the Accelerator Pedal and APPS is not binding.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

While the vehicle is running, lightly tap on ETC Motor, with your hand, and listen for idle to raise.

Were any problems found or did the idle fluctuate while tapping on the ETC Motor?

Yes >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The objective of the Idle “Speed Rationality is to monitor the ability to achieve and maintain a steady idle condition. The monitor will judge the functionality of the idle speed control system by monitoring RPM during idle. If RPM does not come within a calibrated deadband of target idle speed, a timer is started. If the timer reaches its maximum threshold without any sign of the RPM trending towards control, a soft failure is generated.

- **When Monitored:**
  With the engine running at idle, MAF <250 mg/tdc, air temp >-17.8°C (0°F) and <-7°C (19.4°F) enable after coolant temp >70°C (158°F) or air temp >-7°C (19.4°F), coolant temp >-7°C (19.4°F) <130°C (266°F), canister purge <100% duty cycle, and no VSS, MAF/MAP, ECT, TPS, ETC, CRK Sensor DTCs nor any fuel system or injector DTCs.
- **Set Condition:**
  Engine speed is 200 RPM or more above idle speed for 7 seconds. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
AIR INDUCTION SYSTEM
VACUUM LEAKS
THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If any other DTCs are present, they must be diagnosed and repaired before continuing this test.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.
Restrictions: Dirty Air Cleaner, Foreign material trapped in the air intake tube, etc.
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0507-IDLE SPEED PERFORMANCE HIGHER THAN EXCEPTED (CONTINUED)

3. VACUUM LEAKS

Start the engine.
Inspect the vehicle for external vacuum leaks.
Inspect the engine for internal leaks.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. THROTTLE BODY OPERATION

Inspect the throttle body for carbon build up, other restrictions, and a bent throttle plate using a straight edge.
If the throttle plate does not close entirely it may be bent and needs to be replaced.
Verify that the throttle cable between the Accelerator Pedal and APPS is not binding.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.
While the vehicle is running, lightly tap on ETC Motor, with your hand, and listen for idle to fluctuate.

Were any problems found or did the idle fluctuate when tapping on the ETC Motor?

Yes >> Repair or replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. PCM

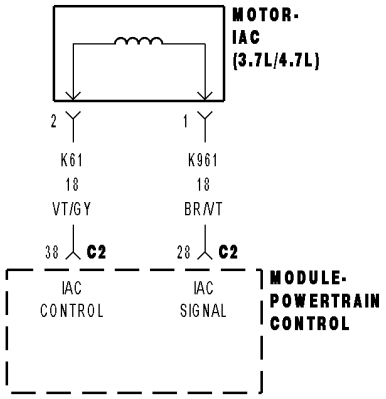
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

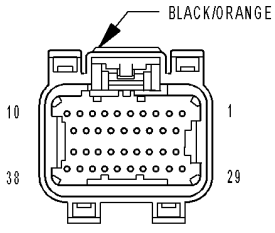
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

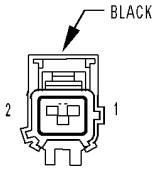
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



MOTOR-IAC
(3.7L/4.7L)

8145446e

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K61) IAC CONTROL CIRCUIT SHORTED TO GROUND
(K961) IAC SIGNAL CIRCUIT OPEN
(K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND
(K61) IAC CONTROL CIRCUIT OPEN
IAC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAC MOTOR OPERATION

NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.

Start the engine.

Allow the engine to idle.

With a scan tool, read the IAC Current.

Is the IAC Current below 146 mA?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

2. IAC MOTOR

Turn the ignition off.

Disconnect the IAC Motor harness connector.

Remove the IAC Motor.

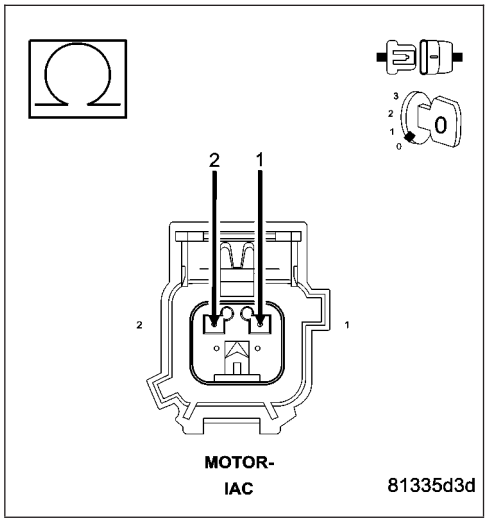
NOTE: Inspect the IAC air passages for restrictions and damage to the IAC valve.

Measure the resistance across the IAC Motor pin terminals (component).

Is the resistance 9.7 +/- 1.0 ohms?

Yes >> Go To 3

No >> Replace the IAC Motor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K961) IAC SIGNAL CIRCUIT OPEN

Disconnect the PCM harness connectors.

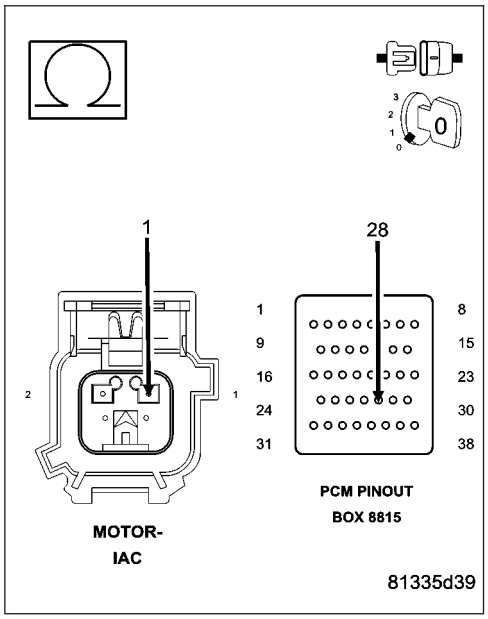
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K961) IAC Signal circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

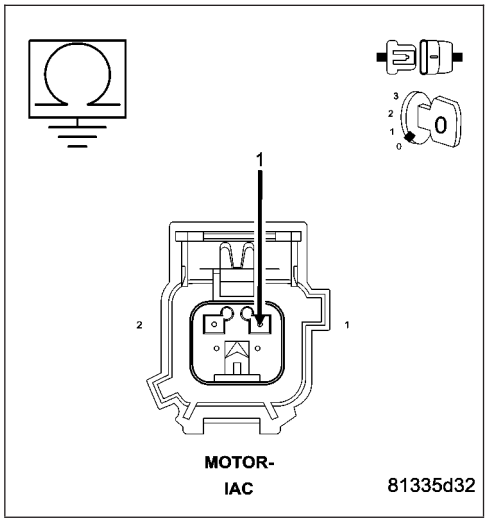
No >> Repair the open in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

4. (K961) IAC SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K961) IAC Signal circuit in the IAC Motor harness connector.



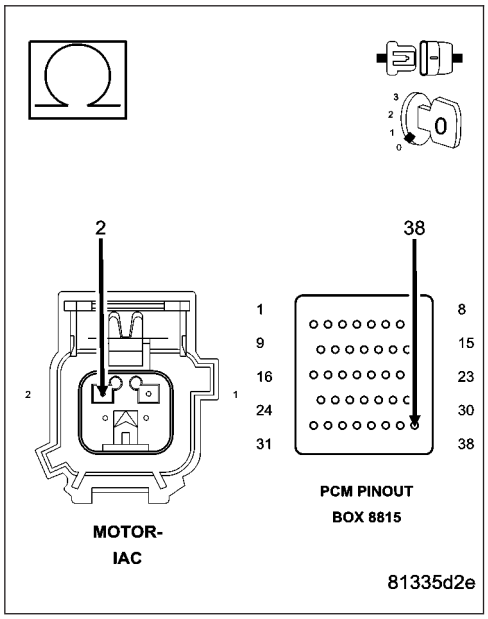
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K961) IAC Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (K61) IAC CONTROL CIRCUIT OPEN

Measure the resistance of the (K61) IAC Control circuit from the IAC Motor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

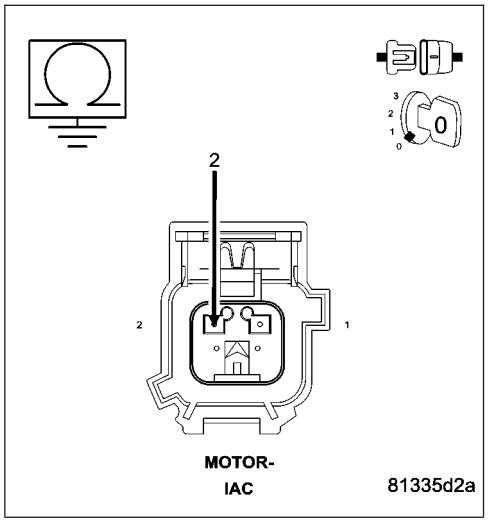
Yes >> Go To 6

No >> Repair the open in the (K61) IAC Control circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0508-IDLE AIR CONTROL VALVE SENSE CIRCUIT LOW (CONTINUED)

6. (K61) IAC CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K61) IAC Control circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

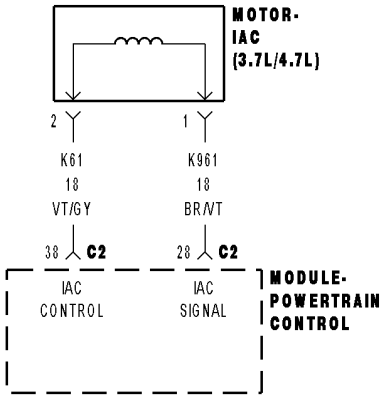
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

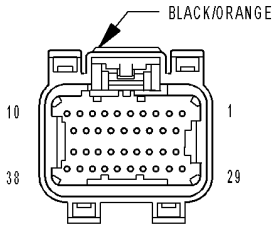
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

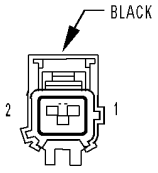
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH





MODULE-
POWERTRAIN
CONTROL C2
(NGC)



MOTOR-IAC
(3.7L/4.7L)

8145446e

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running. Battery voltage greater than 10 volts. IAC motor operating.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the Linear Idle Air Control (LIAC) control circuits for 2.75 seconds while the IAC motor is active. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K961) IAC RETURN CIRCUIT SHORTED TO BATTERY VOLTAGE
(K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT
IAC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAC MOTOR OPERATION

NOTE: If the engine will not idle, maintain an engine speed between 800 and 1500 RPM.
Start the engine.
Allow the engine to idle.
With a scan tool, read the IAC Current.

Is the IAC Current above 999 mA?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. IAC MOTOR

Turn the ignition off.
Disconnect the IAC Motor harness connector.
With the scan tool, monitor the IAC Current.
Ignition on, engine not running.

Does the scan tool display IAC Current at 0 mA?

Yes >> Replace the IAC Motor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

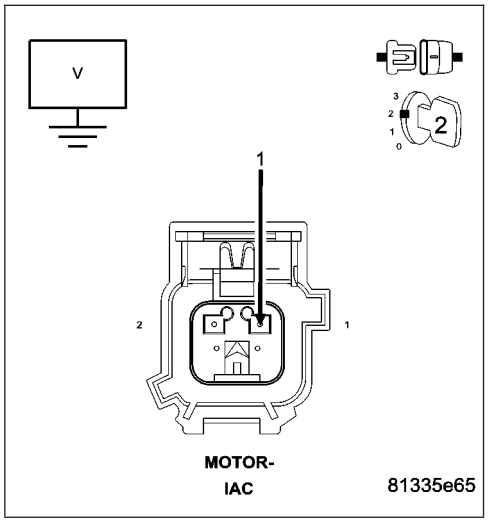
3. (K961) IAC SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K961) IAC Signal circuit in the IAC Motor harness connector.



Is the voltage above 0.5 of a volt?

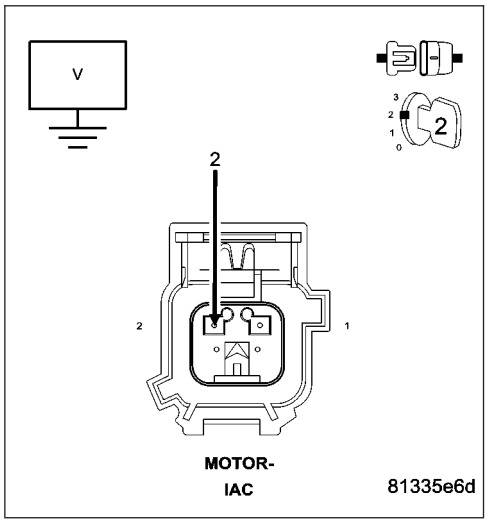
Yes >> Repair the short to battery voltage in the (K961) IAC Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K61) IAC CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Measure the voltage on the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the voltage above 0.5 of a volt?

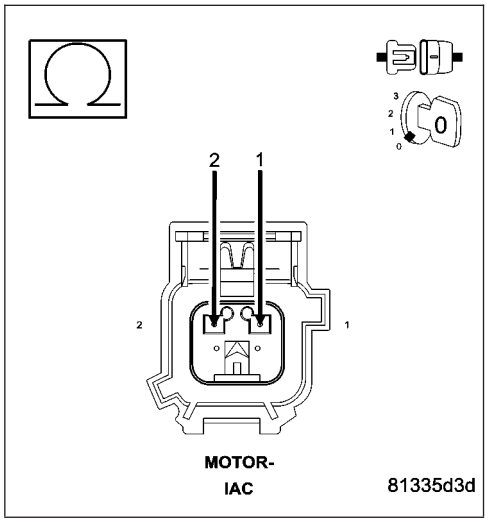
Yes >> Repair the short to battery voltage in the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0509-IDLE AIR CONTROL VALVE SENSE CIRCUIT HIGH (CONTINUED)

5. (K61) IAC CONTROL CIRCUIT SHORTED TO THE (K961) IAC RETURN CIRCUIT

Measure the resistance across the (K961) IAC Signal circuit and the (K61) IAC Control circuit in the IAC Motor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K961) IAC Signal circuit and the (K61) IAC Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0513-INVALID SKIM KEY

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM detects an invalid SKIM key. One Trip Fault.

Possible Causes
INCORRECT VIN PROGRAMMED IN THE PCM
NO COMMUNICATION WITH SKIM
NO VIN PROGRAMMED IN THE PCM
IGNITION KEY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read the PCM DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 6

---

2. NO COMMUNICATION WITH SKIM

With the scan tool, attempt to communicate with the SKIM.

Can the scan tool communicate with the SKIM?

Yes >> Go To 3

No >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform SKIM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

3. SKIM TROUBLE CODES SET

With the scan tool, check for SKIM DTCs.

Are any DTCs present in the SKIM?

Yes >> Refer to Section 8 - Electrical VEHICLE THEFT SECURITY - ELECTRICAL DIAGNOSTICS and perform the appropriate Diagnostic Procedure.
Perform SKIM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Go To 4

P0513-INVALID SKIM KEY (CONTINUED)

4. VIN PROGRAMMED INTO PCM

With the scan tool, display the VIN that is programmed in the PCM.

Has a VIN been programmed into the PCM?

Yes >> Go To 5

No >> Program the correct VIN into the PCM and retest.
Perform SKIM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

5. PCM

Turn the ignition off.
Replace and program the SKIM per Service Information.
Ignition on, engine not running.
With the scan tool, erase all SKIM and PCM DTCs.
Attempt to start and idle the engine.
With the scan tool, read the PCM DTCs.

Does the scan tool display this code?

Yes >> NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.
Perform SKIM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

---

6. IGNITION KEY

NOTE: You must obtain the SKIM pin number.

NOTE: This DTC could have been set if the SKIM harness connector was disconnected, or if the SKIM was replaced recently.

NOTE: All keys that the customer uses for this vehicle must be tested to verify they are operating properly.
Ignition on, engine not running.
Verify the correct VIN is programmed into the PCM and SKIM.
Turn the ignition off.
With each customer key turn the ignition on and crank the engine to start.
With the scan tool, read the PCM DTCs. Look for P0513.

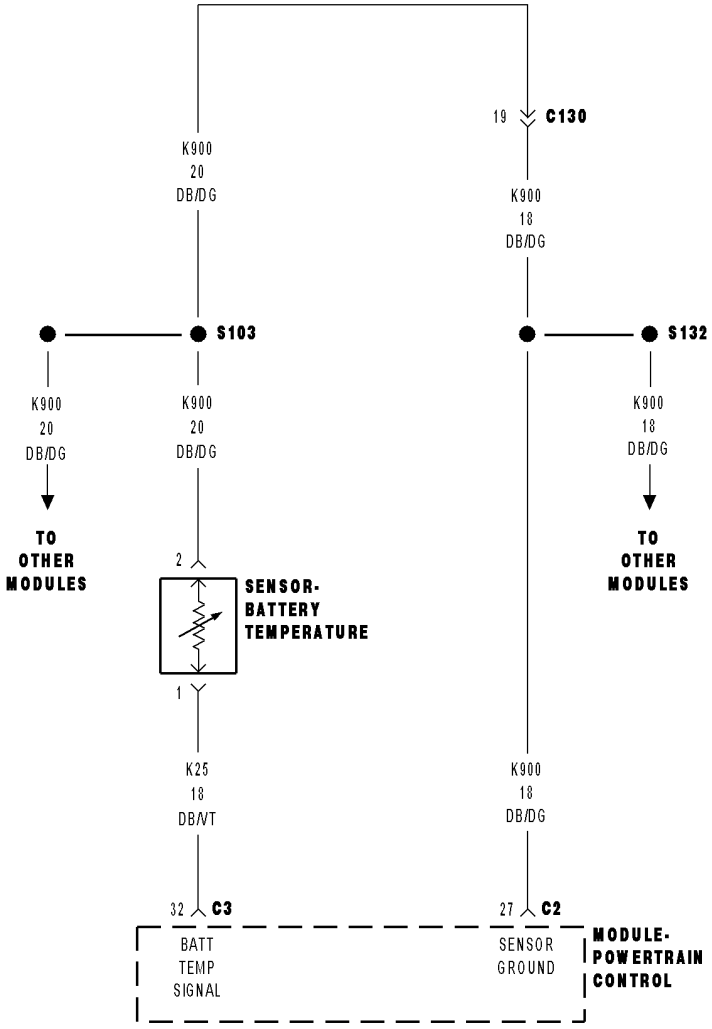
Is the DTC P0513 still active?

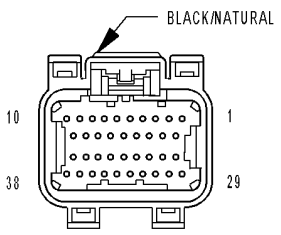
Yes >> Replace the Ignition Key.
Perform SKIM VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete.

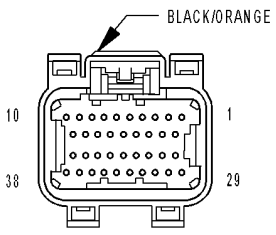
NOTE: If this DTC cannot be reset, it could have been an actual theft attempt.

P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW

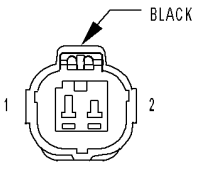




MODULE-
POWERTRAIN
CONTROL C3
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
BATTERY
TEMPERATURE

814544bc

P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Battery temperature sensor voltage below 0.039 of a volt. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO GROUND
(K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
BATTERY TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. BATTERY TEMP SENSOR VOLTAGE BELOW 0.5 OF A VOLT

Ignition on, engine not running.
With the scan tool, monitor Battery Temperature Sensor volts.

Is the voltage below 0.5 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. BATTERY TEMPERATURE SENSOR

Ignition on, engine not running.
With the scan tool, read the Battery Temp Sensor Voltage value.
Disconnect the Battery Temperature Sensor harness connector.

Did the Battery Temperature Voltage value change from below 1.0 volt to above 4.5 volts?

Yes >> Replace the Battery Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0516-BATTERY TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

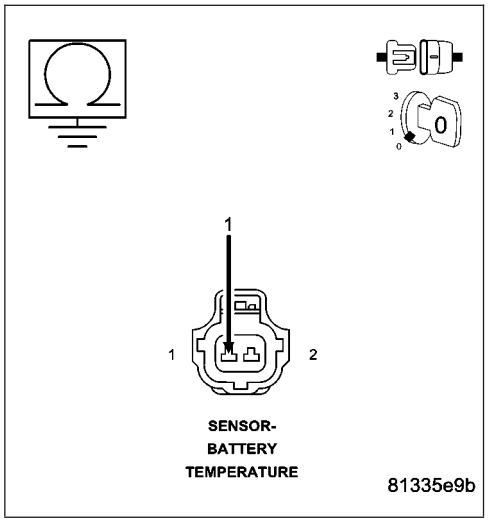
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (K25) Batt Temp Signal circuit in the Battery Temp Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K25) Batt Temp Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



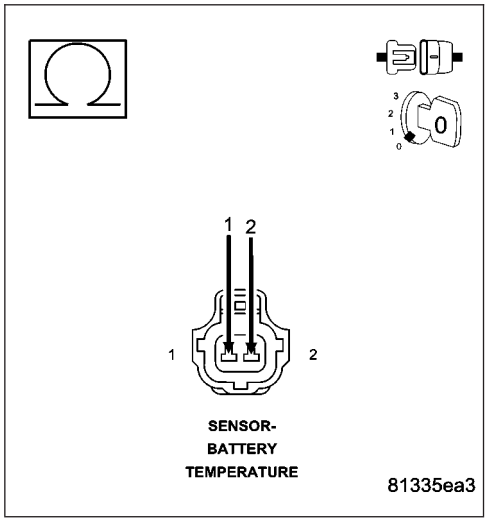
4. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K25) Batt Temp Signal circuit and the (K900) Sensor Ground circuit in the Battery Temp Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor Ground circuit and the (K25) Batt Temp Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

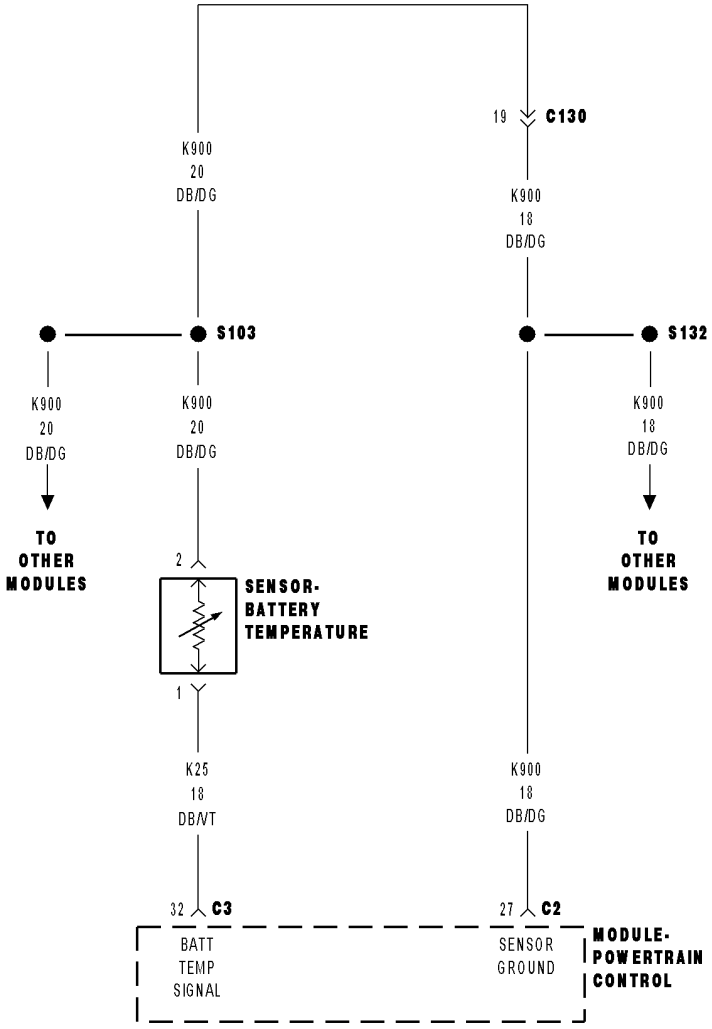
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

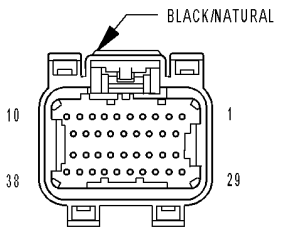
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

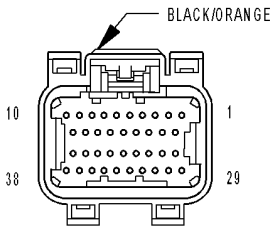
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH

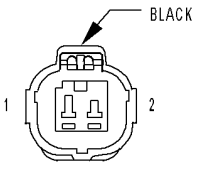




MODULE-
POWERTRAIN
CONTROL C3
(NGC)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
BATTERY
TEMPERATURE

814544bc

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Battery temperature voltage above 4.94 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K25) BATT TEMP SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K25) BATT TEMP SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
BATTERY TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. BATTERY TEMPERATURE SENSOR VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

With a scan tool, monitor the Battery Temperature Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. BATTERY TEMPERATURE SENSOR

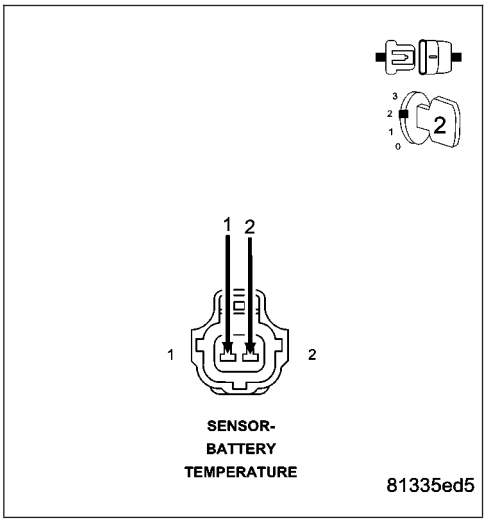
Turn the ignition off.

Disconnect the Battery Temperature Sensor harness connector.

Ignition on, engine not running.

With the scan tool, read the Battery Temp Voltage value.

Connect a jumper wire between the (K25) Batt Temp Signal circuit and the (K900) Sensor Ground circuit in the Battery Temp Sensor harness connector.



Did the Battery Temp voltage value change from greater than 4.5 volts to less than 1.0 volt with the jumper wire installed?

Yes >> Replace the Battery Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

3. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

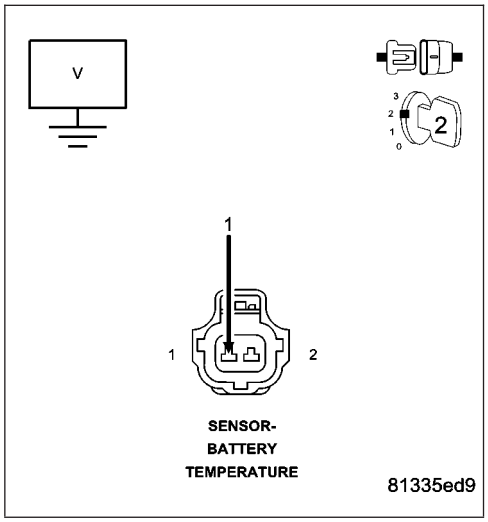
Disconnect the C2 and C3 PCM harness connectors.

Measure the voltage on the (K25) Batt Temp Signal circuit in the Battery Temp Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (K25) Batt Temp Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K25) BATT TEMP SIGNAL CIRCUIT OPEN

Turn the ignition off.

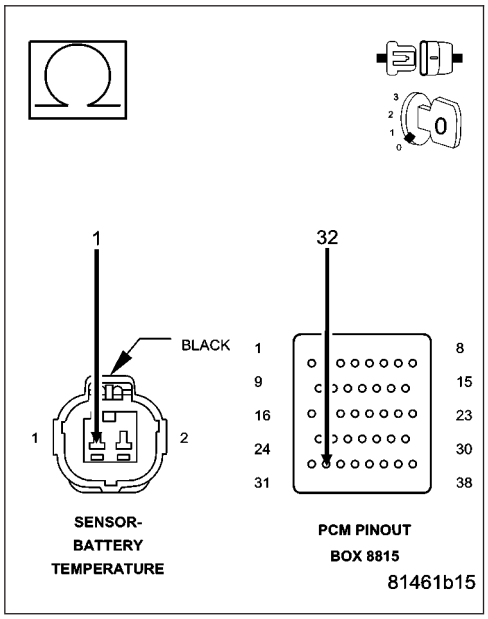
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K25) Batt Temp Signal circuit from the Battery Temp Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

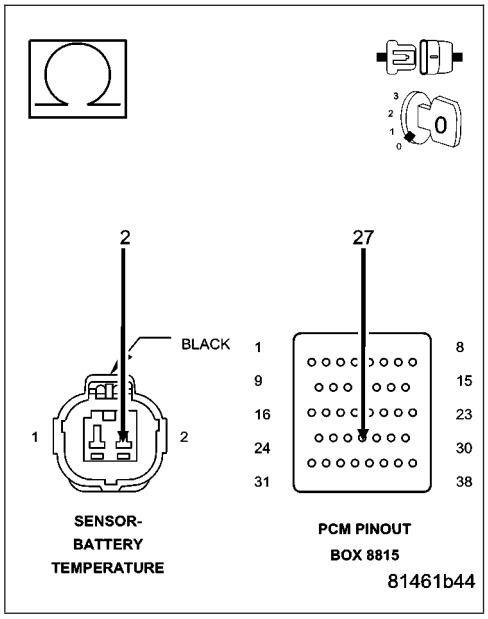
No >> Repair the open in the (K25) Batt Temp Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0517-BATTERY TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance in the (K900) Sensor Ground circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

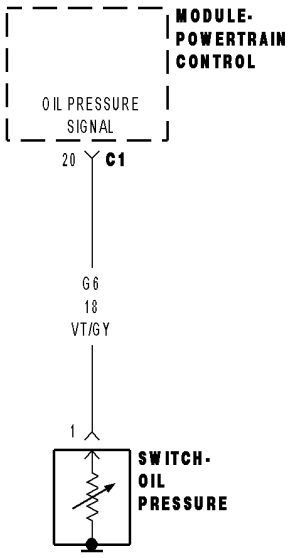
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

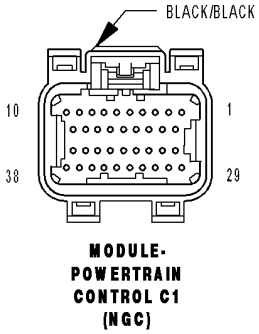
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

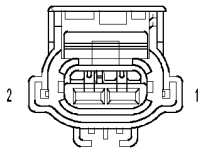
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0522-OIL PRESSURE TOO LOW





MODULE-
POWERTRAIN
CONTROL C1
(NGC)



SWITCH-OIL
PRESSURE

814544e9

P0522-OIL PRESSURE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and battery voltage above 10.4 volts.
- **Set Condition:**
  The oil pressure sensor voltage at PCM goes below 0.1 of a volt for 0.5 of a second. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(G6) OIL PRESSURE SIGNAL CIRCUIT OPEN
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
OIL PRESSURE SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0522-OIL PRESSURE TOO LOW (CONTINUED)

2. OIL PRESSURE SWITCH

Turn the ignition off.

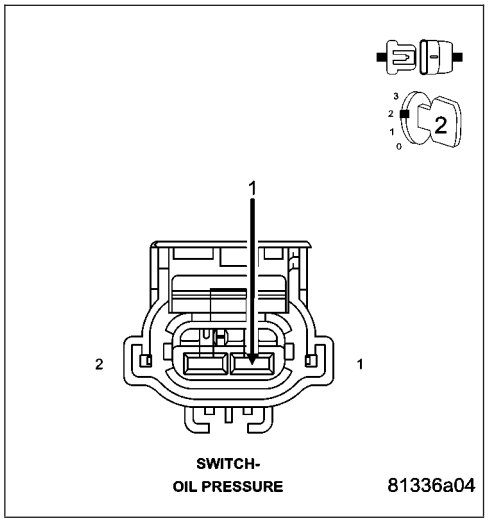
Disconnect the Oil Pressure Switch harness connector.

Ignition on, engine not running.

Connect a jumper wire to the (G6) Oil Pressure Signal circuit in the Sensor harness connector.

With the scan tool monitor the Oil Pressure Switch state.

Touch the other end of the jumper wire to a known good Ground several times.



Did the Oil Pressure Switch state change from High to Low when connecting and disconnecting the jumper wire to ground?

Yes >> Replace the Oil Pressure Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

---

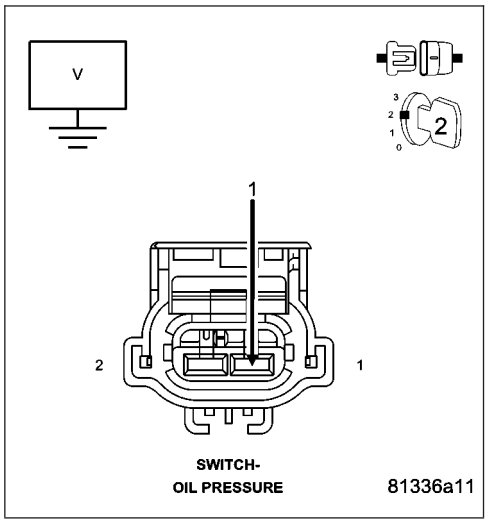
3. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (G6) Oil Pressure Signal circuit in the Switch harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage on the (G6) Oil Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0522-OIL PRESSURE TOO LOW (CONTINUED)

4. (G6) OIL PRESSURE SWITCH SIGNAL CIRCUIT OPEN

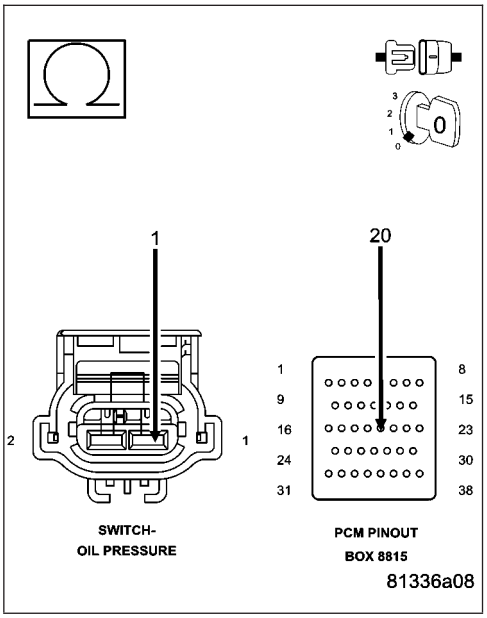
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (G6) Oil Pressure Signal circuit from the Oil Pressure Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (G6) Oil Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



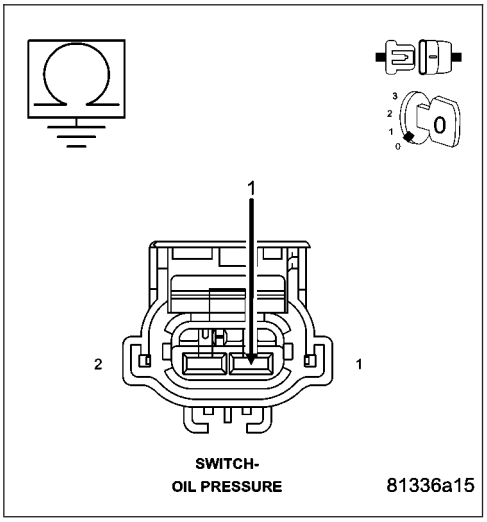
5. (G6) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (G6) Oil Pressure Signal circuit in the Switch connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G6) Oil Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0522-OIL PRESSURE TOO LOW (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

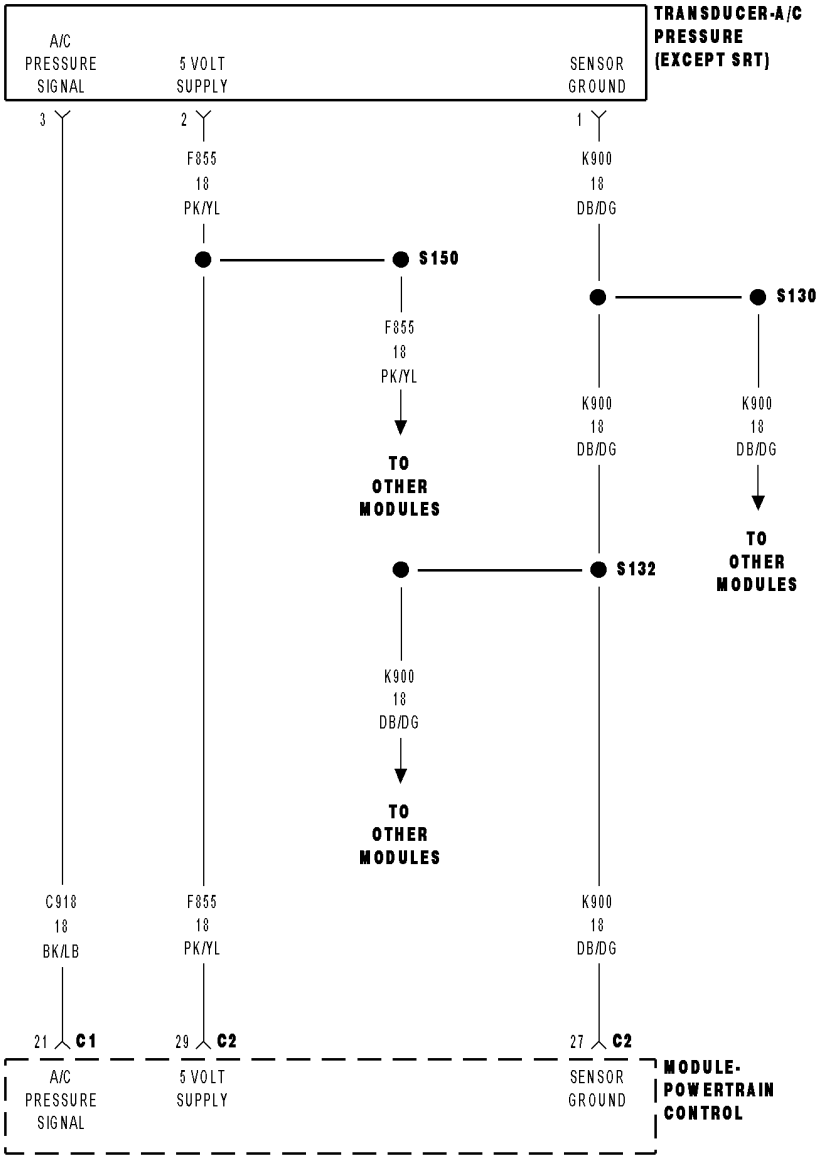
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

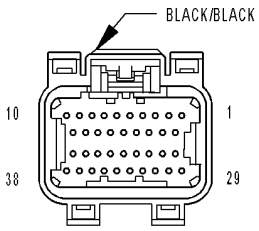
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

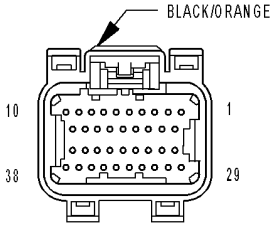
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0532-A/C PRESSURE SENSOR CIRCUIT LOW

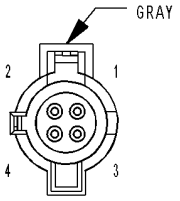




MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



TRANSDUCER-A/C PRESSURE (EXCEPT SRT)

81454504

P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running, AC is learned, and AC Clutch Relay energized.
- **Set Condition:**
  The A/C pressure transducer signal voltage at the PCM goes below 0.58 of a volt for 2.6 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
A/C PRESSURE TRANSDUCER
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C PRESSURE TRANSDUCER VOLTAGE BELOW 0.6 OF A VOLT

NOTE: Make sure the A/C refrigerant System is properly charged per Service Information.

Start the engine.

With a scan tool, read the A/C Pressure Sensor voltage.

Is the voltage below 0.6 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

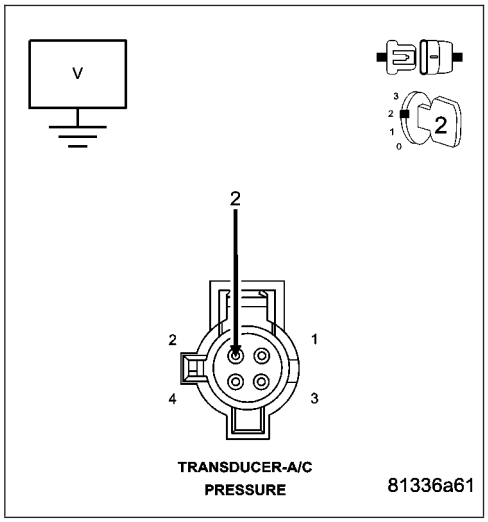
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

3. A/C PRESSURE TRANSDUCER

With the scan tool, monitor the A/C Pressure Transducer voltage.

Is the voltage above 0.6 of a volt?

Yes >> Replace the A/C Pressure Transducer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

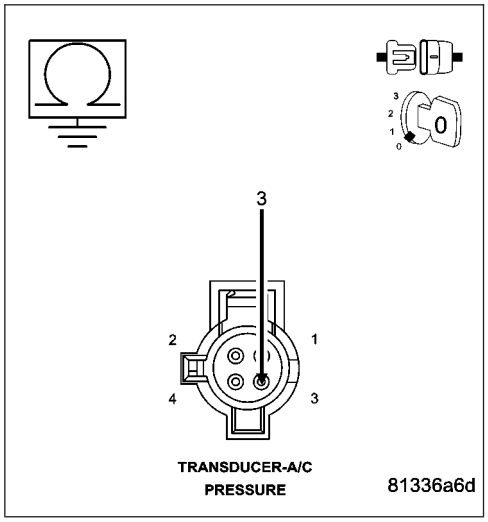
---

4. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (C918) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

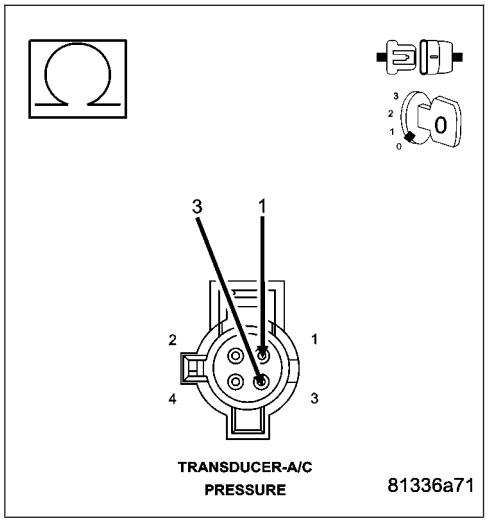
No >> Go To 5

---

5. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Disconnect the C2 PCM harness connector.

Measure the resistance between the (C918) A/C Pressure Signal circuit and the (K900) Sensor Ground circuit in the A/C Pressure Transducer harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor Ground circuit and the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

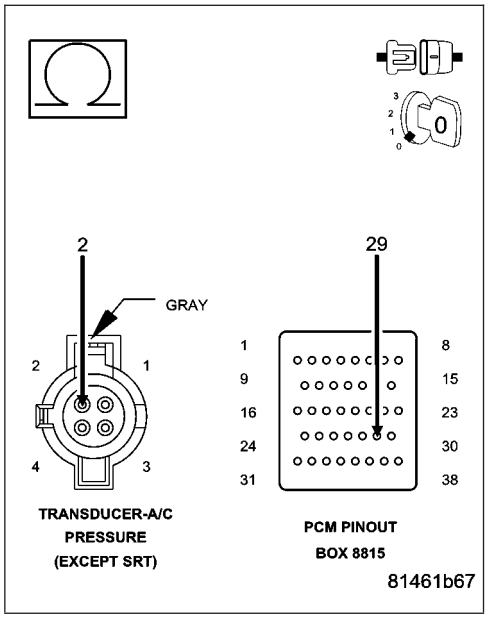
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the A/C Pressure Transducer harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



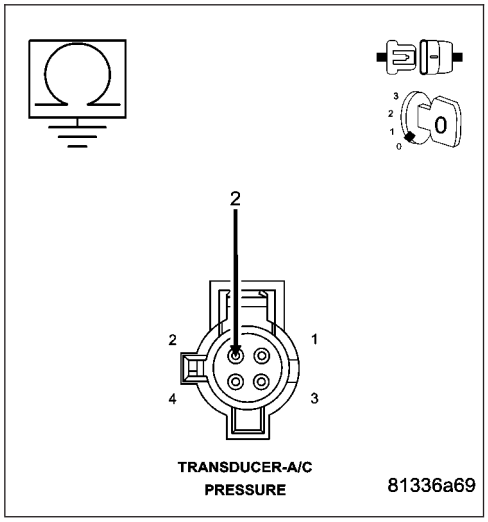
7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0532-A/C PRESSURE SENSOR CIRCUIT LOW (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

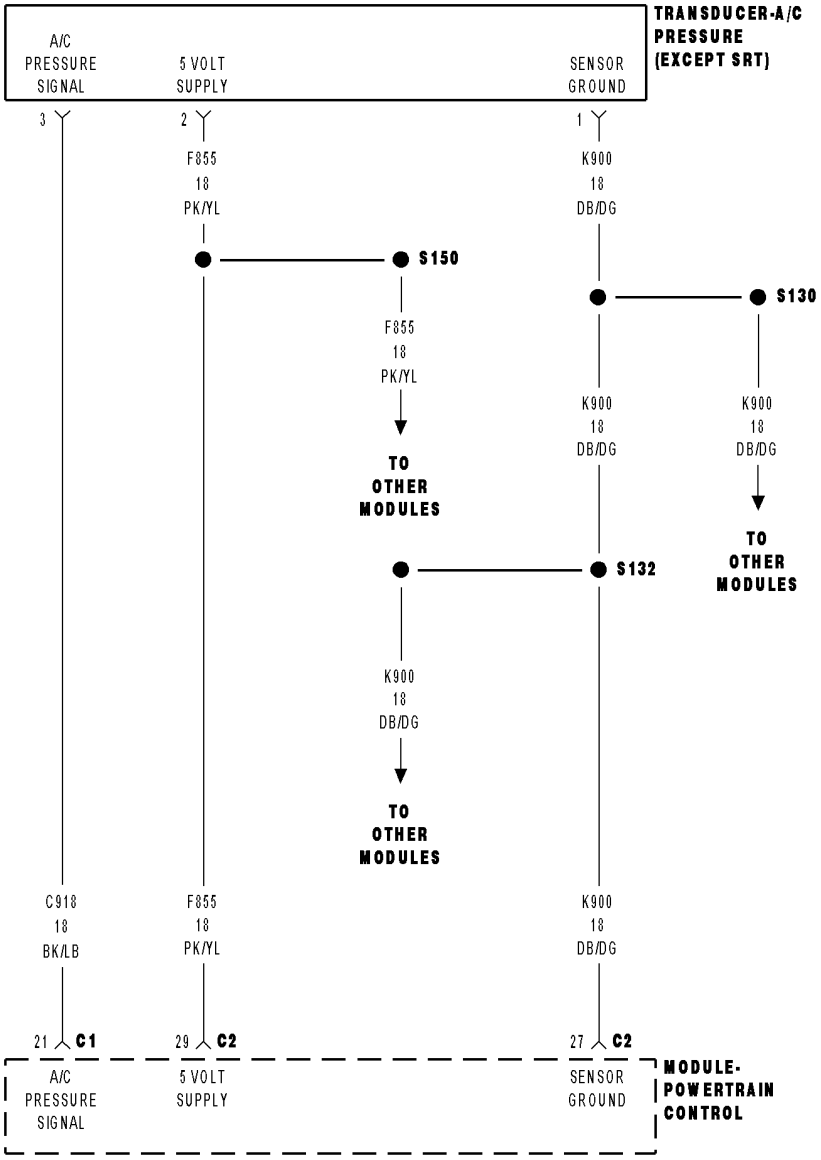
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

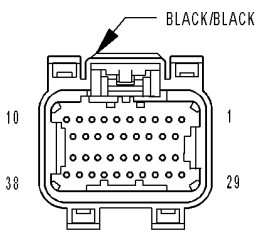
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

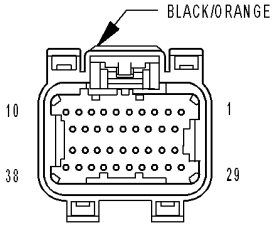
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH

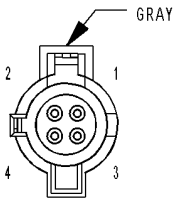




MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



TRANSDUCER-A/C PRESSURE (EXCEPT SRT)

81454504

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and the A/C Clutch Relay energized.
- **Set Condition:**
  The A/C pressure transducer signal at the PCM goes above 4.92 volts. One trip Fault. Three good trips to turn off the MIL.

Possible Causes
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(C918) A/C PRESSURE SIGNAL CIRCUIT OPEN
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
A/C PRESSURE TRANSDUCER
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C PRESSURE TRANSDUCER VOLTAGE ABOVE 4.9 VOLTS

NOTE: Make sure the A/C refrigerant system is properly charged per Service Information.
Start the engine.
With a scan tool, read the A/C Pressure Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

2. A/C PRESSURE TRANSDUCER

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Connect a jumper wire between the (C918) A/C Pressure Signal circuit and the (K900) Sensor Ground circuit in the Transducer harness connector.

Ignition on, engine not running.

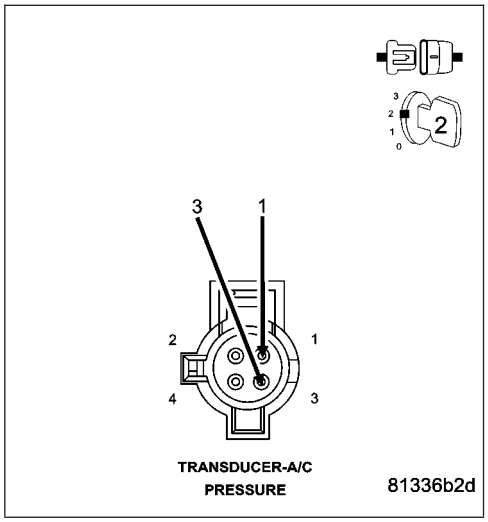
With the scan tool, monitor the A/C Pressure Transducer voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the A/C Pressure Transducer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

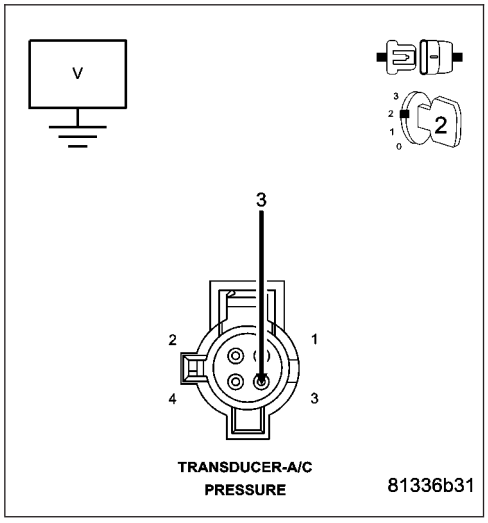
Ignition on, engine not running.

Measure the voltage on the (C918) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (C918) A/C PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off.

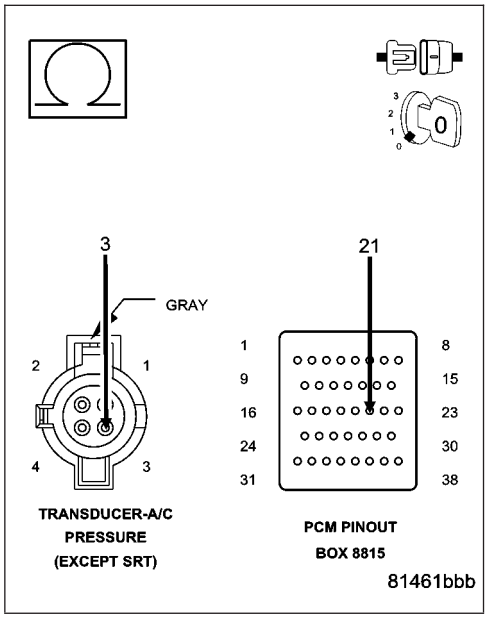
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (C918) A/C Pressure Signal circuit from the A/C Pressure Transducer harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (C918) A/C Pressure Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



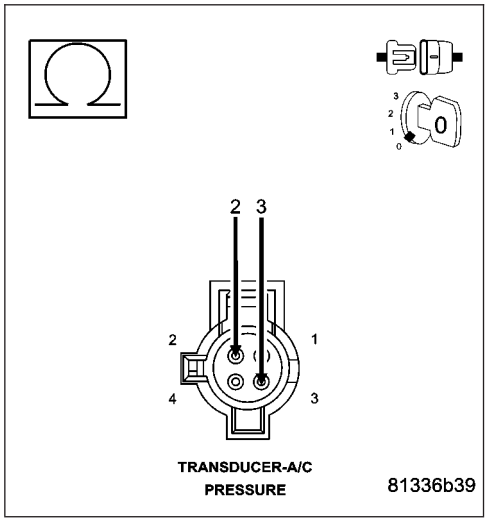
5. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (C918) A/C Pressure Signal circuit and the (F855) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



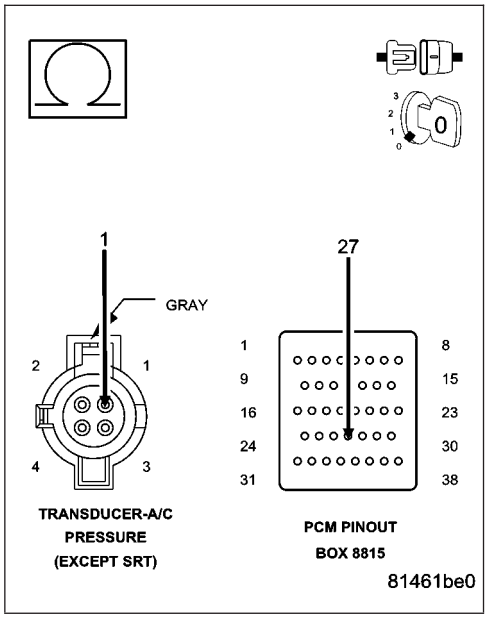
P0533-A/C PRESSURE SENSOR CIRCUIT HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor Ground circuit from the A/C Pressure Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

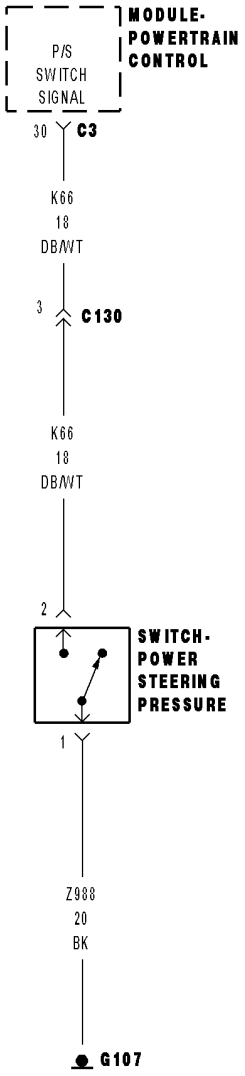
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

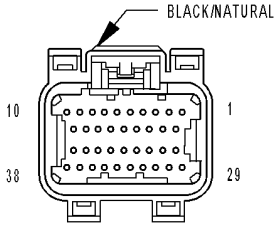
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

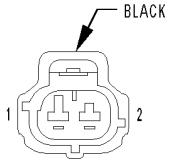
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0551-POWER STEERING PRESSURE SWITCH PERFORMANCE





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-POWER
STEERING PRESSURE
(NGC)

81454524

P0551-POWER STEERING PRESSURE SWITCH PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The power steering switch is used to enable quick spark and fuel corrections for high power steering loads to maintain target idle speed. The power steering switch rationality monitors the switch input during high vehicle speed conditions when the steering wheel cannot be turned far enough to reach the high-pressure switch point. If the power steering switch input remains at a high-pressure condition at high vehicle speeds, a failure timer will increment.

- **When Monitored:**
  With the ignition key on and engine running.
- **Set Condition:**
  With the vehicle above 40 mph for over 30 seconds, the power steering pressure switch remains open. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K66) P/S SWITCH SIGNAL CIRCUIT OPEN
(K66) P/S SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(Z988) GROUND CIRCUIT OPEN
POWER STEERING PRESSURE SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0551-POWER STEERING PRESSURE SWITCH PERFORMANCE (CONTINUED)

2. POWER STEERING PRESSURE SWITCH

Turn the ignition off.

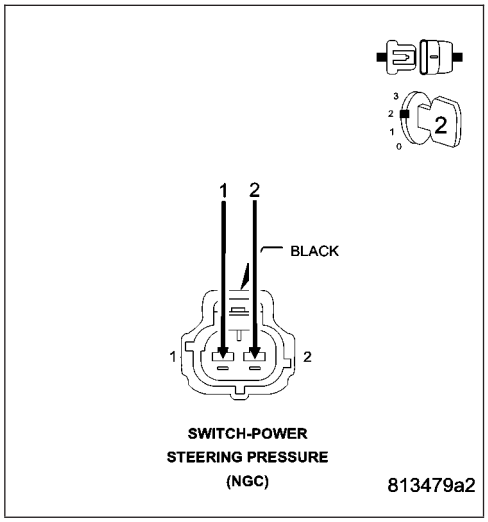
Disconnect the Power Steering Pressure Switch harness connector.

Ignition on, engine not running.

Connect a jumper wire to the (K66) P/S Switch Signal circuit at the harness connector.

Use the scan tool to monitor the Power Steering Pressure Switch status.

Touch the other end of the jumper wire to the (Z988) Ground circuit at the Power Steering Pressure Switch harness connector several times.



Did the Power Steering Pressure Switch status change from High to Low when connecting and disconnecting the jumper wire?

Yes >> Replace the Power Steering Pressure Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

---

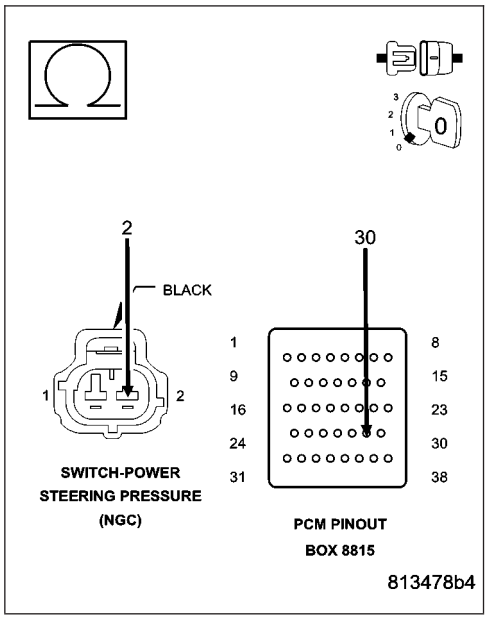
3. (K66) P/S SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure resistance of (K66) P/S Switch Signal circuit from the Power Steering Pressure Switch harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

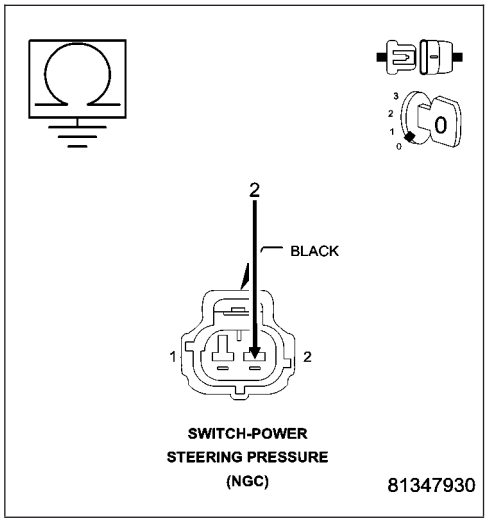
Yes >> Go To 4

No >> Repair the open in the (K66) P/S Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0551-POWER STEERING PRESSURE SWITCH PERFORMANCE (CONTINUED)

4. (K66) P/S SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K66) P/S Switch Signal circuit in the Switch connector.



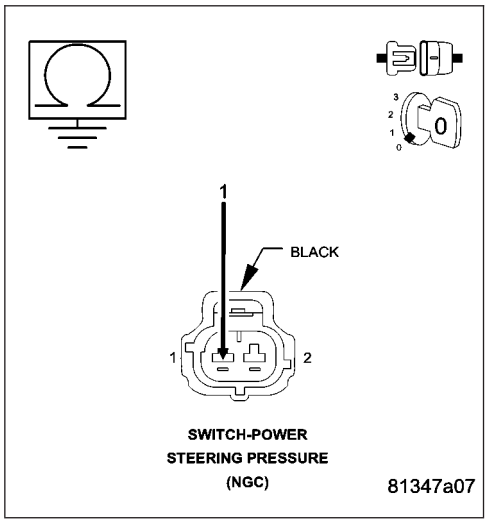
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K66) P/S Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (Z988) GROUND CIRCUIT OPEN

Measure the resistance between Ground and the (Z988) Ground circuit in the Power Steering Pressure Switch connector.



Is the resistance below 100 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z988) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

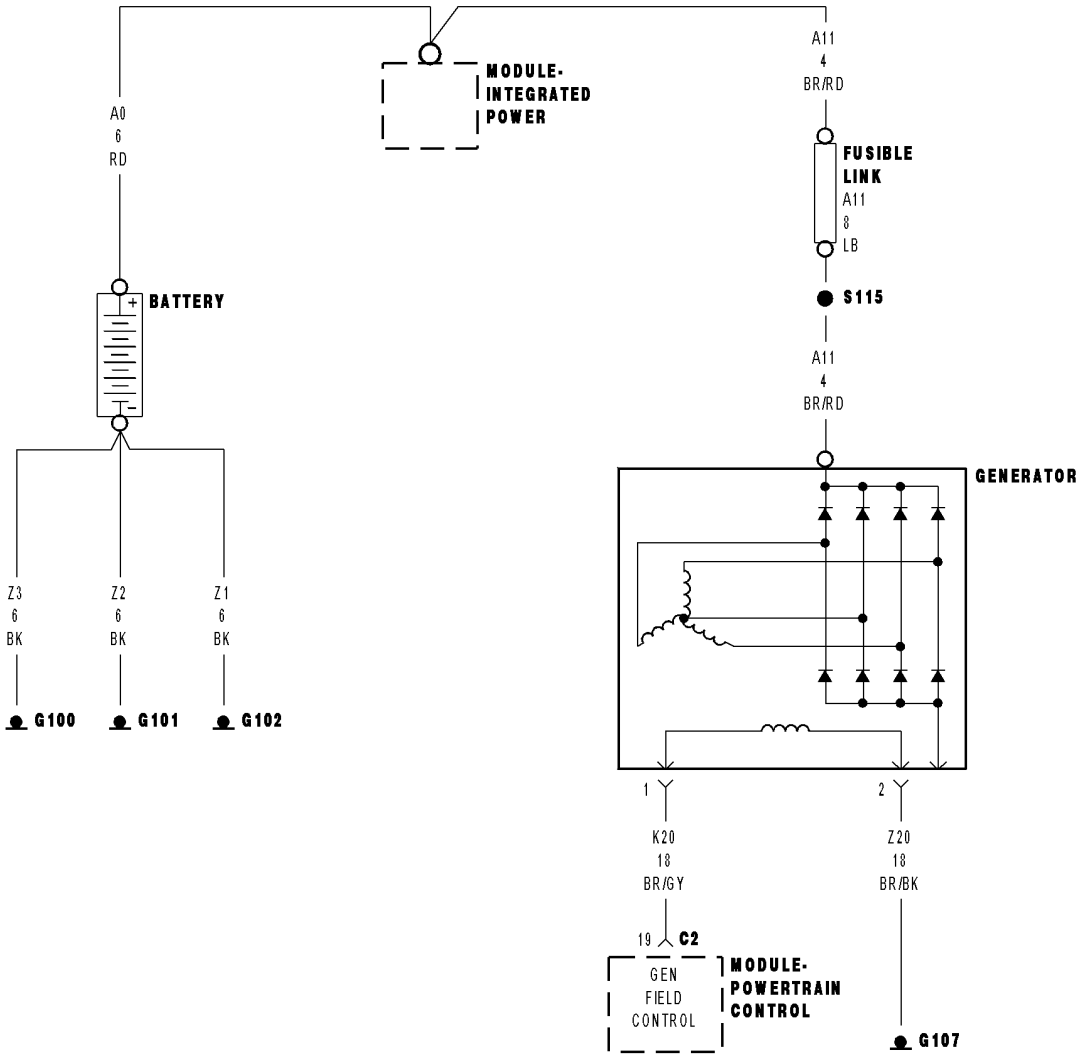
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

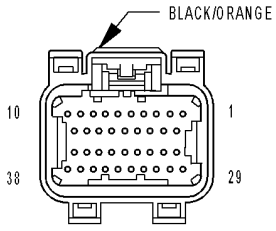
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

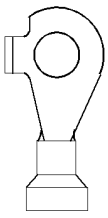
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0562-BATTERY VOLTAGE LOW

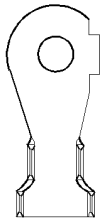




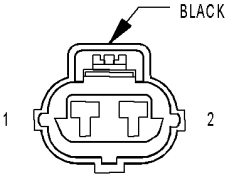
MODULE-
POWERTRAIN
CONTROL C2
(NGC)



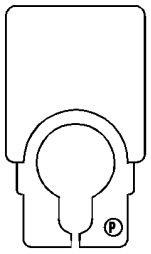
GENERATOR
(5.7L)



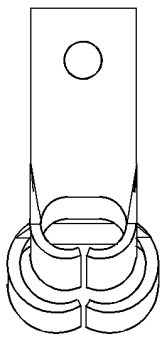
GENERATOR
(DIESEL/3.7L/4.7L/SRT)



GENERATOR
(EXCEPT SRT)



BATTERY-
POSITIVE
(3.7L/4.7L)



BATTERY
POSITIVE
(5.7L EXCEPT OFF ROAD/SRT)

81454554

P0562-BATTERY VOLTAGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1000 RPM.
- **Set Condition:**
  Battery voltage is 1 volt less than desired voltage for a set period of time. One Trip Fault. ETC light is flashing.

Possible Causes
RESISTANCE IN THE (A11) BATTERY POSITIVE CIRCUIT
RESISTANCE IN THE GENERATOR CASE GROUND
GENERATOR OPERATION
(K20) GENERATOR FIELD CONTROL CIRCUIT OPEN
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GROUND CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.
Turn the ignition off.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If an open fuse is found, use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.
Ignition on, engine not running.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0562-BATTERY VOLTAGE LOW (CONTINUED)

2. (A11) B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

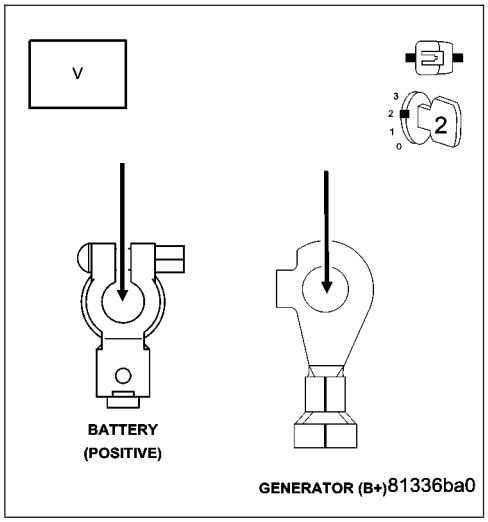
NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the (A11) B+ Terminal at the Generator and the Battery + Post.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the (A11) B+ circuit between the Generator and Battery.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. GENERATOR CASE GROUND HIGH RESISTANCE

Ignition on, engine not running.

Start the engine.

Allow the engine to reach normal operating temperature.

NOTE: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator case and Battery ground post.

Is the voltage above 0.1 of a volt?

Yes >> Repair excessive resistance in the Generator Ground between the Generator Case and Battery ground side.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

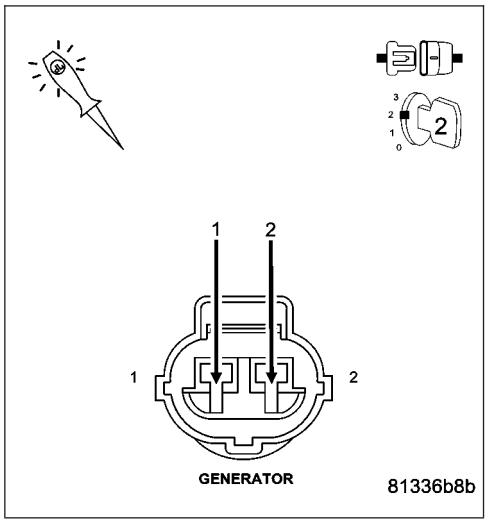
Ignition on, engine not running.

With the scan tool, actuate the Gen Field Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0562-BATTERY VOLTAGE LOW (CONTINUED)

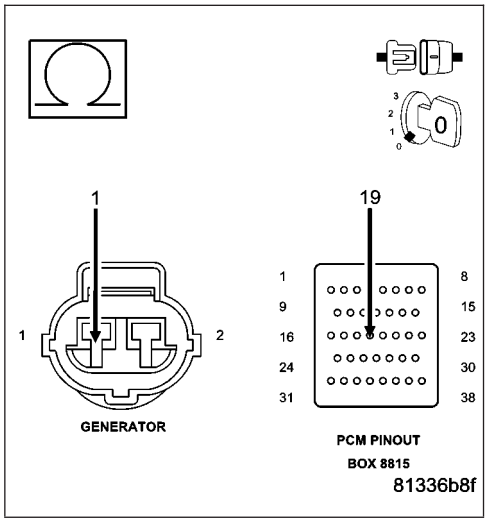
5. (K20) GENERATOR FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator harness connector to the appropriate terminal of the special tool #8815.



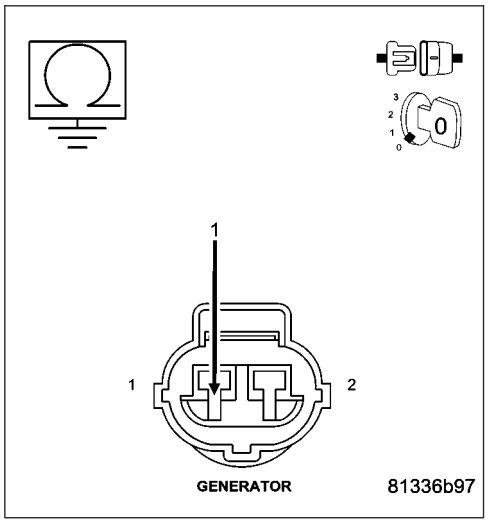
Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the resistance below 100 ohms?

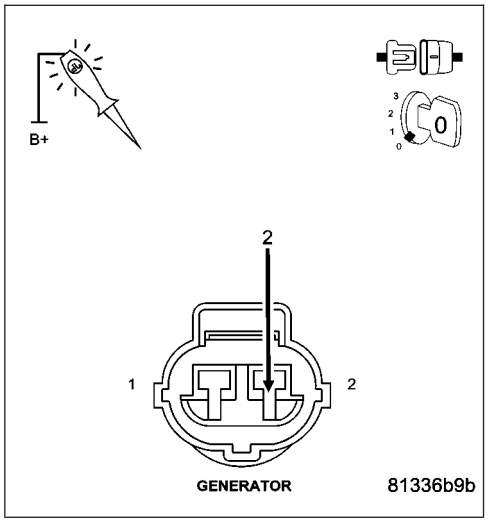
Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0562-BATTERY VOLTAGE LOW (CONTINUED)

7. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, probe the (Z20) Ground circuit in the Generator Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 8

No >> Repair the open in the (Z20) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

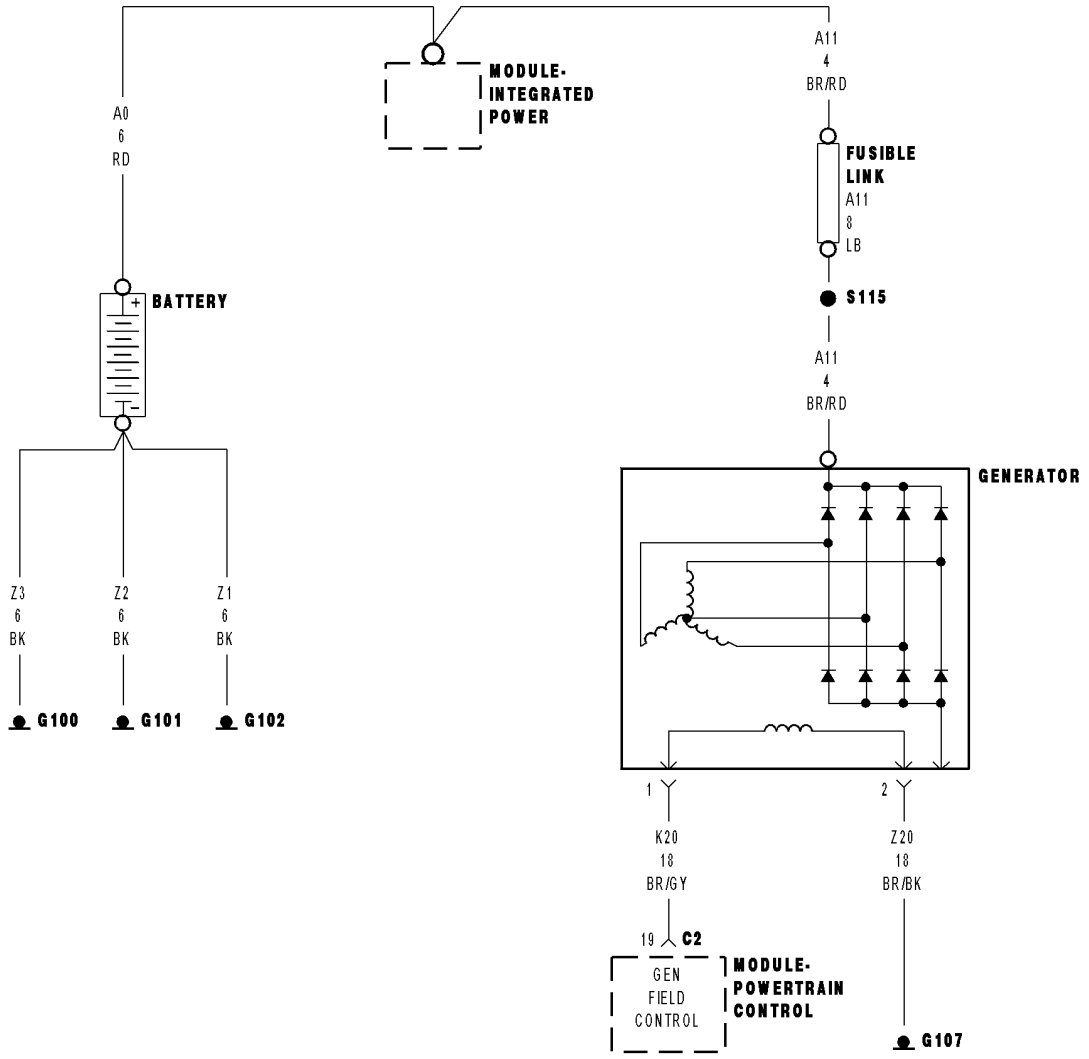
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

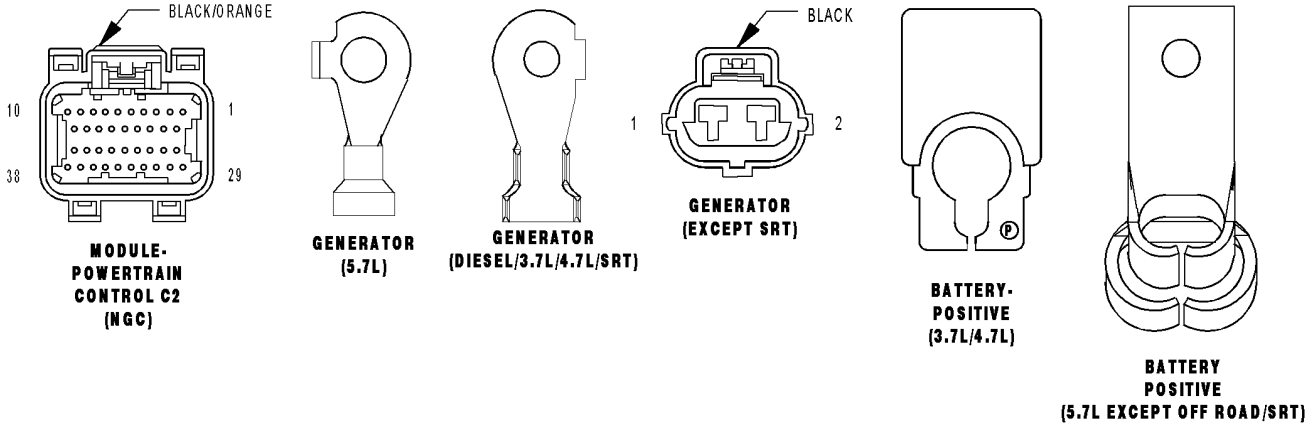
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0563-BATTERY VOLTAGE HIGH





81454554

P0563-BATTERY VOLTAGE HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine RPM greater than 1000 RPM. With no other charging system codes set.
- **Set Condition:**
  Battery voltage is 1 volt greater than desired voltage for more than 10 seconds. Battery voltage greater than 15.75 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Battery is in good condition. Using the Midtronics Battery Tester, test the Battery before continuing.

NOTE: Inspect the vehicle for after market accessories that may exceed the Generator System output.
Turn the ignition off.

NOTE: Make sure the generator drive belt is in good operating condition.

NOTE: Inspect the fuses in the IPM. If a fuse is open use the wire diagram/schematic as a guide, inspect the wiring and connectors for damage.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0563-BATTERY VOLTAGE HIGH (CONTINUED)

2. GENERATOR OPERATION

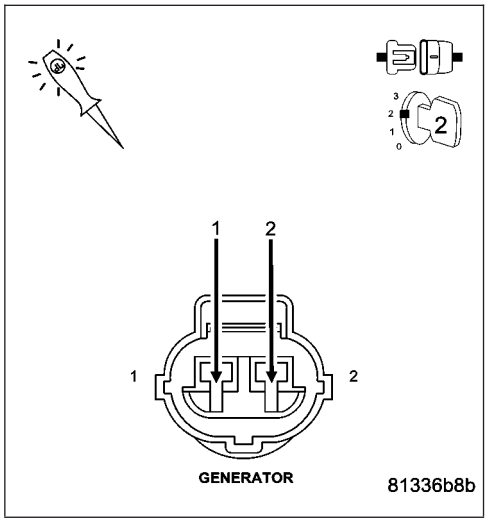
Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

Ignition on, engine not running.

With the scan tool, actuate the Generator Field Driver.



Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

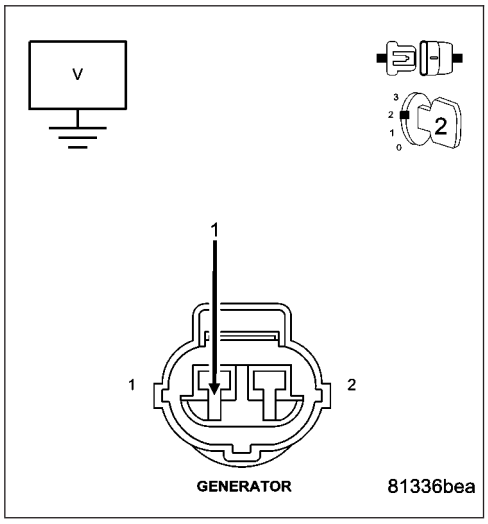
3. (K20) FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit at the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

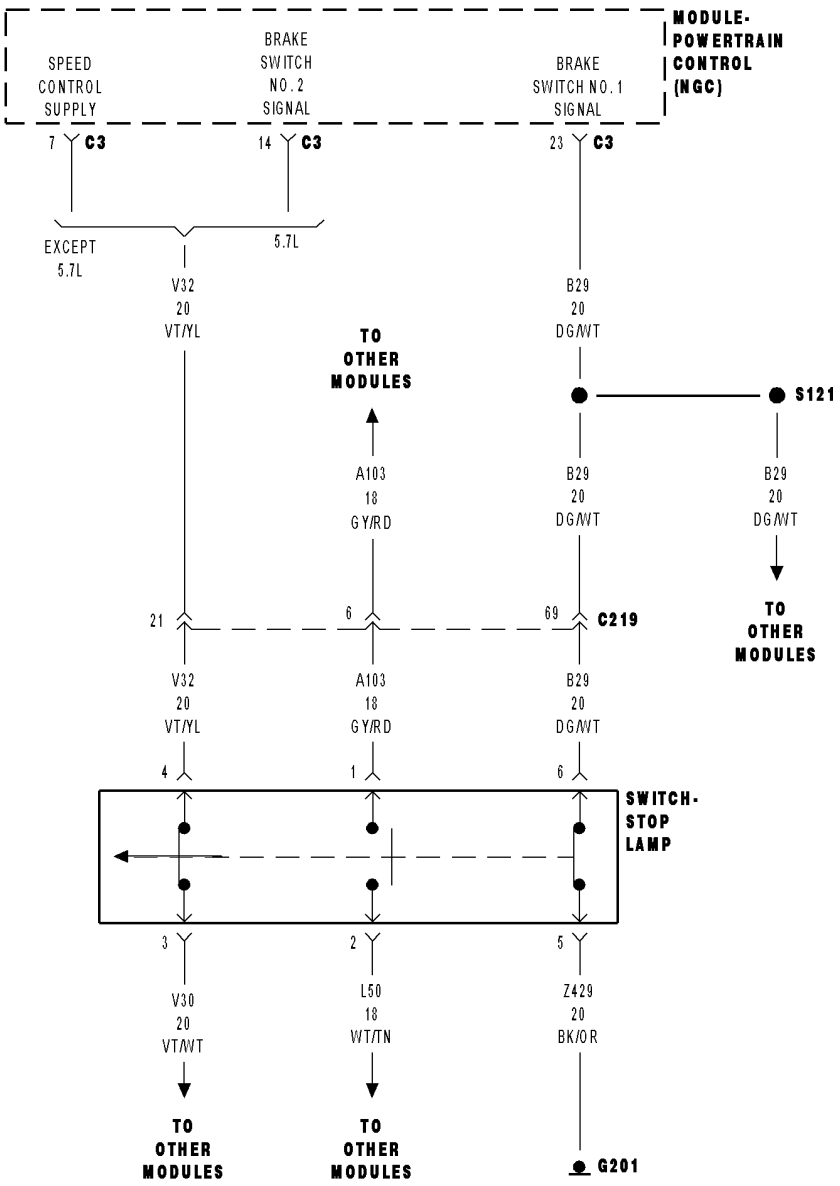
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

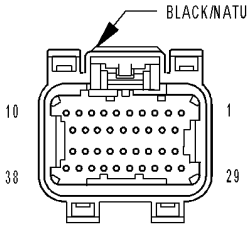
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

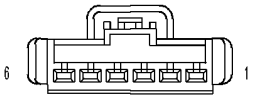
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0571-BRAKE SWITCH 1 PERFORMANCE





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P0571-BRAKE SWITCH 1 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The brake switch rationality checks both failure modes of the brake switch. The brake switch stuck on test checks for a high vehicle speed condition where the brake switch is unexpectedly depressed. The brake switch stuck off test checks for repeated vehicle stop maneuvers without the brake switch depressed.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  If the output of Brake Switch No.1 to the PCM looks like it is not applied, while Brake Lamp Switch Output circuit is applied the fault will mature in 60ms. Two Trip Fault.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL SHORTED TO GROUND
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(Z429) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is properly adjusted before continuing.

NOTE: Make sure the Stop Lamp Switch is properly wired, such as (B29) Brake Switch No.1 and (L50) Brake Lamp Switch Output circuit are not switched at the harness connector.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0571-BRAKE SWITCH 1 PERFORMANCE (CONTINUED)

2. (B29) BRAKE SWITCH NO.1 SIGNAL SHORTED TO GROUND

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Disconnect the C3 PCM harness connector.

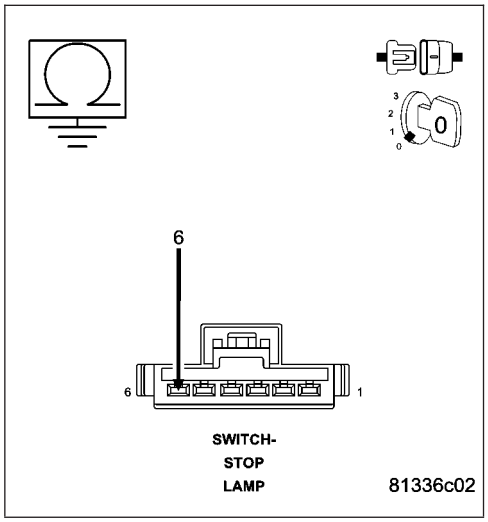
Measure the resistance between ground and the (B29) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B29) Brake Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

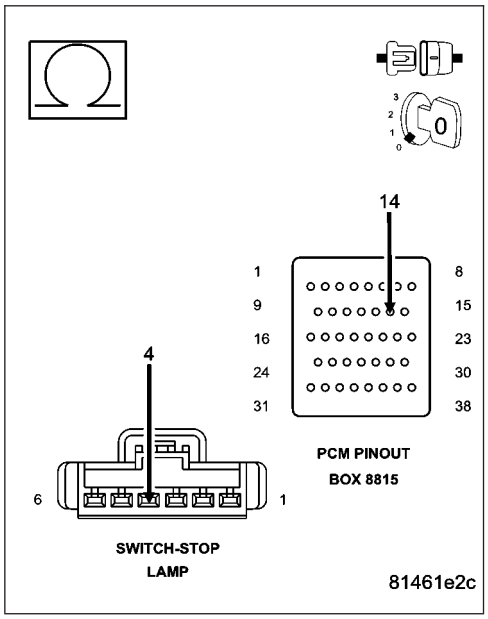
Measure the resistance of the (V32) Brake Switch No.2 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (V32) Brake Switch No.2 Signal circuit.

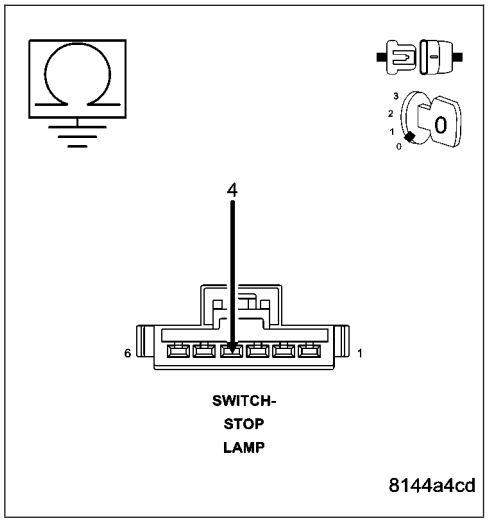
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0571-BRAKE SWITCH 1 PERFORMANCE (CONTINUED)

4. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) Brake Switch No.2 Signal circuit in the Stop Lamp Switch harness connector.



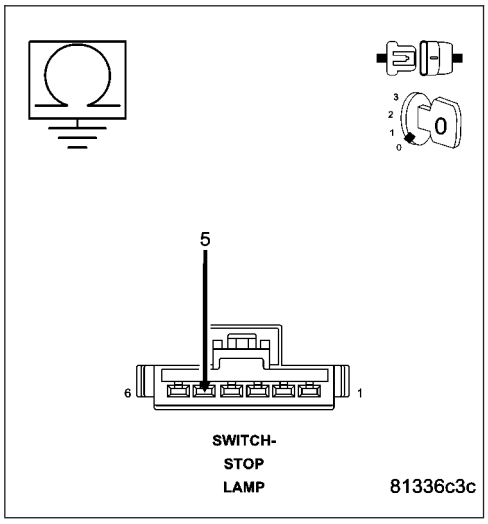
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) Brake Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (Z429) GROUND CIRCUIT OPEN

Measure the resistance between ground and the (Z429) Ground circuit in the Stop Lamp Switch harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z429) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. STOP LAMP SWITCH

Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

Next, measure the resistance between the (V30) Fused Igniton Switch circuit terminal and the (V32) Brake Switch No.2 Signal circuit terminal in the Stop Lamp Switch.

Apply and release the brake pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit for one or both of the measurements taken?

Yes >> Go To 7

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0571-BRAKE SWITCH 1 PERFORMANCE (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

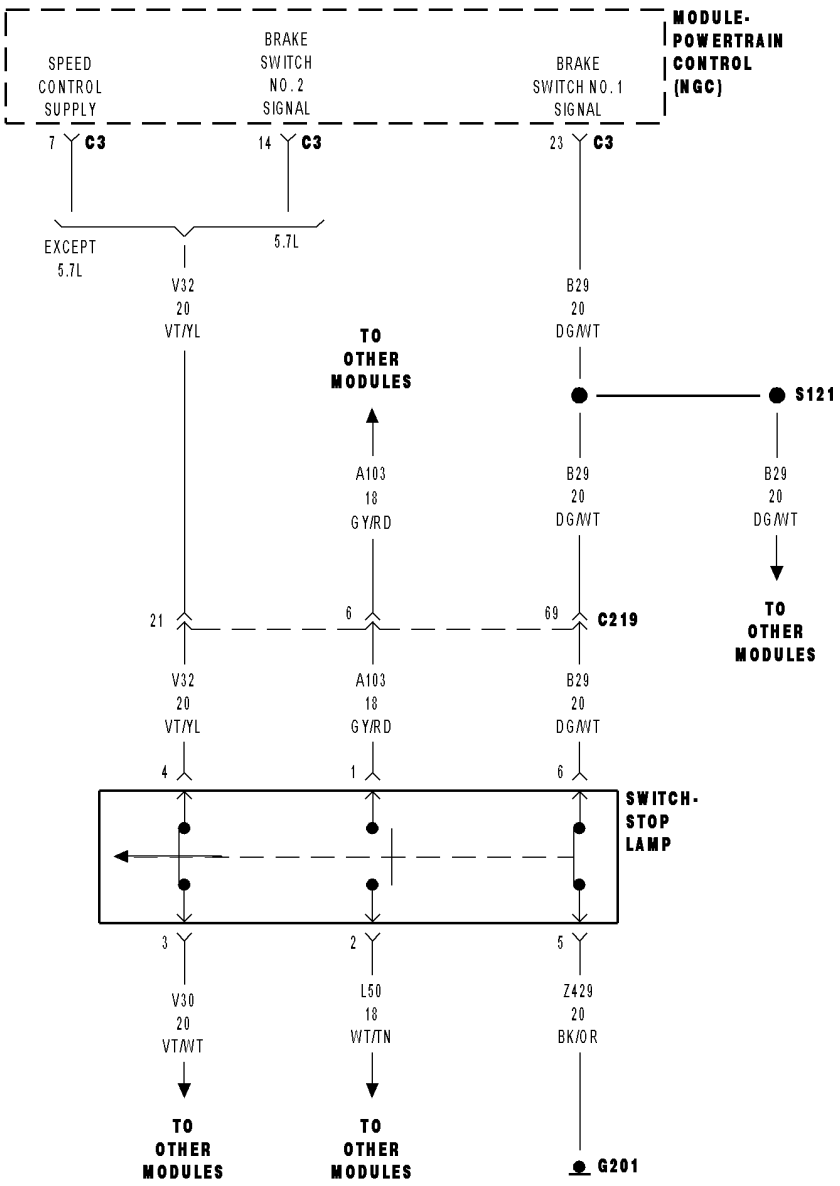
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

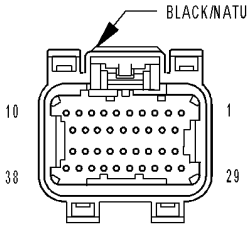
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

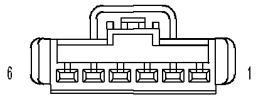
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0572-BRAKE SWITCH 1 STUCK ON





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is mechanically stuck in the low/on position. Two Trip Fault. Three Global Good Trips to Clear.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN (5.7L ONLY)
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Verify battery voltage is greater than 10 volts.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. STOP LAMP SWITCH

Turn the ignition off.

Remove the Stop Lamp Switch and disconnect the harness connector.

Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

Measure the resistance between the (V30) Fused Ignition Switch circuit terminal and the (V32) Brake Switch No.2 Signal terminal in the Stop Lamp Switch.

Apply and release the stop lamp switch plunger while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

3. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

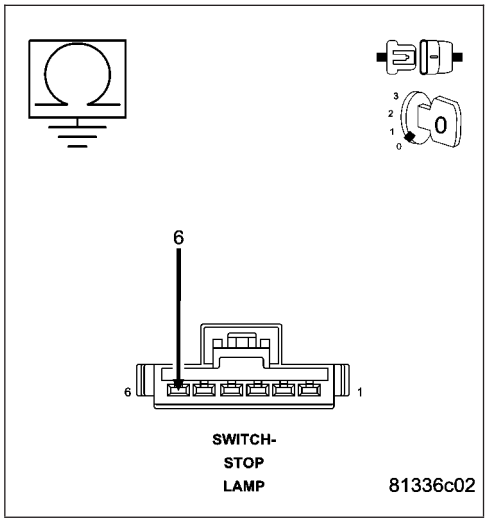
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (B29) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B29) Brake Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN

NOTE: If this vehicle is equipped with a 3.7L or 4.7L engine, answer YES to this test and continue to the next step.

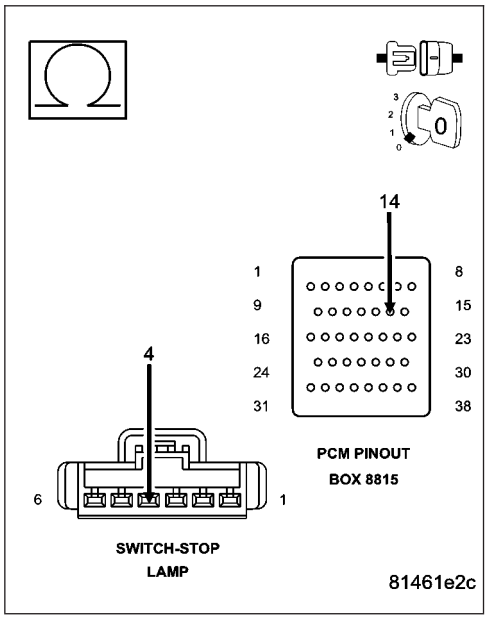
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) Brake Switch No.2 Signal Output circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (V32) Brake Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0572-BRAKE SWITCH 1 STUCK ON (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

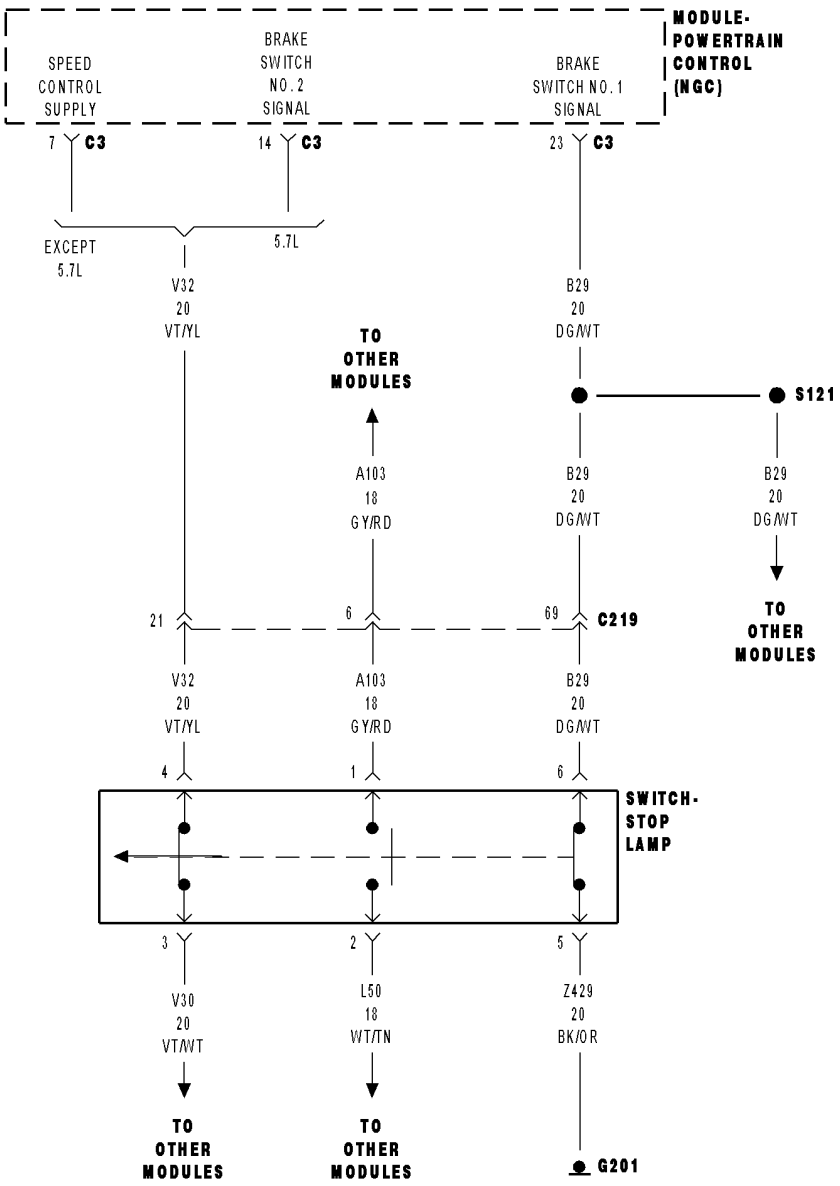
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

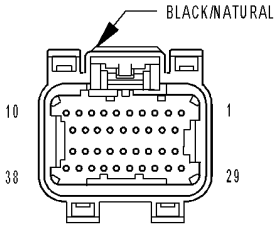
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

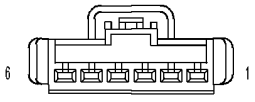
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0573-BRAKE SWITCH 1 STUCK OFF





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.1 is stuck in the high/off position. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND (5.7L ONLY)
(Z429) GROUND CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. STOP LAMP SWITCH

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal circuit terminal in the Stop Lamp Switch.

Apply and release the Stop Lamp Switch while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

3. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

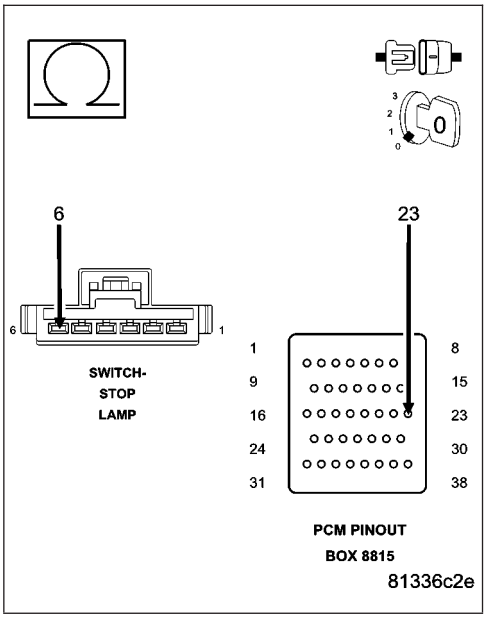
Measure the resistance of the (B29) Brake Switch No.1 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (B29) Brake Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

NOTE: If this vehicle is equipped with a 3.7L or 4.7L engine, answer NO to this test and continue on to the next step.

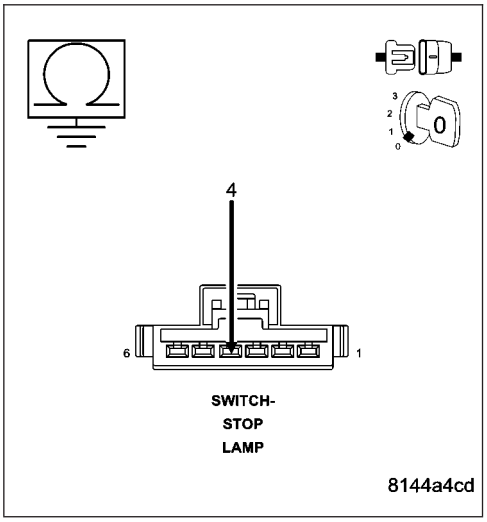
Measure the resistance between ground and the (L50) Brake Lamp Switch Output circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) Brake Switch No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

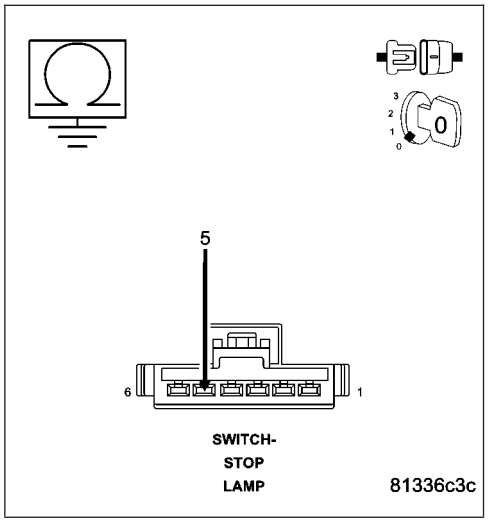
No >> Go To 5



P0573-BRAKE SWITCH 1 STUCK OFF (CONTINUED)

5. (Z429) GROUND CIRCUIT OPEN

Measure the resistance between the (Z429) Ground circuit and ground in the Stop Lamp Switch harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z429) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

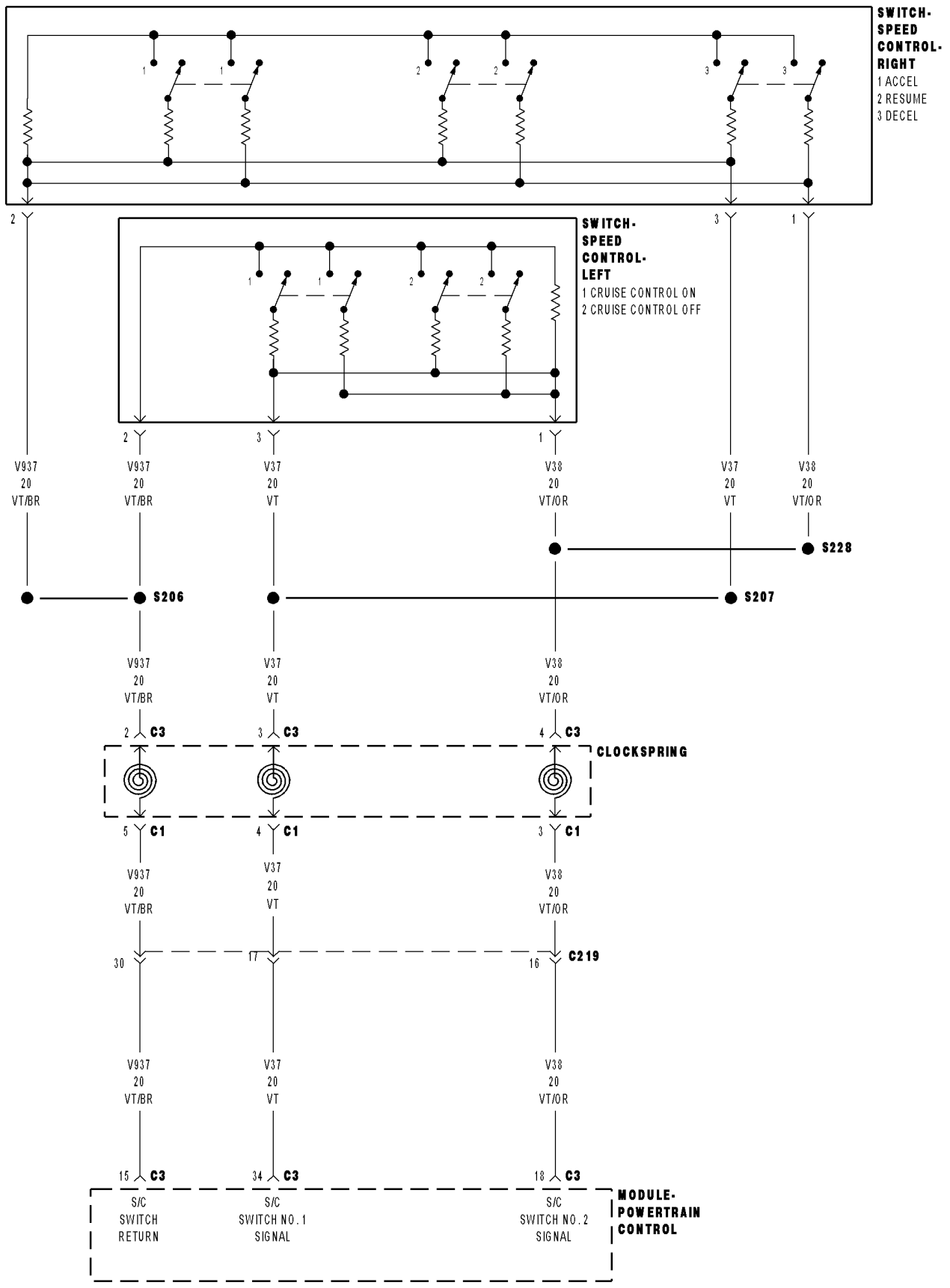
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L)



P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Cruise switch voltage output is not out of range but it does not equal any of the values for any of the button positions.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN
(V937) SWITCH RETURN CIRCUIT OPEN
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT
CLOCKSPRING
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH STATUS

Start the engine.
With a scan tool, monitor each which function for the Speed Control Switches.
Notice the voltage reading when no buttons are pressed.
Press and release each Speed Control Button.
- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

Does each switch function change status when pressing and then depressing each switch?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

2. SPEED CONTROL SWITCH

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

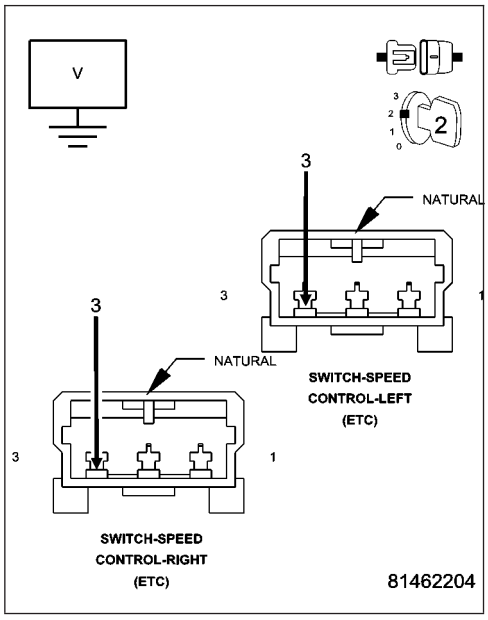
---

3. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



Is the voltage above 5.0 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

4. CLOCKSPRING

Turn the ignition off.

Disconnect the upper and lower clockspring harness connectors per Service Information.

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit between the upper and lower clockspring harness connectors.

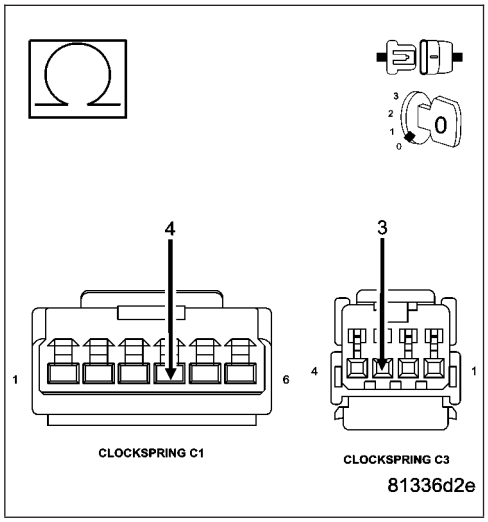
Measure the resistance of the (V937) Switch Return circuit between the upper and lower clockspring harness connectors.

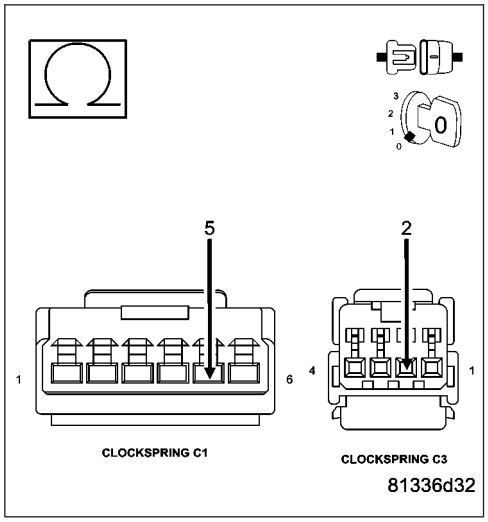
Is the resistance above 5.0 ohms?

Yes >> Replace the Clockspring per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Connect the Clockspring harness connectors per Service Information before continuing.





P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

5. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

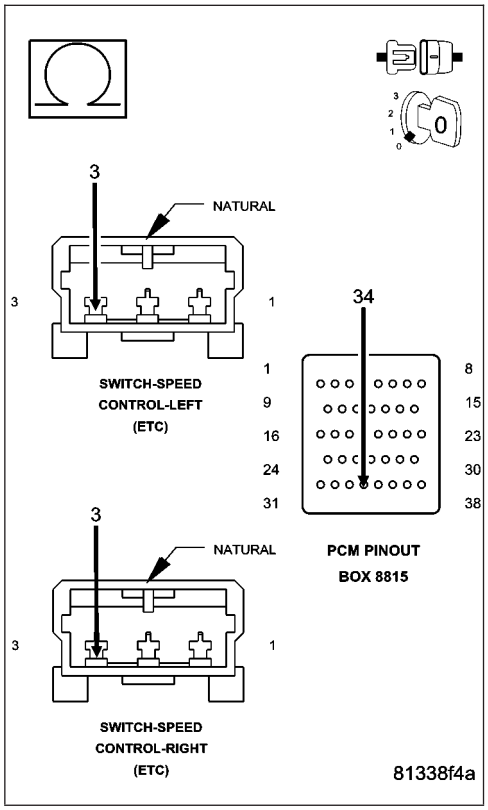
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 6

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V937) SWITCH RETURN CIRCUIT OPEN

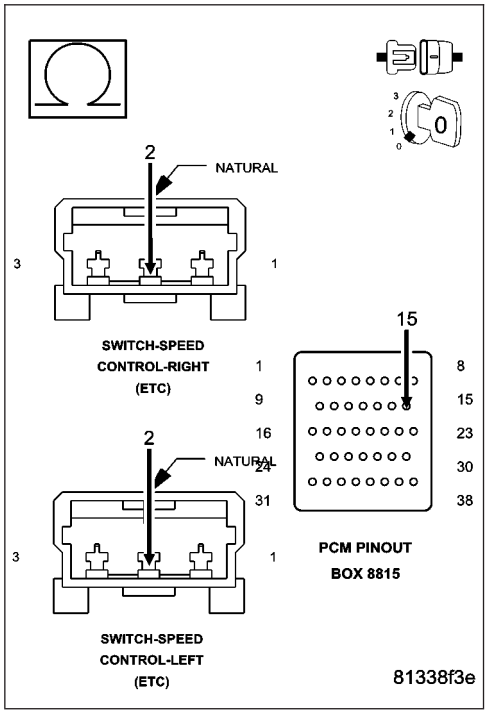
NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) Switch Return circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 7

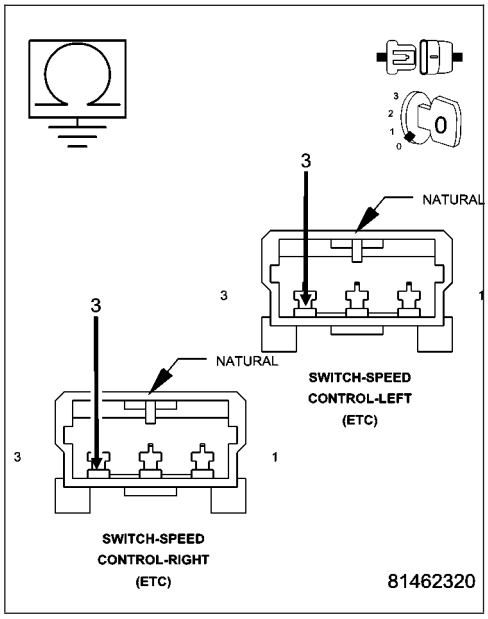
No >> Repair the open in the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

7. (V37) S/C NO.1 SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



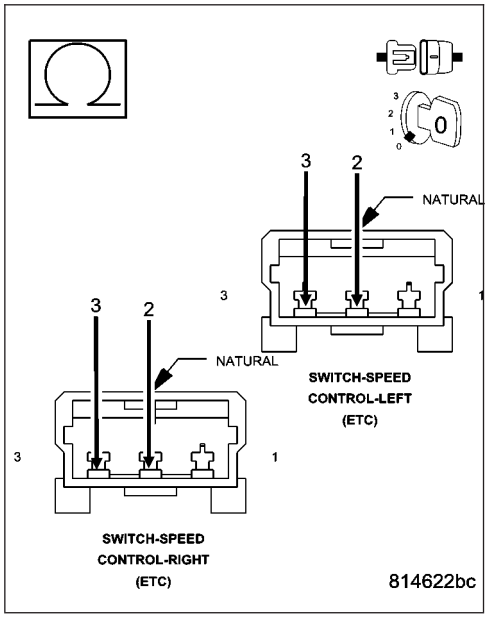
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) S/C SWITCH RETURN CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (V937) S/C Switch Return circuit in the Speed Control harness connector.



Is the resistance below 5.0 ohms?

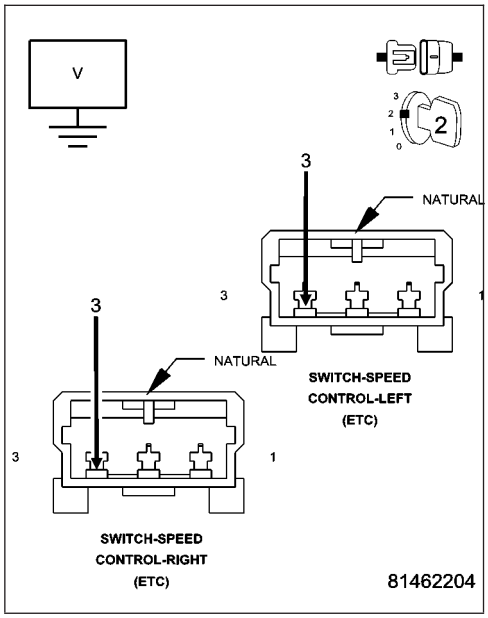
Yes >> Repair the short between the (V37) S/C Switch No.1 Signal circuit and the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

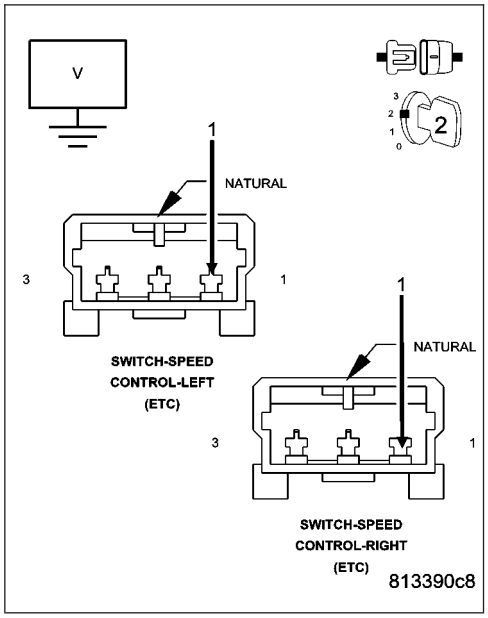
No >> Go To 9

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

9. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.
With a scan tool, monitor the S/C Switch voltage readings.





SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

P0579-SPEED CONTROL SWITCH 1 PERFORMANCE (5.7L) (CONTINUED)

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit and the (V38) S/C Switch No.2 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

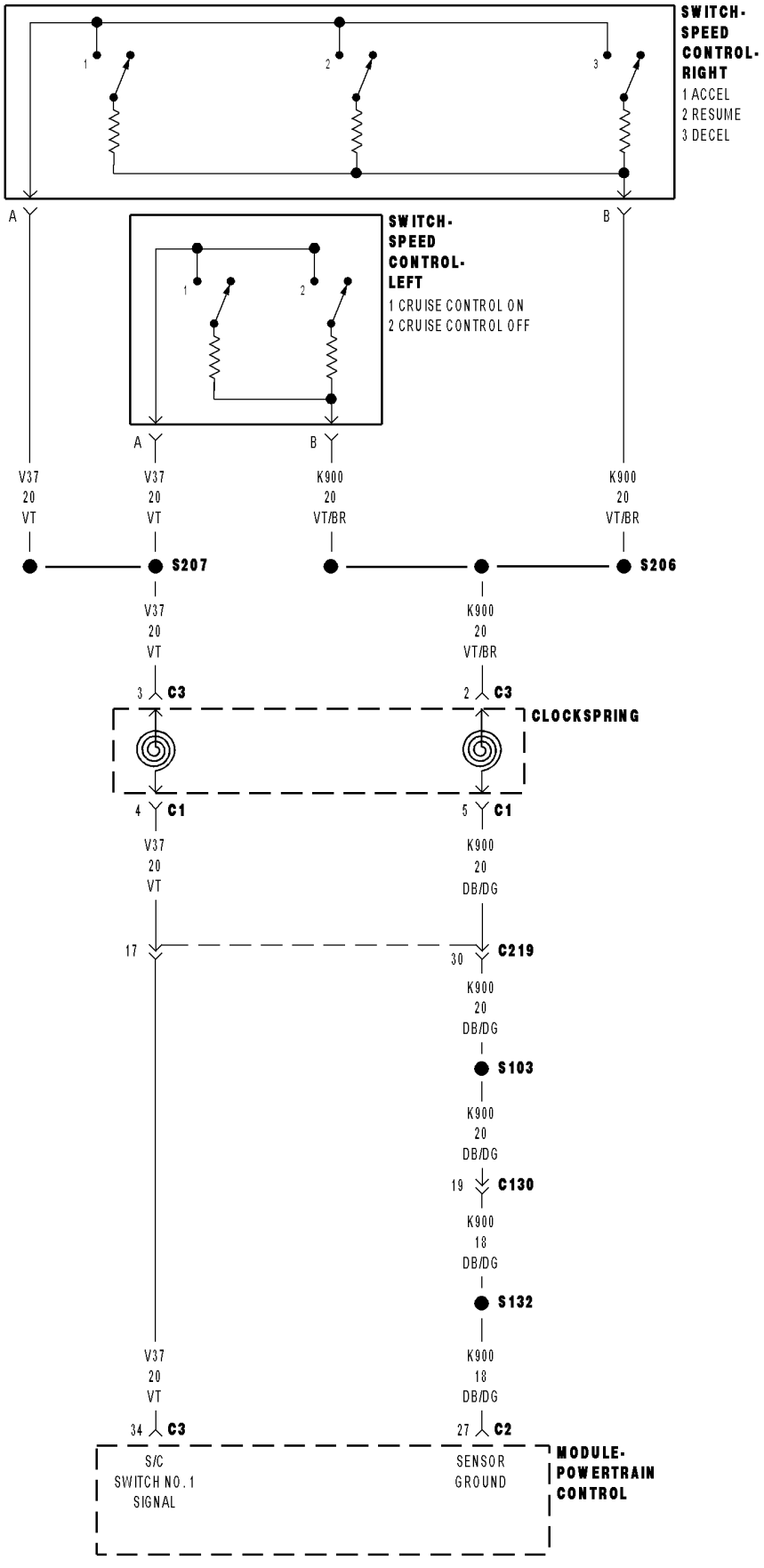
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (3.7L,4.7L)



P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (3.7L,4.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  When switch voltage is less than 0.43 of a volt for 2 minutes. One trip fault. Three good trips to turn off the MIL.

Possible Causes
(V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO GROUND
(V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
CLOCKSPRING
SPEED CONTROL ON/OFF SWITCH
SPEED CONTROL RESUME/ACCEL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE LOW

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage below 1.0 volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. SPEED CONTROL ON/OFF SWITCH

Ignition on, engine not running.
With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control On/Off Switch harness connector per Service Information.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control On/Off Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (3.7L,4.7L) (CONTINUED)

3. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control Resume/Accel Switch harness connector.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control Resume/Accel Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. CLOCKSPRING

Turn the ignition off.

Disconnect the C1 Cockspring 6-way harness connector (instrument panel wiring side) per Service Information.

Ignition on, engine not running.

With the scan tool, read the S/C Switch voltage.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (V37) S/C NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Connect the C1 Clockspring harness connecter per Service Information.

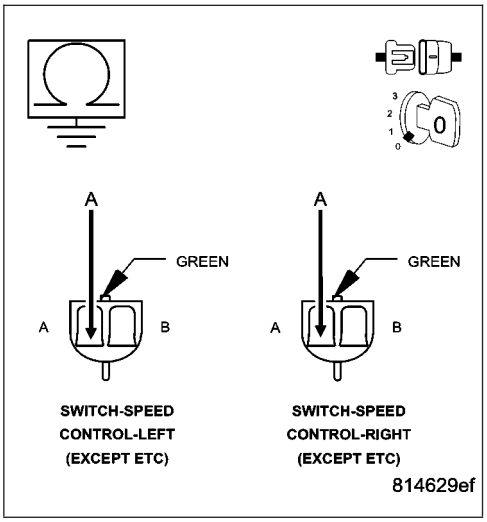
Disconnect the C2 and C3 PCM harness connectors.

Measure the resistance between ground and the (V37) S/C Signal circuit in the Switch harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

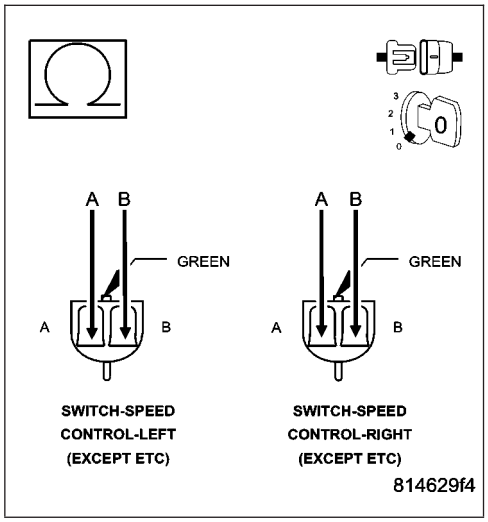
No >> Go To 6



P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (3.7L,4.7L) (CONTINUED)

6. (V37) S/C SIGNAL NO.1 CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K900) Sensor ground circuit and the (V37) S/C Signal No.1 circuit in the Speed Control Switch harness connectors.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V37) S/C Signal No.1 circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. PCM

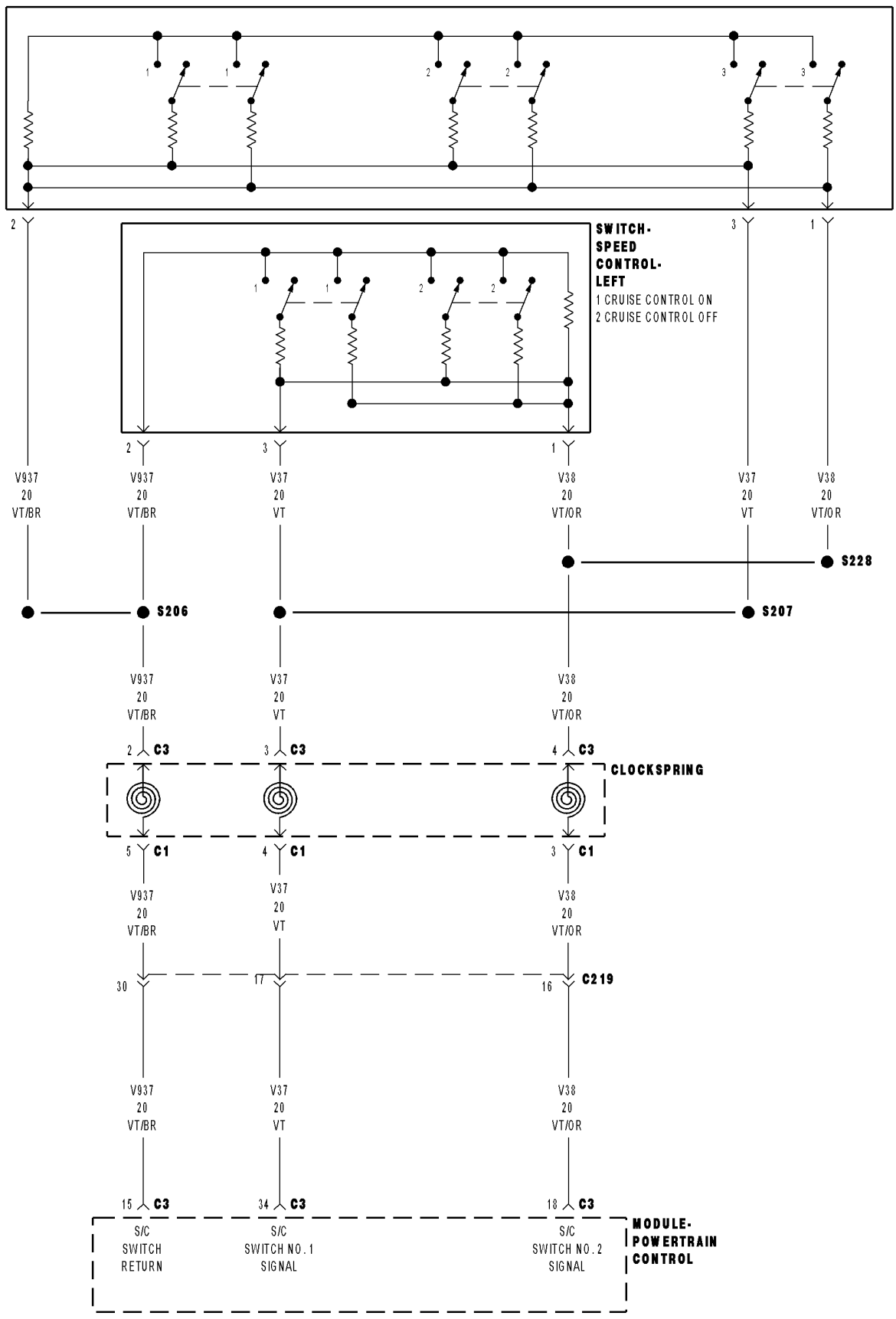
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L)



P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Speed control switch input No.1 is below the minimum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) S/C SWITCH RETURN
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
CLOCKSPRING
SPEED CONTROL ON/OFF SWITCH
SPEED CONTROL RESUME/ACCEL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE LOW

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage below 1.0 volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following positions.

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. SPEED CONTROL ON/OFF SWITCH

Connect the Resume/Accel Switch.

Ignition on, engine not running.

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control On/Off Switch harness connector.

Did the voltage change to above 4.8 volts?

Yes >> Replace the Speed Control On/Off Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control Resume/Accel Switch harness connector per Service Information.

Did the voltage change to above 4.8 volts?

Yes >> Replace the Speed Control Resume/Accel Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) (CONTINUED)

5. CLOCKSPRING

Turn the ignition off.

Disconnect the clockspring harness connector (instrument panel wiring side) per Service Information.

Ignition on, engine not running.

With the scan tool, read the S/C Switch voltage.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) S/C SWITCH RETURN CIRCUIT

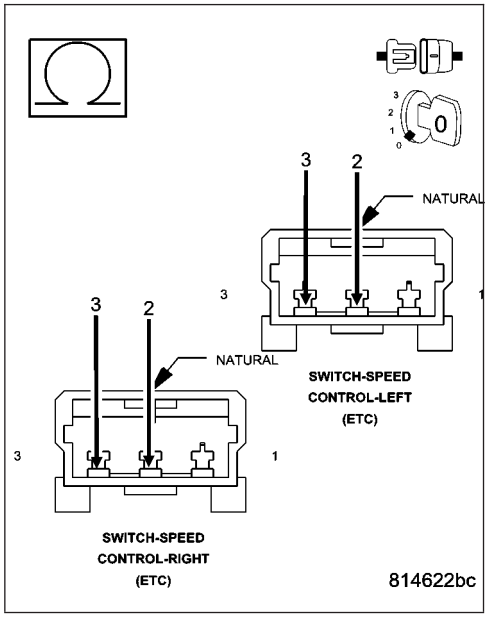
Turn the ignition off.

Connect the Clockspring harness connectors per Service Information.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance between the (V937) S/C Switch Return circuit and the (V37) S/C Switch No.1 Signal circuit at the Speed Control Switch.



Is the resistance below 5.0 ohms?

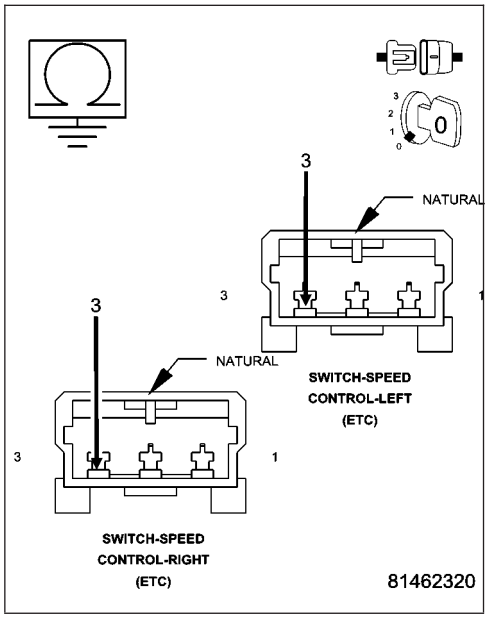
Yes >> Repair the short between the (V37) S/C Switch No.1 Signal circuit and the (V937) S/C Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) (CONTINUED)

7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Switch harness connector.



Is the resistance below 100 ohms?

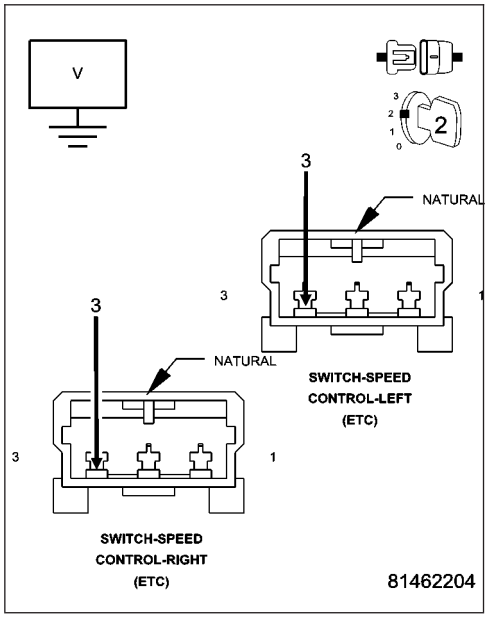
Yes >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.
With a scan tool, monitor the S/C Switch voltage readings.



SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

P0580-SPEED CONTROL SWITCH 1 CIRCUIT LOW (5.7L) (CONTINUED)

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

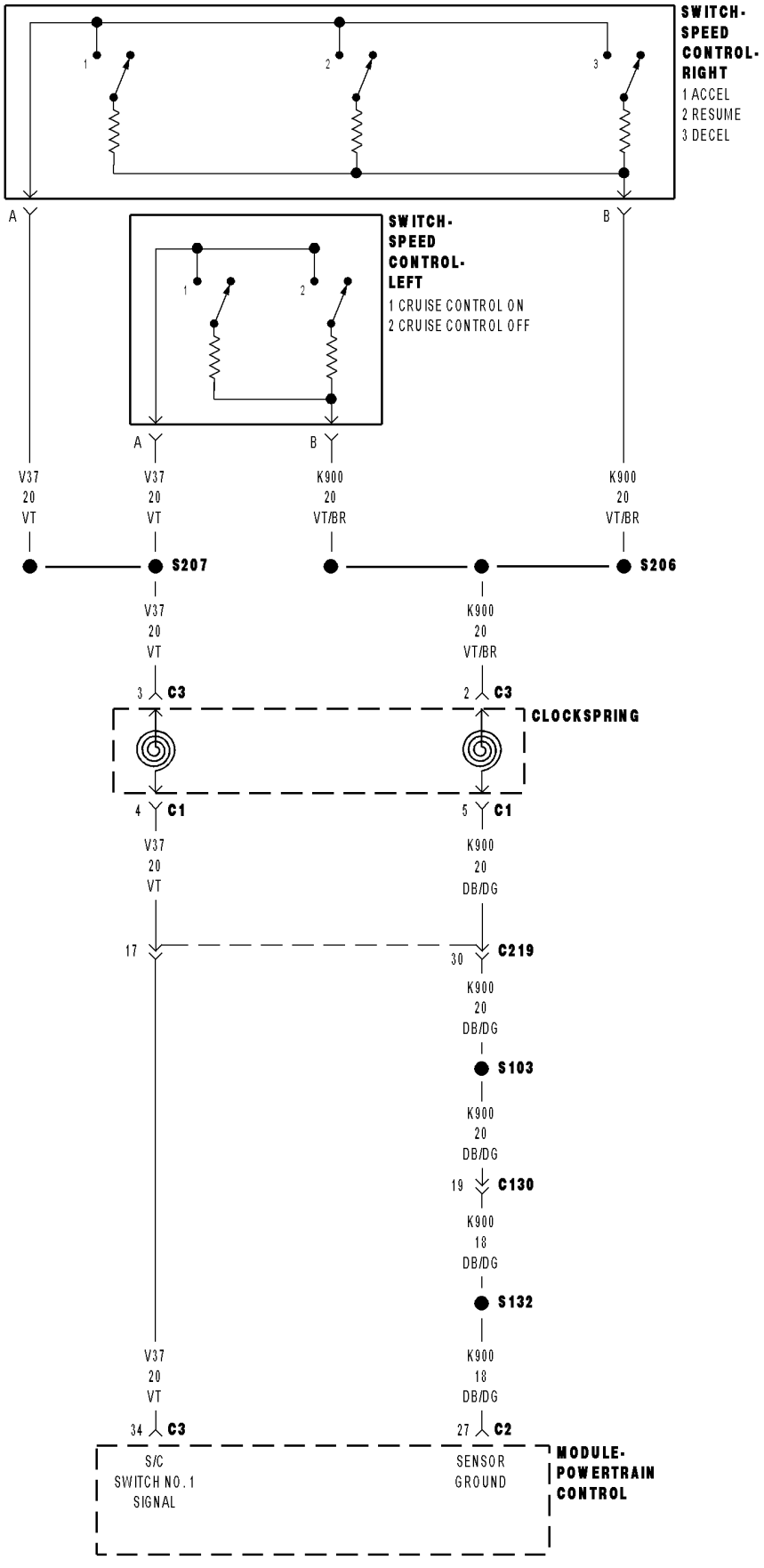
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L)



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. Battery voltage above 10 volts.
- **Set Condition:**
  The PCM detects an open or short to voltage in the Speed Control Switch Signal circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
CLOCKSPRING
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE HIGH

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

Resume/Accel - 15.4 kohms

Cancel - 1.24 kohms

Coast - 2.94 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CLOCKSPRING

Disconnect the upper and lower 6-way clockspring harness connector per Service Information.

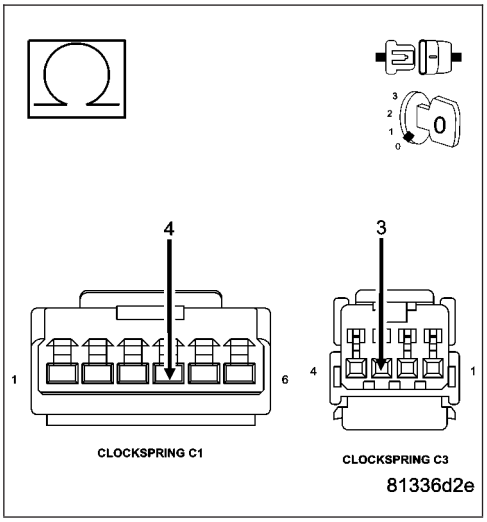
Measure the resistance of the (K900) Sensor ground circuit between the upper and lower 6-way clockspring harness connectors.

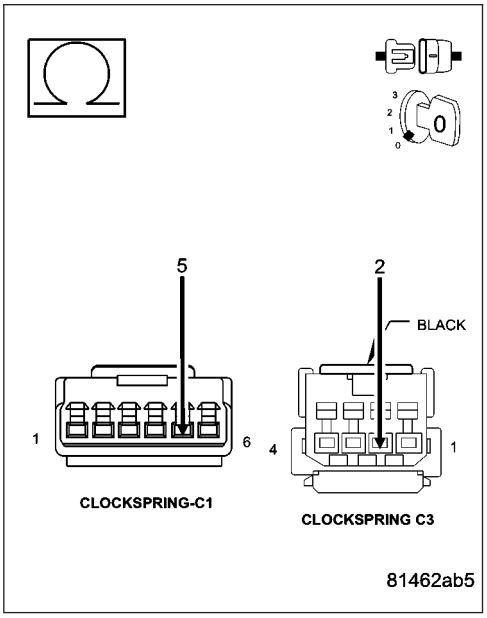
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit between the upper and lower 6-way clockspring harness connectors.

Was the resistance above 5.0 ohms for either circuit?

Yes >> Replace the clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4





P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) (CONTINUED)

4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Connect the Clockspring harness connectors per Service Information.

Disconnect the C2 and C3 PCM harness connectors.

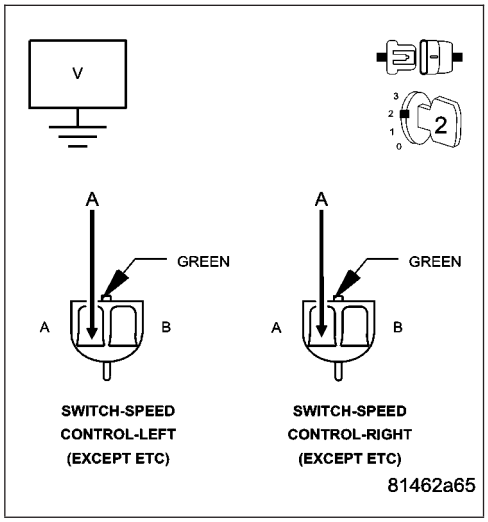
Ignition on, engine not running.

Measure the voltage on the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.

Is the voltage above 5.3 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING

Turn the ignition off.

Disconnect the upper and lower Clockspring harness connectors per Service Information.

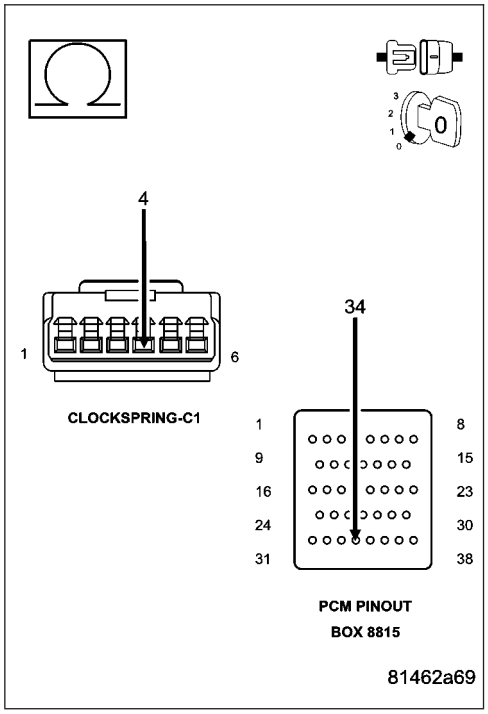
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the lower Clockspring harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit between the PCM and Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) (CONTINUED)

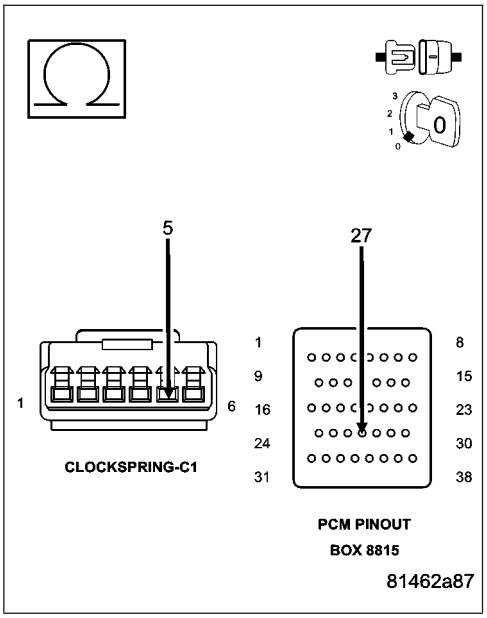
6. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING

Measure the resistance of the (K900) Sensor ground circuit from the lower Clockspring harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open (K900) Sensor ground circuit between the PCM and Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



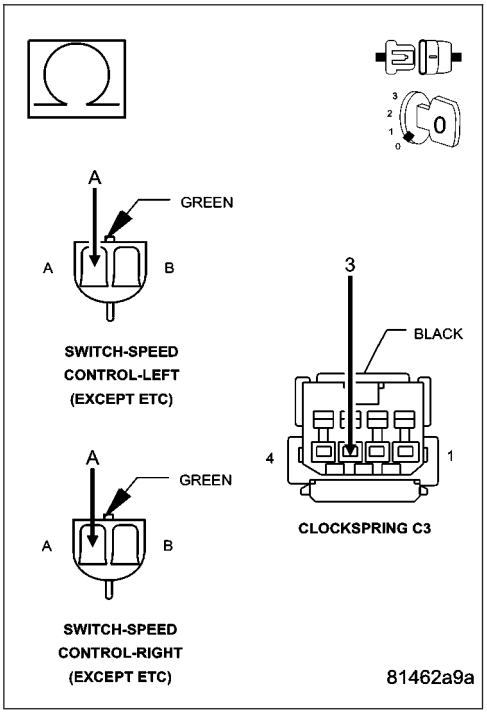
7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the upper Clockspring harness connector to the On/Off switch harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

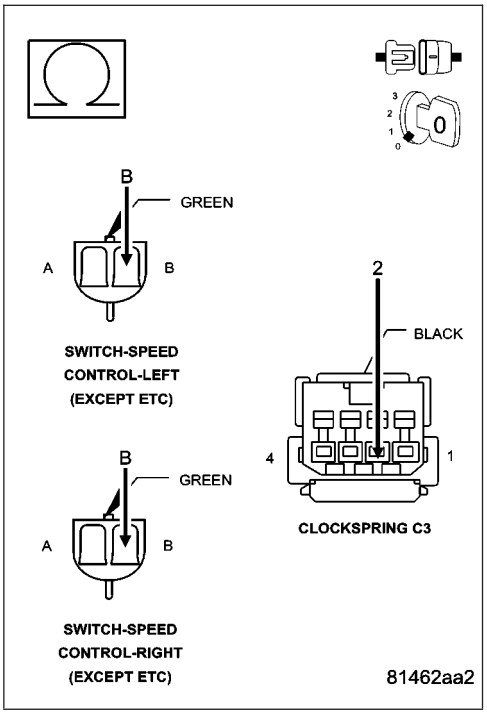
No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit, Clockspring to S/C Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (3.7L,4.7L) (CONTINUED)

8. (K900) SENSOR GROUND CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH

Measure the resistance of the (K900) Sensor ground circuit from the On/Off Switch 2-way harness connector to the upper Clockspring harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (K900) Sensor ground circuit between the Clockspring and S/C Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. PCM

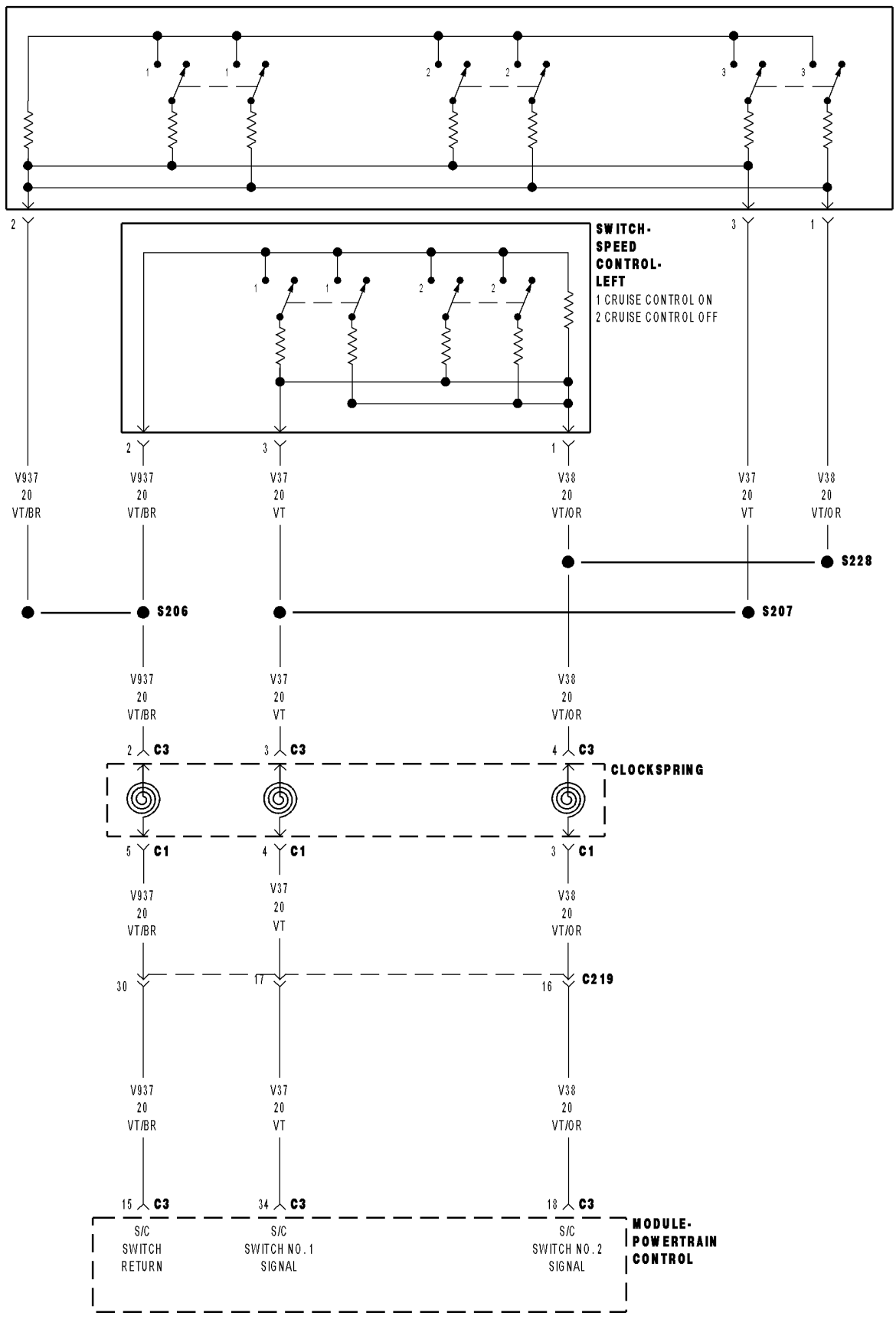
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L)



P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Speed control switch input above the maximum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN
(V937) SWITCH RETURN CIRCUIT OPEN
CLOCKSPRING
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE HIGH

NOTE: Do not press any of the Speed Control Switch buttons.

Ignition on, engine not running.

With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CLOCKSPRING

Disconnect the upper and lower Clockspring harness connector per Service Information.

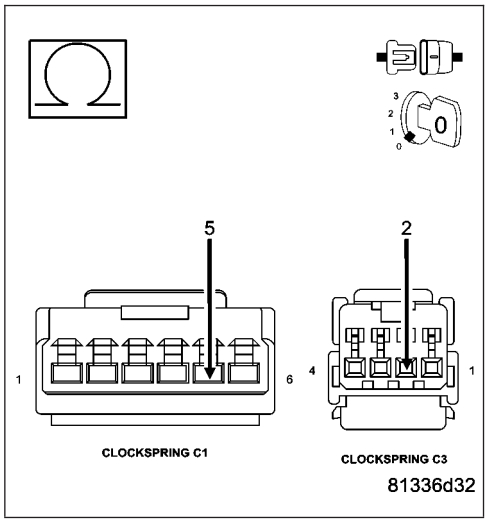
Measure the resistance of the (V937) Switch Return circuit between the upper and lower clockspring harness connectors.

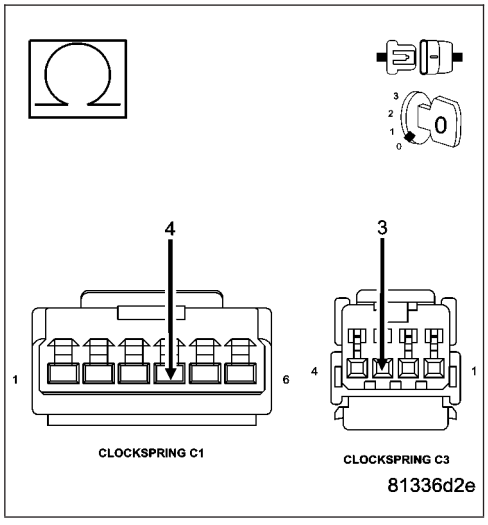
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit between the upper and lower clockspring harness connectors.

Was the resistance above 5.0 ohms for either circuit?

Yes >> Replace the clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4





P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) (CONTINUED)

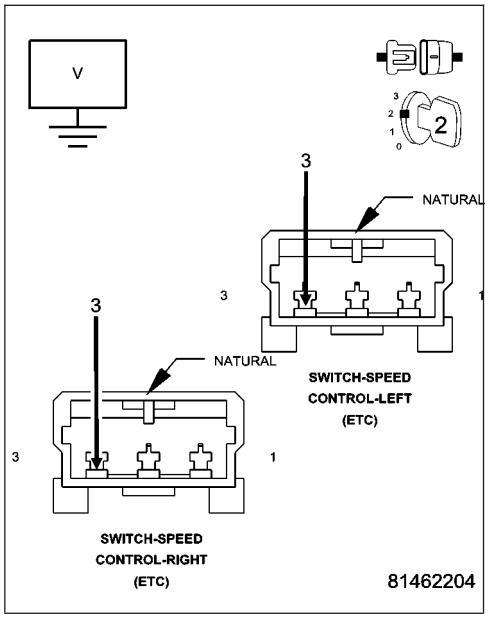
4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Connect the Clockspring harness connectors per Service Information.
Disconnect the C3 PCM harness connector.
Ignition on, engine not running.
Measure the voltage on the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

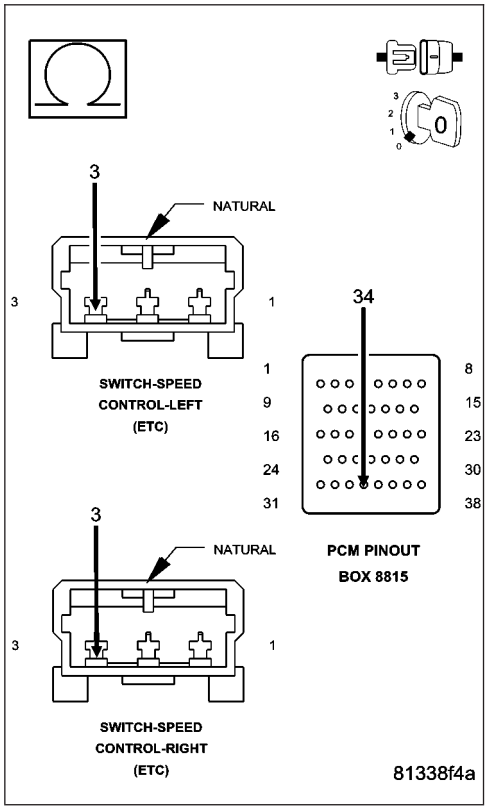
NOTE: The measurement must be taken from both Speed Control Switch harness connectors.
Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

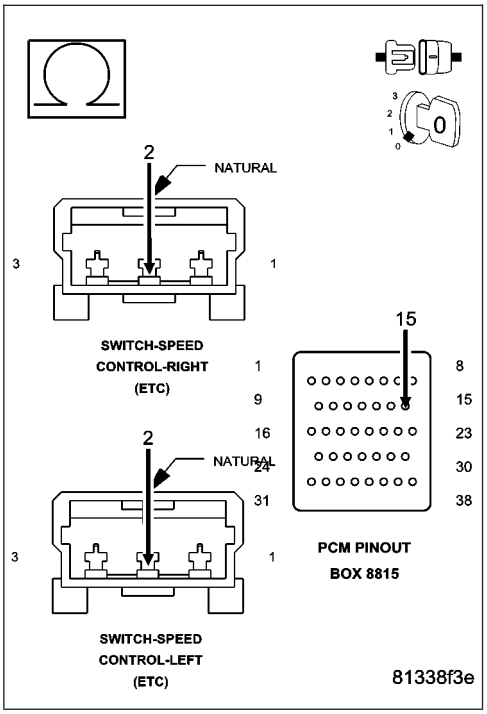


P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) (CONTINUED)

6. (V937) SWITCH RETURN CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) Switch Return circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

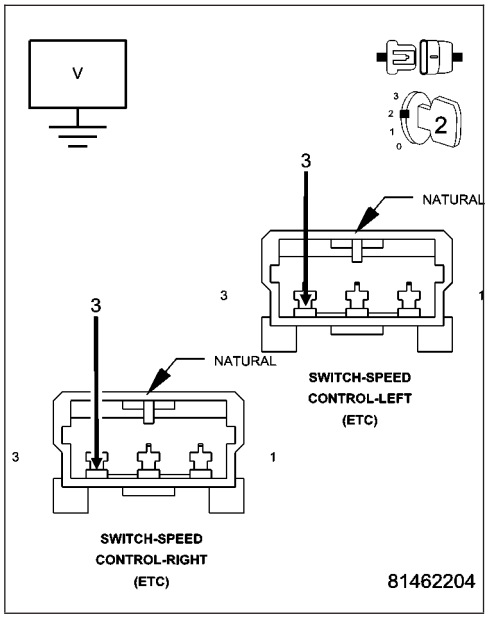
No >> Repair the open in the (V937) Switch Return circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0581-SPEED CONTROL SWITCH 1 CIRCUIT HIGH (5.7L) (CONTINUED)

7. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.



SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

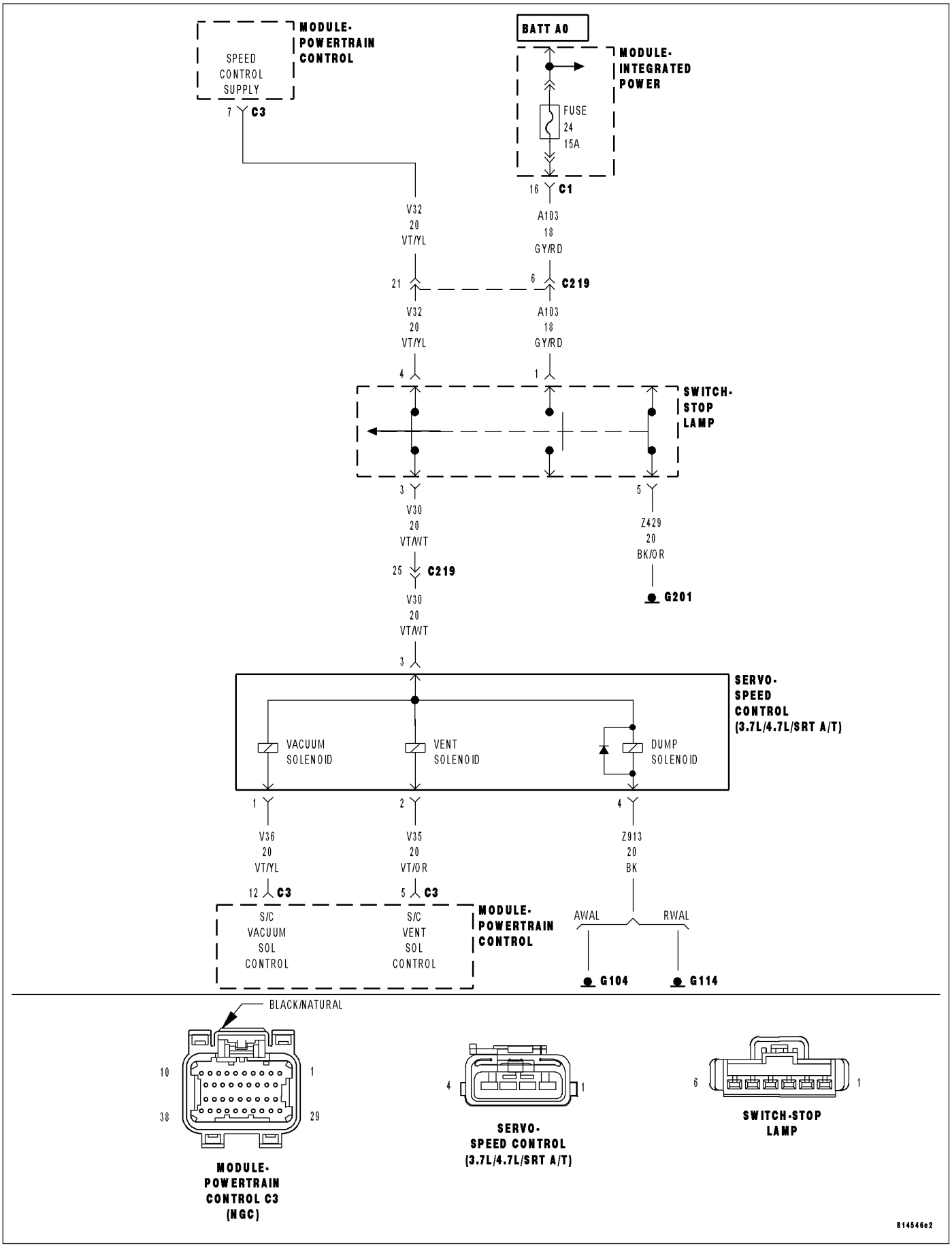
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT



P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted condition detected in the Speed control vacuum solenoid control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY SHORT TO GROUND
(V36) S/C VACUUM SOL CONTROL CIRCUIT SHORTED TO GROUND
(V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN
(Z913) GROUND CIRCUIT OPEN
SPEED CONTROL VACUUM SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL VACUUM CONTROL

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

With the scan tool, actuate the Speed Control Vacuum Solenoid and note operation.

Does the Speed Control Vacuum Solenoid actuate properly?

Yes >> Refer to the INTERMITTENT CONDITION symptom in the Driveability category.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT

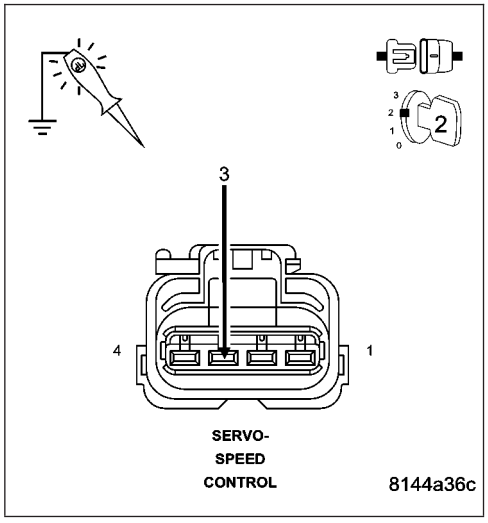
Turn the ignition off.

Disconnect the S/C Servo harness connector.

Ignition on, engine not running.

Using the scan tool, actuate the S/C Vacuum Solenoid.

Using a test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the S/C Servo harness connector.



Does the test light illuminate brightly and flash on and off?

Yes >> Go To 5

No >> Go To 3

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

3. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.

Connect the S/C Servo harness connector.

Disconnect the Stop Lamp Switch harness connector.

Ignition on, engine not running.

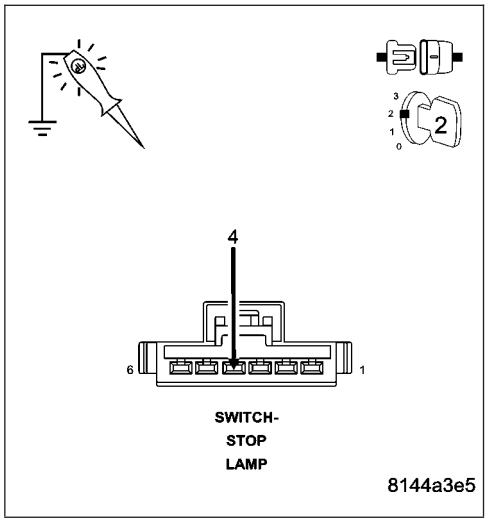
Using the scan tool, actuate the S/C Vacuum Solenoid.

Using a test light connected to ground, probe the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Go To 8



4. (Z913) S/C GROUND CIRCUIT OPEN

Turn the ignition off.

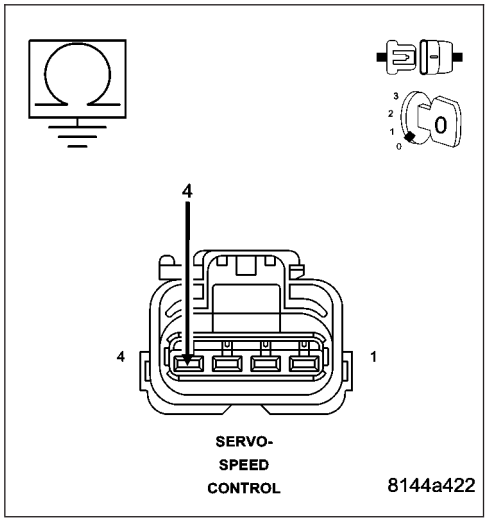
Disconnect the S/C Servo harness connector.

Measure the resistance of the (Z913) S/C Ground circuit at the S/C Servo harness connector to ground.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (Z913) S/C Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

5. SPEED CONTROL VACUUM SOLENOID

Ignition on, engine not running.

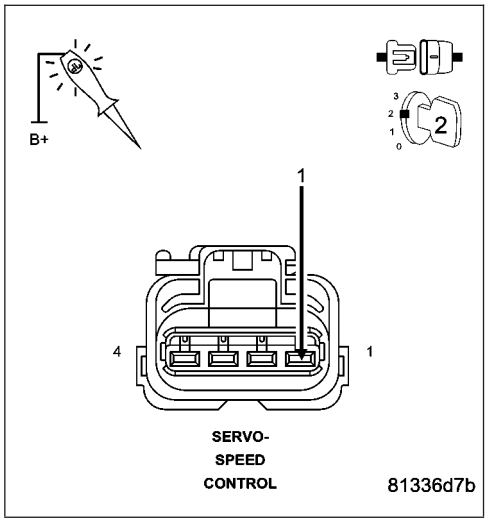
With the scan tool, actuate the Speed Control Vacuum Solenoid.

Using a 12-volt test light connected to battery voltage, probe the (V36) S/C Vacuum Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Speed Control Servo.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (V36) S/C VACUUM SOL CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

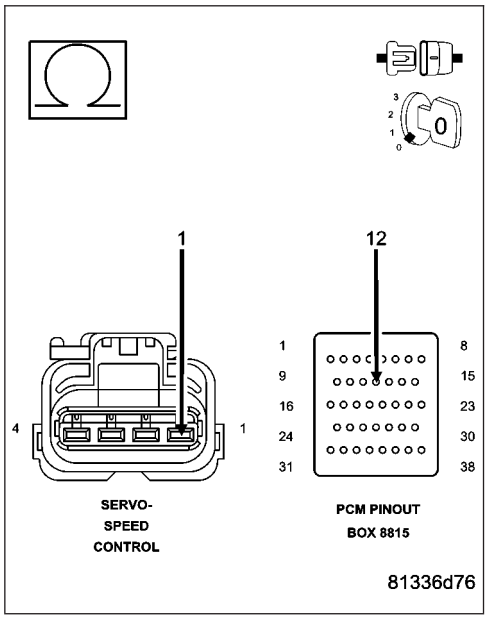
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V36) S/C Vacuum Sol Control circuit from the Speed Control Servo harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

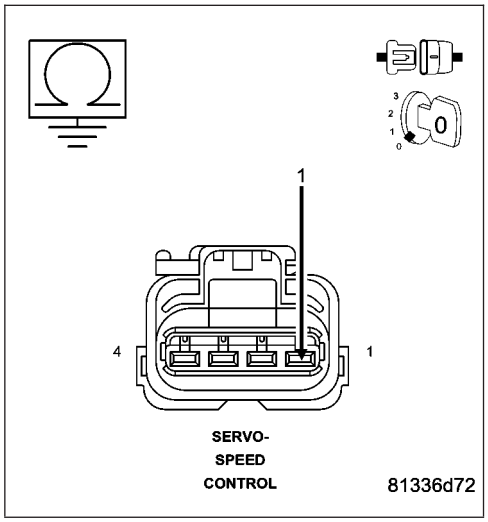
No >> Repair the open/high resistance in the (V36) S/C Vacuum Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

7. (V36) SPEED CONTROL VACUUM SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V36) S/C Vacuum Solenoid Control circuit at the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V36) S/C Vacuum Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

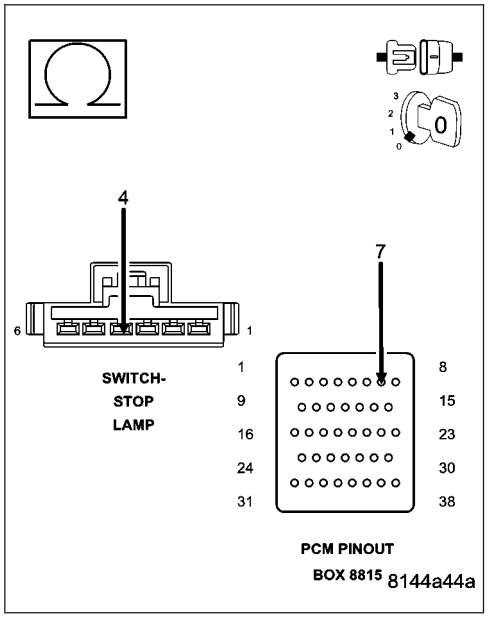
8. (V32) S/C SUPPLY OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

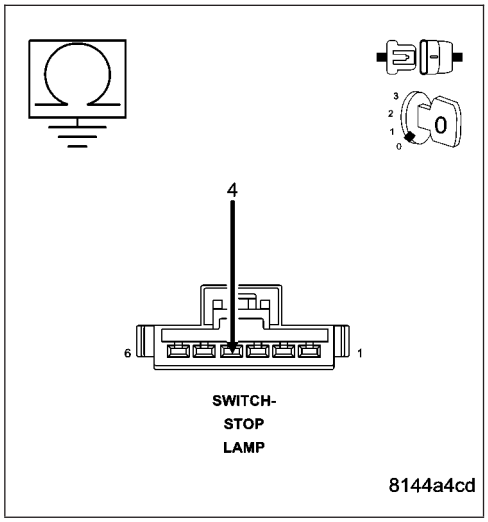
Yes >> Go To 9

No >> Repair the open/high resistance in the (V32) S/C Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0582-SPEED CONTROL VACUUM CONTROL CIRCUIT (CONTINUED)

9. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit at the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

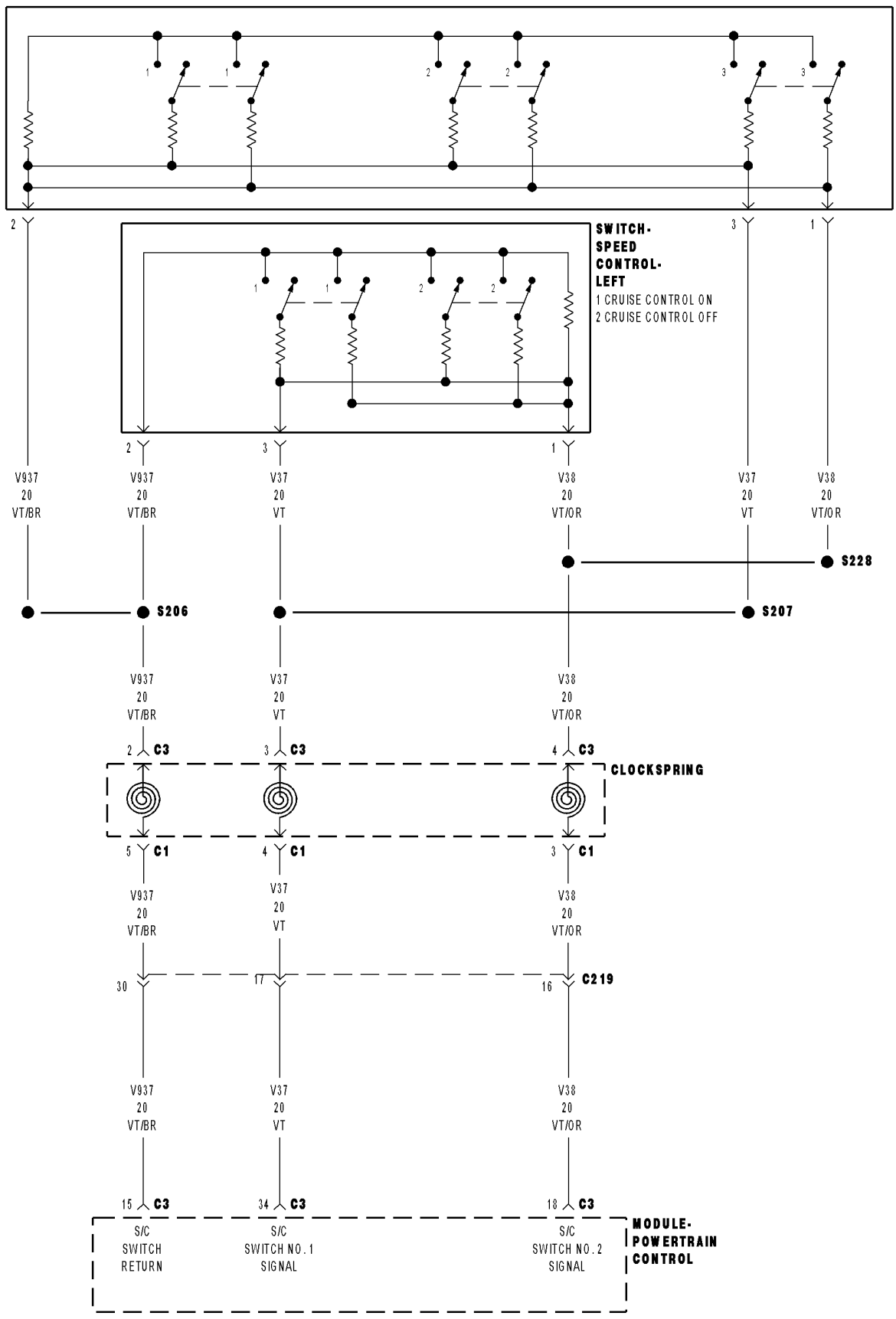
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L)



P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Cruise Switch inputs are not coherent with each other. Example: PCM is reading Switch No.1 as Accel and Switch No.2 as Coast at the same time. One trip fault.

Possible Causes
S/C SWITCH SIGNAL CIRCUITS SHORTED TO BATTERY VOLTAGE
RESISTANCE IN THE S/C SWITCH SIGNAL CIRCUITS
RESISTANCE IN THE (V937) SWITCH RETURN CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO THE (V937) SWITCH RETURN CIRCUIT
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT
S/C SWITCH SIGNAL CIRCUITS SHORTED TO GROUND
CLOCKSPRING
SPEED CONTROL ON/OFF SWITCH
SPEED CONTROL RESUME/ACCEL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: This DTC may be the result of pressing two Speed Control Switch buttons simultaneously for more than 450 msec.

Ask the customer if it is possible that two buttons were pressed at the same time before this DTC set. If this is the case, no repair is necessary.

Is the DTC active a this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. SPEED CONTROL ON/OFF SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control On/Off Switch harness connector.

Did the voltage change to above 4.8 volts?

Yes >> Replace the Speed Control On/Off Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

3. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.

Disconnect the Speed Control Resume/Accel Switch harness connector.

Did the voltage change to above 4.8 volts?

Yes >> Replace the Speed Control Resume/Accel Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove and disconnect the Speed Control Switches from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V38) S/C Switch No.2 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 5

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

5. S/C SWITCH SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

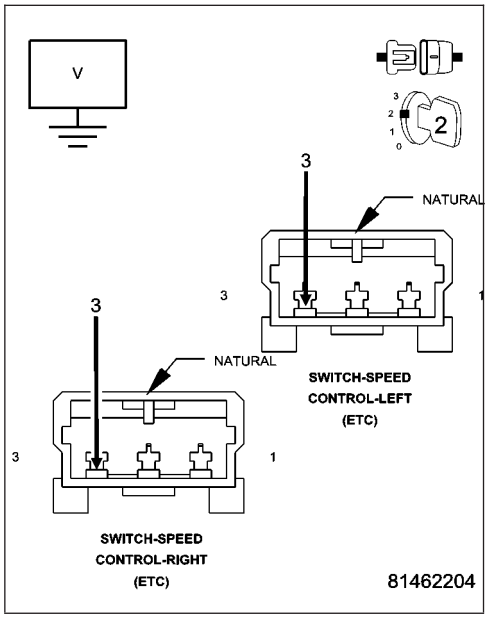
Disconnect the C3 PCM harness connector.

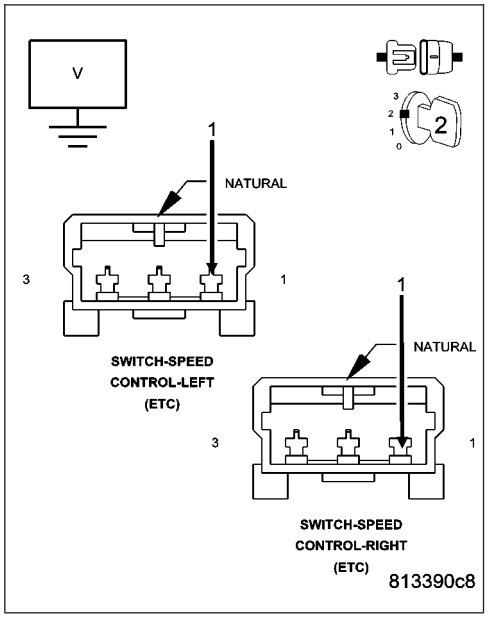
Measure the voltage on the (V37) and (V38) S/C Switch Signal circuits at both Speed Control harness connectors.

Is the voltage above 5.0 volts?

Yes >> Repair the short to battery voltage in the (V37) or (V38) S/C Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6





P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

6. CLOCKSPRING

Turn the ignition off.

Disconnect the upper and lower clockspring harness connectors per Service Information.

Measure the resistance of the (V37) and (V38) S/C Switch Signal circuits between the upper and lower clockspring harness connectors.

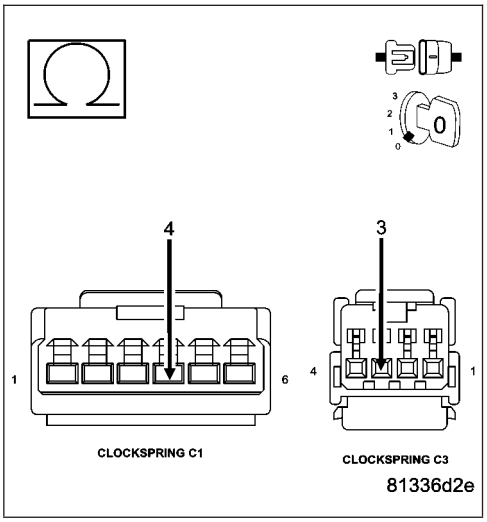
Measure the resistance of the (V937) Switch Return circuit between the upper and lower clockspring harness connectors.

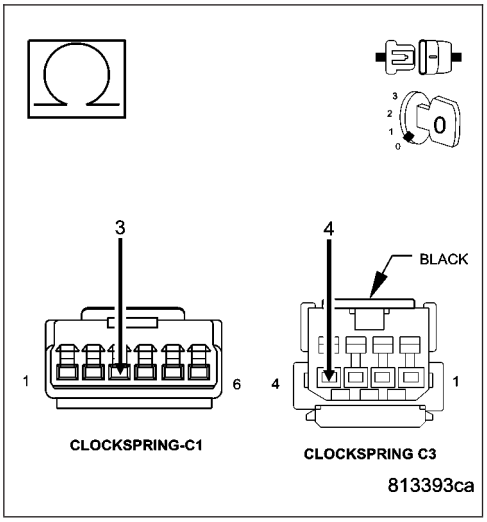
Is the resistance above 5.0 ohms?

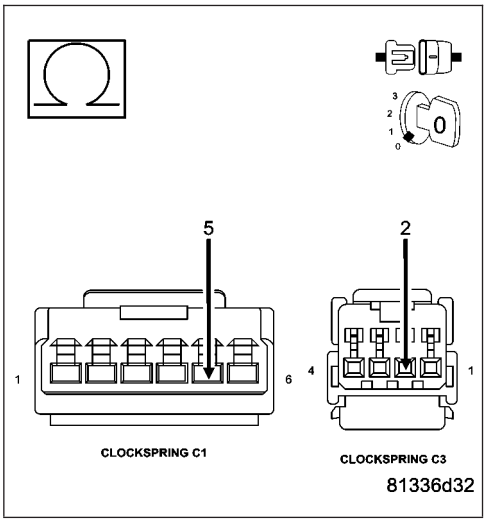
Yes >> Replace the Clockspring per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

NOTE: Connect the Clockspring harness connectors per Service Information before continuing.







P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

7. S/C SWITCH SIGNAL CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

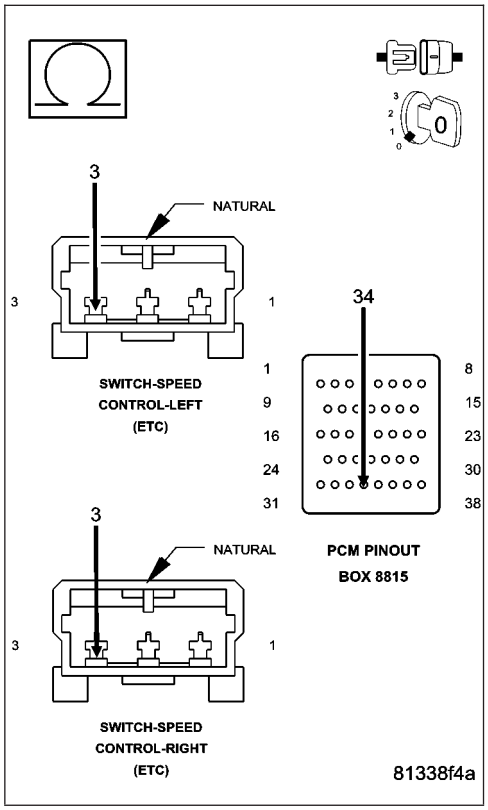
Measure the resistance of the (V37) and (V38) S/C Switch Signal circuits from both Speed Control harness connectors to the appropriate terminals of special tool #8815.

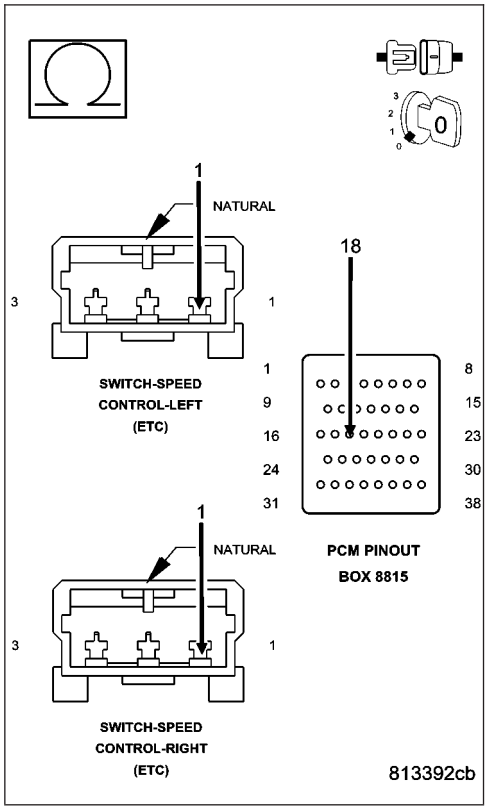
Is the resistance below 5.0 ohms for each measurement?

Yes >> Go To 8

No >> Repair the excessive resistance in the (V37) or (V38) S/C Switch Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



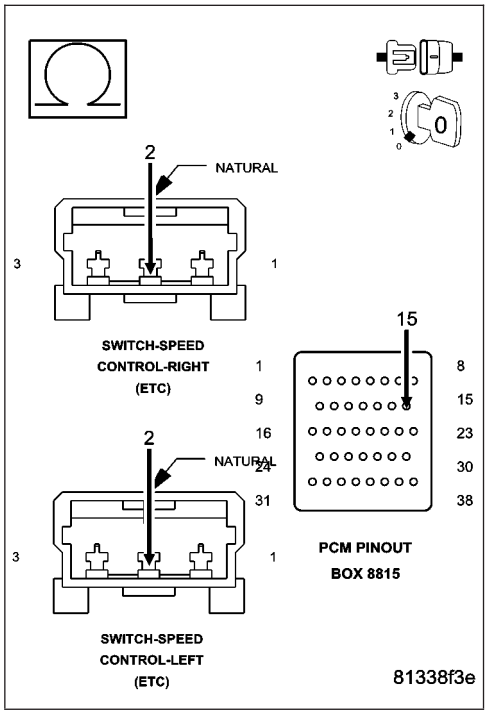


P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

8. (V937) SWITCH RETURN CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) Switch Return circuit from both Speed Control harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 9

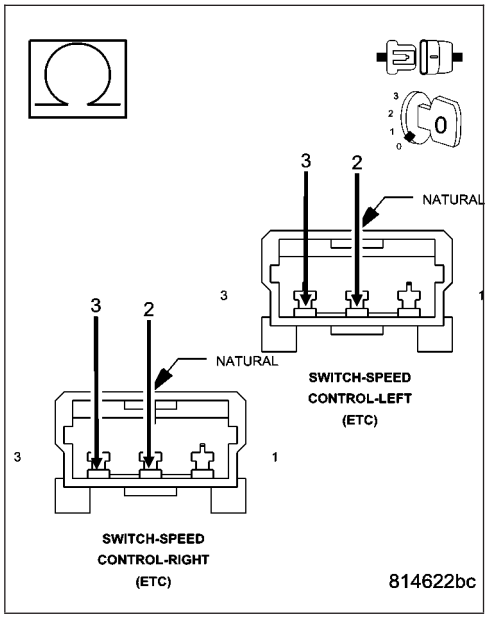
No >> Repair the excessive resistance in the (V937) Switch Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

9. S/C SWITCH SIGNAL CIRCUITS SHORTED TO THE (V937) SWITCH RETURN CIRCUIT

Measure the resistance between the (V937) Switch Return circuit and both of the (V37) and (V38) S/C Switch Signal circuits in the Speed Control harness connector.

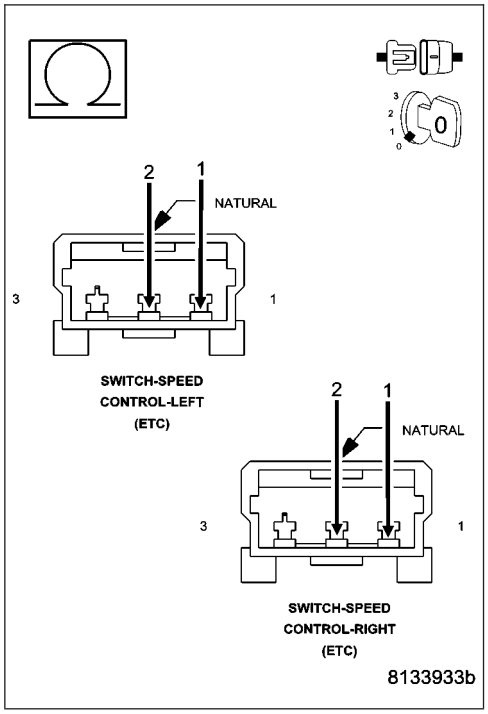


Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V937) Switch Return circuit and the (V37) or (V38) S/C Switch Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

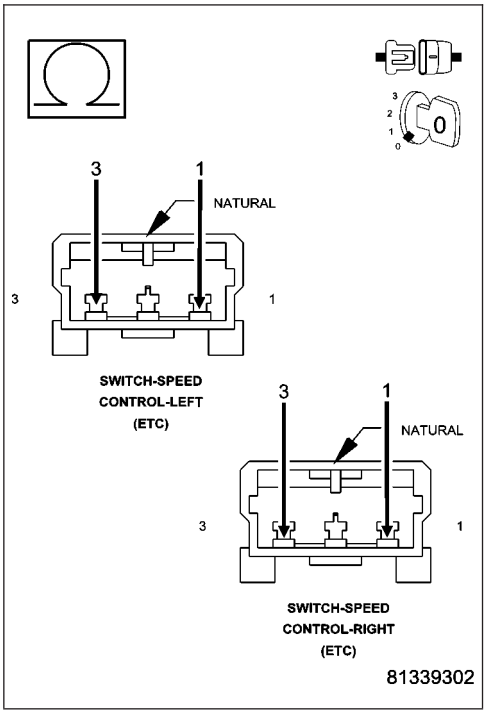
No >> Go To 10



P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

10. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (V38) S/C Switch No.2 Signal circuit at both Speed Control harness connectors.



Is the resistance below 100 ohms for each circuit?

Yes >> Repair the short between the (V38) S/C Switch No.2 Signal circuit and the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

11. S/C SWITCH SIGNAL CIRCUITS SHORTED TO GROUND

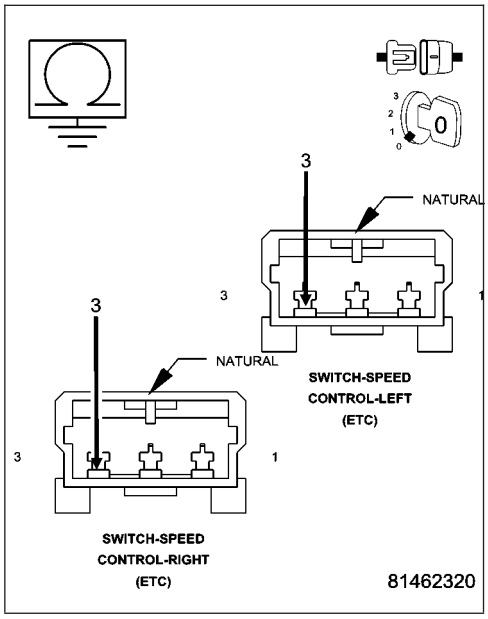
Measure the resistance between ground and the (V37) and (V38) S/C Switch Signal circuits at both Switch harness connectors.

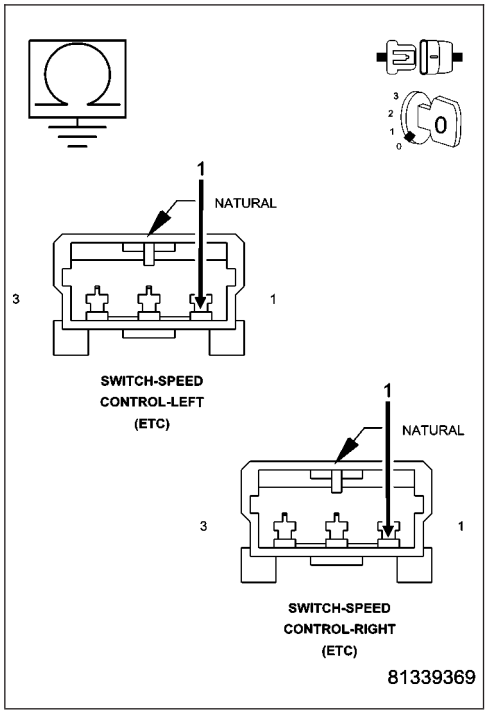
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) or (V38) S/C Switch Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

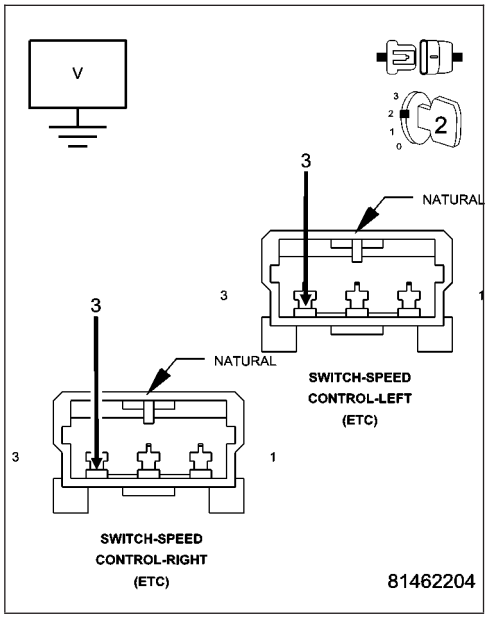


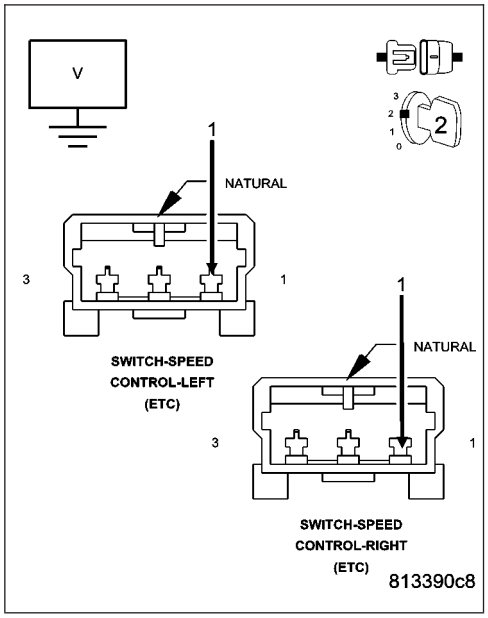


P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

12. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.
With a scan tool, monitor the S/C Switch voltage readings.





SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

P0585-SPEED CONTROL SWITCH 1/2 CORRELATION (5.7L) (CONTINUED)

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit and the (V38) S/C Switch No.2 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

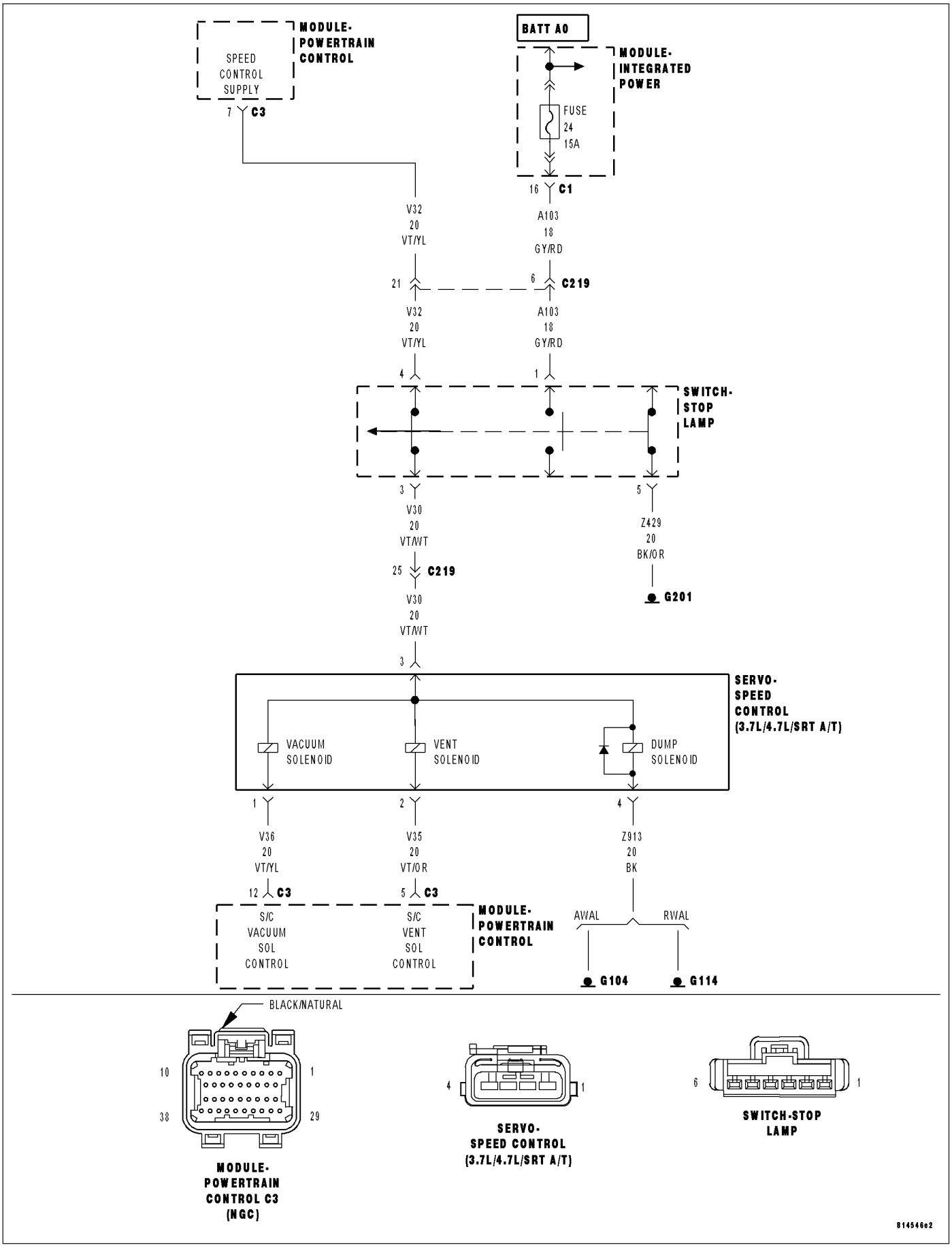
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0586-SPEED CONTROL VENT CONTROL CIRCUIT



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An open or shorted condition detected in the Speed control vent solenoid control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY SHORT TO GROUND
(V35) S/C VENT SOL CONTROL CIRCUIT SHORTED TO GROUND
(V35) S/C VENT SOL CONTROL CIRCUIT OPEN
(Z913) GROUND CIRCUIT OPEN
SPEED CONTROL VENT SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL VENT CONTROL

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

With the scan tool, actuate the Speed Control Vent Solenoid and note operation.

Does the Speed Control Vacuum Solenoid actuate properly?

Yes >> Refer to the INTERMITTENT CONDITION symptom in the Driveability category.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the S/C Servo harness connector.

Ignition on, engine not running.

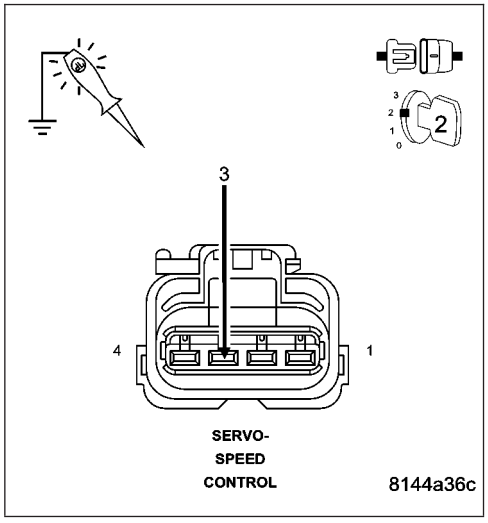
Using the scan tool, actuate the S/C Vent Solenoid.

Using a test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the S/C Servo harness connector.

Does the test light illuminate brightly and flash on and off?

Yes >> Go To 5

No >> Go To 3



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

3. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.

Connect the S/C Servo harness connector.

Disconnect the Stop Lamp Switch harness connector.

Ignition on, engine not running.

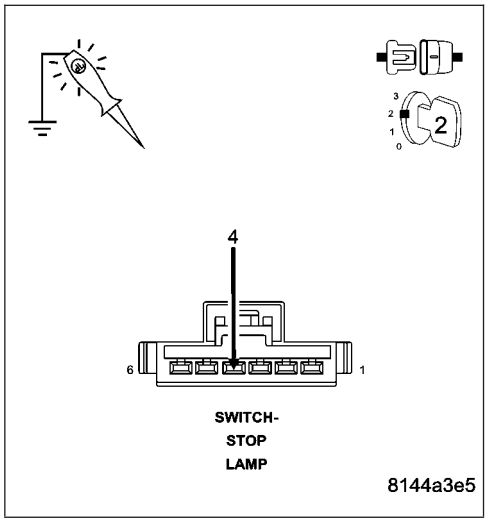
Using the scan tool, actuate the S/C Vent Solenoid.

Using a test light connected to ground, probe the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Go To 8



4. (Z913) S/C GROUND CIRCUIT OPEN

Turn the ignition off.

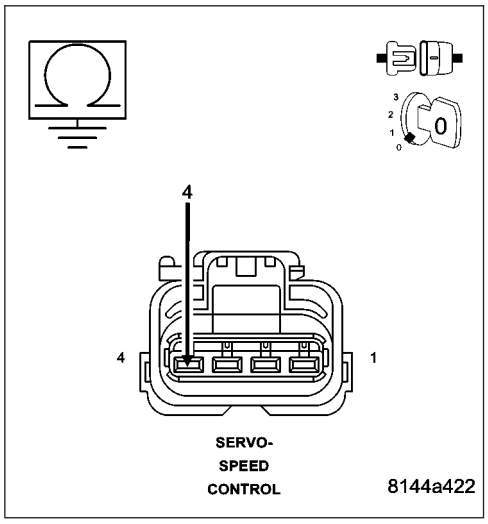
Disconnect the S/C Servo harness connector.

Measure the resistance of the (Z913) S/C Ground circuit at the S/C Servo harness connector to ground.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (Z913) S/C Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

5. SPEED CONTROL VENT SOLENOID

Ignition on, engine not running.

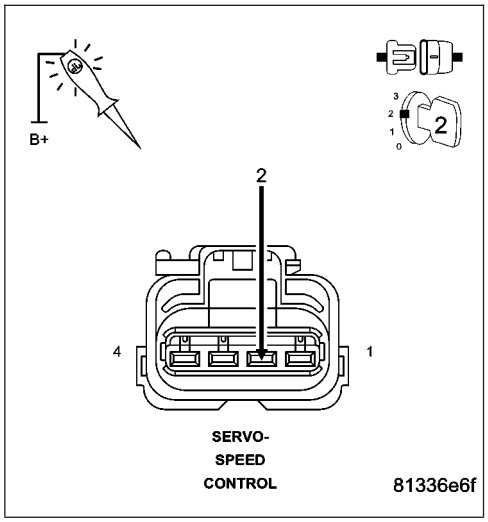
With the scan tool, actuate the Speed Control Vent Solenoid.

Using a 12-volt test light connected to battery voltage, probe the (V36) S/C Vent Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Speed Control Servo.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (V35) S/C VENT CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

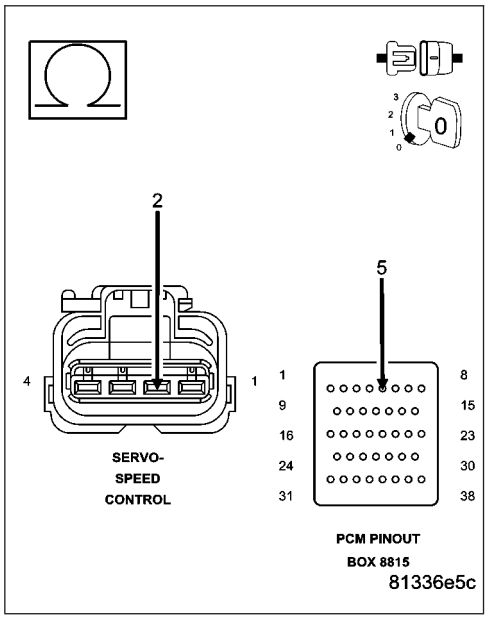
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V35) S/C Vent Sol Control circuit from the Speed Control Servo harness connector to the appropriate terminal of special tool # 8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open/high resistance in the (V35) S/C Vent Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

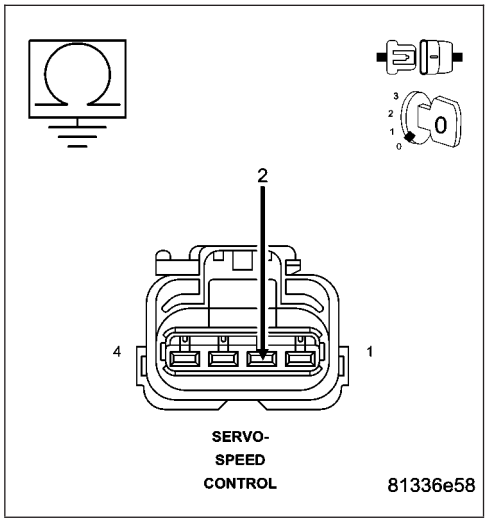
7. (V35) SPEED CONTROL VENT SOLENOID CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V35) S/C Vent Solenoid Control circuit at the Speed Control Servo harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V35) S/C Vent Sol Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



8. (V32) S/C SUPPLY OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

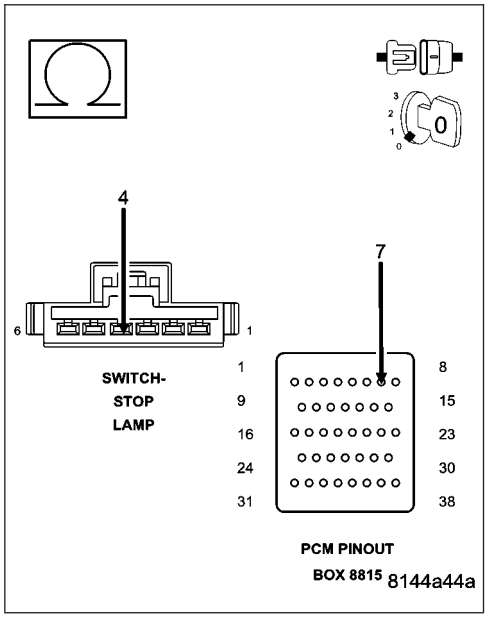
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

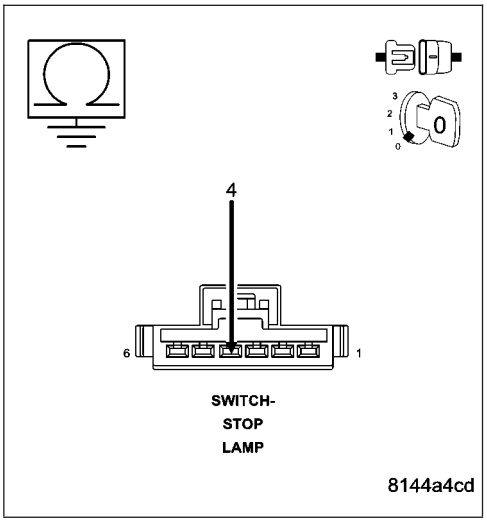
No >> Repair the open/high resistance in the (V32) S/C Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0586-SPEED CONTROL VENT CONTROL CIRCUIT (CONTINUED)

9. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit at the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

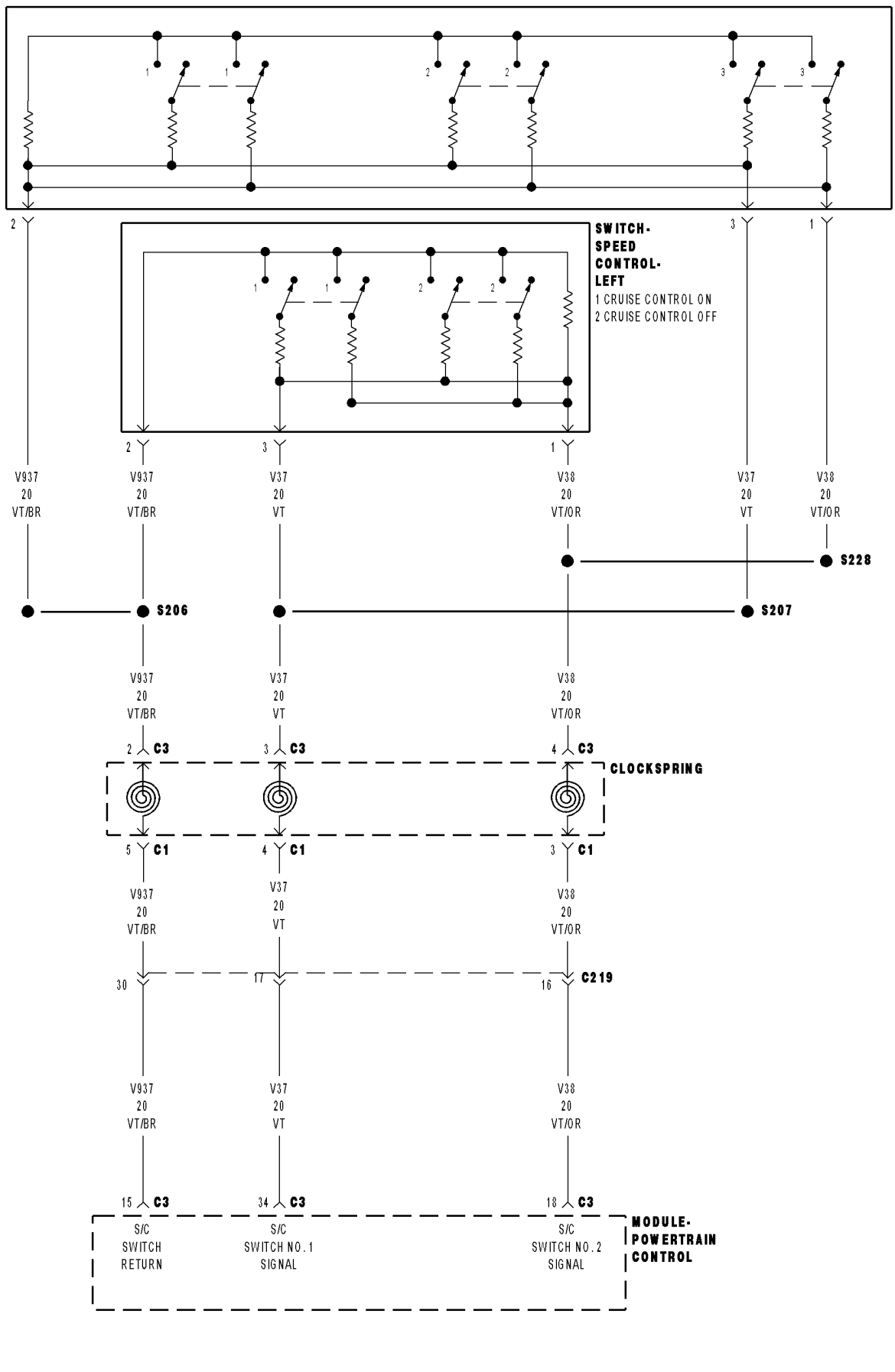
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0591-SPEED CONTROL SWITCH 2 PERFORMANCE



P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Cruise switch voltage output is not out of range but it does not equal any of the values for any of the button positions.

Possible Causes
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V937) SWITCH RETURN CIRCUIT OPEN
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT
SPEED CONTROL SWITCH
CLOCKSPRING
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH STATUS

Start the engine.
With a scan tool, monitor each which function for the Speed Control Switches.
Press and release each Speed Control Button.
- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

Does each switch function change status when pressing and then depressing each switch?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V38) S/C Switch No.2 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position

Not pressing any switch - 20.5 kohms

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

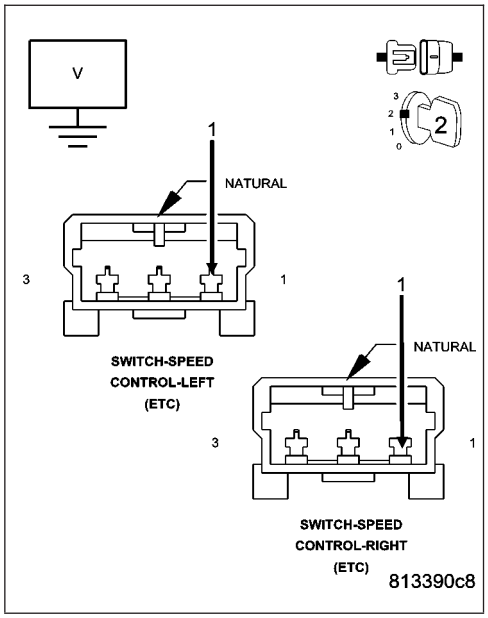
---

3. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage of the (V38) S/C Switch No.2 Signal circuit in the S/C Switch harness connector.



Is the voltage above 5.0 volts?

Yes >> Repair the short to battery voltage in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

4. CLOCKSPRING

Turn the ignition off.

Disconnect the upper and lower clockspring harness connectors per Service Information.

Measure the resistance of the (V38) S/C Switch No.2 Signal circuit between the upper and lower clockspring harness connectors.

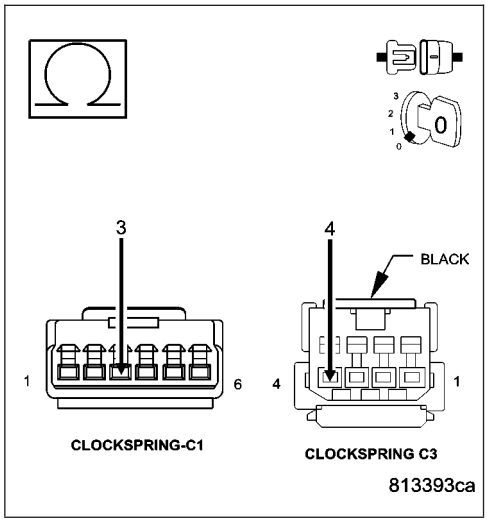
Measure the resistance of the (V937) Switch Return circuit between the upper and lower clockspring harness connectors.

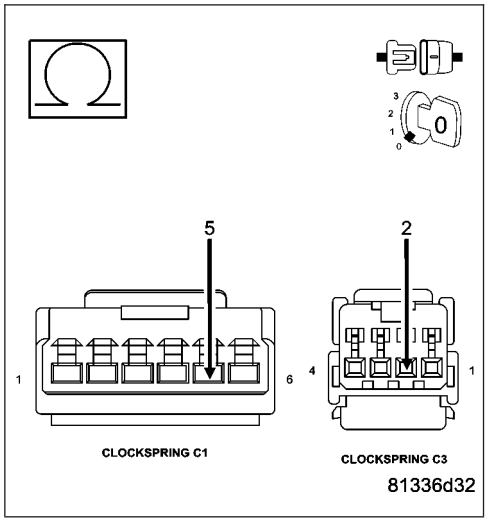
Is the resistance above 5.0 ohms?

Yes >> Replace the Clockspring per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Connect the Clockspring harness connectors per Service Information before continuing.





P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

5. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

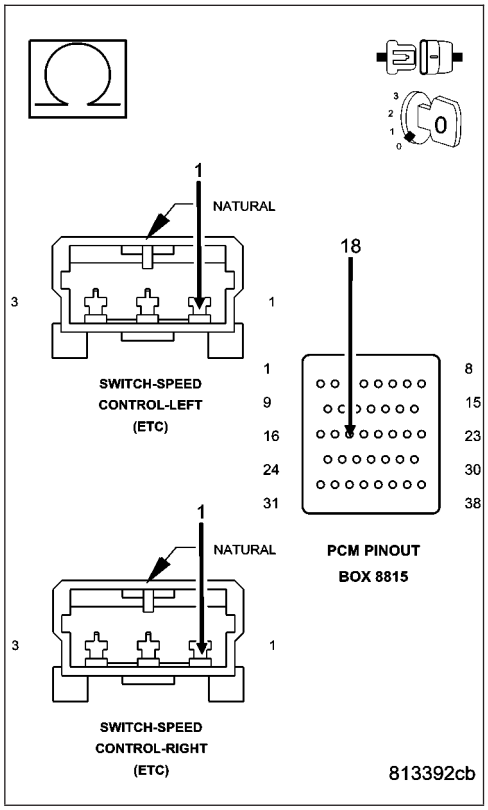
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V38) S/C Switch No.2 Signal circuit from both Speed Control harness connectors to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 6

No >> Repair the open in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (V937) SWITCH RETURN CIRCUIT OPEN

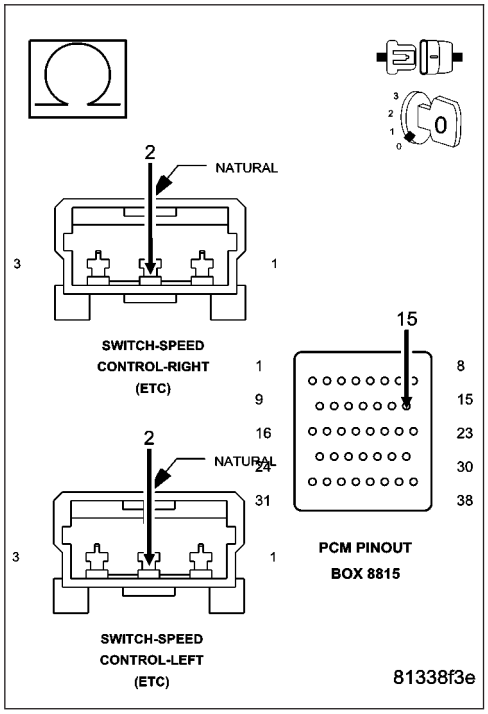
NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) Switch Return circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurement?

Yes >> Go To 7

No >> Repair the open in the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

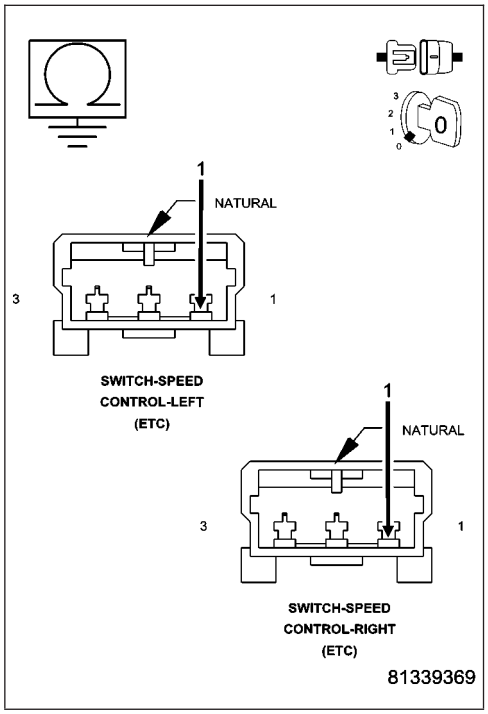
7. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V38) S/C Switch No.2 Signal circuit in the Speed Control harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



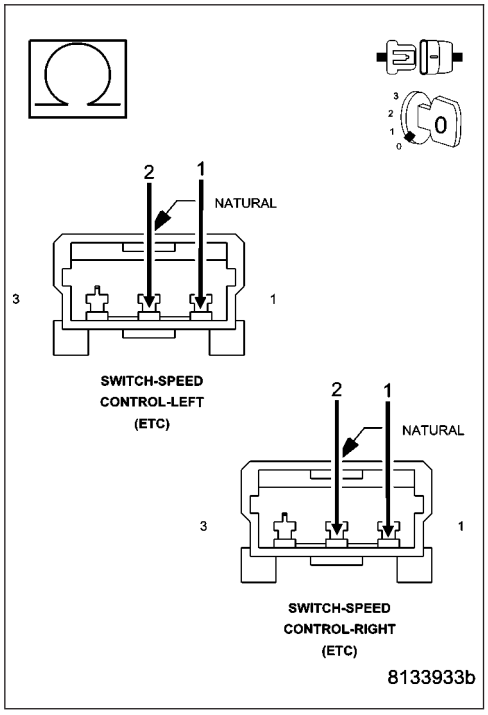
8. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT

Measure the resistance between the (V38) S/C Switch No.2 Signal circuit and the (V937) Switch Return circuit in the Speed Control harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V38) S/C Switch No.2 Signal circuit and the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

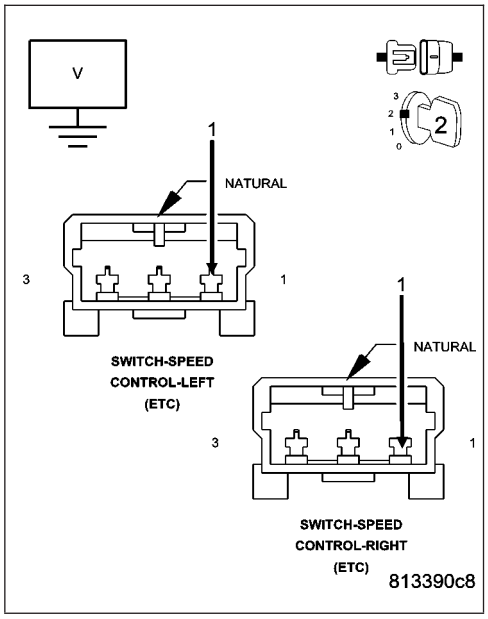
No >> Go To 9

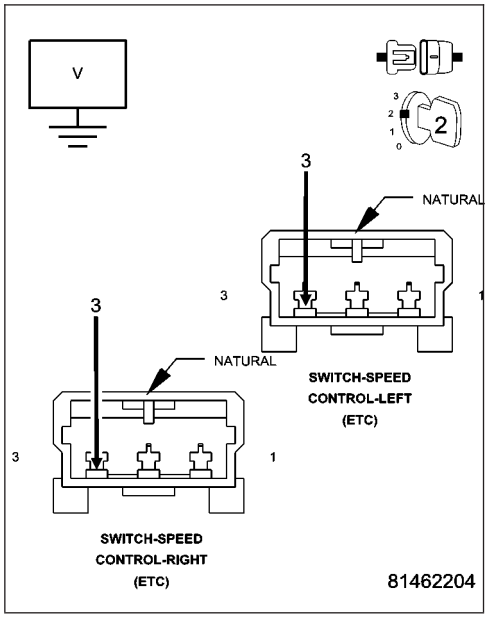


P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

9. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.
With a scan tool, monitor the S/C Switch voltage readings.





SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

P0591-SPEED CONTROL SWITCH 2 PERFORMANCE (CONTINUED)

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit and the (V38) S/C Switch No.2 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

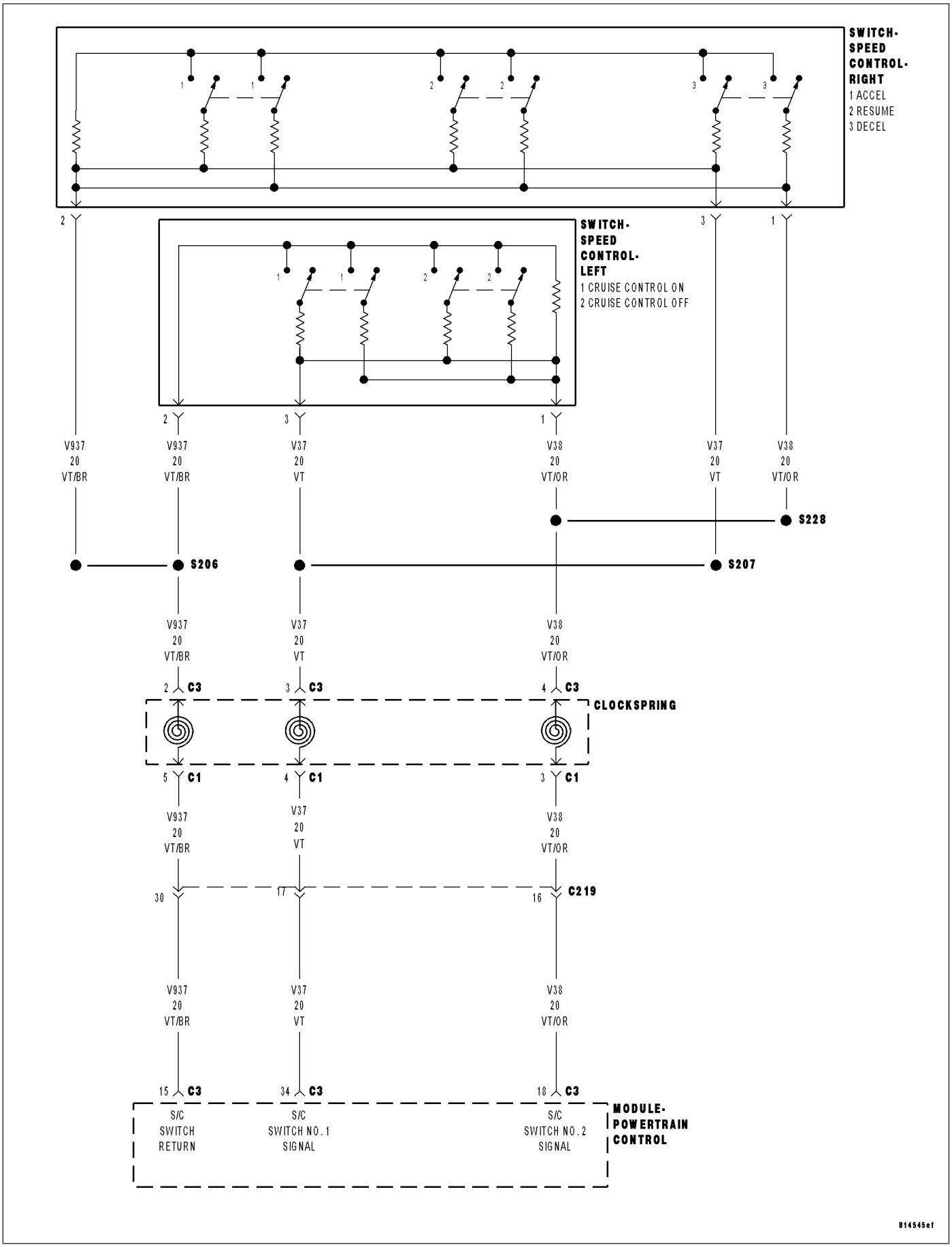
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW



P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Speed control switch input No.2 is below the minimum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT
CLOCKSPRING
SPEED CONTROL RESUME/ACCEL SWITCH
SPEED CONTROL ON/OFF SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE LOW

NOTE: Do not press any of the Speed Control Switch buttons.
Ignition on, engine not running.
With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage below 1.0 volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. SPEED CONTROL ON/OFF SWITCH

With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control On/Off Switch harness connector.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control On/Off Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

3. SPEED CONTROL RESUME/ACCEL SWITCH

With the scan tool, monitor the Speed Control Switch voltage.
Disconnect the Speed Control Resume/Accel Switch harness connector.

Did the voltage change to above 4.7 volts?

Yes >> Replace the Speed Control Resume/Accel Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW (CONTINUED)

4. CLOCKSPRING

Turn the ignition off.

Disconnect the clockspring harness connector (instrument panel wiring side) per Service Information.

Ignition on, engine not running.

With the scan tool, read the S/C Switch voltage.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the Clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

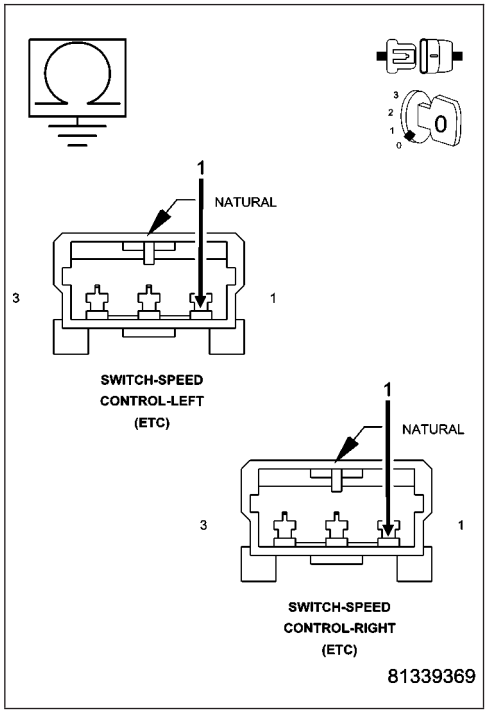
Turn the ignition off.

Connect the Clockspring harness connectors per Service Information.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance between ground and the (V38) S/C Switch No.2 Signal circuit to the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW (CONTINUED)

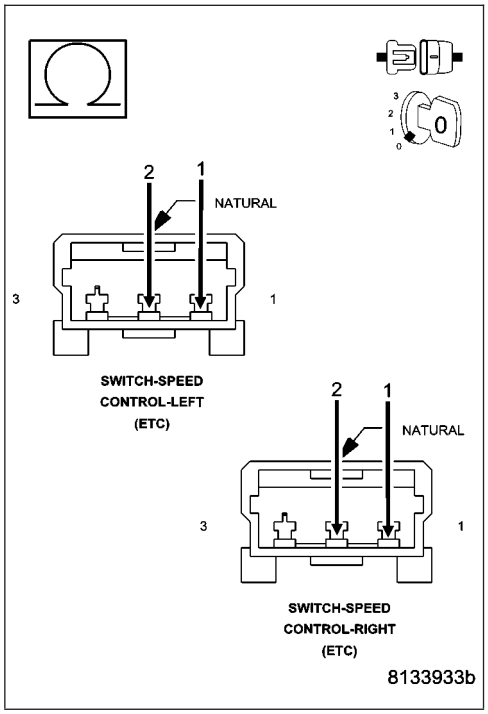
6. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT

Measure the resistance between the (V937) Switch Return circuit and the (V38) S/C Switch No.2 Signal circuit in the Speed Control Switch.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V38) S/C Switch No.2 Signal circuit and the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

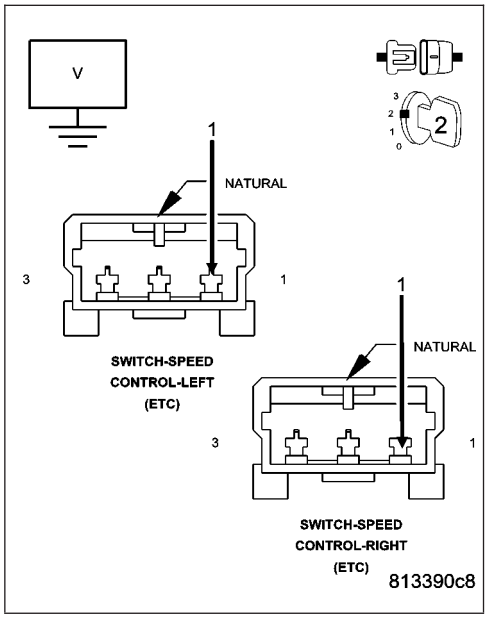


P0592-SPEED CONTROL SWITCH 2 CIRCUIT LOW (CONTINUED)

7. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.



SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

Take these same voltage measurements with a voltmeter by back probing the (V38) S/C Switch No.2 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and is there less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch values?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

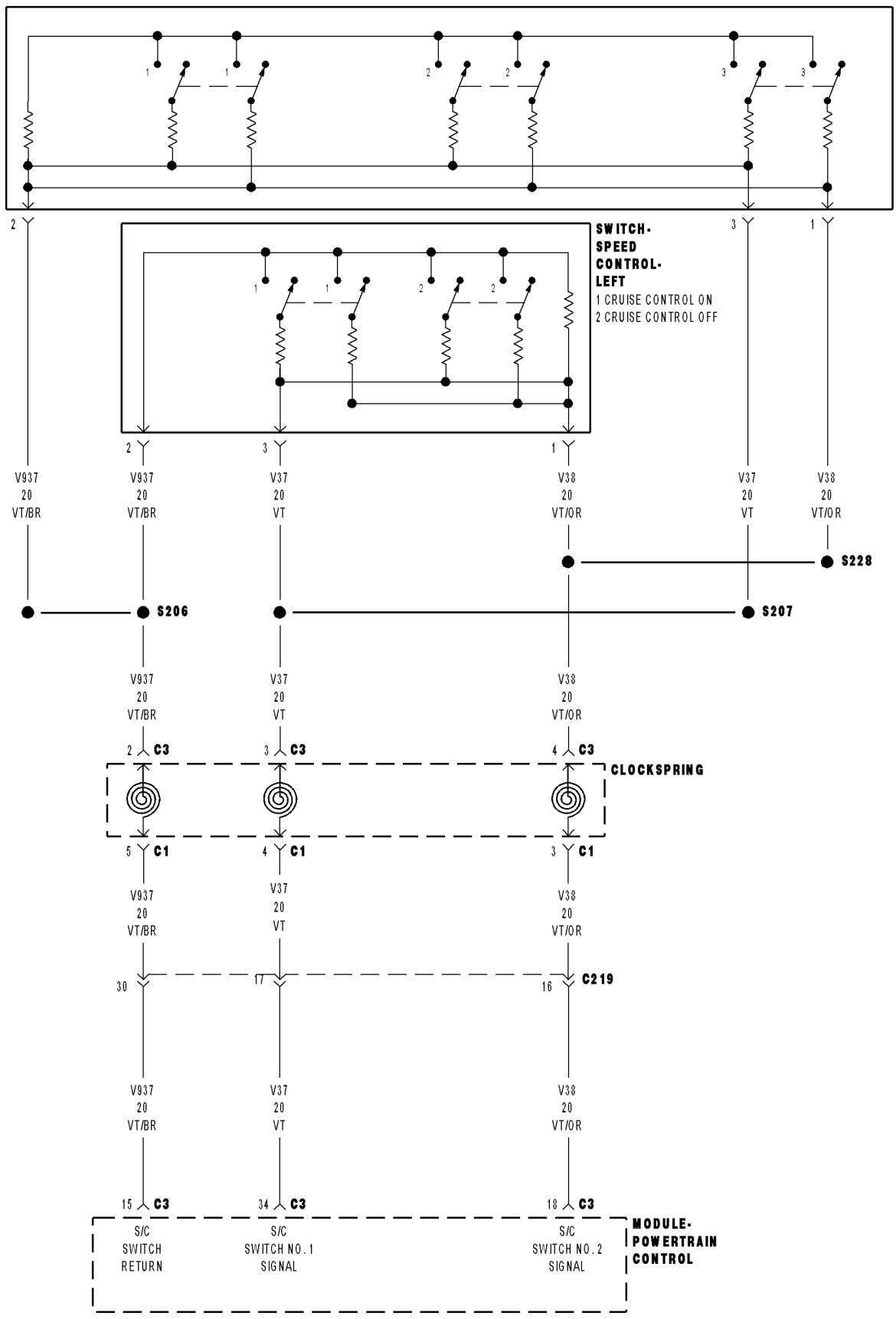
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH



P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  Speed Control Switch No.2 input above the maximum acceptable voltage at the PCM. One trip fault.

Possible Causes
(V38) S/C SIGNAL NO.2 CIRCUIT SHORTED TO VOLTAGE
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN BETWEEN THE PCM AND CLOCKSPRING
(V937) SWITCH RETURN CIRCUIT OPEN BETWEEN PCM AND CLOCKSPRING
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN BETWEEN THE CLOCKSPRING AND S/C SWITCH
(V937) SWITCH RETURN CIRCUIT OPEN BETWEEN CLOCKSPRING AND S/C SWITCH
CLOCKSPRING
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH VOLTAGE HIGH

NOTE: Do not press any of the Speed Control Switch buttons.

Ignition on, engine not running.

With a scan tool, read the Speed Control voltage.

Is the Speed Control voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH (CONTINUED)

2. SPEED CONTROL SWITCHES

Disconnect and remove the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V38) S/C Switch No.2 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position.

Not pressing any switch - 20.5 kohms

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

3. CLOCKSPRING

Disconnect the upper and lower Clockspring harness connector per Service Information.

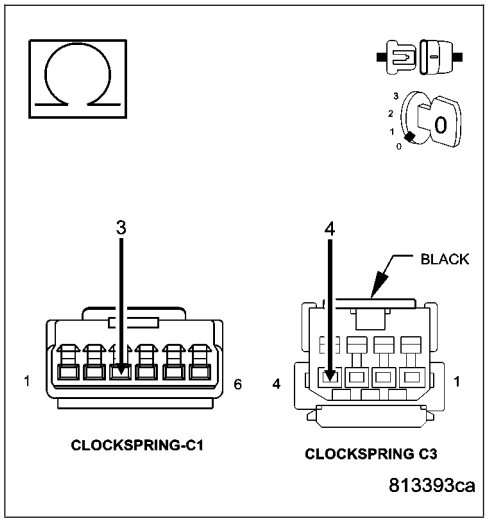
Measure the resistance of the (V937) Switch Return circuit between the upper and lower clockspring harness connectors.

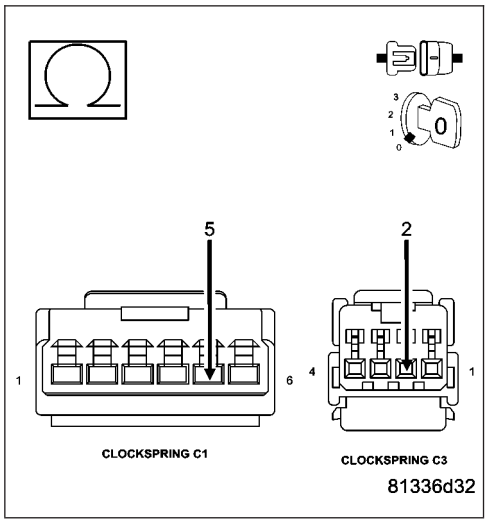
Measure the resistance of the (V38) S/C Switch No.2 Signal circuit between the upper and lower clockspring harness connectors.

Was the resistance above 5.0 ohms for either circuit?

Yes >> Replace the clockspring.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4





P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH (CONTINUED)

4. (V38) SIGNAL NO.2 CIRCUIT SHORTED TO BATTERY VOLTAGE

Connect the Upper and Lower Clockspring harness connectors per Service Information.

Disconnect the C3 PCM harness connector.

Measure the voltage on the (V38) S/C Signal No.2 circuit in the Speed Control harness connector.

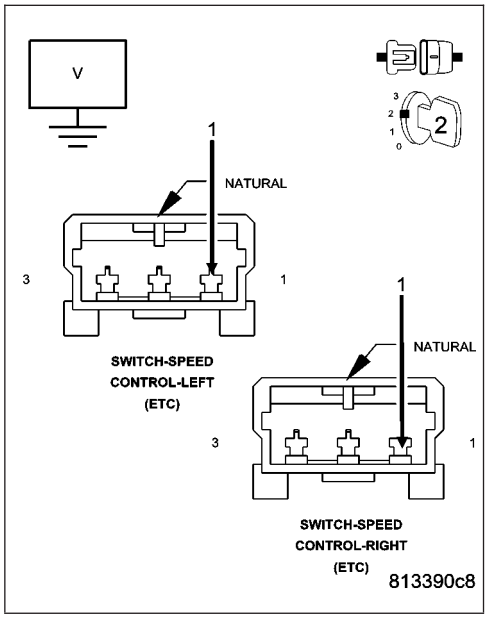
Ignition on, engine not running.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (V38) S/C Signal No.2 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

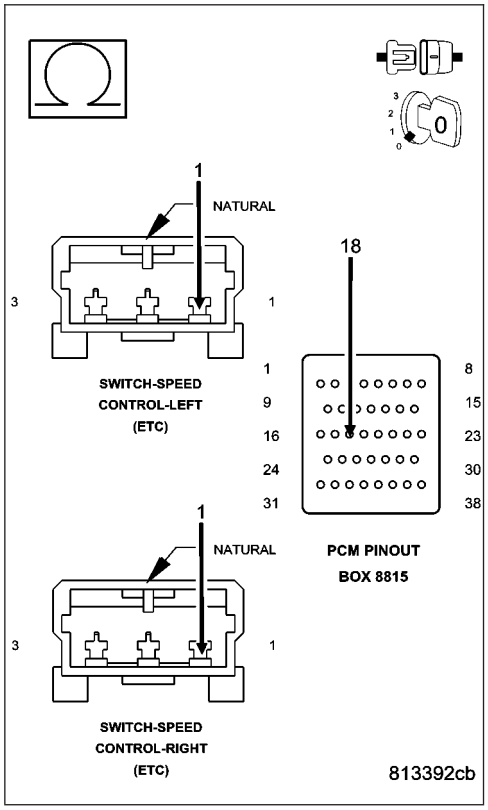
Measure the resistance of the (V38) S/C Switch No.2 Signal circuit from the both Switch harness connectors to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (V38) S/C Switch No.2 Signal circuit.

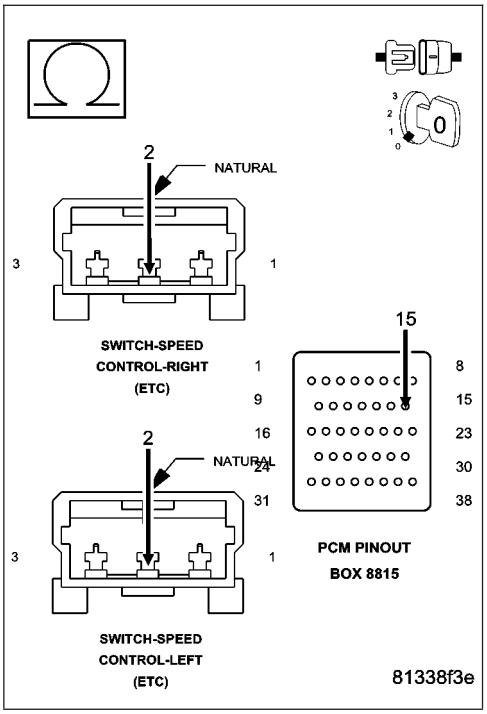
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0593-SPEED CONTROL SWITCH 2 CIRCUIT HIGH (CONTINUED)

6. (V937) SWITCH RETURN CIRCUIT OPEN

Measure the resistance of the (V937) Switch Return circuit from the both Switch harness connectors to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

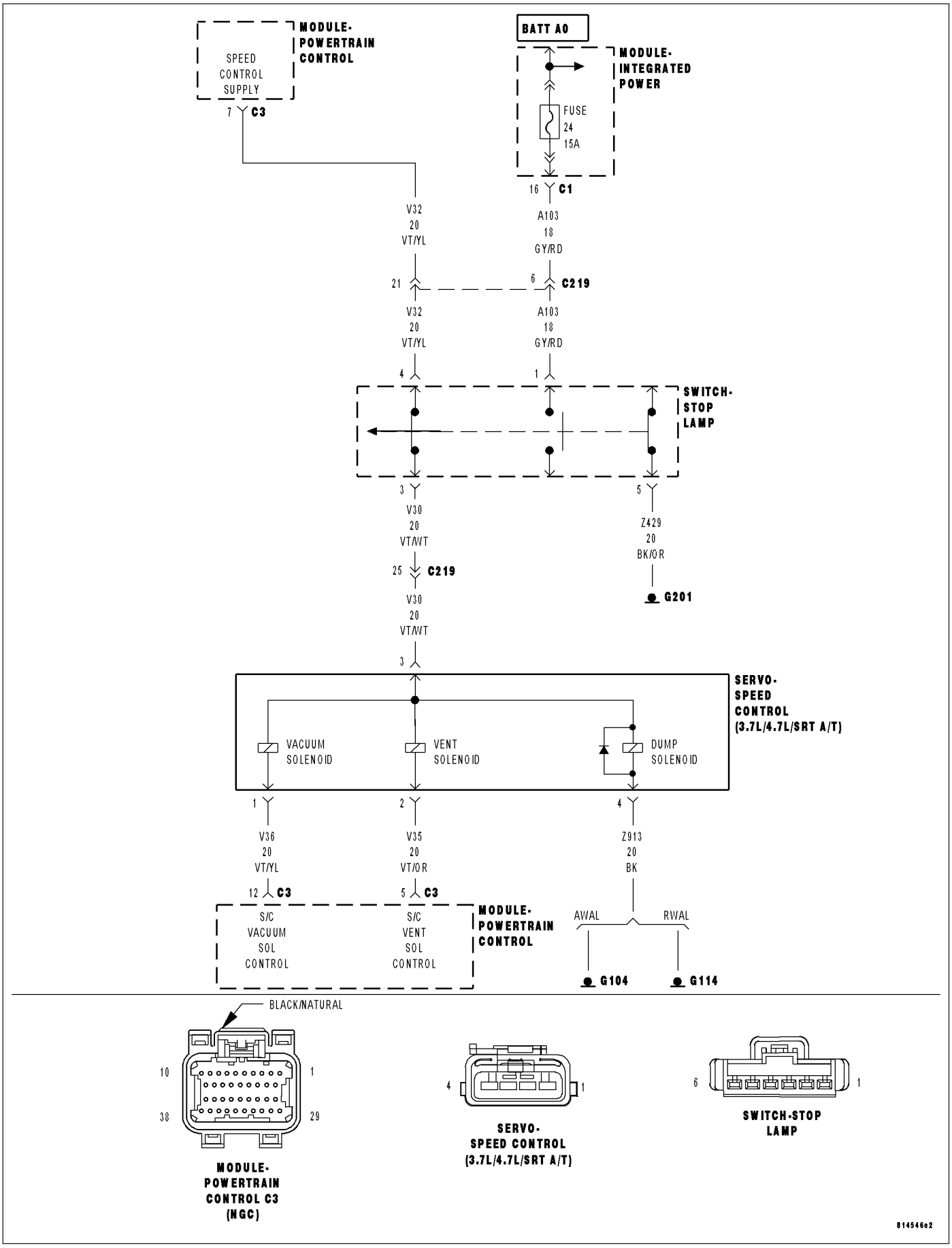
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT



P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on. The speed control switched on.
- **Set Condition:**
  The speed control power supply circuit is either open or shorted to ground for more than 2.6 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(V32) S/C SUPPLY CIRCUIT OPEN
(V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN
(V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: If this code is setting on a vehicle that doesn't have a S/C Servo, flash the correct code into the PCM or the wrong PCM may have previously been installed.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

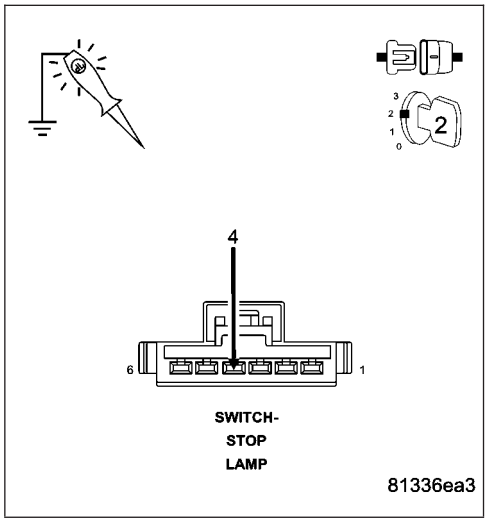
---

2. (V32) S/C SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

Using a 12-volt test light connected to ground, probe the (V32) S/C Supply circuit in the Switch harness connector while holding the Cruise Switch in the ON position.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Go To 7

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

3. STOP LAMP SWITCH

Disconnect and remove the Stop Lamp Switch.

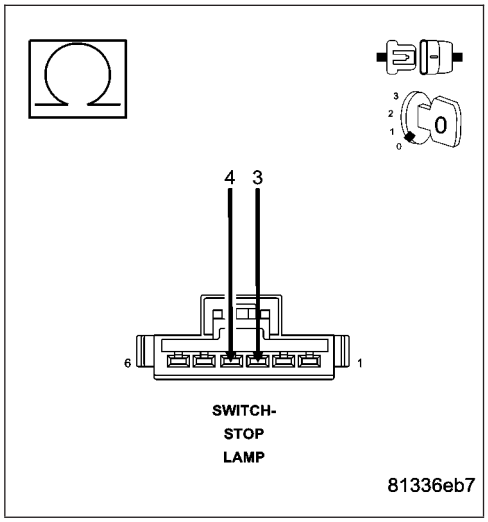
Measure the resistance across the (V32) S/C Supply circuit terminal and the (V30) S/C Brake Switch Output circuit terminal in the Stop Lamp Switch.

Push the Plunger of the Switch in and let it out.

Does the resistance change from below 5.0 ohms to an open circuit?

Yes >> Go To 4

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (V30) S/C BRAKE SWITCH OUTPUT

Turn the ignition off.

Connect the Stop Lamp Switch harness connector and install the Switch.

Disconnect the Speed Control Servo harness connector.

Ignition on, engine not running.

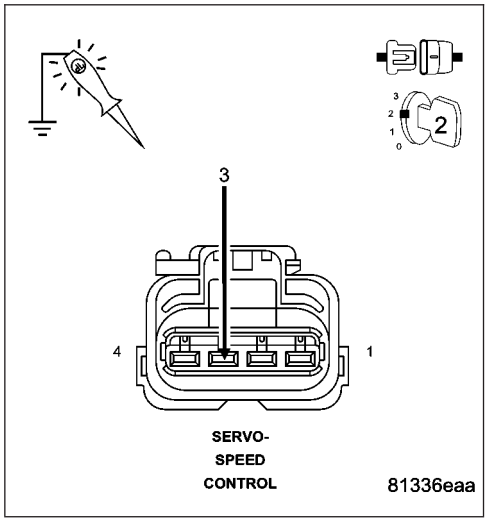
NOTE: It is necessary to PRESS and HOLD the Speed Control Switch in the ON position while checking for voltage.

Using a 12-volt test light connected to ground, probe the (V30) S/C Brake Switch Output circuit in the Servo Harness connector.

Does the test light illuminate brightly?

Yes >> Replace the S/C Servo.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



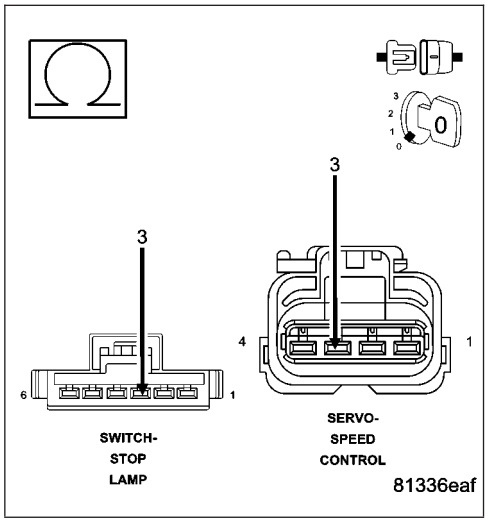
P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

5. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the Brake Lamp Switch harness connector.

Measure the resistance of the (V30) S/C Brake Switch Output circuit from the Stop Lamp Switch harness connector to the S/C Servo harness connector.



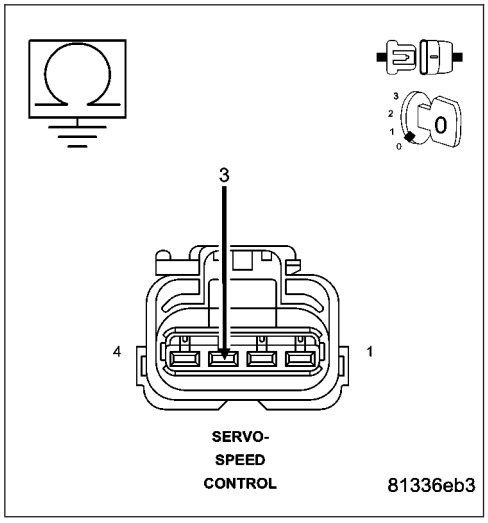
Is the resistance below 5.0 ohms?

Yes >> Repair the excessive resistance in the (V30) S/C Brake Switch Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (V30) S/C BRAKE SWITCH OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V30) S/C Brake Switch Output circuit in the Speed Control Servo harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V30) S/C Brake Switch Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

7. (V32) S/C SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

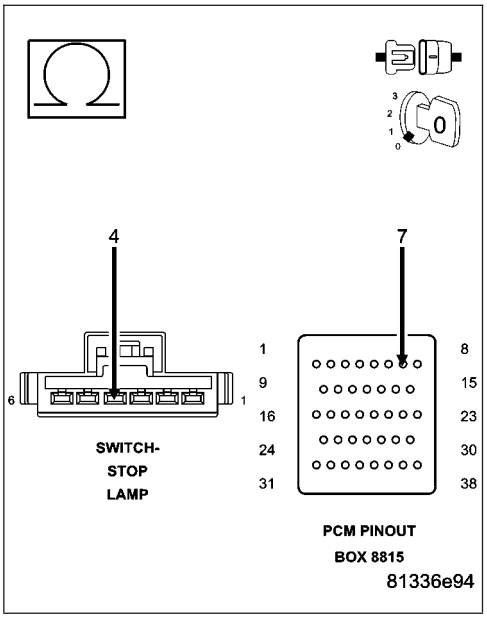
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (V32) S/C Supply circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the open in the (V32) S/C Supply circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



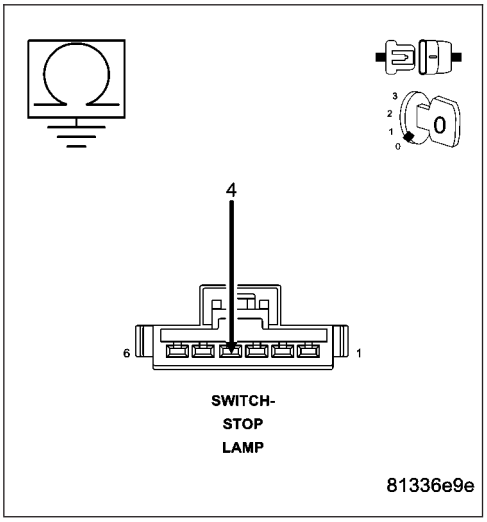
8. (V32) S/C SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) S/C Supply circuit in the Stop Lamp Switch harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V32) S/C Supply circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



P0594-SPEED CONTROL SERVO POWER RELAY CIRCUIT (CONTINUED)

9. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0600-SERIAL COMMUNICATION LINK

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal Bus communication failure between processors. One Trip Fault. Three Global Good Trips to Clear.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0601-INTERNAL MEMORY CHECKSUM INVALID

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal checksum for software failed, does not match calculated value. One Trip Fault, Three Good Trips to clear.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0606-INTERNAL ECM PROCESSOR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  When the PCM recognizes an internal failure to communicate with the ECM or the CMP and CKP Sensor count periods are too short. One trip fault. ETC light is flashing.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P060B-ETC A/D GROUND PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the Throttle Motor is powered.
- **Set Condition:**
  When A2D reading does not return to ground within a set period of time of test activation, this fault sets. The test typically runs a couple of times per second, and is the reason why APP2 signal spikes to ground a couple of times per second in normal running. Reprogramming the module may not always fix this fault. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

NOTE: Diagnose any other DTCs that may have set with the P060B.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, read DTCs.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P060D-ETC LEVEL 2 APP PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered and no matured faults related to APP Sensors.
- **Set Condition:**
  When secondary software determines that APPS 1 and APPS 2 signals do not match for a period of time. ETC lamp will flash

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, read DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060D.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P060E-ETC LEVEL 2 TPS PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered and no matured faults related to TP Sensors.
- **Set Condition:**
  When secondary software determines that TPS 1 and TPS 2 signals do not match for a period of time. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, read DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060E.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P060F-ETC LEVEL 2 ECT PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered and no matured faults related to the Engine Coolant Temp Sensor.
- **Set Condition:**
  When secondary software determines that the Coolant Temperature is implausible for a period of time. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Diagnose any Engine Coolant Temperature Sensor DTCs before continuing.
Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.
Flash the Powertrain Control Module per Service Information if any updates are available.
Start the engine.
Allow the engine to reach normal operating temperature.
Operate the accelerator pedal. (do not exceed 3500 rpm)
With a scan tool, read DTCs.

NOTE: Diagnose any other DTCs that may have set with the P060F.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P061A-ETC LEVEL 2 TORQUE PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered.
- **Set Condition:**
  When secondary software determines that the customer requested output is not being achieved by the engine for a period of time. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Check the engine for air/vacuum leaks and diagnose any Fuel System Lean/Rich as well as MAP Sensor DTCs before continuing.
Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.
Flash the Powertrain Control Module per Service Information if any updates are available.
Start the engine.
Allow the engine to reach normal operating temperature.
Operate the accelerator pedal. (do not exceed 3500 rpm)
With a scan tool, read DTCS.

NOTE: Diagnose any other DTCs that may have set with the P061A.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P061C-ETC LEVEL 2 RPM PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered and no camshaft or crankshaft electrical signal related DTCs are set.
- **Set Condition:**
  When secondary software determines that the engine speed is implausible for a period of time. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

NOTE: Diagnose any Camshaft Position and Crankshaft Position Sensor DTCs before continuing.
Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.
Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, read DTCs.

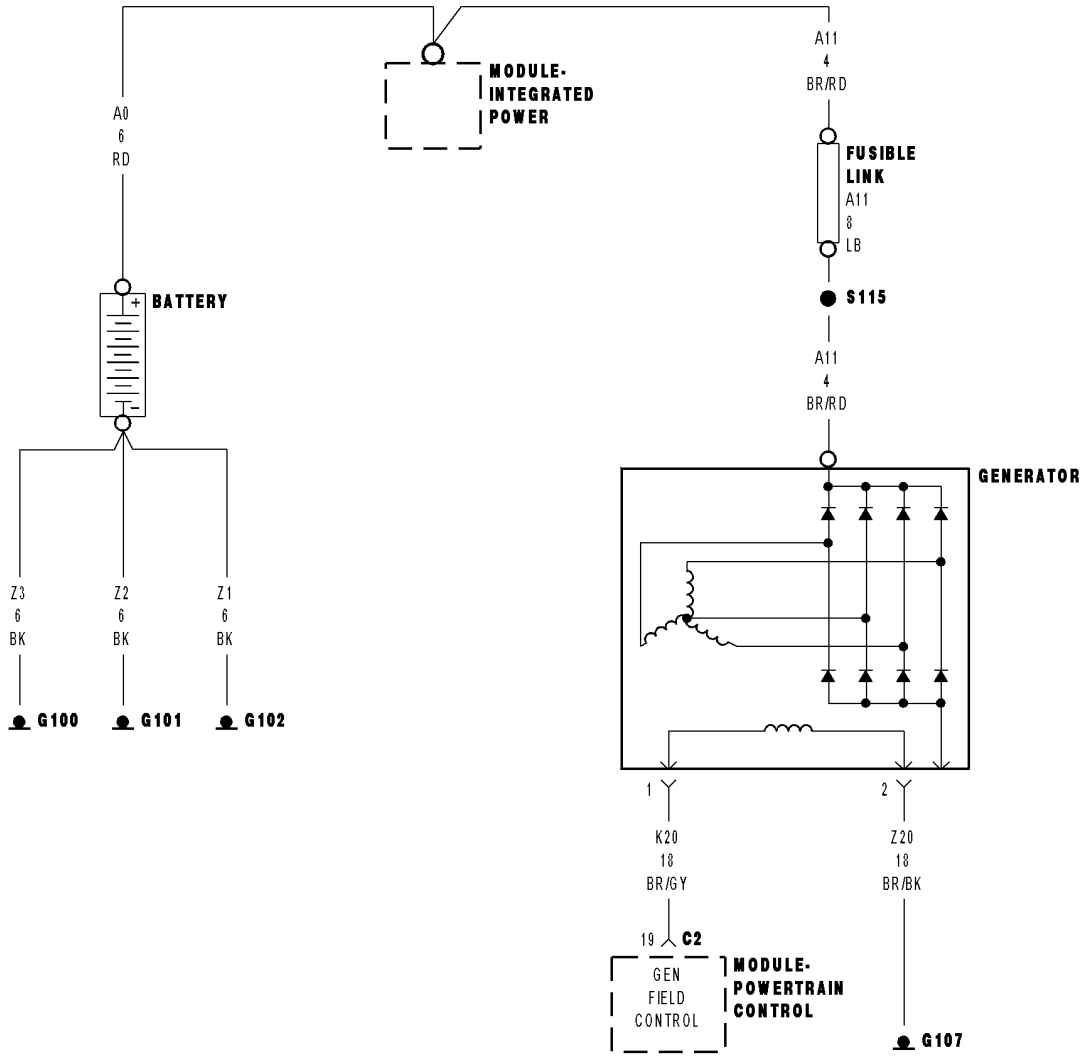
NOTE: Diagnose any other DTCs that may have set with the P061C.

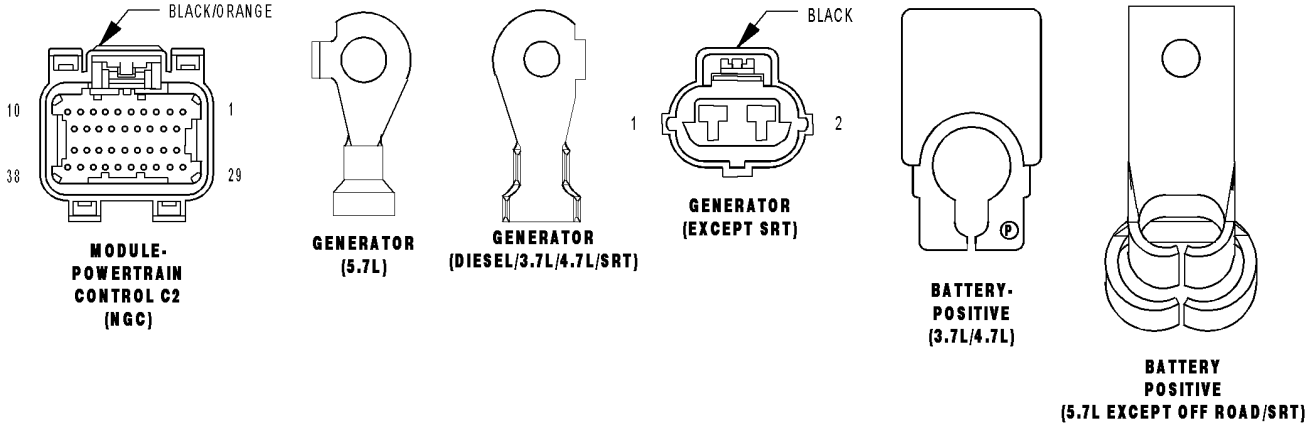
Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0622-GENERATOR FIELD CONTROL CIRCUIT





81454554

P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Engine running.
- **Set Condition:**
  When the PCM tries to regulate the generator field with no result during monitoring. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GROUND CIRCUIT OPEN
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump it across the Generator Field harness connector.

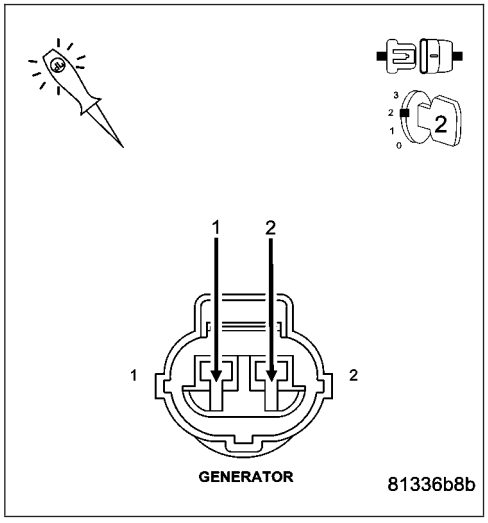
Ignition on, engine not running.

With the scan tool, actuate the Generator Field Control circuit.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

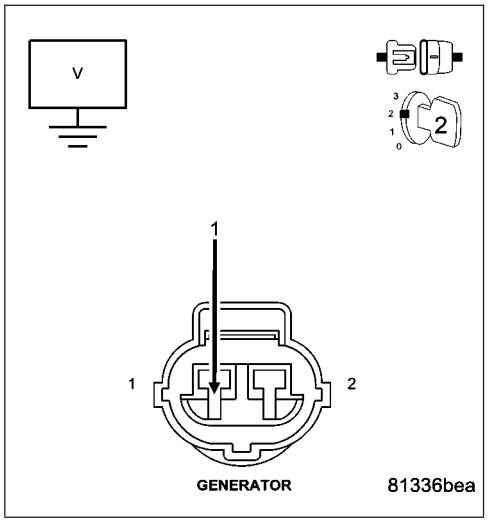
3. (K20) GEN FIELD CIRCUIT SHORTED BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

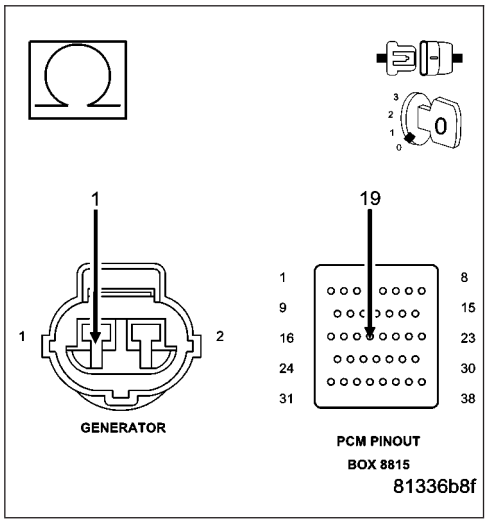
No >> Go To 4

4. (K20) GEN FIELD CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator Field harness connector to appropriate terminal of the special tool #8815.



Is the resistance below 5.0 ohms?

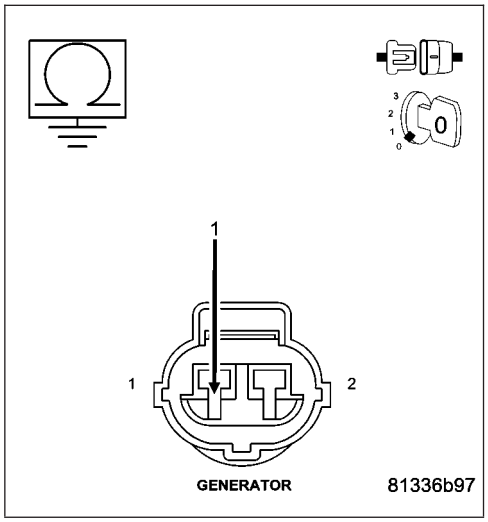
Yes >> Go To 5

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0622-GENERATOR FIELD CONTROL CIRCUIT (CONTINUED)

5. (K20) GEN FIELD CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



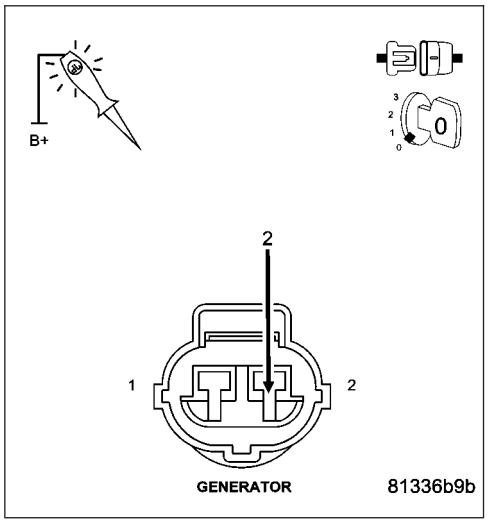
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z20) Ground circuit in the Gen Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 7

No >> Repair the open in the (Z20) Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

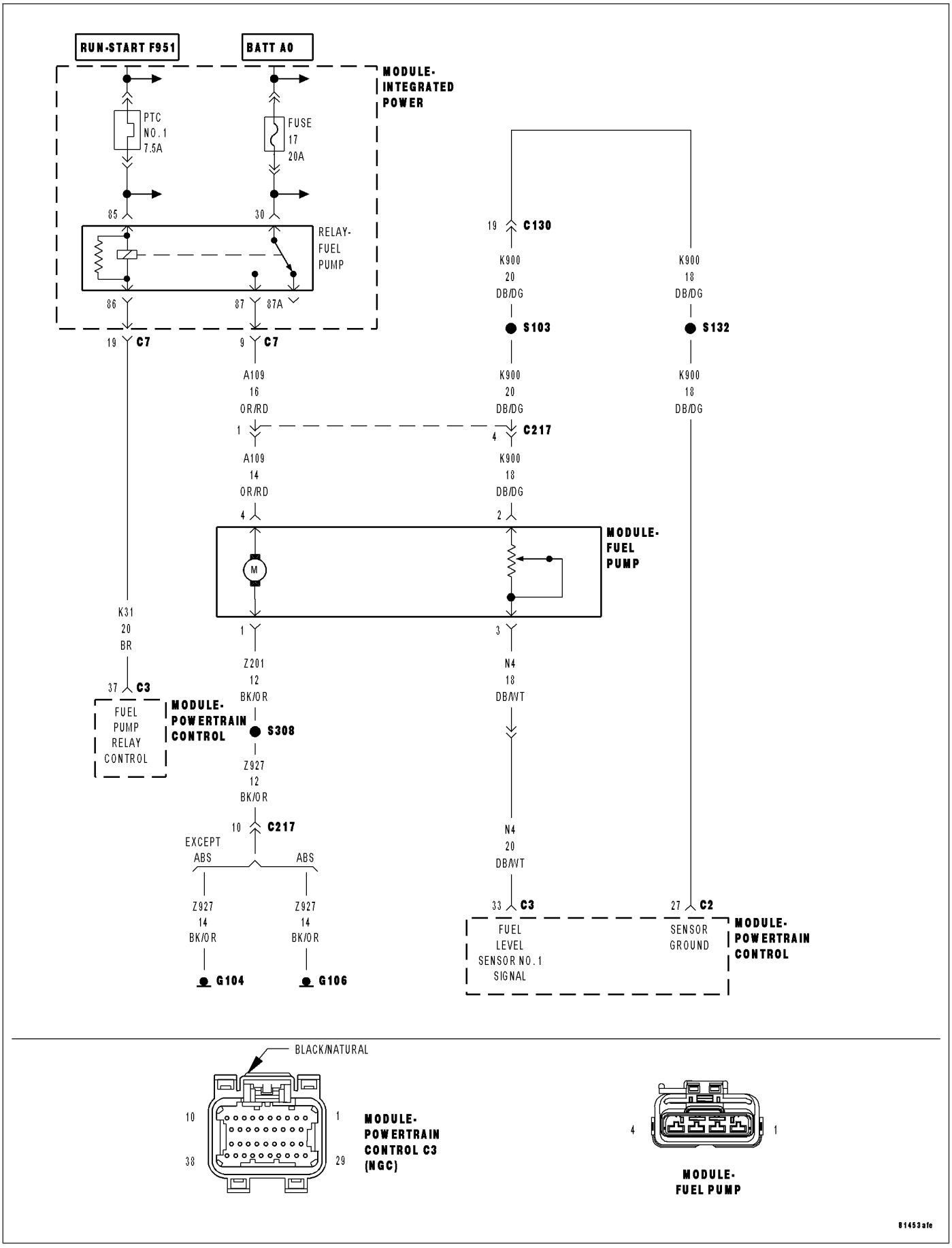
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT



P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts and the ASD sense switch is on.
- **Set Condition:**
  Actual Fuel Pump Relay state is not equal to desired state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K31) FUEL PUMP RELAY CONTROL CIRCUIT
(K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND
FUEL PUMP RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. FUEL PUMP RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Fuel Pump Relay.

Is the Fuel Pump Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. FUEL PUMP RELAY

Turn the ignition off.

Remove the Fuel Pump Relay from the IPM.

Measure the resistance of the Fuel Pump Relay Coil.

Is the resistance between 70 to 90 ohms?

Yes >> Go To 3

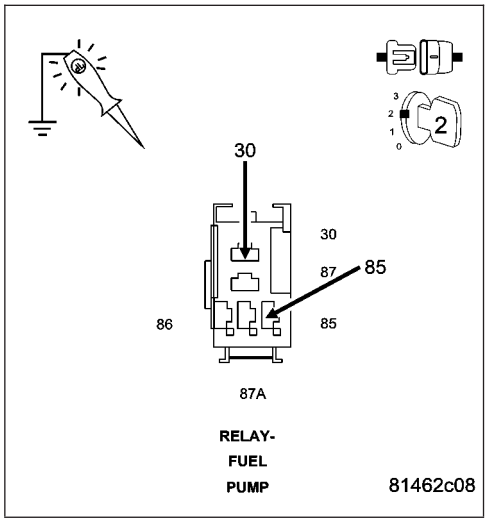
No >> Replace the Fuel Pump Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

3. INTERNAL FUSED IGNITION SWITCH AND FUSED B+ OUTPUT CIRCUITS

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the Internal Fused Ignition Switch Output circuit and Fused B+ circuit.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the Internal Fused Ignition Switch Output circuit or the Fused B+ circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

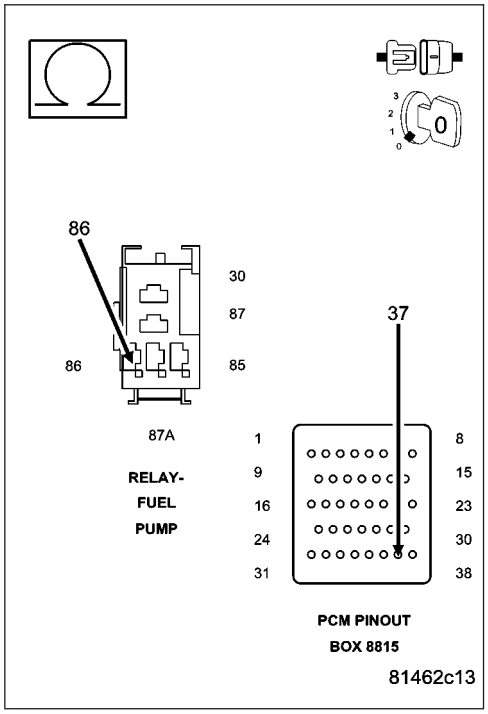
4. (K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K31) Fuel Pump Relay Control circuit from the IPM to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

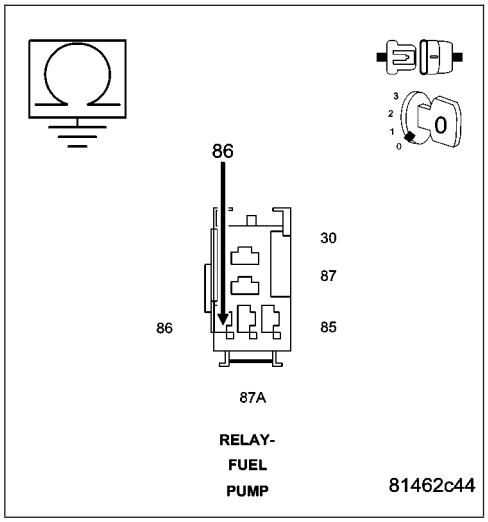
No >> Repair the open in the (K31) Fuel Pump Relay Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0627-FUEL PUMP RELAY CIRCUIT (CONTINUED)

5. (K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Relay Control circuit in the IPM.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K31) Fuel Pump Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P062C-ETC LEVEL 2 MPH PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Throttle motor is powered and no vehicle speed related DTCs have matured.
- **Set Condition:**
  When secondary software determines that the vehicle speed is implausible for a period of time. ETC lamp will flash.

Possible Causes
PCM NEEDS TO BE PROGRAMMED
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAM THE POWERTRAIN CONTROL MODULE

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

With a scan tool, read DTCs.

NOTE: Diagnose any other DTCs that may have set with the P062C.

Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0630-VIN NOT PROGRAMMED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At initialization.
- **Set Condition:**
  The VIN has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING VIN INTO PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING VIN INTO THE PCM

Ignition on, engine not running.

Using the scan tool, program VIN into the PCM.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> The VIN has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0632-ODOMETER NOT PROGRAMMED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Odometer is not programed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING MILEAGE INTO THE PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING MILEAGE INTO THE PCM

Ignition on, engine not running.
With the scan tool, erase DTCs.
Using a scan tool, program the mileage into the PCM.
Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read DTCs.

Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> The mileage has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0633-SKIM KEY NOT PROGRAMMED IN PCM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The SKIM Key information has not been programmed into the PCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PROGRAMMING SKIM KEY INTO THE PCM
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PROGRAMMING SKIM KEY INTO THE PCM

Ignition on, engine not running.

With a scan tool, erase DTCs.

Using the scan tool, program the SKIM Key information into the PCM.

Start the engine.

NOTE: If the engine will not start, crank the engine over for 15 seconds. Crank at least 2 times with the ignition switch returning to the off position each time.

Allow the engine to reach normal operating temperature.

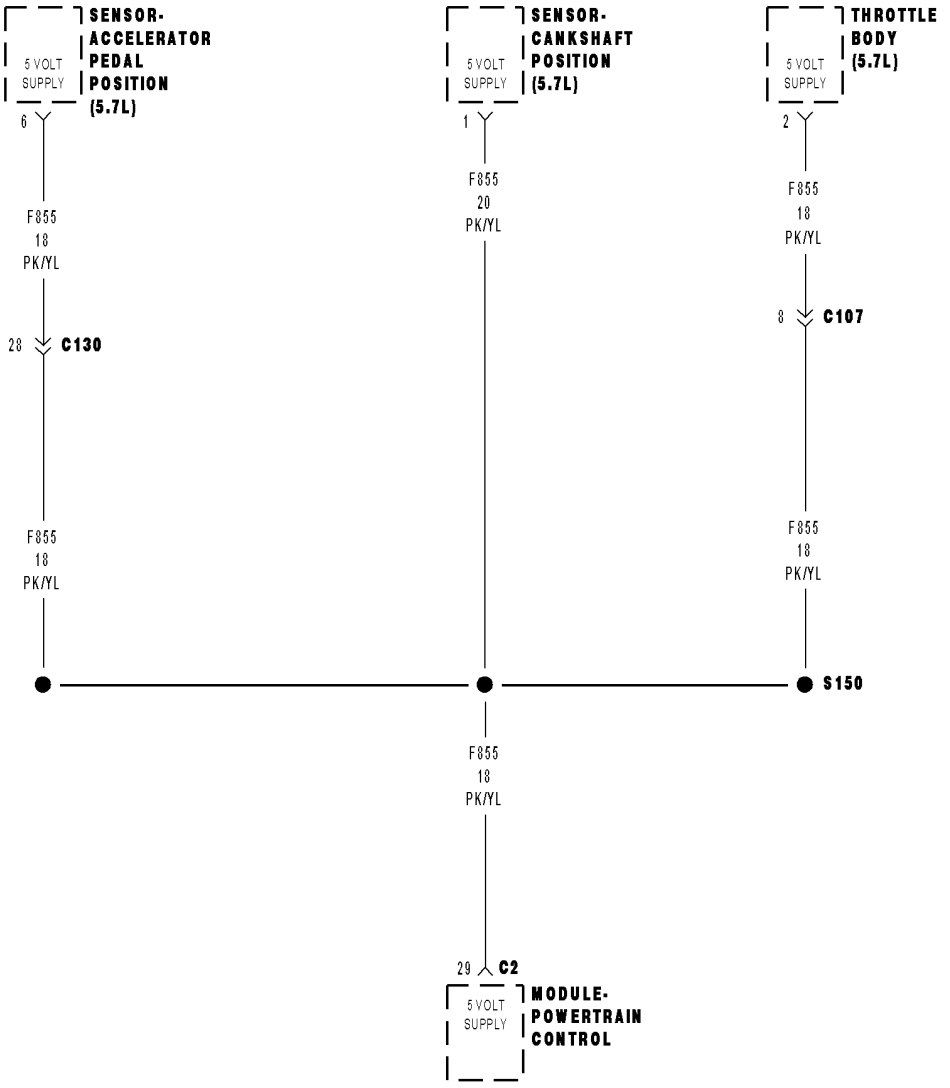
With the scan tool, read DTCs.

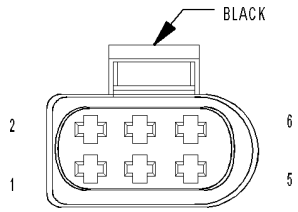
Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

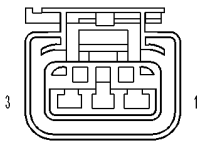
No >> The SKIM KEY information has been successfully programmed into the PCM. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW

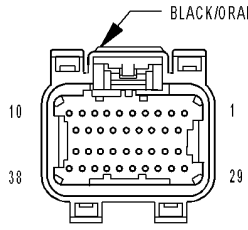




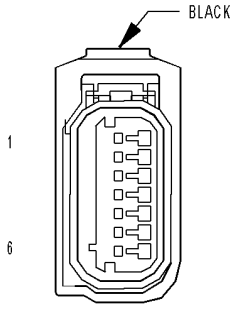
THROTTLE
BODY
(5.7L)



SENSOR-
CRANKSHAFT
POSITION
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
ACCELERATOR
PEDAL
POSITION

81454897

P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Primary 5-volt Supply circuit voltage is too low. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO GROUND
SENSOR SHORTED TO GROUND
5-VOLT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

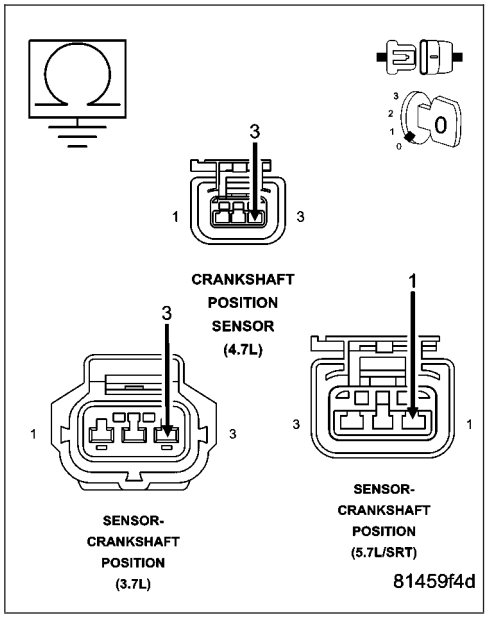
Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

Measure the resistance between ground and the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) Primary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW (CONTINUED)

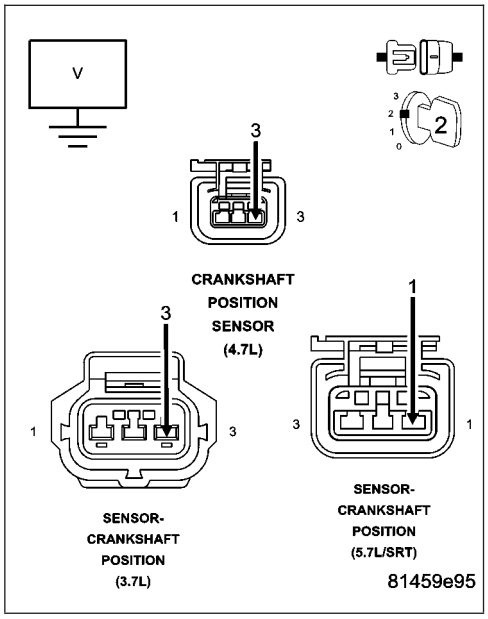
3. 5-VOLT SENSOR

Turn the ignition off.

Reconnect all the previously disconnected Sensors except for the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.



Is the voltage below 4.5 volts?

Yes >> Go To 4

No >> Replace the CKP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

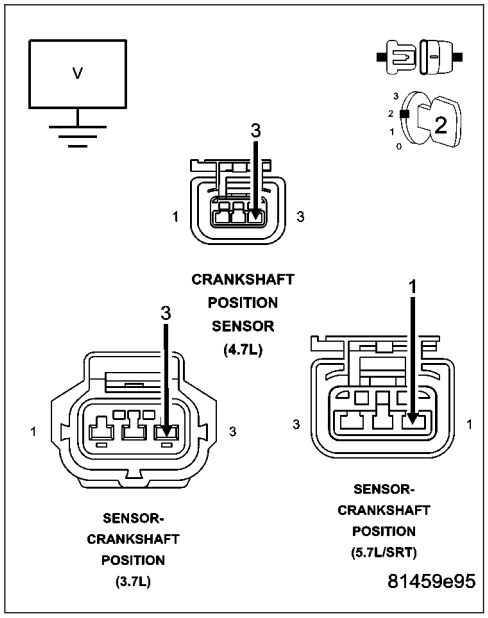
4. 5-VOLT SENSOR SHORTED TO GROUND

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.

CAUTION: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F855) Primary 5-volt Supply circuit, one at a time.

NOTE: Reconnect all the Sensors and clear all trouble codes before continuing.



Does the voltage increase above 4.5 volts when disconnecting any of the remaining Sensors?

Yes >> Replace the Sensor that causes the (F855) Primary 5-volt Supply circuit voltage to increase when disconnected.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0642-SENSOR REFERENCE VOLTAGE 1 CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

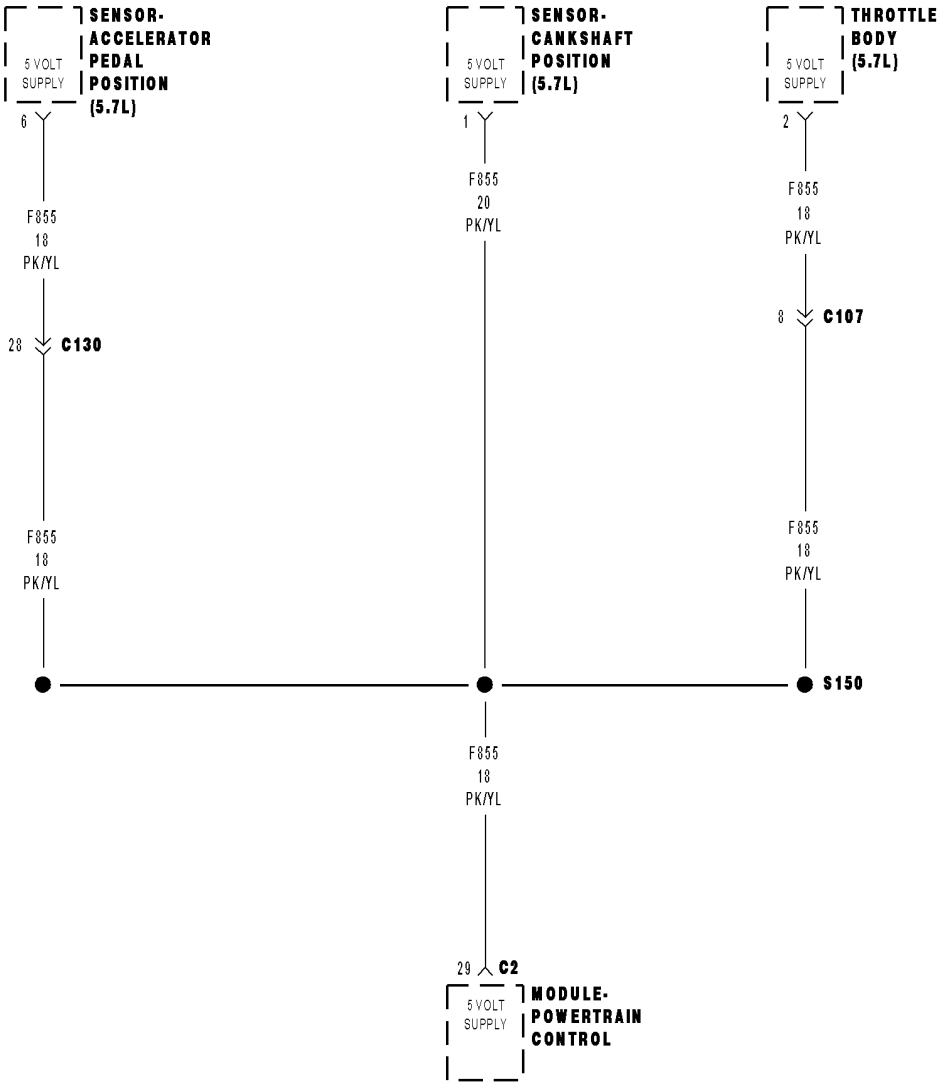
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

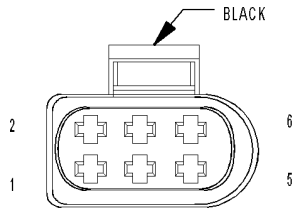
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

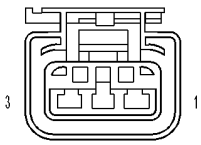
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0643-PRIMARY 5-VOLT SUPPLY CIRCUIT HIGH

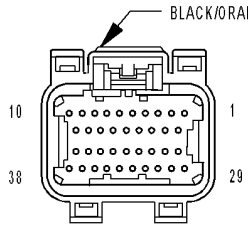




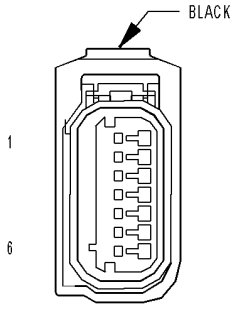
THROTTLE
BODY
(5.7L)



SENSOR-
CRANKSHAFT
POSITION
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
ACCELERATOR
PEDAL
POSITION

81454897

P0643-PRIMARY 5-VOLT SUPPLY CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Primary 5-volt Supply circuit voltage is too high. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (F855) PRIMARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

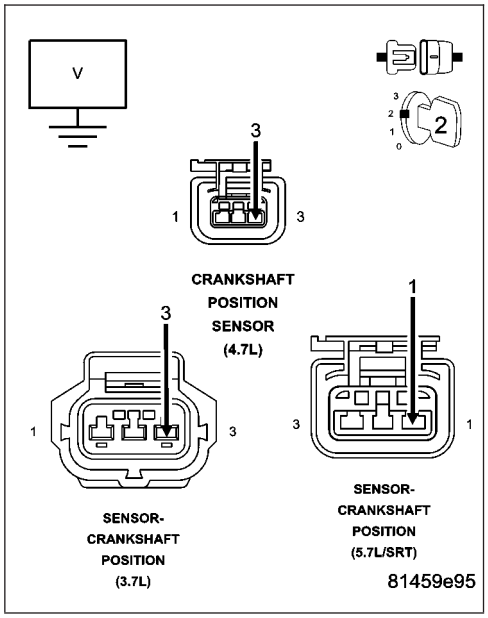
Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (F855) Primary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P0643-PRIMARY 5-VOLT SUPPLY CIRCUIT HIGH (CONTINUED)

3. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

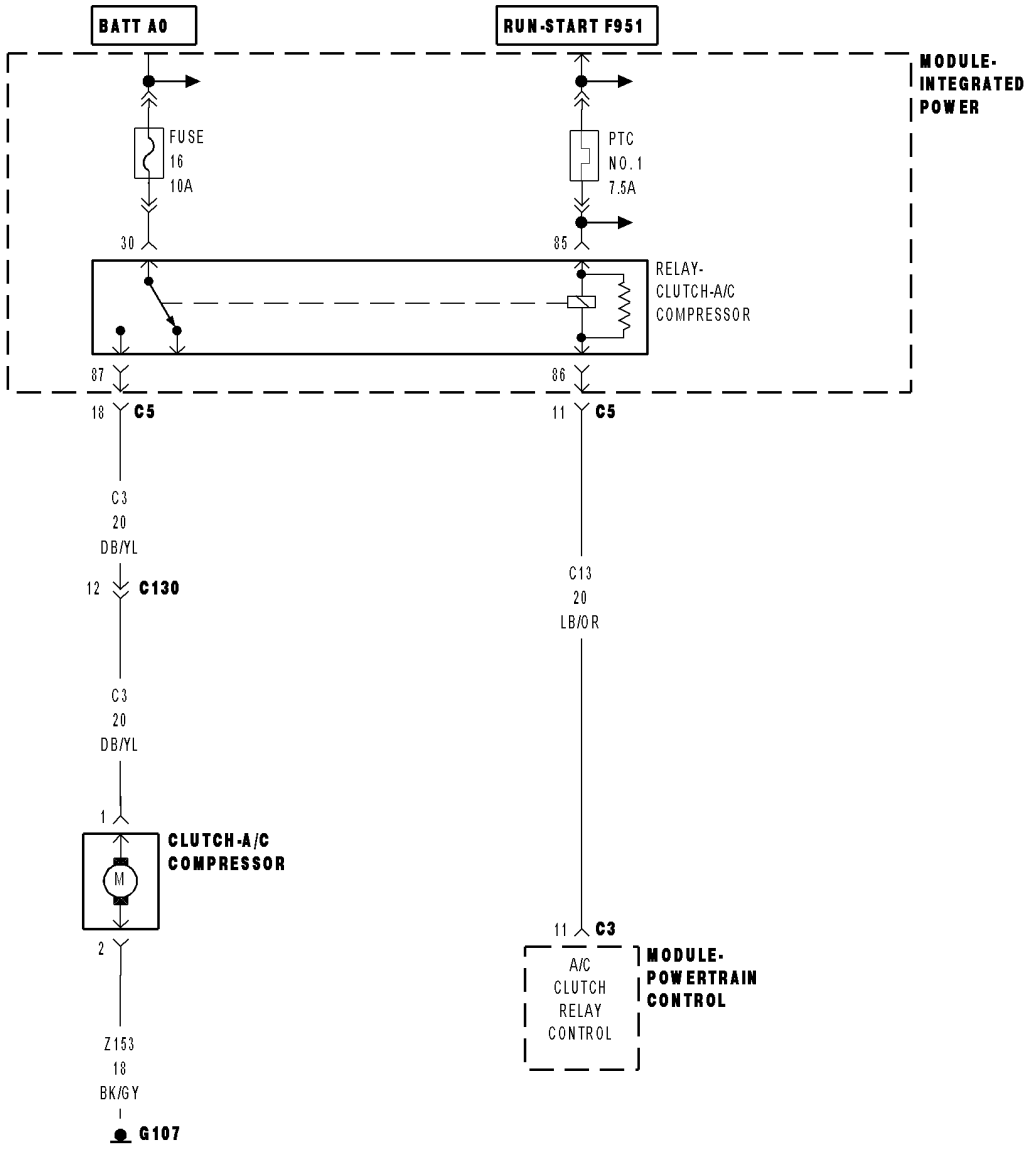
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

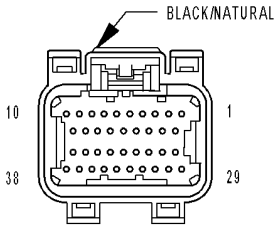
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

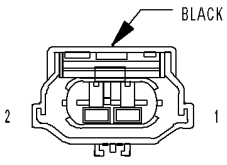
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



CLUTCH-A/C
COMPRESSOR
(GAS)

814548fc

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.
- **Set Condition:**
  An open or shorted condition is detected in the A/C clutch relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT
INTERNAL FUSED B+ CIRCUIT
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND
A/C CLUTCH RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C CLUTCH RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the A/C Clutch Relay.

Is the A/C Clutch Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. A/C CLUTCH RELAY RESISTANCE

Turn the ignition off.

Remove the A/C Clutch Relay from the IPM.

Measure the resistance of the A/C Clutch Relay Coil.

Is the resistance between 60 to 80 ohms?

Yes >> Go To 3

No >> Replace the A/C Clutch Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

3. INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT AND FUSED B+ CIRCUIT

Ignition on, engine not running.

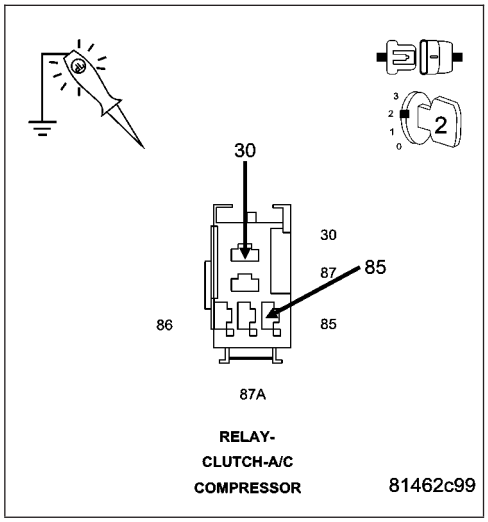
Using a 12-volt test light connected to ground, probe the Internal Fused Ignition Switch Output circuit and the Fused B+ circuit in the connection.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the Fused Ignition Switch Output circuit or the Fused B+ circuit. Check and replace any open fuses.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

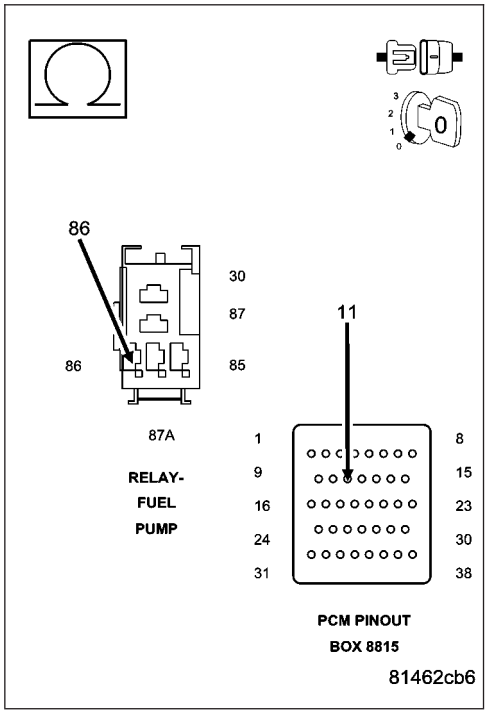
Measure the resistance of the (C13) A/C Clutch Relay Control circuit from the relay connection to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (C13) A/C Clutch Relay Control circuit.

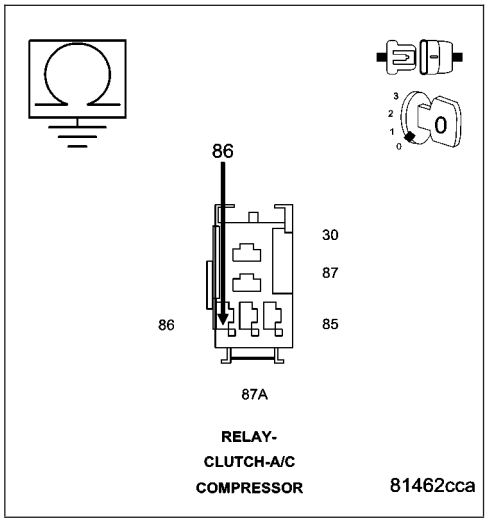
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

5. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C13) A/C Clutch Relay Control circuit at the IPM.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (C13) A/C Relay Clutch Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

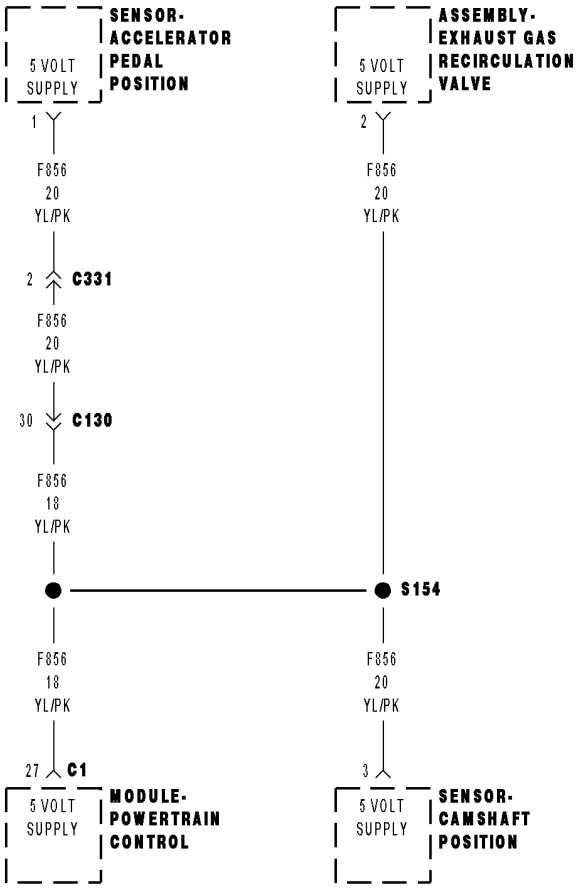
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

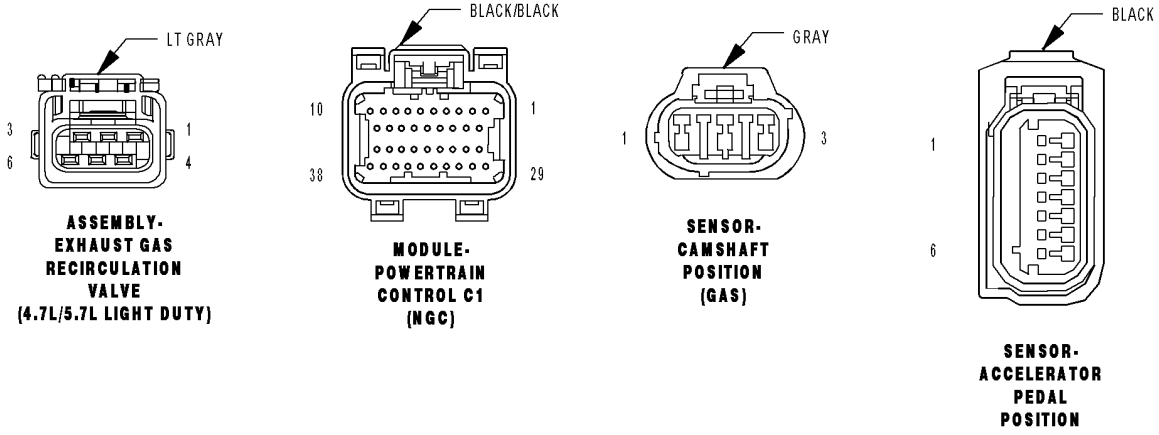
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0652-SENSOR REFERENCE VOLTAGE 2 CIRCUIT LOW





8145491c

P0652-SENSOR REFERENCE VOLTAGE 2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is too low. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO GROUND
SENSOR SHORTED TO GROUND
CAM POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

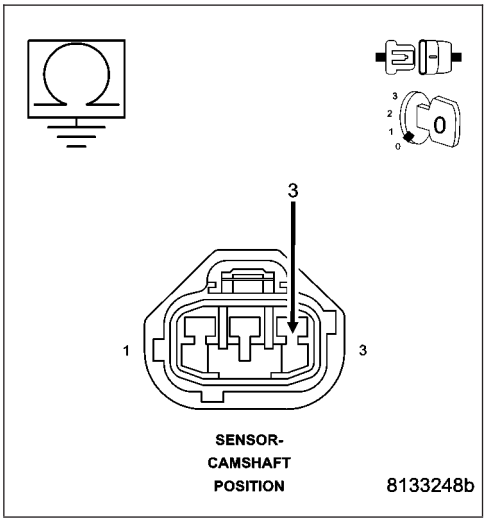
2. (F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

Measure the resistance between ground and the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) Auxiliary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0652-SENSOR REFERENCE VOLTAGE 2 CIRCUIT LOW (CONTINUED)

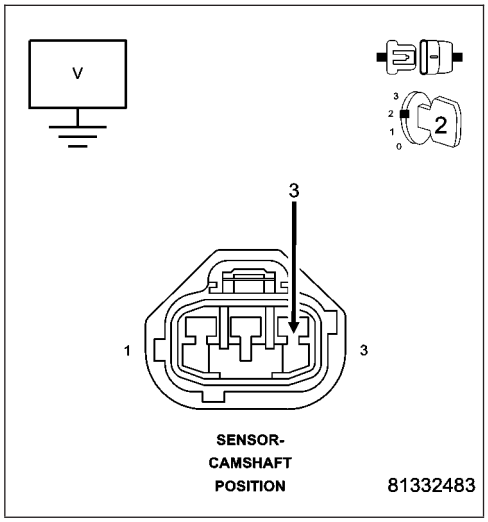
3. CMP SENSOR

Turn the ignition off.

Reconnect all the previously disconnected Sensors except for the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.



Is the voltage below 4.5 volts?

Yes >> Go To 4

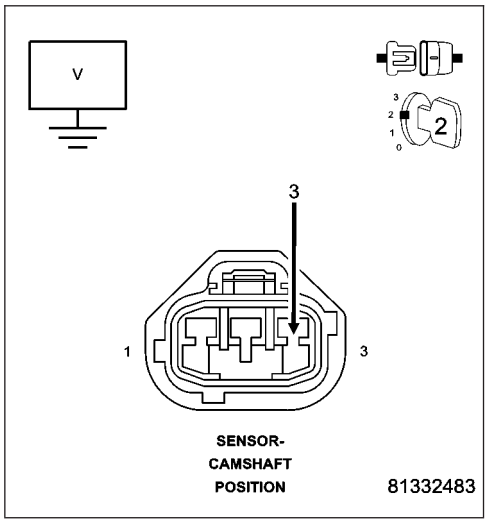
No >> Replace the Cam Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. 5-VOLT SENSOR SHORTED TO GROUND

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.

CAUTION: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F856) Auxiliary 5-volt Supply circuit, one at a time.



Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes >> Replace the Sensor that causes the (F856) Auxiliary 5-volt Supply circuit voltage to increase when disconnected.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

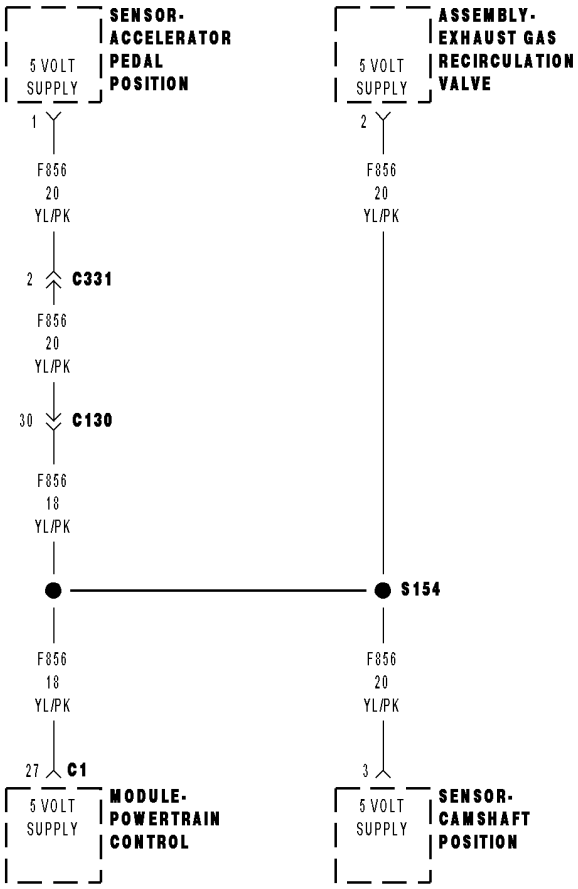
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

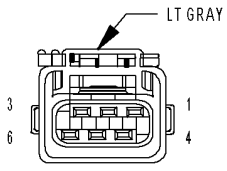
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

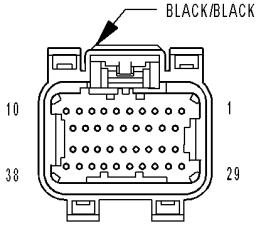
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0653-SENSOR REFERENCE VOLTAGE 2 CIRCUIT HIGH

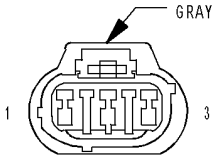




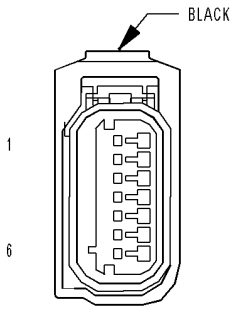
ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L/5.7L LIGHT DUTY)



MODULE-
POWERTRAIN
CONTROL C1
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)



SENSOR-
ACCELERATOR
PEDAL
POSITION

8145491c

P0653-SENSOR REFERENCE VOLTAGE 2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is too high. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (F856) AUXILIARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

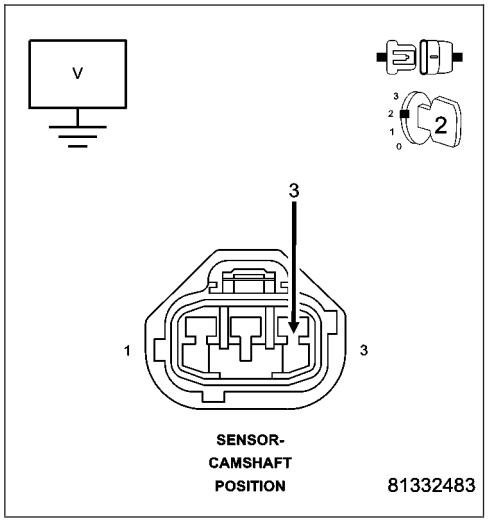
Disconnect the C1 PCM harness connector.

Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

NOTE: Improperly installed aftermarket accessories can cause this DTC to set. Check for wiring added by customer.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F856) Auxiliary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0653-SENSOR REFERENCE VOLTAGE 2 CIRCUIT HIGH (CONTINUED)

3. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

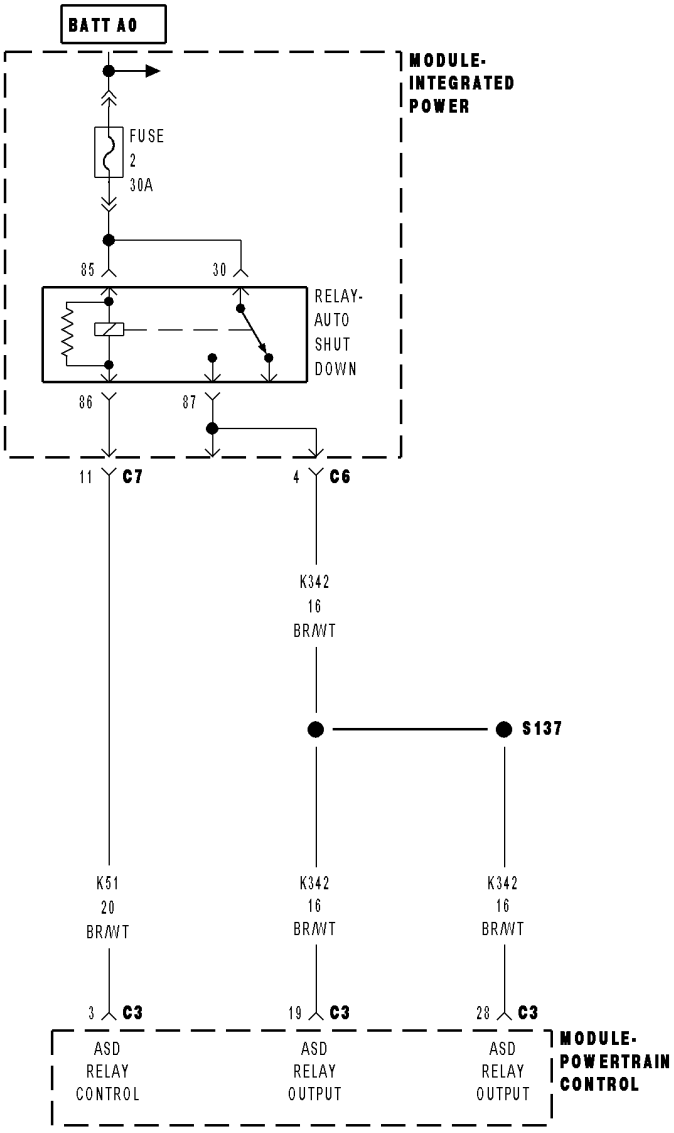
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

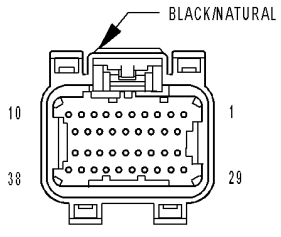
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT





MODULE-
POWERTRAIN
CONTROL C3
(NGC)

8145496a

P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on. Battery voltage above 10 volts.
- **Set Condition:**
  The actual ASD state is not equal to the desired ASD state. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(K51) ASD RELAY CONTROL CIRCUIT OPEN
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND
ASD RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ASD RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Is the ASD Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

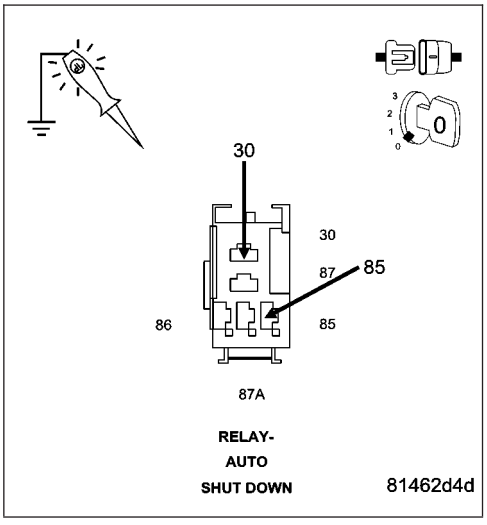
Remove the ASD Relay from the IPM.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits in the IPM.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect and replace any open fuses.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

3. ASD RELAY

Measure the resistance of the ASD Relay Coil.

Is the resistance between 60 to 80 ohms?

Yes >> Go To 4

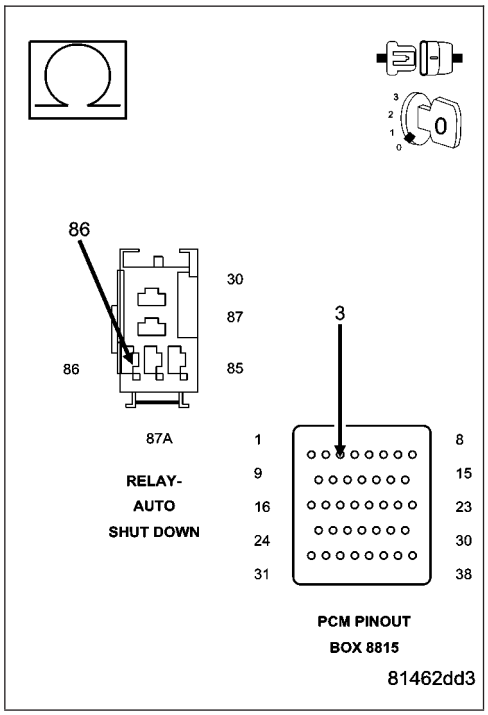
No >> Replace the ASD Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K51) ASD RELAY CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K51) ASD Relay Control circuit from the IPM to the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

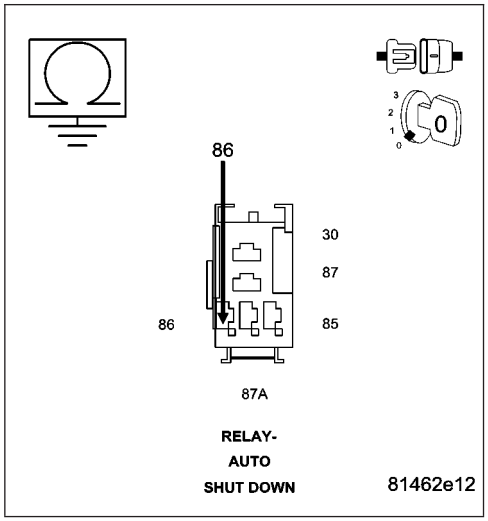
Yes >> Go To 5

No >> Repair the open in the (K51) ASD Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K51) ASD Relay Control circuit in the IPM.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K51) ASD Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0685-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

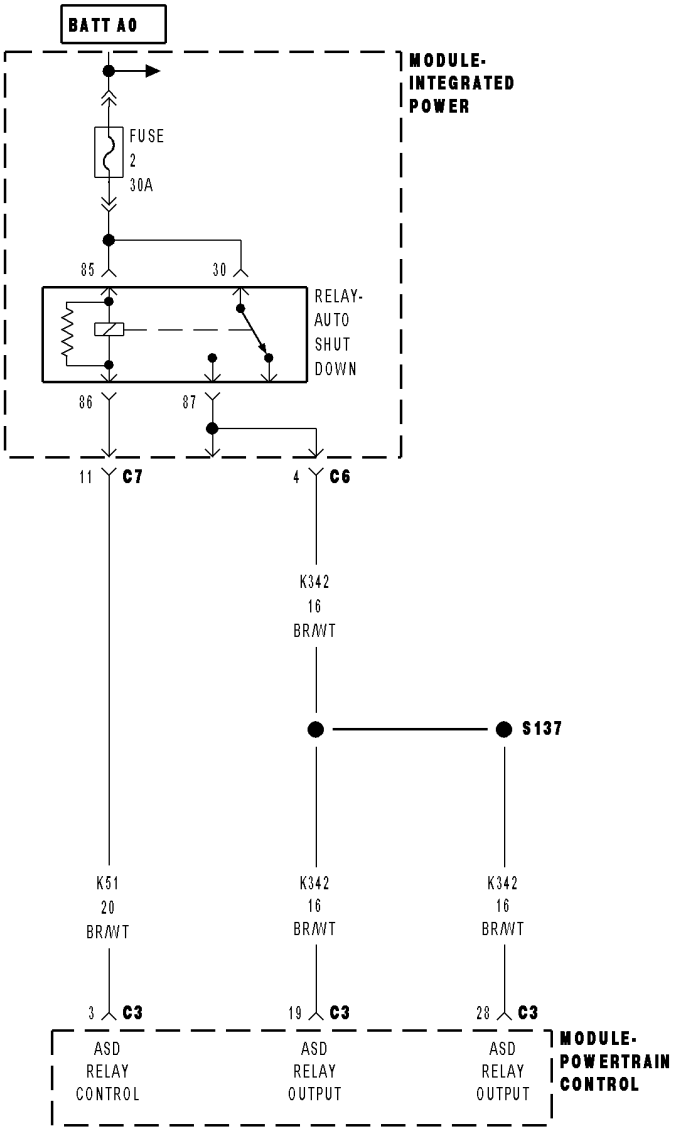
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

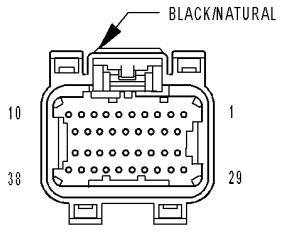
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW





MODULE-
POWERTRAIN
CONTROL C3
(NGC)

8145496a

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition key on. Battery voltage greater than 10 volts.
- **Set Condition:**
  No voltage sensed at the PCM when the ASD relay is energized. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED B+ CIRCUITS
(K342) ASD RELAY OUTPUT CIRCUIT OPEN
ASD RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. VERIFY ASD DTC

NOTE: Diagnose P0685 - Auto Shutdown Relay Control Circuit first if it set along with this DTC.
With a scan tool, erase the DTC.

Attempt to start the engine. If the engine will not start, crank the engine for at least 15 seconds. It may be necessary to repeat several times.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ENGINE OPERATION

Attempt to start the engine.

Does the engine start?

Yes >> Go To 3

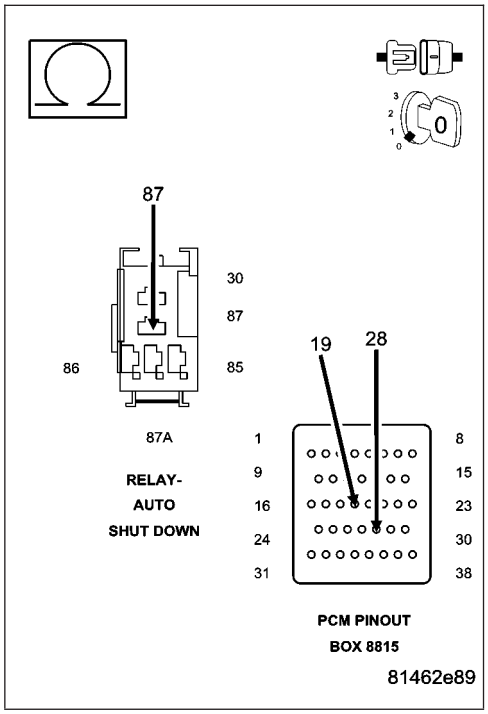
No >> Go To 4

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.
Remove the ASD Relay.
Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K342) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. ASD RELAY

Turn the ignition off.
Install a substitute relay in place of the ASD Relay.
Ignition on, engine not running.
With a scan tool, erase DTCs.
Attempt to start the engine.
With a scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 5

No >> Replace the ASD Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

5. INTERNAL FUSED B+ CIRCUITS

Turn the ignition off.

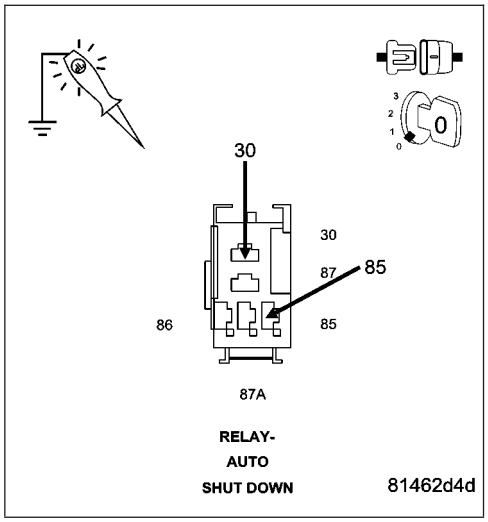
Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuits at the Relay connection.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the open or short to ground in the Internal Fused B+ circuits. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (K342) ASD RELAY OUTPUT CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

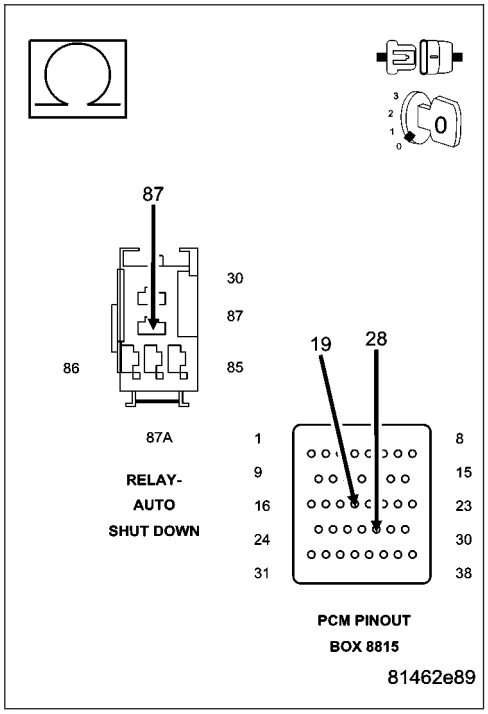
Measure the resistance of the (K342) ASD Relay Output circuit from the Relay connection to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K342) ASD Relay Output circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0688-AUTO SHUTDOWN RELAY SENSE CIRCUIT LOW (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0700-TRANSMISSION CONTROL SYSTEM (MIL REQUEST)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An active DTC is stored in the TCM. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
DTC PRESENT IN THE TRANSMISSION CONTROL MODULE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC PRESENT IN EATX CONTROLLER

This is an informational DTC letting you know that a DTC(s) is stored in the Transmission Control Module.

Erase this DTC from the PCM after all Transmission DTC(s) have been repaired.

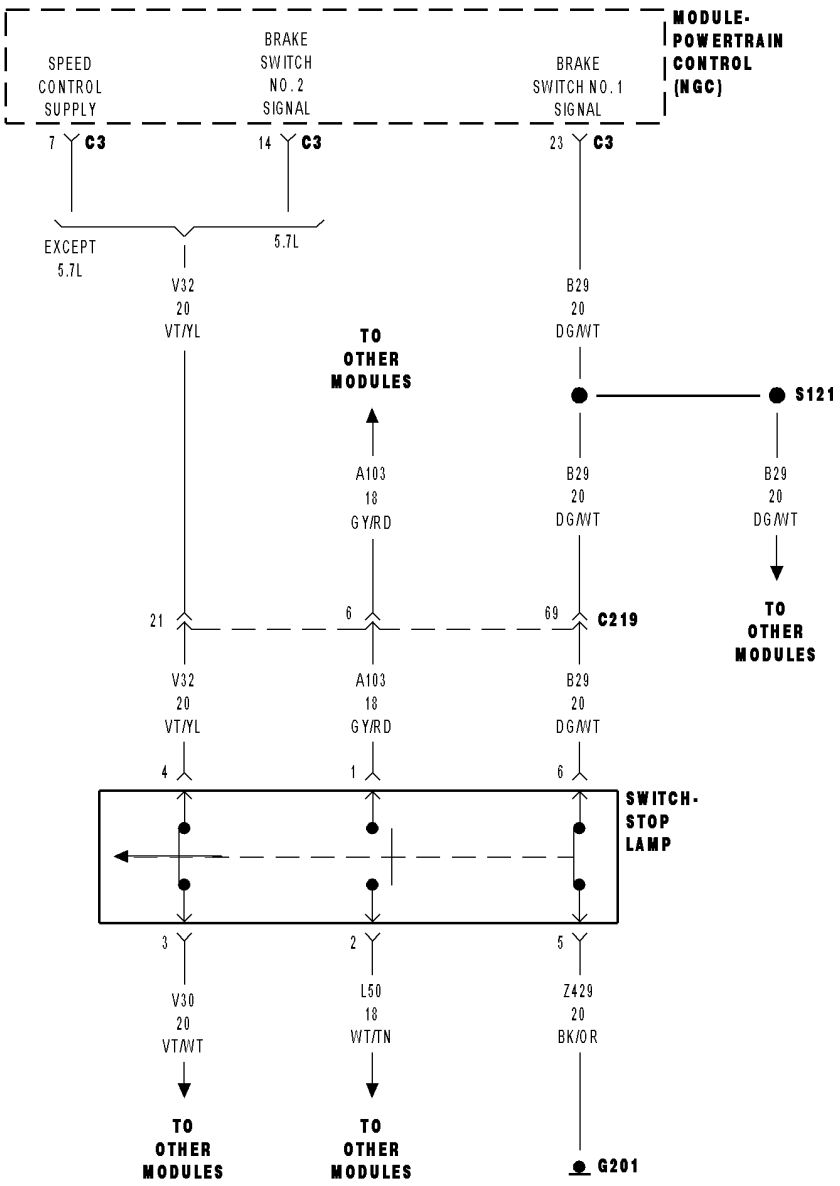
Using a scan tool, read the Transmission Controller DTC and refer to the Transmission Category and perform the appropriate symptom.

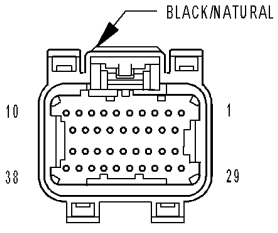
PCM Diagnostic Information complete.

Continue

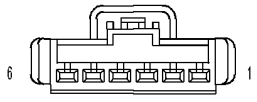
Test Complete.

P0703-BRAKE SWITCH 2 PERFORMANCE





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P0703-BRAKE SWITCH 2 PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes Brake Switch No.2 voltage is not equal to the applied value at the PCM when Brake Switch No.1 is applied. This could be a normal condition. If this condition is seen repeatedly by the PCM the fault is set. Cruise will not work for the rest of the key cycle.

Possible Causes
(V30) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.

NOTE: Make sure the Stop Lamp Switch is properly wired, such as (B29) Brake Switch No.1 and (L50) Brake Lamp Switch Output are not switched at the harness connector.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0703-BRAKE SWITCH 2 PERFORMANCE (CONTINUED)

2. (V30) FUSED IGNITION SWITCH OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Stop Lamp Switch harness connector.

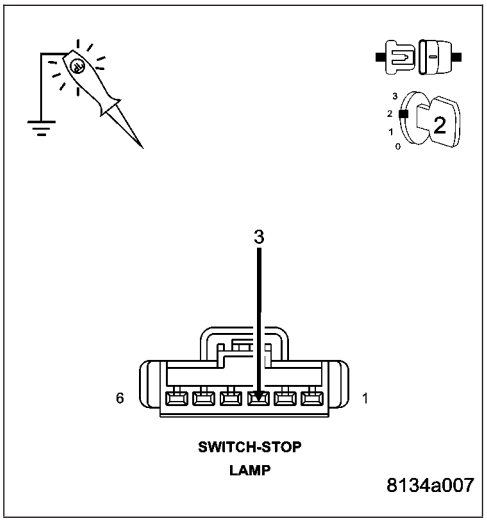
Using a 12-volt test light connected to ground, probe the (V30) Fused Ignition Switch Output circuit in the Stop Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (V30) Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. STOP LAMP SWITCH

Turn the ignition off.

Measure the resistance between the (V30) Fused Ignition Switch circuit terminal and the (V32) Brake Switch No.2 Signal terminal in the Stop Lamp Switch.

Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.

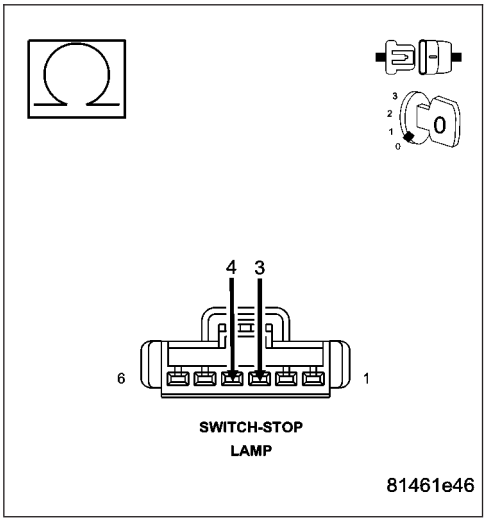
Apply and release the Stop Lamp Switchl while monitoring the ohmmeter.

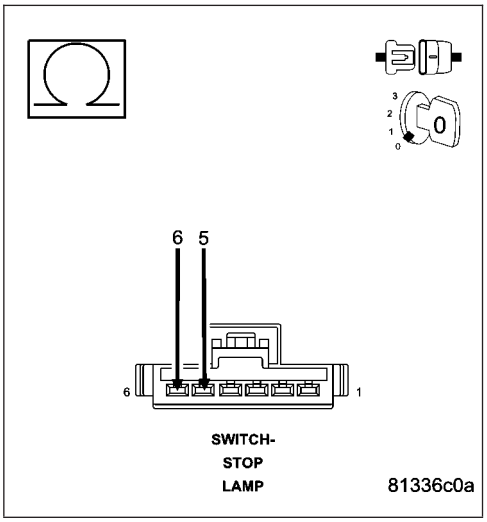
Does the resistance change from below 5.0 ohms to open circuit for each circuit check?

Yes >> Go To 4

No >> Replace the Stop Lamp Switch.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P0703-BRAKE SWITCH 2 PERFORMANCE (CONTINUED)

4. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the voltage on the (V32) Brake Switch No.2 Signal circuit in the Stop Lamp Switch harness connector.

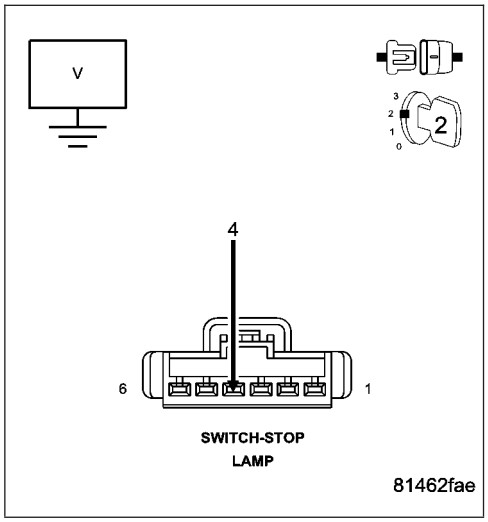
Ignition on, engine not running.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (V32) Brake Switch No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

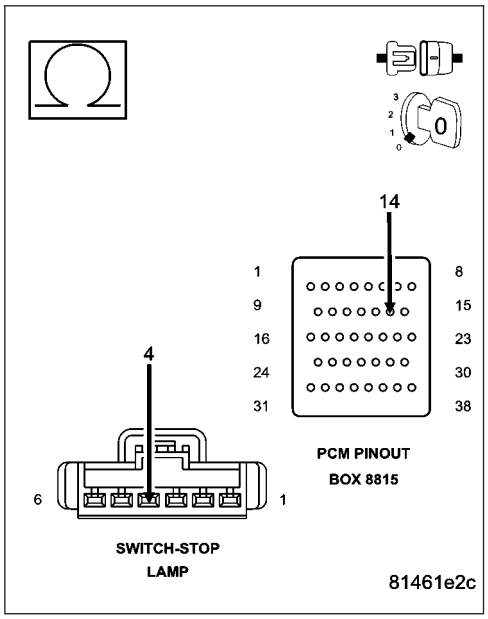
Measure the resistance of the (V32) Brake Switch No.2 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (V32) Brake Switch No.2 Signal circuit.

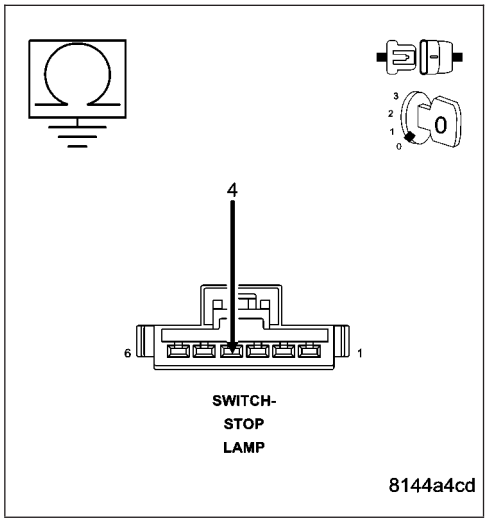
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0703-BRAKE SWITCH 2 PERFORMANCE (CONTINUED)

6. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V32) Brake Switch No.2 Signal circuit in the Stop Lamp Switch harness connector.



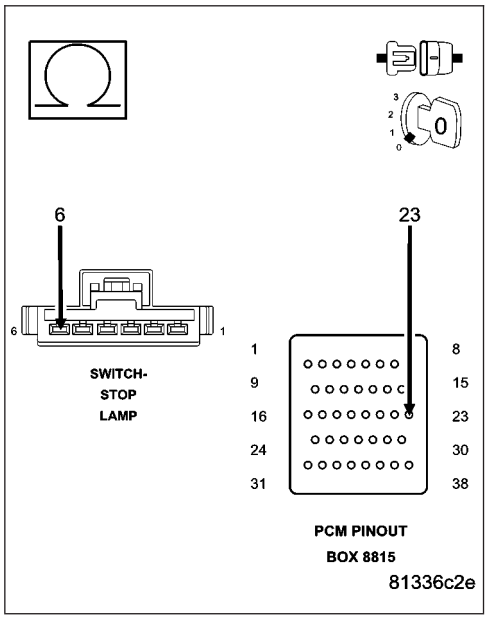
Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (V32) Brake Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN

Measure the resistance of the (B29) Brake Switch No.1 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (B29) Brake Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0703-BRAKE SWITCH 2 PERFORMANCE (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

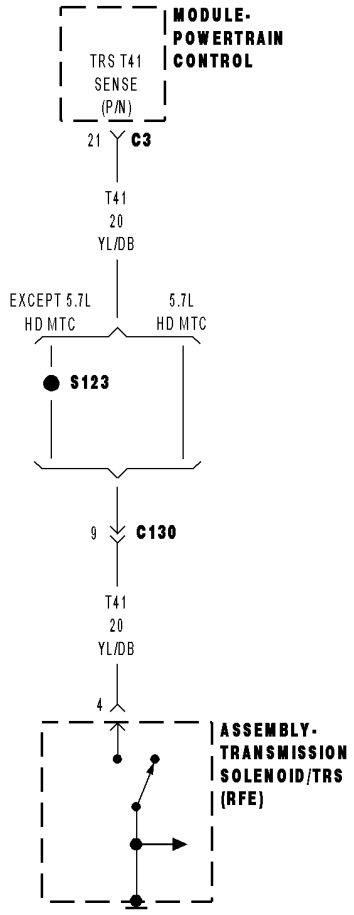
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

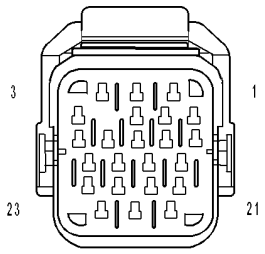
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

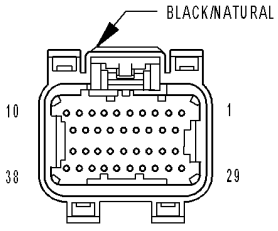
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0850-PARK/NEUTRAL SWITCH PERFORMANCE





ASSEMBLY-
TRANSMISSION
SOLENOID/TRS
(RFE)



MODULE-
POWERTRAIN
CONTROL C3
(NGC)

814549a5

P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The Park Neutral switch rationality test is enabled only for vehicles equipped with a 4/5 speed automatic transmission. This diagnostic checks if the park/neutral switch is incorrectly stuck in the neutral position during driving conditions by comparing Vehicle Speed, Engine Speed, Throttle Position, and Pressure Ratio to the fail thresholds and by looking at the state of the Park/Neutral Switch. The stuck in drive condition is not explicitly checked as the starter relay does not energize and therefore render the vehicle inoperable.

- **When Monitored:**
  Continuously with the transmission in Park, Neutral, or Drive and NOT in Limp-in mode.
- **Set Condition:**
  This code will set if the PCM detects an incorrect Park/Neutral switch state for a given mode of vehicle operation. One trip fault. Three good trips to turn off the MIL.

Possible Causes
TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN
TRS (T41) SENSE (P/N SENSE) CIRCUIT SHORTED TO GROUND
TRANSMISSION RANGE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. P/N & D/R NOT IN CORRECT POSITION

NOTE: Check the TCM for DTCs, if P0706 is set in the TCM diagnose the TCM code before continuing.
Ignition on, engine not running.

With the scan tool, read the Park/Neutral Position Switch input state.

While moving the gear selector through all gear positions (Park to 1 and back to Park), monitor the scan tool display.

Did the scan tool display show P/N and D/R in the correct gear positions?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

2. TRS (T41) SENSE (P/N SENSE) CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Disconnect the Transmission Range Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

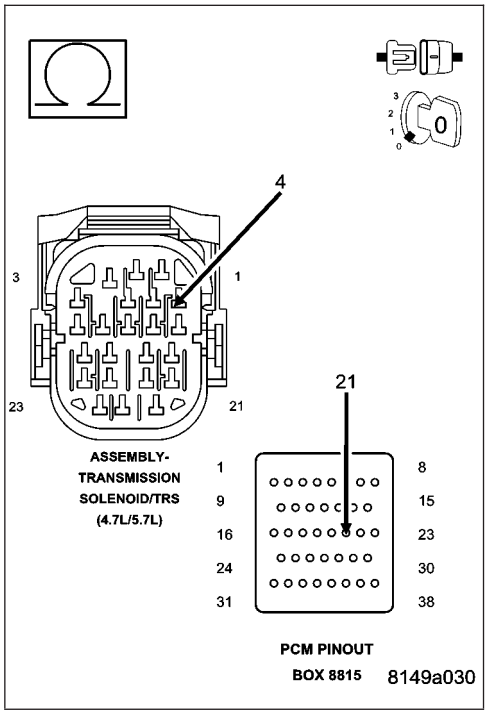
Measure the resistance of the TRS (T41) Sense (P/N Sense) circuit from the TRS harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the open in the TRS (T41) Sense (P/N Sense) circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. TRS (T41) SIGNAL CIRCUIT SHORTED TO GROUND

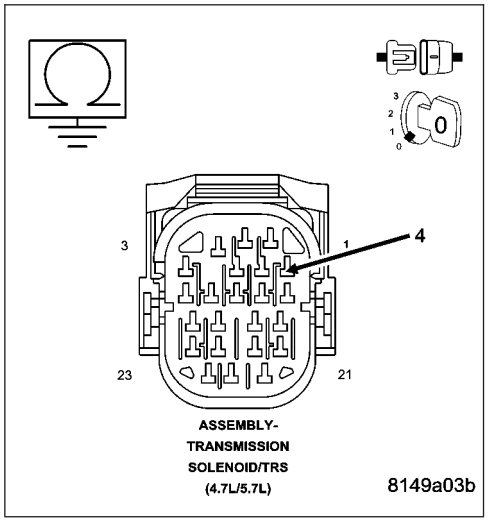
Measure the resistance between ground and the TRS (T41) Sense (P/N Sense) circuit at the TRS harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 4

No >> Repair the short to ground in the TRS (T41) Sense (P/N Sense) circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0850-PARK/NEUTRAL SWITCH PERFORMANCE (CONTINUED)

4. TRANSMISSION RANGE SENSOR

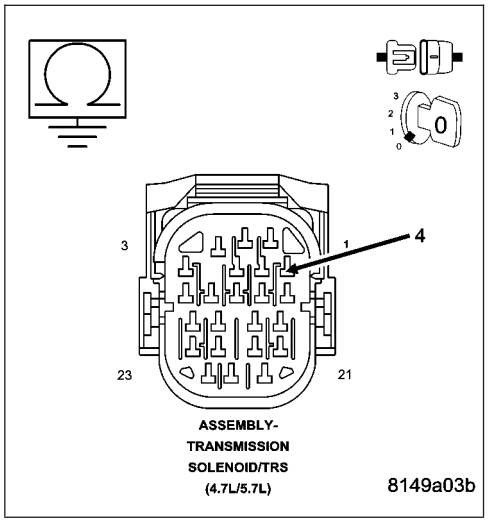
Measure the resistance between ground and the (T41) TRS Sense (P/N Sense) circuit while moving the gear selector through each gear in the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded)?

Yes >> Go To 5

No >> Replace the Transmission Range Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. PCM

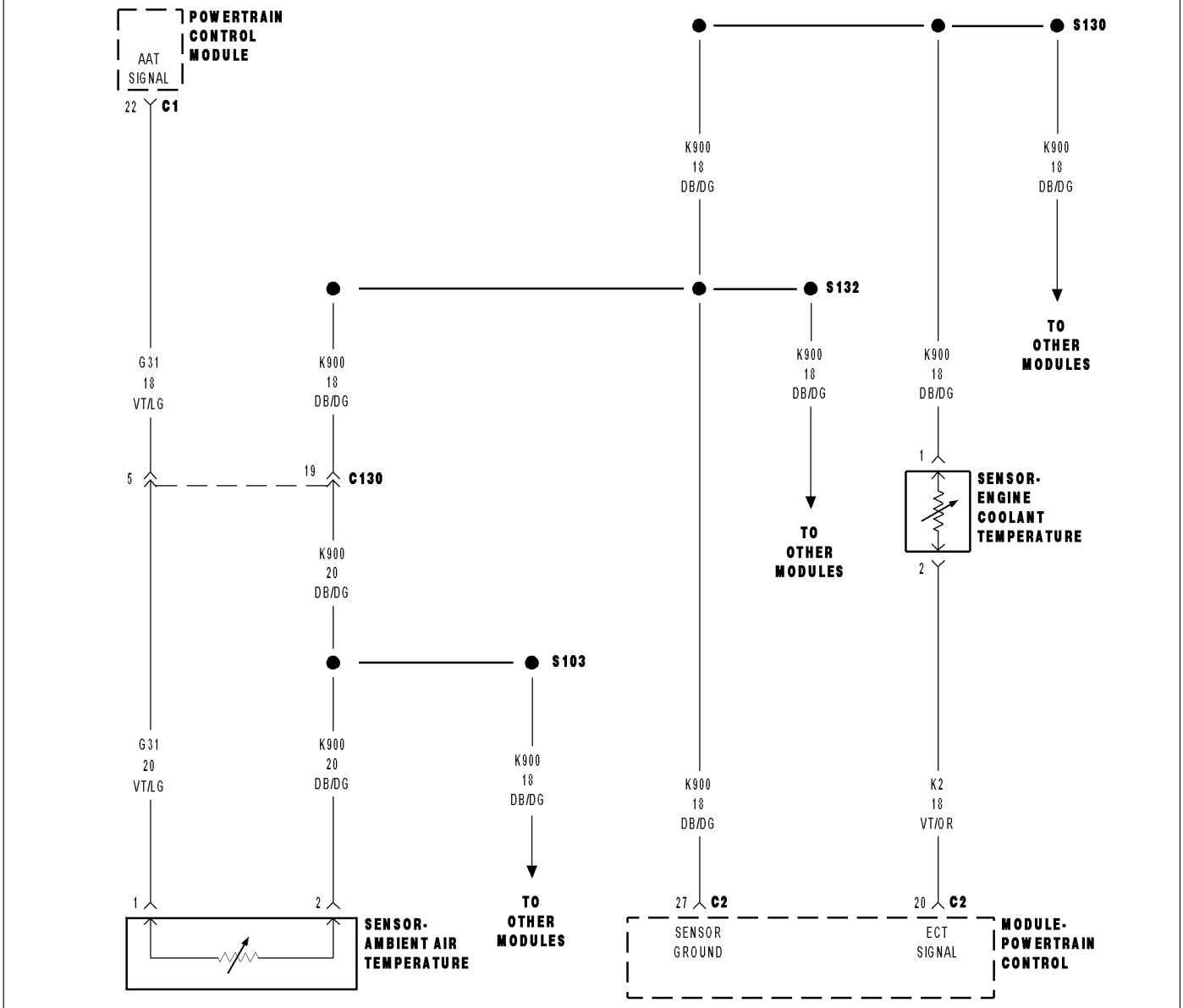
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

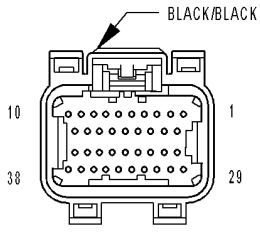
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

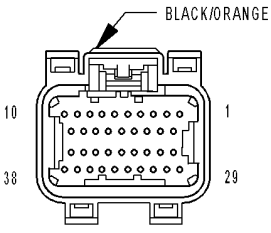
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1115-GENERAL TEMPERATURE RATIONALITY

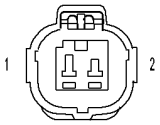




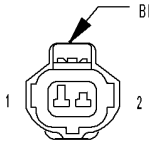
MODULE- POWERTRAIN CONTROL C1 (NGC)



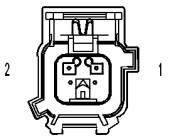
MODULE- POWERTRAIN CONTROL C2 (NGC)



SENSOR- AMBIENT AIR TEMPERATURE



SENSOR- ENGINE COOLANT TEMPERATURE (3.7L/4.7L)



SENSOR- ENGINE COOLANT TEMPERATURE (5.7L/SRT)

81452dd2

P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The General Temperature Rationality looks at the outputs of the three temperature sensors and compare them under cold start conditions. Following a start to run delay time, the outputs of the ambient, engine coolant, and intake air temperature sensors will be compared. If two sensors agree but not the third, the third sensor is declared as irrational. If all three sensors are irrational the General Temperature Sensor Rationality is failed.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Ambient Air, Engine Coolant, and Intake Air Temp sensor inputs are compared under cold start conditions. After start up the temp readings are monitored. If two of the three readings agree and the third doesn't, a DTC is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE SENSOR SIGNAL CIRCUIT
EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read the DTCs.

NOTE: All ECT, Intake Air, and Ambient Air Temperature Sensor codes must be diagnosed and repaired before continuing.

NOTE: In cold weather, this DTC could be set by a high powered block heater and no repair would be required.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. TEMPERATURE SENSOR CIRCUIT

With a scan tool, read the ECT, Ambient Air Temp, and Intake Air Temp Sensor temp values.

Start the engine.

Allow the engine to reach normal operating temperature while monitoring the three Sensor temperature values.

Is the temperature for each of the Sensors increasing properly?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

3. TEMPERATURE SENSOR

Ignition on, engine not running.

Disconnect the suspected sensor.

Connect a jumper wire between the Sensor Signal circuit and the (K900) Sensor ground circuit.

With the scan tool, read the voltage of the suspected Sensor.

Did the voltage reading start at 4.8 to 5.0 volts and decrease to 0 volts when the jumper wire was installed?

Yes >> Replace the Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.

---

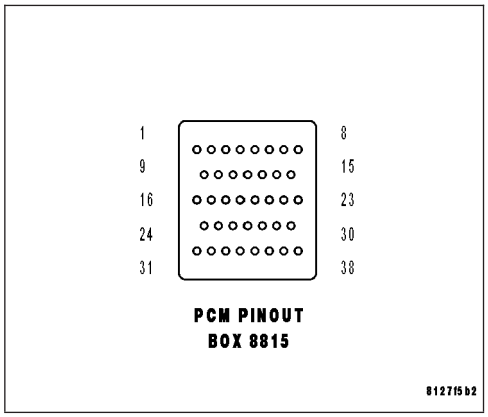
4. EXCESSIVE RESISTANCE IN THE TEMPERATURE SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the Sensor Signal circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 5.0 ohms.

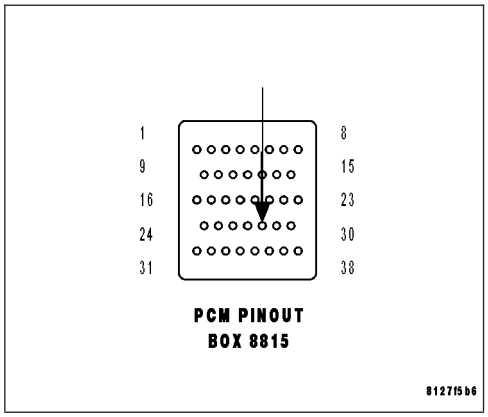
Yes >> Repair the excessive resistance in the Temperature Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 5.0 ohms.

Yes >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P1115-GENERAL TEMPERATURE RATIONALITY (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

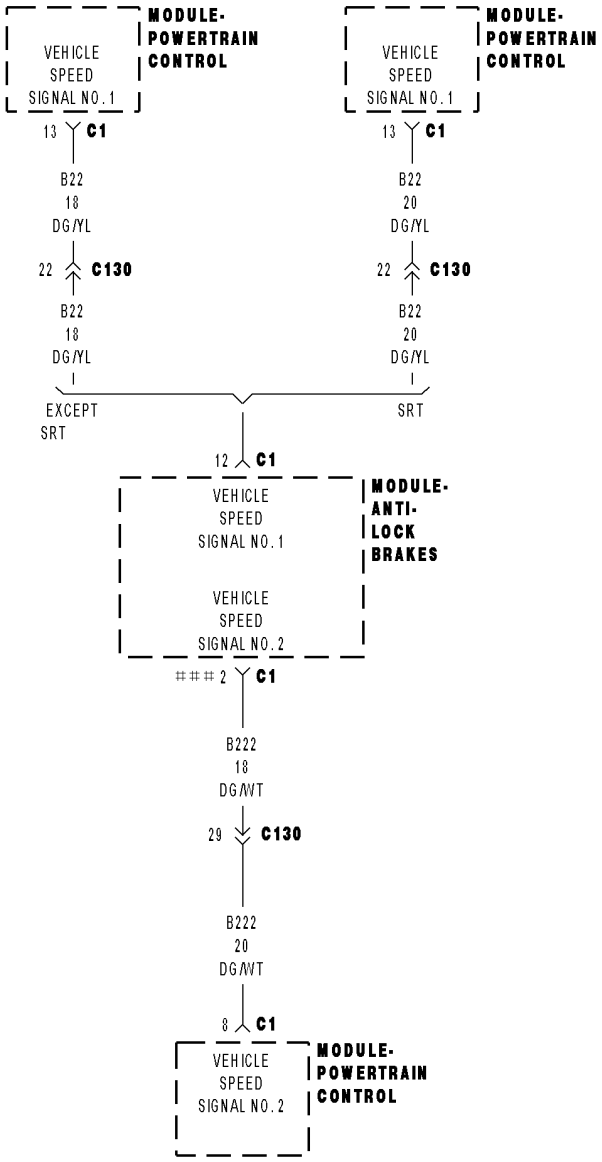
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

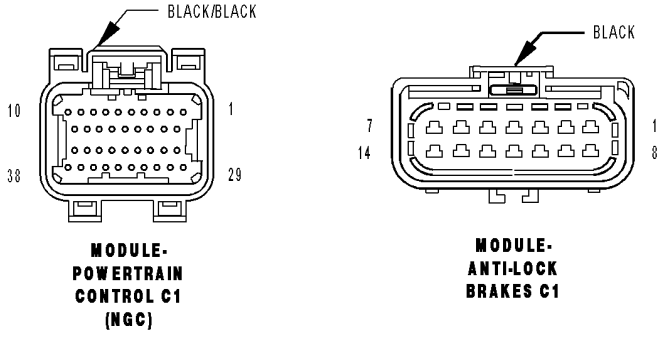
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS





81453b7e

P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and vehicle moving. Cruise is learned and customer is trying to use the Cruise.
- **Set Condition:**
  The PCM recognizes rear wheel speed is greater than front wheel speed.

Possible Causes
VEHICLE SPEED SIGNAL CIRCUITS SHORTED TO VOLTAGE
EXCESSIVE RESISTANCE IN THE VEHICLE SPEED SIGNAL CIRCUITS
VEHICLE SPEED SIGNAL CIRCUITS SHORTED TO GROUND
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS (CONTINUED)

3. VSS SIGNAL CIRCUITS SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 ABS Module harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

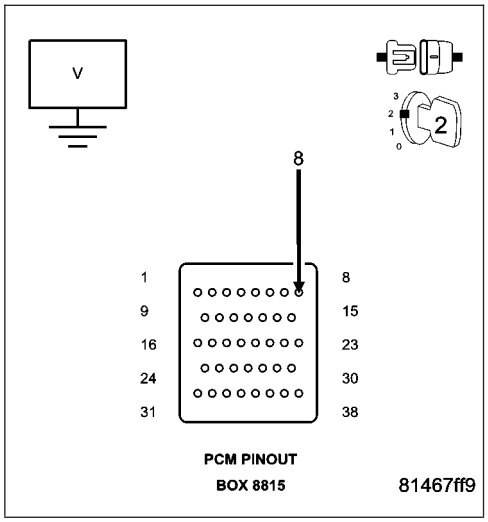
Measure the voltage of the (B22) and (B222) Vehicle Speed Signal circuits at the appropriate terminals of special tool #8815.

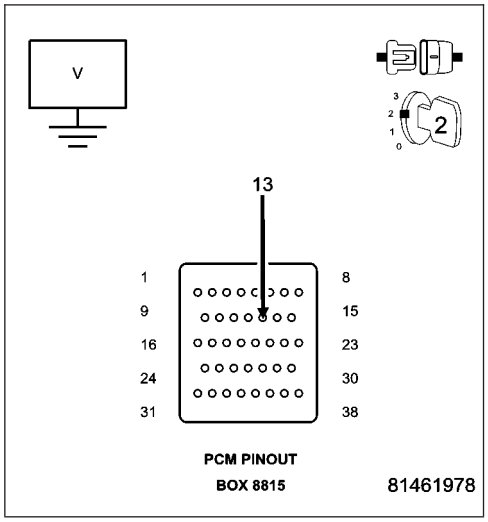
Is the voltage above 6.0 volts?

Yes >> Repair the short to voltage in the (B22) or (B222) Vehicle Speed Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4





P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS (CONTINUED)

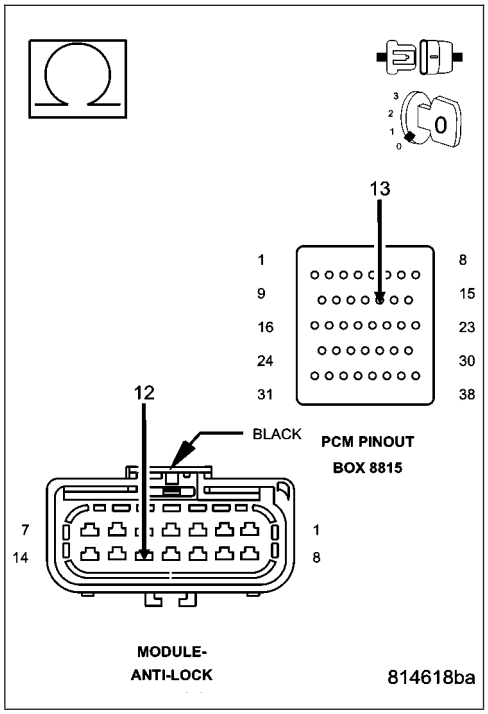
4. EXCESSIVE RESISTANCE IN THE VEHICLE SPEED SIGNAL CIRCUITS

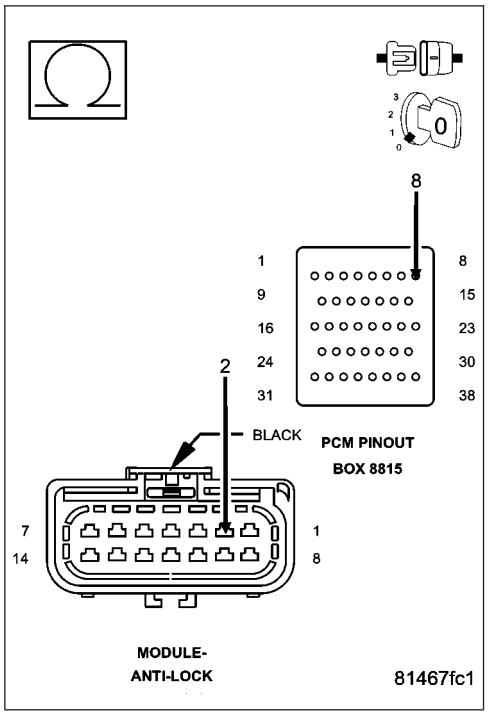
Measure the resistance of the (B22) and (B222) Vehicle Speed Signal circuits from the CAB Module harness connector to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the excessive resistance in the (B22) or (B222) Vehicle Speed Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

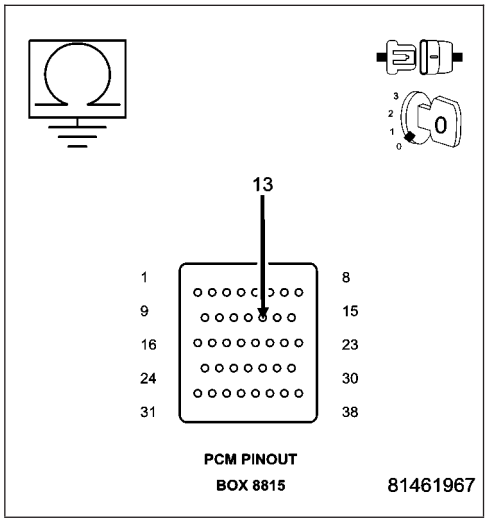


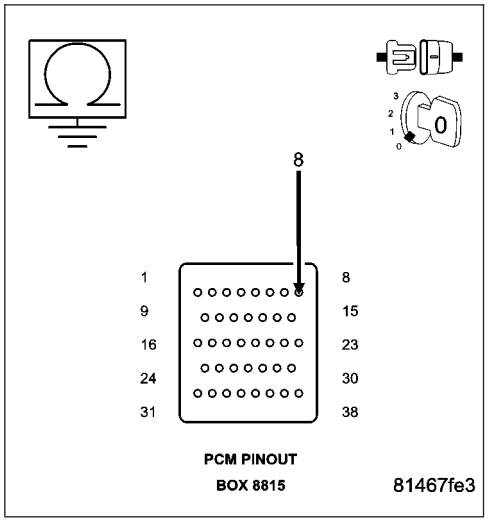


P1501-VEHICLE SPEED SENSOR 1/2 CORRELATION - DRIVE WHEELS (CONTINUED)

5. VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B22) and (B222) Vehicle Speed Signal circuits in the CAB module harness connector.





Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B22) or (B222) Vehicle Speed Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

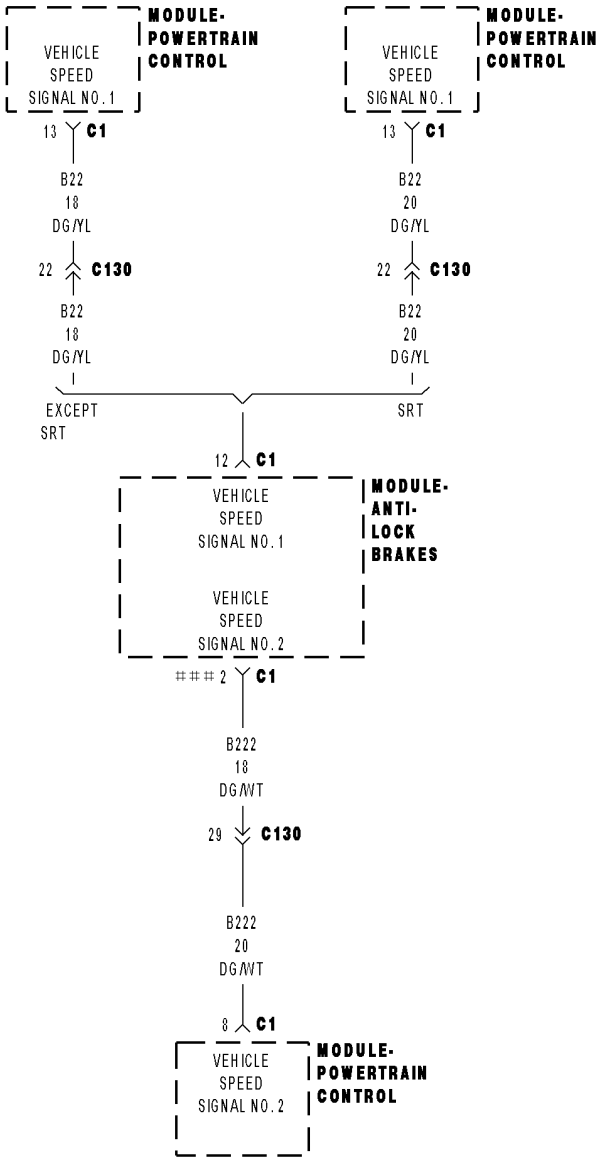
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

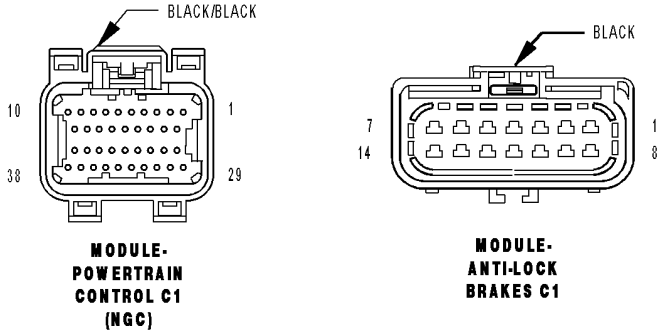
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS





81453b7e

P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and vehicle moving. Cruise is learned and customer is trying to use the Cruise.
- **Set Condition:**
  The PCM recognizes rear wheel speed is greater than front wheel speed.

Possible Causes
VEHICLE SPEED SIGNAL CIRCUITS SHORTED TO VOLTAGE
EXCESSIVE RESISTANCE IN THE VEHICLE SPEED SIGNAL CIRCUITS
VEHICLE SPEED SIGNAL CIRCUITS SHORTED TO GROUND
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS (CONTINUED)

3. VSS SIGNAL CIRCUITS SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ABS Module harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Disconnect the C1 PCM harness connector.

Ignition on, engine not running.

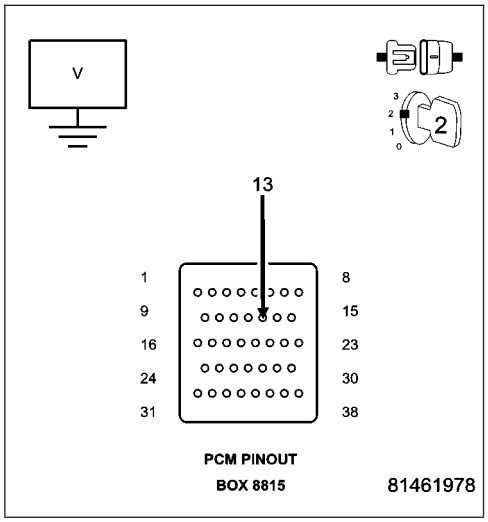
Measure the voltage of the (B22) and (B222) Vehicle Speed Signal circuit at the appropriate terminals of special tool #8815.

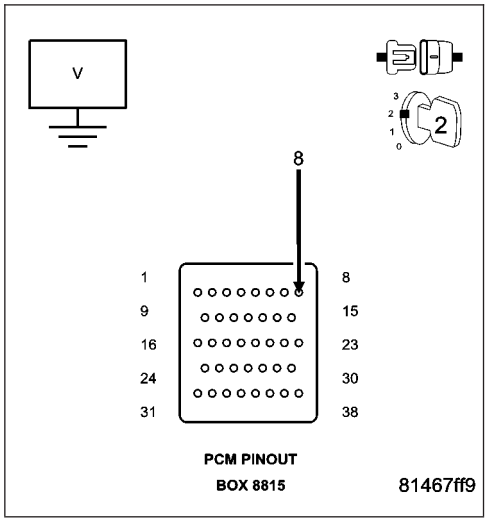
Is the voltage above 6.0 volts?

Yes >> Repair the short to voltage in the (B22) or (B222) Vehicle Speed Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

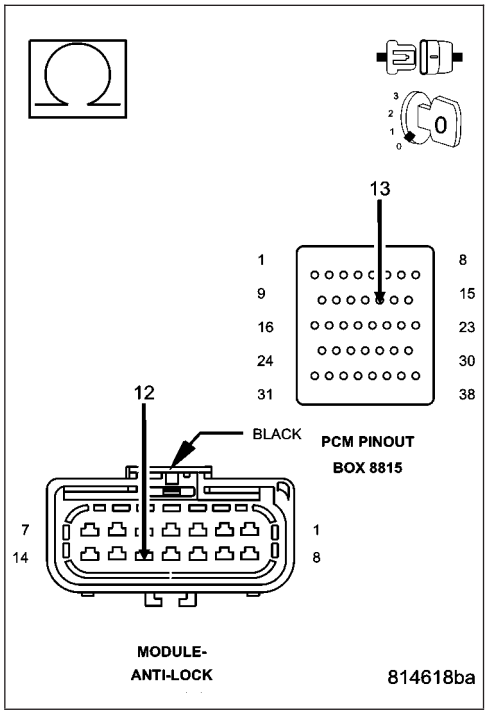


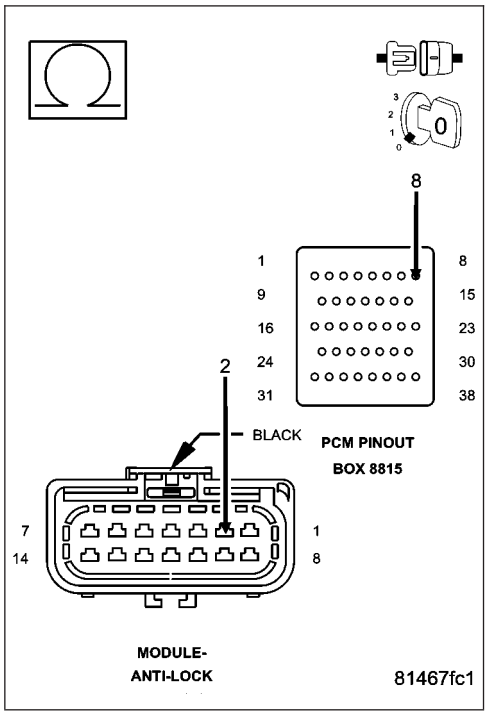


P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS (CONTINUED)

4. EXCESSIVE RESISTANCE IN THE VEHICLE SPEED SIGNAL CIRCUITS

Measure the resistance of the (B22) and (B222) Vehicle Speed Signal circuits from the CAB Module harness connector to the appropriate terminals of special tool #8815.





Is the resistance below 5.0 ohms?

Yes >> Go To 5

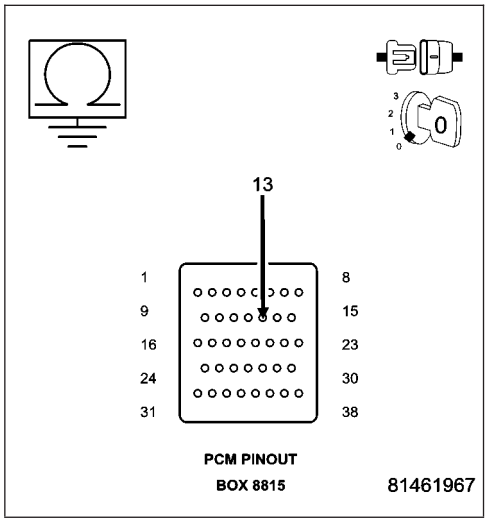
No >> Repair the excessive resistance in the (B22) or (B222) Vehicle Speed Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1502-VEHICLE SPEED SENSOR 1/2 CORRELATION - NON DRIVE WHEELS (CONTINUED)

5. VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND

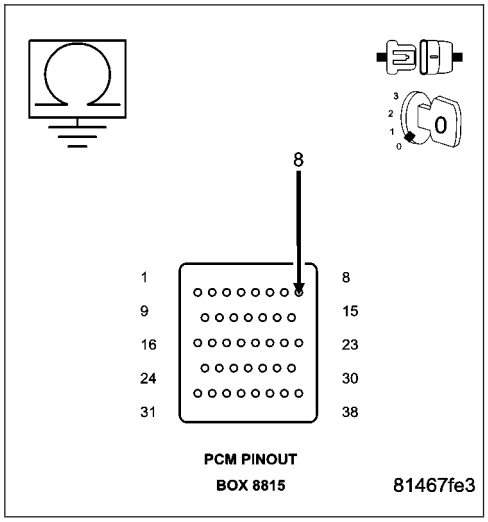
Measure the resistance between ground and the (B22) and (B222) Vehicle Speed Signal circuits at the appropriate terminals of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B22) or (B222) Vehicle Speed Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. PCM

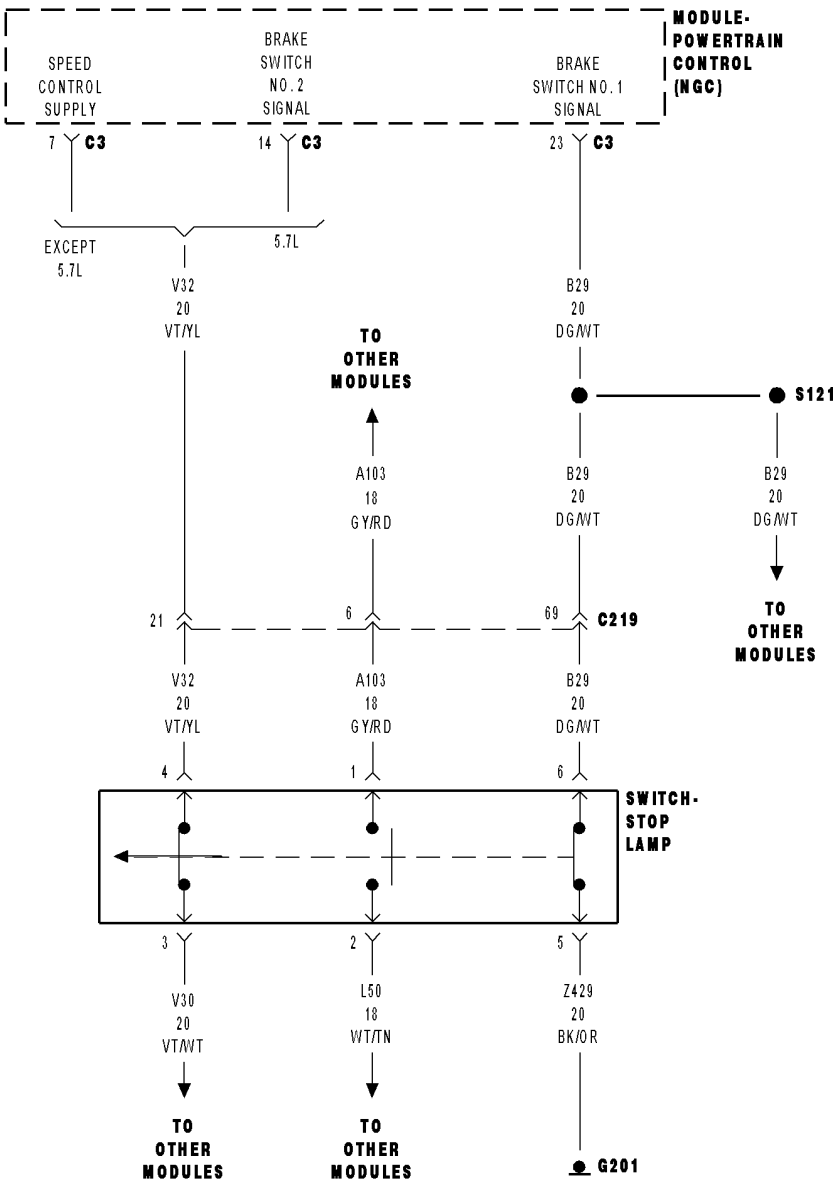
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

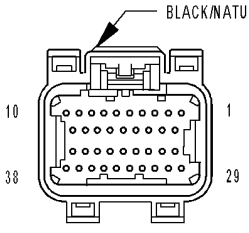
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

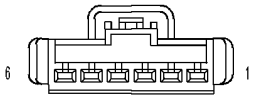
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1572-BRAKE PEDAL STUCK ON





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P1572-BRAKE PEDAL STUCK ON (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. In plant mode only.
- **Set Condition:**
  PCM recognizes the Brake Pedal could not electrically indicate the applied (On) position with both switch inputs. One trip fault.

Possible Causes
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. STOP LAMP SWITCH OPERATION

Turn the ignition off.
Disconnect the Stop Lamp Switch harness connector.
Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.
Apply and release the brake pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit when pressing and releasing the brake pedal switch?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1572-BRAKE PEDAL STUCK ON (CONTINUED)

3. STOP LAMP SWITCH OPERATION

Measure the resistance between the (V30) Fused Igniton Switch Output terminal and the (V32) Brake Switch No.2 Signal circuit terminal in the Stop Lamp Switch.

Apply and release the brake pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit when pressing and releasing the Stop Lamp switch?

Yes >> Go To 4

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

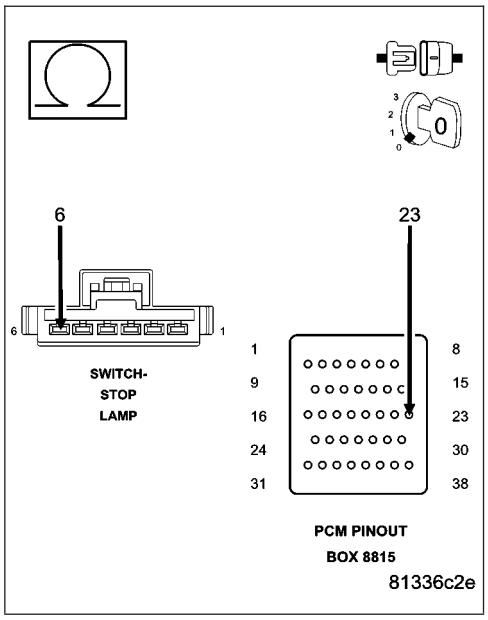
---

4. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (B29) Brake Switch No.1 Signal circuit from the Stop Lamp Switch harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

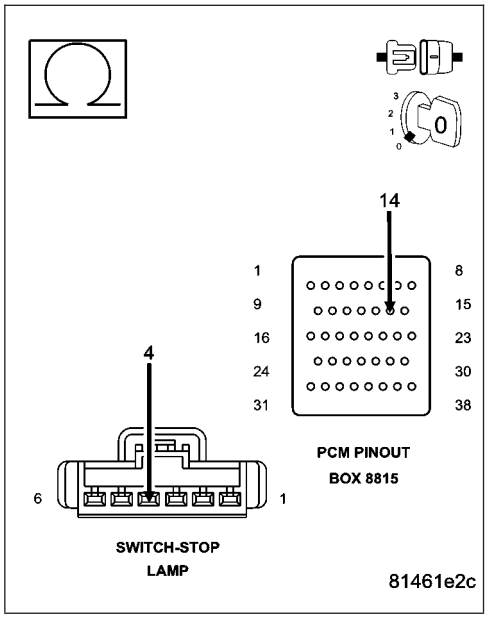
Yes >> Go To 5

No >> Repair the open in the (B29) Brake Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1572-BRAKE PEDAL STUCK ON (CONTINUED)

5. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT OPEN

Measure the resistance of the (V32) Brake Switch No.2 Signal circuit from the Stop Lamp Switch harness connector to the C1 FCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (L50) Brake Lamp Switch Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

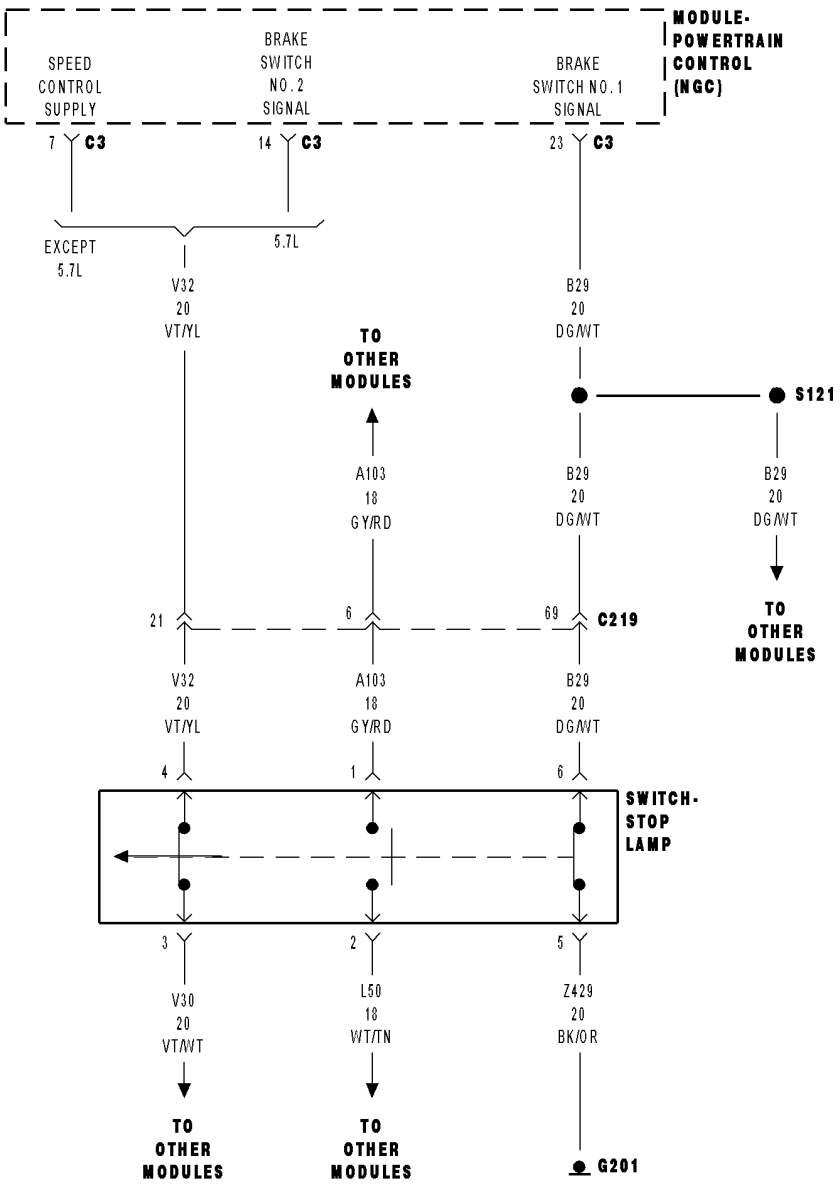
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

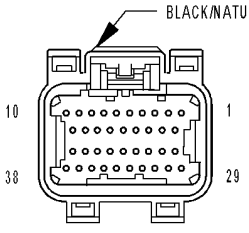
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

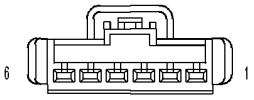
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1573-BRAKE PEDAL STUCK OFF





MODULE-
POWERTRAIN
CONTROL C3
(NGC)



SWITCH-STOP
LAMP

814545c3

P1573-BRAKE PEDAL STUCK OFF (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on, In plant mode passed the Applied test.
- **Set Condition:**
  PCM recognizes the Brake Pedal could not electronically indicate the released (Off) position with both switches. If P1572 sets, P1573 will also set. One trip fault.

Possible Causes
(V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
STOP LAMP SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Make sure the Stop Lamp Switch is adjusted properly before continuing.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. STOP LAMP SWITCH OPERATION

Turn the ignition off.
Disconnect the Stop Lamp Switch harness connectors.
Measure the resistance between the (Z429) Ground circuit terminal and the (B29) Brake Switch No.1 Signal terminal in the Stop Lamp Switch.
Apply and release the brake pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit when pressing and releasing the brake switch?

Yes >> Go To 3

No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1573-BRAKE PEDAL STUCK OFF (CONTINUED)

3. STOP LAMP SWITCH OPERATION

Measure the resistance between the (V30) Fused Ignition Switch Output circuit terminal and the (V32) Brake Switch No.2 Signal terminal in the Stop Lamp Switch.

Apply and release the brake pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to an open circuit when pressing and releasing the Stop Lamp switch?

Yes >> Go To 4

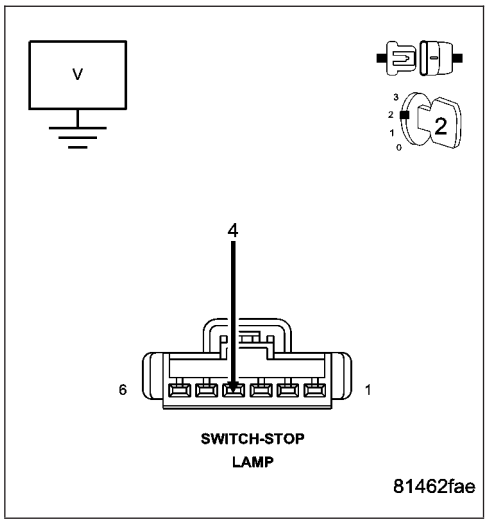
No >> Replace the Stop Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (V32) BRAKE SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (V32) Brake Switch No.2 Signal circuit in the Stop Lamp Switch harness connector.



Is the voltage above 1.0 volt?

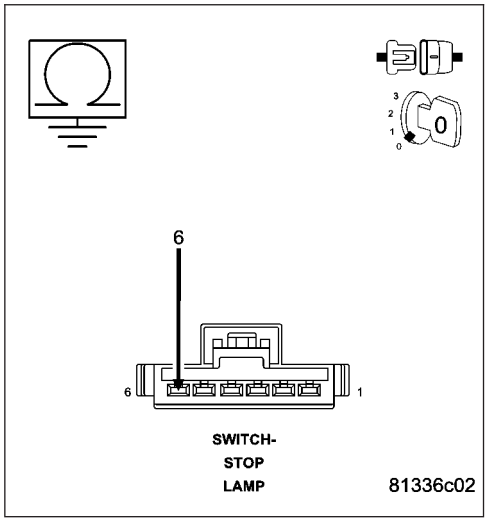
Yes >> Repair the short to battery voltage in the (V32) Brake Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Measure the resistance between ground and the (B29) Brake Switch No.1 Signal circuit in the Stop Lamp Switch harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B29) Brake Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P1573-BRAKE PEDAL STUCK OFF (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

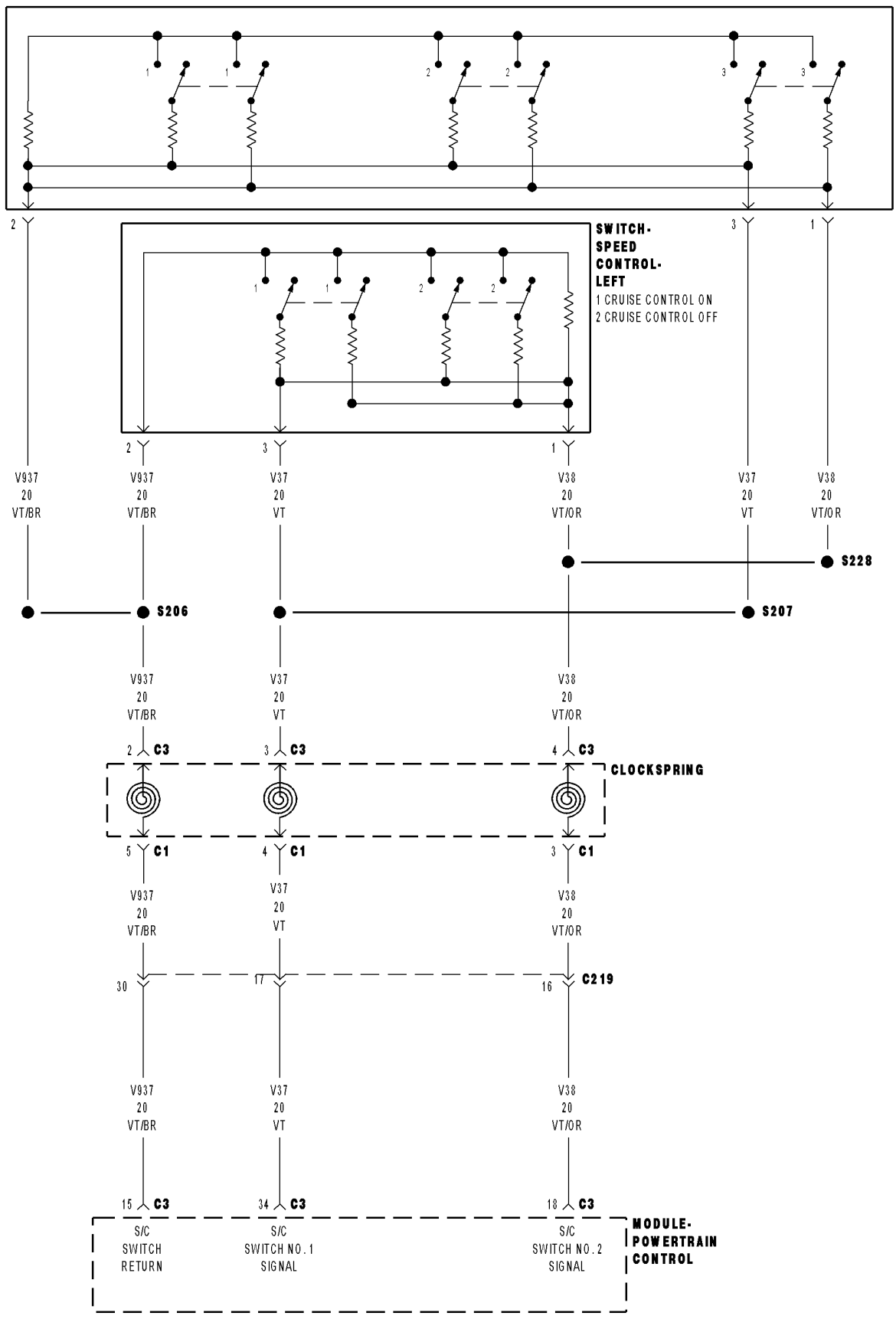
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1593-SPEED CONTROL SWITCH 1/2 STUCK



P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  One of the S/C Switches is mechanically stuck in the On/Off, Resume/Accel, or Set position for too long. One trip fault.

Possible Causes
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN
(V937) SWITCH RETURN CIRCUIT OPEN
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) S/C SWITCH RETURN CIRCUIT
(V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) S/C SWITCH RETURN CIRCUIT
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH NO.1 STUCK

Start the engine.

With a scan tool, monitor each switch function for the Speed Control Switches.

Press and release each Speed Control Button.

Is Switch No.1 Stuck?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

2. SPEED CONTROL SWITCH STATUS

Start the engine.

With a scan tool, monitor each switch function for the Speed Control Switches.

Press and release each Speed Control Button.

- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

Does each switch function change status when pressing and releasing each switch?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. SPEED CONTROL SWITCHES

Turn the ignition off.

Remove the Speed Control Switches from the steering wheel.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

The following resistance specs are taken between terminals (V38) S/C Switch No.2 Signal and (V937) S/C Switch Return circuit of the Switch when holding the switch button in the following position.

On/Off - 8.87 kohms

Set - 0.825 kohms

Coast - 0.47 kohms

Cancel - 3.92 kohms

Resume/Accel - 1.87 kohms

The following resistance specs are taken between terminals (V37) S/C Switch No.1 Signal and (V937) S/C Switch Return circuits of the Switch when holding the switch button in the following position

On/Off - 0.47 kohms

Set - 5.49 kohms

Coast - 2.94 kohms

Cancel - 1.24 kohms

Resume/Accel - 15.4 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 4

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

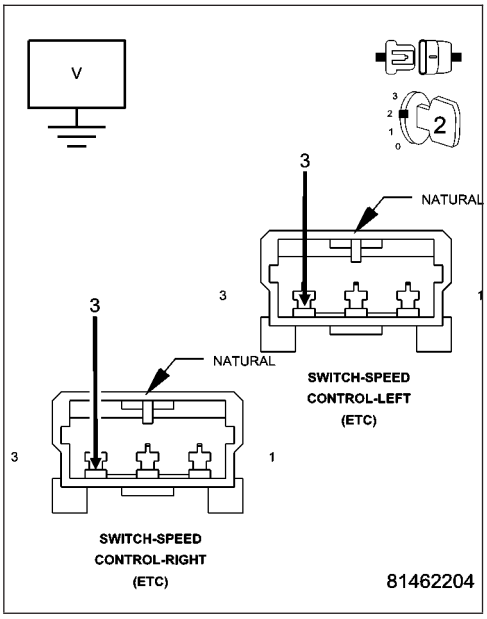
4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage of the (V37) S/C Switch No.1 Signal circuit in the S/C Switch harness connector.



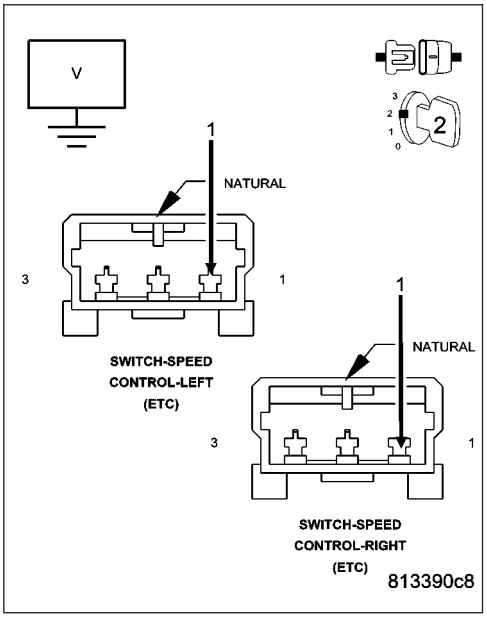
Is the voltage above 5.0 volts?

Yes >> Repair the short to voltage in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Measure the voltage of the (V38) S/C Switch No.2 Signal circuit in the S/C Switch harness connector.



Is the voltage above 5.0 volts?

Yes >> Repair the short to voltage in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

6. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

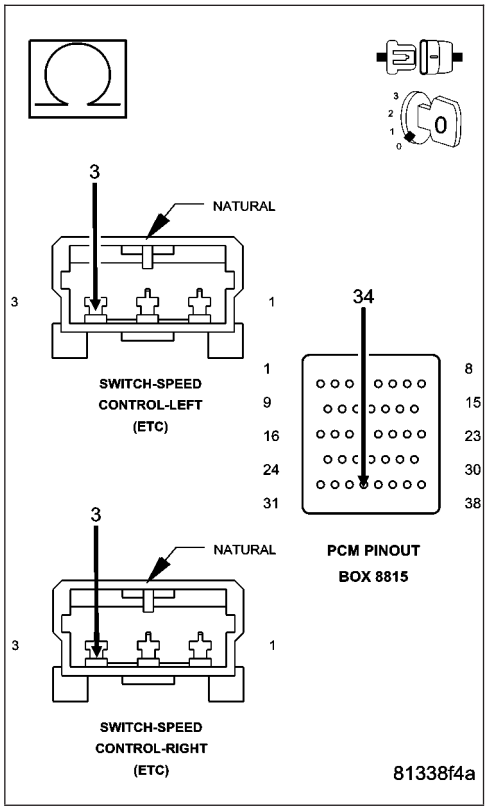
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from both Speed Control harness connectors to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 7

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT OPEN

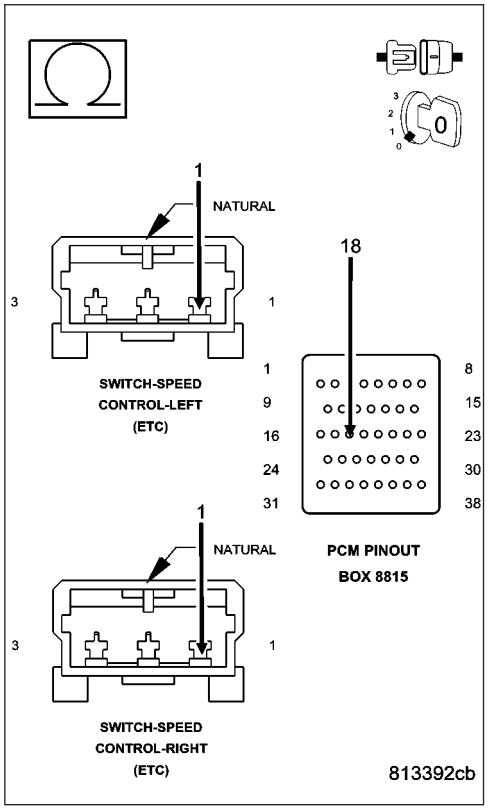
Measure the resistance of the (V38) S/C Switch No.2 Signal circuit from both Speed Control harness connectors to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 8

No >> Repair the open in the (V38) S/C Switch No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

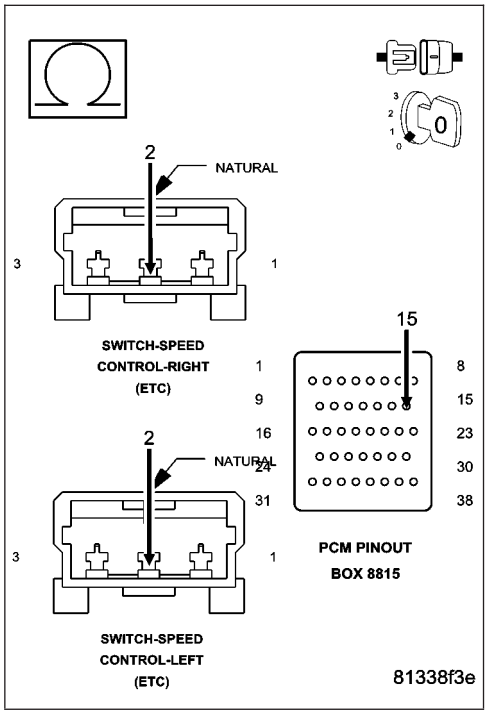


P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

8. (V937) SWITCH RETURN OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.

Measure the resistance of the (V937) Switch Return circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.



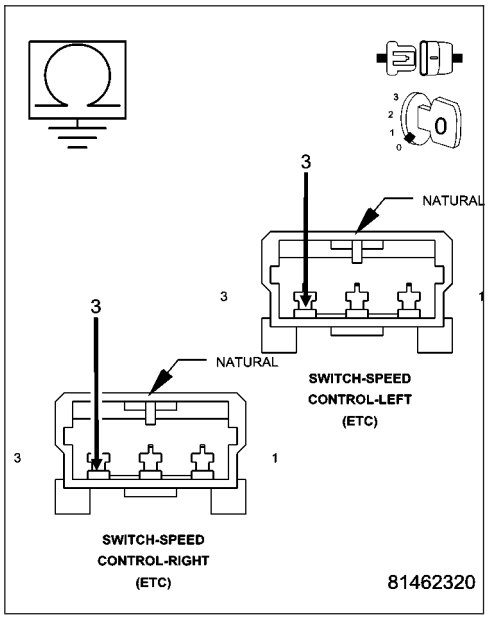
Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 9

No >> Repair the open in the (V937) Switch Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

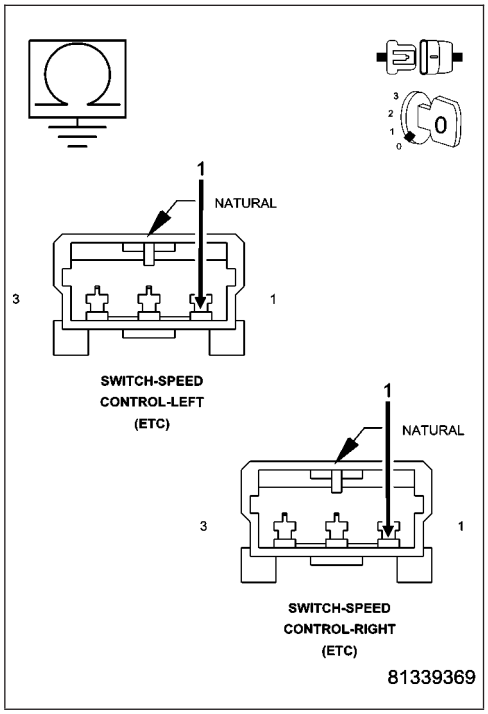
10. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V38) S/C Switch No.2 Signal circuit in the Speed Control harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V38) S/C Switch No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



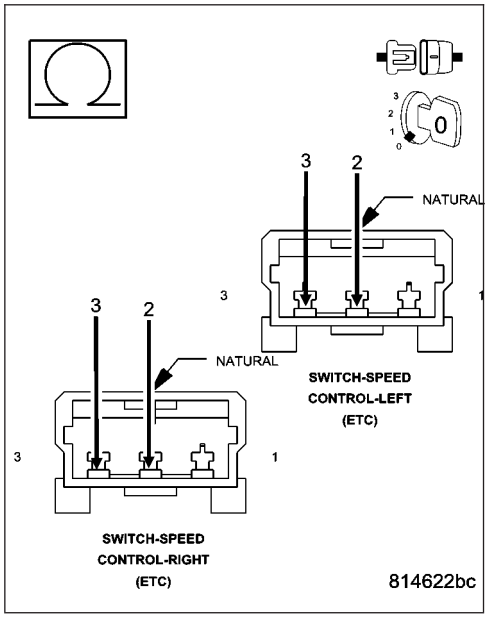
11. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (V937) Switch Return circuit in the Speed Control harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V937) Switch Return circuit and the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

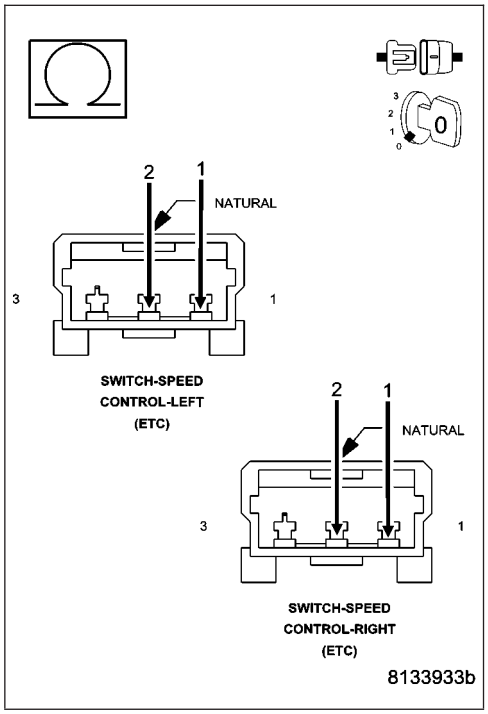
No >> Go To 12



P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

12. (V38) S/C SWITCH NO.2 SIGNAL CIRCUIT SHORTED TO THE (V937) SWITCH RETURN CIRCUIT

Measure the resistance between the (V38) S/C Switch No.2 Signal circuit and the (V937) Switch Return circuit in the Speed Control harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V937) Switch Return circuit and the (V38) S/C Switch No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

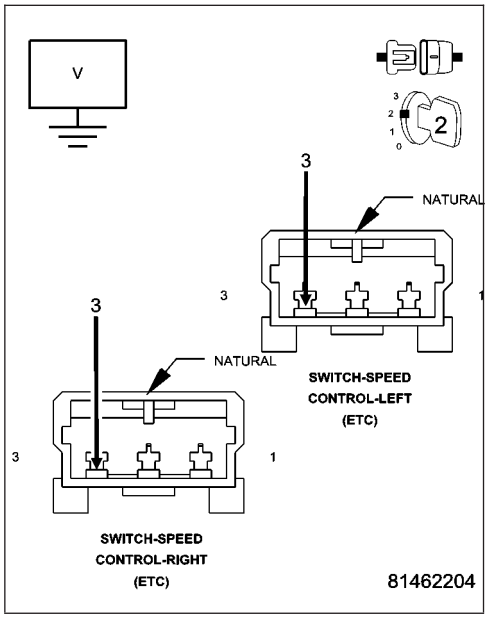
No >> Go To 13

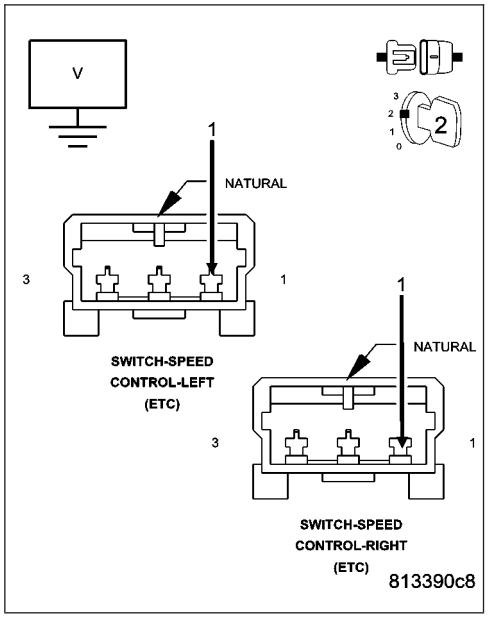
P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

13. SPEED CONTROL SWITCH VOLTAGE VALUES

Allow the engine to idle.

With a scan tool, monitor the S/C Switch voltage readings.





SWITCH POSITION	SWITCH No.1 VOLTAGE VALUE	SWITCH No.2 VOLATGE VALUE
NO SWITCHES PRESSED	4.31 to 4.78 volts	4.31 to 4.78 volts
ON/OFF PRESSED	0.59 to 1.13 volts	3.53 to 3.92 volts
RES/ACCEL PRESSED	3.88 to 4.17 volts	2.04 to 2.47 volts
SET PRESSED	3.16 to 3.56 volts	1.17 to 1.56 volts
COAST PRESSED	2.57 to 2.94 volts	0.77 to 1.09 volts
CANCEL PRESSED	1.59 to 1.99 volts	2.84 to 3.25 volts

P1593-SPEED CONTROL SWITCH 1/2 STUCK (CONTINUED)

Take these same voltage measurements with a voltmeter by back probing the (V37) S/C Switch No.1 Signal circuit and the (V38) S/C Switch No.2 Signal circuit at the switches.

Compare the voltage readings on the voltmeter to what the scan tool displayed.

Are the voltage readings out of the listed specification and do you less than a 0.2 of a volt difference between the voltmeter switch values and the scan tool switch value?

Yes >> Replace the Speed Control Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

---

14. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

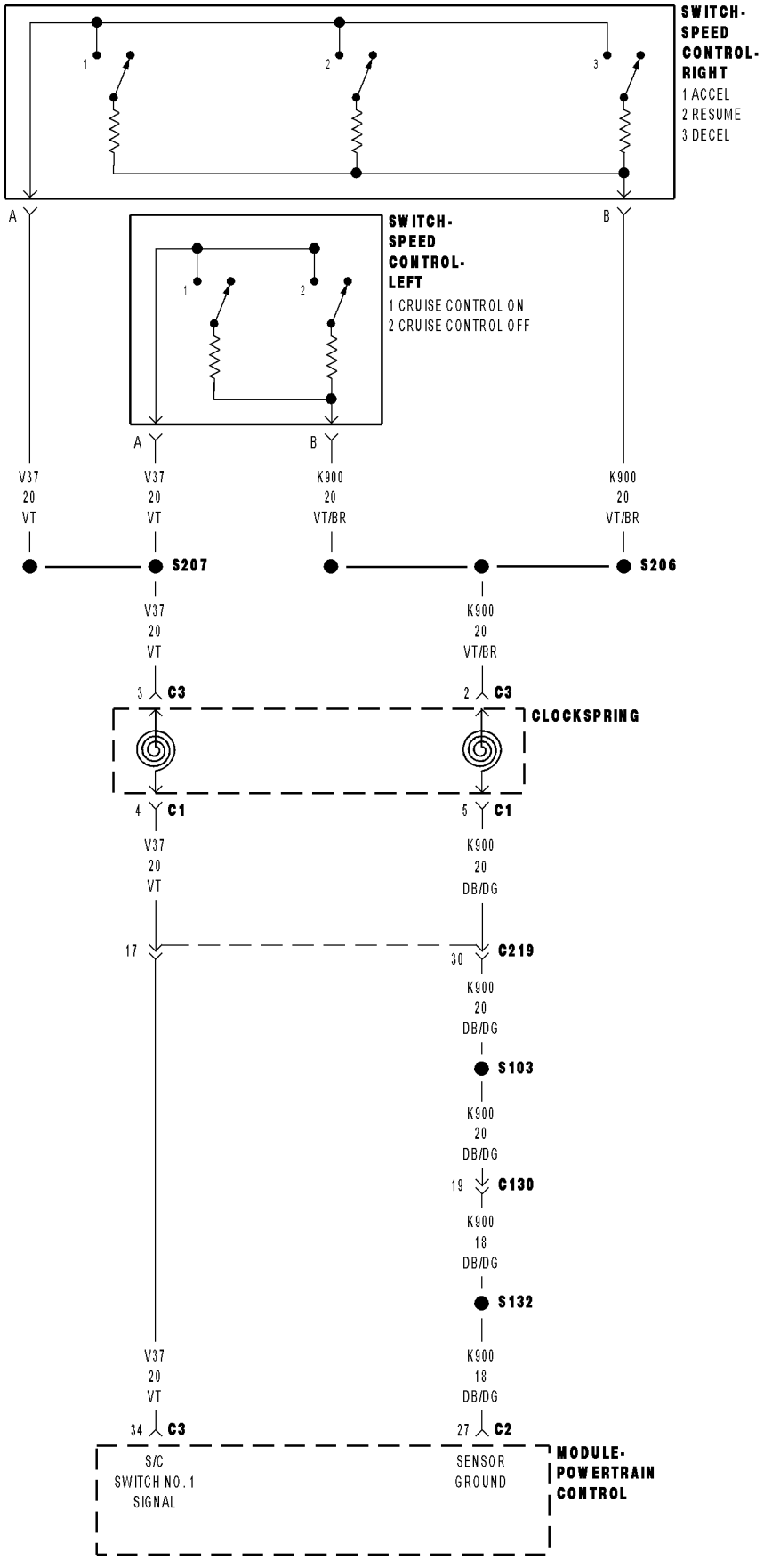
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L)



P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  S/C Switch No.1 is mechanically stuck in the On/Off, Resume/Accel, or Set position for too long. One trip fault.

Possible Causes
(V37) S/C SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(V37) S/C SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND OPEN
(V37) S/C SIGNAL CIRCUIT SHORTED TO GROUND
(V37) S/C SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
SPEED CONTROL SWITCH
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SPEED CONTROL SWITCH STATUS

Start the engine.
With a scan tool, monitor each which function for the Speed Control Switches.
Press and release each Speed Control Button.
- Resume/Accel
- Cancel
- Decel (Coast)
- On/Off
- Set

Does each switch function change status when pressing each switch?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L) (CONTINUED)

2. SPEED CONTROL SWITCHES

Turn the ignition off.

Disconnect and remove the Speed Control Switches from the steering wheel per Service Information.

Measure the resistance across each Speed Control Switch.

Monitor the ohmmeter while pressing each function button on each switch.

Resume/Accel - 15.4 kohms

Cancel - 1.24 kohms

Coast - 2.94 kohms

On/Off -0.47 kohms

Set - 5.49 kohms

Does the function on the Speed Control Switches have the correct resistance value?

Yes >> Go To 3

No >> Replace the Speed Control Switch that had the incorrect resistance value.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

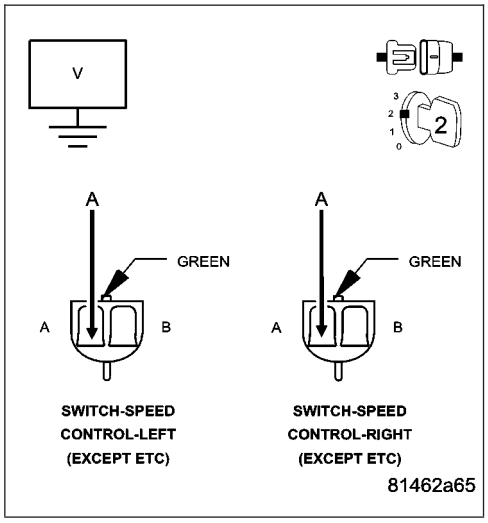
---

3. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 and C3 PCM harness connectors.

Measure the voltage of the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



Is the voltage above 5.0 volts?

Yes >> Repair the short to battery voltage in the (V37) S/C Signal No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L) (CONTINUED)

4. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT OPEN

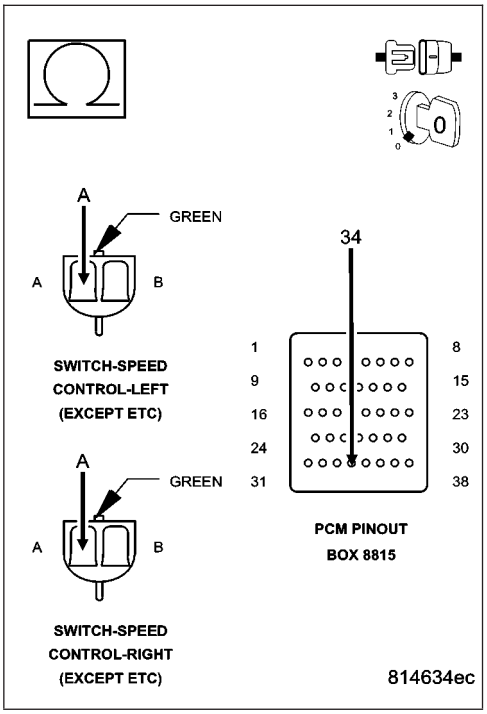
NOTE: The measurement must be taken from both Speed Control Switch harness connectors.
Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (V37) S/C Switch No.1 Signal circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 5

No >> Repair the open in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



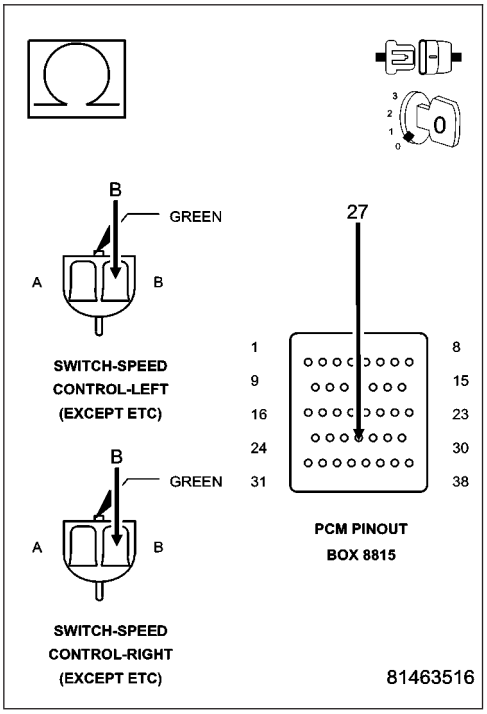
5. (K900) SENSOR GROUND CIRCUIT OPEN

NOTE: The measurement must be taken from both Speed Control Switch harness connectors.
Measure the resistance of the (K900) Sensor ground circuit from the Speed Control harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for both measurements?

Yes >> Go To 6

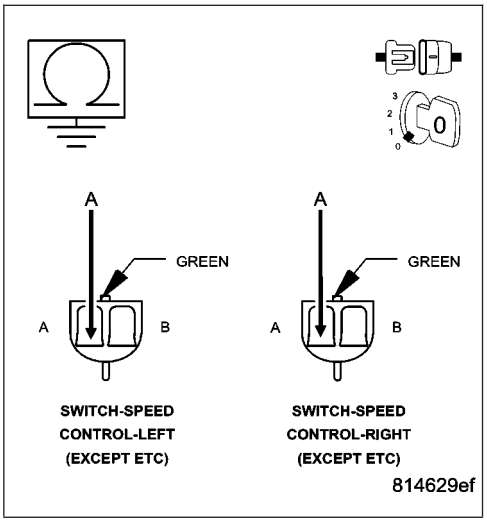
No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1593-SPEED CONTROL SWITCH 1 STUCK (3.7L, 4.7L) (CONTINUED)

6. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (V37) S/C Switch No.1 Signal circuit in the Speed Control harness connector.



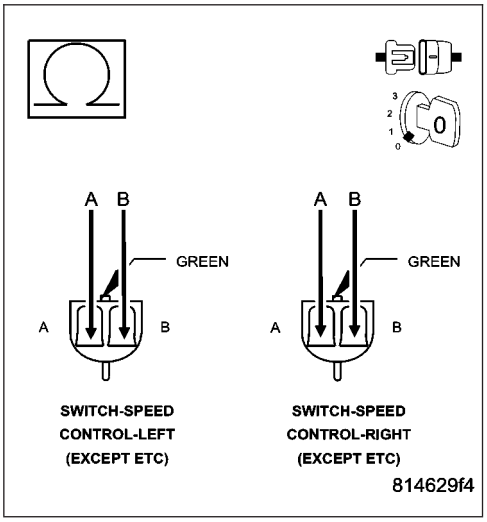
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (V37) S/C Switch No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (V37) S/C SWITCH NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit in the Speed Control harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (V37) S/C Switch No.1 Signal circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1602–PCM NOT PROGRAMMED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  The PCM has not been programmed.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM PROGRAMMED

Ignition on, engine not running.
With a scan tool, erase DTCs.
With a scan tool program the PCM.
Start the engine.
Allow the engine to reach normal operating temperature.
With a scan tool, read DTCs.

Does the DTC reset?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> The PCM has been successfully programmed. Test is complete.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

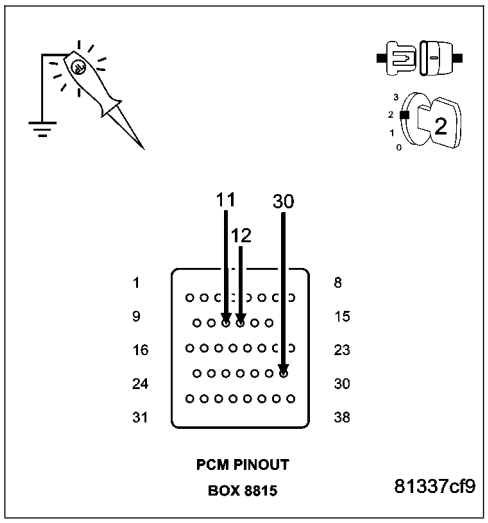
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202), (F1), and (T751) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202), (F1), and (T751) Fused Ignition Switch (Offf, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1603-PCM INTERNAL DUAL-PORT RAM COMMUNICATION FAILURE (CONTINUED)

2. PCM

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

Disconnect the C1 PCM harness connector.

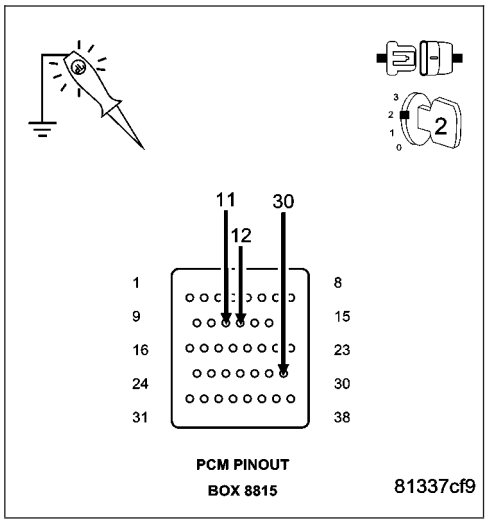
Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202), (F1), and (T751) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202), (F1), and (T751) Fused Ignition Switch (Off, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1604-PCM INTERNAL DUAL-PORT RAM READ/WRITE INTEGRITY FAILURE (CONTINUED)

2. **PCM**

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1607-PCM INTERNAL SHUTDOWN TIMER RATIONALITY

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Internal PCM failure detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM FUSED IGNITION SWITCH CIRCUIT
PCM INTERNAL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM IGNITION CIRCUITS

Turn the ignition off.

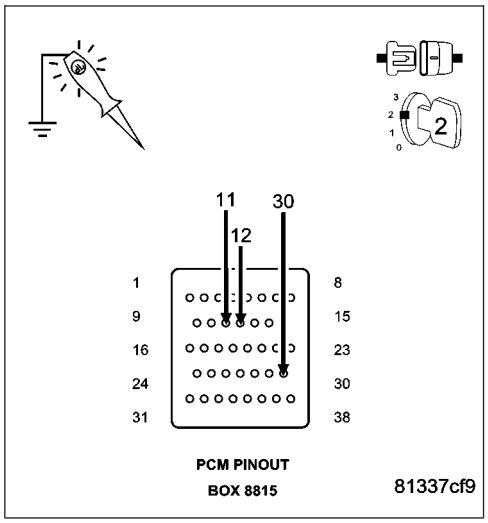
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202), (F1), and (T751) Fused Ignition Switch circuits.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or excessive resistance in the (F202), (F1), and (T751) Fused Ignition Switch (Off, Run, Start) circuits. Inspect the related fuse, if the fuse is open check the circuits for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. PCM

The Powertrain Control Module is reporting internal errors.

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

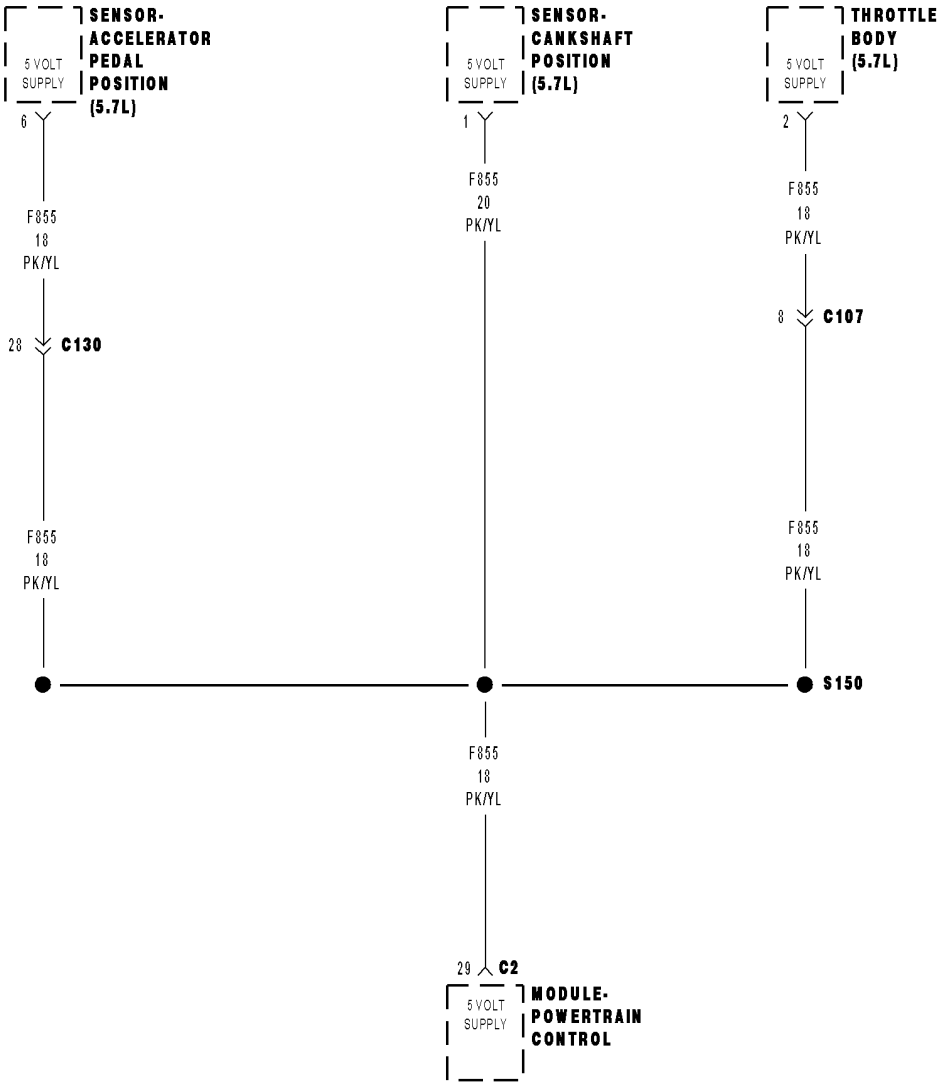
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

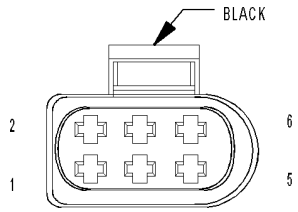
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

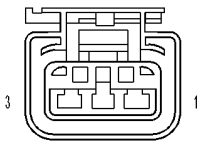
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC

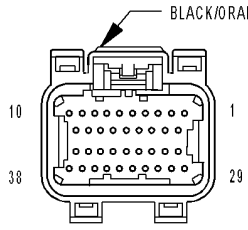




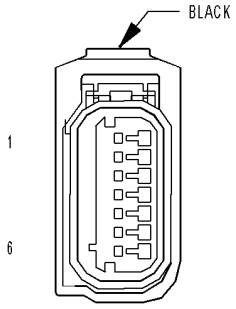
THROTTLE
BODY
(5.7L)



SENSOR-
CRANKSHAFT
POSITION
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C2
(NGC)



SENSOR-
ACCELERATOR
PEDAL
POSITION

81454897

P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Primary 5-volt Supply circuit voltage is varying too much too quickly. One Trip Fault. ETC light is flashing.

Possible Causes
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO GROUND
(F855) PRIMARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE
(F855) PRIMARY 5-VOLT SUPPLY CIRCUIT OPEN
5-VOLT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

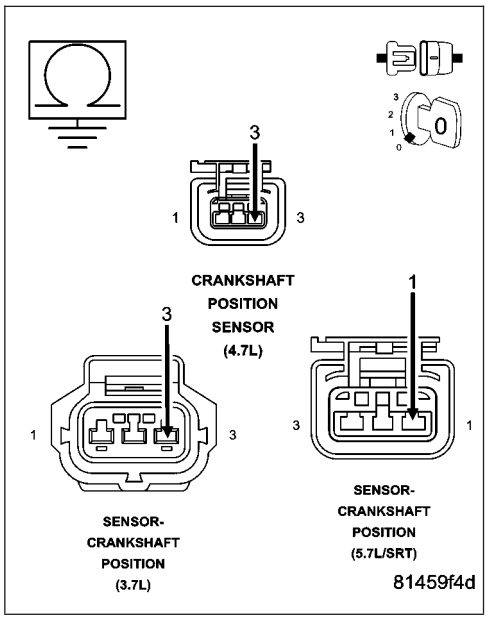
NOTE: This code can be caused by the improper installation of after market accessories that may be causing excessive noise on the (F855) 5-volt Supply circuit.

Measure the resistance between ground and the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) Primary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC (CONTINUED)

3. SENSOR SHORTED TO GROUND

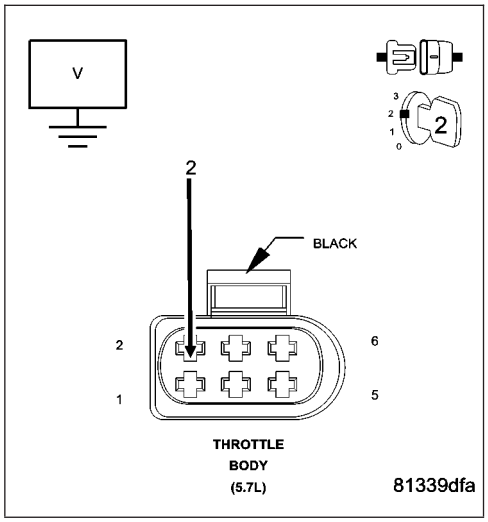
Connect the C2 PCM harness connector and all the previously disconnected Sensor except for the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the Throttle Body harness connector.

CAUTION: You must Turn the Ignition Off when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F855) Primary 5-volt Supply circuit, one at a time.



Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes >> Replace the Sensor that causes the (F855) Primary 5-volt Supply circuit voltage to increase when disconnected.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

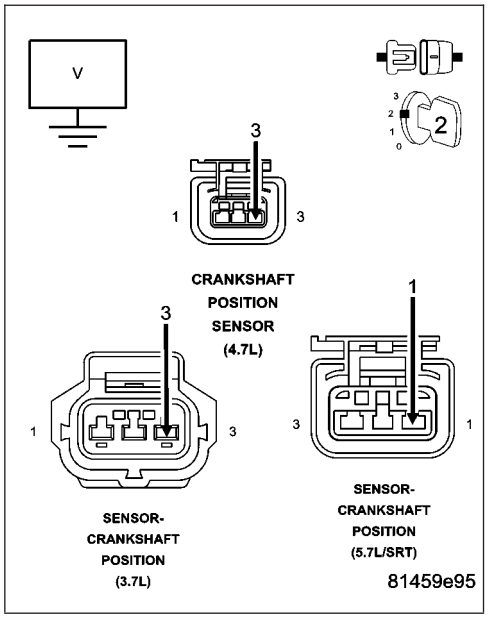
4. 5-VOLT SENSOR

Turn the ignition off.

Connect all the previously disconnected Sensors except for the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit at the CKP Sensor harness connector.



Is the voltage between 4.8 and 5.2 volts?

Yes >> Replace the Crank Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC (CONTINUED)

5. (F855) PRIMARY 5-VOLT SUPPLY SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect all the Sensors that share the (F855) Primary 5-volt Supply circuit.

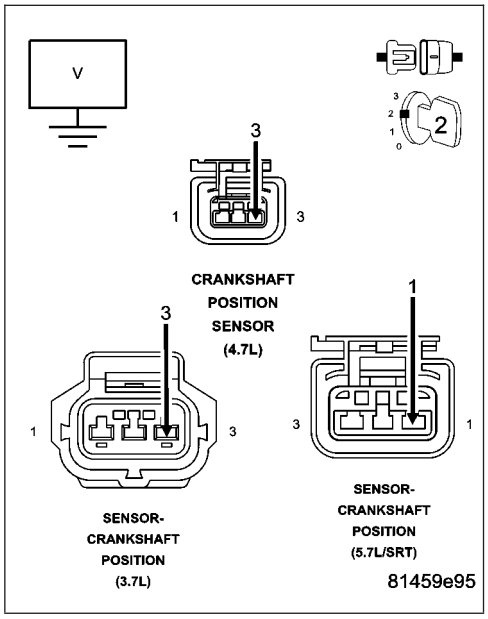
Ignition on, engine not running.

Measure the voltage on the (F855) Primary 5-volt Supply circuit in the CKP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F855) Primary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. (F855) PRIMARY 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Reconnect all the sensors that were disconnected in the previous step except for the CKP Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

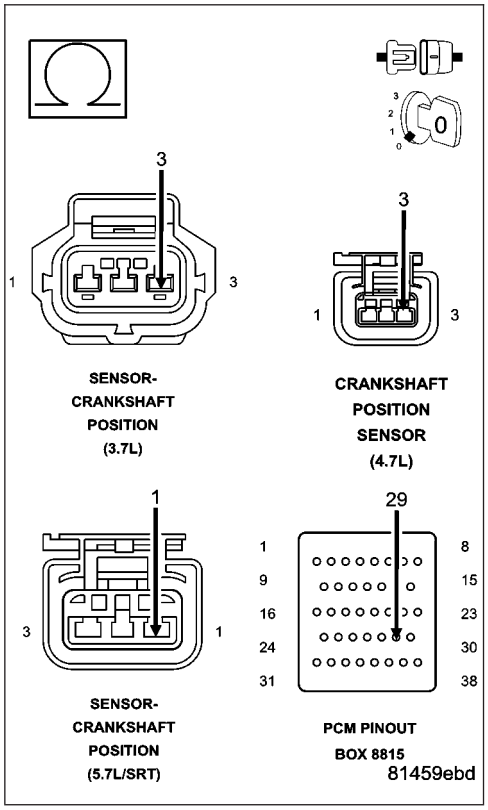
Measure the resistance in the (F855) Primary 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

It may be necessary to perform this test from every sensor that uses the (F855) Primary 5-volt Supply circuit.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) Primary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1618-SENSOR REFERENCE VOLTAGE 1 CIRCUIT ERRATIC (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

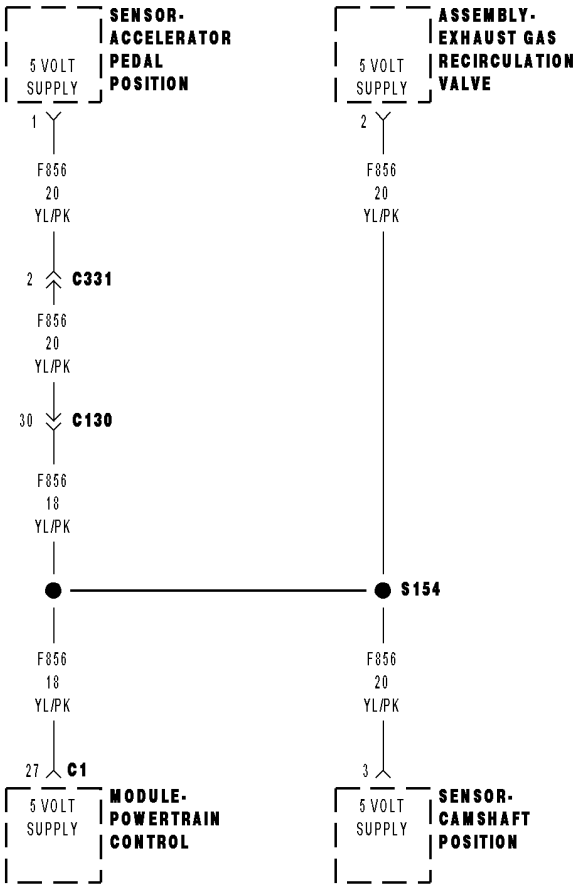
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

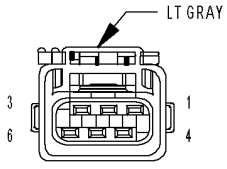
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

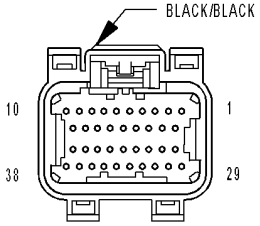
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC

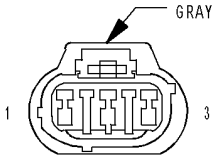




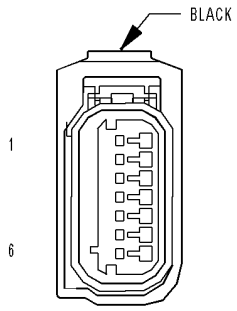
ASSEMBLY-
EXHAUST GAS
RECIRCULATION
VALVE
(4.7L/5.7L LIGHT DUTY)



MODULE-
POWERTRAIN
CONTROL C1
(NGC)



SENSOR-
CAMSHAFT
POSITION
(GAS)



SENSOR-
ACCELERATOR
PEDAL
POSITION

8145491c

P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Auxiliary 5-volt Supply circuit voltage is varying too much too quickly. One Trip Fault. ETC light is flashing.

Possible Causes
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT OPEN
5-VOLT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

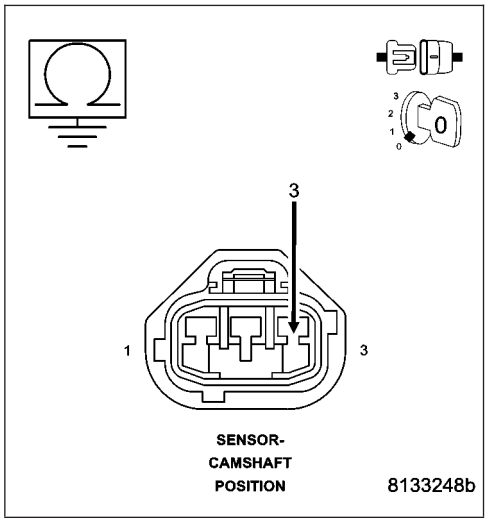
Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

NOTE: This code can be caused by the improper installation of after market accessories that may be causing excessive noise on the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) Auxiliary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC (CONTINUED)

3. SENSOR SHORTED TO GROUND

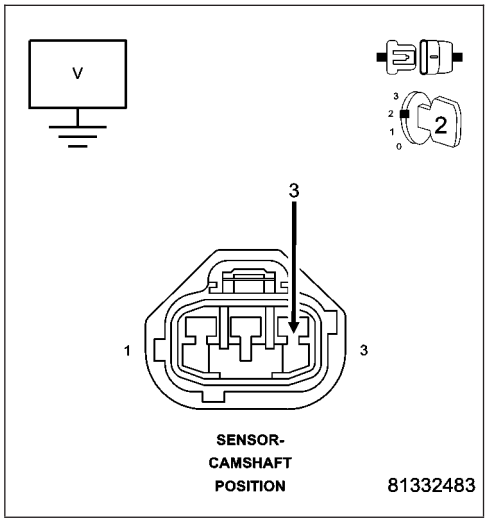
Connect the C1 PCM harness connector and all the previously disconnected Sensor except for the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.

CAUTION: You must Turn the Ignition OFF when disconnecting any of the Sensor harness connectors and Turn the Ignition On to check the voltage readings.

While monitoring the voltage, disconnect each Sensor harness connector that shares the (F856) Auxiliary 5-volt Supply circuit, one at a time.



Does the voltage increase above 4.5 volts when disconnecting any of the Sensor harness connectors?

Yes >> Replace the Sensor that causes the (F856) Auxiliary 5-volt Supply circuit voltage to increase when disconnected.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

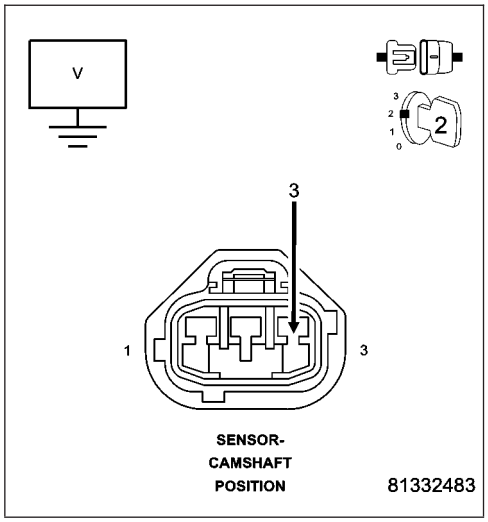
4. 5-VOLT SENSOR

Turn the ignition off.

Connect all the previously disconnected Sensors except for the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit in the CMP Sensor harness connector.



Is the voltage below 4.5 volts?

Yes >> Go To 5

No >> Replace the Cam Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC (CONTINUED)

5. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

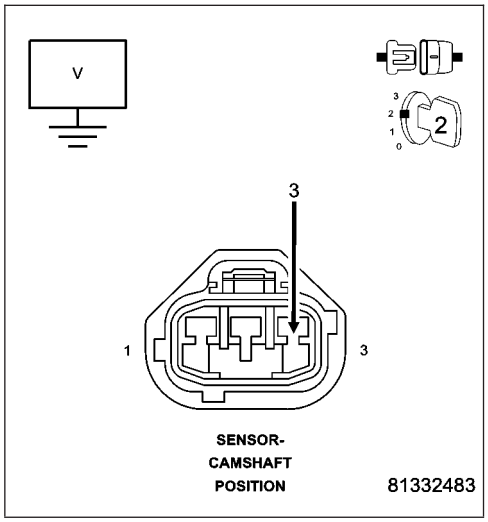
Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect all the Sensors that share the (F856) Auxiliary 5-volt Supply circuit.

Ignition on, engine not running.

Measure the voltage on the (F856) Auxiliary 5-volt Supply circuit at the CMP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F856) Auxiliary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (F856) AUXILIARY 5-VOLT SUPPLY CIRCUIT OPEN

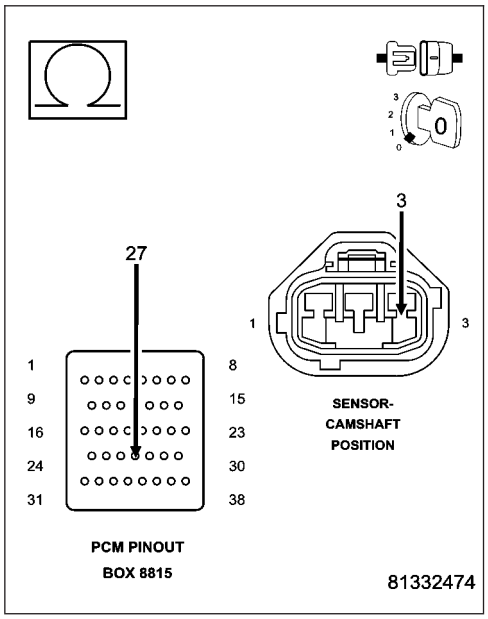
Turn the ignition off.

Reconnect all the sensors that were disconnected in the previous step except the CMP Sensor harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance in the (F856) Auxiliary 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

It may be necessary to perform this test from every sensor that uses the (F856) Auxiliary 5-volt Supply circuit.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F856) Auxiliary 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1628-SENSOR REFERENCE VOLTAGE 2 CIRCUIT ERRATIC (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1696-EEPROM MEMORY WRITE DENIED/INVALID

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at power down. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

Does scan tool display Write Failure?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

Does the scan tool display Write Refused?

Yes >> Go To 3

No >> Go To 4

---

3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

NOTE: Retest the SRI Memory two more times.

Does the scan tool display Write Refused again?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

---

4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

Does the scan tool display SRI Mileage Invalid?

Yes >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1696-EEPROM MEMORY WRITE DENIED/INVALID (CONTINUED)

5. **COMPARE SRI MILEAGE WITH ODOMETER**

Compare the SRI Mileage stored with the Instrument Panel Odometer.

Is the mileage within the specified range displayed on the scan tool?

Yes >> Test Complete.

No >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1697-EMR (SRI) MILEAGE NOT STORED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously with the ignition on.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, Also checks at powerdown. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. SCAN TOOL DISPLAYS A WRITE FAILURE

With a scan tool, perform the SRI Memory Test.

Does scan tool display Write Failure?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. SCAN TOOL DISPLAYS A WRITE REFUSED

With the a scan tool, perform the SRI Memory Test.

Does the scan tool display Write Refused?

Yes >> Go To 3

No >> Go To 4

---

3. PCM REFUSED 2ND TEST

With a scan tool, perform the SRI Memory Test a third time.

NOTE: Retest the SRI Memory two more times.

Does the scan tool display Write Refused again?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

---

4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With a scan tool, perform the SRI Memory Test.

Does the scan tool display SRI Mileage Invalid?

Yes >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1697-EMR (SRI) MILEAGE NOT STORED (CONTINUED)

5. COMPARE SRI MILEAGE WITH ODOMETER

Compare the SRI Mileage stored with the Instrument Panel Odometer.

Is the mileage within the specified range displayed on the scan tool?

Yes >> Test Complete.

No >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2072-ELECTRONIC THROTTLE CONTROL SYSTEM - ICE BLOCKAGE

For the Engine circuit diagram (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The PCM recognizes the Throttle plate is stuck during extremely cold Ambient Temperature operation. The throttle plate goes through a de-icing procedure. If the throttle blade still doesn't move this fault sets. The MIL will not illuminate. The vehicle will be in Limp home condition, limiting rpm and vehicle speed.

Possible Causes
THROTTLE PLATE FROZEN

Diagnostic Test

1. THROTTLE BODY INSPECTION

Ignition on, engine not running.

With a scan tool, read DTCs and record the related Freeze Frame data.

NOTE: This DTC sets in extreme cold Ambient Temperatures with the throttle plate stuck by the time the vehicle gets to the dealership the condition may be corrected.

NOTE: Diagnose any other DTCs that may also be set before continuing.

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

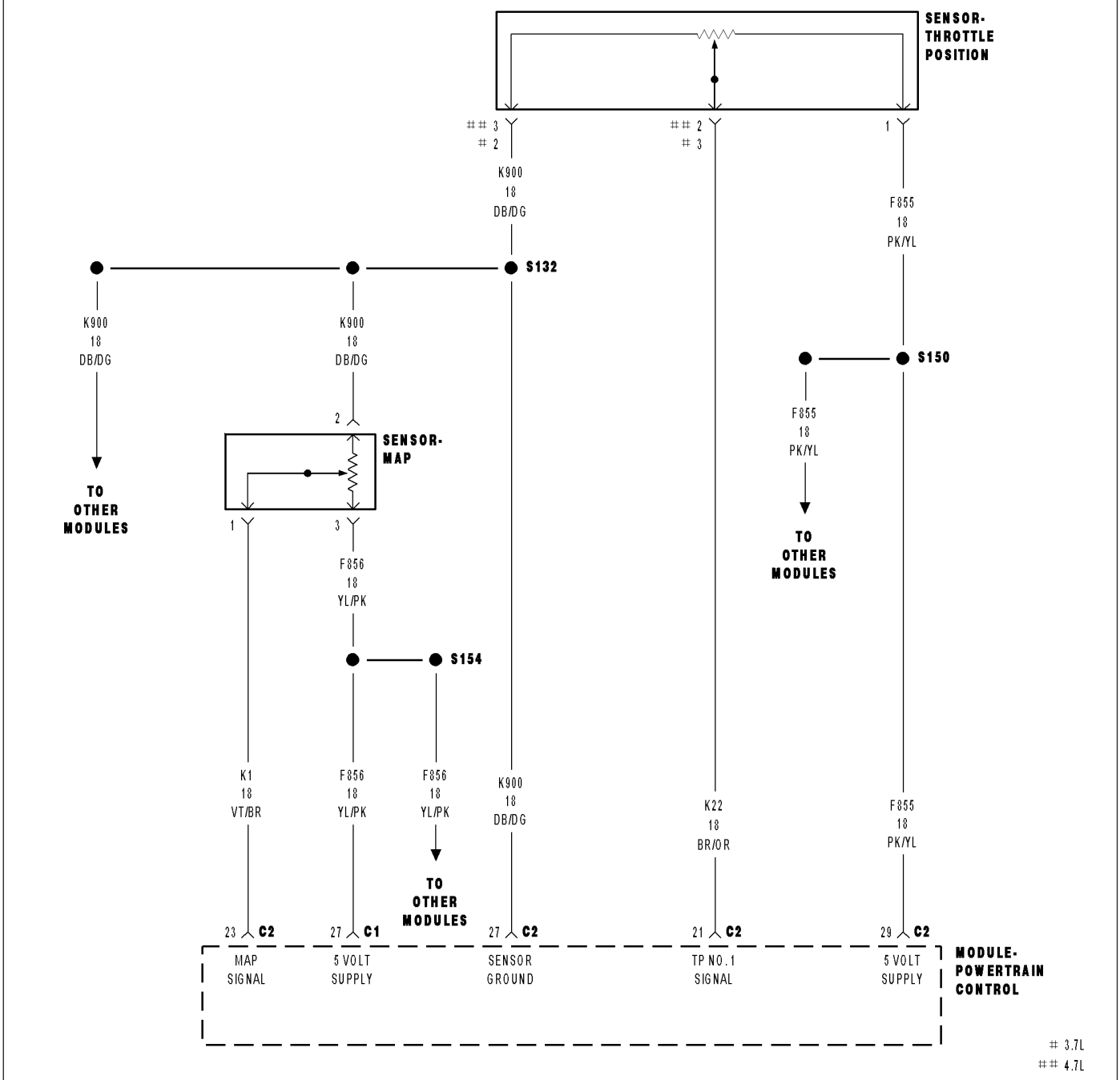
Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

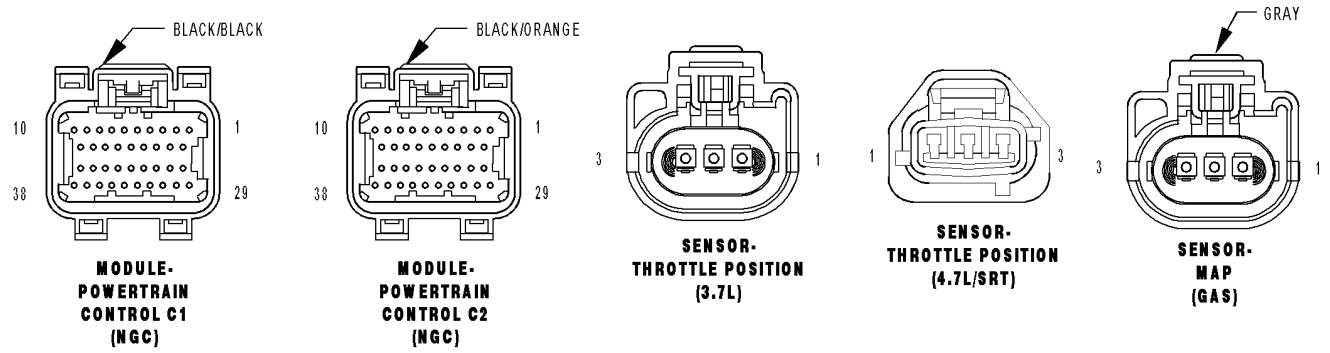
Is the throttle blade still stuck because it is frozen?

Yes >> Allow the Throttle Body to thaw naturally in a room temperature climate.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED





81452c0a

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This DTC sets when an unexpected high intake manifold air flow condition exists that can lead to increased engine speed and puts the NGC into a High Air flow Protection limiting mode. The High Air flow Protection feature includes RPM limits for when a Throttle and/or MAP sensor limp-in fault is present.

- **When Monitored:**
  During all drive modes
- **Set Condition:**
  If vacuum drops below 1.5″Hg with engine RPM greater than 2000 RPM and closed throttle. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Diagnose any TP Sensor or MAP Sensor component DTCs before continuing.

NOTE: If the P0501 - No Vehicle Speed Signal is set long with this DTC, refer to the P0501 diagnostics before continuing.

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to shut down the engine if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation and vacuum leaks.

Inspect the throttle plate to see if it is bent and will close entirely, if it is bent it may need to be replaced.

Inspect the MAP Sensor for proper installation.

Verify the engine is free from any mechanical failures.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at wide open throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage while slowly pressing the throttle pedal from closed to wide open throttle.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

5. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

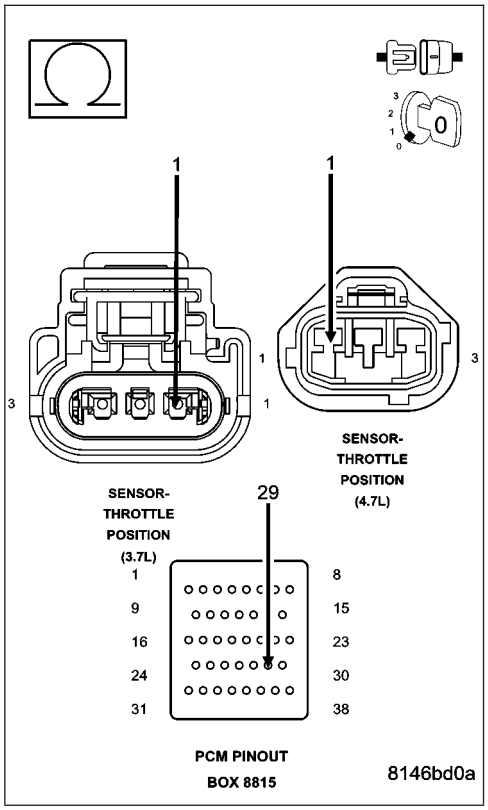
Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

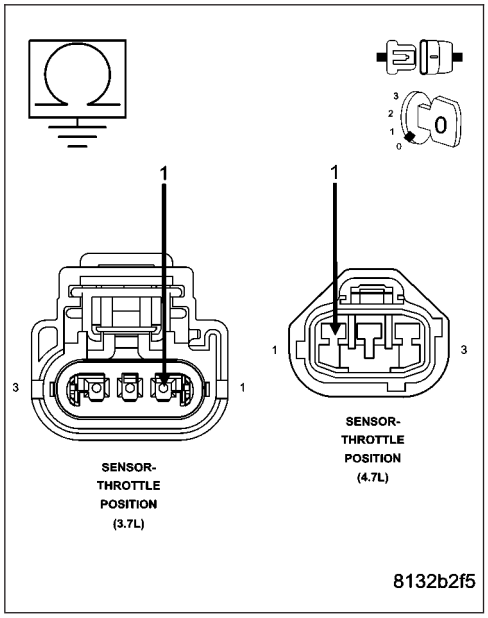
Measure the resistance between ground and (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

7. THROTTLE POSITION SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

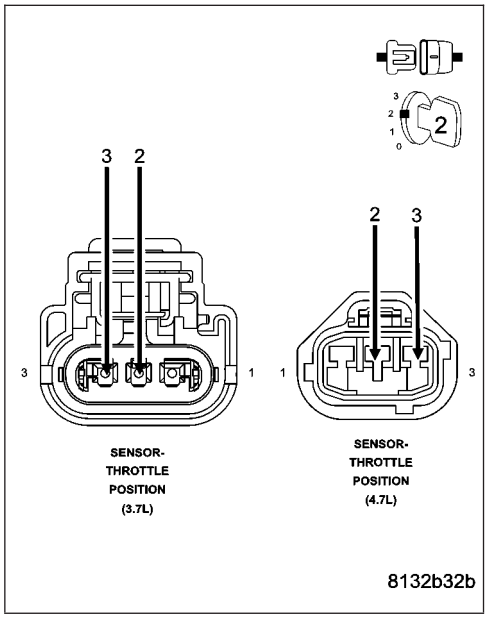
Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Does the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

NOTE: Remove the jumper wire before continuing.



8. EXCESSIVE RESISTANCE IN THE (K22) TP NO.1 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

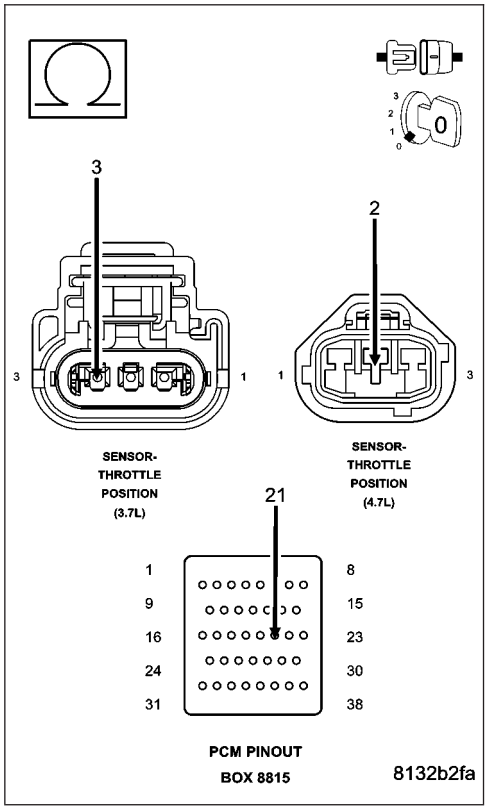
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

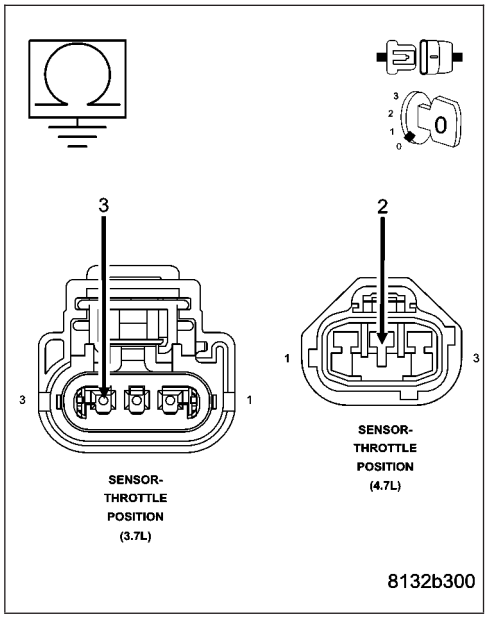
No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

9. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit in the TP Sensor harness connector.



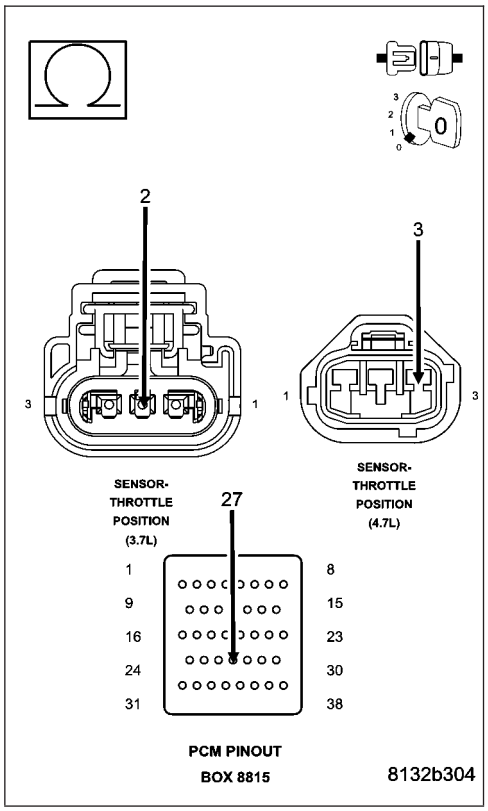
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

11. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

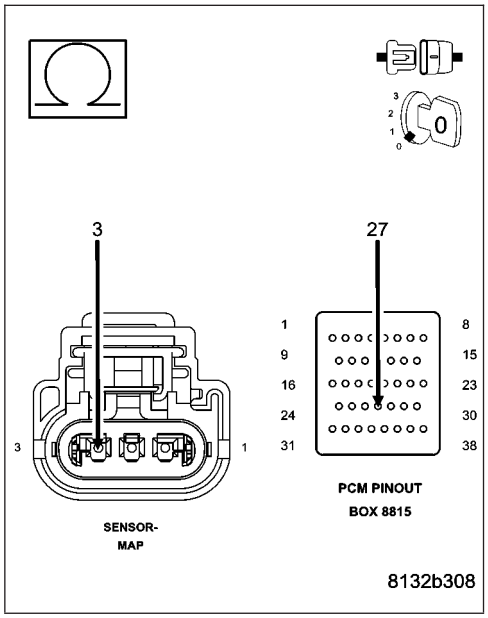
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

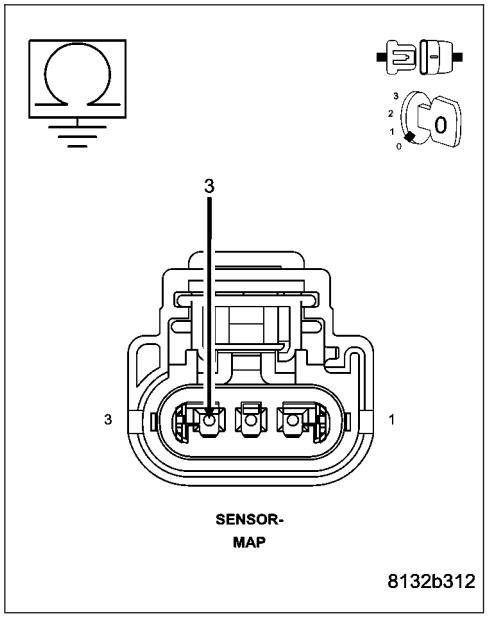
Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

13. MAP SENSOR

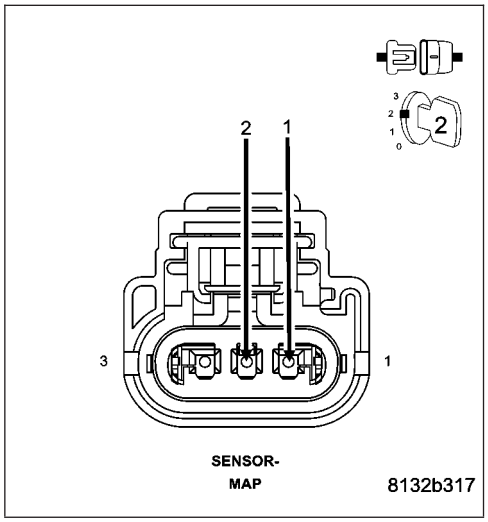
Turn the ignition off.

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.



Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.

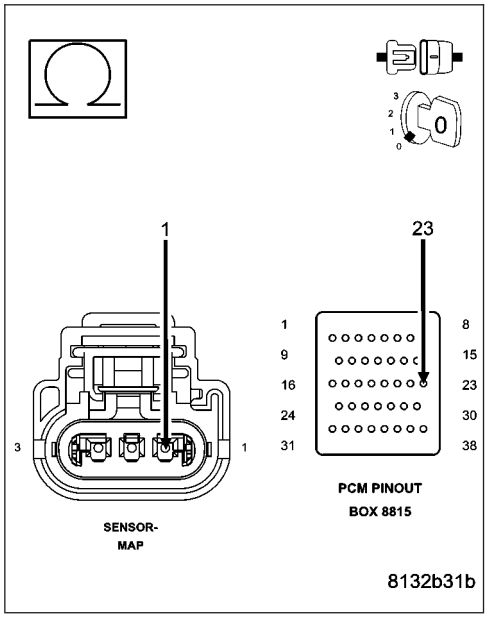
14. EXCESSIVE RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

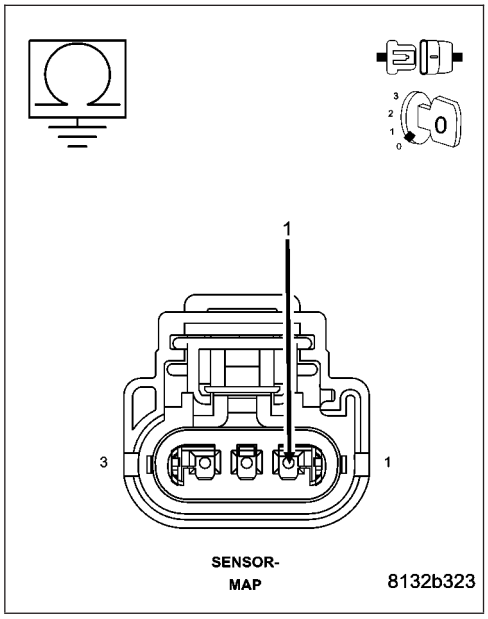
15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



16. EXCESSIVE RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

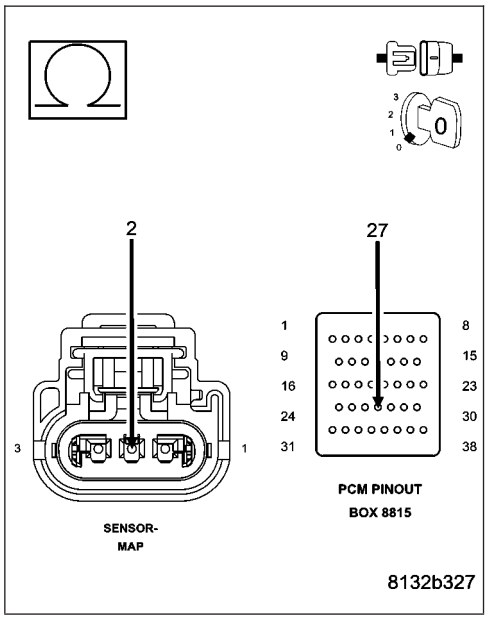
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2074-MAP/TPS CORRELLATION - HIGH AIRFLOW/VACUUM LEAK DETECTED (CONTINUED)

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

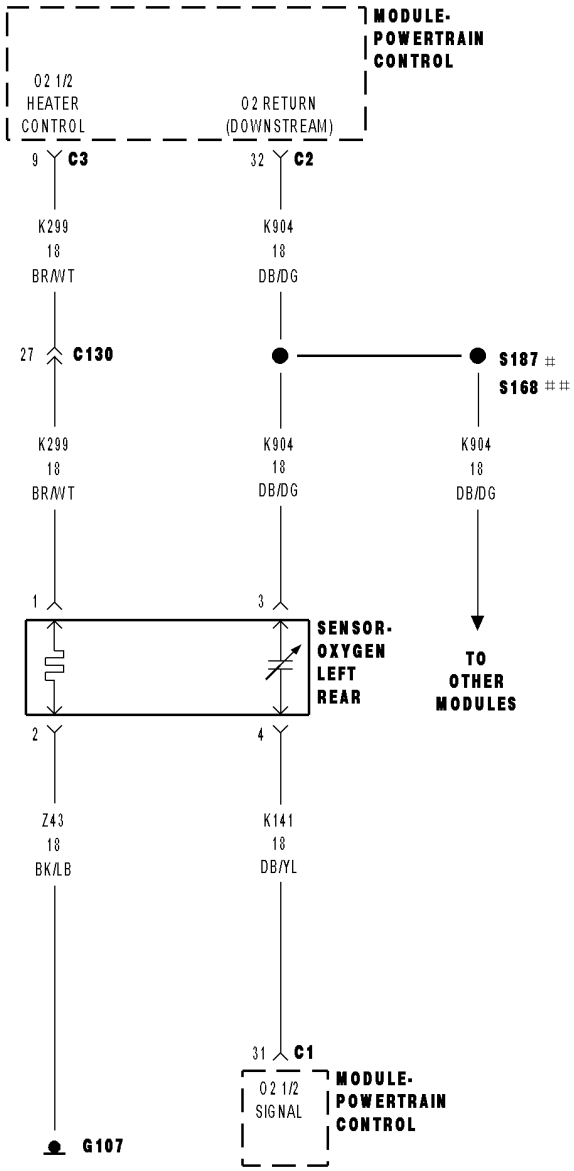
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

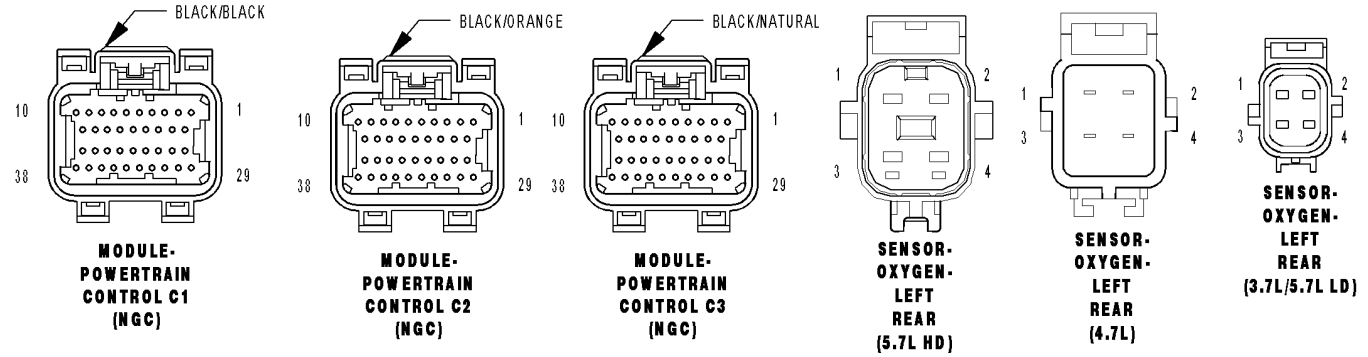
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN





81452b26

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
1/2 O2 SENSOR
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT
(K299) O2 1/2 HEATER CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

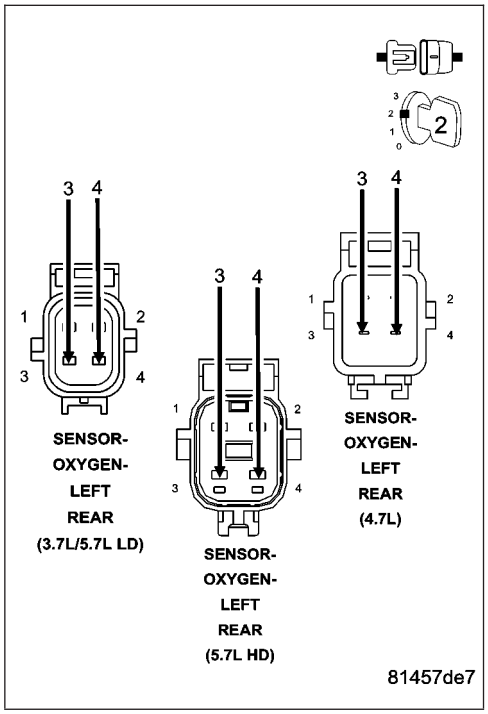
Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

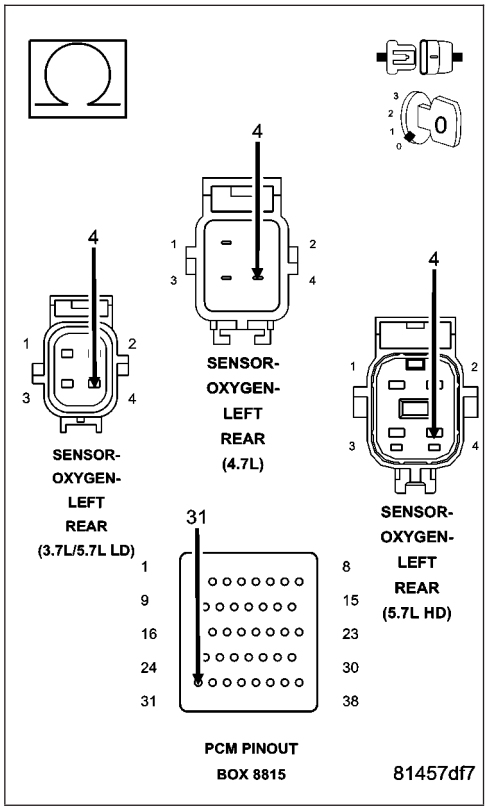
With the scan tool, monitor the 1/2 O2 Sensor voltage.

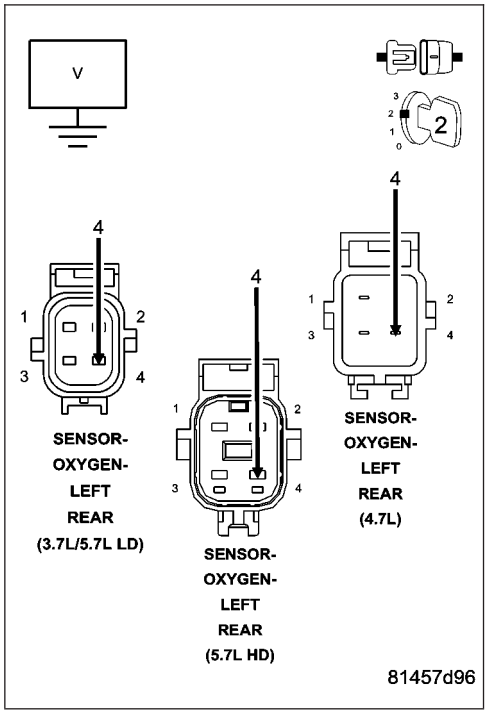
Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

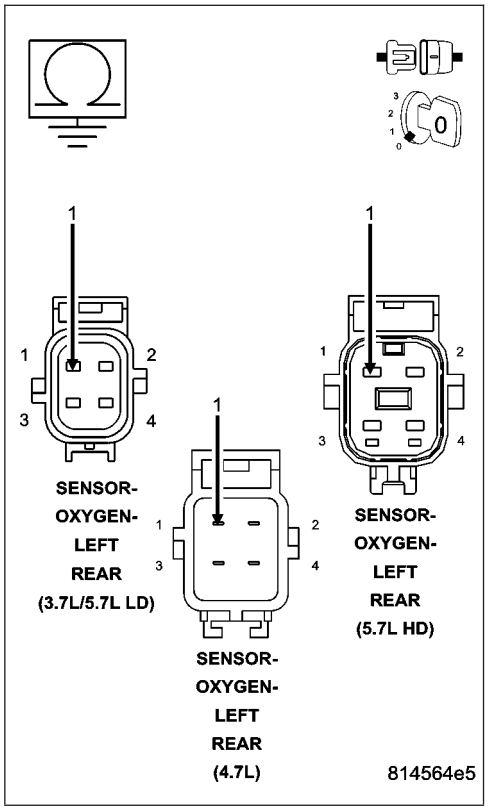
Measure the resistance between ground and the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2096-DOWNSTREAM FUEL TRIM SYSTEM 1 LEAN (CONTINUED)

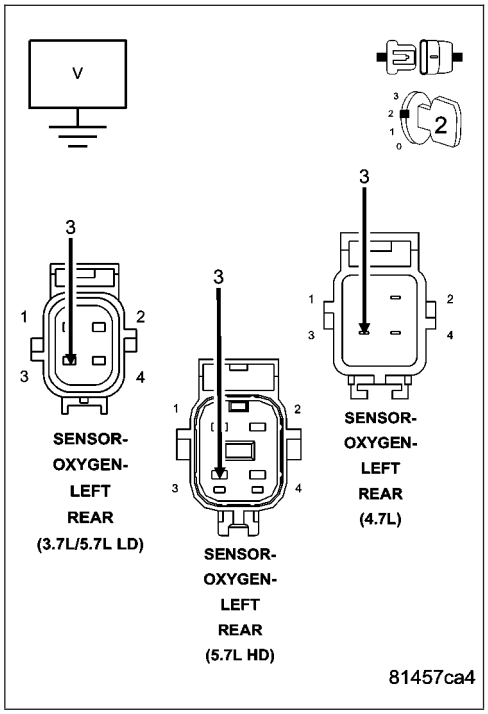
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

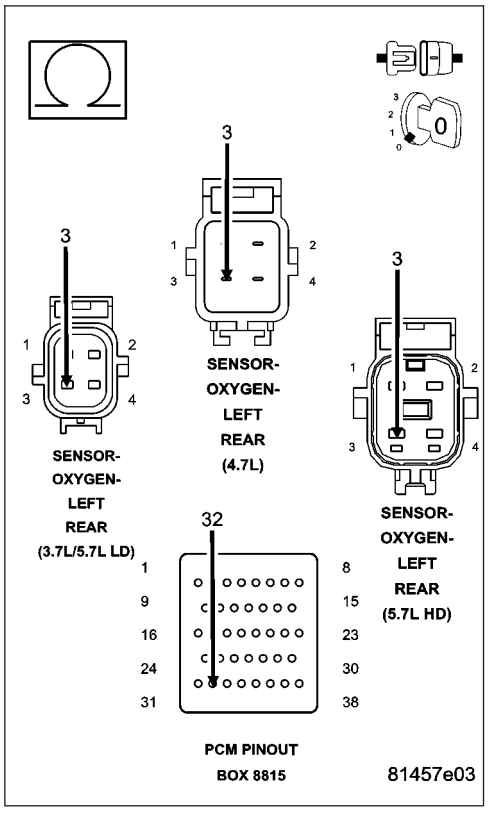
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

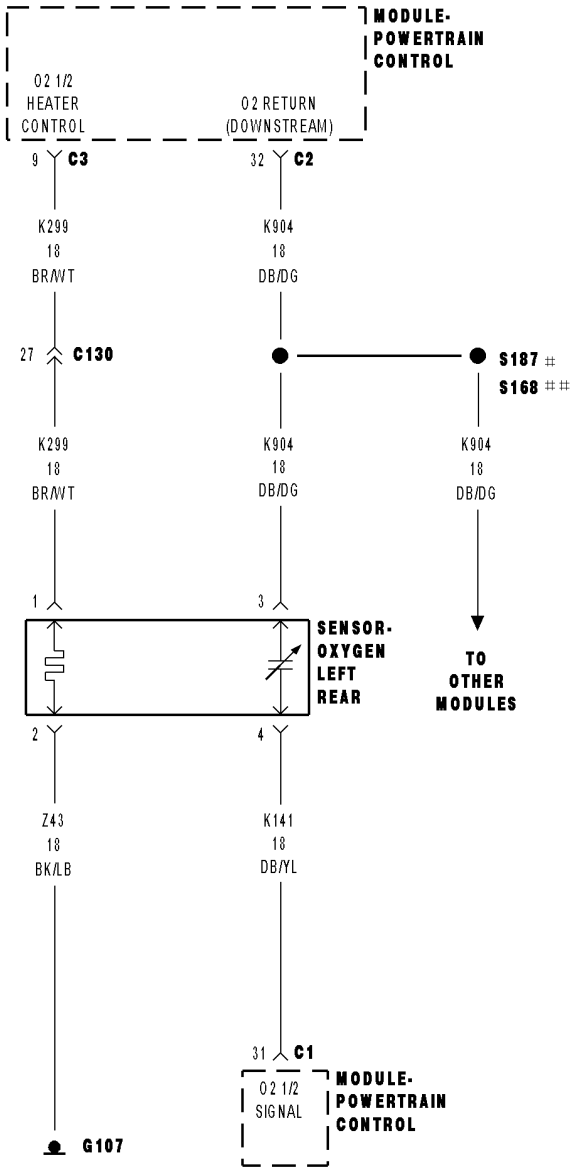
Yes >> Check the fuel system for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

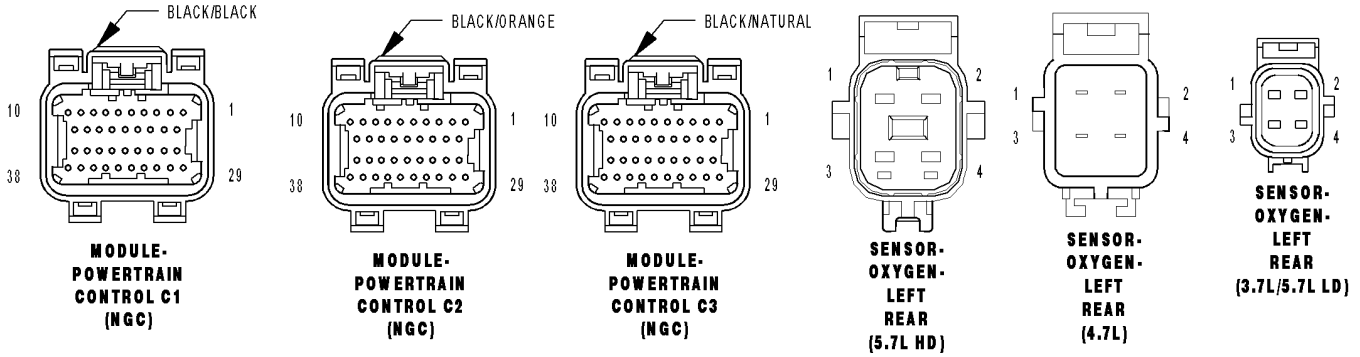
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH





81452b26

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
1/2 O2 SENSOR
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT
(K299) O2 HEATER 1/2 CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 1/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems
AIR INDUCTION SYSTEM - must be free from leaks.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 1/2 O2 Sensor harness connector.

With the scan tool, monitor the 1/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

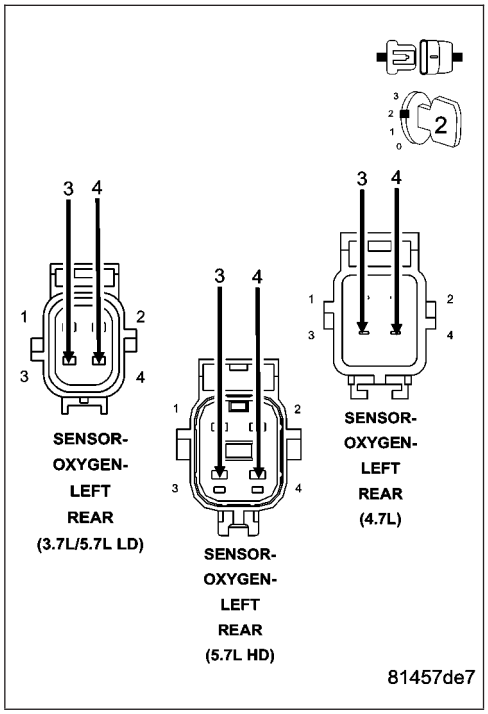
Using a jumper wire, jump the (K141) O2 Sensor 1/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

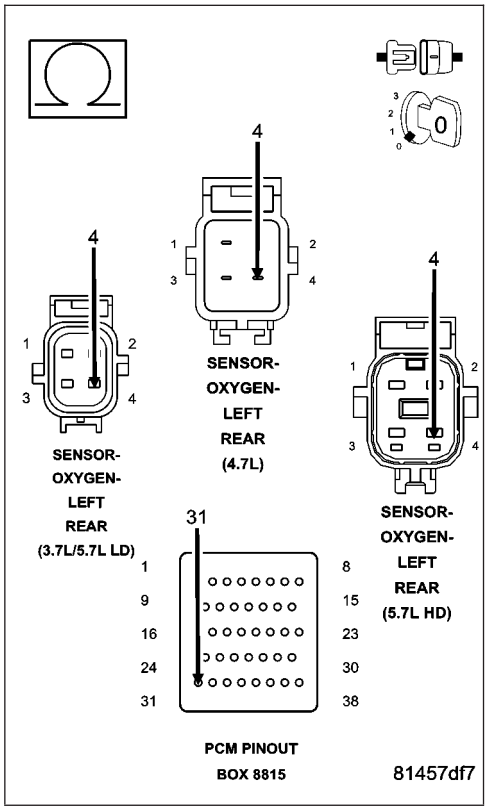
With the scan tool, monitor the 1/2 O2 Sensor voltage.

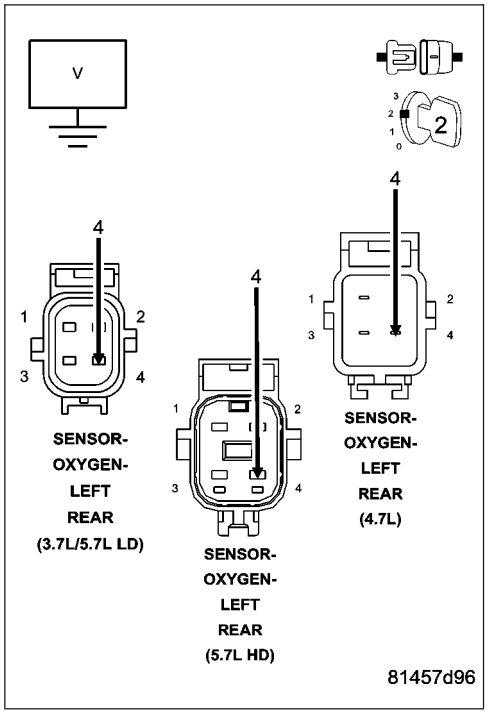
Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K141) O2 Sensor 1/2 Signal circuit for an open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

6. (K299) O2 SENSOR 1/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

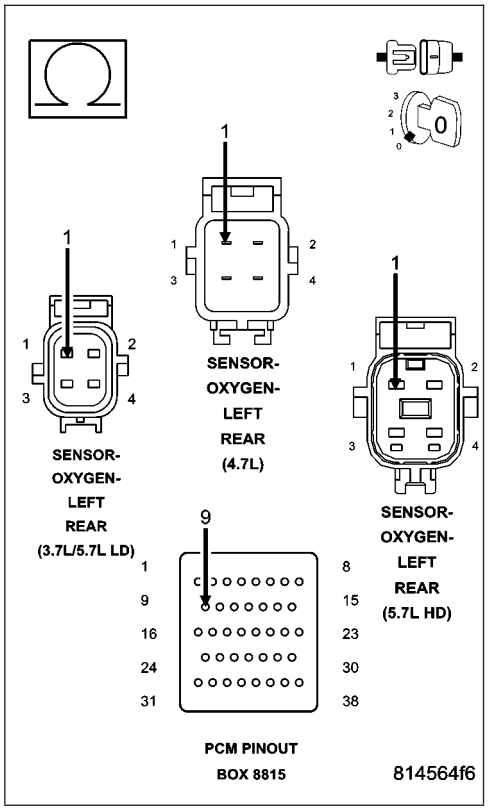
Measure the resistance of the (K299) O2 Sensor 1/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K299) O2 Sensor 1/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2097-DOWNSTREAM FUEL TRIM SYSTEM 1 RICH (CONTINUED)

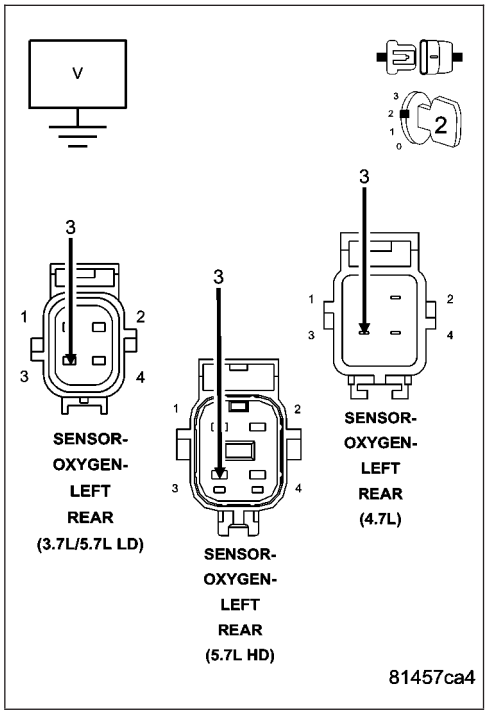
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

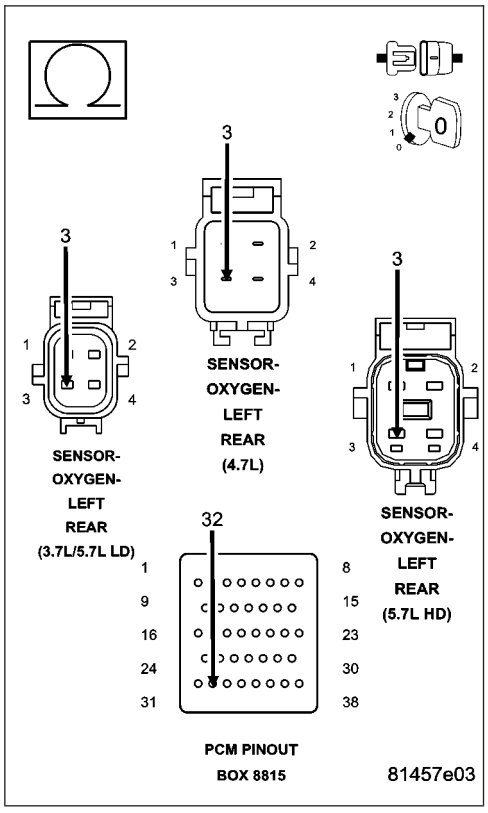
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

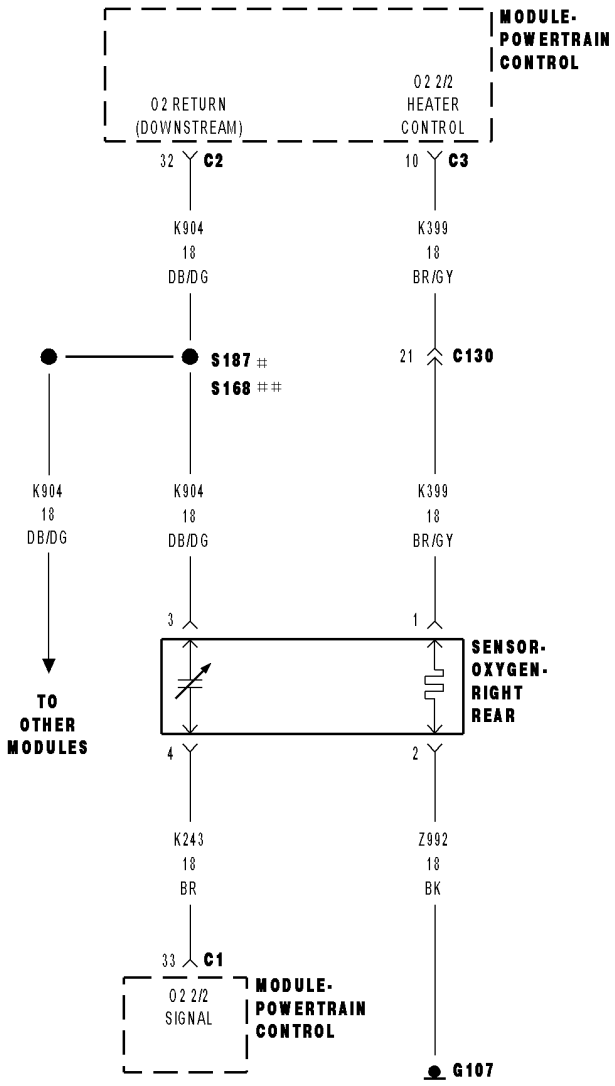
Yes >> Check the fuel system for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

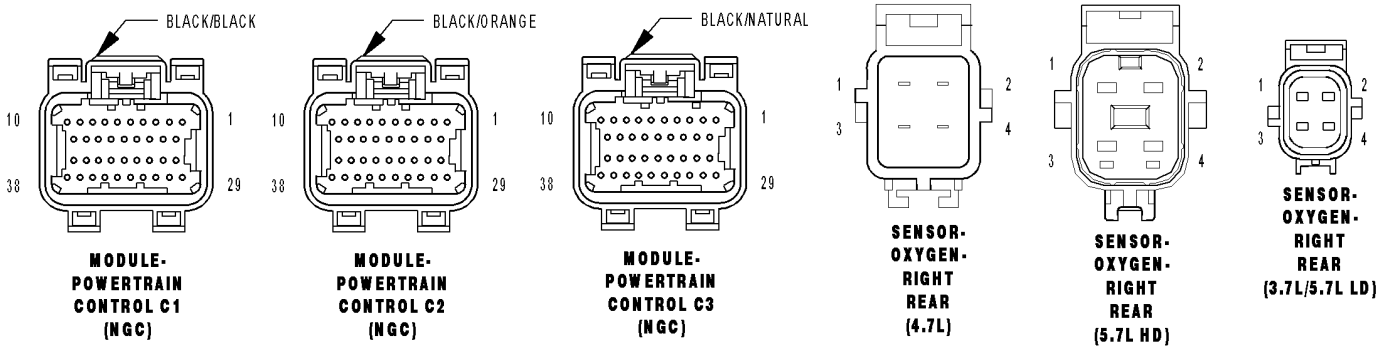
No >> Check the (K904) O2 Return Downstream circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN





81452bb4

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft and fuel level greater than 15%.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
2/2 O2 SENSOR
(K243) O2 2/2 SIGNAL CIRCUIT
(K399) O2 HEATER 2/2 CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

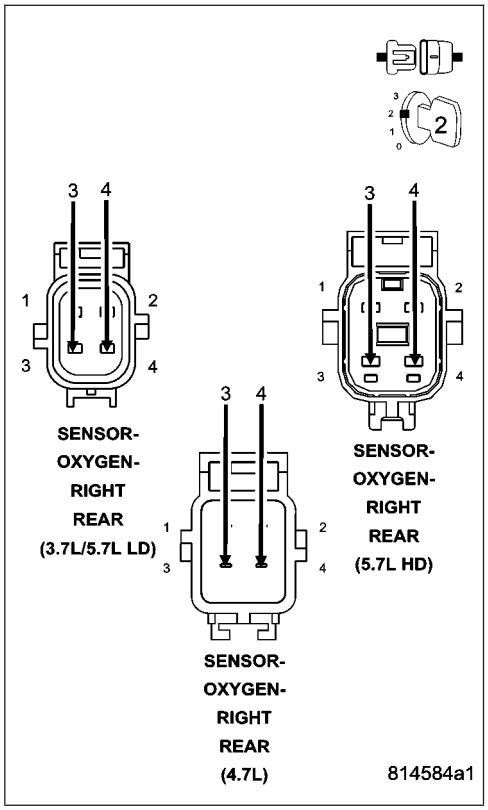
Using a jumper wire, jump the (K243) O2 Sensor 2/2 Signal circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

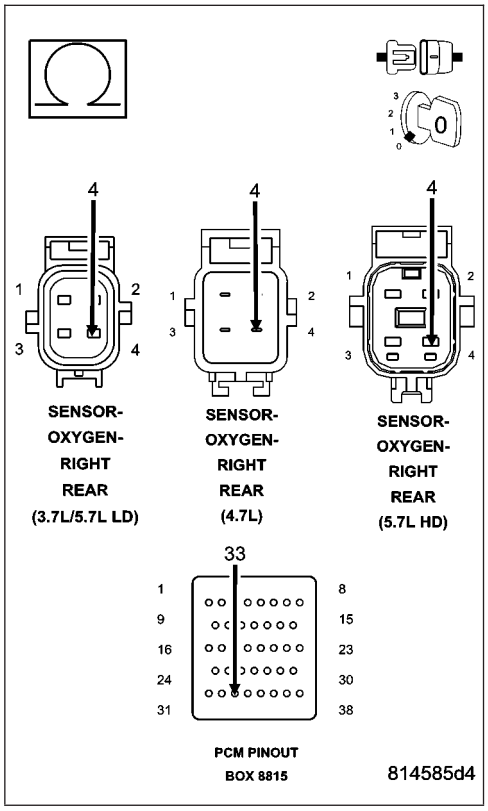
5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

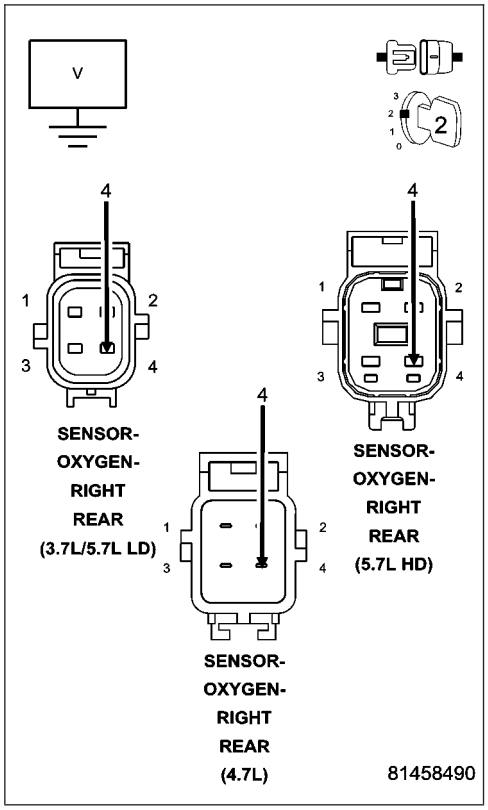
Remove the jump wire.
Ignition on, engine not running.
With the scan tool, monitor the O2 Sensor voltage.

Is the voltage above 4.8 volts?

Yes >> Go To 6

No >> Check the (K243) O2 Sensor 2/2 Signal circuit for a open or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C3 PCM harness connector.

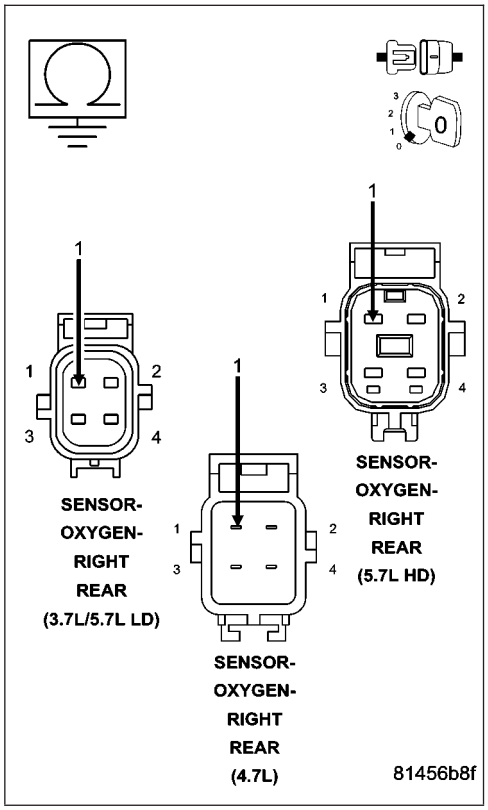
Measure the resistance between ground and the (K399) O2 Sensor 2/2 Heater Control circuit in the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K399) O2 Sensor 2/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2098-DOWNSTREAM FUEL TRIM SYSTEM 2 LEAN (CONTINUED)

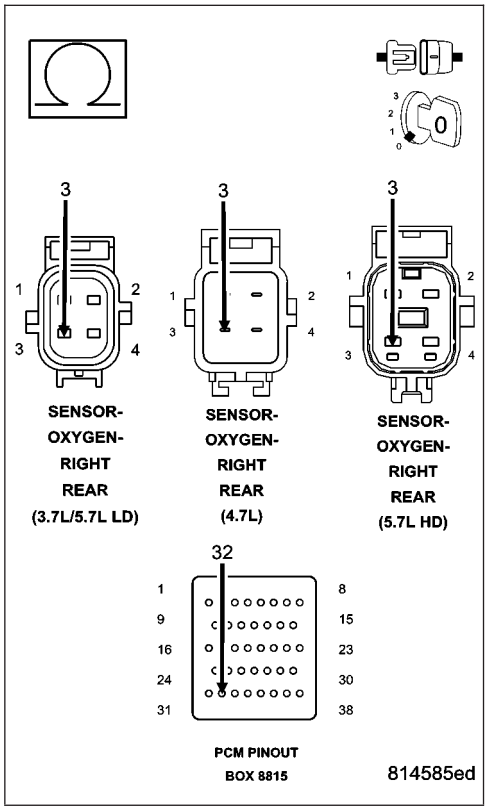
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

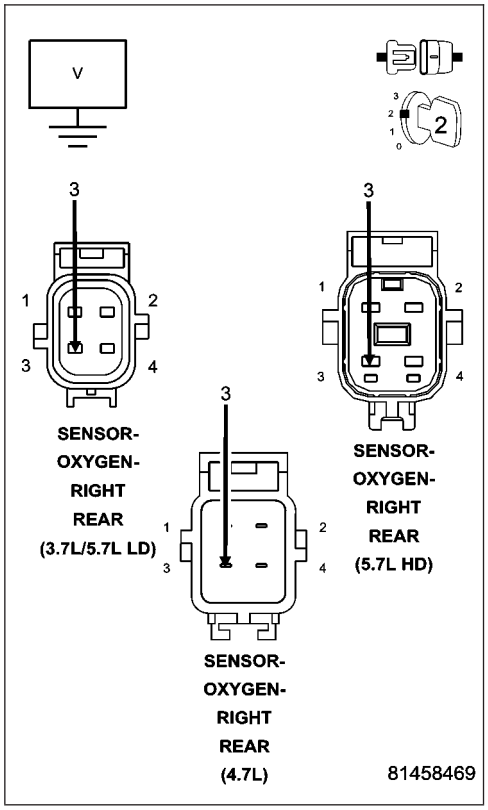
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

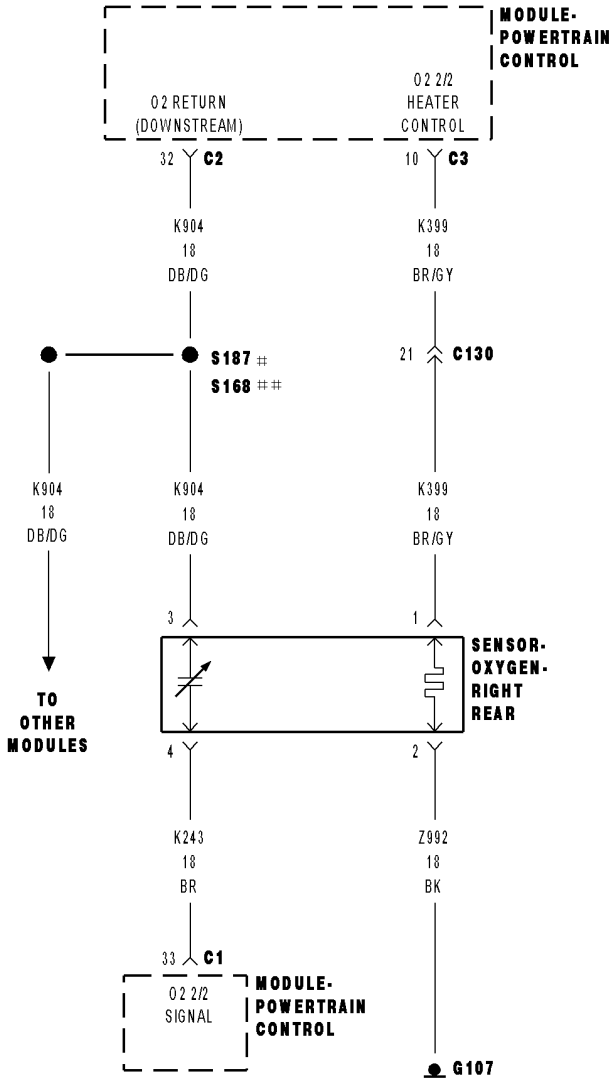
Yes >> Check the fuel system for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

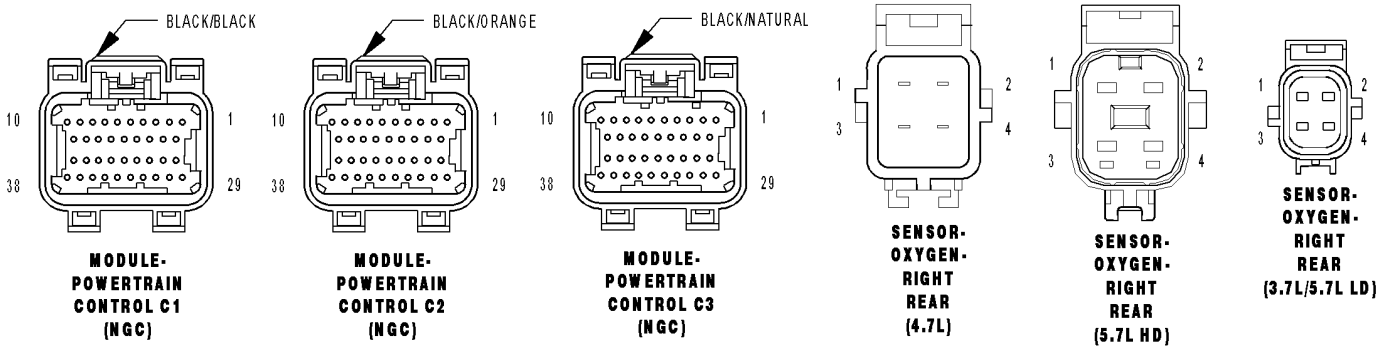
No >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH





81452bb4

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above (-7°C) 20°F, altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive as well as a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
2/2 O2 SENSOR
(K342) O2 SENSOR 2/2 SIGNAL CIRCUIT
(K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT
(K904) O2 RETURN DOWNSTREAM CIRCUIT
FUEL CONTAMINATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check the vehicle repair history. If the 2/2 O2 has been replaced make sure that the O2 sensor was properly installed and meets OEM specification.

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

2. EXHAUST LEAK

Turn the ignition off.

WARNING: To avoid personal injury from the exhaust system being hot, allow the exhaust to cool down to a safe temperature before performing a physical inspection. Failure to follow these instructions can result in personal injury or death.

Visually and Physically inspect the exhaust system for holes, cracks and blockage in the exhaust system.

Is the exhaust system is good condition?

Yes >> Go To 3

No >> Repair or Replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

4. O2 SENSOR

Ignition on, engine not running.

Disconnect the 2/2 O2 Sensor harness connector.

With the scan tool, monitor the 2/2 O2 Sensor voltage.

The O2 Sensor voltage should read 5.0 volts on the scan tool with the connector disconnected.

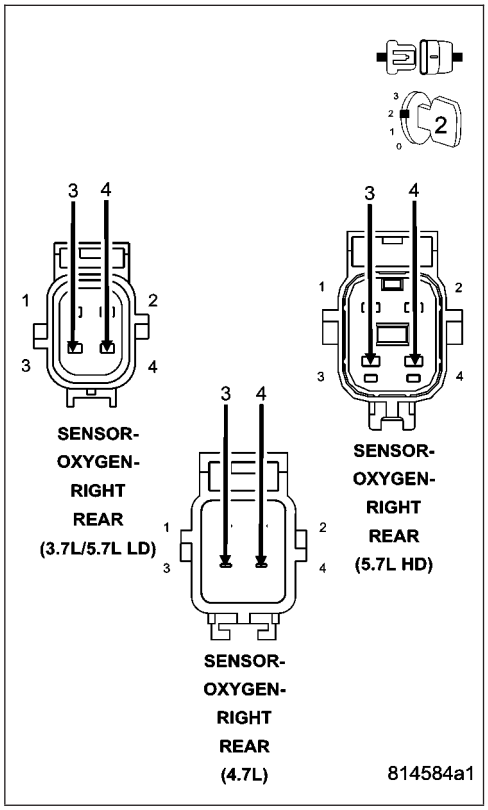
Using a jumper wire, jump the (K243) O2 Signal 2/2 circuit to the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

NOTE: The voltage should drop from 5.0 volts to 2.5 volts with the jumper wire in place.

Did the O2 Sensor volts change from 5.0 volts to 2.5 volts?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT

Remove the jump wire.

Ignition on, engine not running.

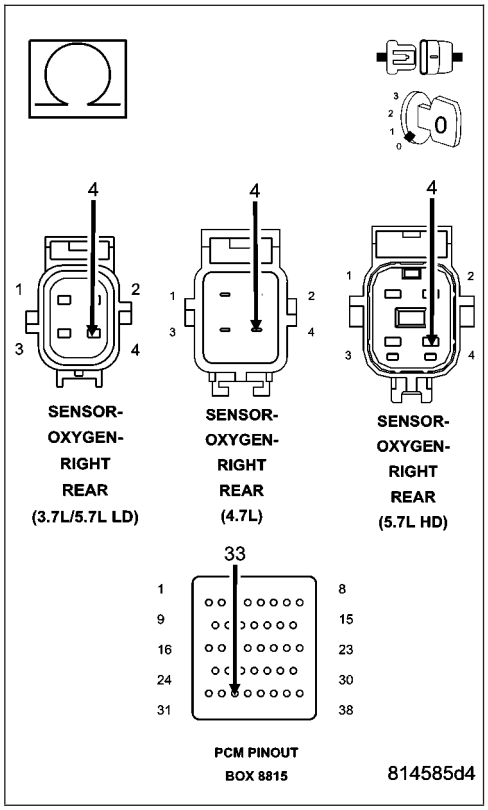
With the scan tool, monitor the 2/2 O2 Sensor voltage.

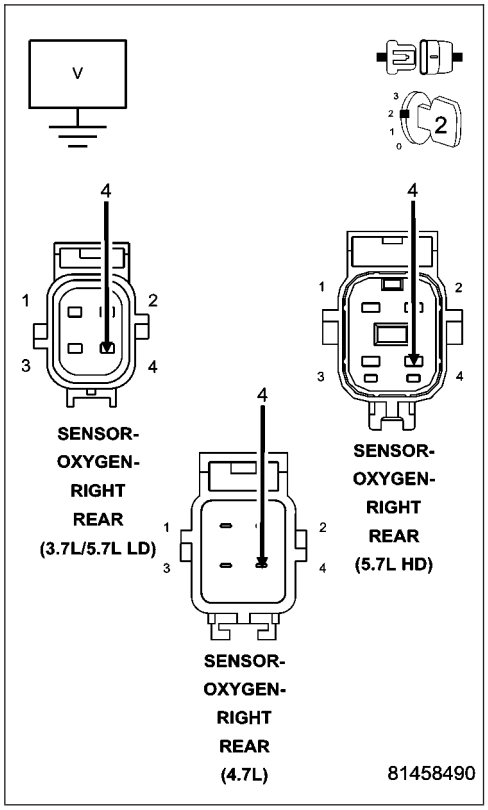
Is the voltage above 4.8 volts?

Yes >> Check the (K243) O2 Sensor 2/2 Signal circuit for an open or short to battery voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6





P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

6. (K399) O2 SENSOR 2/2 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

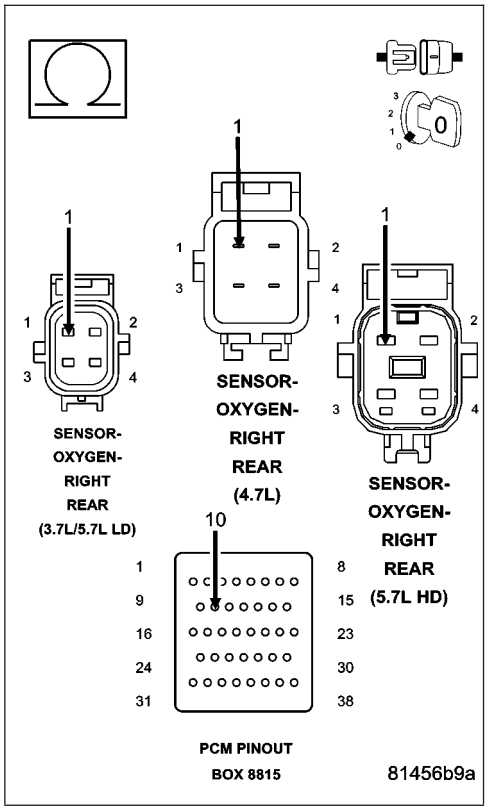
Measure the resistance of the (K399) O2 Sensor 2/2 Heater Control circuit from the O2 Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K399) O2 Sensor 2/2 Heater Control circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2099-DOWNSTREAM FUEL TRIM SYSTEM 2 RICH (CONTINUED)

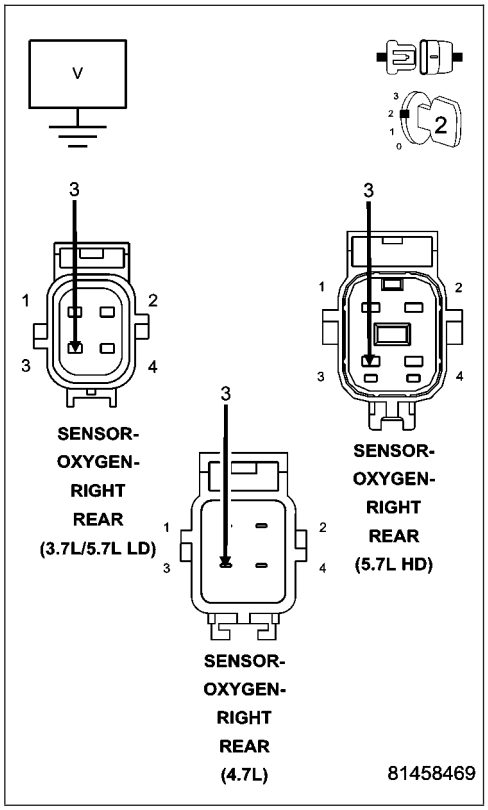
7. (K904) O2 RETURN DOWNSTREAM CIRCUIT

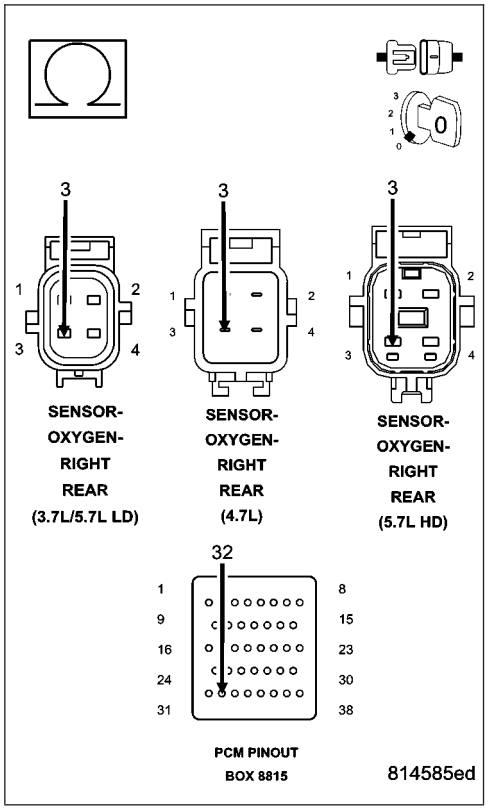
Measure the voltage on the (K904) O2 Return Downstream circuit in the O2 Sensor harness connector.

Is the voltage at 2.5 volts?

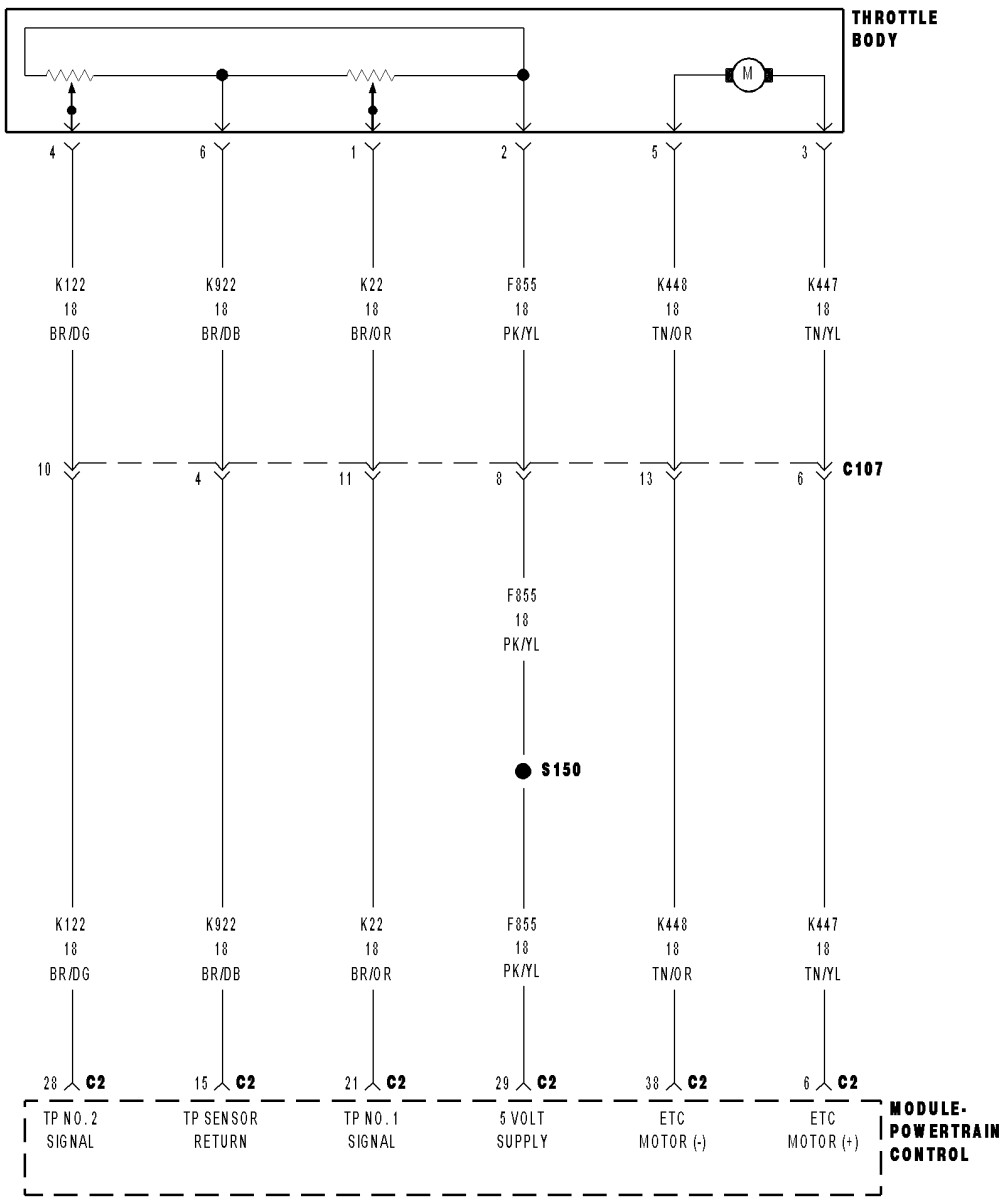
Yes >> Check the fuel system for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

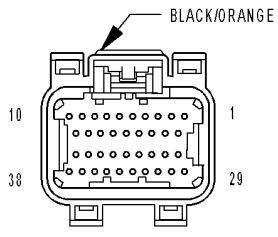
No >> Check the (K904) O2 Downstream Return circuit for a short to ground, open, or short to voltage. Inspect the O2 Sensor connector and the PCM harness connector. If OK, replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



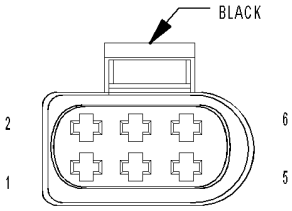


P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT





MODULE- POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)

81454caa

P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and the ETC Motor is not in Limp Home mode.
- **Set Condition:**
  When the PCM detects an internal error or a short between the ETC Motor- and ETC Motor + circuits in the ETC Motor Driver. One trip fault. ETC light is flashing.

Possible Causes
THROTTLE PLATE / BORE INSPECTION
(K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K447) ETC POSITIVE CIRCUIT SHORTED TO THE (K448) ETC NEGATIVE CIRCUIT
(K447) ETC POSITIVE CIRCUIT OPEN
(K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND
(K448) ETC NEGATIVE CIRCUIT OPEN
(K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND
LOW BATTERY VOLTAGE
ETC MOTOR/THROTTLE BODY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: If the P2100 is intermittent, it is possible that the controller is overheating in extreme hot temperatures, and this is considered a normal protection operation. No repair is necessary.

NOTE: Low battery voltage can also cause excessive current draw, in very hot and very cold ambient temperatures. Make sure the battery can pass a load test before continuing.

With a scan tool, read DTCs.

Look closely at the temperatures at which this DTC set.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

2. THROTTLE PLATE INSPECTION

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Were any signs of foreign material or scoring of the throttle plate or bore found?

Yes >> Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

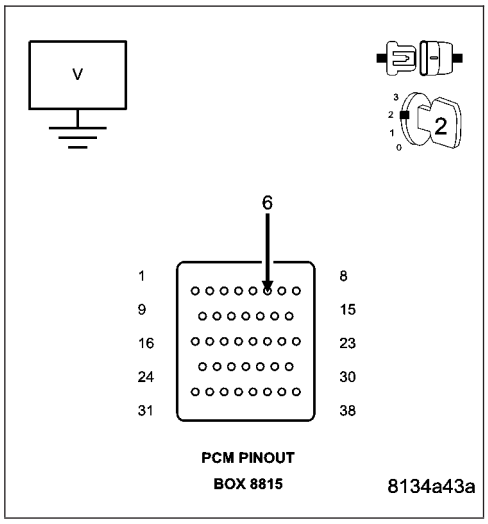
Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform the diagnostics.

With a 12-volt test light connected to ground, probe the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage on the (K447) ETC Positive circuit.

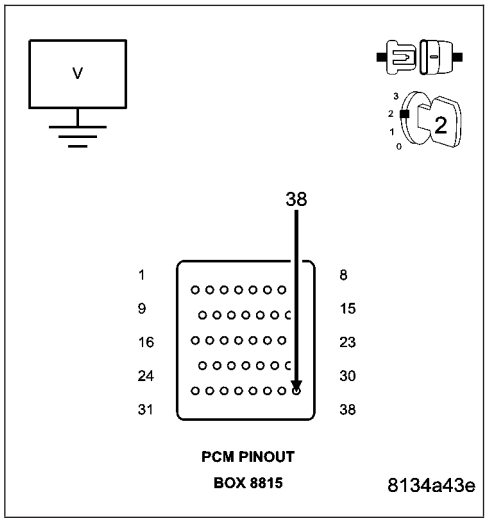
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Using a 12-volt test light connected to ground, probe the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K448) ETC Negative circuit.

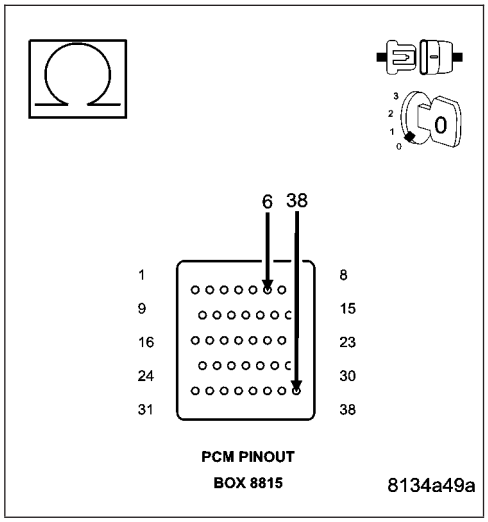
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

5. (K447) ETC POSITIVE CIRCUIT SHORTED TO THE (K448) ETC NEGATIVE CIRCUIT

Measure the resistance between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit at the appropriate terminals of special tool #8815.



Is the resistance below 100 ohms?

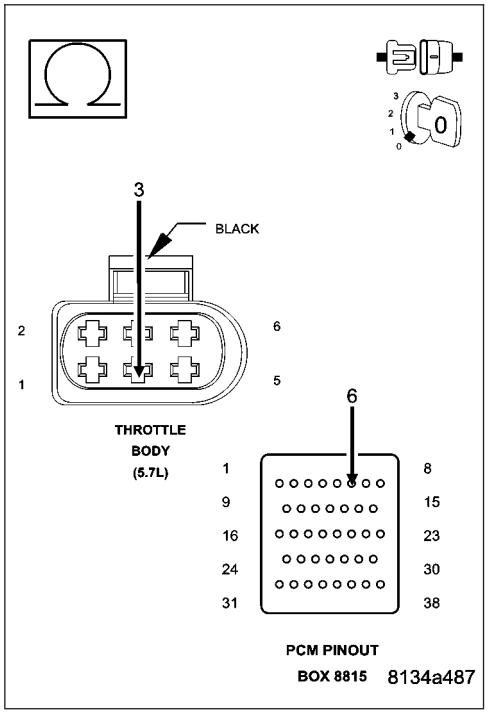
Yes >> Repair the short to between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K447) ETC POSITIVE CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (K447) ETC Positive circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

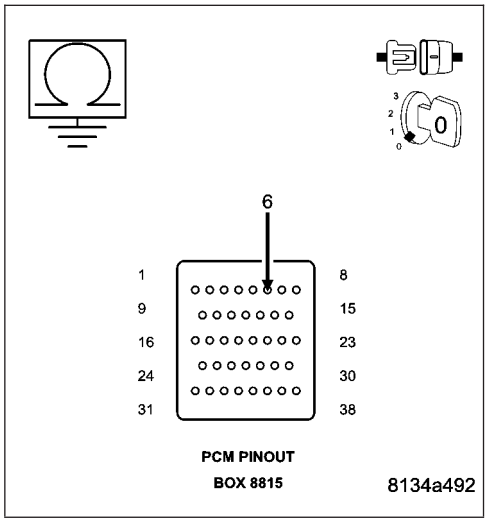
7. (K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K447) ETC Positive circuit between the appropriate terminals of special tool #8815.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



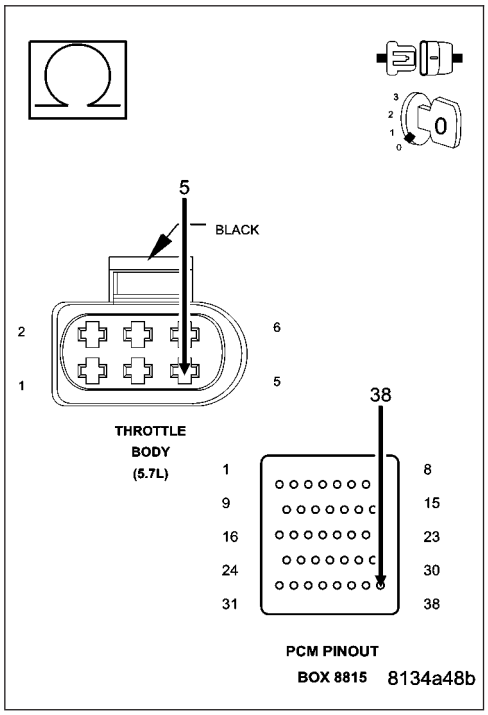
8. (K448) ETC NEGATIVE CIRCUIT OPEN

Measure the resistance of the (K448) ETC Negative circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

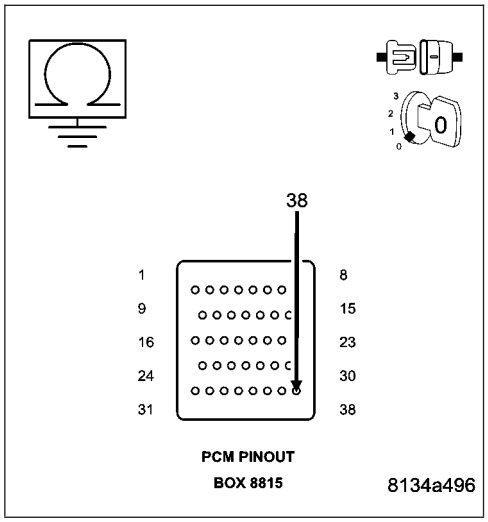
No >> Repair the open in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2100-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

9. (K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K448) ETC Negative circuit using the appropriate terminal of special tool #8815.



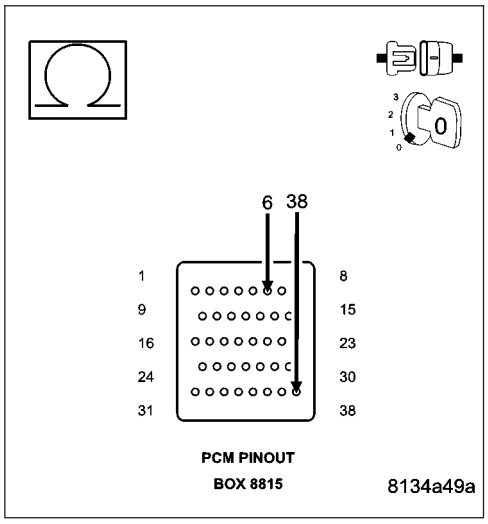
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.
Measure the resistance of the ETC Motor between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit at the appropriate terminals of special tool #8815.



Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes >> Go To 11

No >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2101-ELECTRONIC THROTTLE CONTROL MOTOR PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the vehicle running, ETC Motor not in Limp Home mode, and the TPS adaptation is complete.
- **Set Condition:**
  The PCM recognizes too large of an error between the actual position of the Throttle Plate and the Set Point position. One trip fault and the code will set within 5 seconds. Three good trips to turn off the MIL ETC light is flashing.

Possible Causes
THROTTLE BODY ASSEMBLY
LOW BATTERY VOLTAGE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Before continuing visually inspect the throttle blade and bore for any obstructions. Icing of the throttle body may have caused this code to set.

NOTE: Low battery voltage can also cause excessive current draw, in very hot and very cold ambient temperature. Make sure the battery can pass a Load test before continuing.

NOTE: Diagnose any 5-Volt Supply, Battery, and TP Sensor DTCs before continuing.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. THROTTLE PLATE INSPECTION

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Manually open and close the throttle plate using your hands.

Does the Throttle Plate move?

Yes >> Go To 3

No >> Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2101-ELECTRONIC THROTTLE CONTROL MOTOR PERFORMANCE (CONTINUED)

3. THROTTLE POSITION WITHIN 2° DEGREES OF DESIRED THROTTLE POSITION

Start the engine.

Allow the engine to reach normal operating temperature.

With a scan tool, monitor the Actual Throttle Position and Desired Throttle Position.

Compare the Actual Throttle Position and the Set Point Throttle Position.

Is the Actual Throttle Position within 2° degrees of the Desired Throttle Position?

Yes >> Go To 4

No >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. ETC OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Electronic Throttle Control Motor.

NOTE: It may be necessary to use a mirror to see the throttle blade.
Observe the throttle blade.

NOTE: Make sure the motion of the throttle blade is smooth and that it opens and closes.

Did the ETC motor operate properly?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2107-ELECTRONIC THROTTLE CONTROL MODULE PROCESSOR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Internal PCM failure. Module will attempt to reset, so you will be able to hear the throttle relearning. If the condition is continuous, the vehicle may not be driveable. One trip fault. ETC light is flashing.

Possible Causes
POWERTRAIN CONTROL MODULE NEEDS TO BE REPROGRAMMED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) .

Diagnostic Test

1. REPROGRAM THE POWERTRAIN CONTROL MODULE

Check for any related TSBs.

Verify the PCM is at the latest calibration (flash level).

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

Test drive the vehicle for 10 miles on a flat road surface.

Does this DTC reset?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P2108-ELECTRONIC THROTTLE CONTROL MODULE PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Internal PCM failure. Customer may experience an extended cranking condition with limited driving and a rough idle. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
POWERTRAIN CONTROL MODULE NEEDS TO BE REPROGRAMMED

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. REPROGRAM THE POWERTRAIN CONTROL MODULE

Check for any related TSBs.

Verify the PCM is at the latest calibration (flash level).

NOTE: Inspect the Intake Manifold components for vacuum leaks, repair as necessary

NOTE: An intermittent loss of power to the PCM without performing an ETC Relearn procedure may cause this DTC to set.

NOTE: Diagnose any other DTCs that may have set with the P2108.

Flash the Powertrain Control Module per Service Information if any updates are available.

Start the engine.

Allow the engine to reach normal operating temperature.

Operate the accelerator pedal. (do not exceed 3500 rpm)

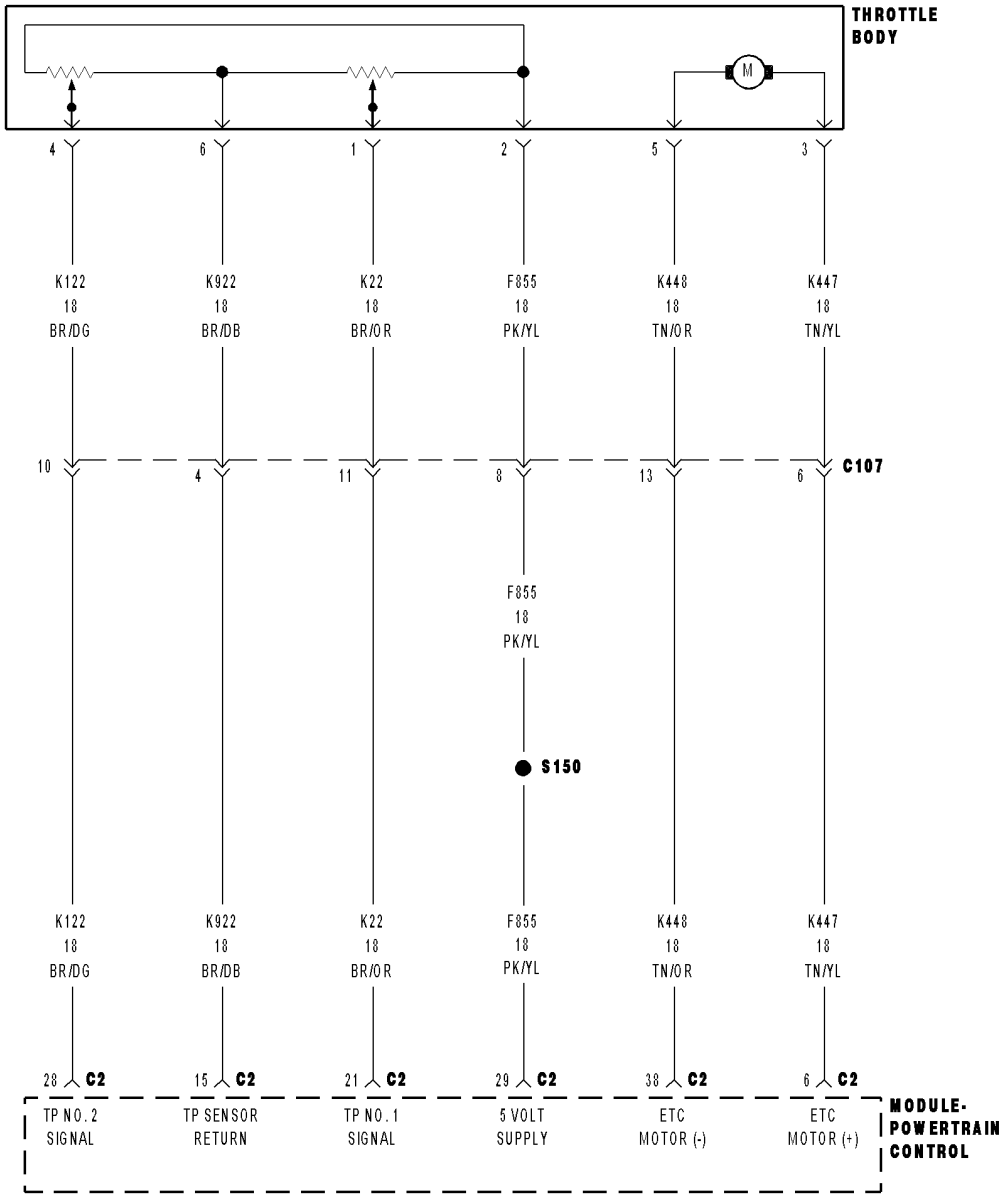
Test drive the vehicle for 10 miles on a flat road surface.

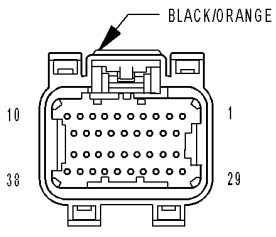
Does this DTC reset by itself?

Yes >> Replace and reprogram the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

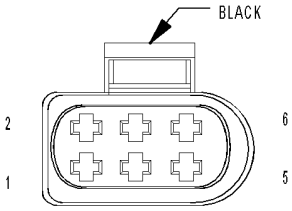
No >> Test Complete.

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM





MODULE- POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)

81454caa

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and ETC motor is working.
- **Set Condition:**
  When the PCM requests to limit engine speed if PWM is too high for 20.5 seconds and before P2118 sets. One trip fault and the code will set within 5 seconds. ETC light is illuminated.

Possible Causes
THROTTLE PLATE STUCK
(K447) ETC POSITIVE CIRCUIT OPEN
(K448) ETC NEGATIVE CIRCUIT OPEN
(K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND
(K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND
ETC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool read DTCs.

In the Freeze Frame data, look at the temperature at which the fault occurred. If it occurred in extreme cold temperatures, Icing of the throttle body may have caused this code to set.

NOTE: Diagnose any TP Sensor faults, 5-Volt Supply faults, and Battery Voltage High or Low DTCs before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. THROTTLE PLATE STUCK

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) causing the Throttle to stick.

Manually open and close the throttle plate using your hands.

Does the Throttle Plate move?

Yes >> Go To 3

No >> Remove the debris if possible or replace the Throttle Body Assembly if signs of physical damage are present. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM (CONTINUED)

3. (K447) ETC POSITIVE CIRCUIT OPEN

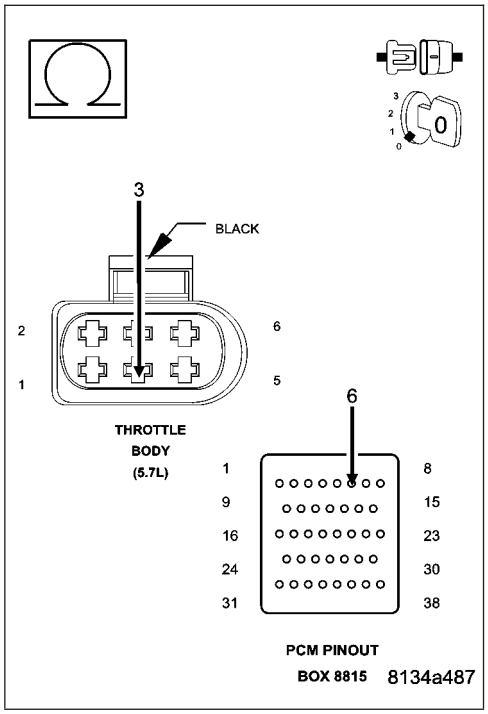
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K447) ETC Positive circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



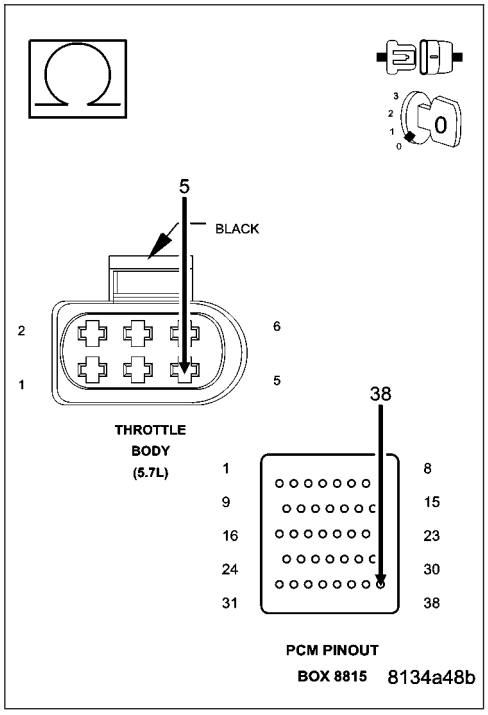
Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K448) ETC NEGATIVE CIRCUIT OPEN

Measure the resistance of the (K448) ETC Negative circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

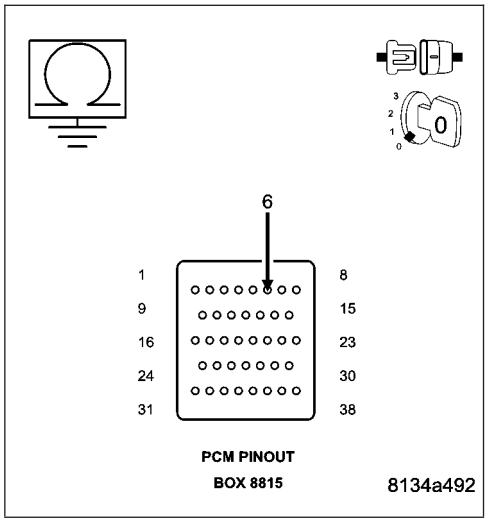
Yes >> Go To 5

No >> Repair the open in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM (CONTINUED)

5. (K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



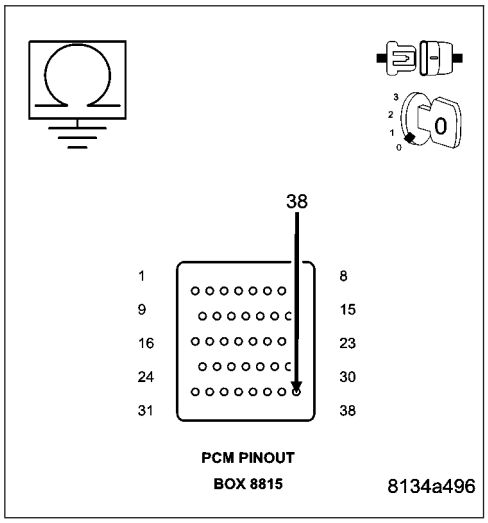
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

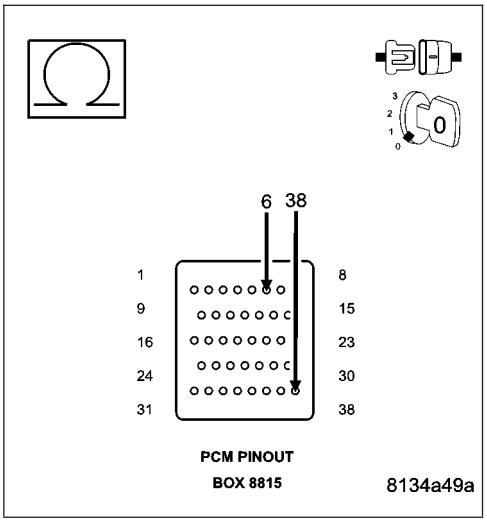
No >> Go To 7

P2110-ELECTRONIC THROTTLE CONTROL - FORCED LIMITED RPM (CONTINUED)

7. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.

Measure the resistance of the ETC Motor between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit at the appropriate terminals of special tool #8815.



Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes >> Go To 8

No >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

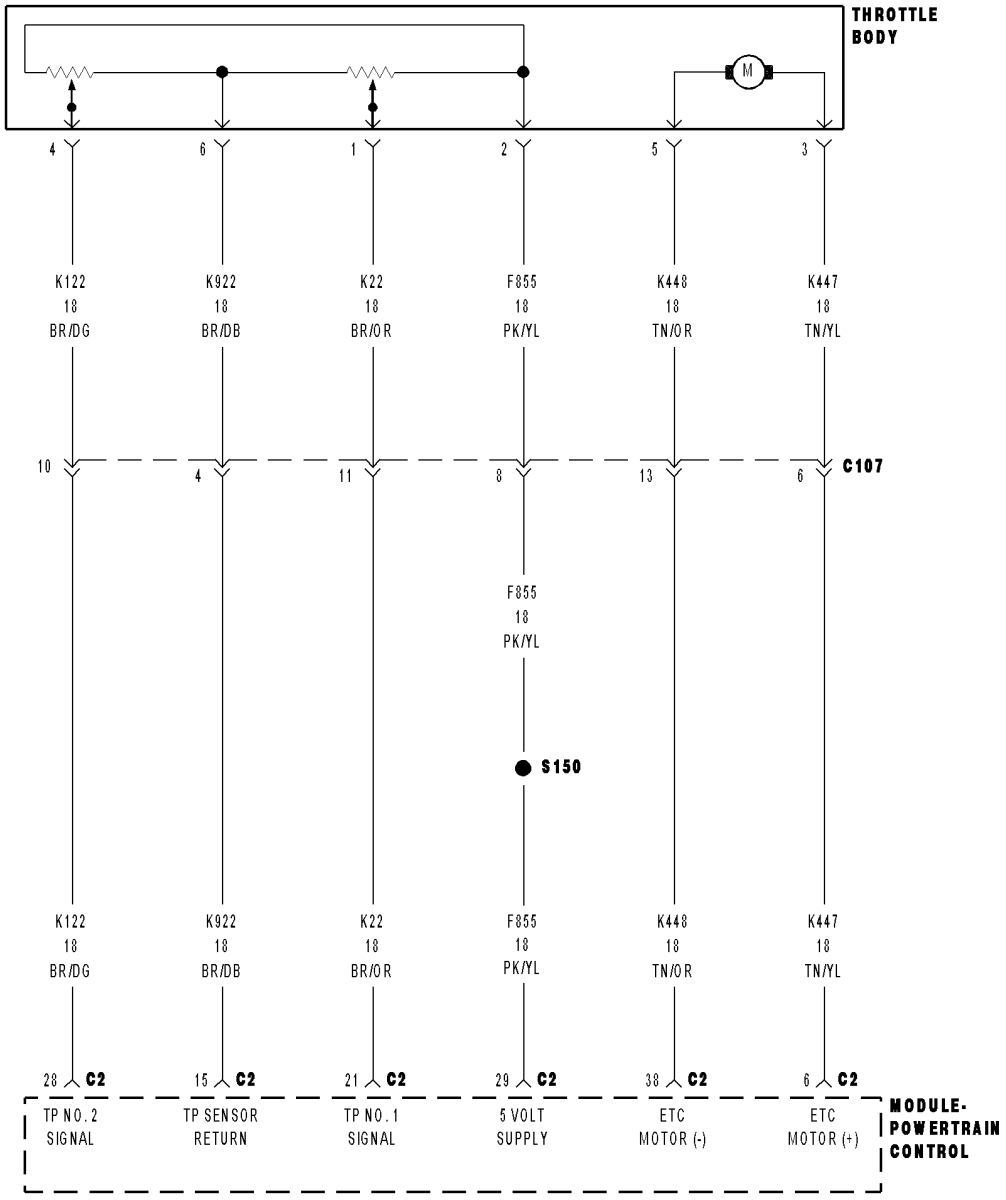
Yes >> Repair as necessary.

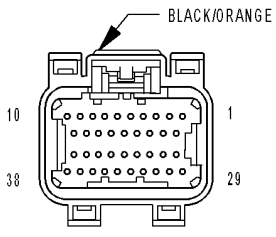
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.

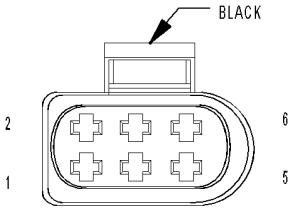
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE





MODULE- POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)

81454caa

P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Just after key on, the throttle is opened and closed to test the system. If the TP Sensor does not return to Limp Home Position at the end of this test, this DTC will set. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
THROTTLE PLATE STUCK ABOVE LIMP HOME POSITION
TP SENSOR NO.1 AND TP SENSOR NO.2 BOTH READ 2.5 VOLTS
(K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K447) ETC POSITIVE CIRCUIT OPEN
(K448) ETC NEGATIVE CIRCUIT OPEN
(K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND
(K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Maximum engine speed could be reduced while this fault is active, it just depends where the throttle gets stuck.

Ignition on, engine not running.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

With a scan tool read DTCs.

NOTE: Diagnose any TP Sensor or 5-Volt Supply DTCs before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE (CONTINUED)

2. THROTTLE PLATE STUCK OPEN

Turn the ignition off.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material causing the Throttle to remain open.

Using a scan tool actuate the ETC Motor.

Does the Throttle Plate move?

Yes >> Go To 3

No >> Remove the debris if possible or replace the Throttle Body Assembly if signs of physical damage are present. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and perform the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. TP SENSOR NO.1 AND TP SENSOR NO.2 BOTH EQUAL 2.5 VOLTS

With a scan tool, perform the Throttle Follower test while reading both TP Sensor voltage readings.

Are both TP Sensor readings stuck at 2.5 volts?

Yes >> Check the TP Sensor Signal circuits for excessive resistance, being shorted to each other, or shorted to the Sensor Return circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

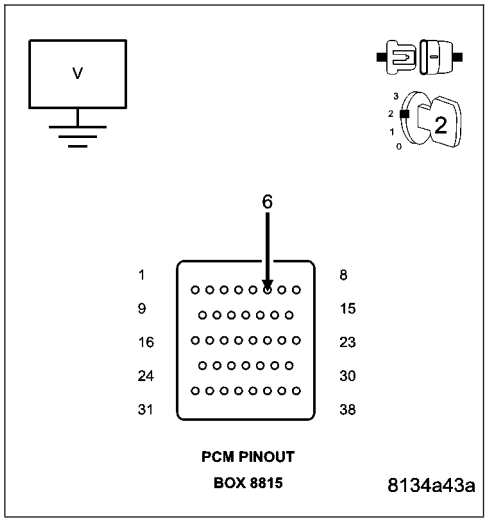
Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform the diagnostics.

Ignition on, engine not running.

With a 12-volt test light connected to ground, probe the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage on the (K447) ETC Positive circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE (CONTINUED)

5. (K447) ETC POSITIVE CIRCUIT OPEN

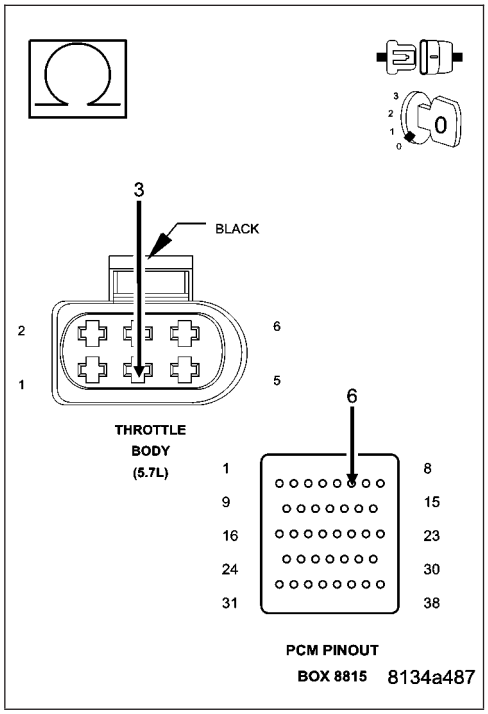
Turn the ignition off.

Measure the resistance of the (K447) ETC Positive circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K447) ETC Positive circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



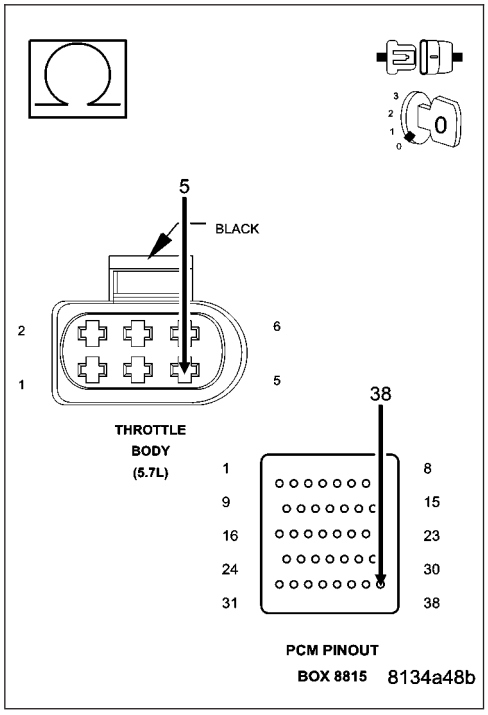
6. (K448) ETC NEGATIVE CIRCUIT OPEN

Measure the resistance of the (K448) ETC Negative circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

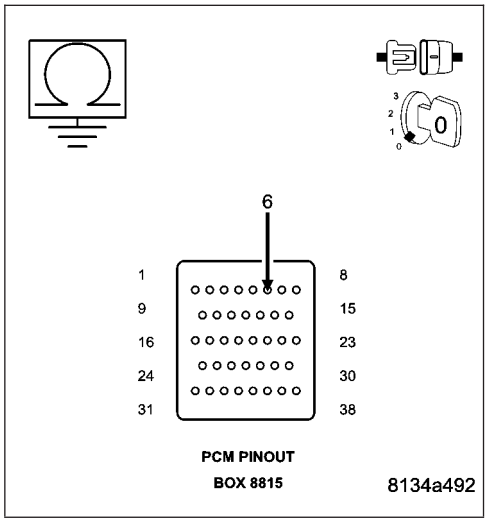
No >> Repair the open in the (K448) ETC Negative circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2111-ELECTRONIC THROTTLE CONTROL - UNABLE TO CLOSE (CONTINUED)

7. (K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



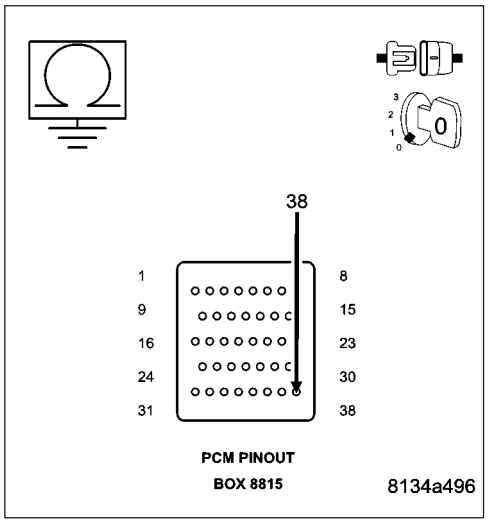
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

9. PCM

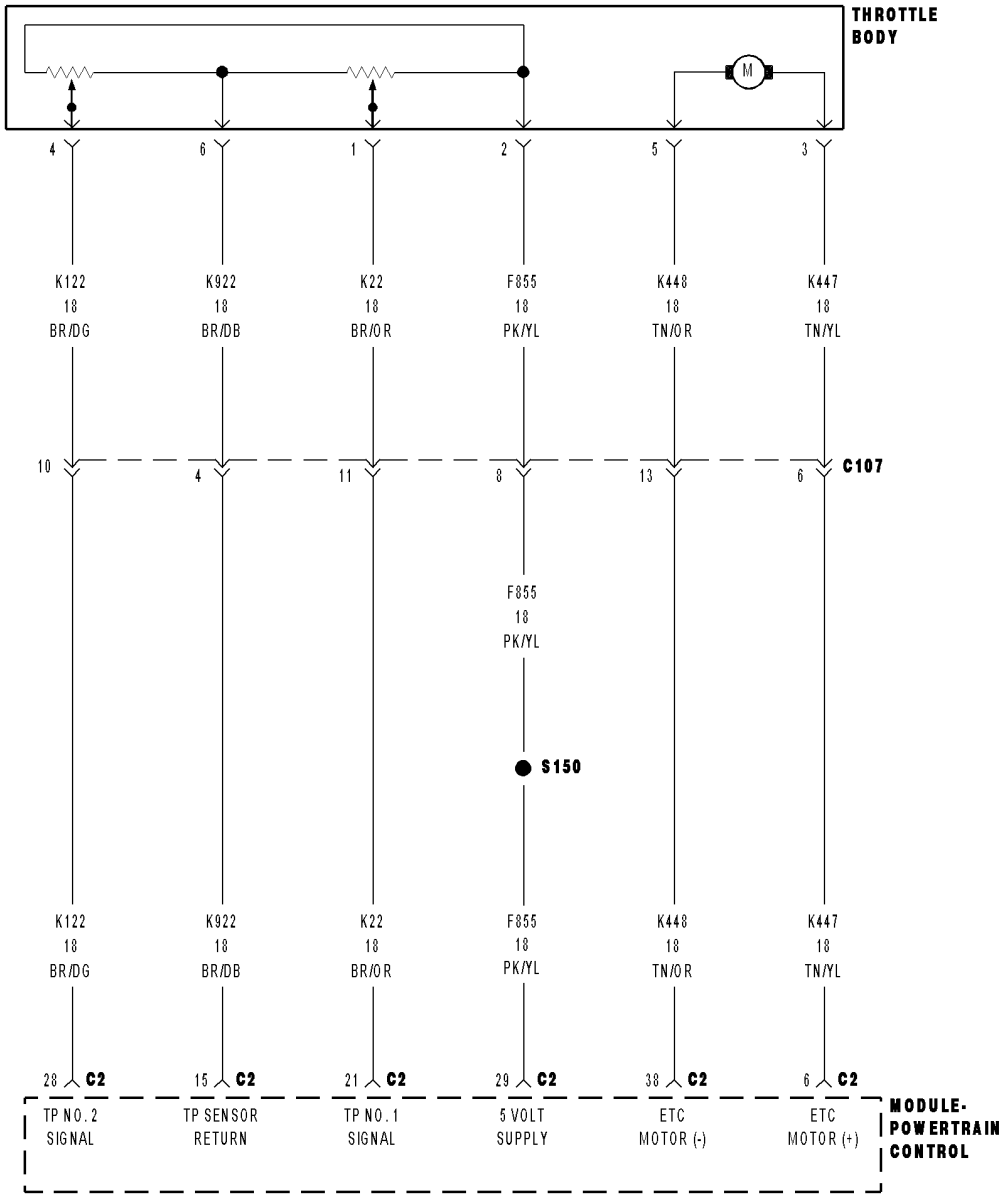
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

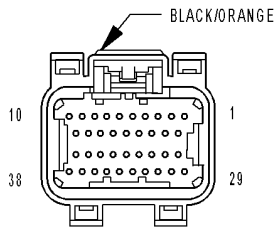
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

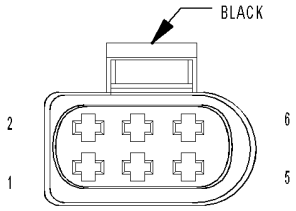
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN





MODULE-POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)

81454caa

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  Just after key on, the throttle is opened and closed to test the system. If the TP Sensor does not return to Limp Home Position at the end of this test, this DTC will set. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
THROTTLE PLATE STUCK AT OR BELOW LIMP HOME POSITION
(K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K447) ETC POSITIVE CIRCUIT OPEN
(K448) ETC NEGATIVE CIRCUIT OPEN
(K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND
(K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not return to the closed position this DTC sets.

With a scan tool read DTCs.

NOTE: Diagnose any TP Sensor, Battery Voltage, and 5-Volt Supply DTCs before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN (CONTINUED)

2. THROTTLE PLATE STUCK OPEN

Turn the ignition off.

NOTE: The PCM tests the ETC Motor by opening and closing the Throttle Plate before starting the engine. If during this test the Throttle plate does not open this DTC sets.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material causing the Throttle to remain open.

Using a scan tool actuate the ETC Motor.

Does the Throttle Plate move?

Yes >> Go To 3

No >> Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. (K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

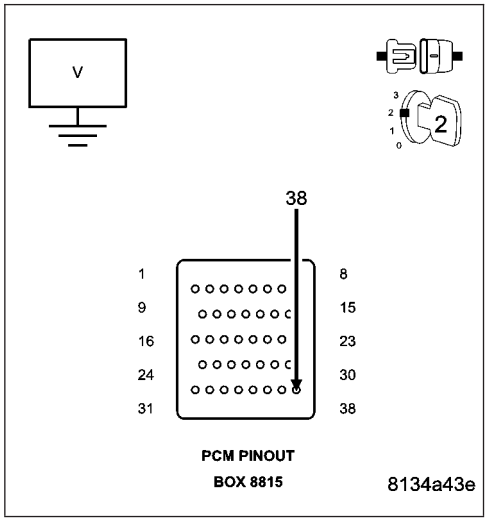
Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

With a 12-volt test light connected to ground, probe the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage on the (K448) ETC Negative circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN (CONTINUED)

4. (K447) ETC POSITIVE CIRCUIT OPEN

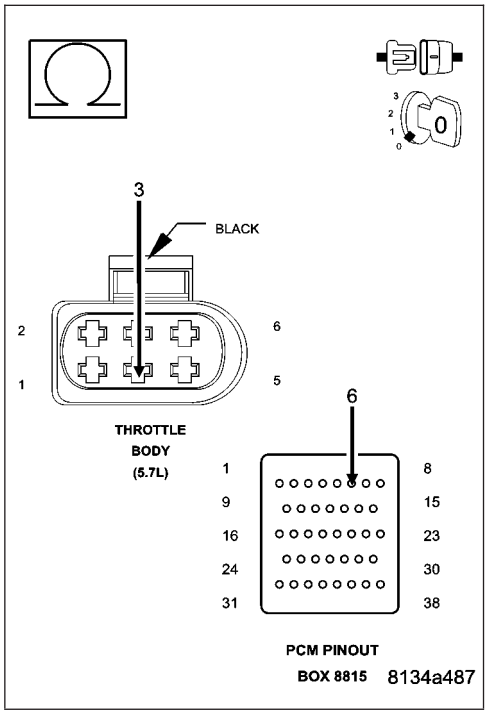
Turn the ignition off.

Measure the resistance of the (K447) ETC Positive circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K447) ETC Positive circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



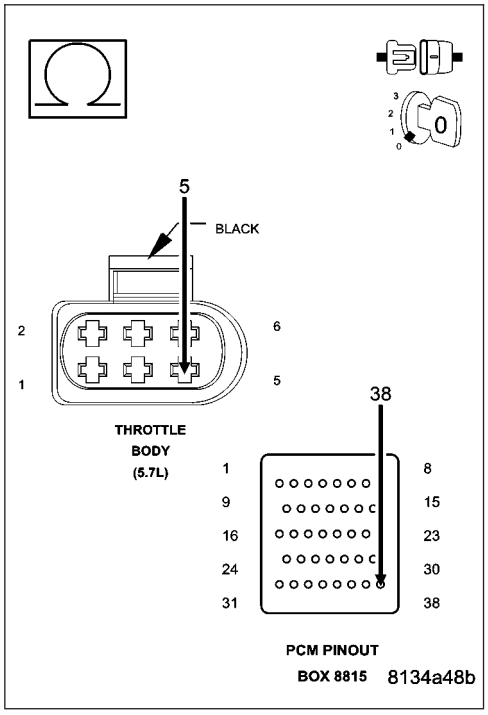
5. (K448) ETC NEGATIVE CIRCUIT OPEN

Measure the resistance of the (K448) ETC Negative circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

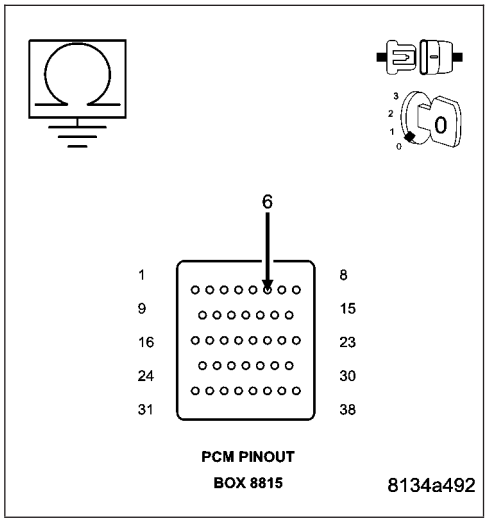
No >> Repair the open in the (K448) ETC Negative circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2112-ELECTRONIC THROTTLE CONTROL - UNABLE TO OPEN (CONTINUED)

6. (K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



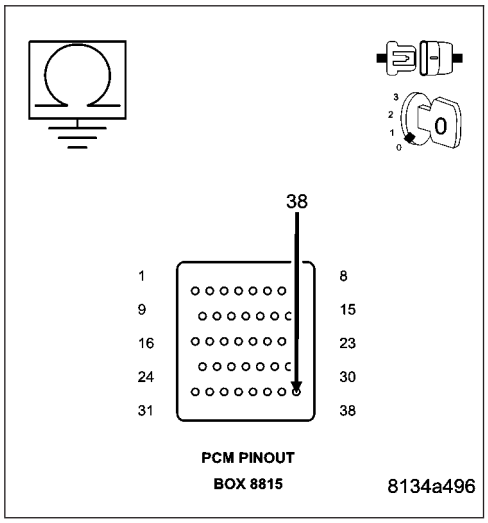
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between a known good ground and the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2115-ACCELERATOR PEDAL POSITION SENSOR 1 MINIMUM STOP PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors. The test for P2115 is only enabled once test for P2166 has passed.
- **Set Condition:**
  APPS No.1 has failed to achieve the required minimum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool read DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read DTCs.

NOTE: Diagnose any APPS out of Range and 5-Volt Supply DTCs before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

Start the engine.

Does the DTC return?

Yes >> Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P2116-ACCELERATOR PEDAL POSITION SENSOR 2 MINIMUM STOP PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors. The test for P2116 is only enabled once test for P2167 has passed.
- **Set Condition:**
  APPS No.2 has failed to achieve the required minimum value during In Plant testing. One trip fault and the code will be stored within 5 seconds. Engine will only idle.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool read DTCs and record the related Freeze Frame data.

With a scan tool, erase DTCs.

Start the engine.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

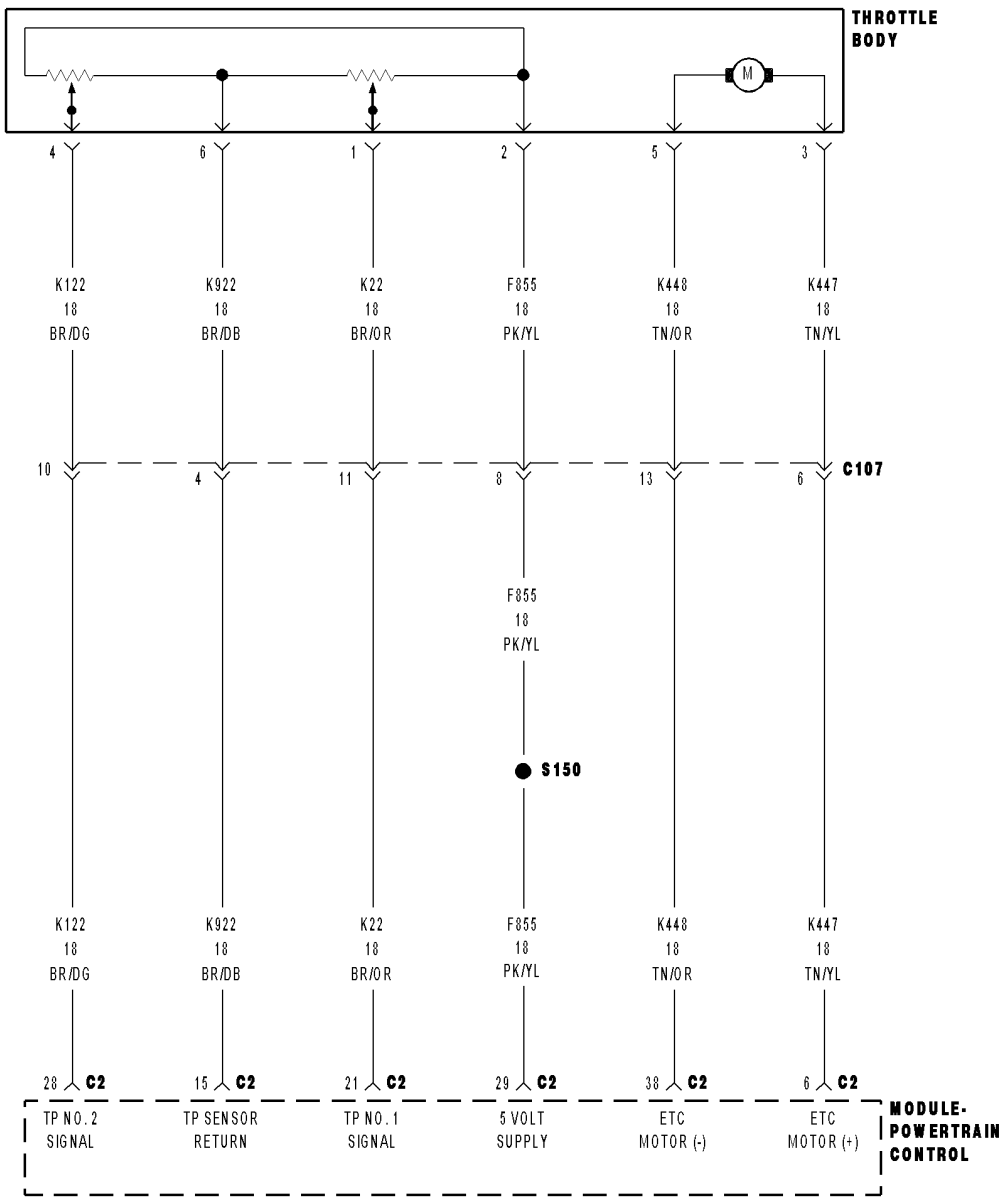
Start the engine.

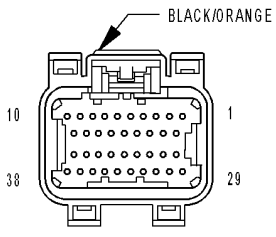
Does the DTC return?

Yes >> Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

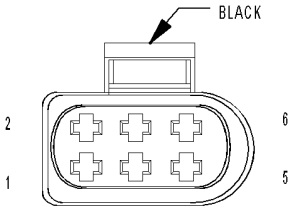
No >> Test Complete.

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT





MODULE-POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)

81454caa

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and the ETC Motor is not in Limp Home mode.
- **Set Condition:**
  When the PCM detects an internal error or a short between the ETC Motor- and ETC Motor + circuits in the ETC Motor Driver. One trip fault. ETC light is flashing.

Possible Causes
THROTTLE PLATE / BORE INSPECTION
(K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE
(K447) ETC POSITIVE CIRCUIT SHORTED TO THE (K448) ETC NEGATIVE CIRCUIT
(K447) ETC POSITIVE CIRCUIT OPEN
(K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND
(K448) ETC NEGATIVE CIRCUIT OPEN
(K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND
ETC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: If the P2118 is intermittent, it is possible that the controller is overheating in extreme hot temperatures, and this is considered a normal protection operation. No repair is necessary.

With a scan tool, read DTCs.

Look closely at the temperatures at which this DTC set.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

2. THROTTLE PLATE INSPECTION

Turn the ignition off.

Remove the Air Cleaner Assembly from the Throttle Body.

Check for any signs of a foreign material (ice or dirt) on the Throttle Plate or in the bore causing the Throttle Plate to stick.

Were any signs of foreign material or scoring of the throttle plate or bore found?

Yes >> Remove the debris if possible or replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K447) ETC POSITIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

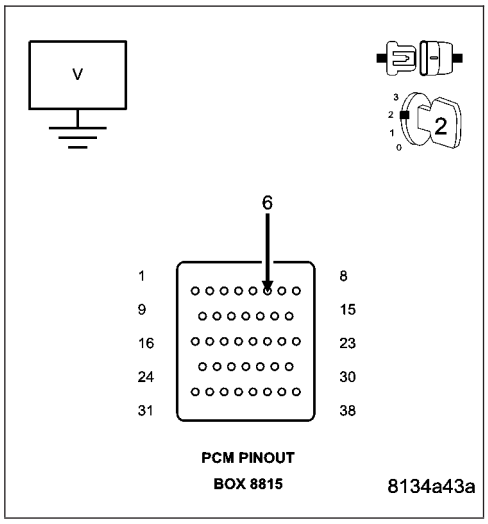
Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground, probe the (K447) ETC Positive circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage on the (K447) ETC Positive circuit.

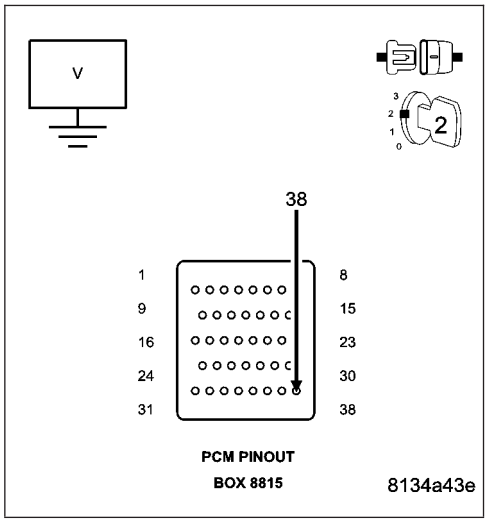
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (K448) ETC NEGATIVE CIRCUIT SHORTED TO BATTERY VOLTAGE

Using a 12-volt test light connected to ground, probe the (K448) ETC Negative circuit at the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Repair the short to battery voltage in the (K448) ETC Negative circuit.

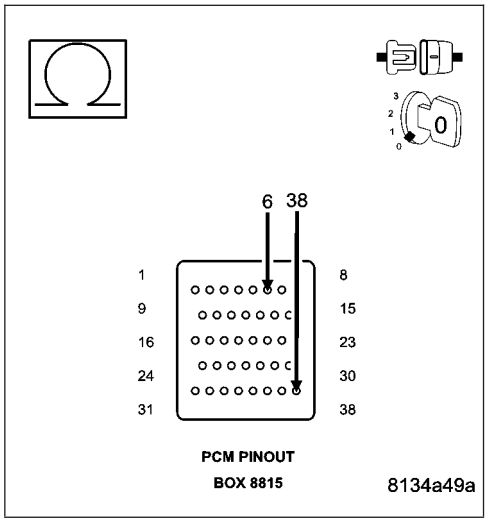
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

5. (K447) ETC POSITIVE CIRCUIT SHORTED TO THE (K448) ETC NEGATIVE CIRCUIT

Measure the resistance between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit at the appropriate terminals of special tool #8815.



Is the resistance below 100 ohms?

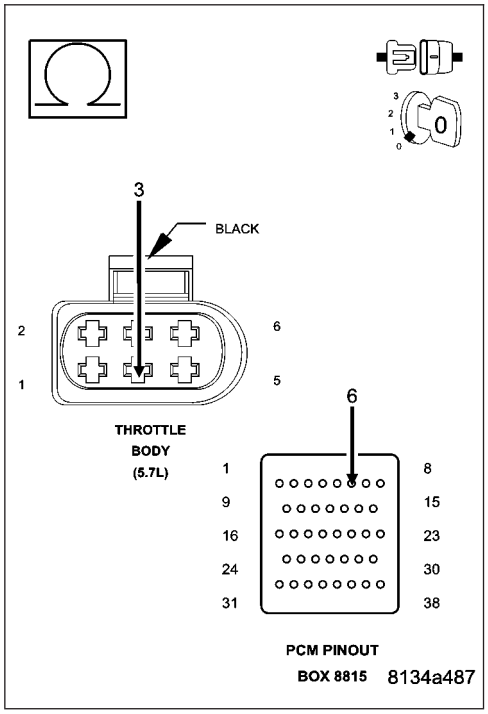
Yes >> Repair the short to between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K447) ETC POSITIVE CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (K447) ETC Positive circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

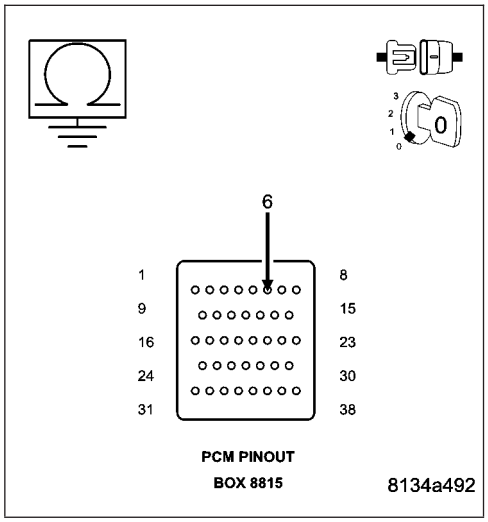
7. (K447) ETC POSITIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K447) ETC Positive circuit between the appropriate terminals of special tool #8815.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K447) ETC Positive circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



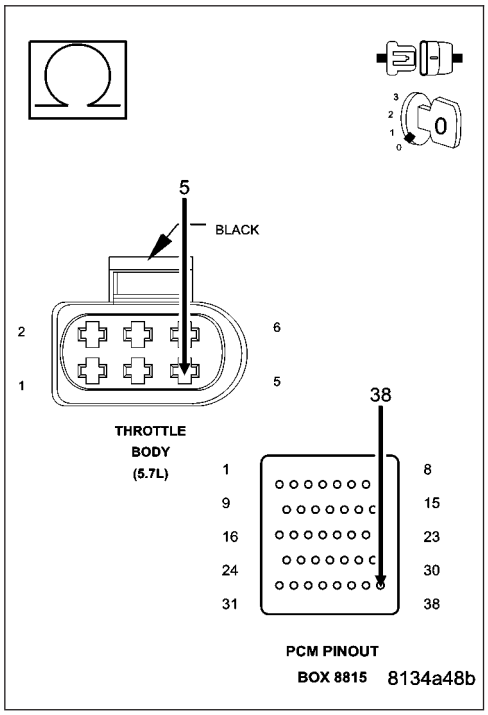
8. (K448) ETC NEGATIVE CIRCUIT OPEN

Measure the resistance of the (K448) ETC Negative circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

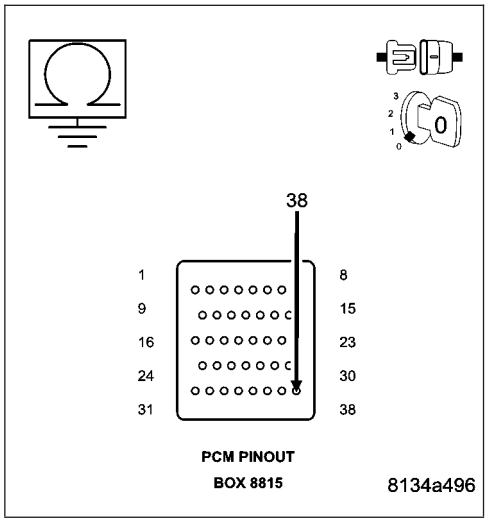
No >> Repair the open in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2118-ELECTRONIC THROTTLE CONTROL MOTOR CIRCUIT (CONTINUED)

9. (K448) ETC NEGATIVE CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K448) ETC Negative circuit between the appropriate terminals of special tool #8815.



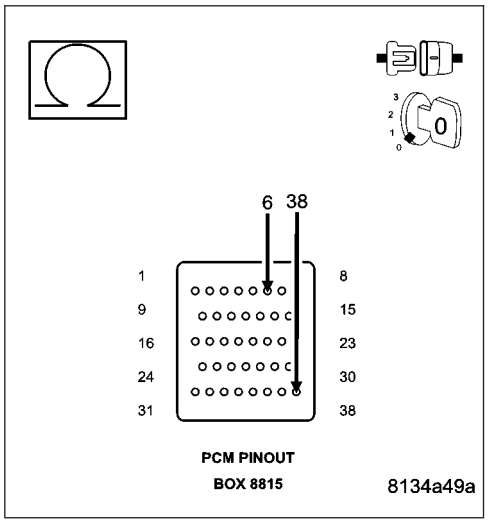
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K448) ETC Negative circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. ETC MOTOR

NOTE: Take the following measurement using special tool #8815 to avoid possible damage to the Throttle Body harness connector.
Measure the resistance of the ETC Motor between the (K447) ETC Positive circuit and the (K448) ETC Negative circuit at the appropriate terminals of special tool #8815.



Is the resistance between 2.5 and 25 ohms at closed throttle?

Yes >> Go To 11

No >> Replace the Throttle Body Assembly. Disconnect the Battery when replacing the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. PCM

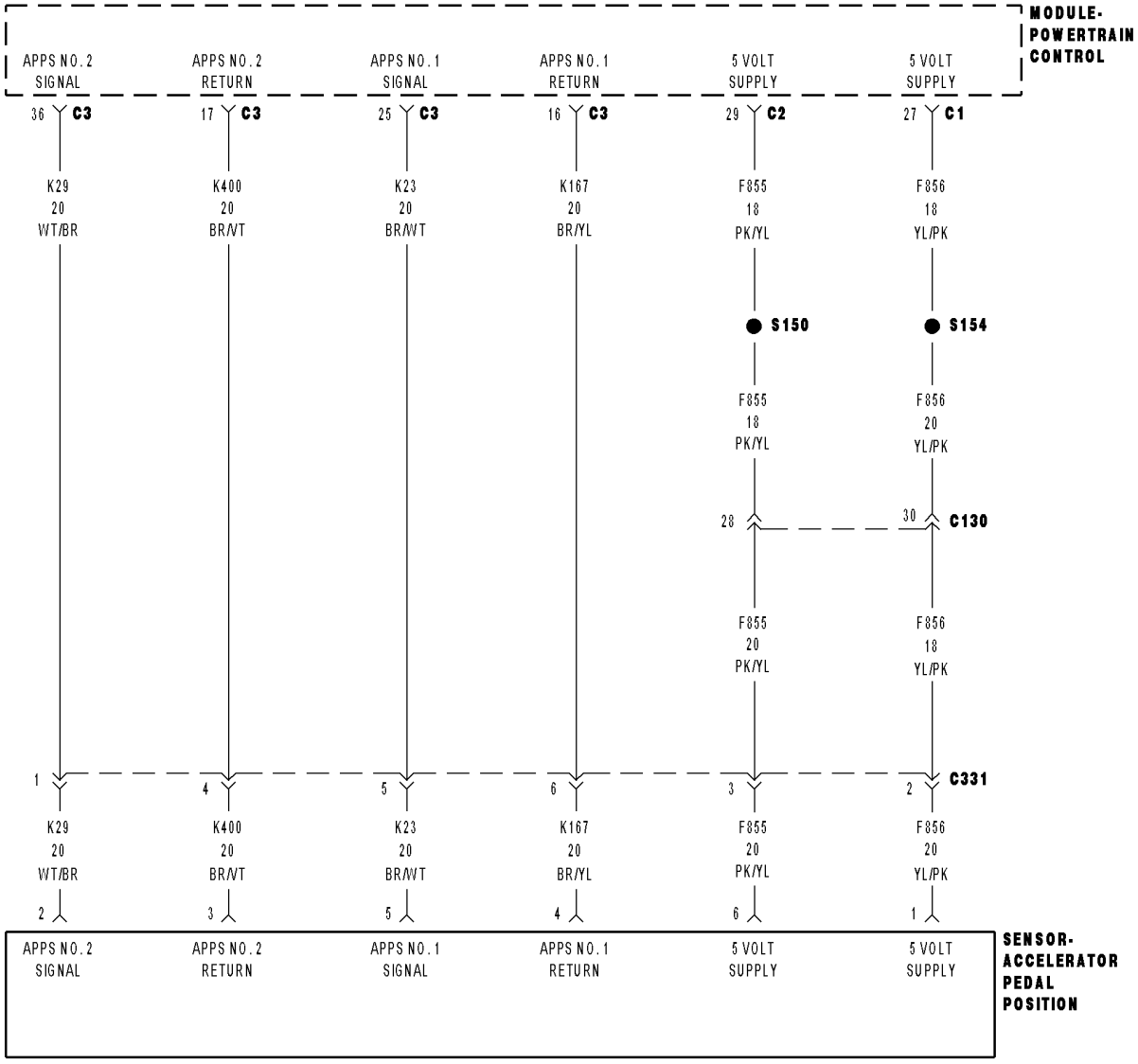
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

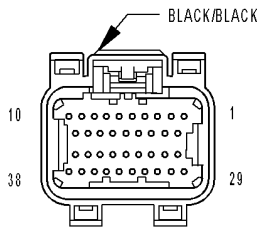
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

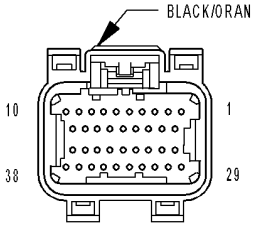
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW

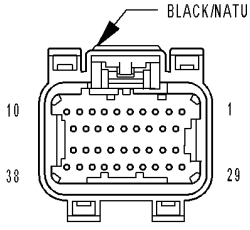




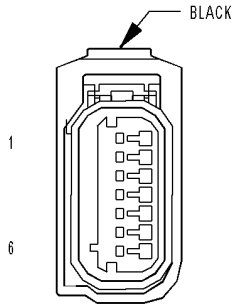
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SENSOR-ACCELERATOR PEDAL POSITION

81454f11d

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no other APPS No.1 DTCs present.
- **Set Condition:**
  When the APP Sensor No.1 voltage is too low. Engine will additionally idle if the brake pedal is pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K23) APP SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K167) APP SENSOR NO.1 RETURN CIRCUIT
(K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K400) APP SENSOR NO.2 RETURN CIRCUIT
APP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. APP SENSOR BELOW 0.25 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the APP Sensor No.1 voltage.

Is the voltage below 0.25 of a volt?

Yes >> Go To 2

No >> Go To 11

---

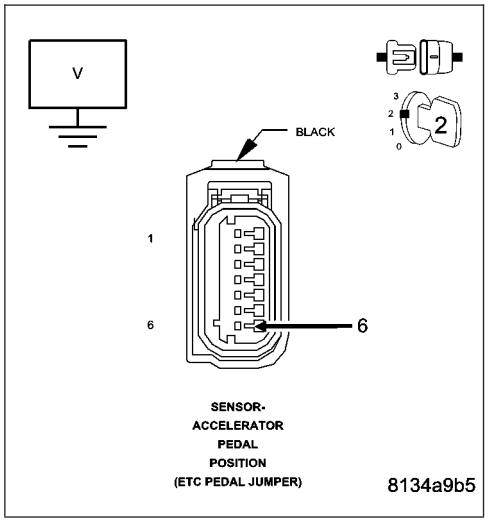
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the APP Sensor harness connector.



Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 8

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

3. ACCELERATOR PEDAL POSITION SENSOR

Connect a jumper wire between the (F855) 5-volt Supply circuit and the (K23) APP Sensor No.1 Signal circuit in the Sensor harness connector.

With a scan tool, monitor the APP Sensor No.1 voltage.

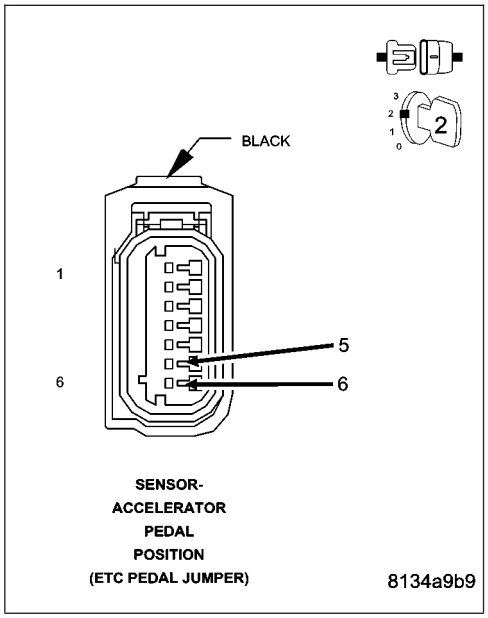
Is the voltage above 4.5 volts?

Yes >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.



4. (K23) APP SENSOR NO.1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

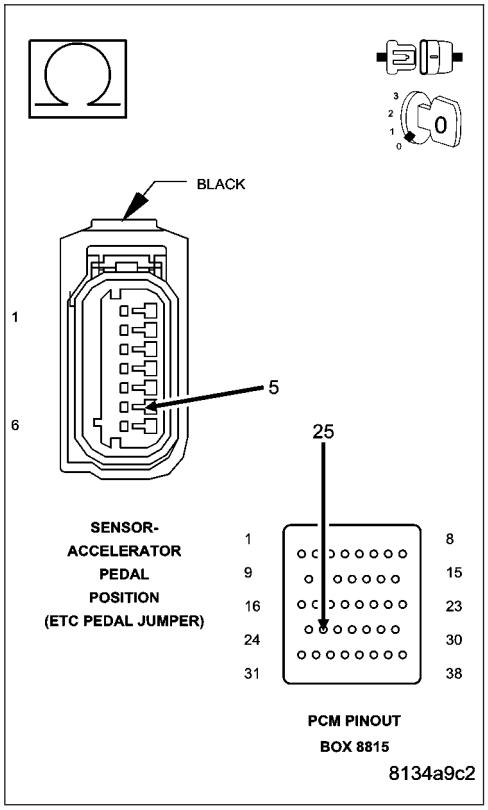
Measure the resistance of the (K23) APP Sensor No.1 Signal circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K23) APP Sensor No.1 Signal circuit.

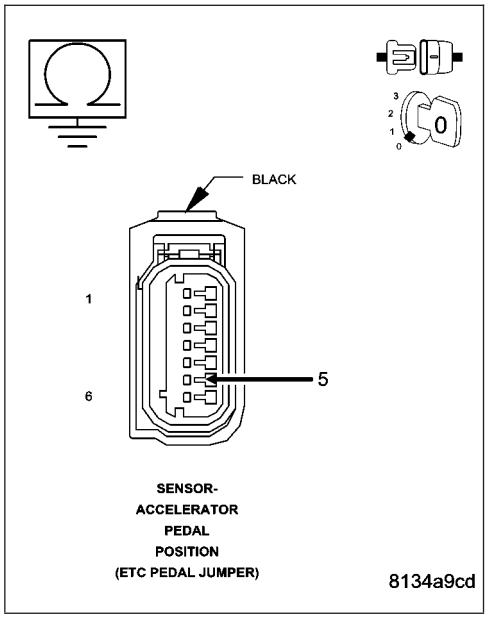
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

5. (K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K23) APP Sensor No.1 Signal circuit in the APP Sensor harness connector.



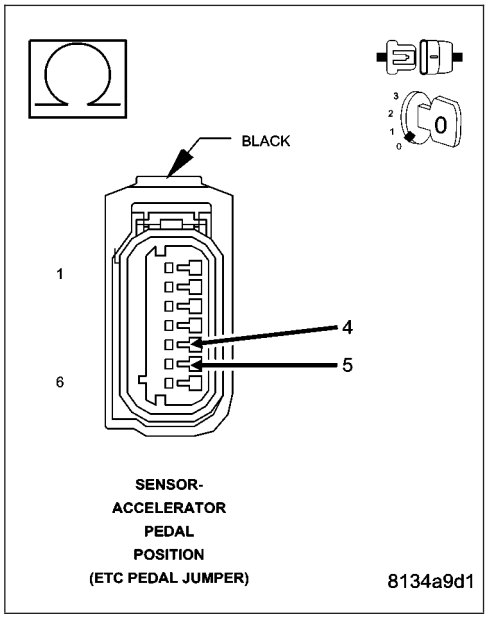
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K23) APP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K167) APP SENSOR NO.1 RETURN CIRCUIT

Measure the resistance between the (K23) APP Sensor No.1 Signal circuit and the (K167) Sensor No.1 Return circuit at the APP Sensor harness connector.



Is the resistance below 100 ohms?

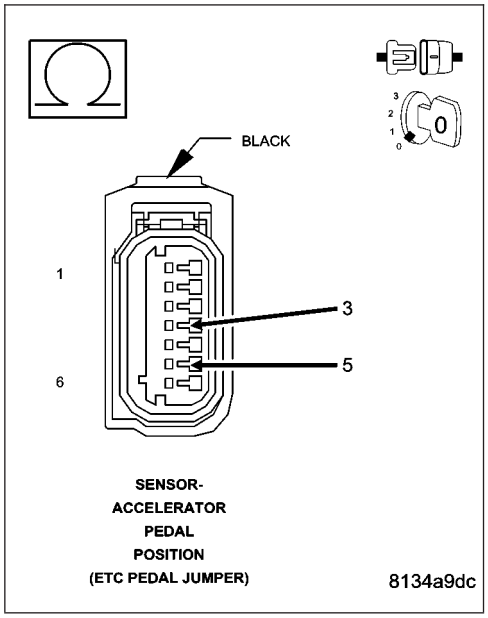
Yes >> Repair the short between the (K167) App Sensor No.1 Return circuit and the (K23) APP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

7. (K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K400) APP SENSOR NO.2 RETURN CIRCUIT

Measure the resistance between the (K23) APP Sensor No.1 Signal circuit and the (K400) Sensor No.2 Return circuit in the APP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K400) App Sensor No.2 Return circuit and the (K23) APP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

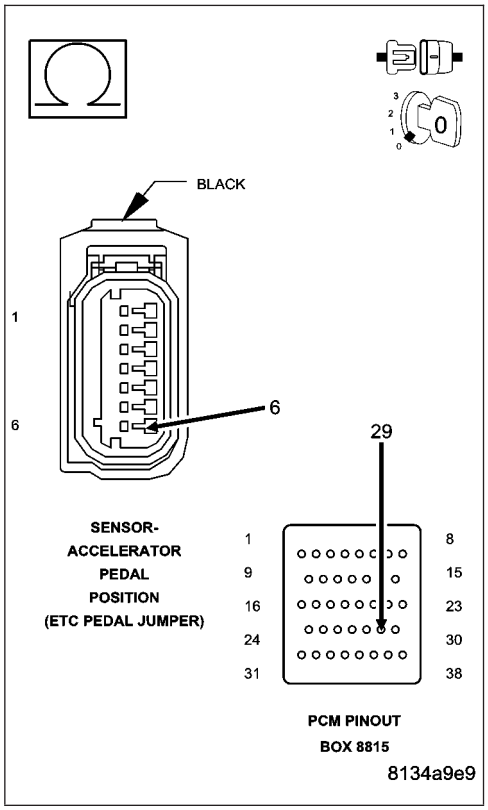
8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

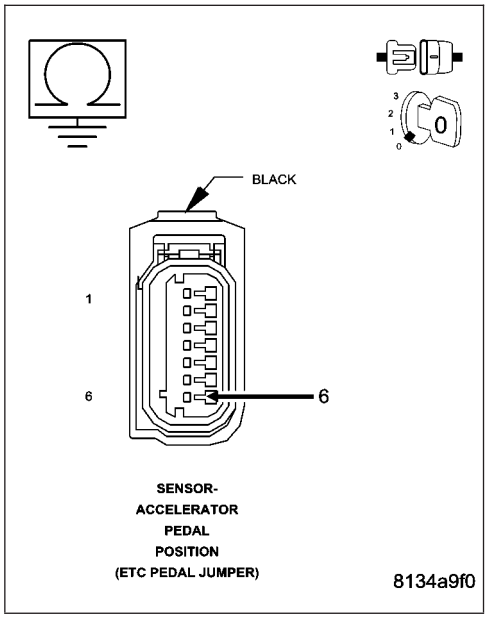
Yes >> Go To 9

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2122-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT LOW (CONTINUED)

9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor No.1 voltage.

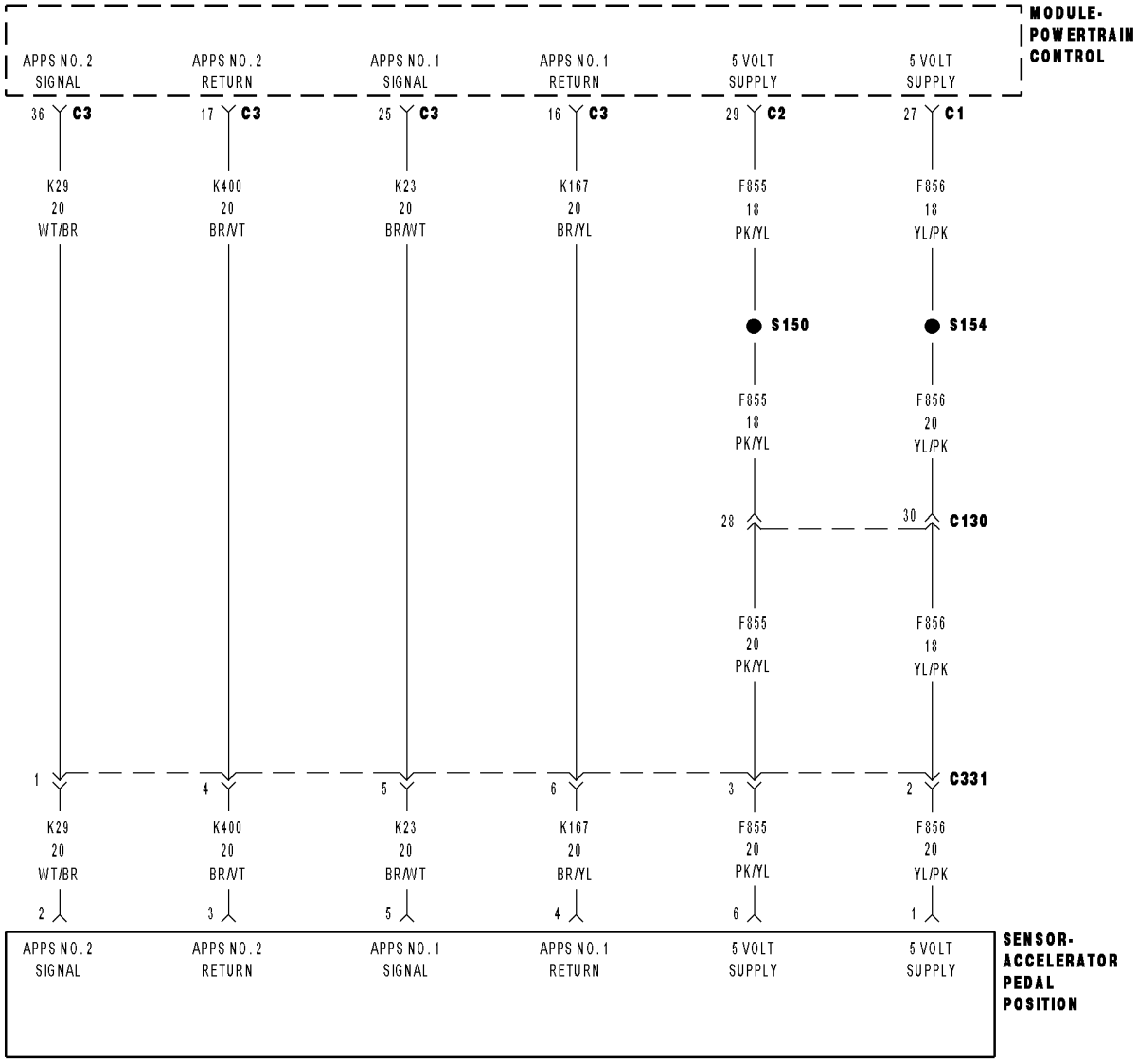
Slowly press the Accelerator pedal down.

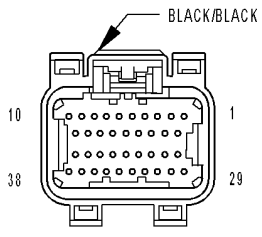
Does voltage start at approximately 0.45 of a volt and go above 4.6 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

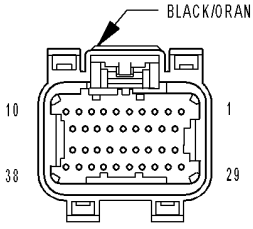
No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH

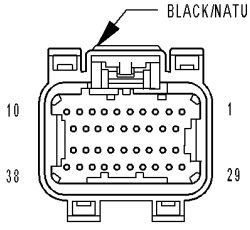




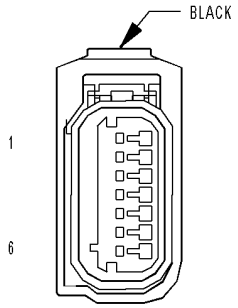
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SENSOR-ACCELERATOR PEDAL POSITION

81454f1d

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no other APPS No.1 DTCs present.
- **Set Condition:**
  When APP Sensor No.1 voltage is too high. Engine will additionally idle if the brake pedal is pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K23) APP SENSOR NO.1 SIGNAL SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K23) APP SENSOR NO.1 SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K167) APP SENSOR NO.1 RETURN CIRCUIT OPEN
APP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. APPS NO.1 VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

With a scan tool, read the APP Sensor No.1 voltage.

Is the voltage above 4.8 volts?

Yes >> Go To 2

No >> Go To 8

---

2. ACCELERATOR PEDAL POSITION SENSOR

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Ignition on, engine not running.

With a scan tool, monitor the Accelerator Pedal Position Sensor voltage.

Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

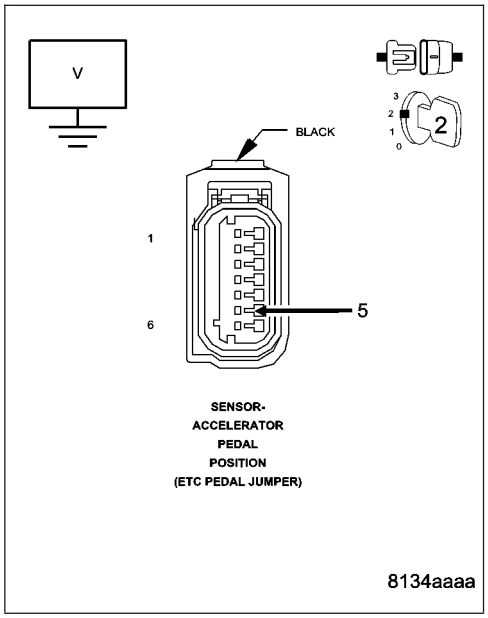
3. (K23) APP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1, C2, and C3 PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (K23) APP Sensor No.1 Signal circuit in the APP Sensor harness connector.



Is the voltage above 0 volts?

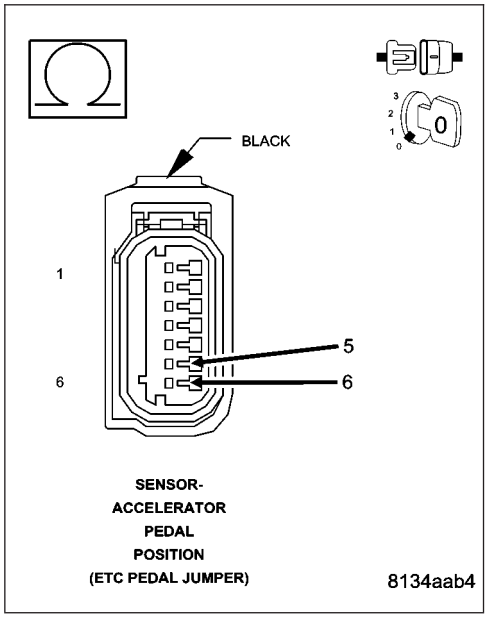
Yes >> Repair the short to battery voltage in the (K23) APP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K23) APPS NO.1 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Measure the resistance between the (K23) APP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.



Is the resistance below 100 ohms?

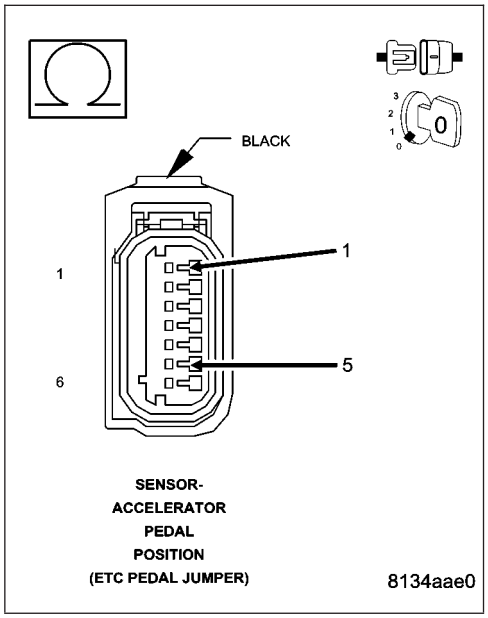
Yes >> Repair the short between the (K23) APP Sensor No.1 Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

5. (K23) APPS NO.1 SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K23) APP Sensor No.1 Signal circuit and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K23) APP Sensor No.1 Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

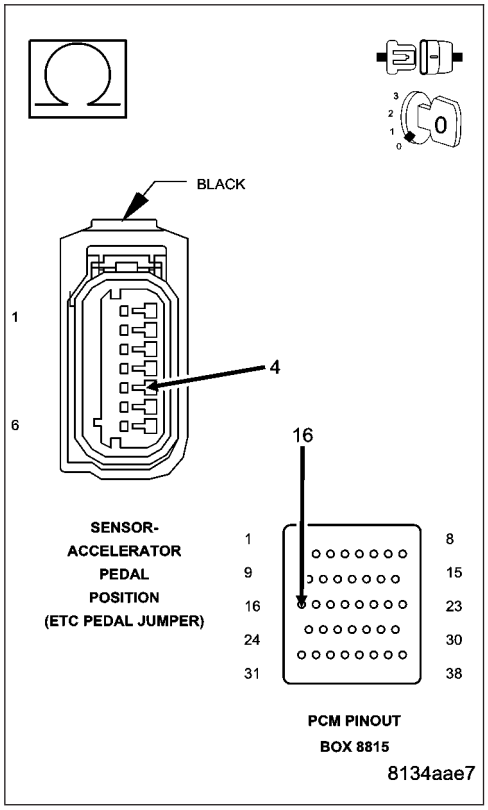
No >> Go To 6

---

6. (K167) APP SENSOR NO.1 RETURN CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K167) APP Sensor No.1 Return circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K167) APP Sensor No.1 Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2123-ACCELERATOR PEDAL POSITION SENSOR 1 CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. APP SENSOR NO.1 SWEEP

Ignition on, engine not running.

With a scan tool, monitor the Accelerator Pedal Position Sensor voltage.

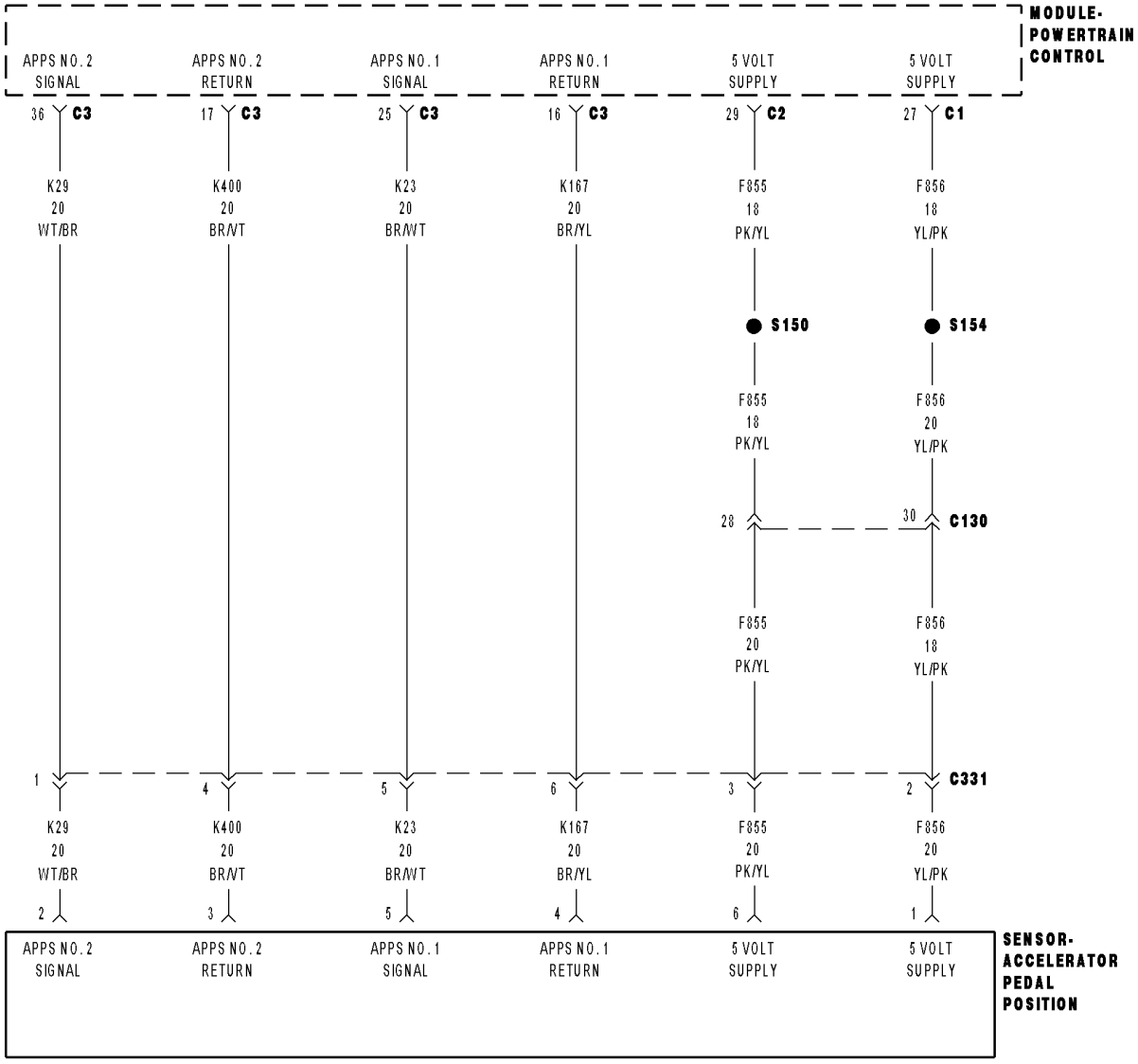
Slowly press the Accelerator Pedal down.

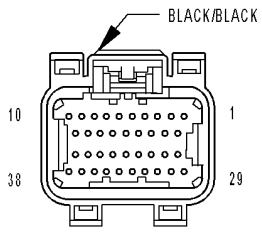
Does voltage start at approximately 0.45 of a volt and go above 4.6 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

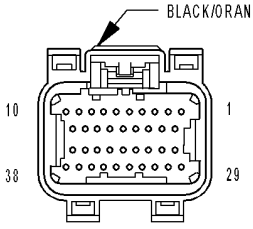
No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW

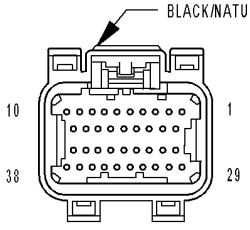




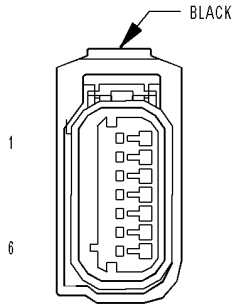
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SENSOR-ACCELERATOR PEDAL POSITION

81454f1d

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no other APPS No.2 DTCs present.
- **Set Condition:**
  When the APP Sensor No.2 voltage is too low. Engine will only idle if the Brake pedal is Pressed or has failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(F856) 5-VOLT SUPPLY CIRCUIT OPEN
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K29) APP SENSOR NO.2 SIGNAL CIRCUIT OPEN
(K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
(K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K167) APP SENSOR NO.1 RETURN CIRCUIT
(K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K400) APP SENSOR NO.2 RETURN CIRCUIT
APP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. APP SENSOR BELOW 0.25 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the APP Sensor No.1 voltage.

NOTE: Sensor No. 2 is pulled low by the PCM as part of its system testing. This test happens a couple of times a second. So you can expect to see voltages close to zero occasionally with a normal sensor.

Is the voltage consistently below 0.25 of a volt?

Yes >> Go To 2

No >> Go To 11

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

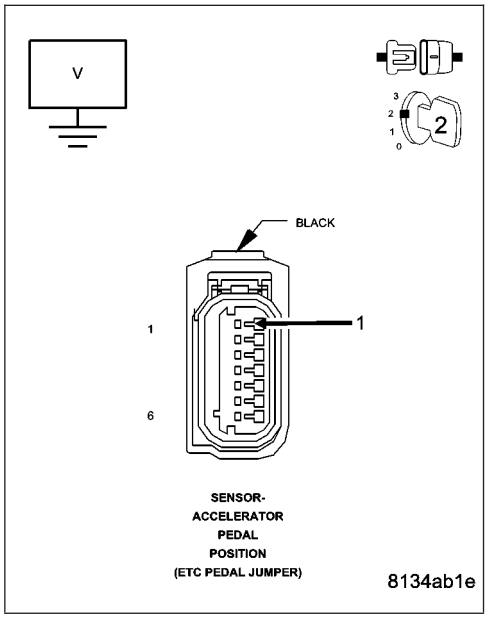
2. (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the APP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F856) 5-volt Supply circuit in the APP Sensor harness connector.



Is the voltage between 4.5 and 5.2 volts?

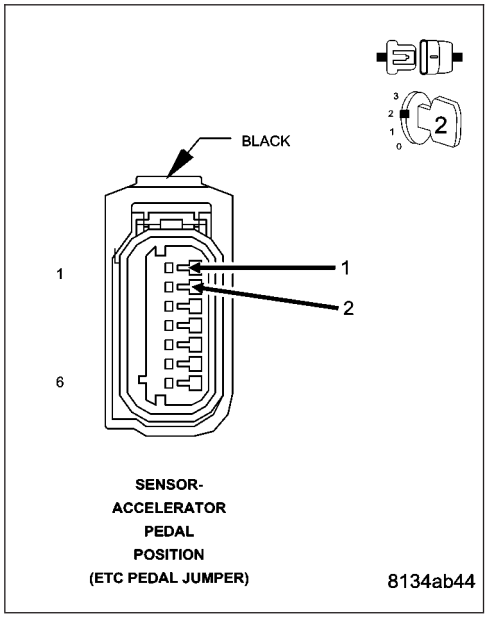
Yes >> Go To 3

No >> Go To 8

3. ACCELERATOR PEDAL POSITION SENSOR

Connect a jumper wire between the (F856) 5-volt Supply circuit and the (K29) APP Sensor No.2 Signal circuit in the Sensor harness connector.

With a scan tool, monitor the APP Sensor No.2 voltage.



Is the voltage above 4.5 volts with the jumper wire installed?

Yes >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.

P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

4. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

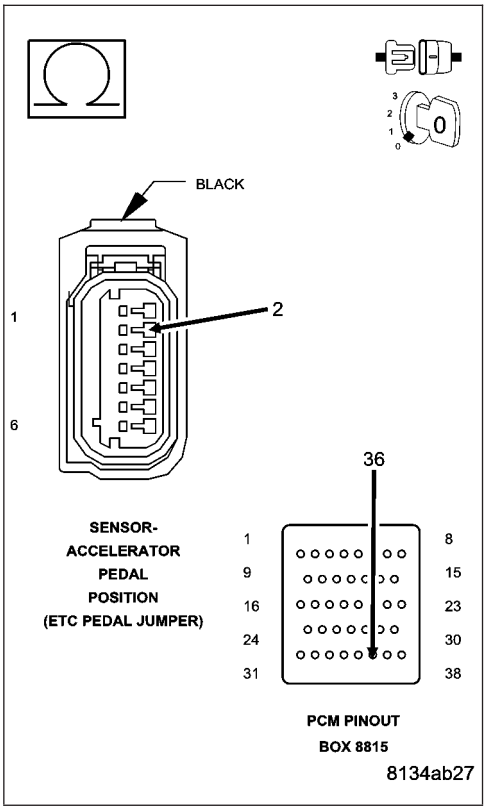
Measure the resistance of the (K29) APP Sensor No.2 Signal circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K29) APP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

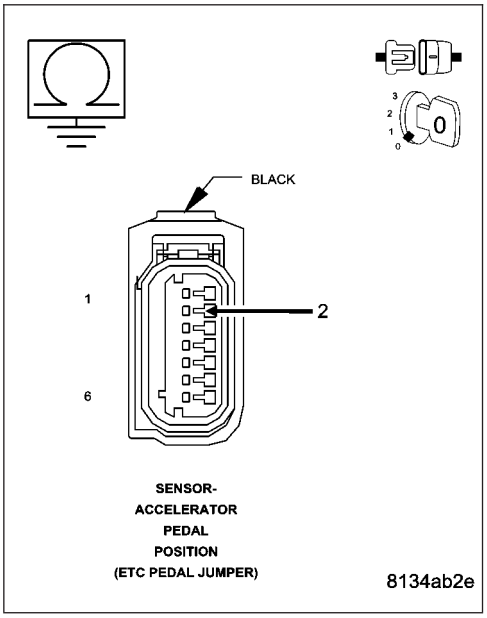
Measure the resistance between ground and the (K29) APP Sensor No.2 Signal circuit in the APP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K29) APP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

6. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K400) APP SENSOR NO.2 RETURN CIRCUIT

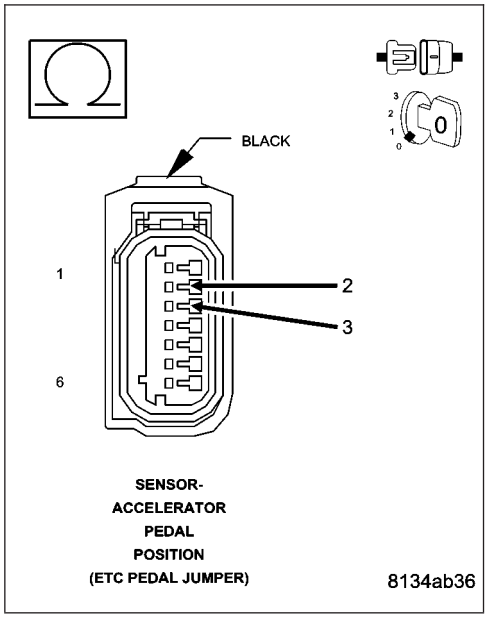
Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (K400) Sensor No.2 Return circuit in the APP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K400) App Sensor No.2 Return circuit and the (K29) APP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



7. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K167) APP SENSOR NO.1 RETURN CIRCUIT

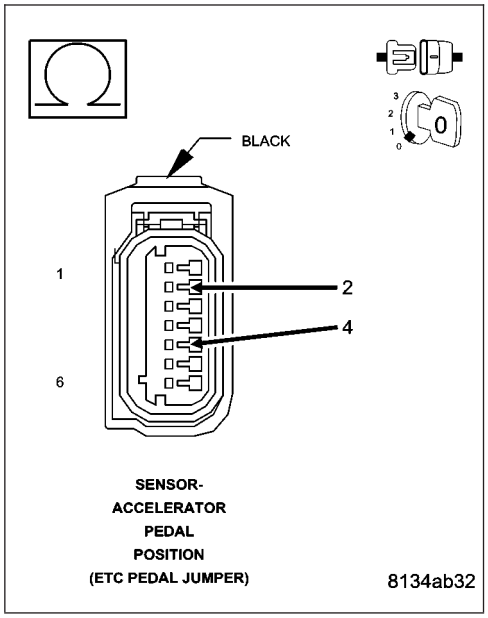
Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (K167) Sensor No.1 Return circuit in the APP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K167) App Sensor No.1 Return circuit and the (K29) APP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

8. (F856) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

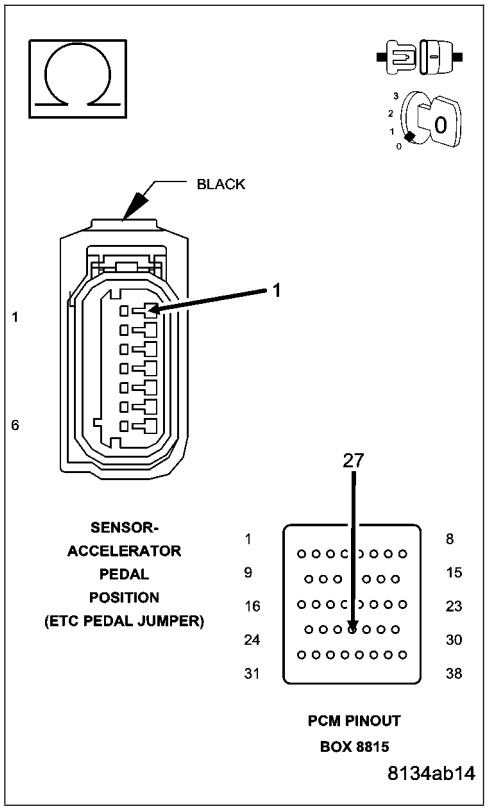
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



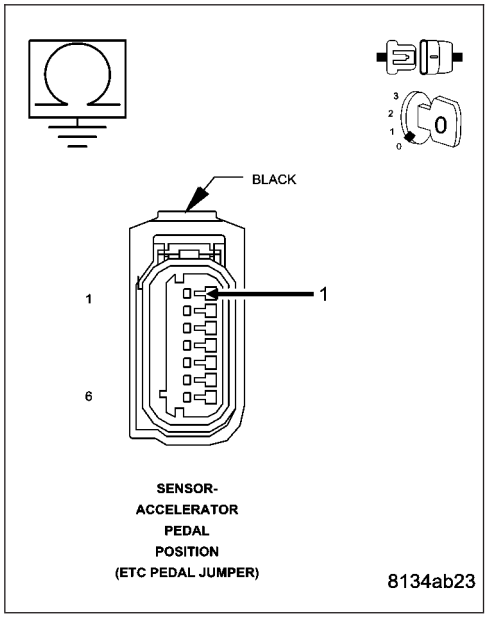
9. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



P2127-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT LOW (CONTINUED)

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor the APP Sensor No.2 voltage.

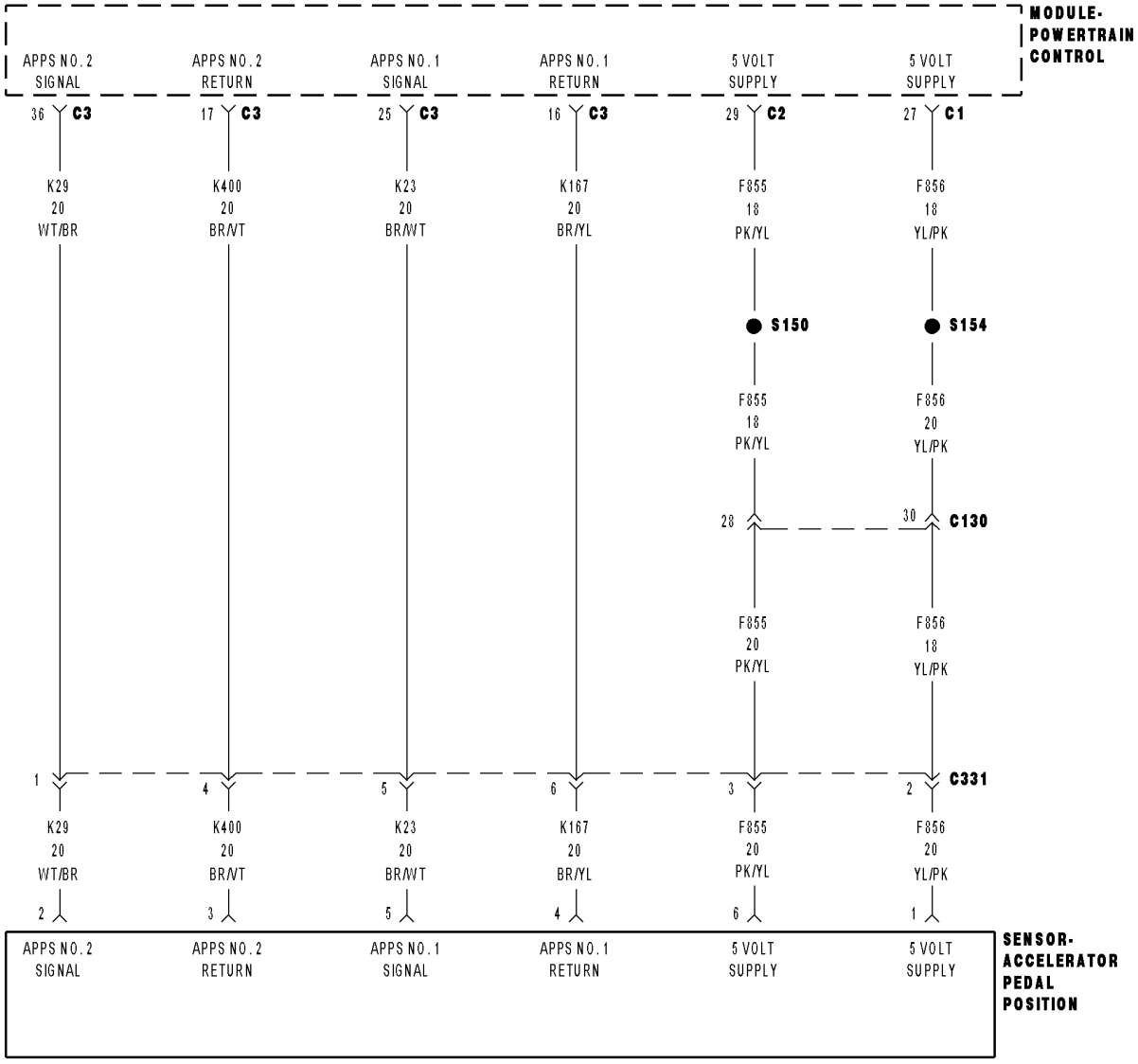
Slowly press the Accelerator pedal down.

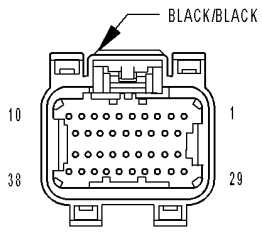
Does voltage start at approximately 0.22 of a volt and go above 2.31 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

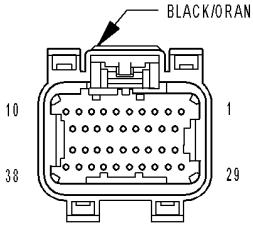
No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH

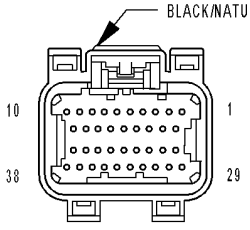




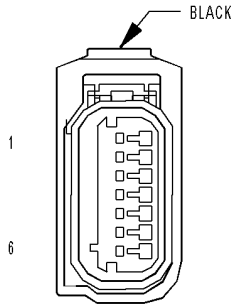
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SENSOR-ACCELERATOR PEDAL POSITION

81454f11d

P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no other APPS No.2 DTCs present.
- **Set Condition:**
  When APP Sensor No.2 voltage is too high. Idle is additionally forced any time the brake is applied or failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
(K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K29) APP SENSOR NO.2 SIGNAL SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K29) APP SENSOR NO.2 SIGNAL SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K400) APP SENSOR NO.2 RETURN CIRCUIT OPEN
APP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. APPS NO.2 VOLTAGE ABOVE 3.0 VOLTS

Ignition on, engine not running.

With a scan tool, read the APP Sensor No.2 voltage.

NOTE: Diagnose any 5-Volt Supply DTCs before continuing.

Is the voltage above 3.0 volts?

Yes >> Go To 2

No >> Go To 8

---

2. ACCELERATOR PEDAL POSITION SENSOR

Turn the ignition off.

Disconnect the APPS harnesss connector.

Ignition on, engine not running.

With a scan tool, monitor the Accelerator Pedal Position Sensor voltage.

Is the voltage above 3.0 volts?

Yes >> Go To 3

No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

3. (K29) APP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

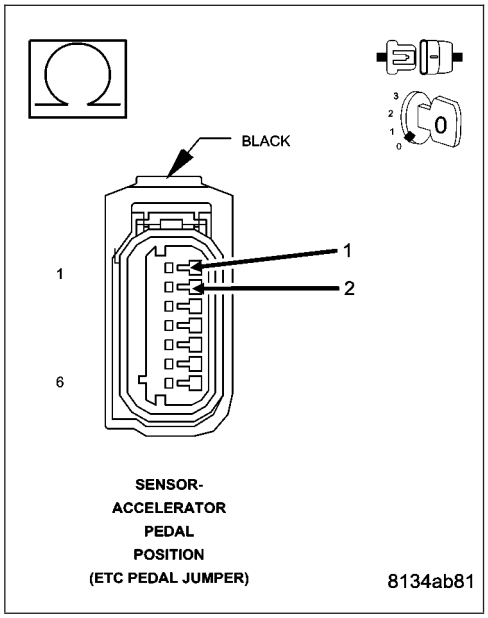
Ignition on, engine not running.

Measure the voltage on the (K29) APP Sensor No.2 Signal circuit in the APP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K29) APP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K29) APPS NO.2 SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

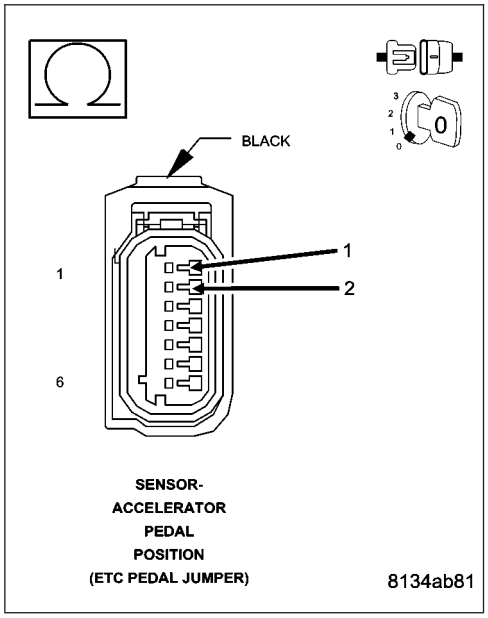
Turn the ignition off.

Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (F856) 5-volt Supply circuit in the APP Sensor harness connector.

Is the resistance below 10 ohms?

Yes >> Repair the short between the (K29) APP Sensor No.2 Signal circuit and the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

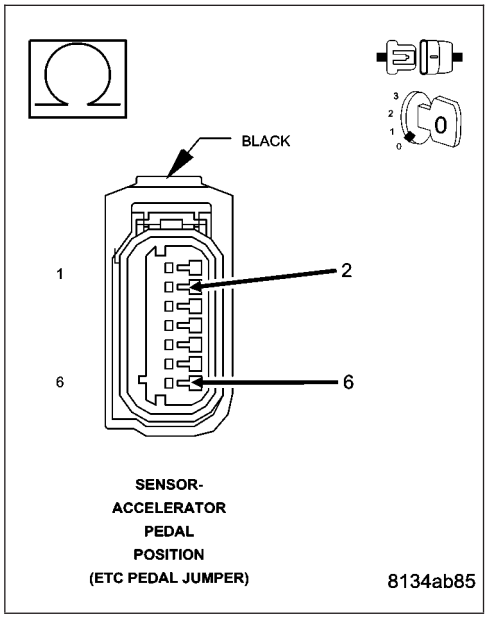
5. (K29) APPS NO.2 SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K29) APP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit in the APP Sensor harness connector.

Is the resistance below 10 ohms?

Yes >> Repair the short between the (K29) APP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



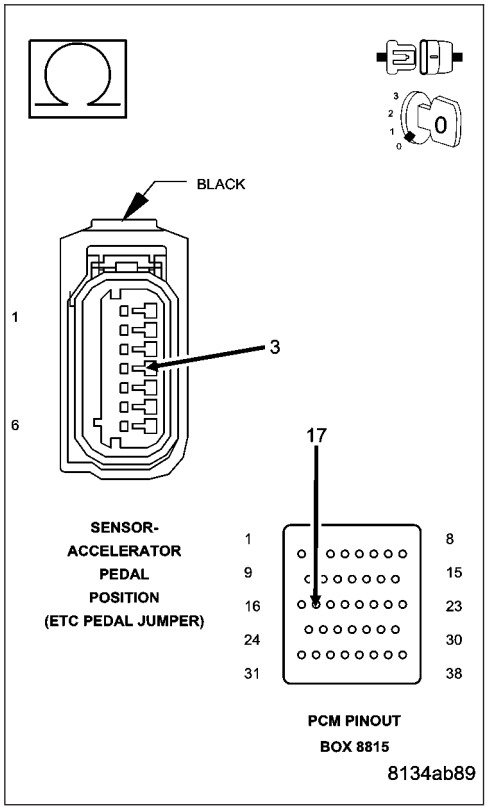
6. (K400) APP SENSOR NO.2 RETURN CIRCUIT OPEN

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (K400) APP Sensor No.2 Return circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K400) APP Sensor No.2 Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2128-ACCELERATOR PEDAL POSITION SENSOR 2 CIRCUIT HIGH (CONTINUED)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. APP SENSOR NO.2 SWEEP

Ignition on, engine not running.

With a scan tool, monitor the Accelerator Pedal Position Sensor voltage.

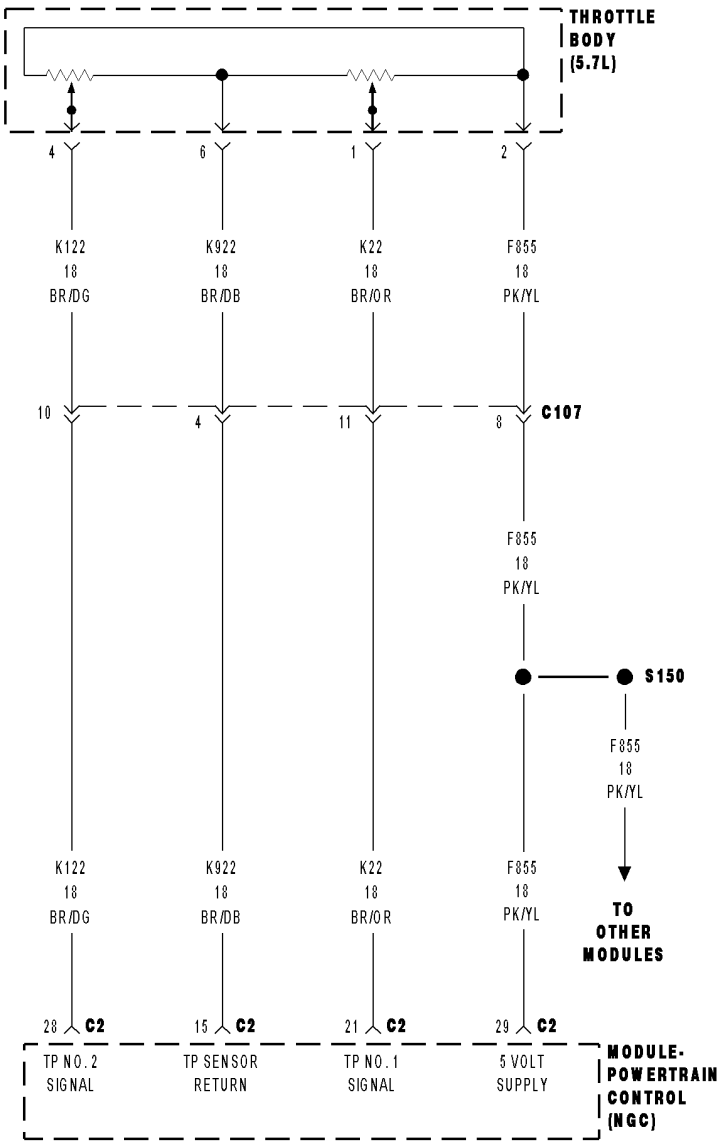
Slowly press the Accelerator Pedal down.

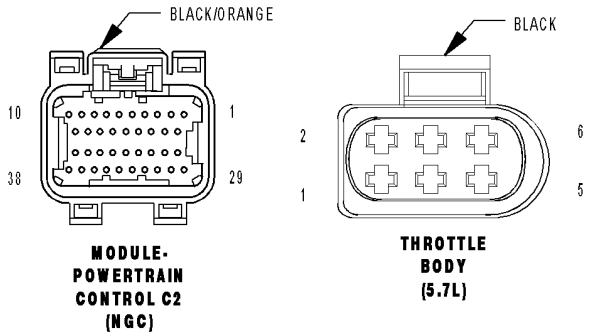
Does voltage start at approximately 0.22 of a volt and go above 2.31 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION





81452d8c

P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no other DTCs present for TP Sensor No.1 or No.2.
- **Set Condition:**
  PCM recognizes TP Sensors No.1 and No.2 are not coherent. One trip fault and the code will set within 5 seconds. ETC light is illuminated.

Possible Causes
(K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
RESISTANCE IN THE (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
(K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) SENSOR GROUND CIRCUIT
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K122) TP SENSOR NO.2 SIGNAL CIRCUIT
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The throttle plate and linkage should be free from binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.
Ignition on, engine not running.

NOTE: Inspect the engine for vacuum leaks.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 11

P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

2. (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the Throttle Body harness connector.

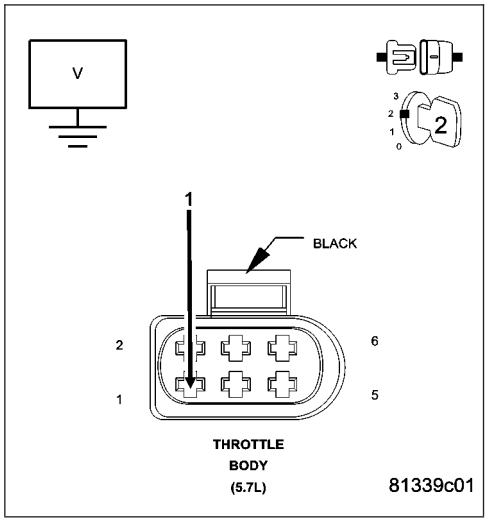
Ignition on, engine not running.

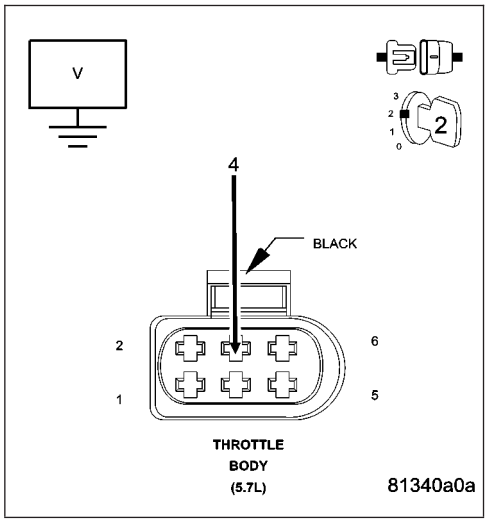
Measure the voltage on the (K22) TP No.1 Signal and the (K122) TP No.2 Signal circuits in the Throttle Body harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor No.1 or (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3





P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

3. THROTTLE POSITION SENSOR

Turn the ignition off.

Connect the C2 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor No.1 and No.2 voltage.

Connect a jumper wire between the (K922) Sensor Return circuit and the (K22) TP Sensor No.1 Signal circuit.

TP Sensor No.1 voltage should change from approximately 4.5 volts to 0.5 of a volt?

For TP Sensor No.2, connect a jumper wire between (F855) 5-volt supply circuit and the (K122) TP Sensor No.2 signal circuit.

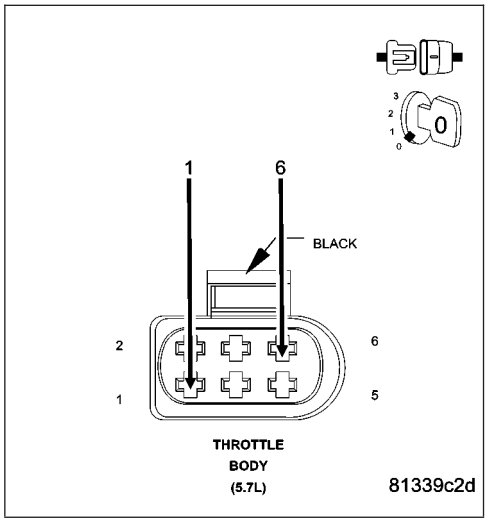
TP Sensor No.2 voltage should change from approximately 0 volts to 5.0 volts?

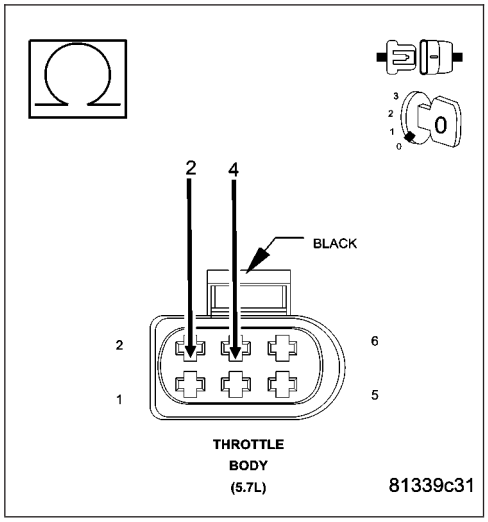
Is the voltage reading within the listed specification with the jumper wire installed?

Yes >> Replace the Throttle Body Assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire before continuing.





P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

4. EXCESSIVE RESISTANCE IN THE (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.2 SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

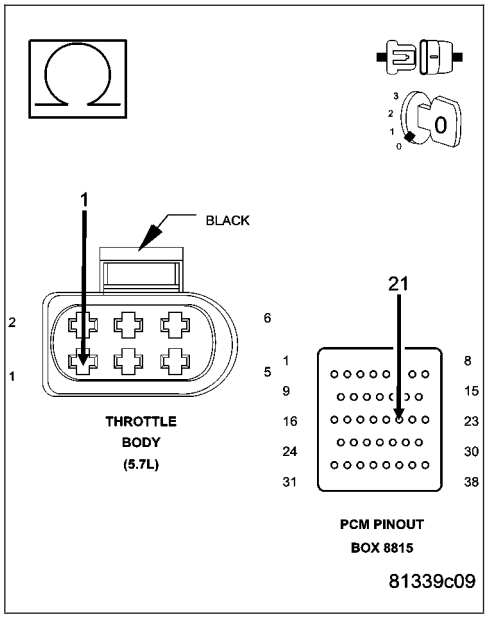
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

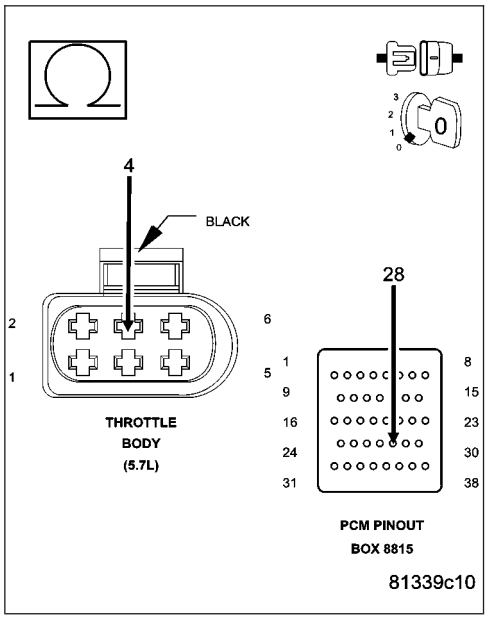
Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.Measure the resistance of the (K122) TP Sensor No.2 Signal circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 or (K122) TP Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

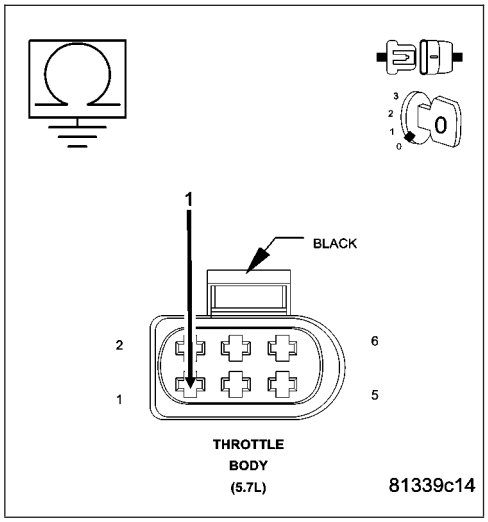
5. (K22) TP SENSOR NO.1 OR (K122) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

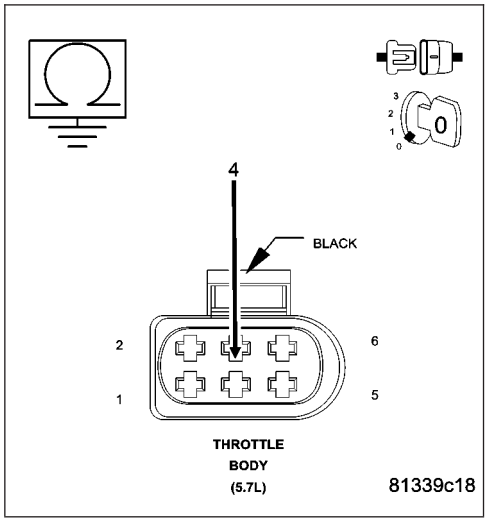
Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit and the (K122) TP Sensor No.2 Signal circuit at the appropriate terminals of special tool #8815.

Is the resistance below 100 ohms for either circuit?

Yes >> Repair the short to ground in the (K22) TP No.1 Signal or (K122) TP No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6





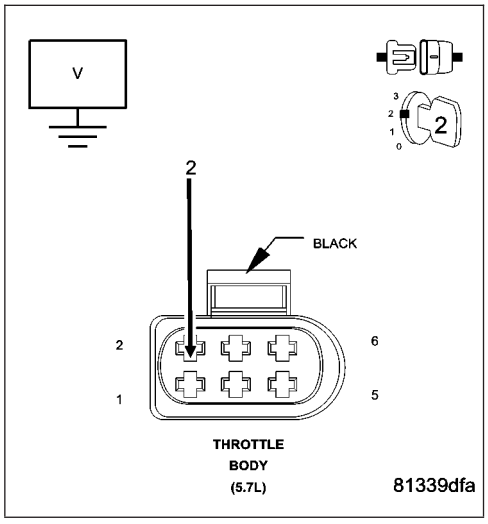
6. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

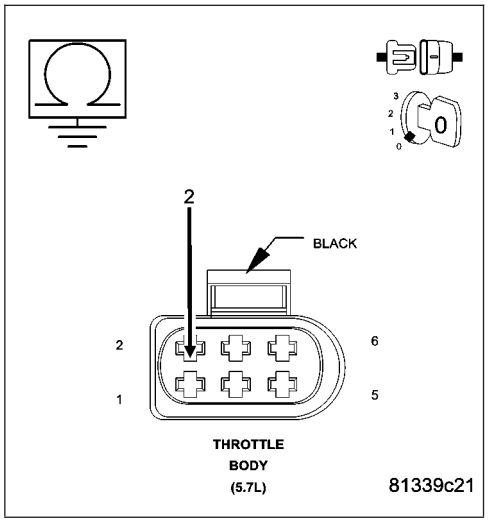
No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

7. (F855) 5-VOLT SUPPLY SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the appropriate terminals of special tool #8815.



Is the resistance below 100 ohms?

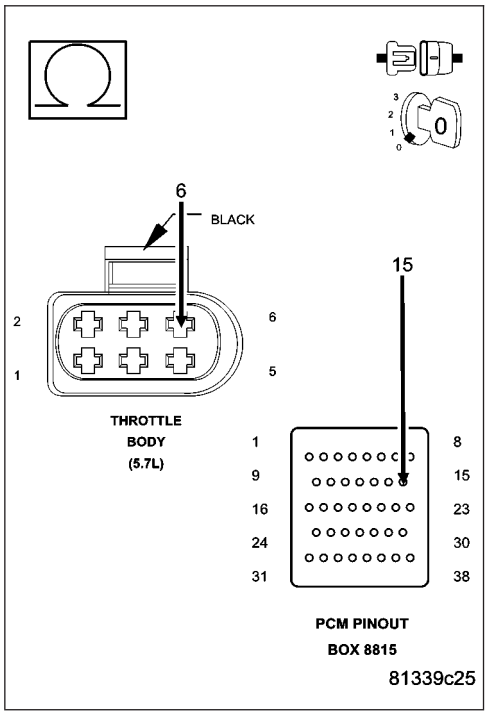
Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. EXCESSIVE RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

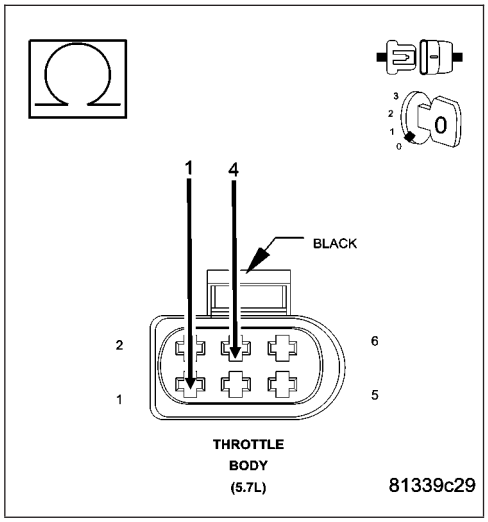
Yes >> Go To 9

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2135-THROTTLE POSITION SENSOR 1/2 CORRELATION (CONTINUED)

9. (K22) TP SENSOR NO.1 SIGNAL SHORTED TO (K122) TP SENSOR NO.2 SIGNAL

Measure the resistance between the (K22) TP Sensor No.1 Signal circuit and the (K122) TP Sensor No.2 Signal circuit between the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K122) TP Sensor No.2 Signal circuit and the (K22) TP Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. THROTTLE FOLLOWER TEST

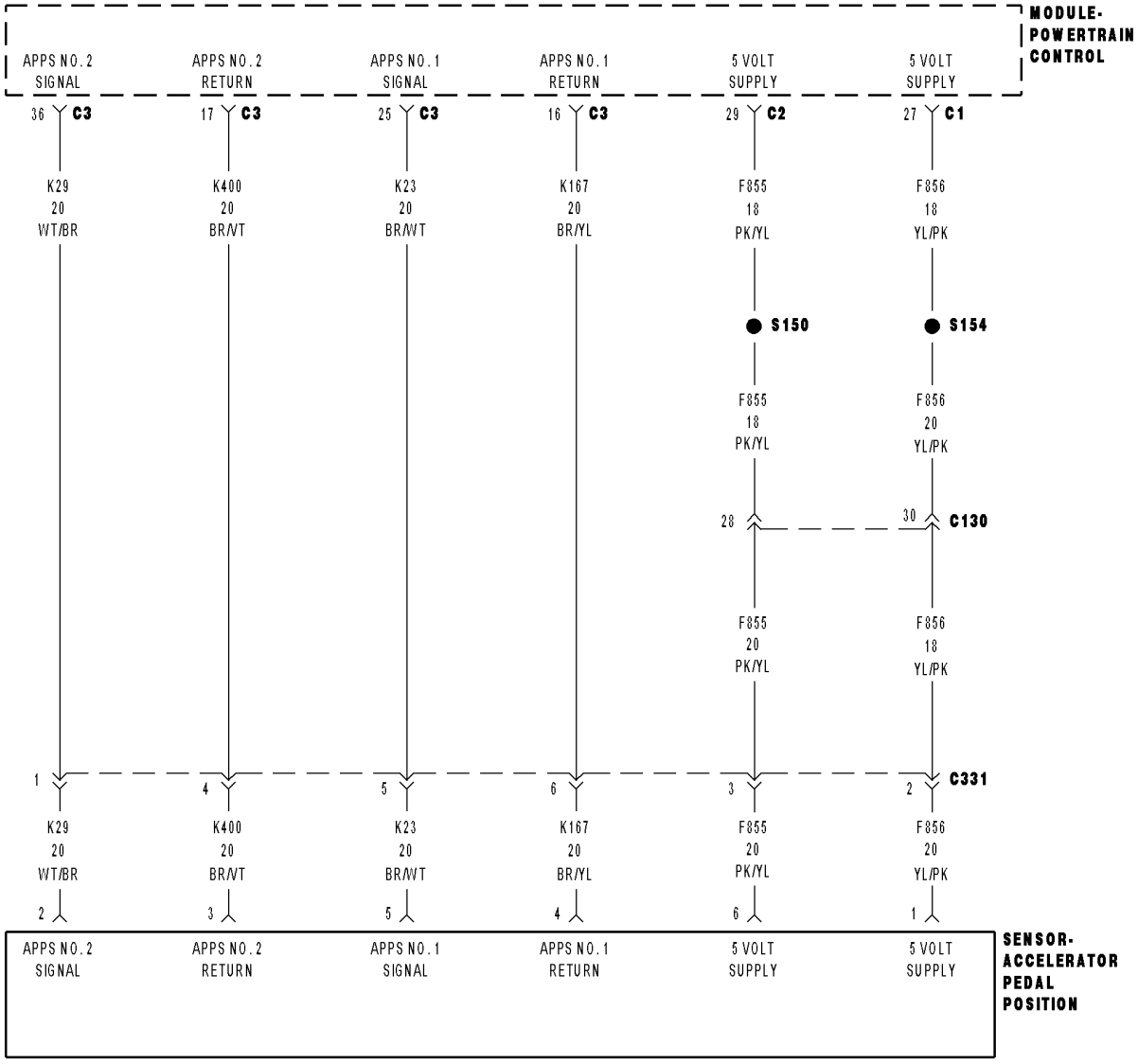
Ignition on, engine not running.
With a scan tool, perform the Throttle Follower Test and monitor the TP Sensor No.1 or No.2 voltage.
Slowly press the throttle pedal down.
The voltage for TP Sensor No.1 should start at approximately 0.8 of a volt and increase to above 4.2 volts.
The voltage for TP Sensor No.2 should start at approximately 4.2 volts and decrease to approximately 0.8 of a volt.

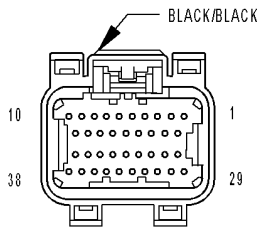
Is the voltage within the range of the listed specification for the appropriate Sensor?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

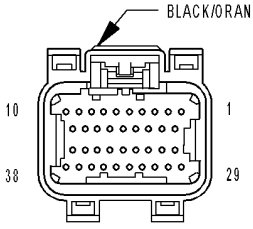
No >> Disconnect the Battery when replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION

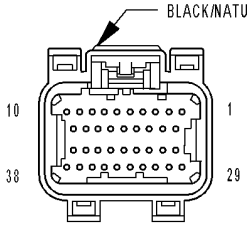




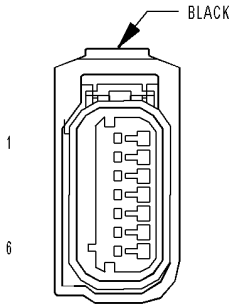
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SENSOR-ACCELERATOR PEDAL POSITION

81454f1d

P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no APPS No.1 and APPS No.2 DTC present.
- **Set Condition:**
  APPS values No.1 and No.2 are not coherent. Idle is additionally forced when the brake pedal is pressed or failed. Acceleration rate and Engine output are limited. One trip fault and the code will set within 5 seconds. ETC light is flashing.

Possible Causes
EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
EXCESSIVE RESISTANCE IN THE (K167) SENSOR NO.1 RETURN CIRCUIT
EXCESSIVE RESISTANCE IN THE (K400) SENSOR NO.2 RETURN CIRCUIT
EXCESSIVE RESISTANCE IN THE (K23) APP SENSOR NO.1 SIGNAL CIRCUIT
EXCESSIVE RESISTANCE IN THE (K29) APP SENSOR NO.2 SIGNAL CIRCUIT
APP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

NOTE: Repair any other 5-Volt Supply or APPS High and Low DTCs before diagnosing P2138.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION (CONTINUED)

2. EXCESSIVE RESISTANCE IN THE (K23) APPS NO.1 SIGNAL CIRCUIT

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Disconnect the APP Sensor harness connector.

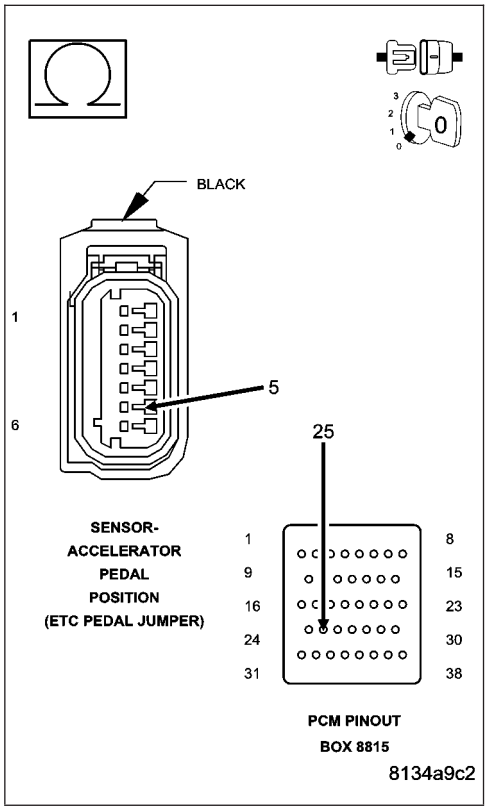
Measure the resistance of (K23) APP Sensor No.1 Signal circuit from the APP Sensor harness connector to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the excessive resistance in the (K23) APP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. EXCESSIVE RESISTANCE IN THE (K29) APPS NO.2 SIGNAL CIRCUIT

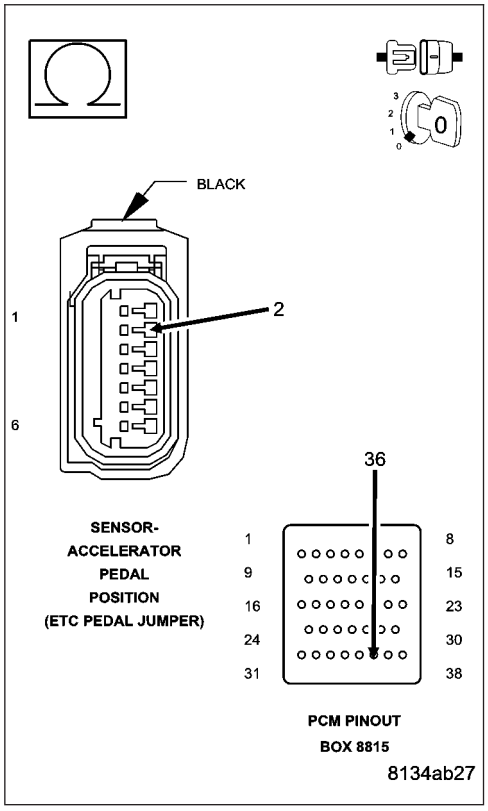
Measure the resistance of (K29) APPS No.2 Signal circuit from the APP Sensor harness connector to the appropriate terminals of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K29) APP Sensor No.2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION (CONTINUED)

4. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

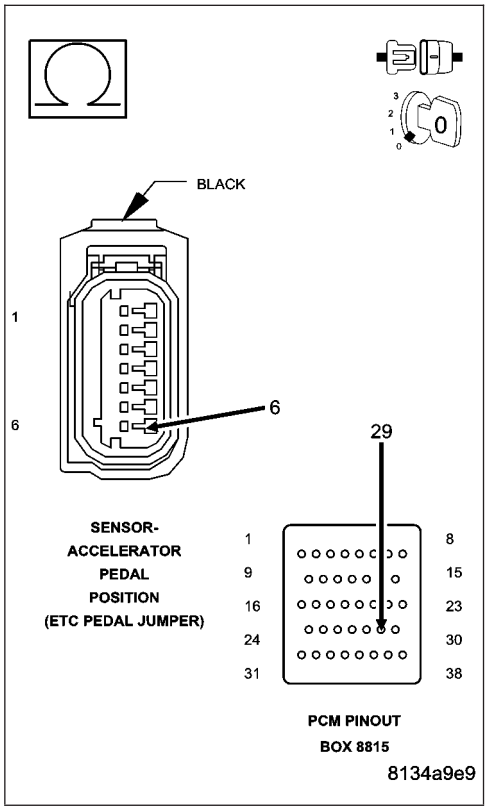
Disconnect the C2 PCM harness connector.

Measure the resistance of the (F855) 5-volt Supply circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. EXCESSIVE RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

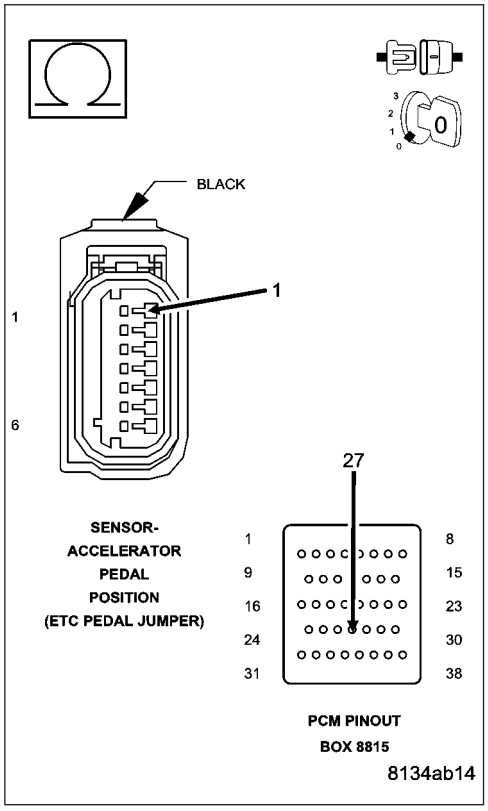
Disconnect the C1 PCM harness connector.

Measure the resistance of the (F856) 5-volt Supply circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION (CONTINUED)

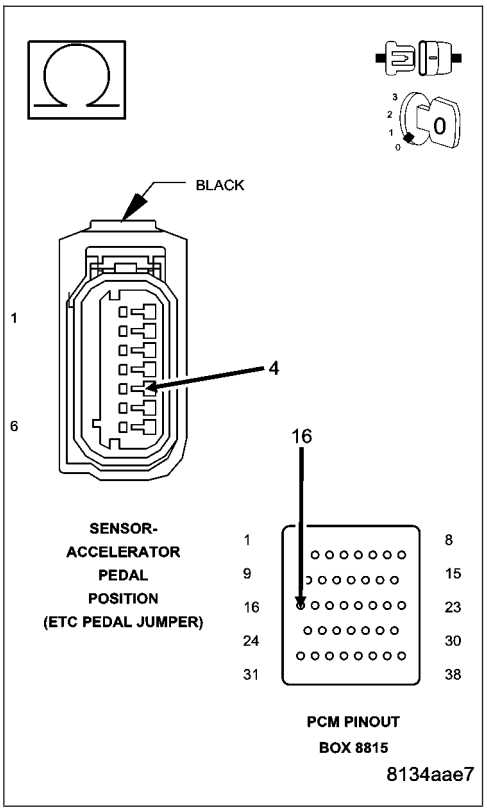
6. EXCESSIVE RESISTANCE IN THE (K167) SENSOR NO.1 RETURN CIRCUIT

Measure the resistance of the (K167) APP Sensor No.1 Return circuit from the APP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the excessive resistance in the (K167) Sensor No.1 Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



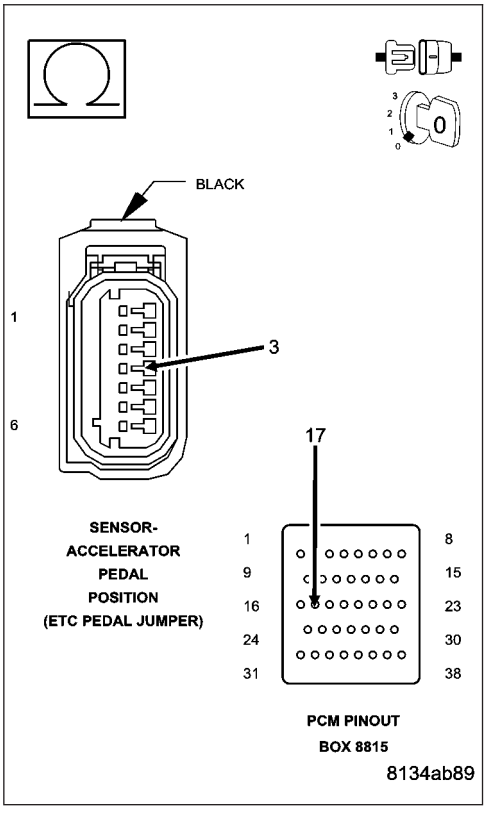
7. EXCESSIVE RESISTANCE IN THE (K400) SENSOR NO.2 RETURN CIRCUIT

Measure the resistance of the (K400) APP Sensor No.2 Return circuit from the APP Sensor harness connector to the appropriate terminal special tool #8815.

Is the resistance above 5.0 ohms?

Yes >> Repair the excessive resistance in the (K400) Sensor No.2 Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P2138-ACCELERATOR PEDAL POSITION SENSOR 1/2 CORRELATION (CONTINUED)

8. CHECKING APPS NO.1 AND NO.2 WITH A LAB SCOPE

Ignition on, engine not running.

Set up a lab scope in a way that you can view two graphs simultaneously.

Backprobe (K23) APP Sensor No.1 Signal circuit using Channel 1 at the APP Sensor harness connector.

Backprobe (K29) APP Sensor No.2 Signal circuit using Channel 2 at the APP Sensor harness connector.

Slowly press and release the Accelerator Pedal while monitoring the lab scope screen.

Does the scope pattern show any missing or erratic signals?

Yes >> Replace the APP Sensor Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

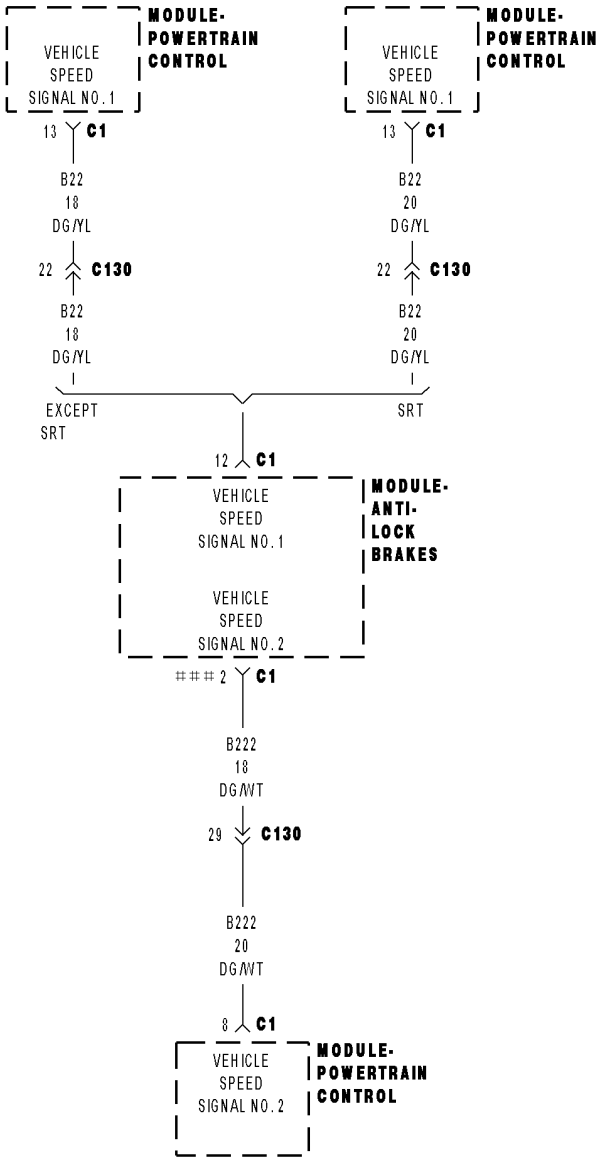
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

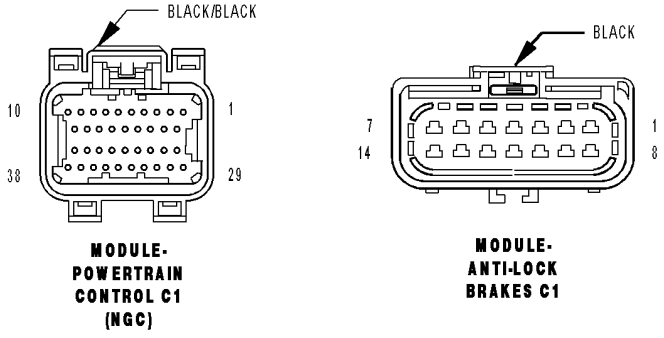
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2161-VEHICLE SPEED SENSOR 2 ERRATIC





81453b7e

P2161-VEHICLE SPEED SENSOR 2 ERRATIC (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  PCM recognizes Vehicle speed input No.2 erratic or high. VSS No.2 is based on the average of the Front Wheel Speeds. One trip fault and the code will set within 5 seconds. No MIL and No ETC light. Cruise is disabled.

Possible Causes
(B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT OPEN
(B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
TIRE CIRCUMFERENCE
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: Check for any Bus Communication DTCs. If no Bus or Communication DTCs are set, check for active DTCs stored in the Ant-Lock Brake Module. Any bus or communication DTCs or VSS DTCs in the Ant-Lock Brake Module must be properly diagnosed before continuing.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL INSPECTION

NOTE: This code can set due to tire circumference differences and from the front or rear wheels being on a slippery surface while the opposite tires are not.

This code may also set on a hard acceleration on loose gravel or during other off road driving conditions.

Check tire pressure of all the tires.

Check tire wear on all the tires.

Ask the customer what the road and driving conditions were like when the fault set.

Were any problems found?

Yes >> Repair as necessary. If the code set during a front OR rear wheel spin condition, no repair is necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P2161-VEHICLE SPEED SENSOR 2 ERRATIC (CONTINUED)

3. (B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

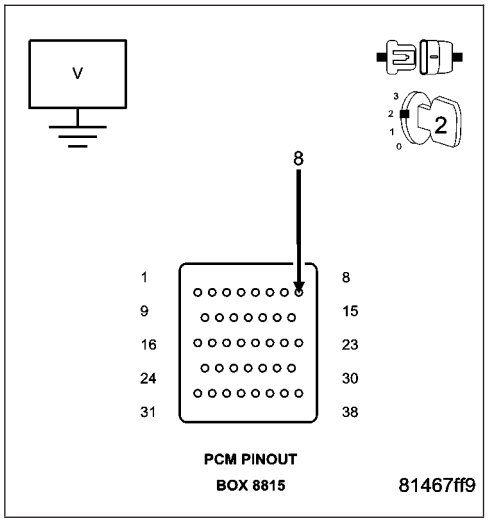
Disconnect the ABS Module harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Ignition on, engine not running.

Measure the voltage of the (B222) Vehicle Speed No.2 Signal circuit at the appropriate terminals of special tool #8815.



Is the voltage above 6.0 volts?

Yes >> Repair the short to voltage in the (B222) Vehicle Speed No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

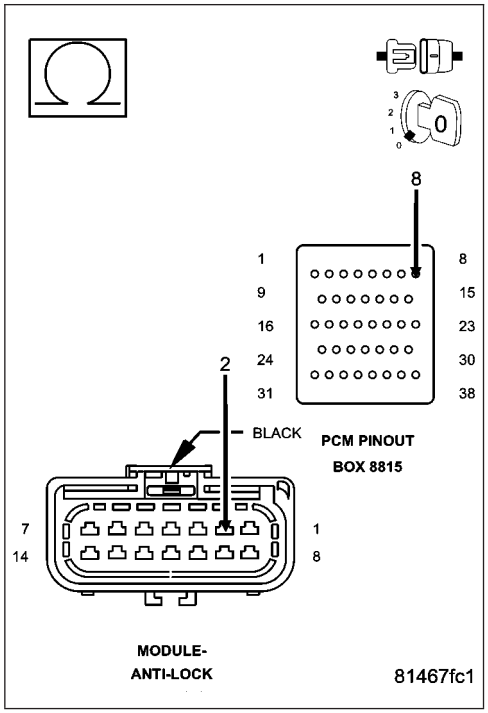
No >> Go To 4

---

4. (B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (B222) Vehicle Speed No.2 Signal circuit from the ABS Module harness connector to the appropriate terminal special tool #8815.



Is the resistance below 5.0 ohms?

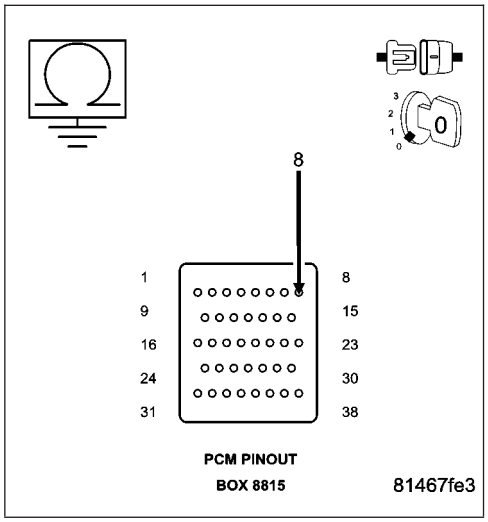
Yes >> Go To 5

No >> Repair the open in the (B222) Vehicle Speed No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2161-VEHICLE SPEED SENSOR 2 ERRATIC (CONTINUED)

5. (B222) VEHICLE SPEED NO.2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B222) Vehicle Speed No.2 Signal circuit at the appropriate terminals of special tool #8815.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B222) Vehicle Speed No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2166-ACCELERATOR PEDAL POSITION SENSOR 1 MAXIMUM STOP PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors.
- **Set Condition:**
  APPS No.1 has failed to achieve the required maximum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool read DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

Start the engine.

Does the DTC return?

Yes >> Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P2167-ACCELERATOR PEDAL POSITION SENSOR 2 MAXIMUM STOP PERFORMANCE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. During in plant mode the APP Sensors need to be checked to make sure that idle and full pedal travel can be reached on both sensors.
- **Set Condition:**
  APPS No.2 has failed to achieve the required maximum value during In Plant testing. One trip fault and the code will set within 5 seconds. Engine will only idle.

Possible Causes
IN PLANT TEST FAILURE
APPS RELEARN

Diagnostic Test

1. IN PLANT TEST FAILURE

Ignition on, engine not running.

NOTE: This DTC is set when the APP Sensors are learned in plant but do not reach the Minimum or Maximum voltage range.

With a scan tool read DTCs.

With the scan tool, erase DTCs.

Start the engine.

With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. APPS RELEARN

With a scan tool select the ETC RELEARN function.

Next, erase DTCs.

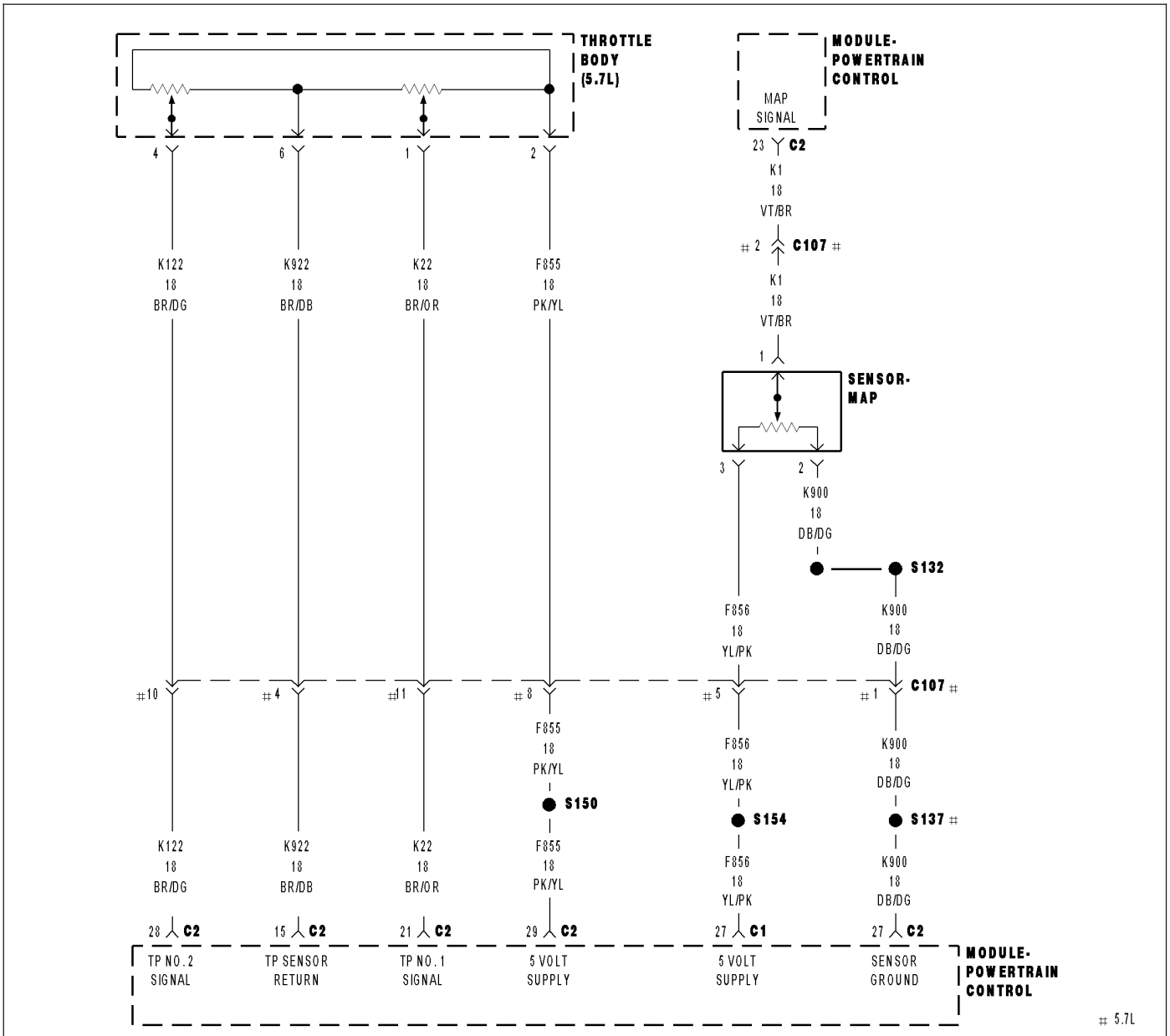
Start the engine.

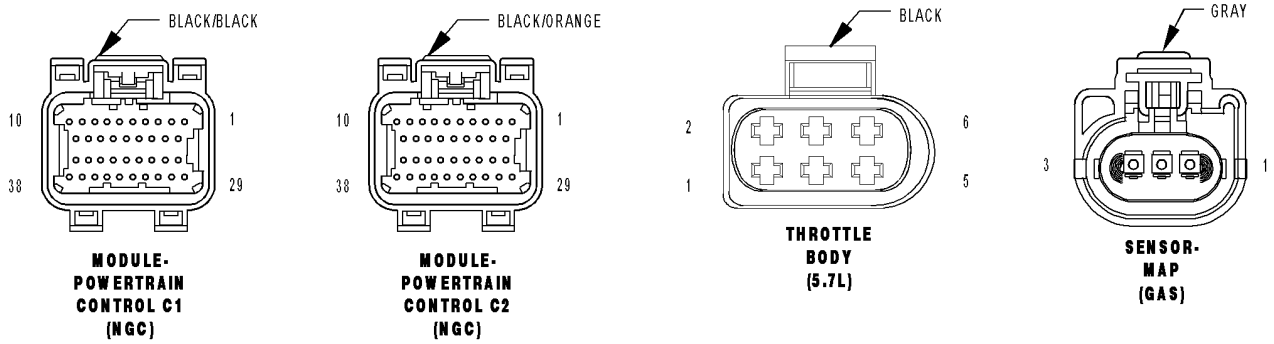
Does the DTC return?

Yes >> Replace the APPS Assembly per Service Information. After installation is complete, use a scan tool and select the ETC RELEARN function.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION)





81455202

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and engine running with no MAP Sensor DTCs.
- **Set Condition:**
  A large vacuum leak has been detected or both of the TP Sensors have failed based on their position being 2.5 volts and the calculated MAP value is less than the actual MAP minus an Offset value. One trip fault and the code will set within 5 seconds. ETC light will flash.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP SENSOR RETURN CIRCUIT
MAP SENSOR
TP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a vacuum leak.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Fuel System Lean or Rich, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to limit the maximum engine speed if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold and Throttle body for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation or any vacuum leaks.

Inspect the MAP Sensor for proper installation.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, perform the Throttle Follower Test.

TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.

TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

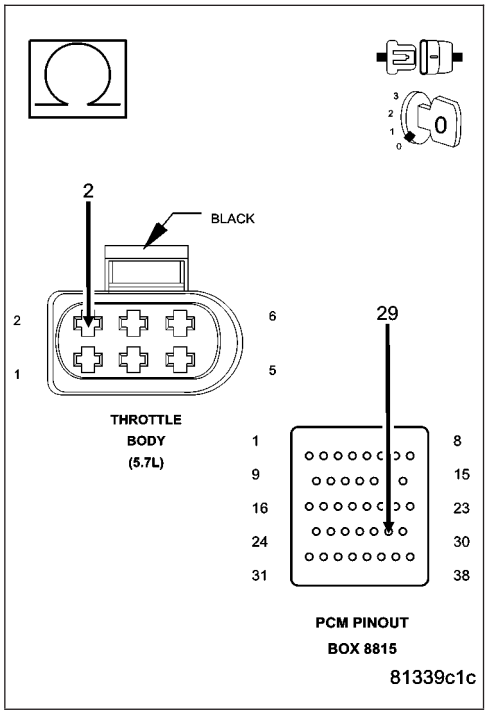
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance above 100 ohms?

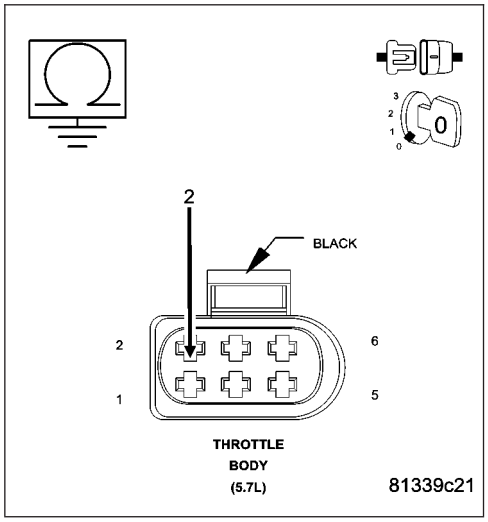
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit between the appropriate terminals of special tool #8815.



Is the resistance above 100 ohms?

Yes >> Go To 7

No >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

7. TP SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

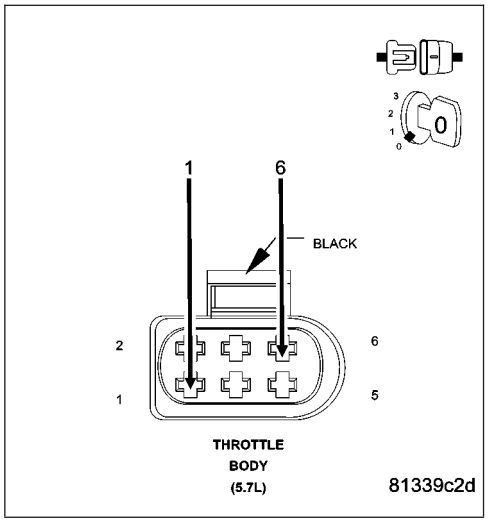
With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.

TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.

Connect a jumper wire between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

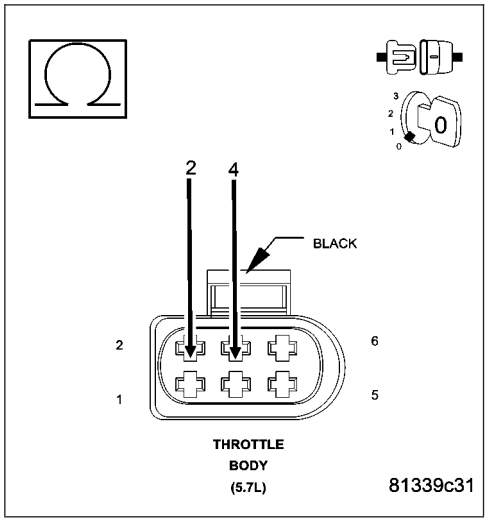


Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes >> Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

8. RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

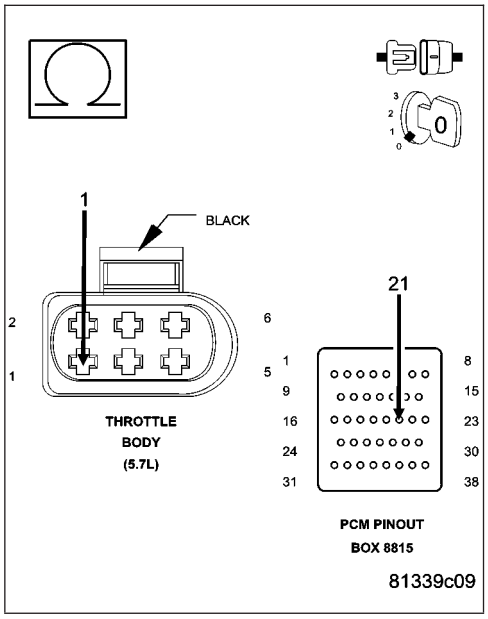
Measure the resistance of the (K22) and (K122) TP Signal circuits from the Throttle Body harness connector to the appropriate terminals of special tool #8815.

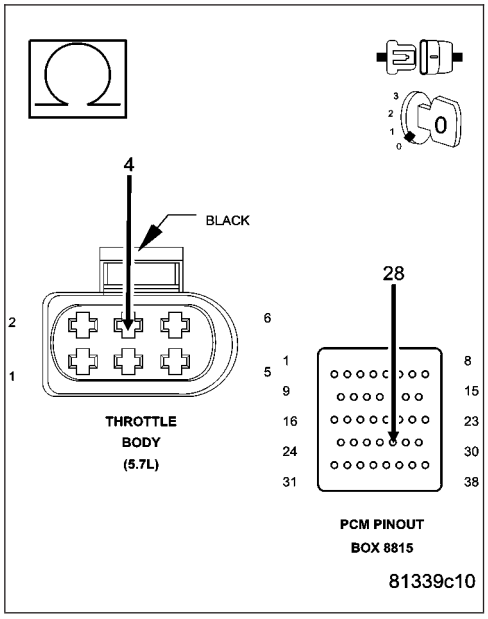
Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) or (K122) TP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

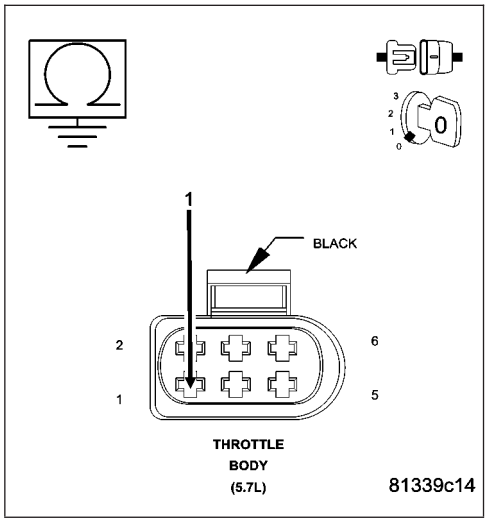
9. TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

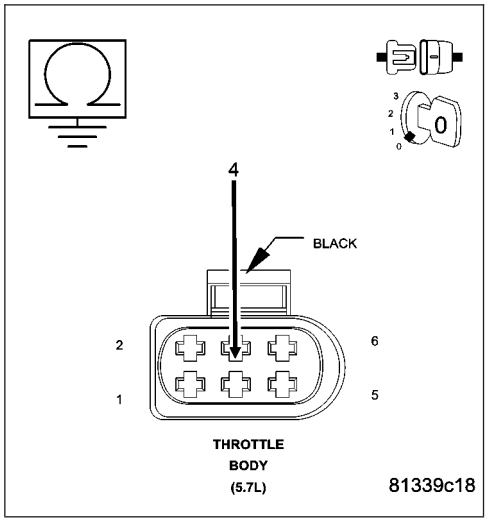
Measure the resistance between ground and the (K22) and (K122) TP Signal circuits at the appropriate terminals of special tool #8815.

Is the resistance above 100 ohms for each circuit?

Yes >> Go To 10

No >> Repair the short to ground in the (K22) or (K122) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

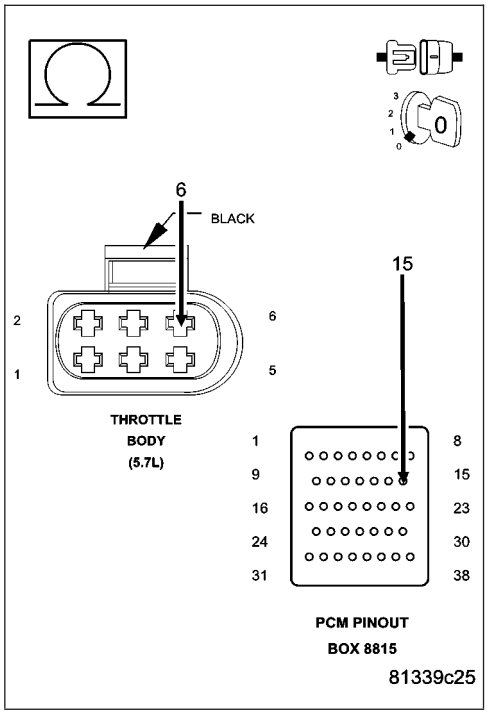




P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

10. RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

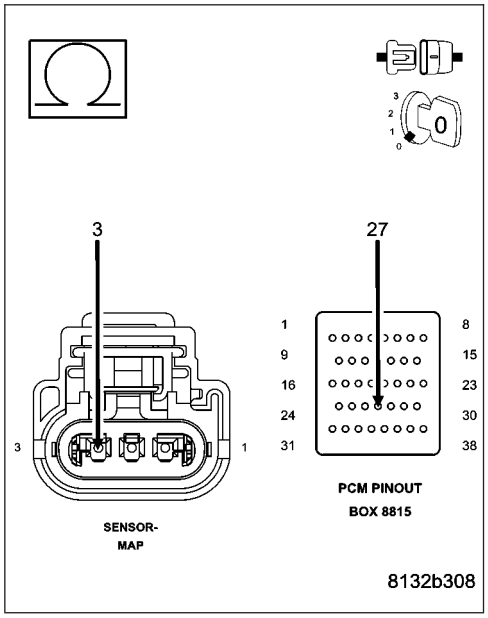
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

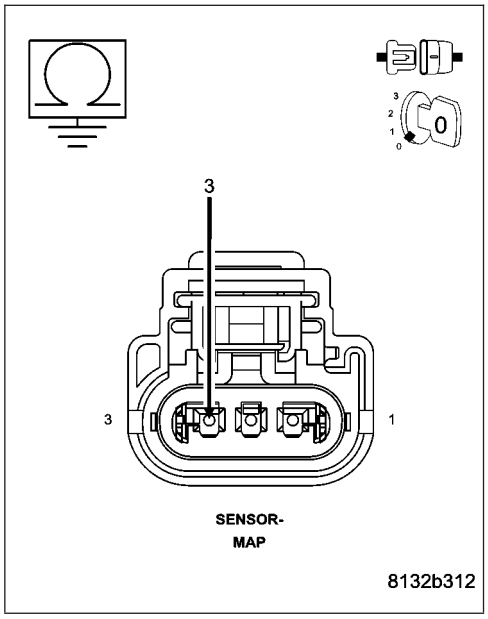
Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

13. MAP SENSOR

Connect the C1 PCM harness connector.

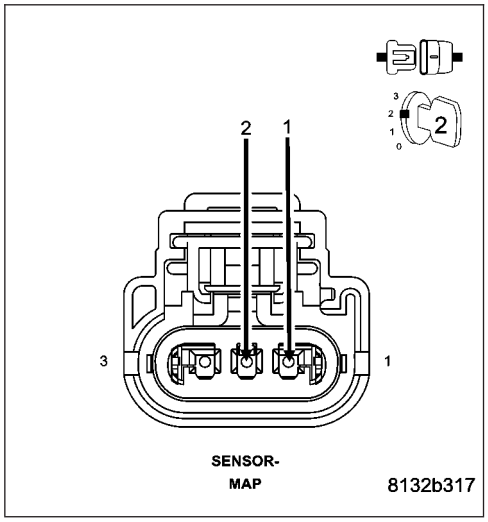
Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

Cycle the ignition switch from off to on.

With a scan tool, monitor the MAP Sensor voltage.



Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.

P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

14. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

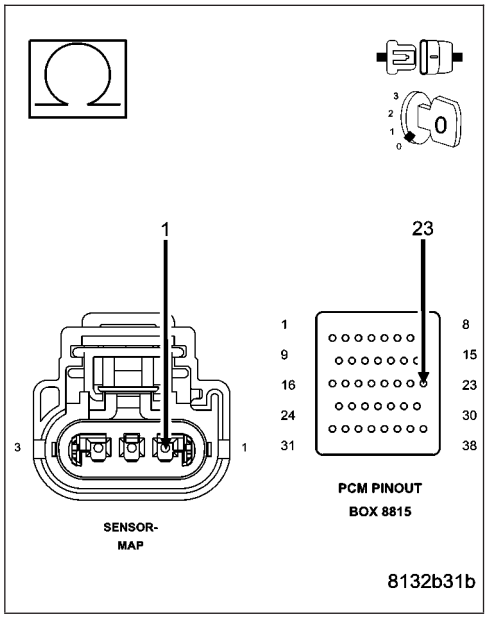
Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

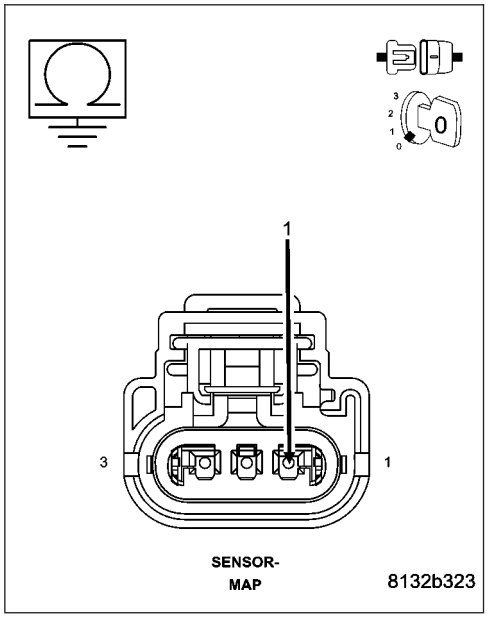
Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 16

No >> Repair the short to ground in the (K1) MAP Signal circuit.

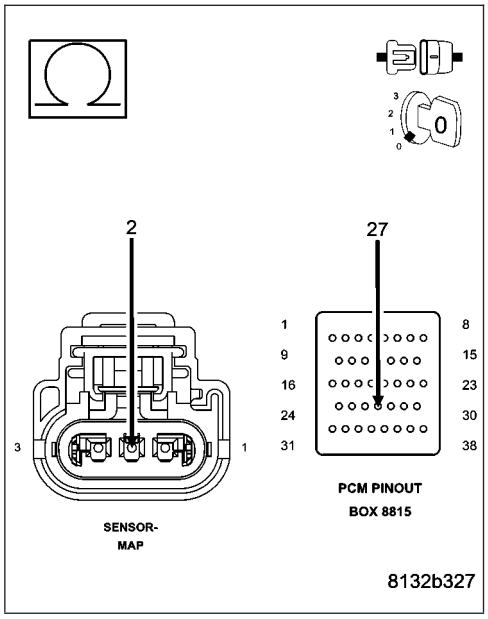
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2172-HIGH AIRFLOW/VACUUM LEAK DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

16. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

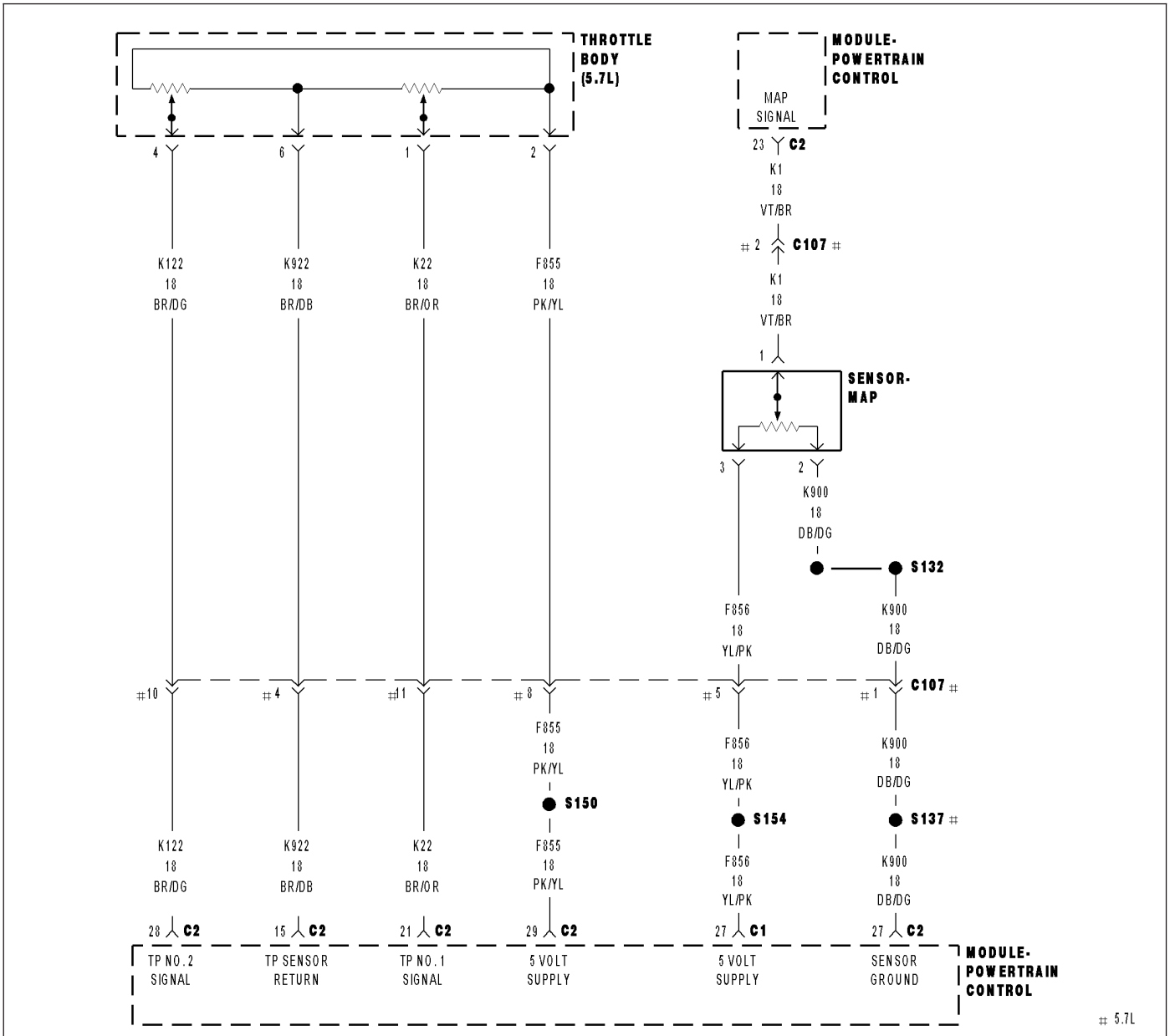
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

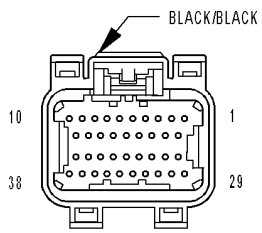
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

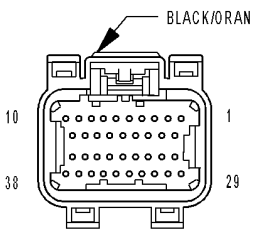
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION)

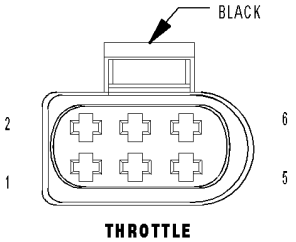




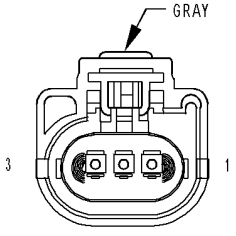
MODULE- POWERTRAIN CONTROL C1 (NGC)



MODULE- POWERTRAIN CONTROL C2 (NGC)



THROTTLE BODY (5.7L)



SENSOR- MAP (GAS)

81455202

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and engine running with no MAP Sensor DTCs.
- **Set Condition:**
  A large vacuum leak has been detected or both of the TP Sensors have failed based on their position being 2.5 volts and the calculated MAP value is less than the Gas Flow Adaptation value is too high. One trip fault the code will set within 5 seconds. ETC light will flash.

Possible Causes
VACUUM LEAK
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP SENSOR RETURN CIRCUIT
MAP SENSOR
TP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a vacuum leak.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Oxygen Sensor, Fuel related, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

2. VACUUM LEAK

NOTE: This code is enabled on engines with a plastic intake manifold and is intended to limit the maximum engine speed if a large crack occurs.

NOTE: A large vacuum leak is most likely the cause of this DTC.

Inspect the Intake Manifold and Throttle body for leaks and cracks.

Inspect the Power Brake Booster for any vacuum leaks.

Inspect the PCV system for proper operation or any vacuum leaks.

Inspect the MAP Sensor for proper installation.

Were any vacuum leaks found?

Yes >> Repair the vacuum leak as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.

With a scan tool, monitor the MAP Sensor voltage.

Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, perform the Throttle Follower Test.

TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.

TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

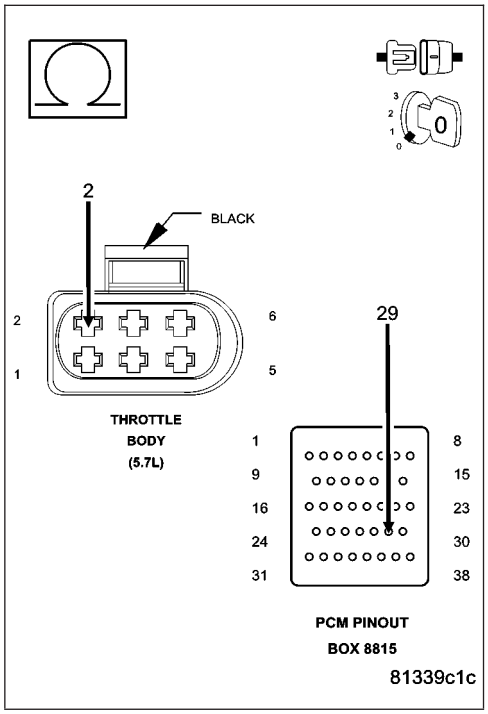
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

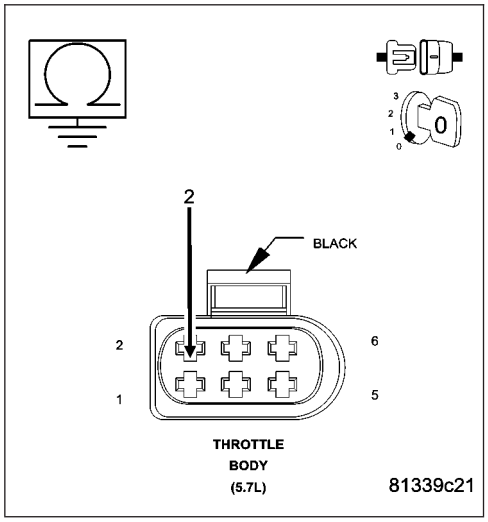
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit between the appropriate terminals of special tool #8815.



Is the resistance above 100 ohms?

Yes >> Go To 7

No >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

7. TP SENSOR

Connect the C2 PCM harness connector.

Ignition on, engine not running.

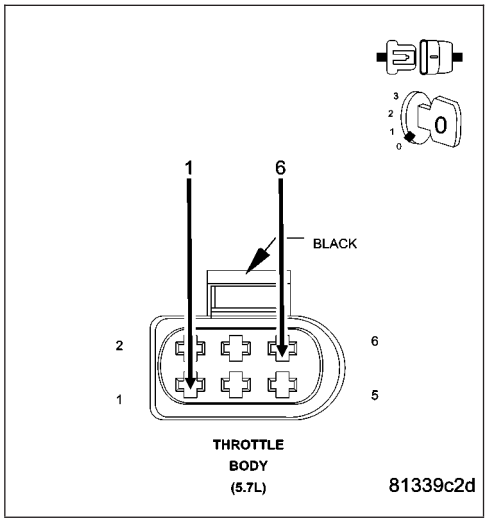
With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.

TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.

Connect a jumper wire between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

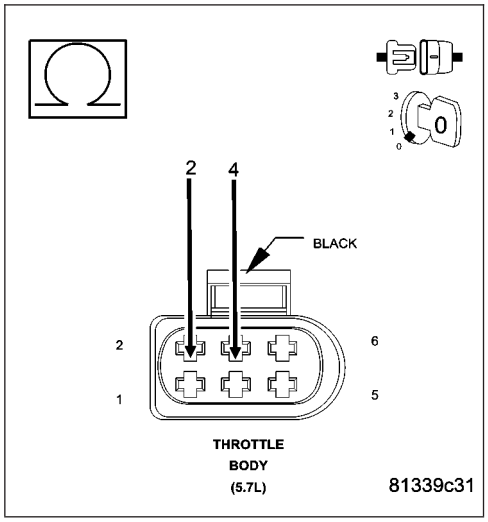


Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes >> Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

8. RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

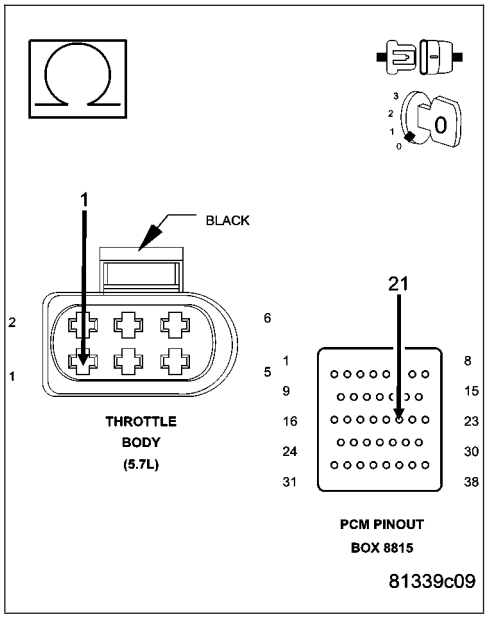
Measure the resistance of the (K22) and (K122) TP Signal circuits from the Throttle Body harness connector to the appropriate terminals of special tool #8815.

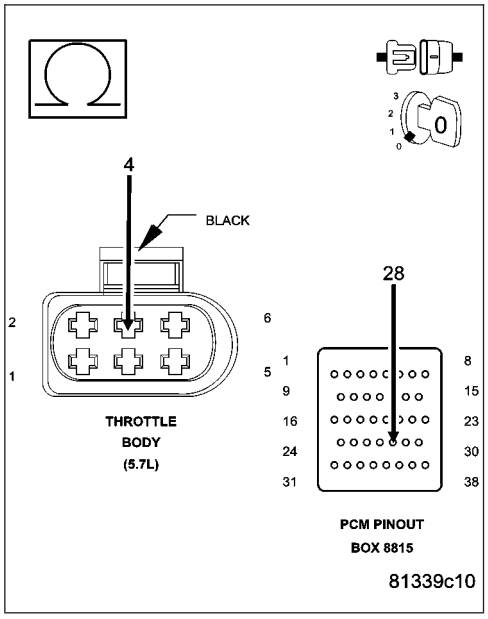
Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) or (K122) TP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

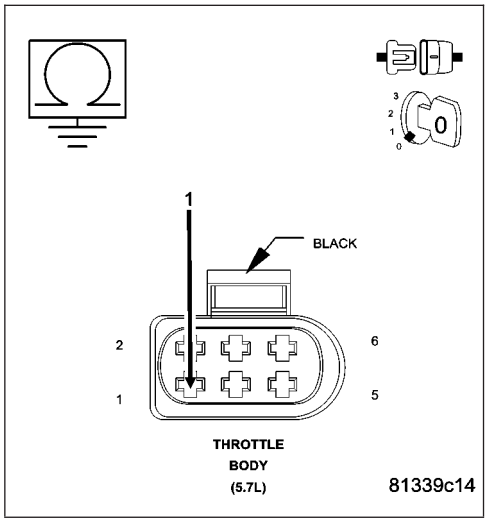
9. TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

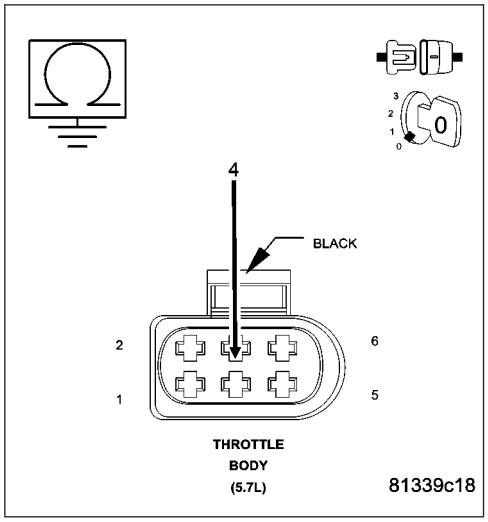
Measure the resistance between ground and the (K22) and (K122) TP Signal circuits at the appropriate terminals of special tool #8815.

Is the resistance above 100k ohms for each circuit?

Yes >> Go To 10

No >> Repair the short to ground in the (K22) or (K122) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

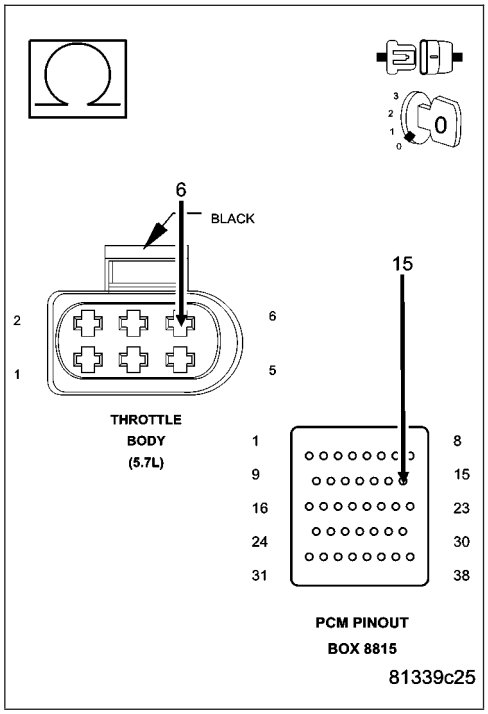




P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

10. RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

11. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

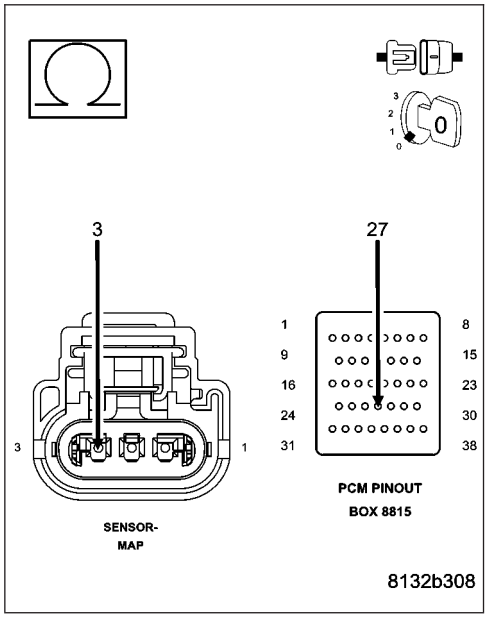
Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

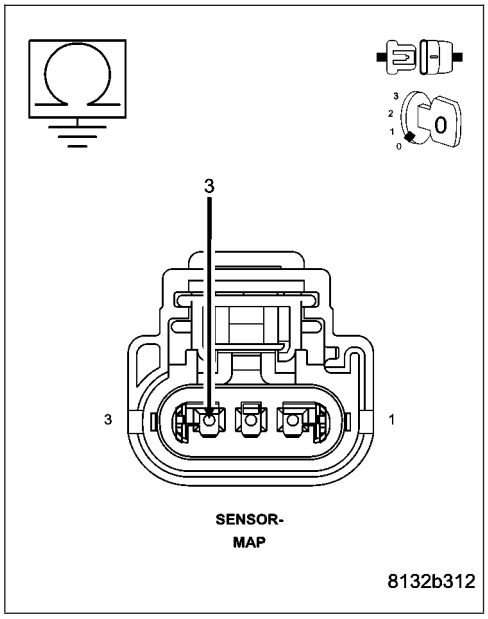
12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. MAP SENSOR

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

Cycle the ignition switch from off to on.

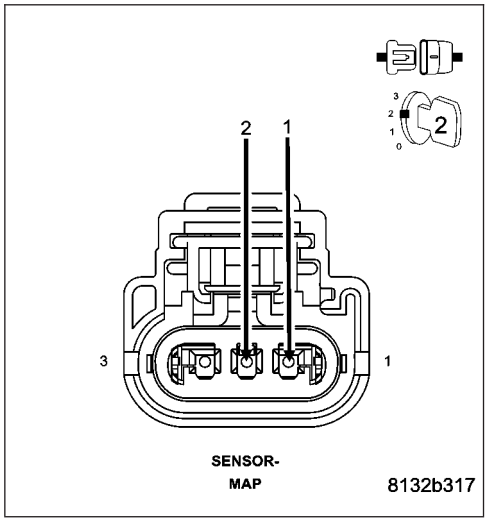
With a scan tool, monitor the MAP Sensor voltage.

Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.



P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

14. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

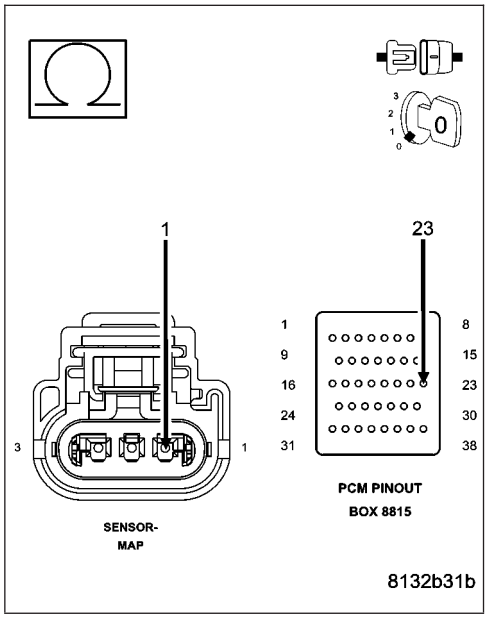
Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

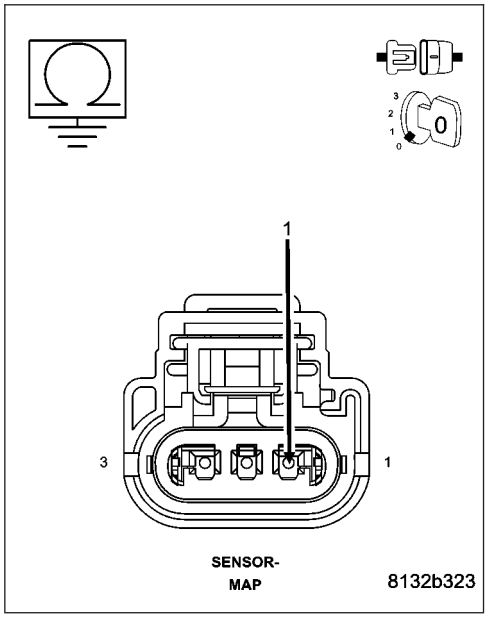
Measure the resistance between ground and the (K1) MAP Signal circuit at the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 16

No >> Repair the short to ground in the (K1) MAP Signal circuit.

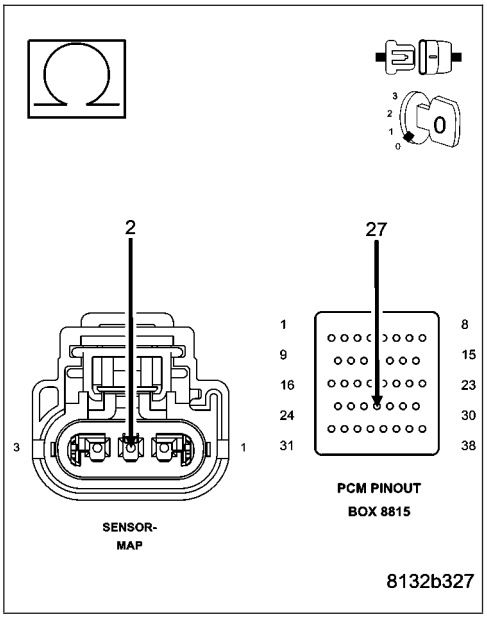
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2173-HIGH AIRFLOW/VACUUM LEAK DETECTED (SLOW ACCUMULATION) (CONTINUED)

16. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

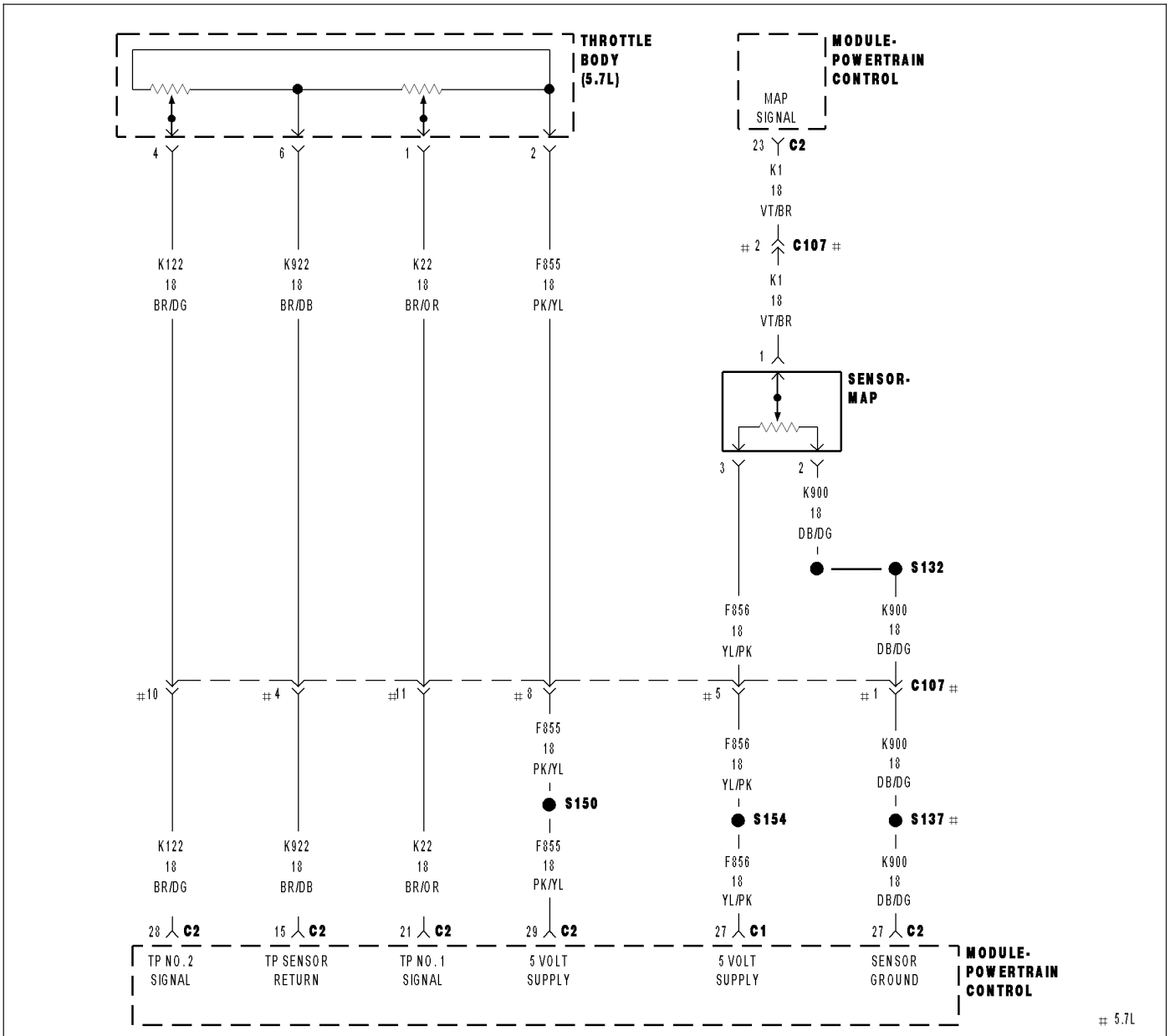
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

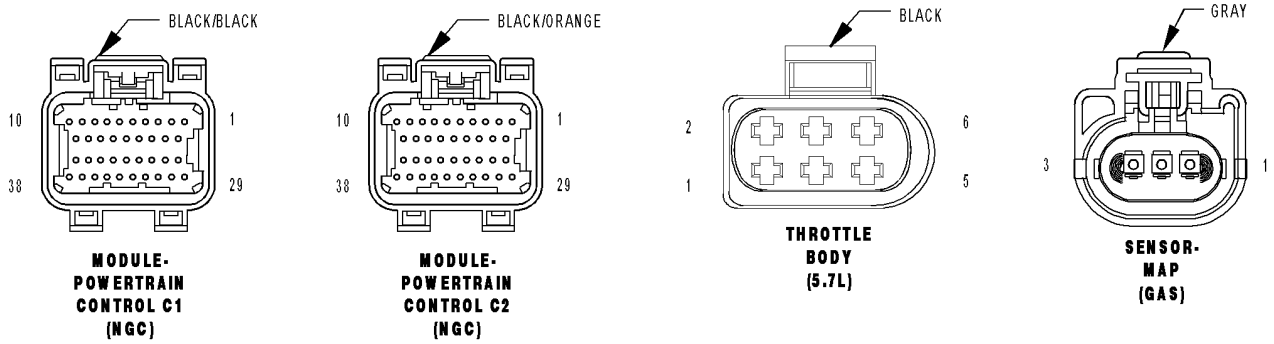
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION)





814552b2

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and engine running with no MAP Sensor DTCs.
- **Set Condition:**
  PCM calculated MAP value is greater than actual MAP value plus an offset value. One trip fault. Three good trips to turn of the mil. ETC light will flash.

Possible Causes
RESTRICTED AIR INLET SYSTEM
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP SENSOR RETURN CIRCUIT
MAP SENSOR
TP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a plugged intake air system or Dirty Throttle Body. Check for TSB's before continuing.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Fuel System Lean or Rich, or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Question the customer about weather conditions, as ICE build up on the blade can cause this fault when ambient is around +4 to -10 Celsius range.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

2. RESTRICTED AIR INLET SYSTEM

Turn the ignition off.
Remove the Air Cleaner Assembly.
Remove the Air Filter.
Inspect the Throttle Body opening for signs of any foreign materials.
Check the intake tube / aircleaner for obstructions - include snow packing questions to customer.

Were any restrictions found?

Yes >> Repair the restriction as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.
With a scan tool, perform the Throttle Follower Test.
TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.
TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

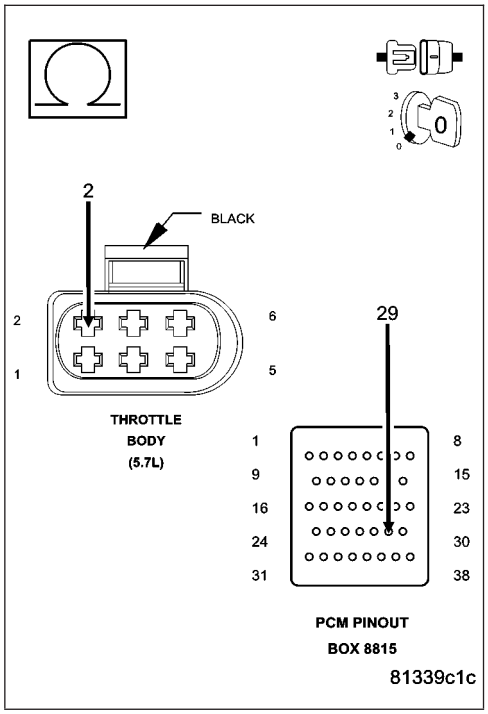
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

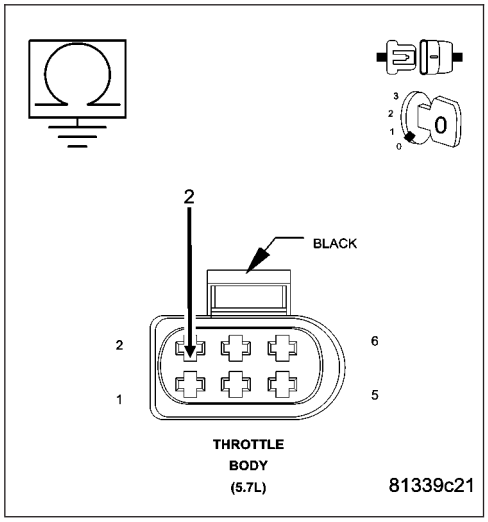
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit between the appropriate terminals of special tool #8815.



Is the resistance above 100k ohms?

Yes >> Go To 7

No >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

7. TP SENSOR

Connect the PCM harness connectors.

Ignition on, engine not running.

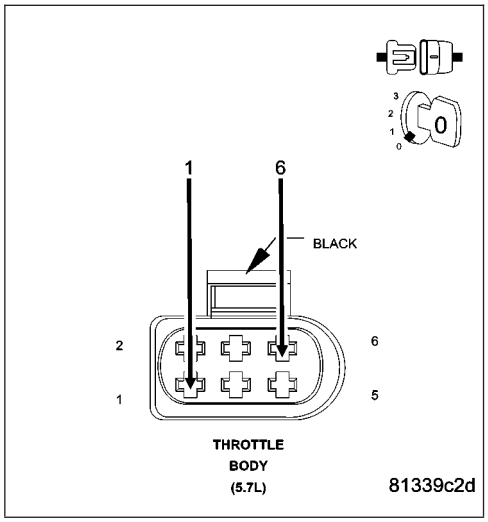
With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.

TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.

Connect a jumper wire between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

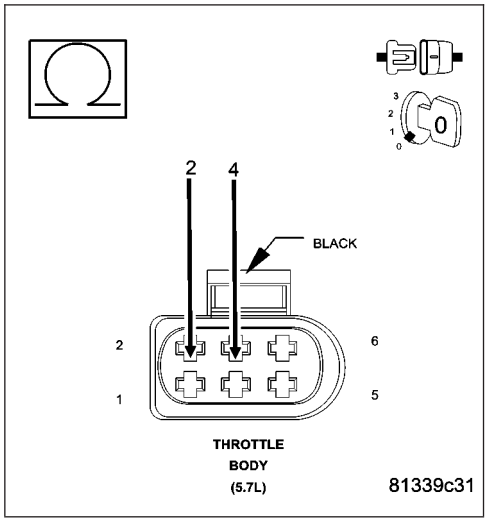


Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes >> Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

8. RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

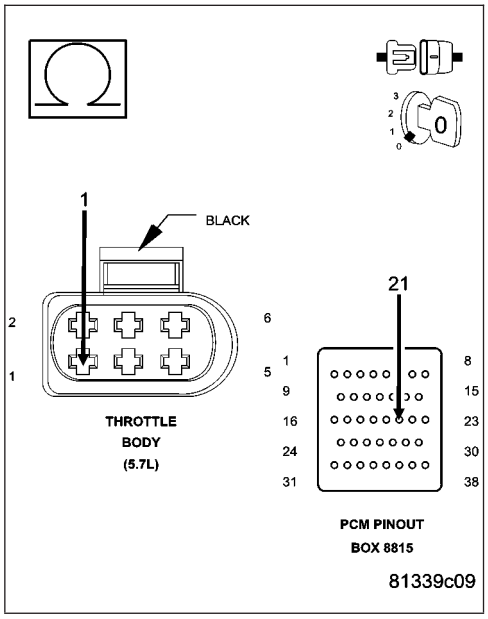
Measure the resistance of the (K22) and (K122) TP Signal circuits from the Throttle Body harness connector to the appropriate terminals of special tool #8815.

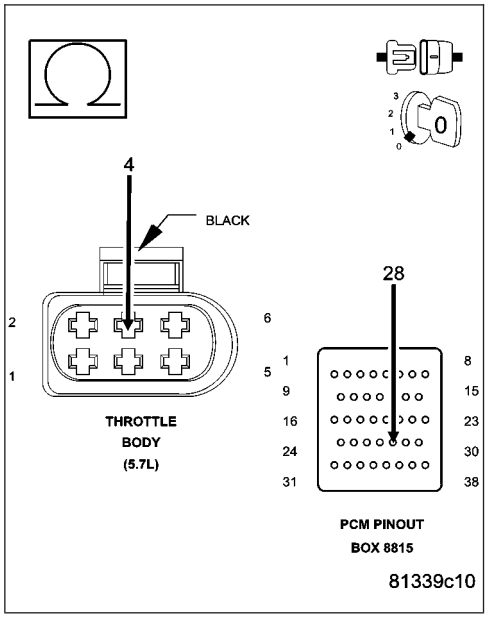
Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) or (K122) TP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

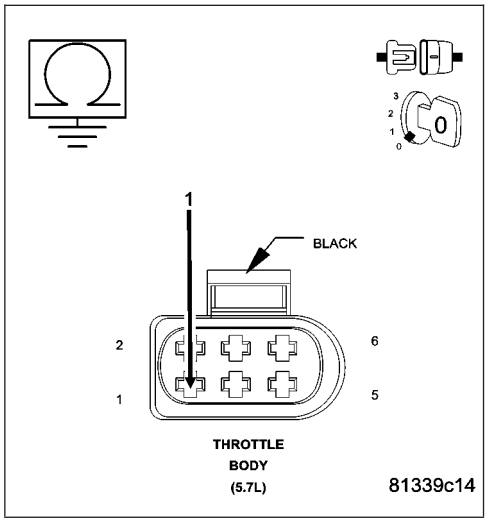
9. TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

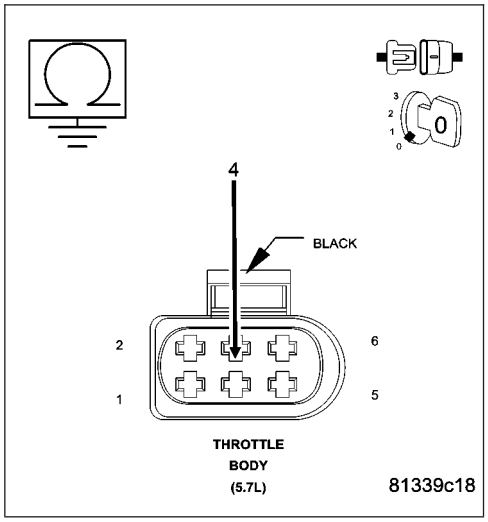
Measure the resistance between ground and the (K22) and (K122) TP Signal circuits at the appropriate terminals of special tool #8815.

Is the resistance above 100k ohms for each circuit?

Yes >> Go To 10

No >> Repair the short to ground in the (K22) or (K122) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

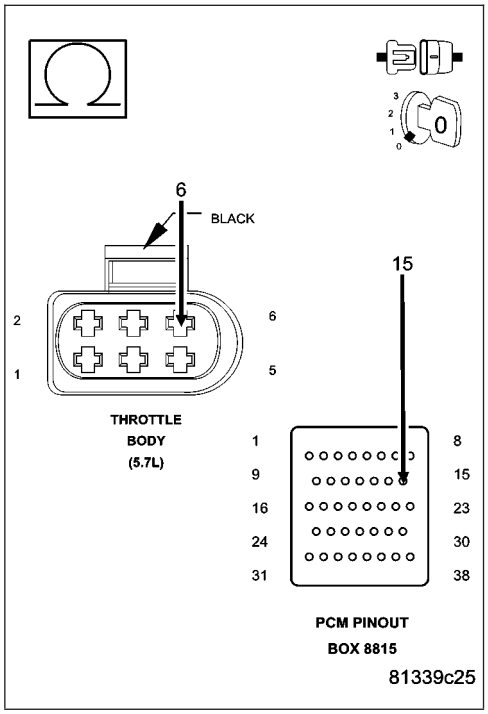
10. RESISTANCE IN (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



11. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

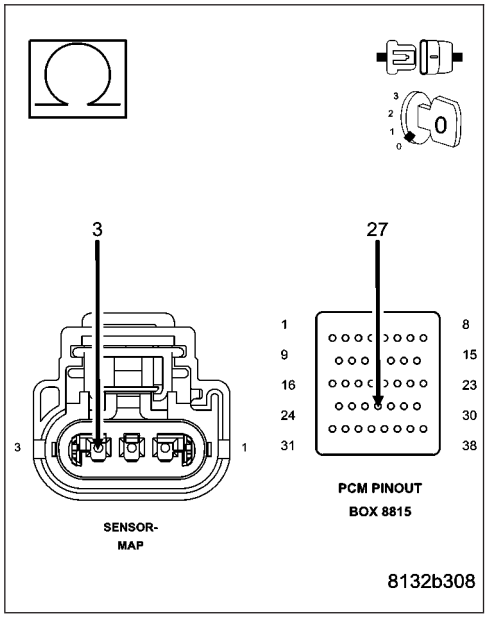
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

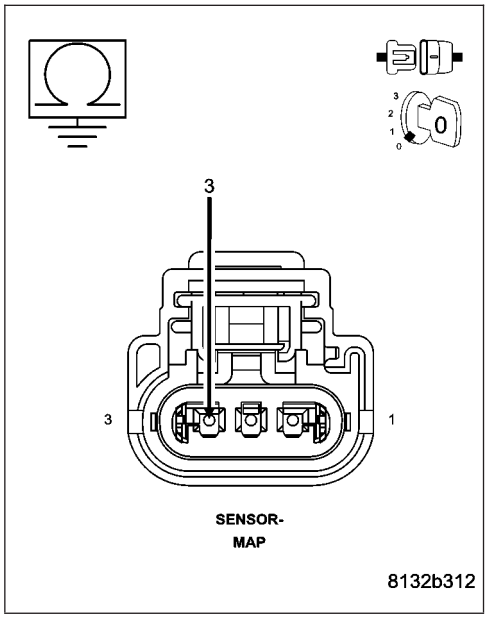
12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. MAP SENSOR

Connect the PCM harness connectors.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.

Cycle the ignition switch from off to on.

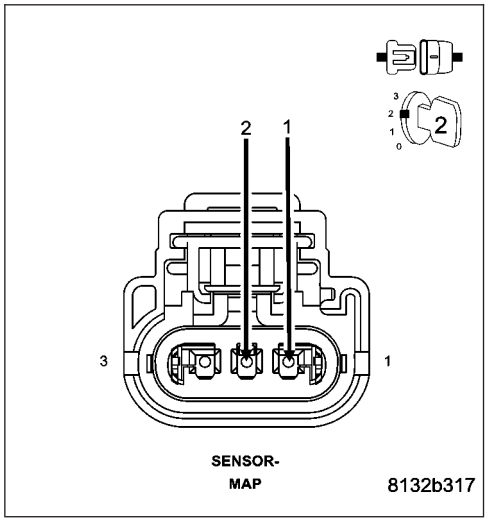
With a scan tool, monitor the MAP Sensor voltage.

Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.



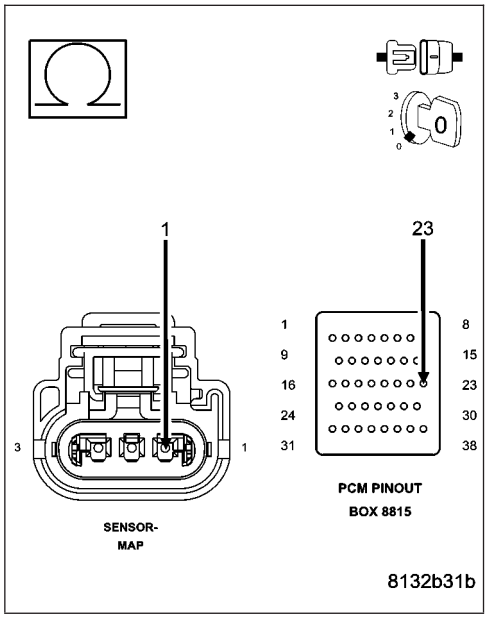
P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

14. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

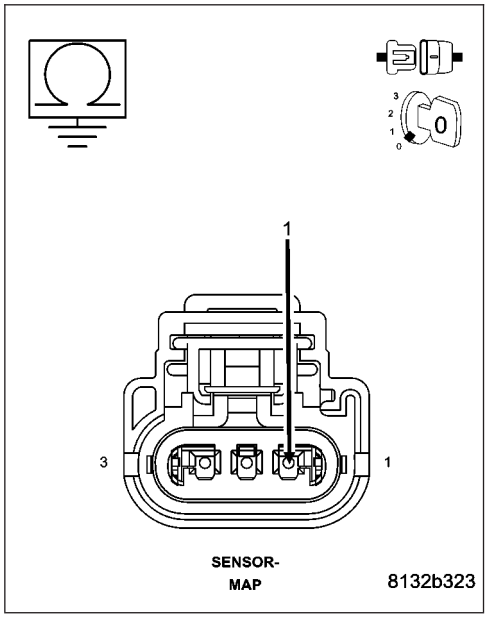
Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 16

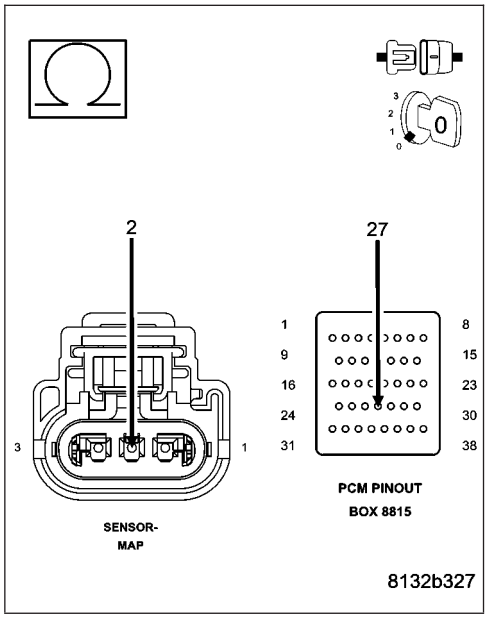
No >> Repair the short to ground in the (K1) MAP Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2174-LOW AIRFLOW/RESTRICTION DETECTED (INSTANTANEOUS ACCUMULATION) (CONTINUED)

16. RESISTANCE IN (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

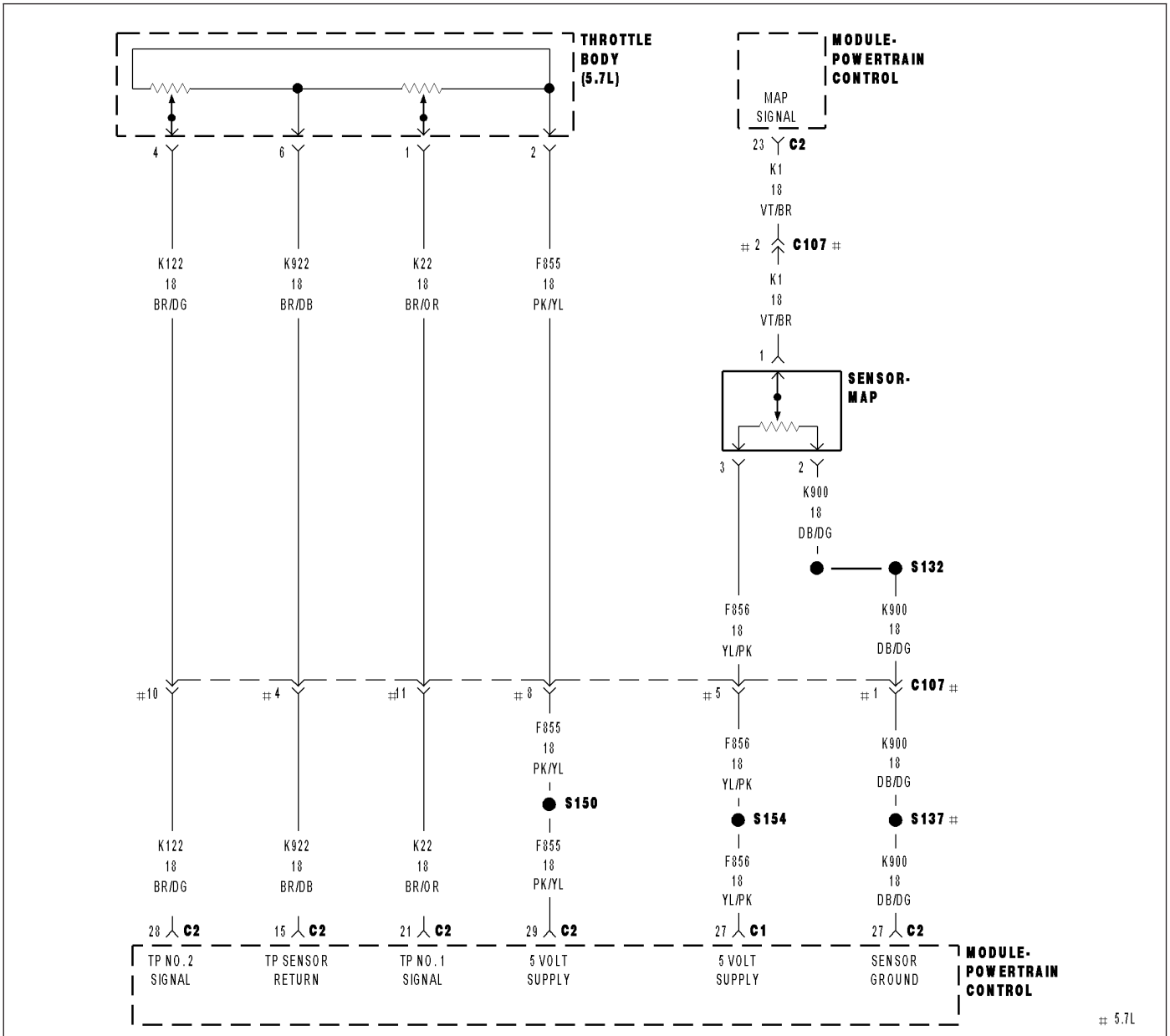
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

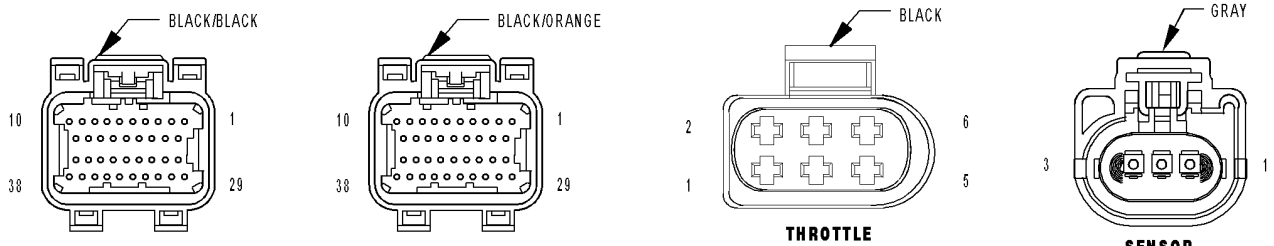
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION)





P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and engine running with no MAP Sensor DTCs.
- **Set Condition:**
  PCM calculated MAP value is greater than actual MAP value plus an offset value. One trip fault and the code will set within 5 seconds. Three good trips to turn of the mil. ETC light will flash.

Possible Causes
RESTRICTED AIR INLET SYSTEM
RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN (K900) SENSOR GROUND CIRCUIT
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT
TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K922) TP SENSOR RETURN CIRCUIT
MAP SENSOR
TP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: The most likely cause of this DTC is a plugged intake air system or dirty Throttle Body. Check for any TSB's before continuing.

NOTE: Diagnose any 5-Volt Supply, TP Sensor, Oxygen Sensor, Fuel related or MAP Sensor DTCs before continuing.

NOTE: The throttle plate should be free from binding and carbon build up.

NOTE: Question the customer about weather conditions, as ICE build up on the blade can cause this fault when ambient is around +4 to -10 Celsius range.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

2. RESTRICTED AIR INLET SYSTEM

Turn the ignition off.
Remove the Air Cleaner Assembly.
Remove the Air Filter.
Inspect the Throttle Body opening for signs of any foreign materials.
Check the intake tube / air cleaner for obstructions - include snow packing questions to customer.

Were any restrictions found?

Yes >> Repair the restriction as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. MAP SENSOR OPERATION

Start the engine.
With a scan tool, monitor the MAP Sensor voltage.
Snap the Accelerator pedal.

Does the MAP Sensor voltage vary from below 2.0 volts at idle to above 3.5 volts at Wide Open Throttle?

Yes >> Go To 4

No >> Go To 11

---

4. TP SENSOR OPERATION

Ignition on, engine not running.
With a scan tool, perform the Throttle Follower Test.
TP Sensor No.1 should start at approximately 0.8 of a volt and increase to 4.2 volts.
TP Sensor No.2 should start at approximately 4.2 volts and decrease to 0.8 of a volt.

Is the voltage transition smooth between the appropriate values?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

5. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

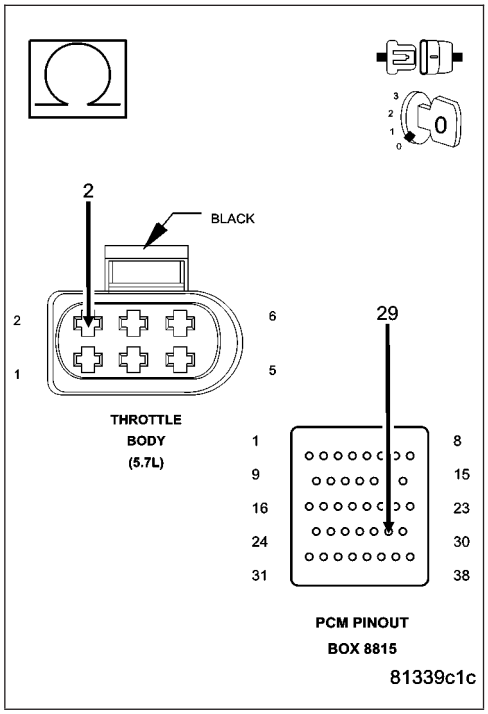
Turn the ignition off.

Disconnect the Throttle Body harness connector.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (F855) 5-volt Supply circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 100 ohms?

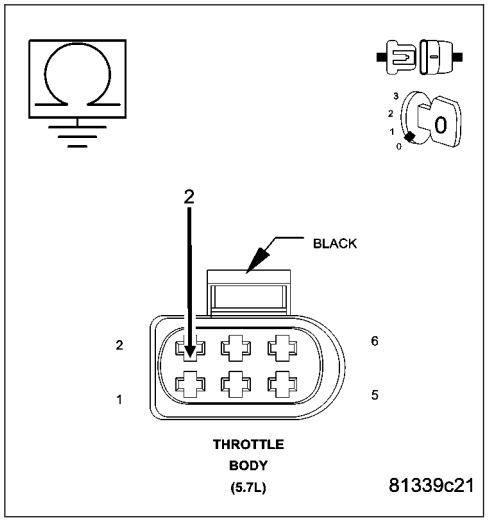
Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and (F855) 5-volt Supply circuit between the appropriate terminals of special tool #8815.



Is the resistance above 100k ohms?

Yes >> Go To 7

No >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

7. TP SENSOR

Connect the PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the TP Sensor voltage.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K922) Sensor Return circuit in the Throttle Body harness connector.

TP Sensor No.1 voltage should start at approximately 4.8 volts and decrease to 0.2 of a volt.

Connect a jumper wire between the (K122) TP Sensor No.2 Signal circuit and the (F855) 5-volt Supply circuit in the Throttle Body harness connector.

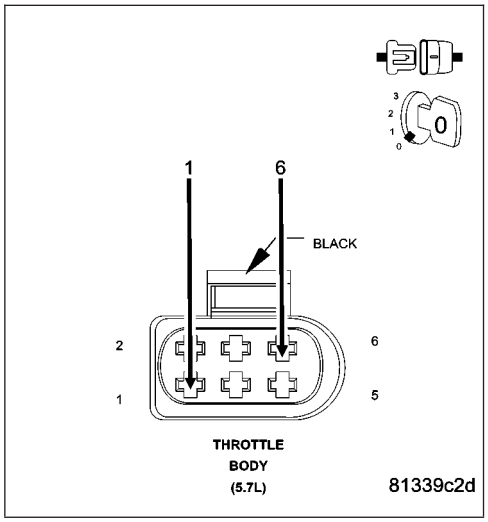
TP Sensor No.2 voltage should start at approximately 0 volts and increase to 4.8 to 5.2 volts.

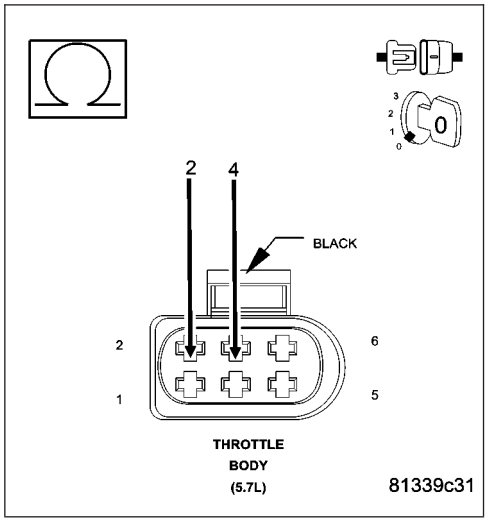
Does the TP Sensor voltage change to the appropriate voltage with the jumper wire installed?

Yes >> Disconnect the Battery before replacing the Throttle Body Assembly. Replace the Throttle Body Assembly. After installation is complete, use a scan tool and select the ETC RELEARN function

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8





P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

8. RESISTANCE IN THE TP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the C2 PCM harness connector.

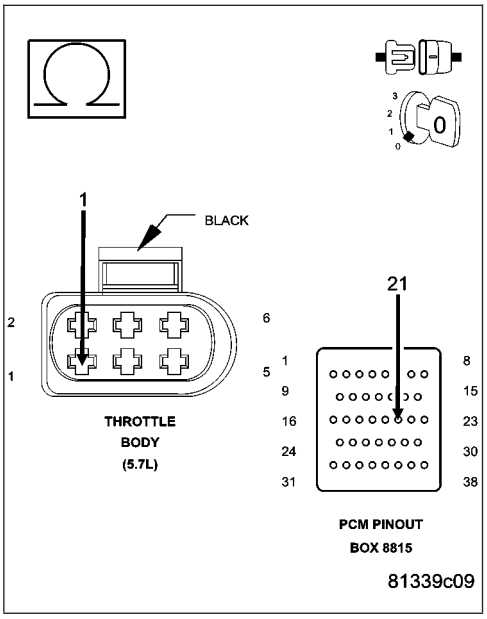
Measure the resistance of the (K22) and (K122) TP Signal circuits from the Throttle Body harness connector to the appropriate terminals of special tool #8815.

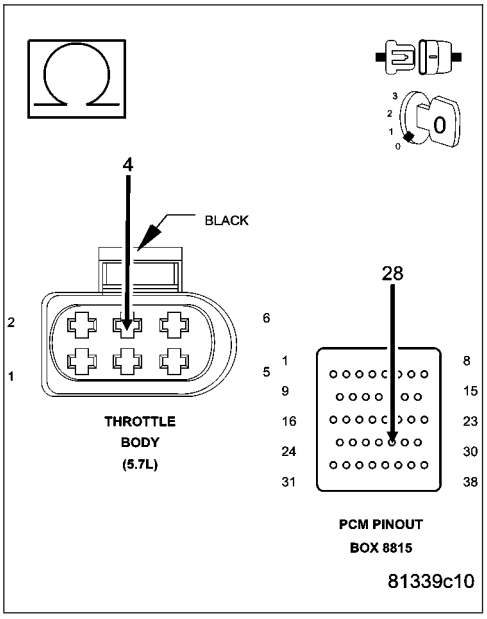
Is the resistance below 5.0 ohms for each circuit?

Yes >> Go To 9

No >> Repair the excessive resistance in the (K22) or (K122) TP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

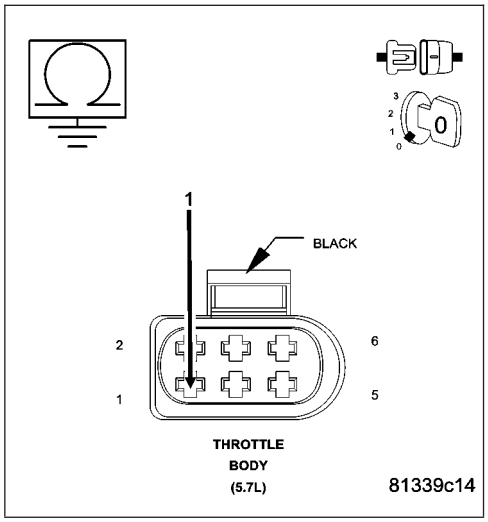
9. TP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

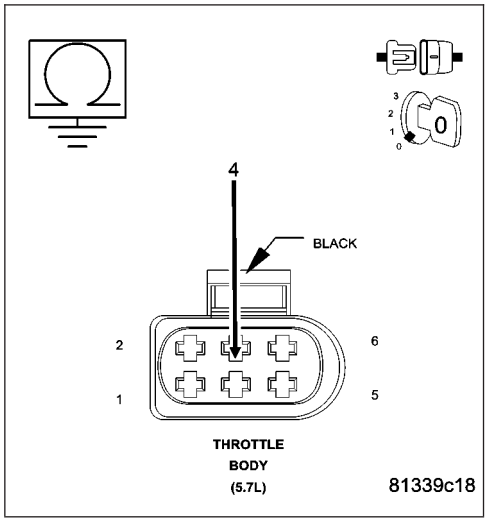
Measure the resistance between ground and the (K22) and (K122) TP Signal circuits at the appropriate terminals of special tool #8815.

Is the resistance above 100k ohms for each circuit?

Yes >> Go To 10

No >> Repair the short to ground in the (K22) or (K122) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





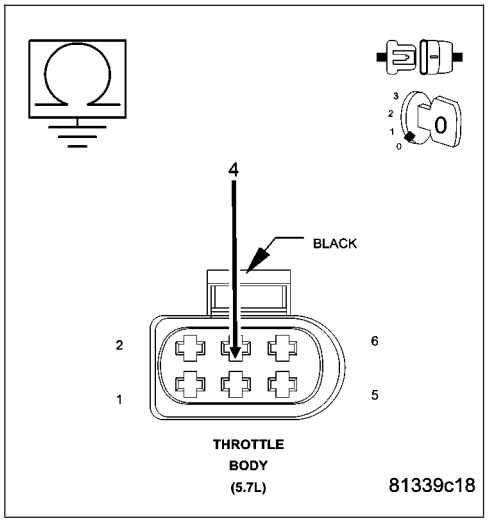
10. RESISTANCE IN THE (K922) SENSOR RETURN CIRCUIT

Measure the resistance of the (K922) Sensor Return circuit from the Throttle Body harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K922) Sensor Return circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

11. RESISTANCE IN THE (F856) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

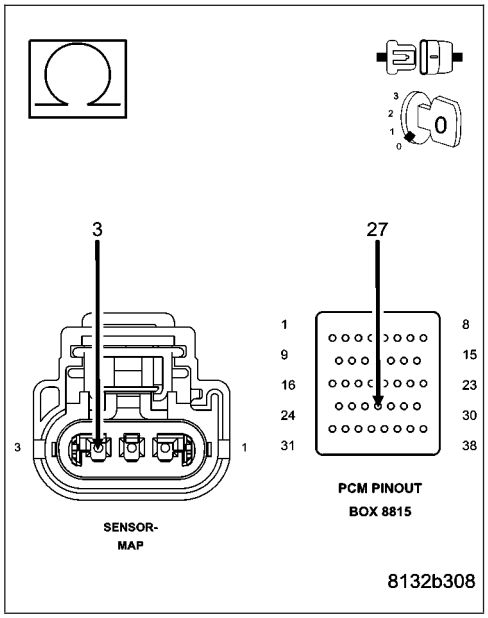
Measure the resistance of the (F856) 5-volt Supply circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the excessive resistance in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



12. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

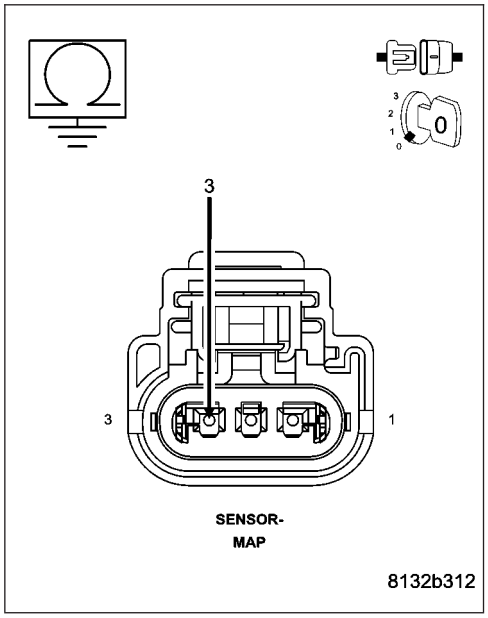
Measure the resistance between ground and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 13

No >> Repair the short to ground in the (F856) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

13. MAP SENSOR

Connect the C1 PCM harness connector.

Ignition on, engine not running.

With a scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit.

Cycle the ignition switch from off to on.

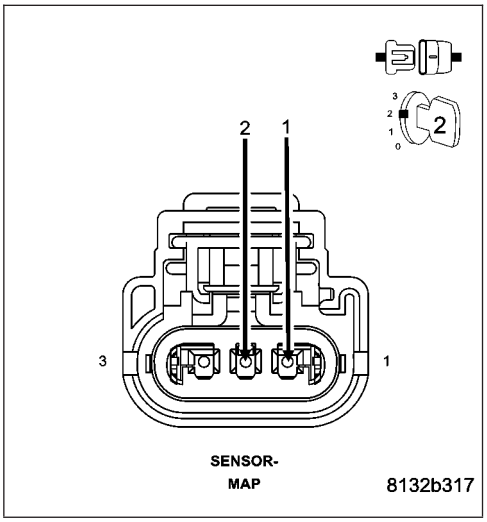
With a scan tool, monitor the MAP Sensor voltage.

Does the scan tool display MAP voltage from approximately 4.9 volts to below 0.5 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Remove the jumper wire before continuing.



14. RESISTANCE IN THE (K1) MAP SIGNAL CIRCUIT

Turn the ignition off.

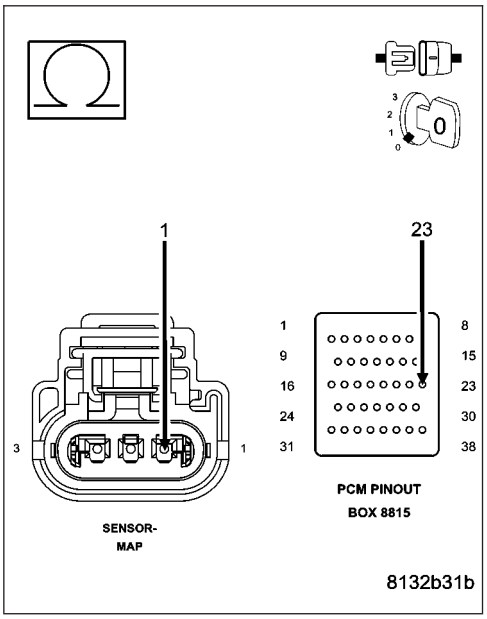
Disconnect the C2 PCM harness connector.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 15

No >> Repair the excessive resistance in the (K1) MAP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

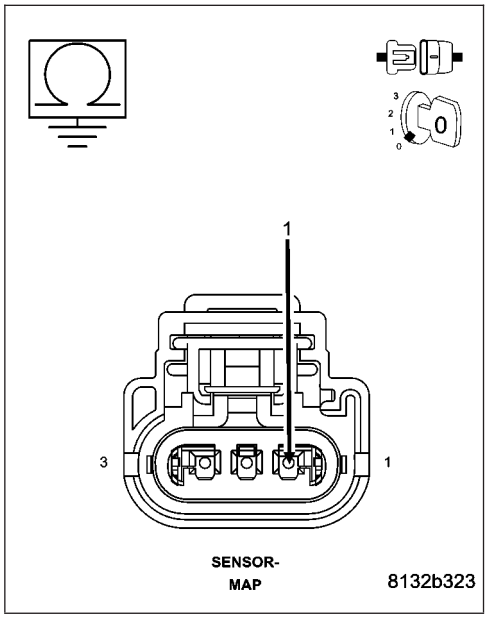
15. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance above 100k ohms?

Yes >> Go To 16

No >> Repair the short to ground in the (K1) MAP Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



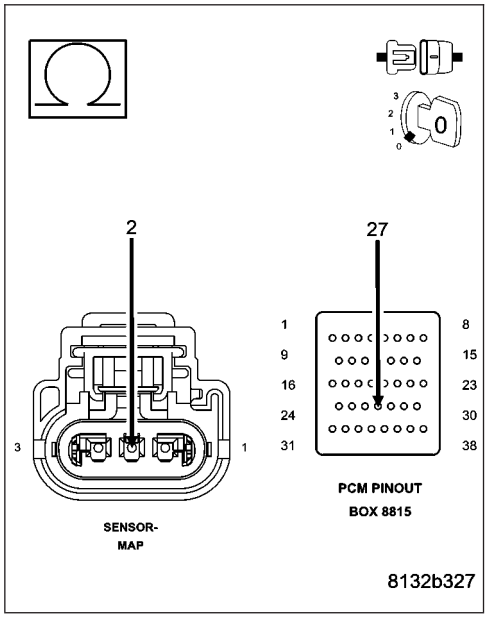
16. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 17

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2175-LOW AIRFLOW/RESTRICTION DETECTED (SLOW ACCUMULATION) (CONTINUED)

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

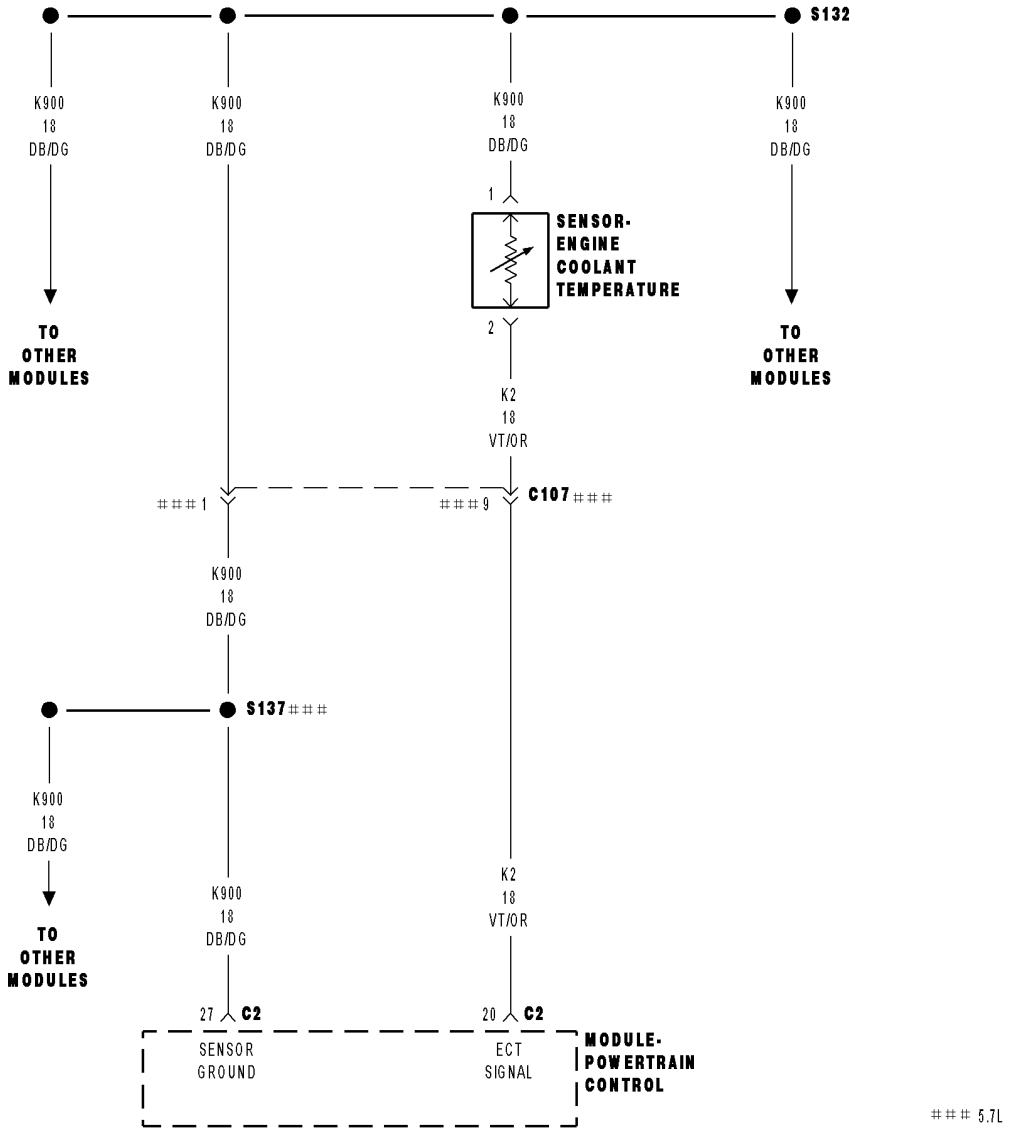
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

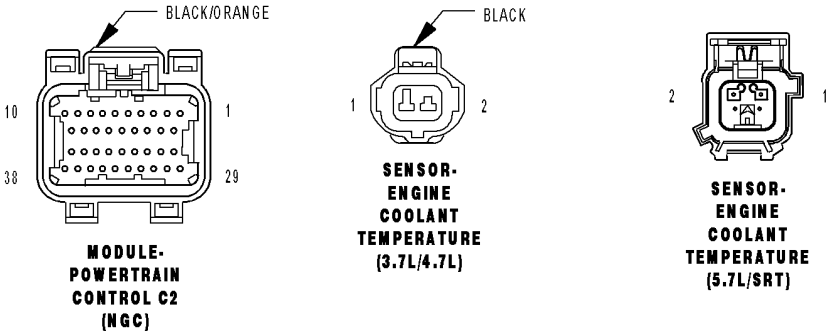
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2181-COOLING SYSTEM PERFORMANCE





81452d65

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on, Engine running, and no ECT DTCs present.
- **Set Condition:**
  PCM recognizes that the ECT has failed its self coherence test. The coolant temp should only change at a certain rate, if this rate is too slow or too fast this fault will set. Two trip fault. Three good trips to clear MIL. ETC light will illuminate on first trip failure.

Possible Causes
LOW COOLANT LEVEL
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
THERMOSTAT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

NOTE: If this code sets during extreme ambient temperatures, improper installation of a block heater could be the cause of this DTC.

With a scan tool, read DTCs.

Diagnose all other ECT and Cooling System codes before continuing.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

2. LOW COOLANT LEVEL

NOTE: If a Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Ensure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

NOTE: Need to make sure that no Cooling System DTCs are set or changes that would make the warm up much slower or much faster: broken water pump can set this, addition of aftermarket auxiliary cooler can set this DTC.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes >> Go To 3

No >> Inspect the vehicle for a coolant leak and add the necessary amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. THERMOSTAT

NOTE: This test works best if performed on a cold engine (cold soak).

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the Eng Coolant Tmp Deg on the scan tool should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 4

No >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

4. ECT SENSOR

Connect a jumper between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Turn the ignition off.

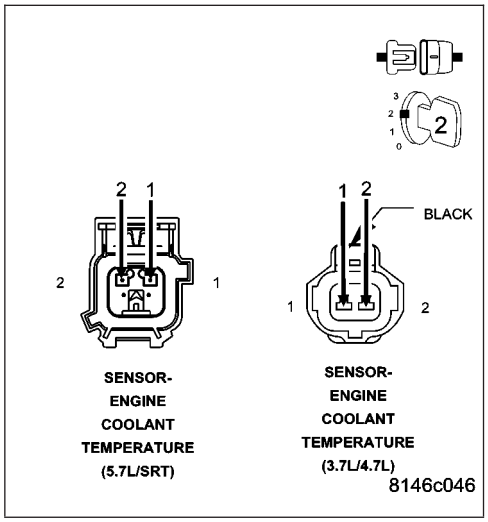
Disconnect the ECT Sensor harness connector.

With a scan tool, read the ECT voltage.

Is the voltage below 1.0 volt?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

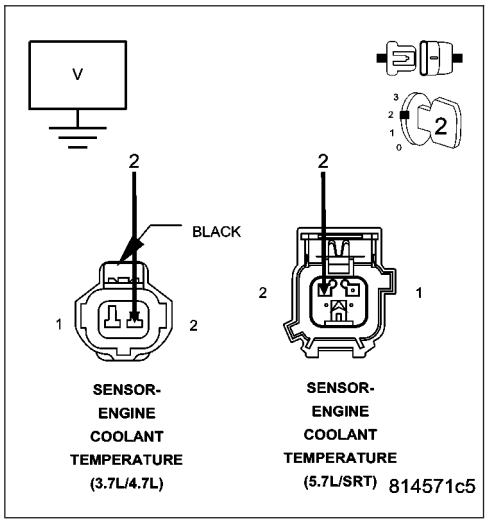
Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

6. (K2) ECT SIGNAL CIRCUIT OPEN

Turn the ignition off.

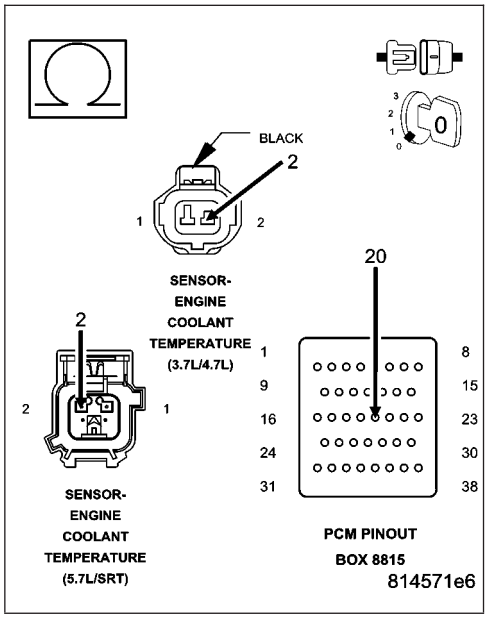
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



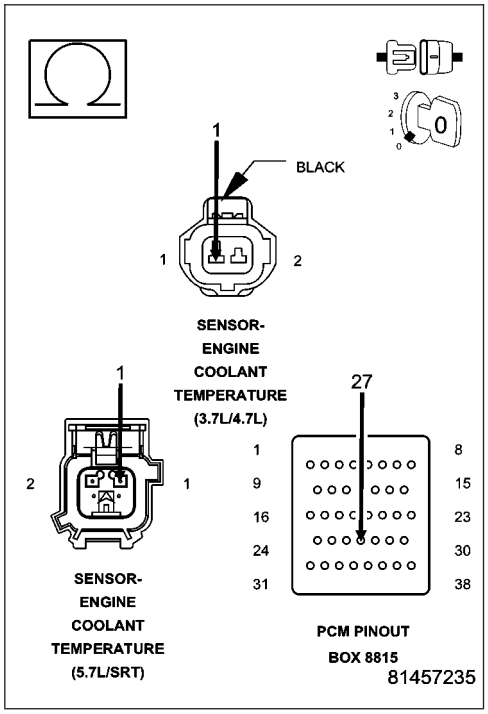
7. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

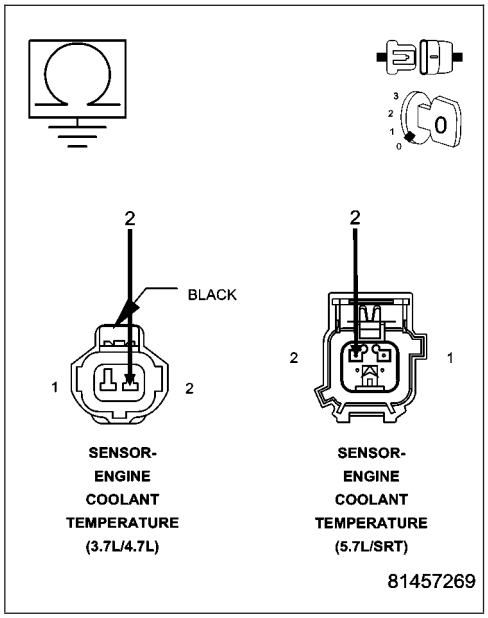
8. (K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



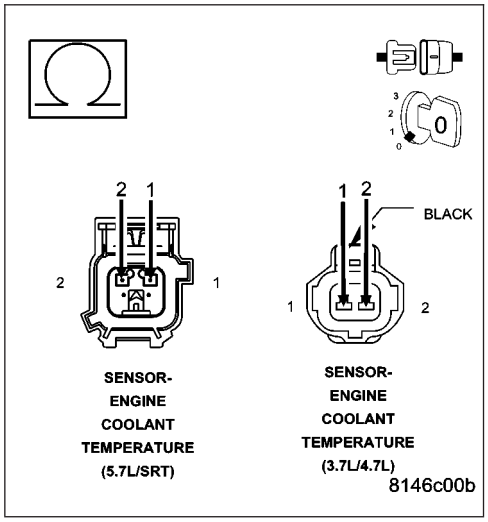
9. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



P2181-COOLING SYSTEM PERFORMANCE (CONTINUED)

10. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

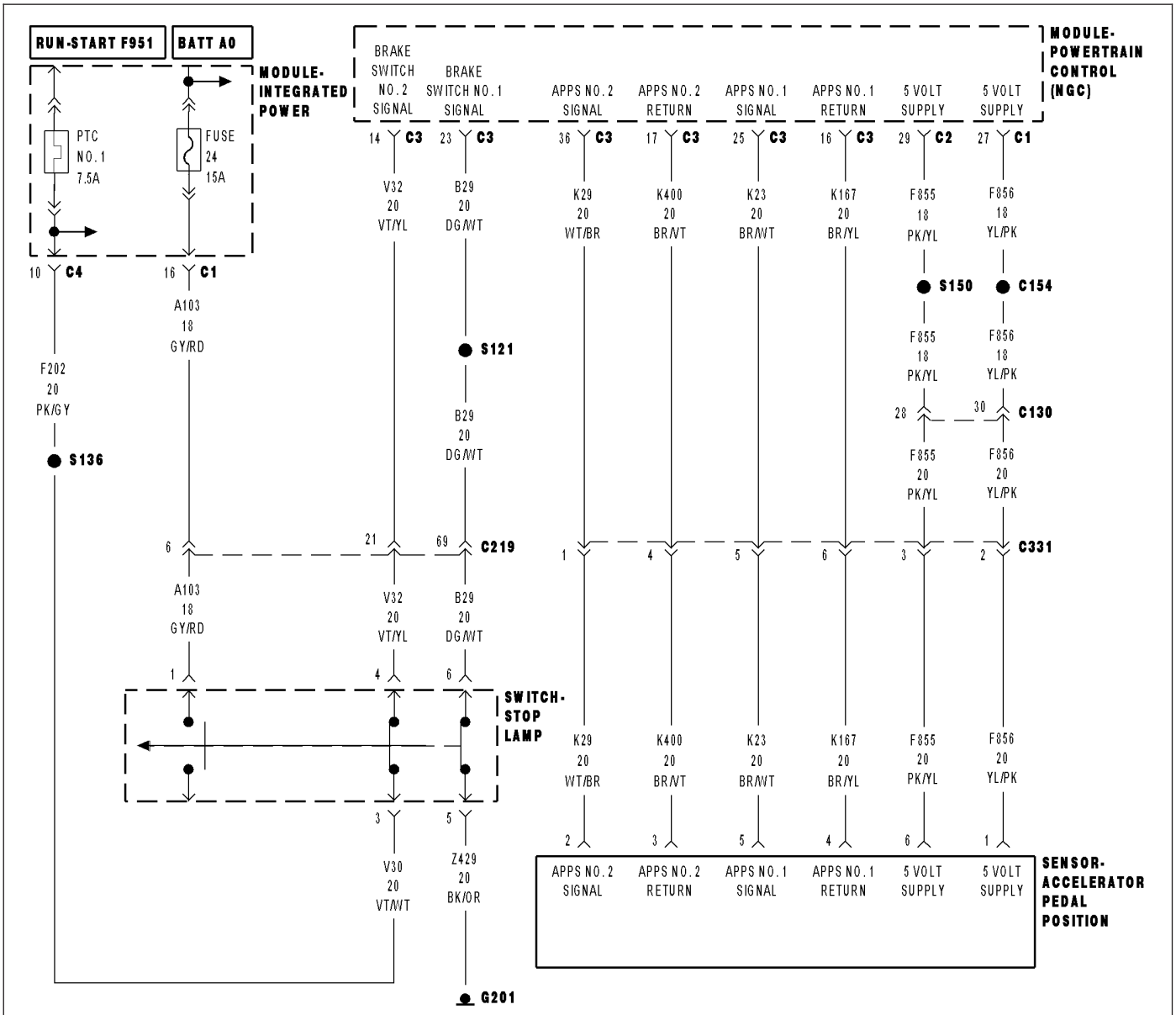
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

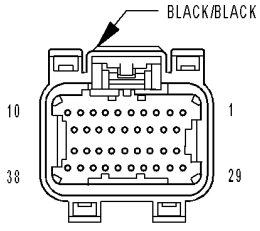
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

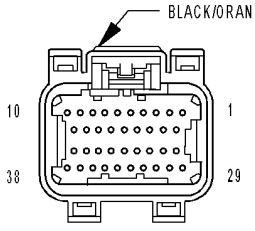
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2299-BRAKE PEDAL POSITION / ACCELERATOR PEDAL POSITION INCOMPATIBLE

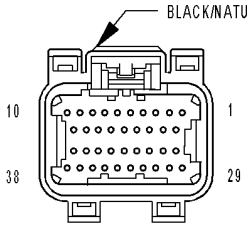




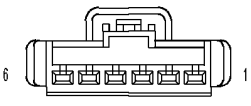
MODULE-POWERTRAIN CONTROL C1 (NGC)



MODULE-POWERTRAIN CONTROL C2 (NGC)



MODULE-POWERTRAIN CONTROL C3 (NGC)



SWITCH-STOP LAMP

814553a6

P2299-BRAKE PEDAL POSITION / ACCELERATOR PEDAL POSITION INCOMPATIBLE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on. No Break or APPS faults present.
- **Set Condition:**
  The PCM recognizes a brake application following the APPS showing a fixed pedal opening. Temporary or permanent. Internally the PCM will reduce throttle opening below driver demand. One trip fault and the code will be set within 5 seconds. ETC light will illuminate, the light will only stay illuminated while DTC is active.

Possible Causes
CUSTOMER PRESSING ACCLERATOR PEDAL, THEN PRESSING BRAKE PEDAL, AND CONTINUES HOLDING THEM DOWN SIMULTANEOUSLY
STOP LAMP SWITCH
APP SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. DTC INFORMATION

NOTE: If a pedal assembly becomes mechanically stuck the voltage output will stay fixed, if this is also Followed by a long application of the brakes this code will set.

NOTE: When this code sets the pedal position in the PCM software will ramp to idle. If the Pedal voltage changes OR the brake pedal is released, the pedal position in the PCM software will ramp up to the pedal position and the ETC light will go out.

With a scan tool, read DTCs and record the related Freeze Frame data.

Diagnose all other Stop Lamp Switch and APP Sensor codes before continuing.

This code can be set by a driver who uses both feet while driving, one for the Accelerator Pedal and the other for the Brake Pedal.

NOTE: The most likely cause of this DTC is caused by the customer Brake Torquing the engine by pressing the Accelerator pedal and the pressing the Brake Pedal.

Ask the driver of the vehicle if these conditions apply to their driving habits.

Are the listed conditions part of the customers driving habits?

Yes >> Advise the customer of what caused the DTC. This is normal operation of a ETC equipped vehicle because of safety issues.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. STOP LAMP SWITCH OPERATION

With a scan tool, read both Stop Lamp Switch statuses while pressing and releasing the Brake Pedal.

Does the scan tool display the Pressed and Released while pressing and releasing the Pedal?

Yes >> Go To 3

No >> Check the Stop Lamp Switch for proper installation and check the related circuits for opens and shorts using the appropriate wiring diagram. If OK, replace the Stop Lamp Switch assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2299-BRAKE PEDAL POSITION / ACCELERATOR PEDAL POSITION INCOMPATIBLE (CONTINUED)

3. APP SENSOR SWEEP

Ignition on, engine not running.

With a scan tool, monitor both APP Sensor voltage readings.

Slowly press the accelerator pedal from idle until it reaches the end stop near the floor.

APPS No.1 voltage should start at approximately 0.45 of a volt and increase to approximately 4.6 volts with a smooth transition.

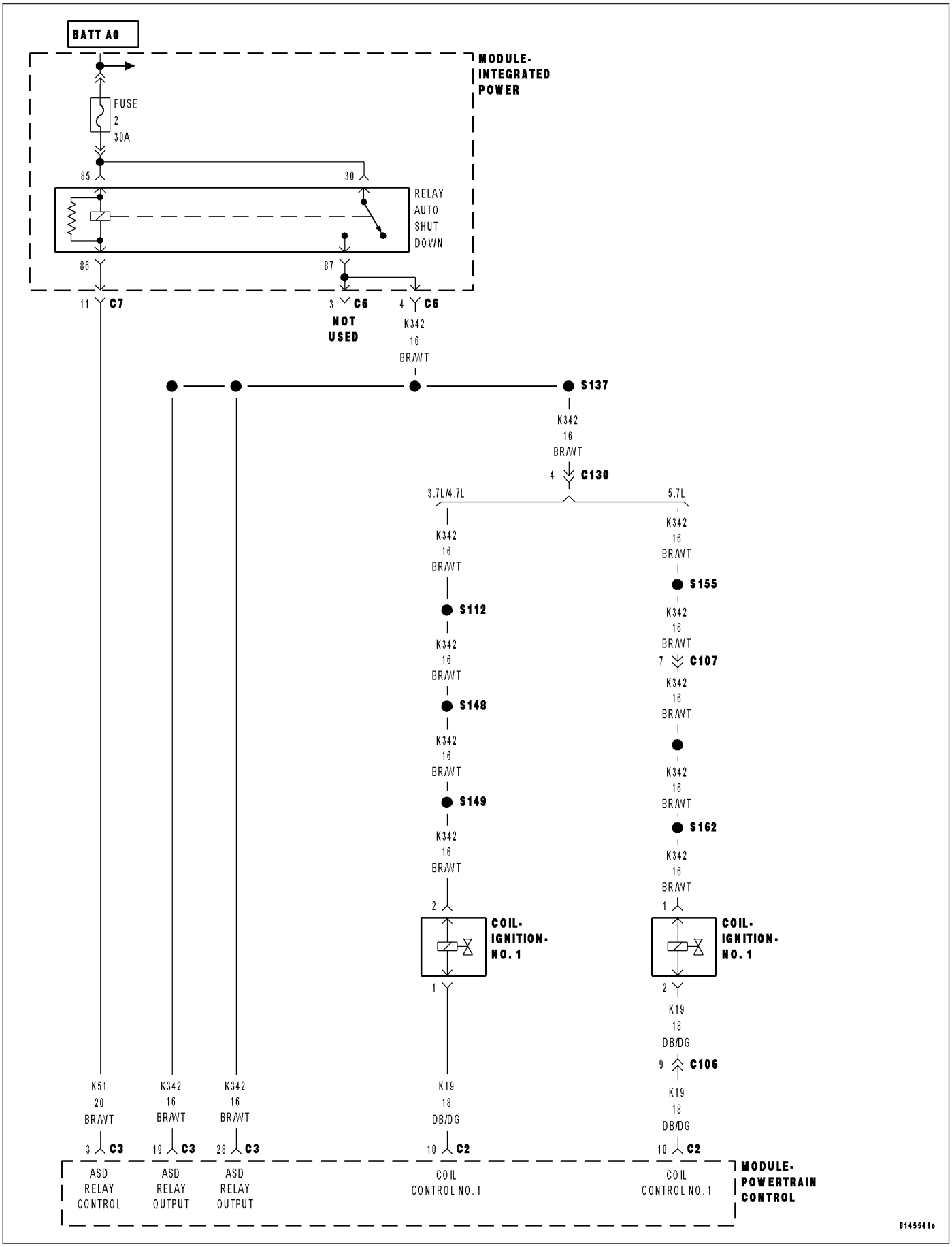
APPS No.2 voltage should start at approximately 0.22 of a volt and increase to approximately 2.31 volts with a smooth transition.

Does the voltage for the appropriate sensor follow the list specification?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Check the Signal and Return circuits for opens and shorts. If OK, Replace the APP Sensor Assembly per Service Information. After installation is complete, with a scan tool select the ETC RELEARN function to relearn the APPS values.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K19) COIL CONTROL NO.1 CIRCUIT OPEN
(K19) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

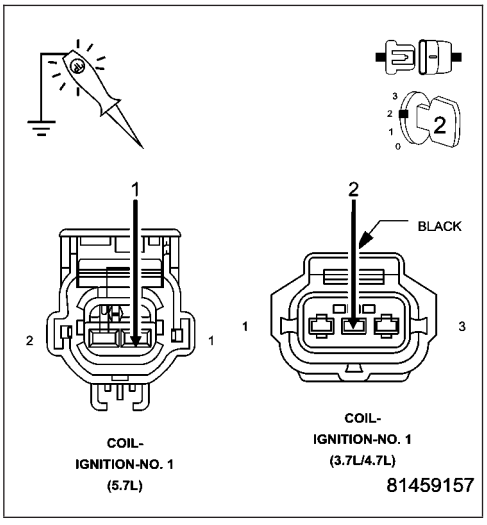
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.



P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

5.7L Primary Ignition Coil resistance is 0.558 to 0.682 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K19) Coil Control No.1 circuit.

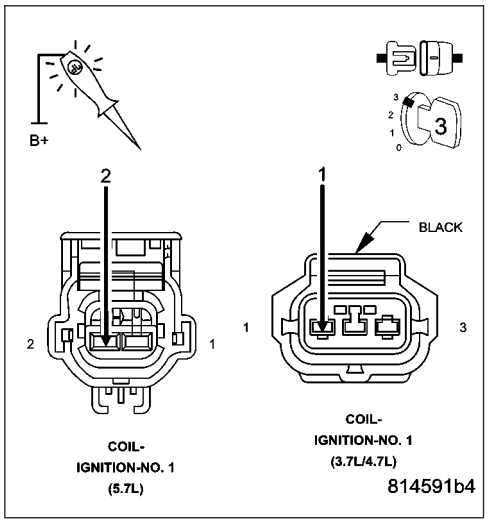
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K19) COIL CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

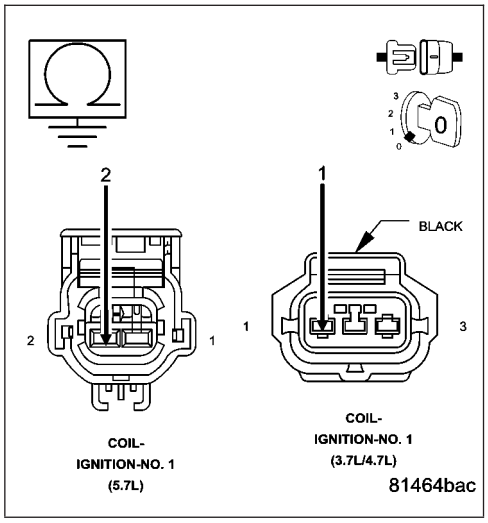
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K19) Coil Control No.1 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K19) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2302-IGNITION COIL 1 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

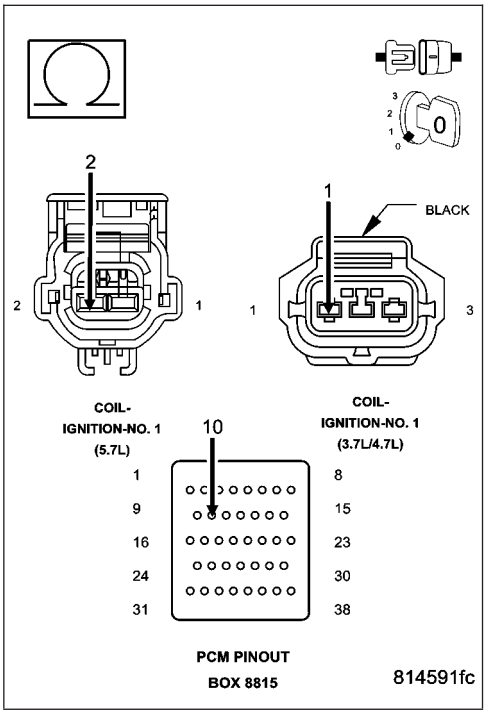
6. (K19) COIL CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K19) Coil Control No.1 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K19) Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

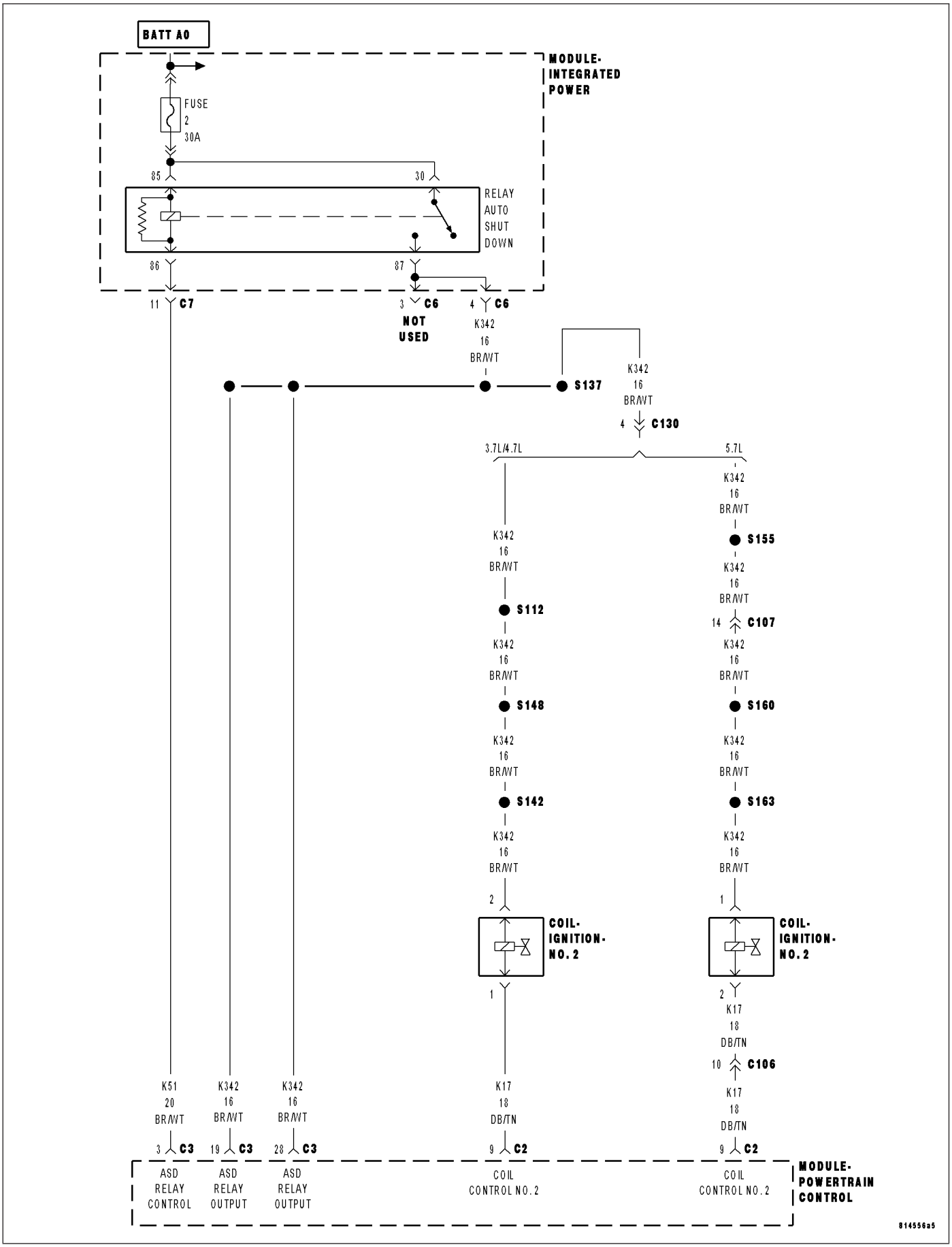
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K17) COIL CONTROL NO.2 CIRCUIT OPEN
(K17) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

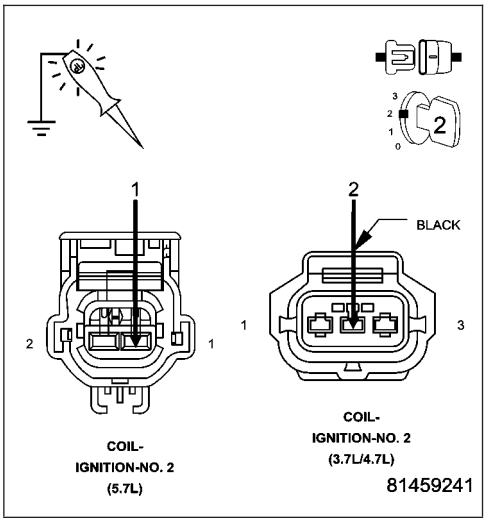
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.



P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

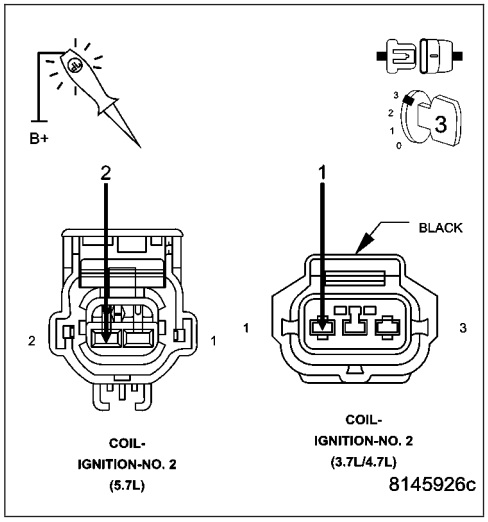
No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K17) Coil Control No.2 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

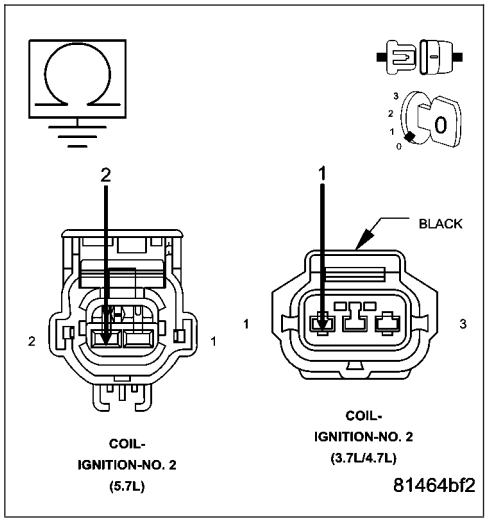
---

5. (K17) COIL CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K17) Coil Control No.2 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K17) Coil Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2305-IGNITION COIL 2 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

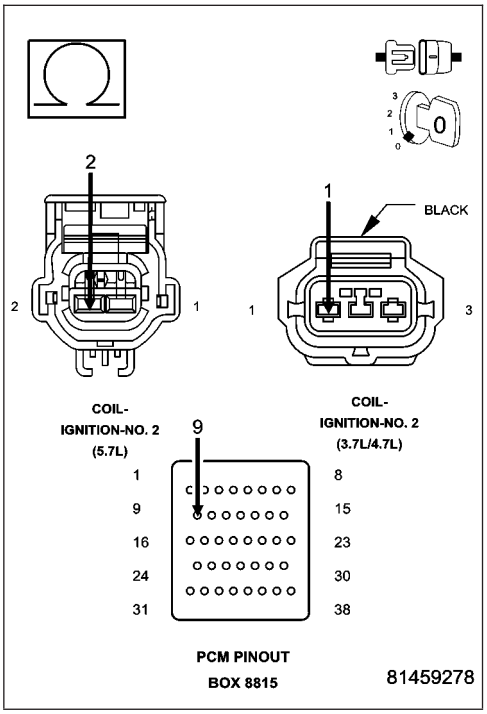
6. (K17) COIL CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K17) Coil Control No.2 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K17) Coil Control No.2 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

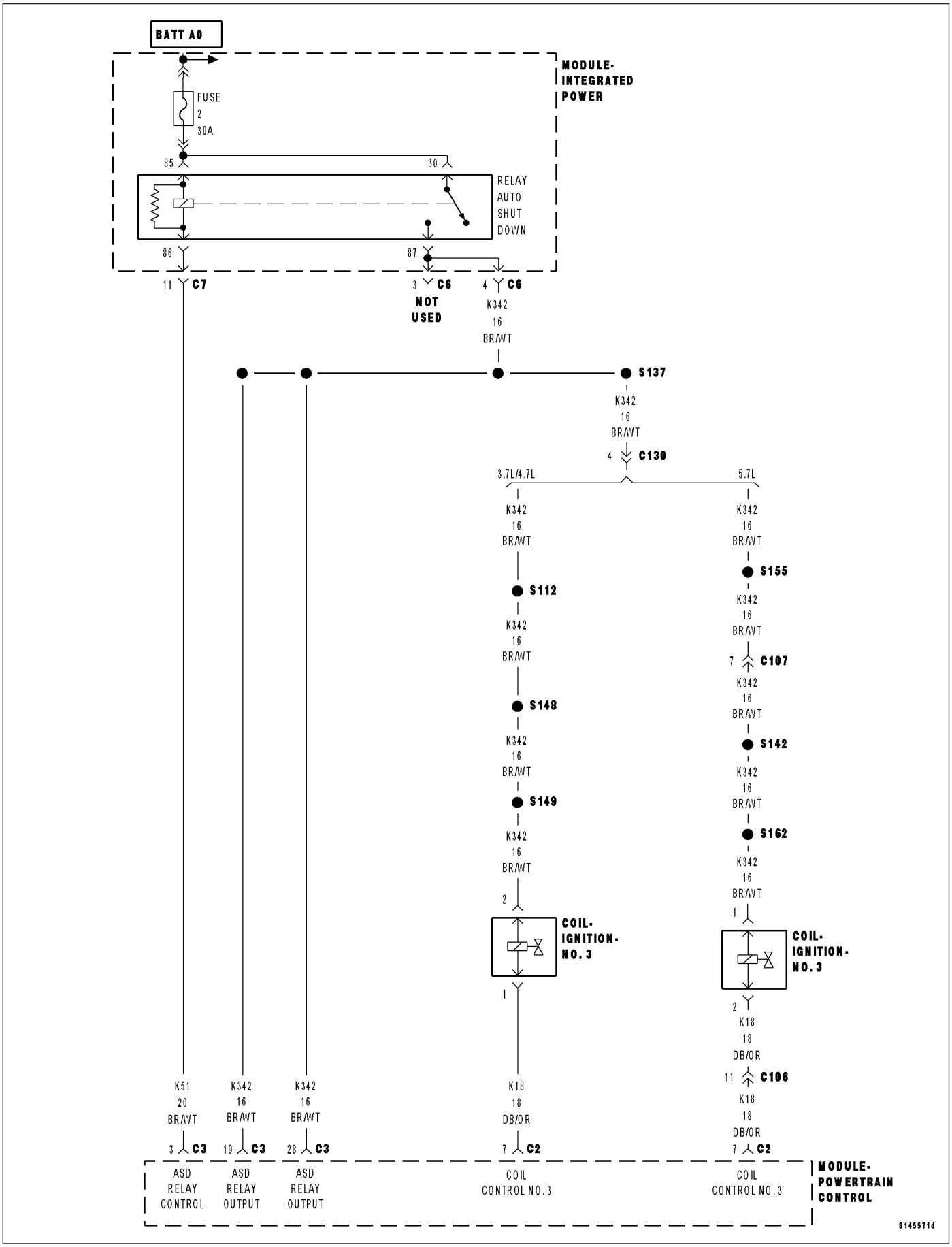
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K18) COIL CONTROL NO.3 CIRCUIT OPEN
(K18) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

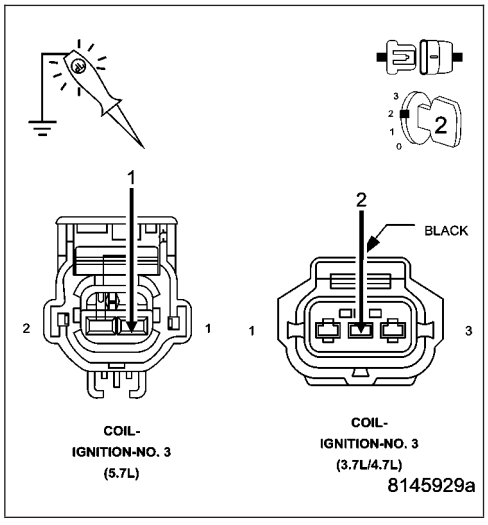
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.



P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K18) Coil Control No.3 circuit.

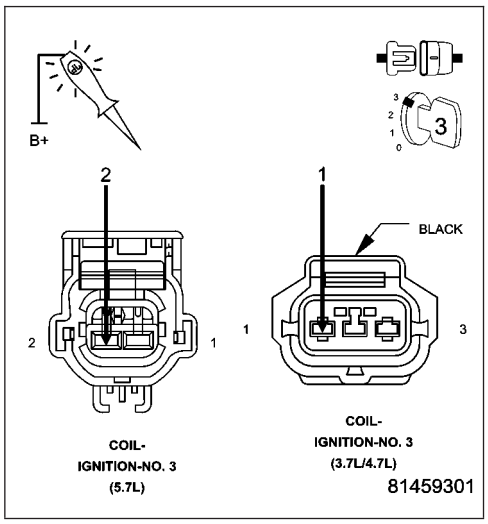
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K18) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

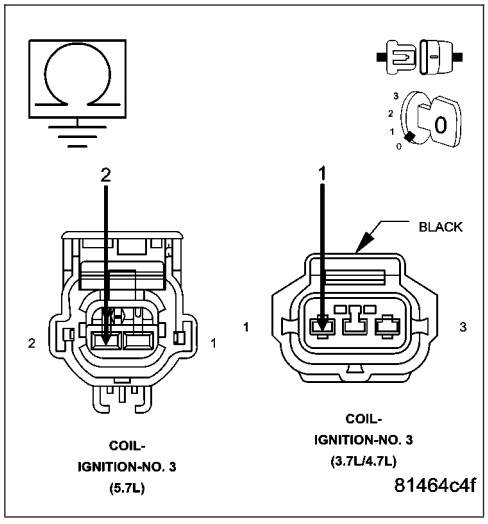
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K18) Coil Control No.3 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K18) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2308-IGNITION COIL 3 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

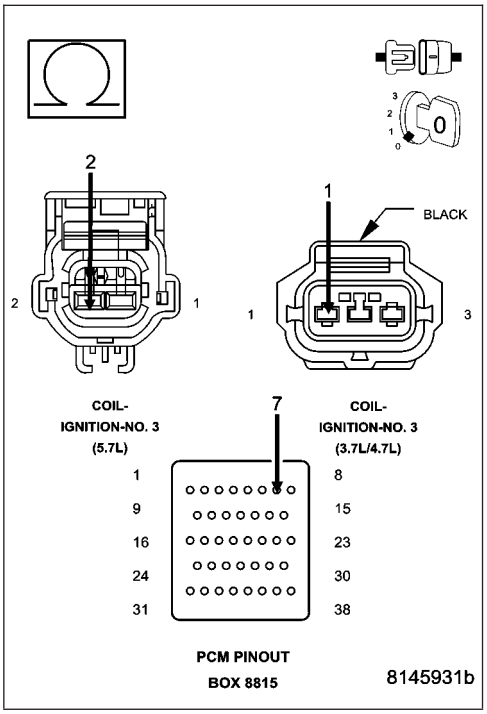
6. (K18) COIL CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K18) Coil Control No.3 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K18) Coil Control No.3 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

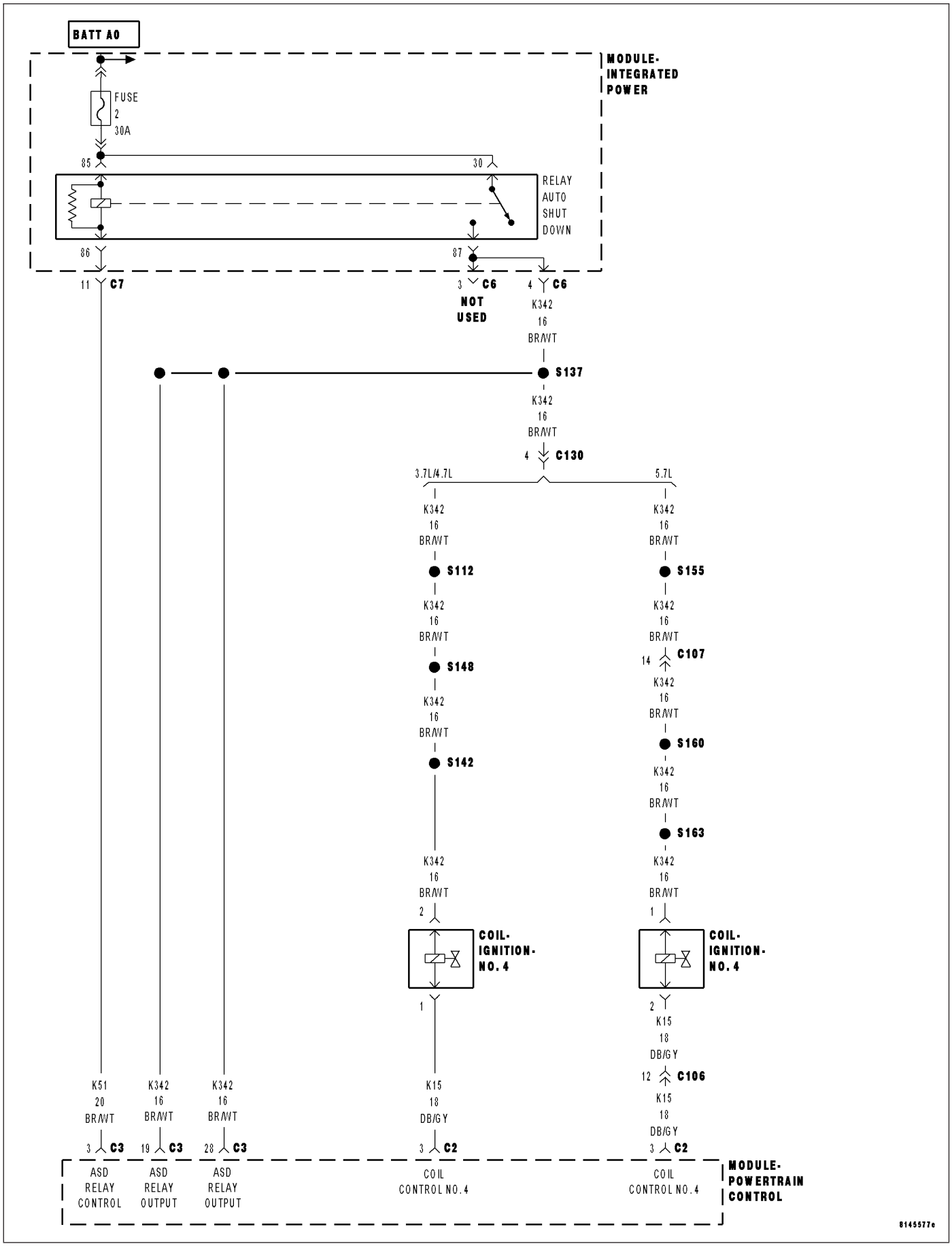
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K15) COIL CONTROL NO.4 CIRCUIT OPEN
(K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

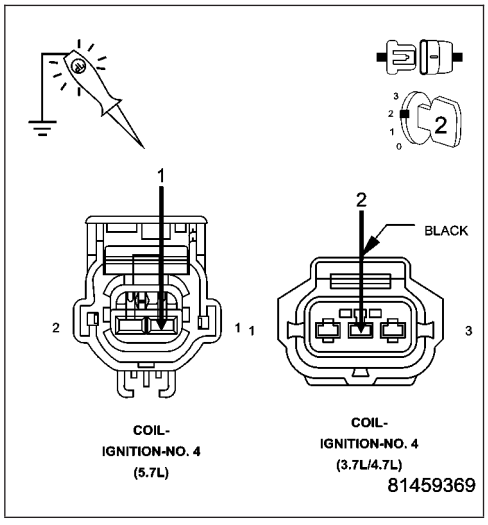
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

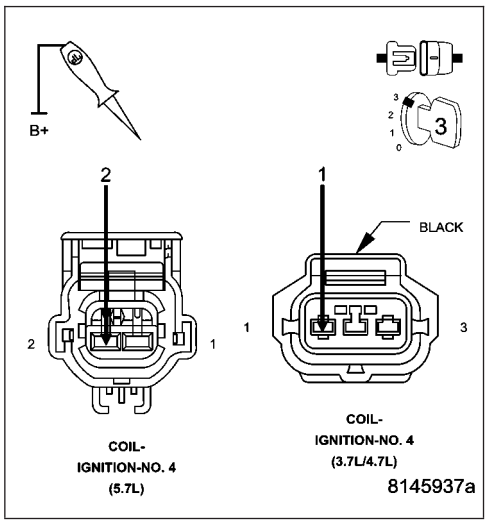
No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K15) Coil Control No.4 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

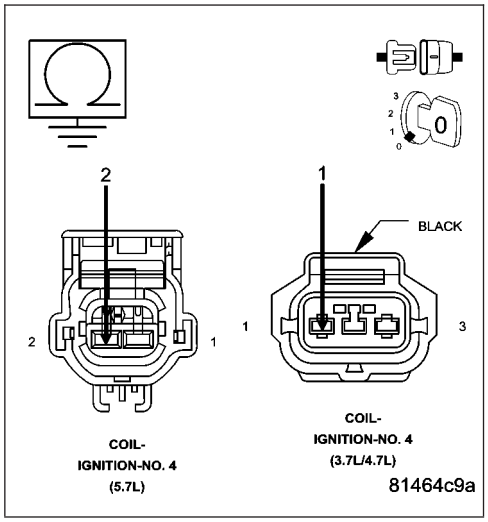
---

5. (K15) COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K15) Coil Control No.4 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K15) Coil Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2311-IGNITION COIL 4 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

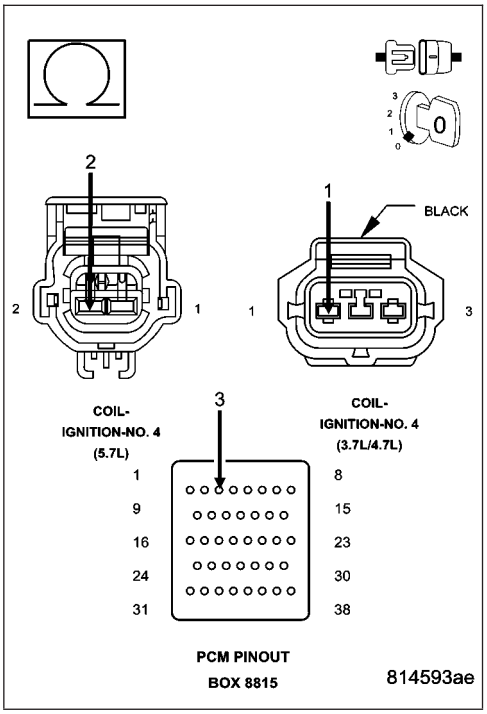
6. (K15) COIL CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K15) Coil Control No.4 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K15) Coil Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

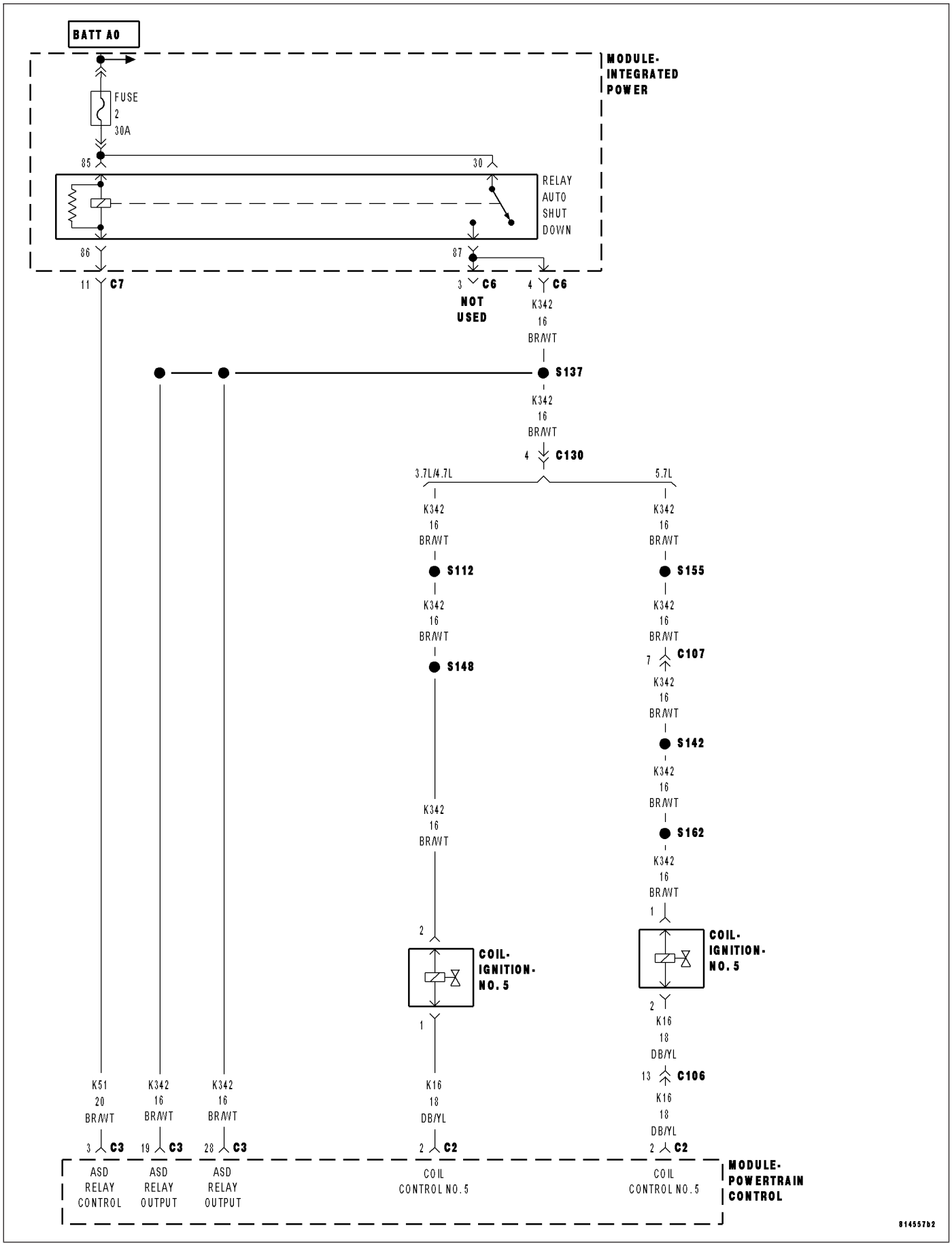
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K16) COIL CONTROL NO.5 CIRCUIT OPEN
(K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

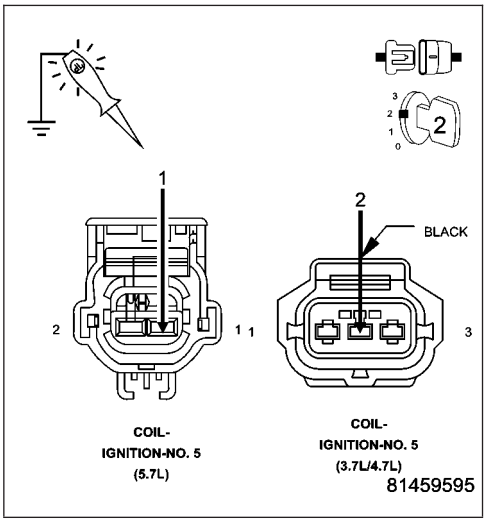
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

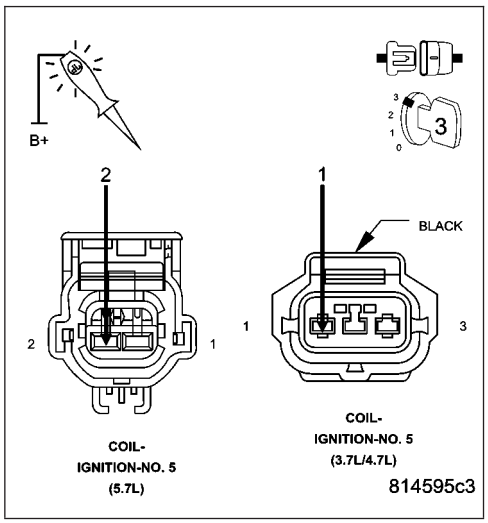
No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K16) Coil Control No.5 circuit.

Crank the engine for 5 seconds while observing the test light.



What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6

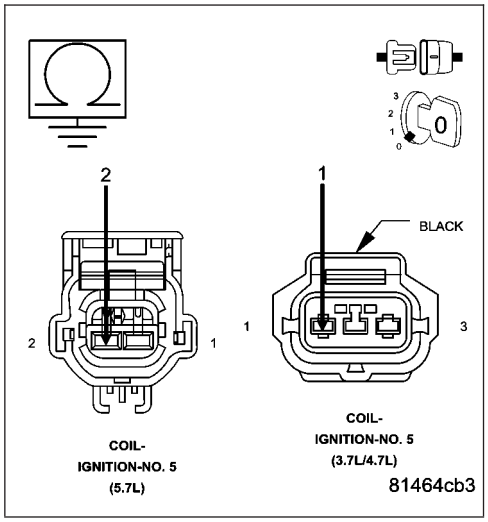
---

5. (K16) COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K16) Coil Control No.5 circuit in the Coil on Plug harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

P2314-IGNITION COIL 5 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

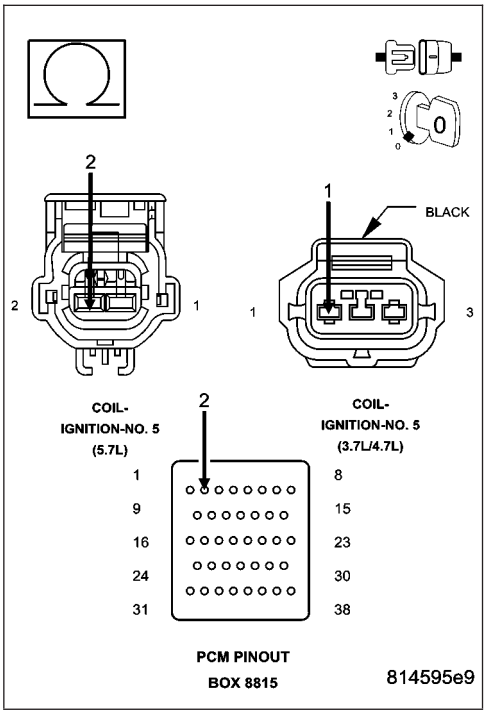
6. (K16) COIL CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K16) Coil Control No.5 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K16) Coil Control No.5 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

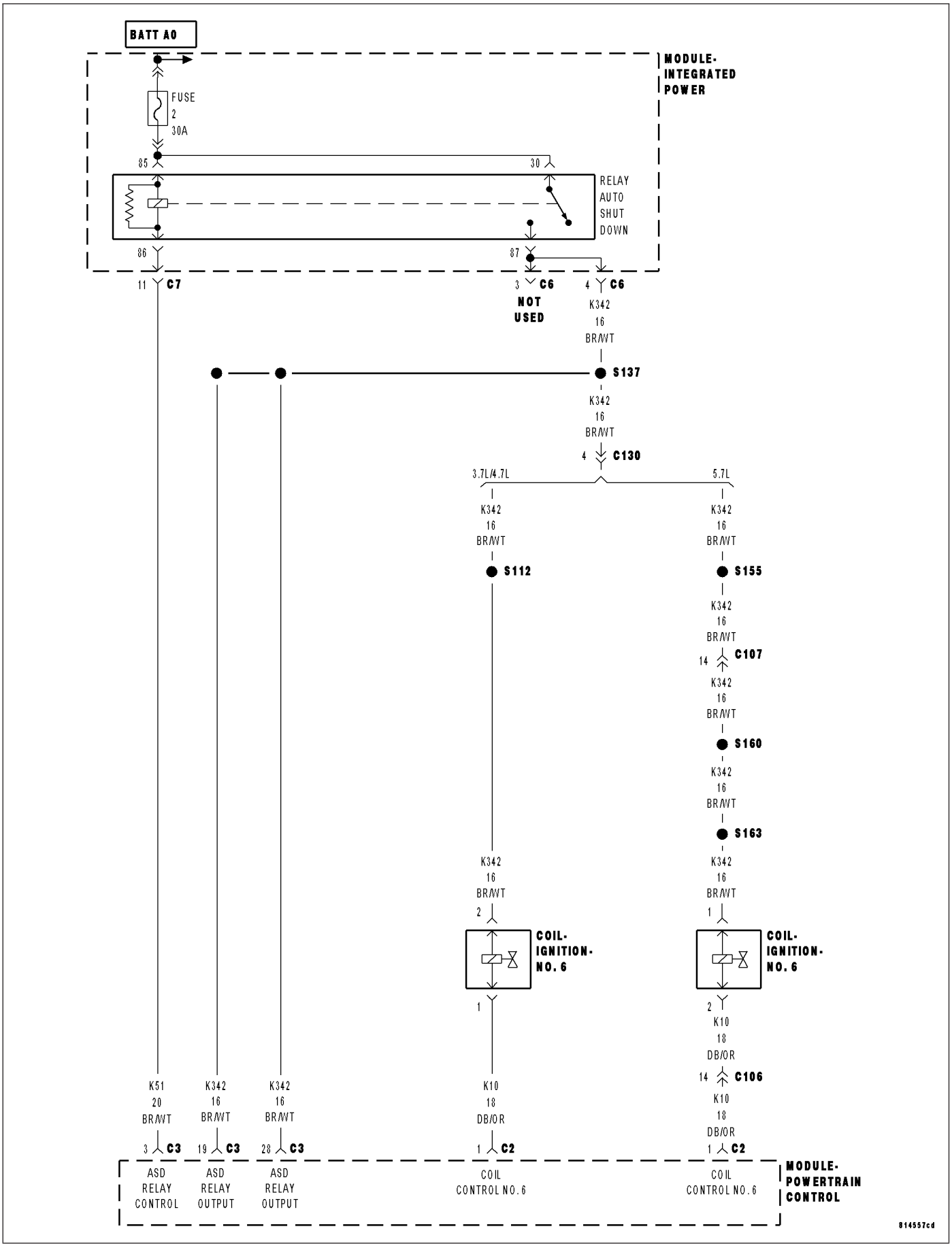
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K10) COIL CONTROL NO.6 CIRCUIT OPEN
(K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

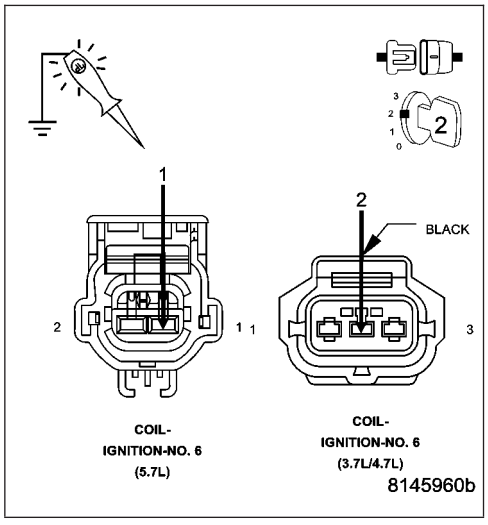
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L and 3.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K10) Coil Control No.6 circuit.

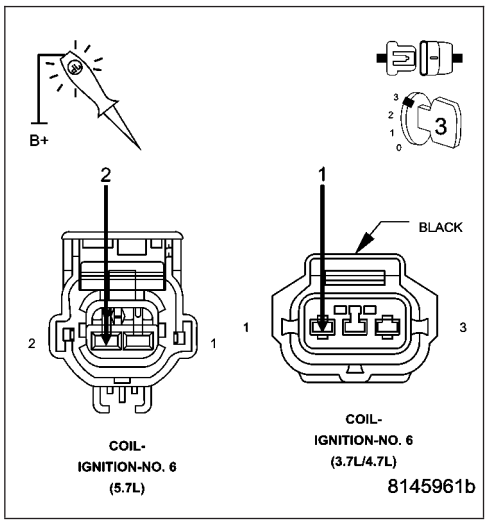
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K10) COIL CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

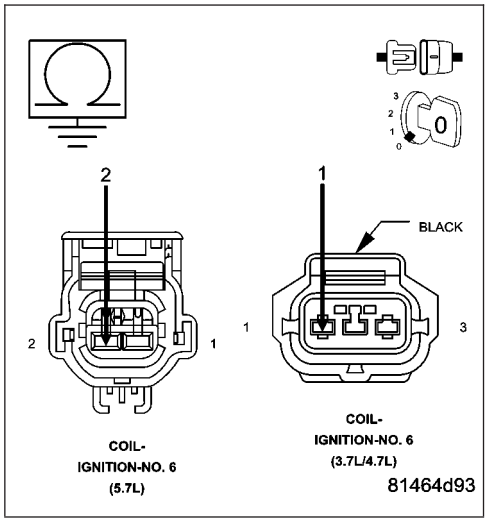
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K10) Coil Control No.6 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2317-IGNITION COIL 6 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

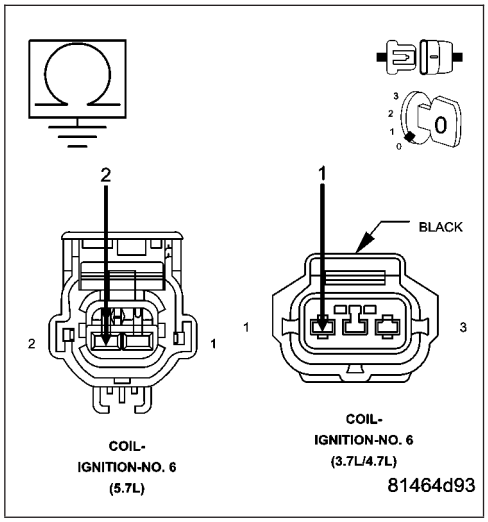
6. (K10) COIL CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K10) Coil Control No.6 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K10) Coil Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

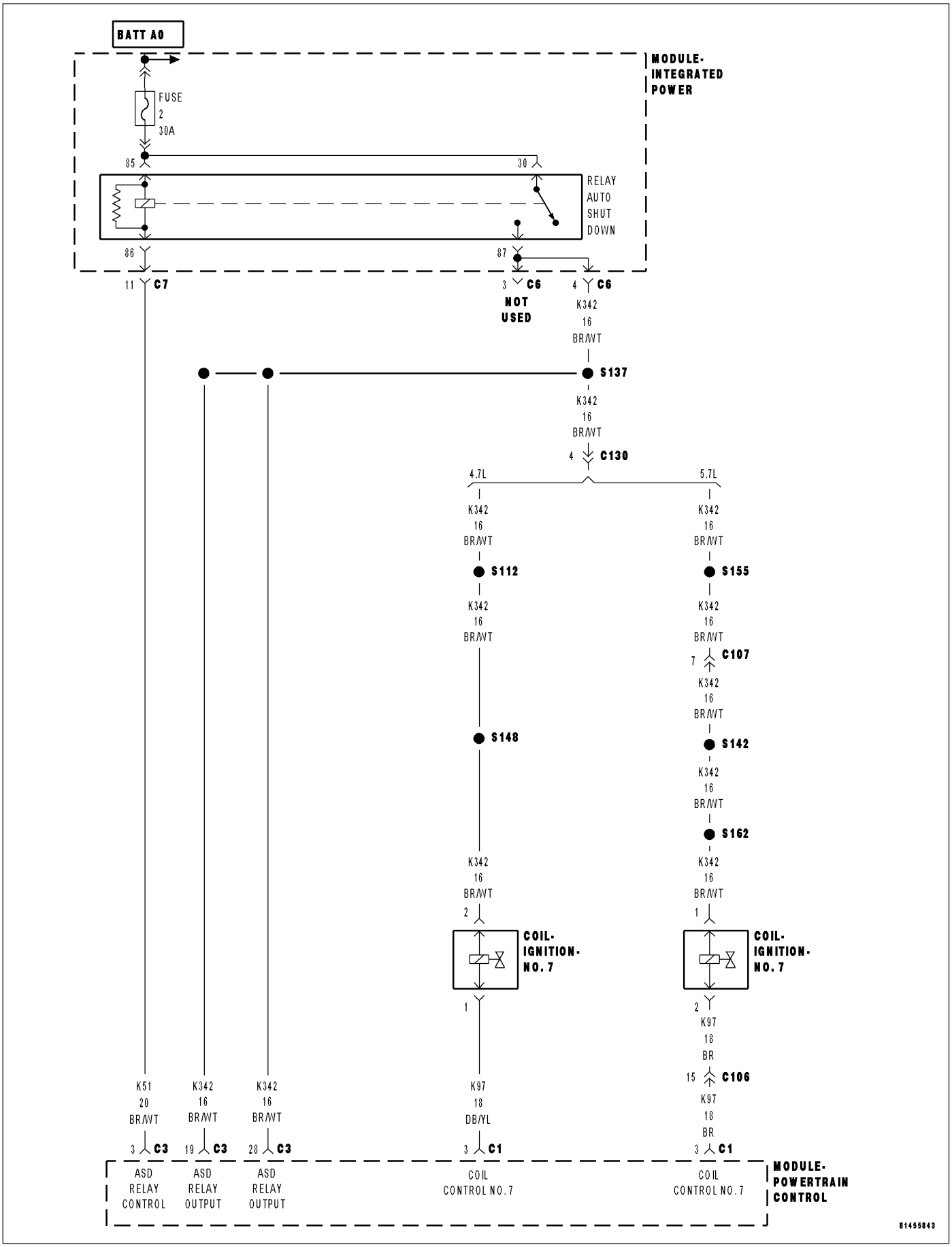
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, too short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K97) COIL CONTROL NO.7 CIRCUIT OPEN
(K97) COIL CONTROL NO.7 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

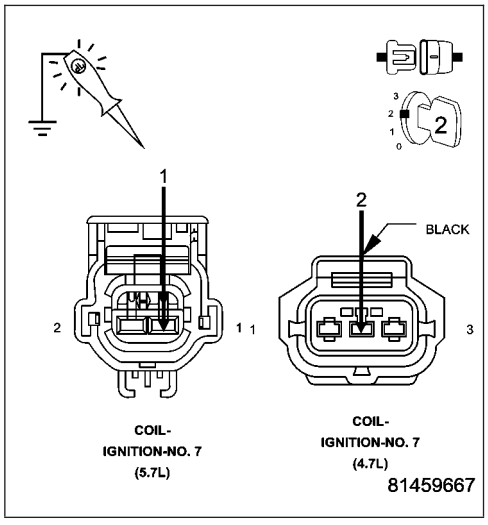
Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.

P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K97) Coil Control No.7 circuit.

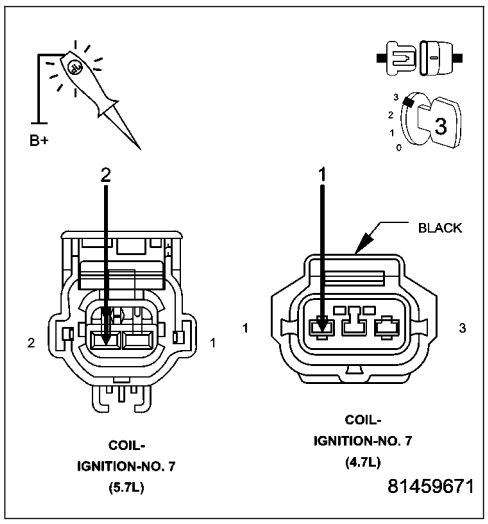
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K97) COIL CONTROL NO.7 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

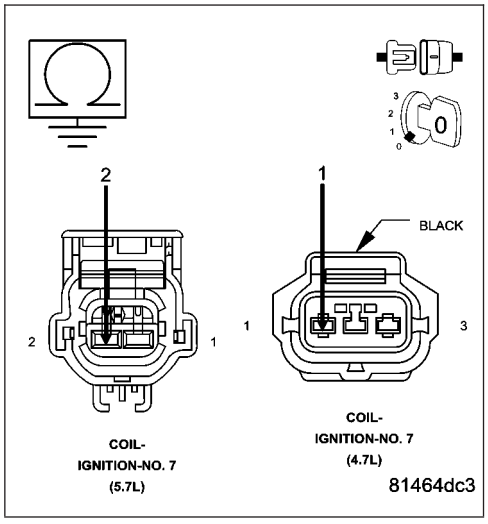
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K97) Coil Control No.7 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K97) Coil Control No.7 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2320-IGNITION COIL 7 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

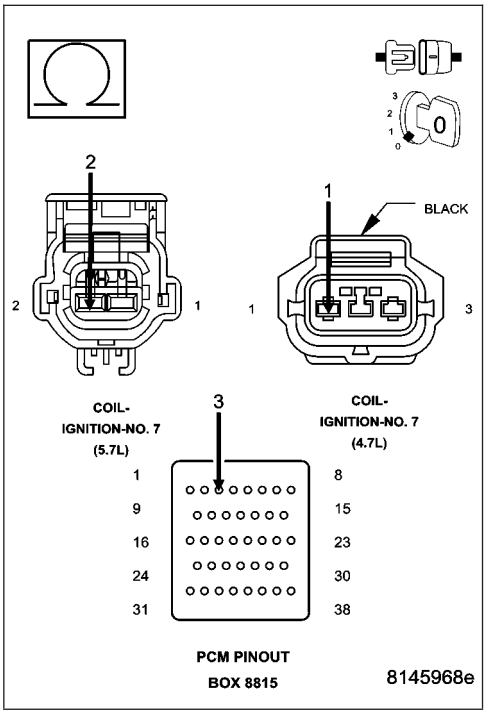
6. (K97) COIL CONTROL NO.7 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K97) Coil Control No.7 circuit from the Coil on Plug connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K97) Coil Control No.7 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

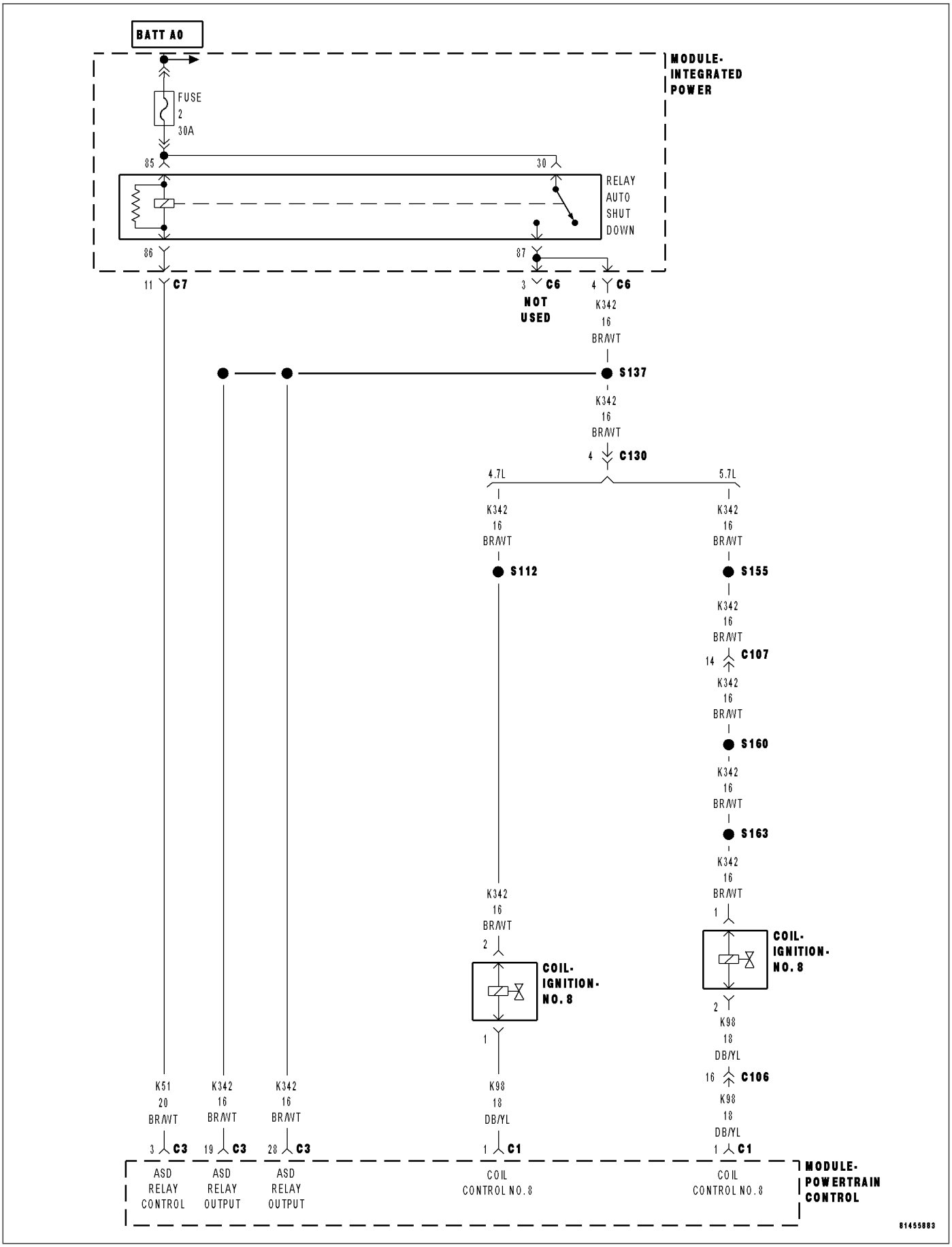
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION



P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and battery voltage greater than 10 volts.
- **Set Condition:**
  If PCM detects that the secondary ignition burn time is incorrect, to short, or not present, an error is detected. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K98) COIL CONTROL NO.8 CIRCUIT OPEN
(K98) COIL CONTROL NO.8 CIRCUIT SHORTED TO GROUND
COIL ON PLUG
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Coil on Plug harness connector.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

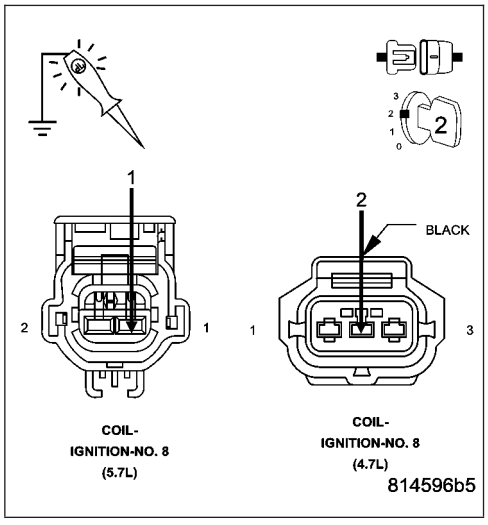
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Coil on Plug harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) ASD Relay Output circuit between the IPM and Coil harness connector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop All Actuations.



P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

3. COIL ON PLUG RESISTANCE

Turn the ignition off.

NOTE: The following resistance measurement should be taken at 70°-80° F.

Measure the resistance of the Coil on Plug.

4.7L Primary Ignition Coil resistance is 0.6 to 0.9 of an ohm at 77°F (25°C).

Is the resistance within the given specification for the Ignition Coil being tested?

Yes >> Go To 4

No >> Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K98) Coil Control No.8 circuit.

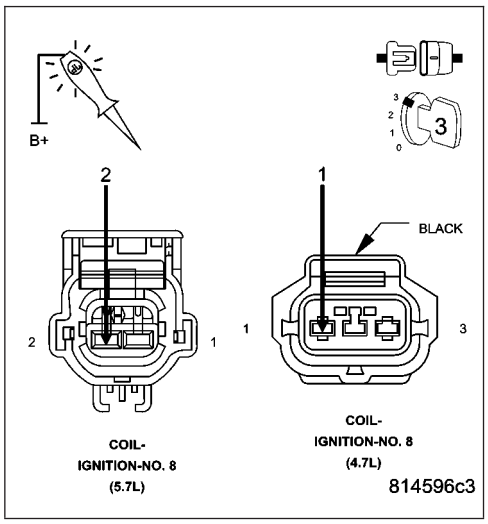
Crank the engine for 5 seconds while observing the test light.

What is the state of the test light while cranking the engine?

Brightly blinking.
Replace the Coil on plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



---

5. (K98) COIL CONTROL NO.8 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

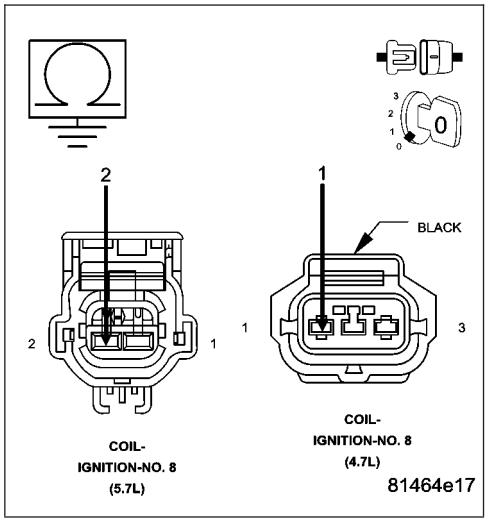
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K98) Coil Control No.8 circuit in the Coil on Plug harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K98) Coil Control No.8 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P2323-IGNITION COIL 8 SECONDARY CIRCUIT- INSUFFICIENT IONIZATION (CONTINUED)

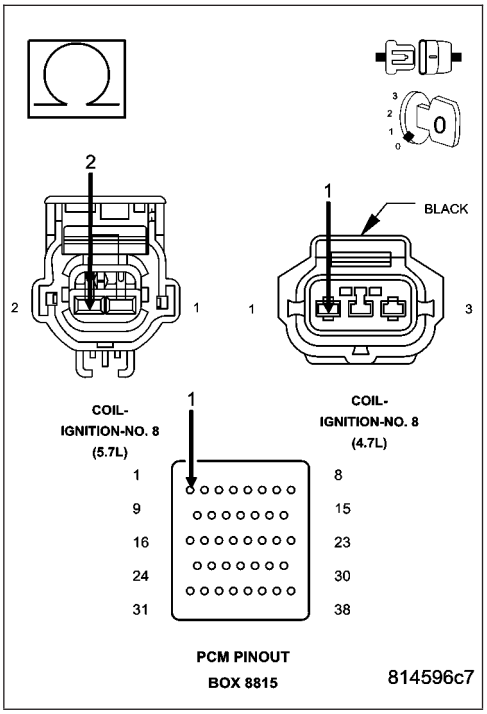
6. (K98) COIL CONTROL NO.8 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K98) Coil Control No.8 circuit from the Coil on Plug harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K98) Coil Control No.8 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

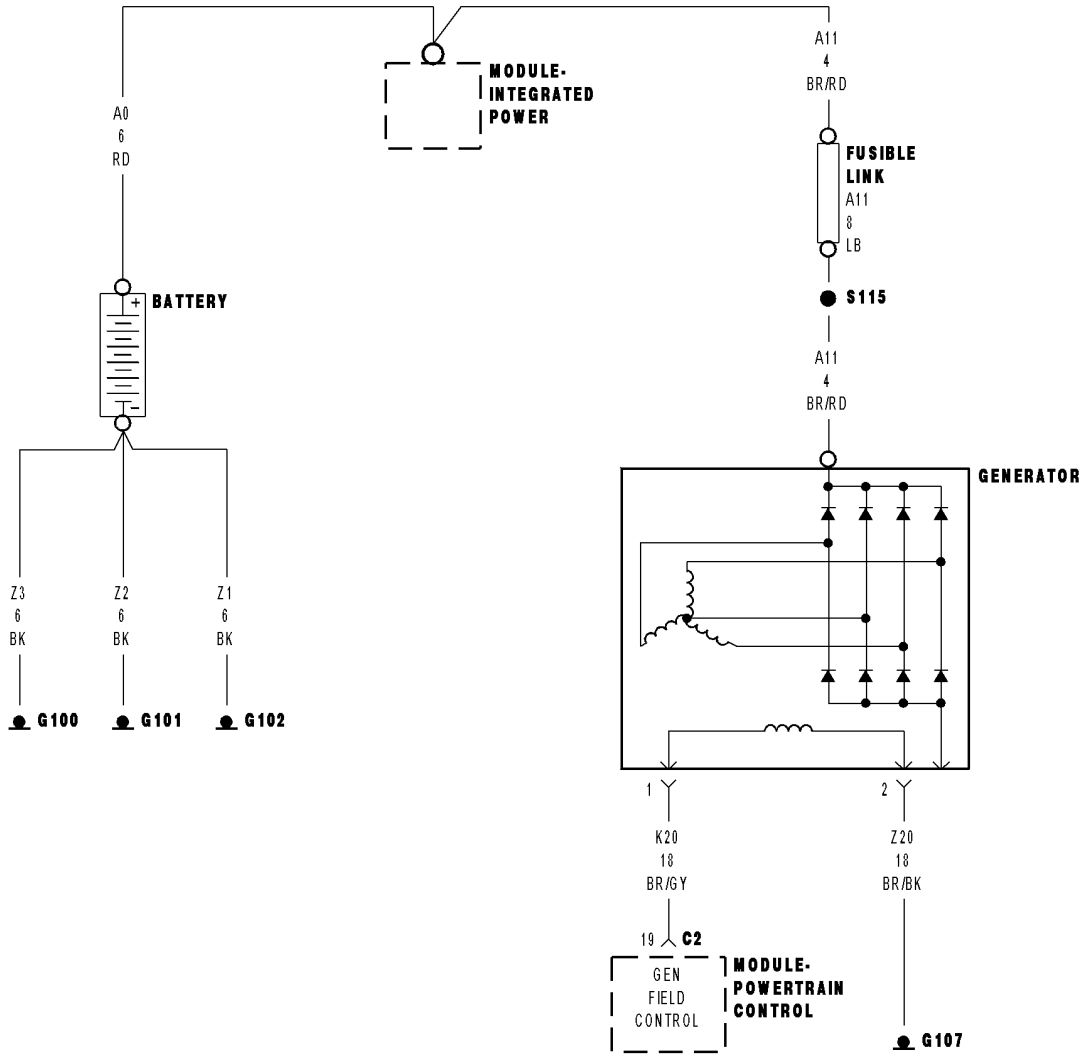
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

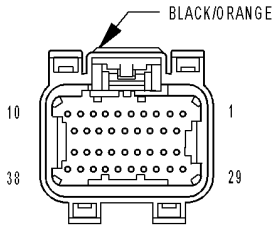
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

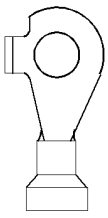
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2503-CHARGING SYSTEM OUTPUT LOW

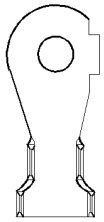




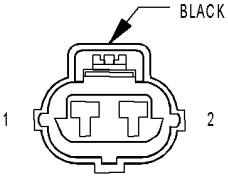
MODULE-
POWERTRAIN
CONTROL C2
(NGC)



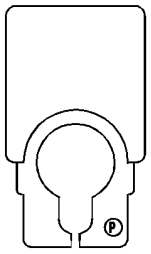
GENERATOR
(5.7L)



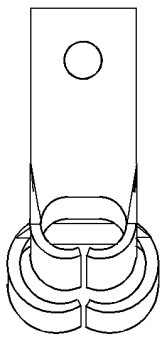
GENERATOR
(DIESEL/3.7L/4.7L/SRT)



GENERATOR
(EXCEPT SRT)



BATTERY-
POSITIVE
(3.7L/4.7L)



BATTERY
POSITIVE
(5.7L EXCEPT OFF ROAD/SRT)

81454554

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The engine running. The engine speed greater than 1157 RPM.
- **Set Condition:**
  The battery sensed voltage is 1 volt below the charging goal for 13.47 seconds. The PCM senses the battery voltage turns off the field driver and senses the battery voltage again. If the voltages are the same, the code is set. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
EXCESSIVE RESISTANCE IN THE BATTERY POSITIVE CIRCUIT
EXCESSIVE RESISTANCE IN THE CASE GROUND
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO VOLTAGE
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
(Z20) GEN GROUND CIRCUIT OPEN
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Inspect the vehicle for aftermarket accessories that may exceed the Generator System output.
Ignition on, engine not running.

NOTE: The battery must be fully charged.

NOTE: The Generator belt tension and condition must be checked before continuing.
With a scan tool, read DTCs.
With a scan tool, erase DTCs.
Start the engine.
Allow the idle to stabilize.
Ignition on, engine not running.
With the scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

2. FUSED B+ CIRCUIT HIGH RESISTANCE

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Measure the voltage between the Generator B+ Output Terminal and the Battery+ Post.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the battery positive circuit between the Generator and Battery.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXCESSIVE RESISTANCE IN THE CASE GROUND

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Start the engine.

Warm the engine to operating temperature.

NOTE: Make sure all wires are clear of the engine's moving parts.

Measure the voltage between the Generator Case and Battery ground post.

Is the voltage above 0.1 of a volt?

Yes >> Repair the excessive resistance in the Generator Case Ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. GENERATOR OPERATION

Turn the ignition off.

Disconnect the Generator Field harness connector.

Using a 12-volt test light, jump across the Generator Field harness connector.

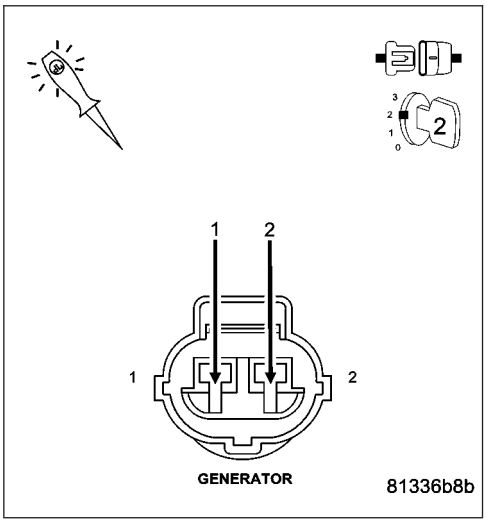
Ignition on, engine not running.

With a scan tool, actuate the Generator Field Driver.

Does the test light illuminate brightly and flash on and off?

Yes >> Replace the Generator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

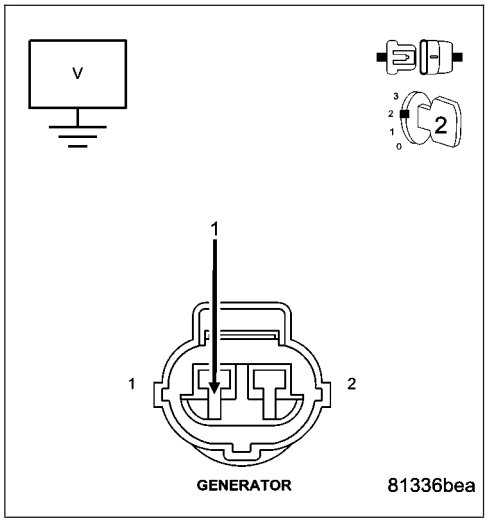
5. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (K20) Gen Field Control circuit in the Generator Field harness connector.



Is the voltage above 1.0 volt?

Yes >> Repair the short to battery voltage in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

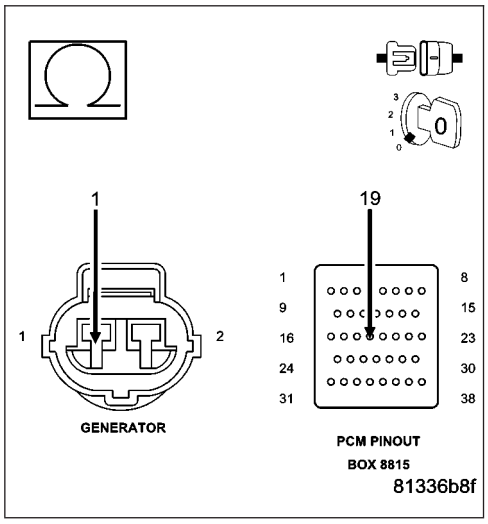
No >> Go To 6

6. (K20) FIELD CONTROL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K20) Gen Field Control circuit from the Generator Field harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

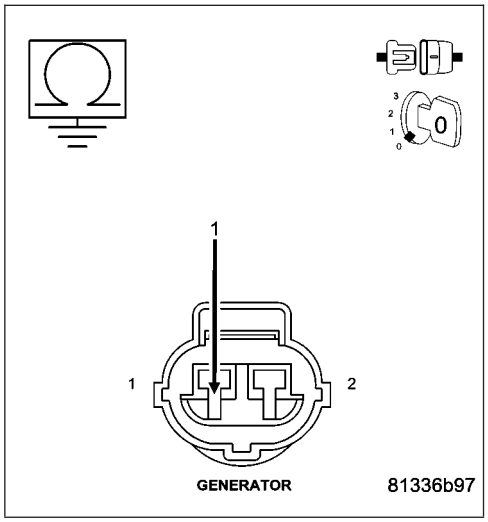
Yes >> Go To 7

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

7. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Gen Field Control circuit in the Generator Field harness connector.



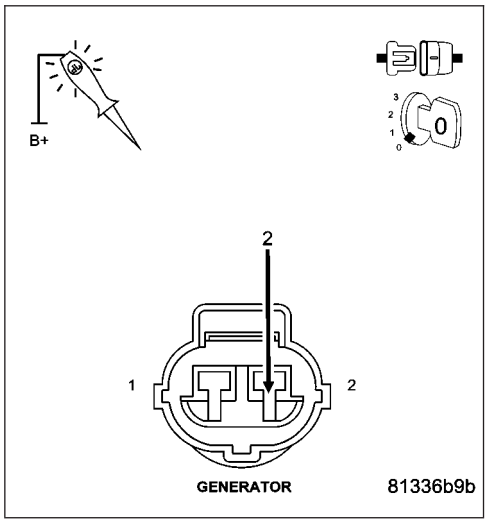
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. (Z20) GROUND CIRCUIT OPEN

Using a 12-volt test light connected to battery voltage, probe the (Z20) Ground circuit in the Generator Field harness connector.



Does the test light illuminate brightly?

Yes >> Go To 9

No >> Repair the open in the (Z346) Generator Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0101-LOST COMMUNICATION WITH TCM

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition run time is greater than 1 second. Battey voltage between 9 and 16 volts. Engine run time greater than 3 seconds.
- **Set Condition:**
  The PCM doesn't receive a Bus Message from the Transmission Control Module for 7 consecutive seconds. The circuit is continuously monitored.

Possible Causes
PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT CHECK
BUS FAILURE OPEN OR SHORTED CONDITION
PCI BUS UNABLE TO COMMUNICATE WITH THE SCAN TOOL
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, erase DTCs.
Cycle the ignition key on and off several times. Leaving the ignition on for at least 20 seconds.
With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0101-LOST COMMUNICATION WITH TCM (CONTINUED)

2. PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT

Turn the ignition off.

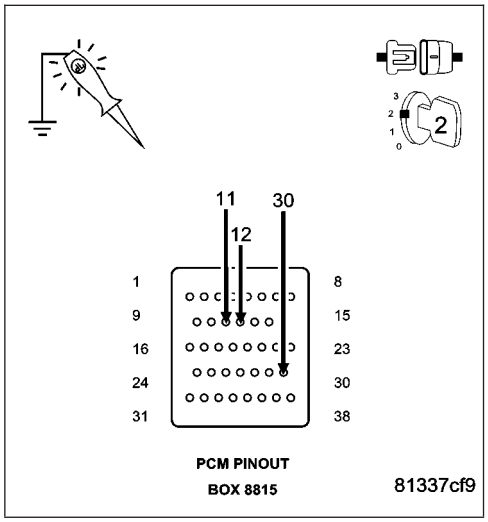
Disconnect the C1 PCM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

With a 12-volt test light connected to ground and with special tool #8815 installed, probe the (F202), (F1), and (T751) Fused Ignition Switch Output circuit.

Perform the above check with the Ignition key in the off lock position, Ignition on, engine not running position, and during cranking.

Wiggle the related wire harness while probing the special tool with the test light to try to interrupt the circuit.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance in the (F202), (F1), and (T751) Fused Ignition Switch (Offf, Run, Start) circuit. Inspect the related fuse, if the fuse is open check the circuit for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. PCI BUS UNABLE TO COMMUNICATE WITH THE SCAN TOOL

NOTE: Determine which modules this vehicle is equipped with before beginning.

NOTE: When attempting to communicate with any of the modules on this vehicle, the scan tool will display 1 of 2 different communication errors: a NO RESPONSE message or a BUS +/- SIGNALS OPEN MESSAGE.

Ignition on, engine not running.

Use the scan tool, attempt to communicate with the remaining control modules.

Was the scan tool able to communicate with one or more of the Modules?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0155-NO CLUSTER BUS MESSAGE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition key on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  No messages received from the MIC (Instrument Cluster) for more than 20 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
BUS CIRCUIT OPEN OR SHORTED
INSTRUMENT CLUSTER
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With the scan tool, erase DTCs.
Cycle the ignition key on and off several times.
With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. COMMUNICATE WITH CLUSTER

With the scan tool, attempt to communicate with the Instrument cluster.

Can communication be established with the Instrument Cluster?

Yes >> Go To 3

No >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0155-NO CLUSTER BUS MESSAGE (CONTINUED)

3. **INSTRUMENT CLUSTER OPERATION**

Start the engine

Allow the engine to idle.

Is the correct engine speed display in the instrument cluster (Tach)?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the Instrument Category and perform the appropriate symptom.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

U0168-NO SKIM BUS MESSAGE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  No J1850 messages received from the Smart Key Immobilizer Module (SKIM) One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
NO RESPONCE FROM SKIM
BUS CIRCUIT OPEN OR SHORTED
SKIM
PCM

Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With the scan tool, read the DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform SKIS VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

2. NO RESPONSE FROM SKIM

With the scan tool , attempt to communicate with the SKIM.

NOTE: NOTE: This test will indicate if the Bus is operational from the DLC to the SKIM.

Was the scan tool able to communicate with the SKIM?

Yes >> Go To 3

No >> Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES - DIAGNOSIS AND TESTING for diagnostic procedures and for further possible causes.
Refer to symptom BUS +/- SIGNAL OPEN FROM SKIM in the COMMUNICATION category.
Perform SKIS VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

U0168-NO SKIM BUS MESSAGE (CONTINUED)

3. PCI BUS CIRCUIT OPEN FROM PCM TO SKIM

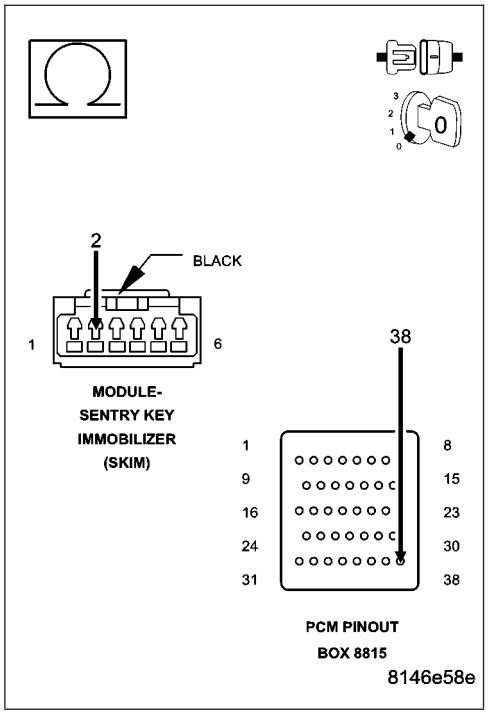
Turn the ignition off.

Disconnect the C1 PCM harness connector.

Disconnect the SKIM harness connector.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the PCI Bus circuit from the SKIM harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the PCI Bus circuit between the PCM and the SKIM.
Perform SKIS VERIFICATION. (Refer to 8 - ELECTRICAL/ VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

---

4. SKIM/PCM

Replace the Sentry Key Immobilizer Module per Service Information.

Ignition on, engine not running.

Display and erase all PCM and SKIM DTCs.

Perform 5 ignition key cycles leaving the ignition key on for 90 seconds per cycle.

With the scan tool, display PCM DTCs.

Does the scan tool display the same DTC?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform SKIS VERIFICATION. (Refer to 8 - ELECTRICAL/VEHICLE THEFT SECURITY - STANDARD PROCEDURE)

No >> Test Complete the conditions that set this DTC are no longer present.

---

*5.7L INTERMITTENT NO CRANK CONDITION

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
ETC STARTER INHIBIT

Diagnostic Test

1. ETC STARTER INHIBIT

NOTE: This 5.7L engine will try to relearn ETC position when the key is left in the on position for an extended period of time and will not allow the starter to crank during this procedure. This procedure can take up to 2.5 seconds.

To verify the cause of the no crank condition or delayed crank use the scan tool, and read the ETC Starter Inhibit mileage.

The controller will store the mileage at which the no start condition occurred because of the ETC testing procedure.

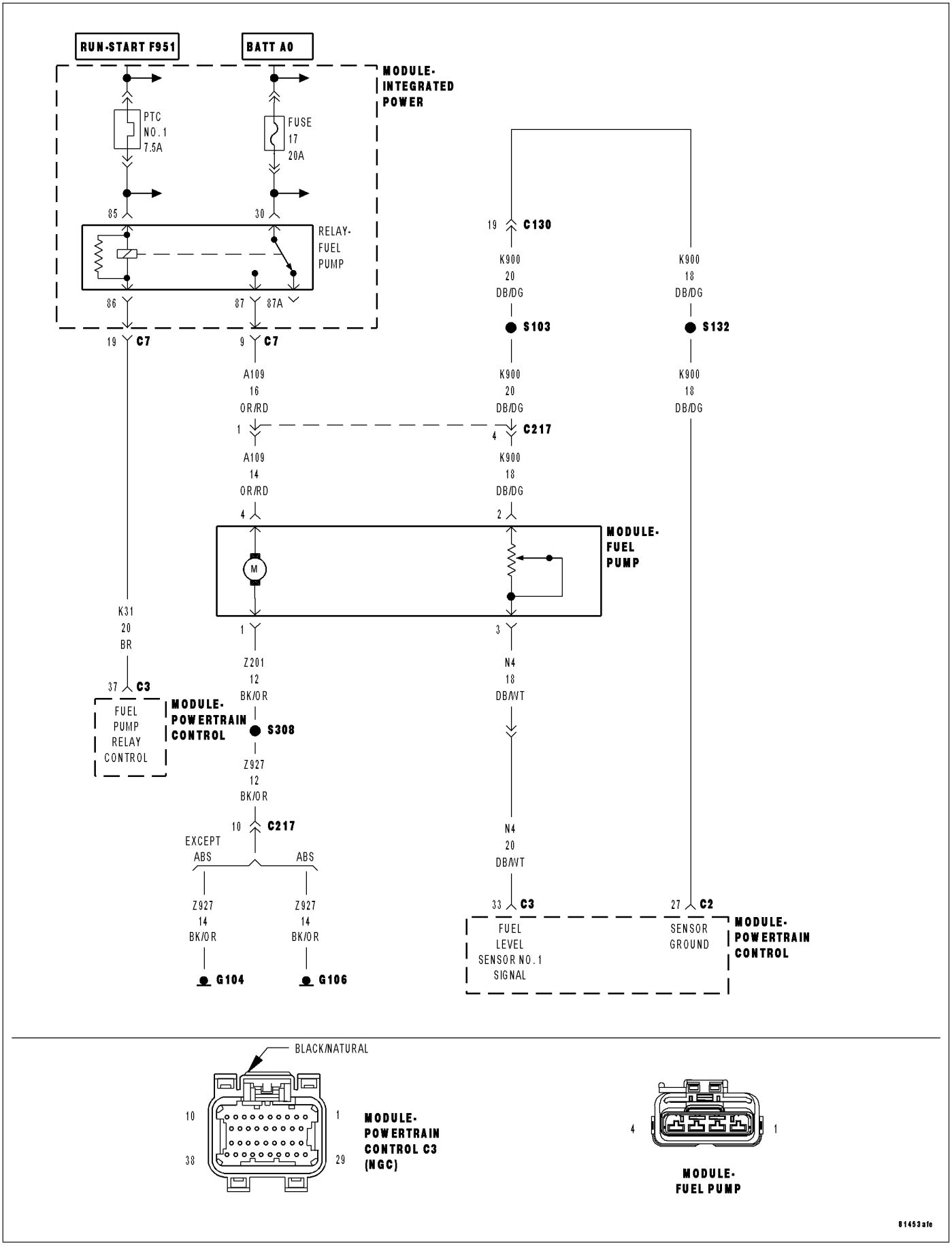
This is considered normal operation for a vehicle equipped with an Electronic Throttle Control System and no repairs are necessary.

Is a mileage stored under the ETC Starter Inhibit?

Yes >> Test Complete.

No >> Refer to the appropriate diagnostic procedure for further assistance if any other DTC's are set. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*CHECKING THE FUEL DELIVERY SYSTEM



***CHECKING THE FUEL DELIVERY SYSTEM (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
(N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN
FUEL PUMP RELAY
FUEL PUMP

Diagnostic Test

1. FUEL PUMP OPERATION

Ignition on, engine not running.

With a scan tool, actuate the Fuel System test.

NOTE: It may be necessary to use a mechanics stethoscope in the next step.
Listen for fuel pump operation at the fuel tank.

CAUTION: Stop All Actuations.

Does the Fuel Pump operate?

Yes >> Go To 2

No >> Go To 5

---

2. FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Below Specification
Go To 3

Within Specification
Test Complete.

Above Specification
Replace the fuel filter/fuel pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE FUEL DELIVERY SYSTEM (CONTINUED)**

3. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) or #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification now?

Yes >> Repair/replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. CHECKING FUEL INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (N1) FUEL PUMP RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the Fuel Pump Relay from the IPM.

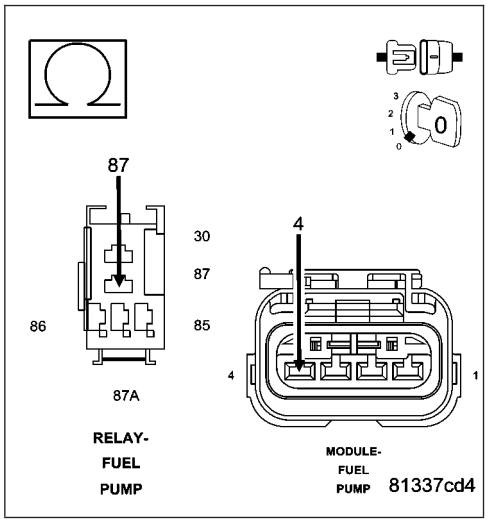
Disconnect the Fuel Pump Module harness connector.

Measure the resistance of the (N1) Fuel Pump Relay Output circuit from the relay connector to the fuel pump module connector.

Is the resistance below 5.0 ohms?

Yes >> Replace the Fuel Pump Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (N1) Fuel Pump Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



*HARD START FUEL SYSTEM

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
FUEL CONTAMINATION
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. CHECKING FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge at the engine.

Ignition on, engine not running.

With a scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Below Specification
Go To 2

Within Specification
Go To 4

---

2. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel supply line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Visually and physically inspect the fuel supply lines between the fuel tank and the fuel rail. Repair/replace as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

***HARD START FUEL SYSTEM (CONTINUED)**

3. CHECKING THE FUEL INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the fuel pressure drop?

Yes >> Replace Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

***HARD START FUEL SYSTEM (CONTINUED)**

5. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

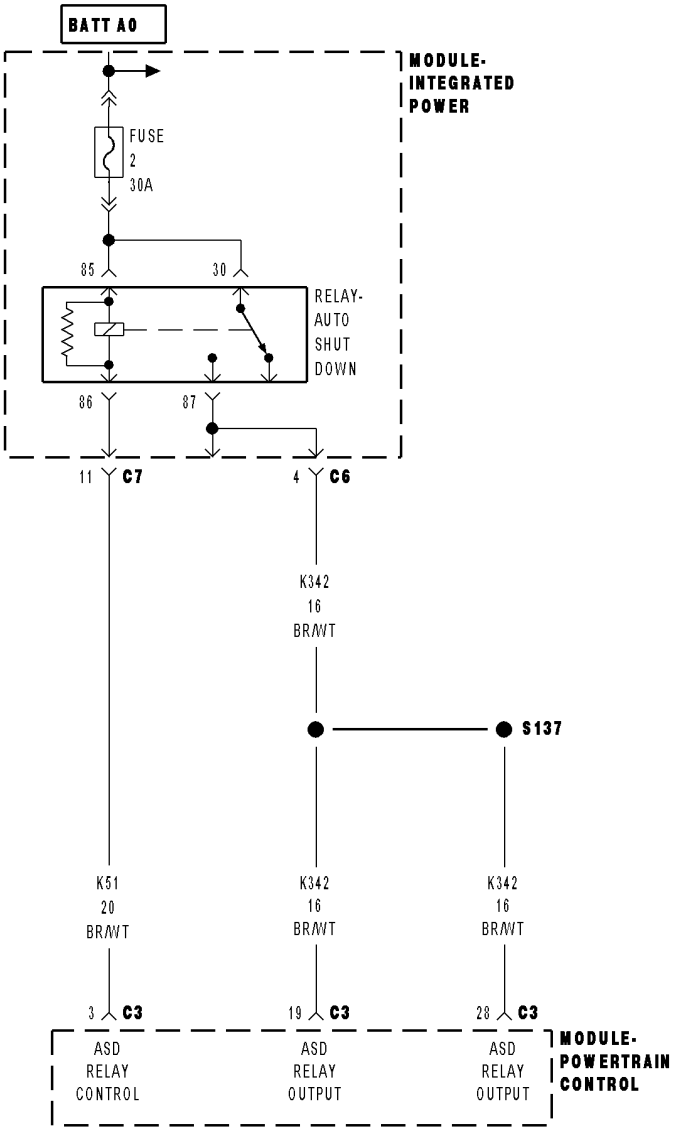
NOTE: The pressure should not fall below 241 KPa (35 psi)

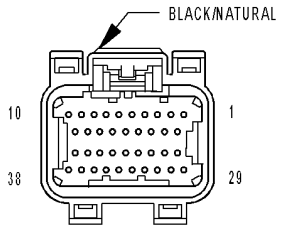
Does the fuel pressure drop?

Yes >> Replace the leaking fuel injectors.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Check the fuel for contaminants.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*ENGINE CRANKS BUT DOES NOT START





MODULE-
POWERTRAIN
CONTROL C3
(NGC)

8145496a

***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
NO START PRE-TEST
POWERTRAIN FUSES OPEN
SECONDARY INDICATORS PRESENT
ENGINE MECHANICAL
(K342) ASD RELAY OUTPUT CIRCUITS OPEN
FUEL CONTAMINATION

Diagnostic Test

1. NO START PRE-TEST

NOTE: The following list of items must be checked before continuing with any no start tests.

The battery must be fully charged and in good condition. A low charged battery may produce invalid test results. If the battery is low, charge the battery and then attempt to start the vehicle by cranking the engine for 15 seconds, 3 consecutive times.

This will allow any DTCs to set that may have been erased due to a dead battery.

Try to communicate with PCM if not able to communicate check fuses.

Make sure the Powers and Ground to the PCM are OK.

Make sure the PCM communicates with the scan tool and that there are no DTCs stored in the PCM memory. If the PCM reports a No Response condition, refer to section 8 Electrical Electronic Control Module Electrical Diagnostics for the proper tests.

Read the PCM DTCs with the scan tool. If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. Refer to the Table of Contents for the related P-code that is reported by the PCM.

Make sure that the Bus is functional. Attempt to communicate with the Instrument Cluster and VTSS, If you are unable to establish communications refer to 8 Electrical Electronic Control Module Electrical Diagnostics for the proper Diagnostic procedures.

The Sentry Key Immobilizer System must be operating properly. Check for proper communication with the scan tool and check for DTCs that may be stored in the Sentry Key Immobilizer Module (SKIM). Repair the DTC(s) before continuing.

If no DTCs are found, using the scan tool, select Clear PCM (BATT Disconnect).

Crank the engine several times. Using the scan tool, read DTCs. If a DTC is present perform the DTC diagnostics before continuing.

Were any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

2. OPEN FUSE

Check for any open fuses in the IPM or Junction Block that may be related to the No Start condition.

Are any of the fuses open?

Yes >> Replace the open fuse and check the related circuit(s) for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. SECONDARY INDICATORS PRESENT

Ignition on, engine not running.
With the scan tool, under DTCs & Related Functions, read the Secondary Indicators while cranking the engine.

Are there any Secondary Indicators present while cranking the engine?

Yes >> Refer to the Engine Electrical Diagnostics group and perform the tests related to the secondary indicator that is reported by the scan tool.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VALVE TIMING - must be within specifications, check for broken timing components
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

***ENGINE CRANKS BUT DOES NOT START (CONTINUED)**

5. (K342) ASD RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

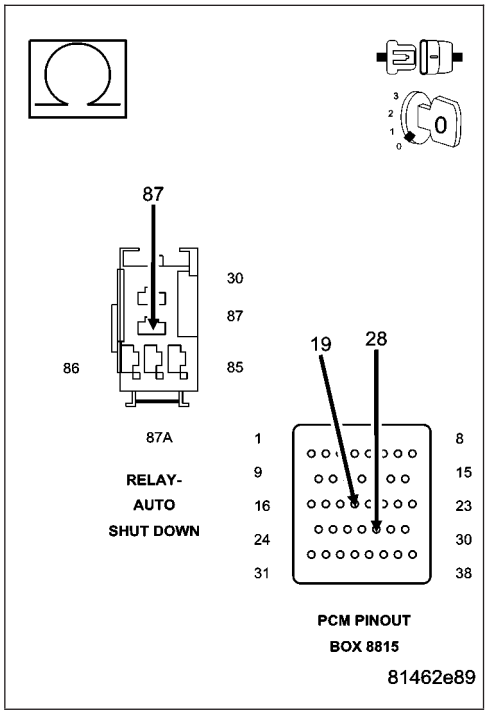
Remove the ASD relay from the IPM.

Disconnect the C3 PCM harness connector.

Verify the ASD Relay is getting voltage on the Fused B+ circuits before continuing.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the ASD Relay Output circuit from the ASD Relay connector to the appropriate terminals of special tool #8815, Ignition coil, and the fuel injectors.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K342) ASD Relay Output circuits. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in the Driveability section of this manual.

Was the No Start condition solved after following the above diagnostic test?

Yes >> Test Complete.

No >> Check for contamination/water in the fuel. Make sure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*FUEL PRESSURE LEAK DOWN

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
FUEL PUMP MODULE
FUEL INJECTOR(S)

Diagnostic Test

1. FUEL PUMP MODULE

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the fuel pressure drop?

Yes >> Replace Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

***FUEL PRESSURE LEAK DOWN (CONTINUED)**

2. FUEL INJECTOR(S)

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove special tool #C4390.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Move special tool #C4390, Hose Clamp Pliers, from between the fuel pressure gauge and the engine to between the fuel pressure gauge and fuel pump module.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

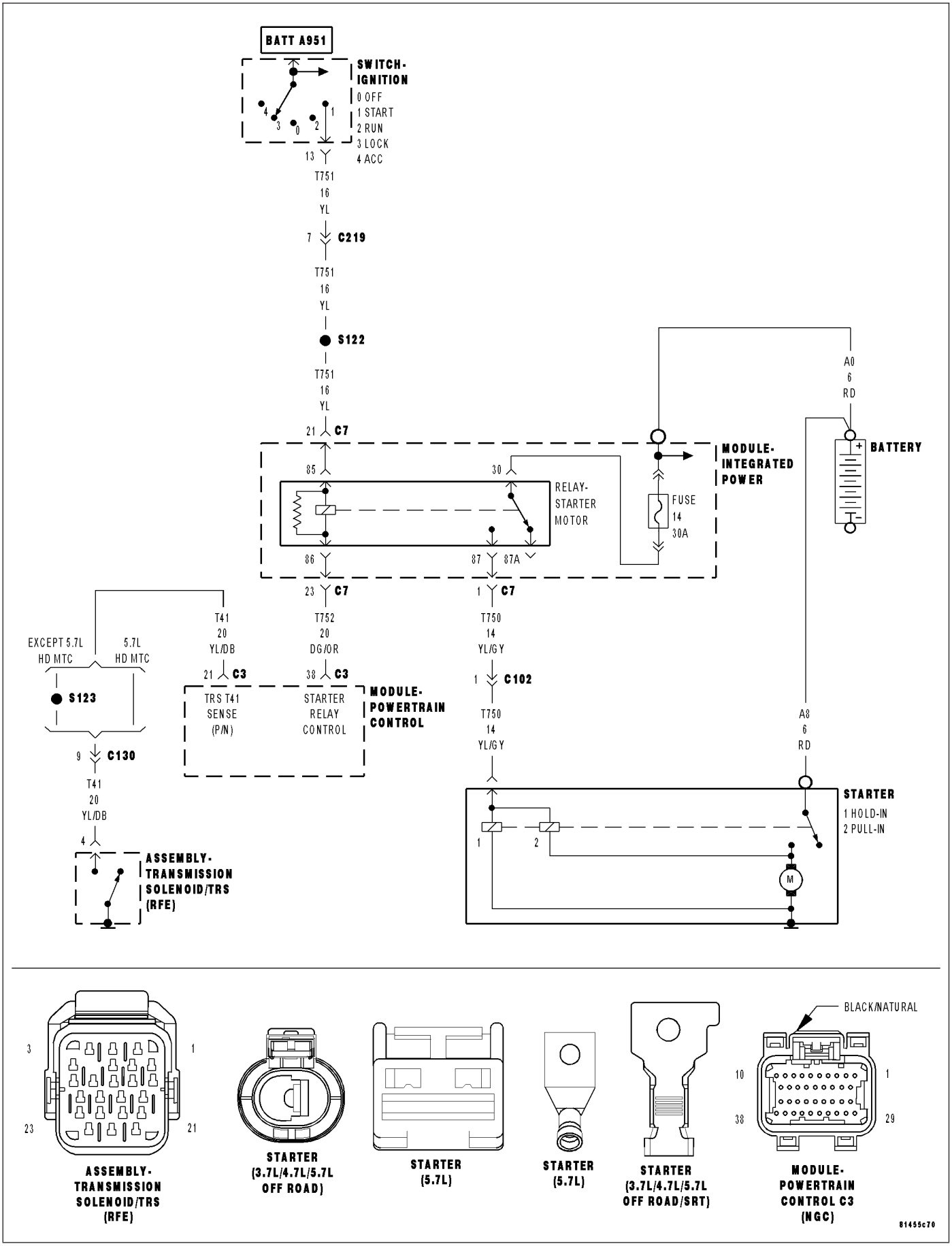
NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the fuel pressure drop?

Yes >> Replace the leaking fuel injectors.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

*NO CRANK CONDITION



ASSEMBLY-TRANSMISSION SOLENOID/TRS (RFE)

STARTER (3.7L/4.7L/5.7L OFF ROAD)

STARTER (5.7L)

STARTER (5.7L)

STARTER (3.7L/4.7L/5.7L OFF ROAD/SRT)

MODULE-POWERTRAIN CONTROL C3 (NGC)

81455c70

***NO CRANK CONDITION (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
MECHANICAL CONDITION
BATTERY CIRCUIT RESISTANCE TOO HIGH
FUSED IGNITION SWITCH OUTPUT CIRCUITS
FUSED B+ CIRCUIT OPEN
(T752) STARTER RELAY CONTROL CIRCUIT OPEN
(T750) STARTER RELAY OUTPUT CIRCUIT OPEN
TRANSMISSION RANGE SENSOR
STARTER RELAY
STARTER

Diagnostic Test

1. MECHANICAL CONDITION

NOTE: Verify the battery is fully charged and capable of passing a load test before continuing.

WARNING: Make sure the battery is disconnected, then wait two minutes before proceeding. Failure to do so may result in personal injury or possible death.

Turn the engine over by hand to make sure the engine is not seized.

Is the engine able to turn over?

Yes >> Go To 2

No >> Repair the mechanical condition preventing the starter motor from cranking.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. TRANSMISSION RANGE SENSOR

Turn the ignition off.

Disconnect the TRS harness connectors.

Move the Gear selector through all gear positions, from Park to 1st and back.

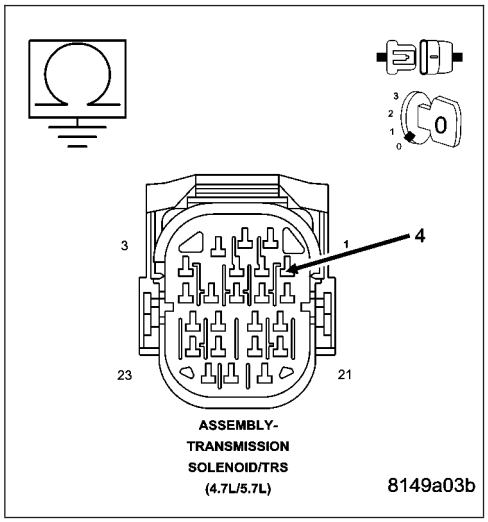
While moving the gear selector through each gear, measure the resistance between ground and the TRS (T41) Sense (P/NSense) circuit at the TRS connector.

NOTE: The circuit is grounded in Park and Neutral and open in the other positions.

Did the resistance change from above 100 kohms (open) to below 10.0 ohms (grounded) ?

Yes >> Go To 3

No >> Replace the Transmission Range Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***NO CRANK CONDITION (CONTINUED)**

3. EXCESSIVE RESISTANCE IN THE BATTERY CIRCUIT

Turn the ignition off.

Check the Battery Cables for excessive resistance using the service information procedure.

Did either Battery Cable have a voltage drop greater than 0.2 of a volt?

Yes >> Repair the excessive resistance in the Battery circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. STARTER RELAY

Turn ignition off.

Remove the Starter Relay from IPM.

CAUTION: The Parking Brake must be on and the Transmission must be in park for a vehicle equipped with an automatic transmission.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Briefly connect a jumper wire from the Internal Fused B+ circuit to the (T750) Starter Relay Output circuit.

Did the Starter Motor crank the engine?

Yes >> Go To 5

No >> Go To 7

---

5. (T751) FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

Using a 12-volt test light, probe the (T751) Fused Ignition Switch Output circuit in the Starter Relay connector.

While observing 12-volt test light, hold ignition key in the start position.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the excessive resistance in the (T751) Fused Ignition Switch Output circuit. Inspect related fuses and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO CRANK CONDITION (CONTINUED)**

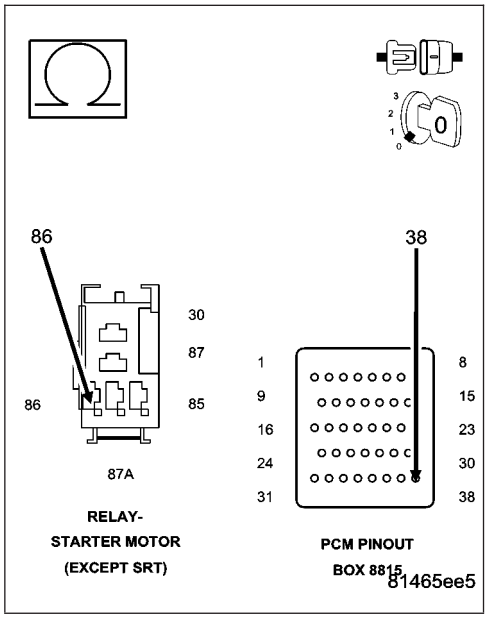
6. (T752) STARTER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Remove the Starter Relay from the IPM.

Disconnect the C3 PCM harness connector.

Measure the resistance in the (T752) Starter Relay Control circuit from the Relay terminal to the appropriate terminals of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Replace the Starter Motor Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (T752) Starter Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. INTERNAL FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Using a 12-volt test light connected to ground, probe the Internal Fused B+ circuit at the Starter Relay terminal.

Does the test light illuminate brightly?

Yes >> Go To 8

No >> Repair the excessive resistance in the Internal Fused B+ circuit. Inspect related fuses and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO CRANK CONDITION (CONTINUED)**

8. (T750) STARTER RELAY OUTPUT CIRCUIT OPEN

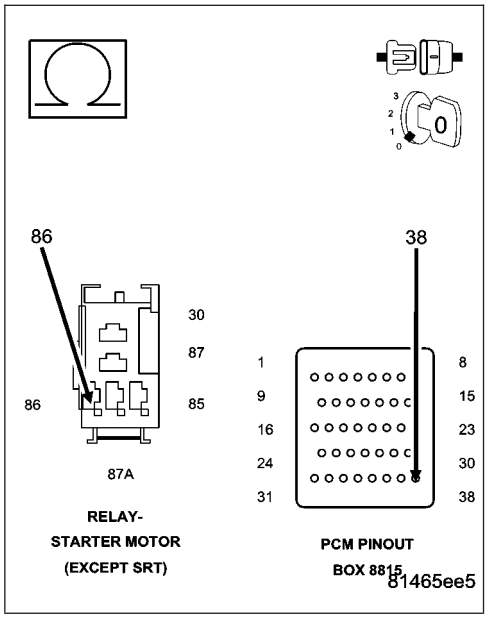
Disconnect the Starter Relay Output connector from the Starter Solenoid.

Measure the resistance of the (T750) Starter Relay Output circuit between the Relay and the Solenoid harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the Starter Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



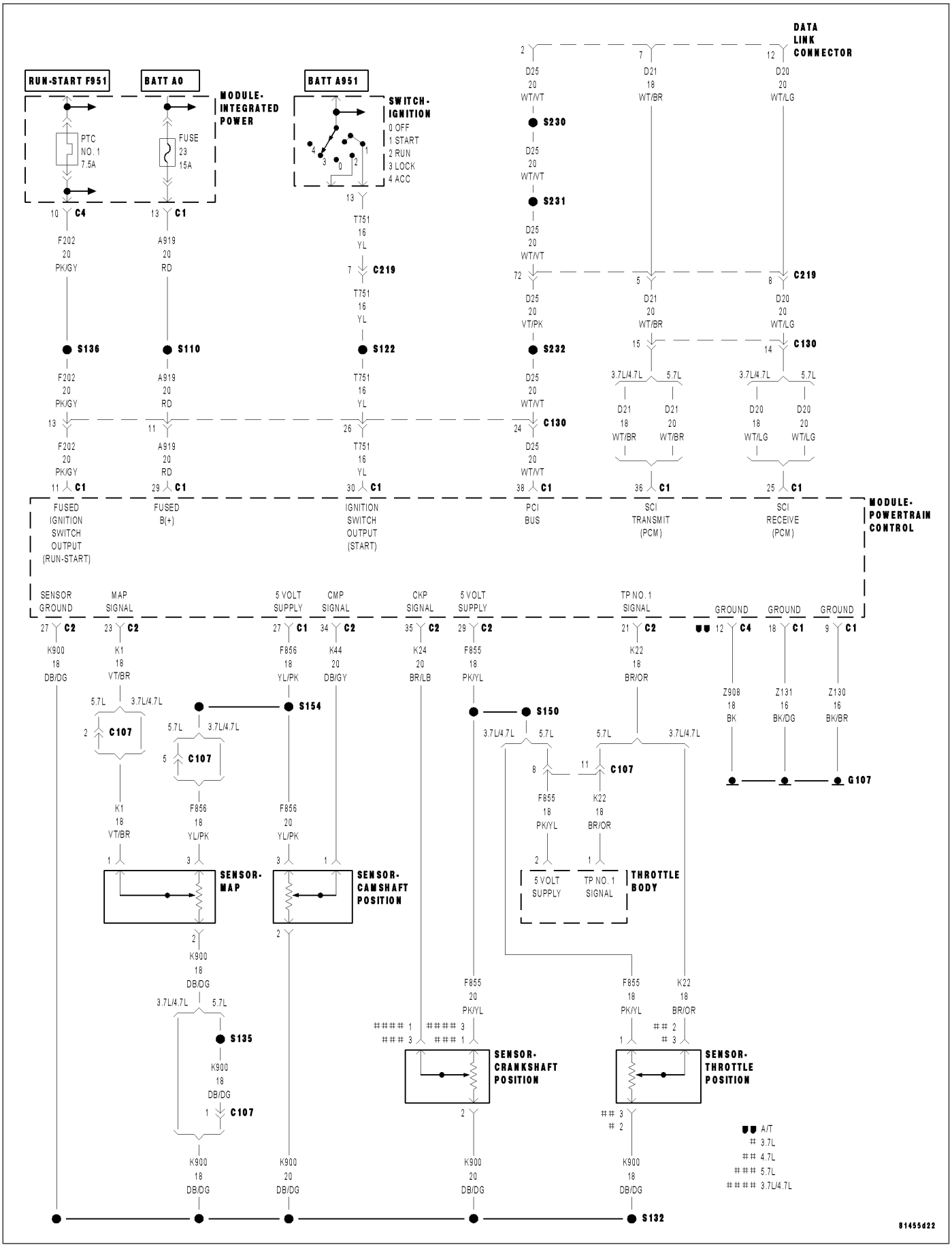
9. STARTER

If there are no other possible causes remaining, review repair.

Repair

Replace the Starter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

*NO RESPONSE WITH A NO START CONDITION



***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A919) PCM FUSED B+ CIRCUIT
PCM NO RESPONSE
(F202) (F1) (T751) PCM FUSED IGNITION SWITCH OUTPUT CIRCUITS
(Z130) (Z131) PCM GROUND CIRCUITS
CRANKSHAFT POSITION SENSOR
(F855) 5-VOLT SENSOR OPEN/SHORTED
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
PCM

Diagnostic Test

1. (A919) PCM FUSED B+ CIRCUIT

NOTE: The scan tool and cable must be operating properly for the results of this test to be valid.

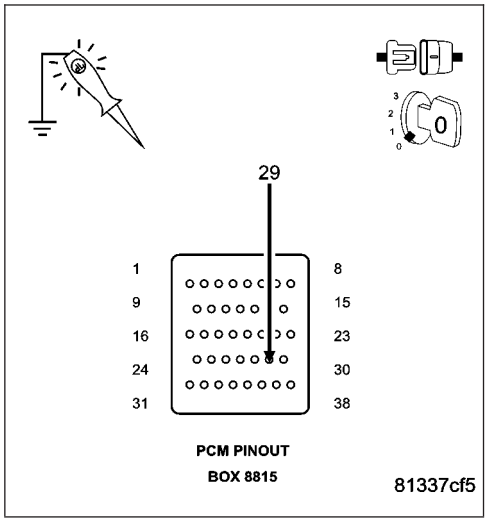
NOTE: Make sure the ignition switch was on while trying to communicate with the PCM.

Turn the ignition off.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Using a 12-volt test light connected to ground probe the appropriate terminal of special tool #8815.



Does the test light illuminate brightly?

Yes >> Go To 2

No >> Repair the open or short to ground in the (A919) Fused B+ circuit. Inspect and replace fuses as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

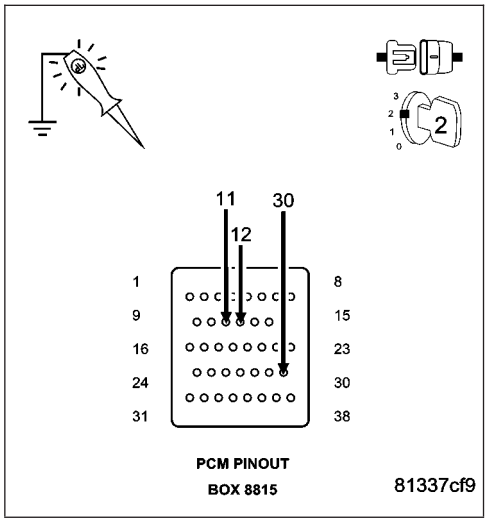
2. (F202), (F1), (T751) PCM FUSED IGNITION SWITCH CIRCUITS

Using a 12-volt test light connected to ground, probe the PCM Fused Ignition Switch Output circuit in the appropriate terminals of special tool #8815.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the (F202) (F924) Ignition Switch Output circuit. Inspect and replace fuses as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



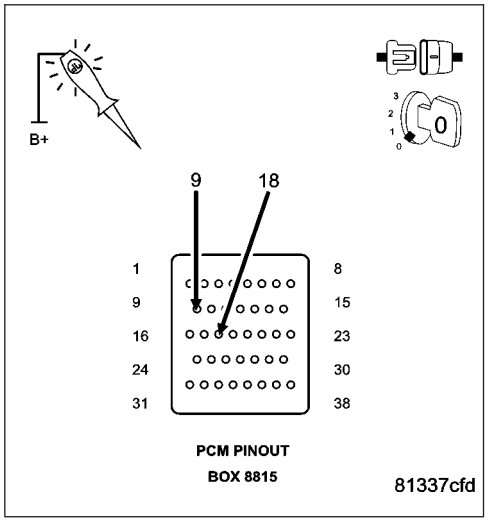
3. (Z130) AND (Z131) PCM GROUND CIRCUITS

Using a 12-volt test light connected to battery voltage, probe the (Z130) (Z131) PCM ground circuits in the appropriate terminals of special tool #8815.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the PCM ground circuits.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

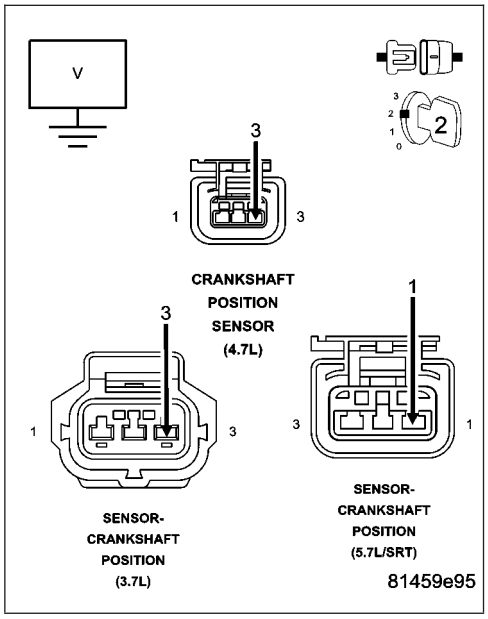
4. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.
Connect the PCM harness connectors.
Disconnect the Crankshaft Position Sensor harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit.

Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 5

No >> Go To 6



***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

5. CKP SENSOR

Turn the ignition off.

Disconnect the TP Sensor harness connector on 3.7L and 4.7L vehicles.

Disconnect the Throttle Body Harness connector on 5.7L vehicles.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor or Throttle Body harness connector.

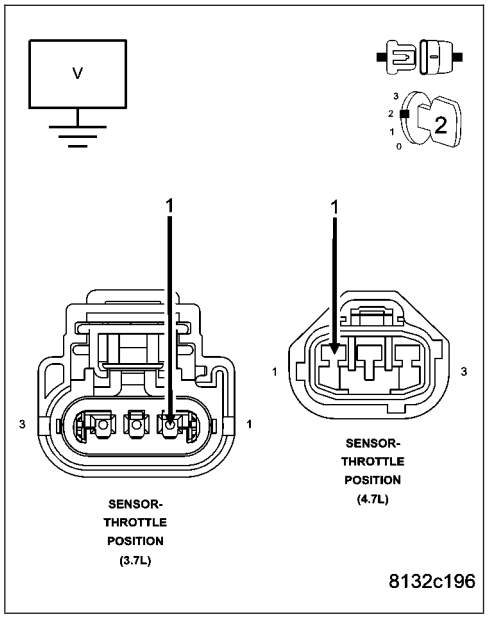
Is the voltage between 4.5 and 5.2 volts?

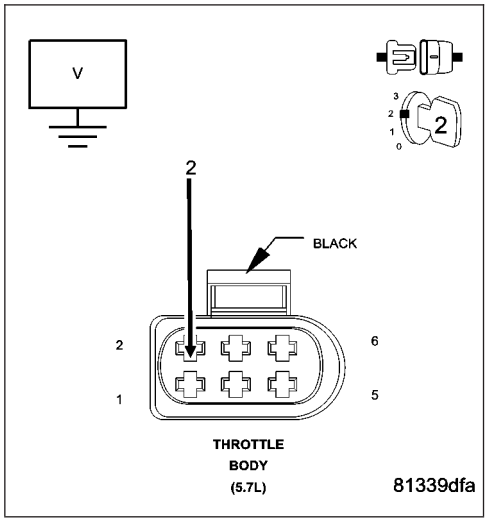
Yes >> If communication is available with a PCM on a like vehicle, replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace the Crankshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

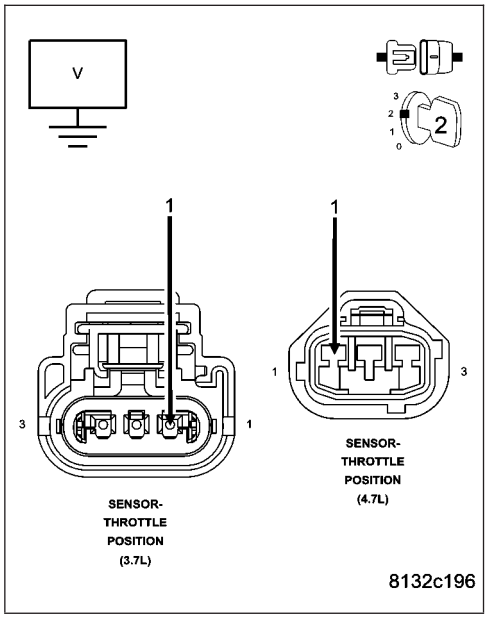
6. (F855) 5-VOLT SENSOR OPEN/SHORTED

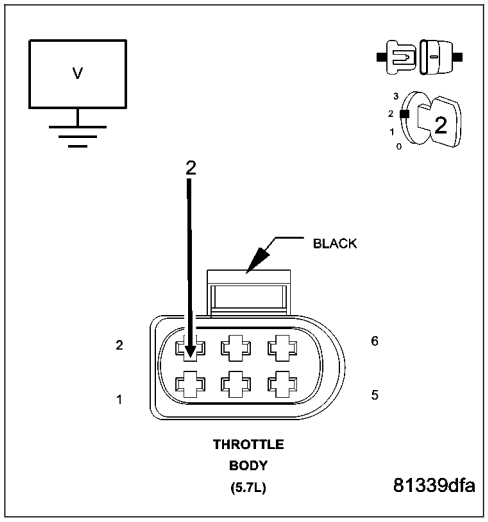
Turn the ignition off.
Disconnect the TP Sensor/Throttle Body harness connector.
Ignition on, engine not running.
Measure the voltage on the (F855) 5-volt Supply circuit.
Disconnect all the sensors that use the (F855) 5-volt Supply circuit.

Did the voltage return to 4.5 to 5.2 volts when disconnecting any of the sensors.

Yes >> Replace the sensor that is pulling down the (F855) 5-volt supply.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7





7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Turn the ignition off.
Disconnect C2 PCM harness connector.
Disconnect all the sensors that share the (F855) 5-volt Supply circuit.
Measure the resistance between ground and the (F855) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

***NO RESPONSE WITH A NO START CONDITION (CONTINUED)**

8. (F856) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Disconnect all the sensors that share the (F856) 5-volt Supply circuit.

Measure the resistance between ground and the (F856) 5-volt Supply circuit at one of the sensor harness connectors.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F856) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

*START AND STALL CONDITION

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
CURRENT PCM DTCS
CURRENT SKIM DTCS
THROTTLE POSITION SENSOR SWEEP
TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED
ECT SENSOR
OTHER POSSIBLE CAUSES FOR START AND STALL CONDITON
FUEL CONTAMINATION

Diagnostic Test

1. CHECKING DTCS

Ignition on, engine not running.

With a scan tool, read DTCs.

Are any DTCs present?

Yes >> Refer to the appropriate Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. CHECKING SKREEM DTCS

NOTE: If you are unable to communicate with the SKIM/SKREEM, refer to the VEHICLE THEFT AND SECURITY ELECTRICAL DIAGNOSTICS in Section 8 and perform the appropriate diagnostics.

With the scan tool, read the SKIM codes.

Are there any SKIM DTCs?

Yes >> Refer to the Sentry Key Vehicle Theft Security Electrical Diagnostics in Section 8.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. TP SENSOR SWEEP

Ignition on, engine not running.

With the scan tool read TP Sensor voltage.

While monitoring the scan tool, slowly open and close the Throttle on vehicles equipped with a 3.7L or 4.7L engine.

On vehicles equipped with a 5.7L engine, using a scan tool perform the pedal follower test and monitor both TP Sensor voltage readings.

Was the voltage change smooth?

Yes >> Go To 4

No >> Replace the Throttle Position Sensor on a 3.7L and 4.7L engines or the Throttle Body Assembly on a 5.7L engine.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***START AND STALL CONDITION (CONTINUED)**

4. TP SENSOR NO.1 VOLTAGE GREATER THAN 0.92 VOLTS WITH THROTTLE CLOSED

With the scan tool, read Throttle Position Sensor No.1 voltage.

Throttle must be against its stop.

Is the voltage 0.92 or less with the Throttle closed?

Yes >> Go To 5

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor or the Throttle Body Assembly on a 5.7L.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soaked).

NOTE: If the vehicle was allowed to sit over night with no engine start, coolant temperature should be near ambient temperatures.

Ignition on, engine not running.

With the scan tool, read the ECT value.

NOTE: If engine coolant temperature is above 82° C (180° F), allow the engine to cool until 65° C (150° F) is reached.

Start the engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temperature value change should be a smooth transition from start up to normal operating temp 82° C (180° F). The value should reach at least 82° C (180° F).

Did the Engine Temperature value increase smoothly and did it reach at least 82° C (180° F)?

Yes >> Go To 6

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. OTHER POSSIBLE CAUSES OF START AND STALL CONDITION

The following additional items should be checked as a possible cause for a start and stall condition.

Refer to any Technical Service Bulletins (TSBs) that may apply to the symptom.

The exhaust system must be free of any restrictions.

The engine compression must be within specifications.

The engine valve timing must be within specifications.

The engine must be free from vacuum leaks.

The throttle body must be free of carbon buildup and dirt.

Do any of the above conditions exist?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

***START AND STALL CONDITION (CONTINUED)**

7. FUEL PUMP DELIVERY

Verify that the Fuel tank is not empty before continuing.

Follow the diagnostics for Checking Fuel Delivery in this manual.

Was the No Start condition solved after following the above diagnostic test?

Yes >> Test Complete.

No >> Check for contamination/water in the fuel. Ensure the fuel being used in this vehicle meets manufactures Fuel Requirement, refer to the service manual.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

STANDARD PROCEDURE

POWERTRAIN VERIFICATION TEST

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SELECTING THE PROPER VERIFICATION TEST

The following verification test are for different repairs. Select the appropriate Verification test for the repair that has been completed.

Speed Control repair
Go To 2

Charging System repair
Go To 3

NVLD System repair
Go To 4

All other repairs
Go To 5

POWERTRAIN VERIFICATION TEST (CONTINUED)

2. POWERTRAIN VERIFICATION TEST 1

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all engine components are properly installed and connected.

6. Connect the scan tool to the data link connector and erase all codes.

7. Turn the speed control ON (if equipped, cruise light will be on).

8. Depress and release the SET Switch when the vehicle speed is greater than 35 MPH. The speed control should engage and hold the selected speed.

9. Press and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 MPH.

10. Press and hold the COAST switch. The vehicle speed should decrease.

11. Using caution, press and release the brake pedal. The speed control should disengage.

12. Bring the vehicle speed back up to 35 MPH.

13. Press the RESUME/ACCEL switch. The speed control should resume the previously set speed.

14. Hold down the SET switch. The vehicle should decelerate.

15. Make sure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed.

16. Press and release the CANCEL switch. The speed control should disengage.

17. Bring the vehicle speed back up above 35 mph and engage speed control.

18. Turn the Speed Control Off. (Cruise light will be off). The speed control should disengage.

NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.

20. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).

21. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

22. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.

23. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.

24. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop.

25. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).

26. Then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.

27. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

POWERTRAIN VERIFICATION TEST (CONTINUED)

3. POWERTRAIN VERIFICATION TEST 2

1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly has been replaced use a scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all components related to the repair are properly installed and connected.
6. With the scan tool, clear DTCs.
7. Perform generator output test. Refer to the appropriate service information as necessary.
8. Start the engine and set engine speed to 2000 RPM for at least thirty seconds.
9. Cycle the ignition key off and on.
10. With the scan tool, read the DTCs.

Are any DTCs or symptoms remaining?

Yes >> Check for any Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

No >> Repair is complete.

---

4. POWERTRAIN VERIFICATION TEST 3

1. Install the Miller Tool #8404 Evaporative Emission Leak Detector (EELD) according to the instructions in the previous DTC table.
2. Set the smoke/air control switch to AIR.
3. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).
4. Press the remote smoke/air start button.
5. Position the red flag on the air flow meter so it is aligned with the indicator ball.
6. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size of leak indicated by the DTC set in the PCM.
7. Install the service port adapter #8404-14 on the vehicle's service port.
8. Connect the Air supply hose from the EELD to the vehicle.
9. Press the remote button to activate AIR flow.

NOTE: 10. Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

11. Compare the flow meter indicator ball reading to the red flag.
12. ABOVE the red flag indicates a leak present.
13. BELOW the red flag indicates a sealed system.

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

15. If the indicator ball shows a leak present, perform the smoke test indicated in the previous test and identify the leak and repair. Perform this verification test when the repair is complete.

Did the indicator ball indicate the a leak is present?

Yes >> Repeat the DTC test to identify the leak and repair.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST (CONTINUED)

5. POWERTRAIN VERIFICATION TEST 4

NOTE: 1. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 2. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 3. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

NOTE: 4. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 5. When replacing an O2 Sensor, the PCM RAM memory must be cleared, either by disconnecting the PCM C1 connector or momentarily disconnecting the Battery negative terminal.

6. The NGC learns the characteristics of each O2 heater element and these old values should be cleared when installing a new O2 sensor. The customer may experience driveability issues if this is not performed.

7. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

8. Connect the scan tool to the data link connector.

9. Make sure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.

10. If the Catalyst was replaced, with the scan tool go to the Miscellaneous Menu Option ″Catalyst Replaced″ and press enter.

11. If a Comprehensive Component DTC was repaired, perform steps 12 - 14. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.

12. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.

13. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).

14. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Engine Electrical Diagnostic List.

15. If the conditions cannot be duplicated, erase all DTCs with the Scan tool.

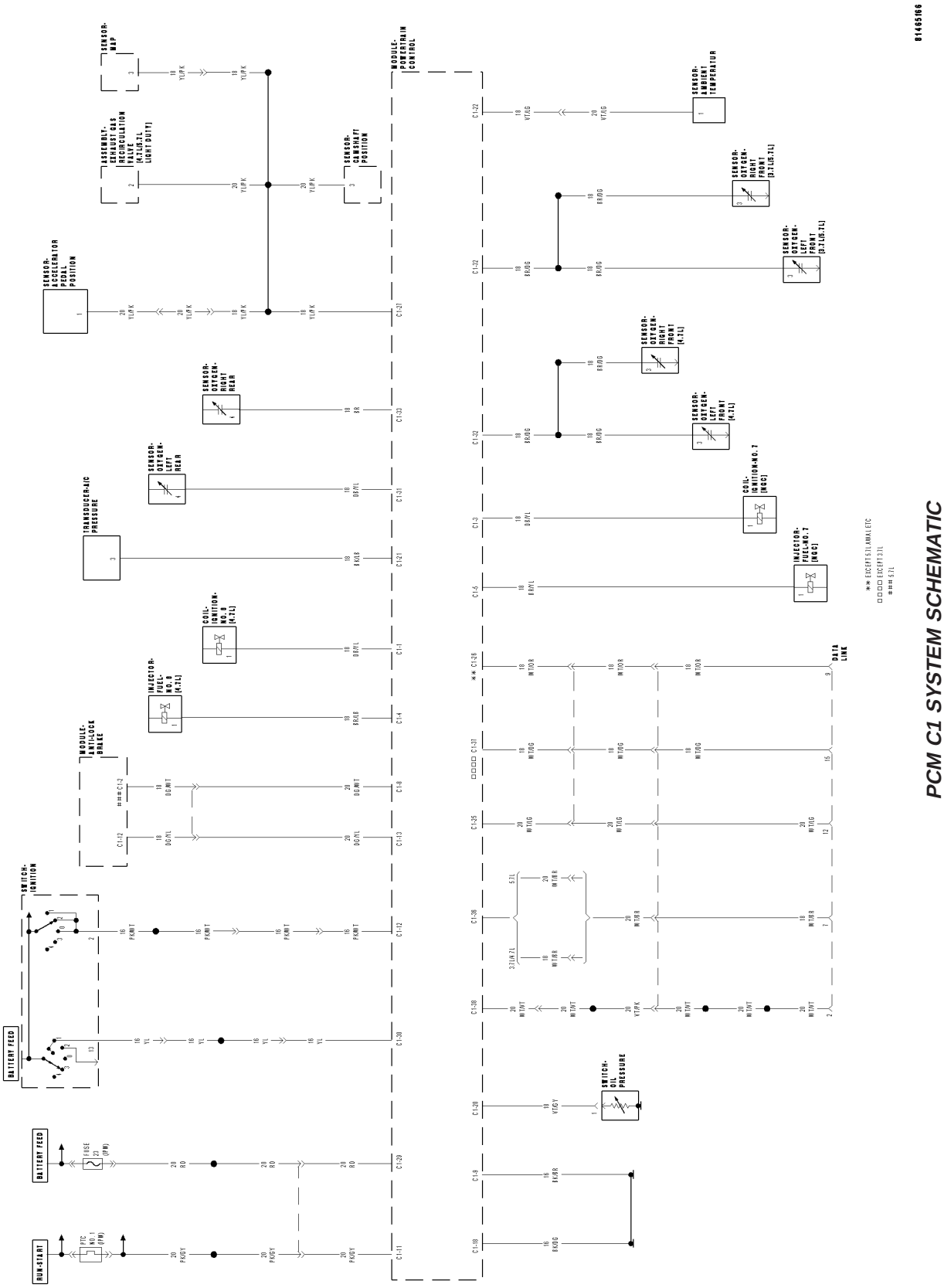
16. If another DTC has set, return to the Engine Electrical Diagnostic List and follow the path specified for that DTC.

Did the OBDII Monitor run successfully and has the Good Trip Counter changed to one or more?

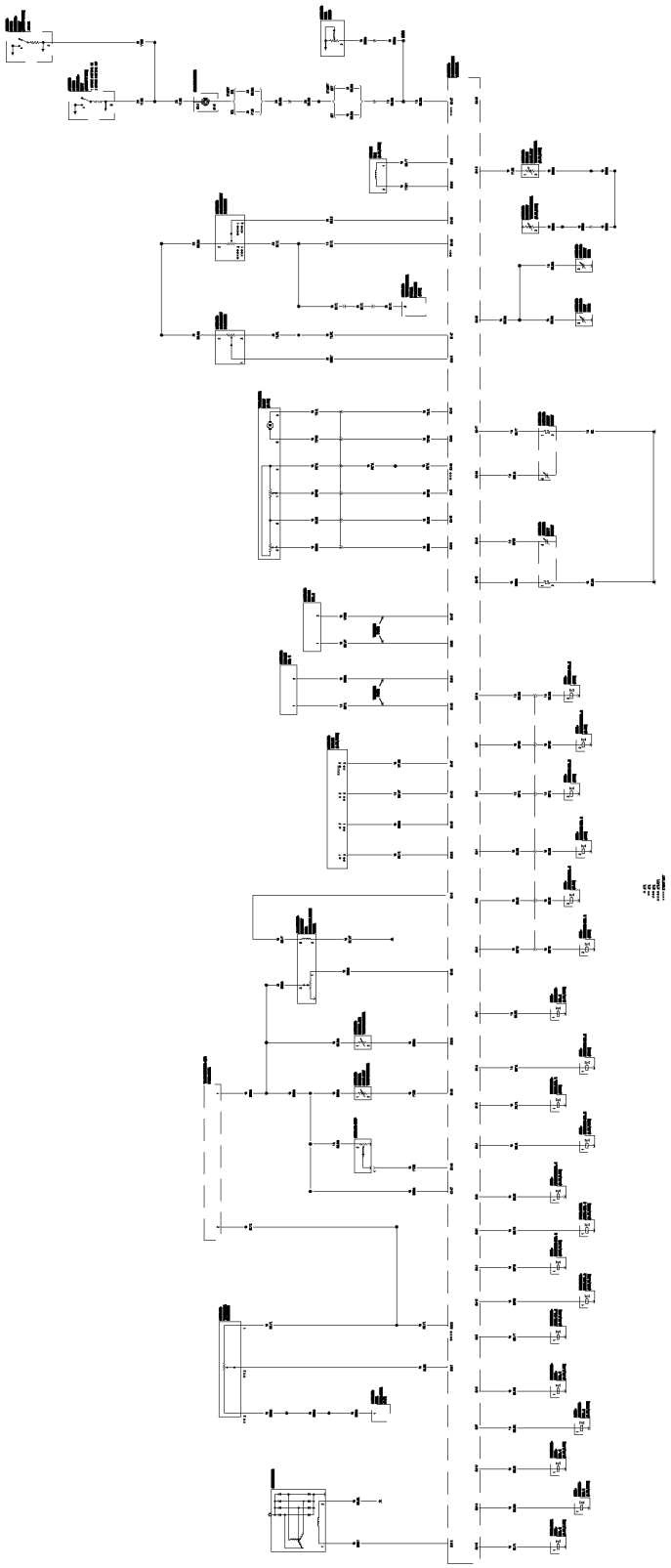
Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

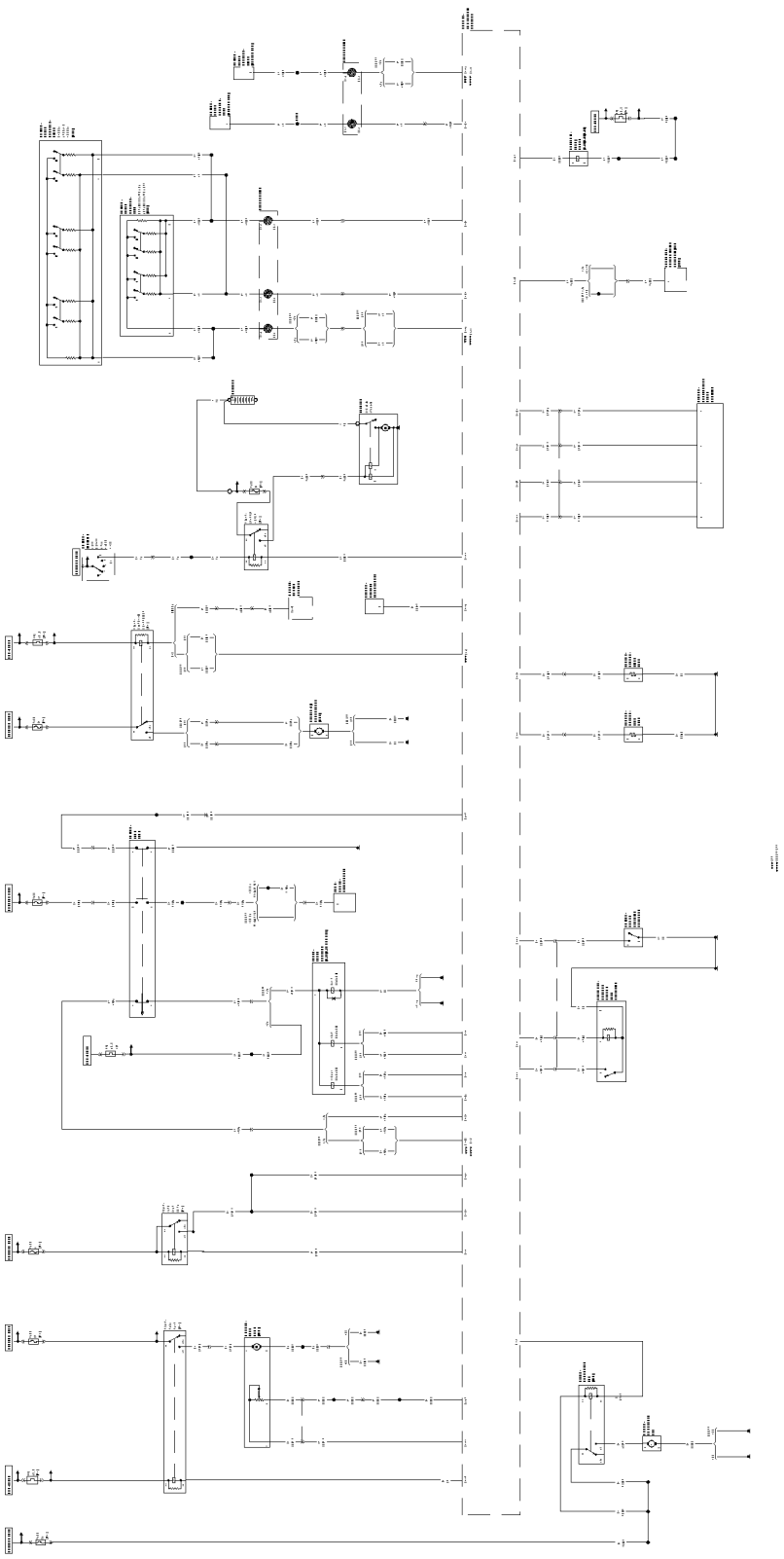
SCHEMATICS AND DIAGRAMS



PCM C1 SYSTEM SCHEMATIC



PCM C2 SYSTEM SCHEMATIC



PCM C3 SYSTEM SCHEMATIC

ENGINE - ELECTRICAL DIAGNOSTICS - DIESEL

TABLE OF CONTENTS

page

ENGINE - ELECTRICAL DIAGNOSTICS - DIESEL
CAUTION
P0016-ENGINE SPEED SIGNAL MISMATCH 1048
DIAGNOSIS AND TESTING
PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE 1051
POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL) 1053
POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL) 1054
POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL) 1055
POWERTRAIN VERIFICATION TEST VER - 5 (DIESEL) 1057
INTERMITTENT CONDITION 1058
P0069-BOOST KEY ON RATIONALITY 1059
P0071-INLET AIR TEMP SENSOR RATIONALITY 1062
P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW 1064
P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH 1069
P0088-FUEL RAIL PRESSURE SIGNAL IS ABOVE MAX LIMIT 1074
P0106-INLET AIR PRESSURE SENSOR RATIONALITY 1076
P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW 1078
P0108-INLET AIR Pressure Sensor Voltage Too high 1085
P0111-INTAKE AIR TEMPERATURE (IAT) SENSOR RATIONALITY 1091
P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW 1093
P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH 1098
P0116-ENGINE COOLANT TEMPERATURE (ECT) SENSOR RATIONALITY 1103
P0117-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO LOW 1106
P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH 1110
P0128-THERMOSTAT RATIONALITY 1115
P0148-HIGH PRESSURE COMMON RAIL (HPCR) CHECKSUM 1116
P0169-WATER IN FUEL (WIF) LIGHT ON TOO LONG 1119
P0191-FUEL RAIL PRESSURE SENSOR PERFORMANCE 1121

page

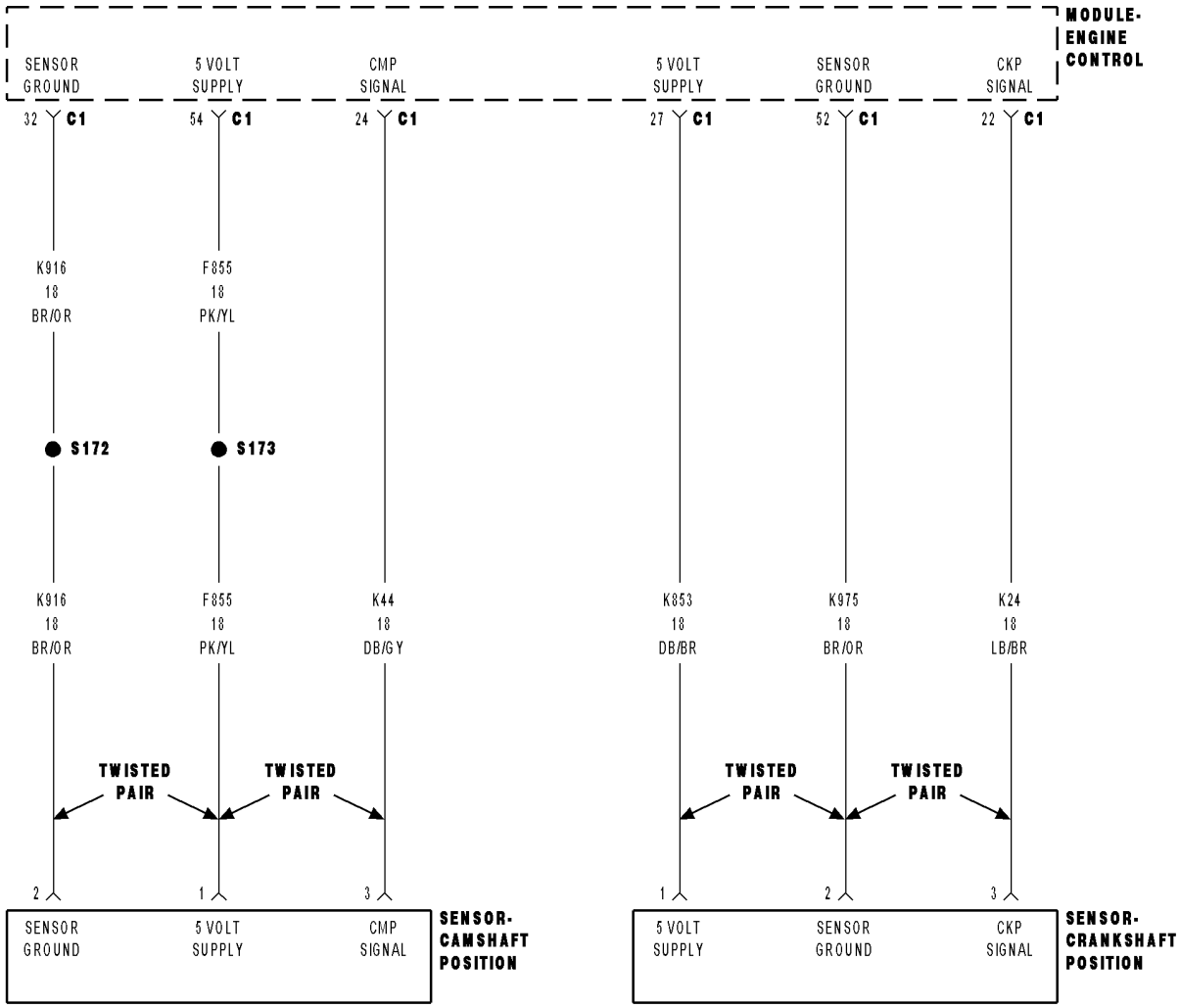
P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW 1124
P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH 1130
P0201-INJECTOR #1 CONTROL CIRCUIT . 1135
P0202-INJECTOR #2 CONTROL CIRCUIT . 1139
P0203-INJECTOR #3 CONTROL CIRCUIT . 1143
P0204-INJECTOR #4 CONTROL CIRCUIT . 1147
P0205-INJECTOR #5 CONTROL CIRCUIT . 1151
P0206-INJECTOR #6 CONTROL CIRCUIT . 1155
P0217-DECREASED ENGINE PERFORMANCE DUE TO ENGINE OVERHEAT CONDITION 1159
P0219-CRANKSHAFT POSITION SENSOR OVER SPEED SIGNAL 1161
P0234-TURBOCHARGER OVERBOOST CONDITION 1163
P0236-MAP SENSOR TOO HIGH TOO LONG 1165
P0237-MAP SENSOR VOLTAGE TOO LOW . . 1168
P0238-MAP SENSOR VOLTAGE TOO HIGH 1174
P0243-WASTEGATE PRESSURE CONTROL PWM 1179
P0251-CP3 PUMP REGULATOR CONTROL 1185
P0299-BOOST IN RANGE LOW 1192
P0300-MULTIPLE CYLINDER MISFIRE 1196
P0301-CYLINDER # 1 MISFIRE 1199
P0302-CYLINDER # 2 MISFIRE 1202
P0303-CYLINDER # 3 MISFIRE 1205
P0304-CYLINDER # 4 MISFIRE 1208
P0305-CYLINDER # 5 MISFIRE 1211
P0306-CYLINDER # 6 MISFIRE 1214
P0335-CRANKSHAFT POSITION (CKP) LOST 1217
P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL 1224
P0337-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO LOW 1231
P0338-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO HIGH 1234
P0340-CAMSHAFT POSITION (CMP) LOST 1237
P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL 1243
P0381-WAIT TO START LAMP INOPERATIVE 1250
P0461-Fuel Level Unit No Change Over Time 1252

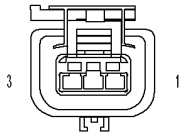
P0462-LOW VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR 1255
P0463-HIGH VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR 1259
P0477-LOW VOLTAGE ON THE ENGINE BRAKE DRIVER 1262
P0478-HIGH VOLTAGE ON THE ENGINE BRAKE DRIVER 1265
P0480-FAN CLUTCH 1267
P0483-FAN SPEED 1272
P0500-NO VEHICLE SPEED SENSOR SIGNAL 1280
P0514-BAT TEMPERATURE SENSOR RATIONALITY 1284
P0516-LOW VOLTAGE AT THE BAT TEMP SENSOR 1286
P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR 1290
P0521-OIL PRESSURE SWITCH RATIONALITY 1295
P0524-OIL PRESSURE TOO LOW 1298
P0532-A/C SENDING UNIT VOLTS TOO LOW 1301
P0533-A/C SENDING UNIT VOLTS TOO HIGH 1308
P0541-LOW VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY 1313
P0542-HIGH VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY 1316
P0562-BATTERY VOLTAGE LOW 1319
P0563-BATTERY VOLTAGE HIGH 1323
P0572-LOW VOLTAGE DETECTED AT THE BRAKE SWITCH. 1326
P0573-HIGH VOLTAGE DETECTED AT THE BRAKE SWITCH. 1330
P0580-LOW VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH 1333
P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH 1337
P0602-CHECKSUM ERROR 1343
P0604-ECM SOFTWARE ERROR 1344
P0606-ECM HARDWARE ERROR 1345
P0607-ECM INTERNAL FAILURE 1346
P0622-GENERATOR FIELD NOT SWITCHING PROPERLY 1347
P0628-LOW VOLTAGE DETECTED AT THE FUEL LIFT PUMP 1351
P0629-HIGH VOLTAGE DETECTED AT THE FUEL LIFT PUMP 1355
P0630-VIN NOT ENTERED ERROR 1359
P0633-SKIM SECRET KEY NOT ENTERED . . 1360
P0642-LOW VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT. 1361
P0643-HIGH VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT. 1365
P0646-LOW VOLTAGE DETECTED AT THE A/C CLUTCH RELAY 1368
P0647-HIGH VOLTAGE DETECTED AT THE A/C CLUTCH RELAY 1372
P0652-LOW VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT. 1375
P0653-HIGH VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT. 1379
P0698-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO LOW 1382
P0699-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO HIGH 1386
P1652-J1850 SHORT TO GROUND 1389
P2121-PPS CONFORMANCE ERROR 1392
P2122-PPS 1 VOLTAGE TOO LOW 1404
P2123-PPS 1 VOLTAGE TOO HIGH 1410
P2127-PPS 2 VOLTAGE TOO LOW 1414
P2128-PPS 2 VOLTAGE TOO HIGH 1420
P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW. 1424
P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW. 1433
P2266-WATER IN FUEL (WIF) SENSOR VOLTAGE TOO LOW 1442
P2269-WATER IN FUEL (WIF) 1445
P2502-CHARGING SYSTEM ERROR 1448
P2503-CHARGING SYSTEM OUTPUT LOW . . 1452
P2504-CHARGING SYSTEM OUTPUT HIGH . . 1455
P2509-POWERDOWN DATA LOST ERROR . . 1459
P2607-LOW VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY 1463
P2608-HIGH VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY 1467
P2609-NO VOLTAGE DROP SEEN FROM INTAKE AIR HEATERS 1470
*ENGINE SPEED SURGES UNDER LOAD OR IN OPERATING RANGE 1473
*ENGINE SPEED SURGES LOW OR HIGH IDLE. 1474
*ENGINE DIFFICULT TO START OR WILL NOT START (NO EXHAUST SMOKE WHILE CRANKING) 1475
*ENGINE DIFFICULT TO START OR WILL NOT START (EXHAUST SMOKE) 1476
*ENGINE SPEED SURGES IN PTO OR CRUISE CONTROL 1477
*CHECKING THE ACCELERATOR PEDAL SENSOR CALIBRATION 1478
*CHECKING THE ECM POWER AND GROUNDS 1479
*CHECKING PRESSURE LIMITING VALVE ON THE FUEL RAIL FOR INTERNAL LEAKS 1480
*FUEL HEATER THERMOSTAT TEST 1481
*FUEL PUMP RETURN FLOW TEST 1482
*HIGH PRESSURE FUEL PUMP PERFORMANCE TEST. 1483
*INJECTOR RETURN FLOW TEST 1484
*INTAKE AIR SYSTEM PRESSURE TEST . 1485

ENGINE - ELECTRICAL DIAGNOSTICS - DIESEL

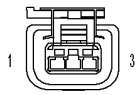
CAUTION

P0016-ENGINE SPEED SIGNAL MISMATCH

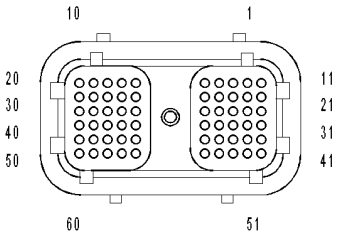




SENSOR-CAMSHAFT POSITION (DIESEL)



SENSOR-CRANKSHAFT POSITION (DIESEL)



MODULE-ENGINE CONTROL C1

813f9e4

P0016-ENGINE SPEED SIGNAL MISMATCH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While Engine is running.
- **Set Condition:**
  When the engine speed detected by the Engine Position Sensor (cam) and the Engine Speed Sensor (crank) differ by a specified RPM amount.

Possible Causes
DAMAGE TO THE ESS OR EPS
MECHANICAL MISALIGNMENT OF THE ESS OR EPS
MECHANICAL MISALIGNMENT OF THE CAMSHAFT AND CRANKSHAFT GEARS
INTERMITTENT CONDITION

Diagnostic Test

1. DAMAGE TO THE ESS OR EPS

Visually inspect the condition of the tone wheel, ESS, and EPS for damage.

Are any of the components damaged?

Yes >> Repair or replace any damaged component.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. MECHANICAL MISALIGNMENT OF THE ESS OR EPS

Verify the speed indicator ring is properly positioned relative to the locating pin in the front face of the crankshaft.

Is the speed indicator ring properly installed?

Yes >> Go To 3

No >> Repair the speed ring indicator ring installation.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

3. Test Mechanical misalignment of the camshaft and crankshaft gears.

Check the mechanical alignment of the camshaft gear to the crankshaft gear. Refer to service manual for assistance.

Are the gear teeth in proper alignment?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Repair the gear alignment.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

Are you currently experiencing a NO RESPONSE condition?

Yes >> The NO RESPONSE condition must be properly diagnosed before continuing.
Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No >> Go To 2

---

2. NO START

Is the customer complaint a NO START condition?

Yes >> Check the vehicle for any NO START related PCM DTC(s) or Vehicle Theft Security related DTC(s).
If no Theft related DTC(s) are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No >> Go To 3

---

3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTC(s) and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customers complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inpect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSB(s) related to the customer's complaint or DTC(s).

If a TSB applies, follow the instructions per the TSB.

Choose the following scenario that best applies.

The TSB repaired the customers complaint.
Testing complete.

A DTC is present, no TSB applies, or the TSB didn't repair the customers complaint.
Go To 4

No DTC(s) are present.
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE (CONTINUED)

4. WIRE HARNESS INSPECTION

Clear the DTC(s).

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTC(s) that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTC(s) are fuel or air related, check the fuel level and quality.

Were any repairs made that fixed the customer's complaint?

Yes >> Testing complete.

No >> Refer to the diagnostic test procedure related to the DTC.

POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL)

Diagnostic Test

1. POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL)

1. Clear the DTC before continuing.
2. Check if any of the following conditions exist.
3. The ECM has been disconnected or replaced.
4. The battery power has been disconnected.
5. If the ECM has been replaced, do the following: (Other go to step 12).

NOTE: 8. If the Engine Control Module has been replaced and the correct VIN and mileage have not been programmed, a DTC will be set in the ABS, Airbag Modules and SKIM module.

6. For ABS and Airbag Systems: Action: Enter correct VIN and Mileage in PCM. Erase ABS and Airbag Module codes.
7. If the ECM has not been replaced, do the following.
8. Inspect the vehicles to ensure that all engine components are connected. Reassemble and reconnect components as necessary.
9. Attempt to start the engine.
10. If the engine is unable to start, look for any Technical Service Bulletins that may relate to this condition. Return to Symptom list if necessary.
11. If the there are no DTCs present and all components are functional, the repair is complete.

Are any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL)

Diagnostic Test

1. POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL)

1. Check if any of the following conditions exist.
2. The ECM has been disconnected or replace.
3. The Battery power has been disconnected.
4. If the PCM has been replaced, do the following: (Otherwise go to step 12)

NOTE: 5. If the Engine Control Module has been changed and the correct VIN andmileage have not been programmed, a DTC will be set in the ABS and Airbag Module.

6. For ABS and Airbag Systems: Action: Enter correct VIN and Mileage in the ECM. Erase ABS and Airbag Module codes.
7. If the ECM has been replace, do the following.
8. If this verification procedure is being performed after a No Trouble Code repair, do the following.
9. Check to see if the initial symptom still exists. If the initial or another symptom exists, the repair is not complete. Check all pertinent Technical Service Bulletins and return to the Symptom list if necessary.
10. If this verification procedure is being performed after a Trouble Code repair, do the following.
11. Connect the scan tool to the data link connector and erase trouble codes.
12. With the scan tool, reset all memory values.
13. If this test is for an A/C trouble code, ensure it is operating during the following road test.
14. Drive the vehicle for at least five minutes, For some of the drive, go at least 40 MPH; at some point stop the vehicle and turn the engine off for 10 seconds or more; then restart and continue. Ensure the transmission shifts through all gears.
15. Upon completion of the road test, turn the engine off and read trouble codes with the scan tool. If a trouble code has been set, return to the Symptom list and follow the path specified.

Is there any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL)

1. POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL)

1. Check if any of the following conditions exist.

2. The ECM has been disconnected or replace.

3. The Battery power has been disconnected.

4. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

5. With the DRBIII®, erase DTCs.

6. If the ECM has been replaced, perform steps 11 through 13, then continue with the verification.

7. If ECM has been changed and correct VIN and mileage have not been programmed, a DTC will be set in ABS and Air bag modules. In addition, if vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start.

8. For ABS and Air Bag systems: Enter correct VIN and Mileage in ECM. Erase codes in ABS and Air Bag modules.

9. For SKIM theft alarm: Connect DRBIII® to data link conn. Go to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode, by using the appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM

10. Turn the speed control ON (if equipped, cruise light will be on).

11. Depress and release the SET Switch. If the speed control did not engage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

12. Depress and hold the RESUME/ACCEL Switch. If the vehicle speed did not increase by at least 2 mph, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

13. Press and hold the COAST switch. The vehicle speed should decrease. If it did not decrease, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

14. Using caution, depress and release the brake pedal. If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

15. Bring the vehicle speed back up to 35 MPH.

16. Depress the RESUME/ACCEL switch. If the speed control did not resume the previously set speed, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

17. Hold down the SET switch. If the vehicle did not decelerate, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

18. Ensure vehicle speed is greater than 35 mph and release the SET Switch. If vehicle did not adjust and set a new vehicle speed, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

19. Depress and release the CANCEL switch. If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

20. Bring the vehicle speed back up above 35 mph and engage speed control.

21. Depress the OFF switch to turn OFF, (Cruise light will be off). If the speed control did not disengage, the repair is not complete. Check for TSBs that pertain to speed control problem and then, if necessary, return to Symptom List.

22. If the vehicle successfully passed all of the previous tests, the speed control system is now functioning as designed. The repair is now complete.

23. NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.

24. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).

POWERTRAIN VERIFICATION TEST VER - 4 (DIESEL) (CONTINUED)

25. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

26. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.

27. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.

28. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop.

29. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).

30. Then turning the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.

31. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST VER - 5 (DIESEL)

Diagnostic Test

1. POWERTRAIN VERIFICATION TEST VER - 5 (DIESEL)

1. Check if any of the following conditions exist.
2. The ECM has been disconnected or replace.
3. The Battery power has been disconnected.
4. Inspect the vehicle to ensure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.
5. If any existing diagnostic trouble codes have not been repaired, go to Symptom List and follow path specified.
6. Connect the scan tool to the data link connector.
7. Ensure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.
8. Perform steps 15 through 17 if the PCM has been replaced. Then proceed with the verification. If the ECM has not been replaced skip those steps and continue verification.
9. If ECM has been changed and correct VIN and mileage have not been programmed, a DTC will be set in ABS and Air bag modules. In addition, if vehicle is equipped with a Sentry Key Immobilizer Module (SKIM), Secret Key data must be updated to enable start.
10. For ABS and Air Bag systems: Enter correct VIN and Mileage in ECM. Erase codes in ABS and Air Bag modules.
11. For SKIM theft alarm: Connect scan tool to data link connector to Theft Alarm, SKIM, Misc. and place SKIM in secured access mode by using appropriate PIN code for this vehicle. Select Update the Secret Key data. Data will be transferred from SKIM to PCM.
12. If a Comprehensive Component DTC was repaired, perform steps 10-13. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.
13. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.
14. If there are no new DTC's, the repair was successful and is now complete. Erase DTC's and disconnect the scan tool.
15. If the repaired DTC has reset, the repair is not complete. Check for any related TSB's or flash updates and return to the Symptom list.
16. If another DTC has set, return to the Symptom List and follow the path specified for that DTC.
17. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).
18. If the monitor ran, the repair was successful and is now complete. Erase DTC's and disconnect the scan tool.
19. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Symptom List.
20. If another DTC has set, return to the Symptom List and follow the path specified for that DTC.

Is any DTC(s) present?

Yes >> Repair is not complete, refer to appropriate symptom.

No >> Repair is complete.

INTERMITTENT CONDITION

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

POSSIBLE CAUSES
INTERMITTENT CONDITION

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected faulty component and the ECM.

Inspect and clean all ECM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTC's check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

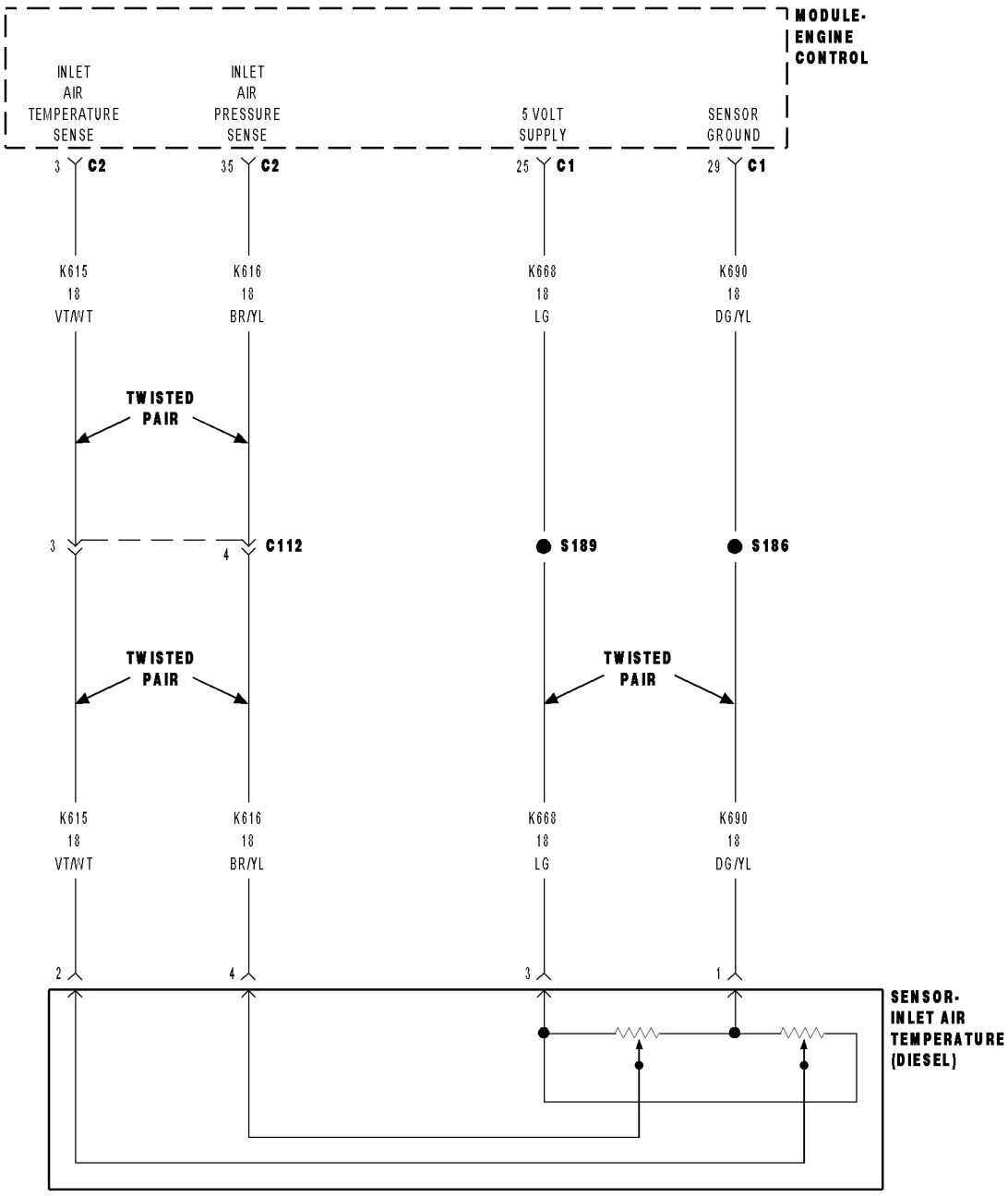
A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

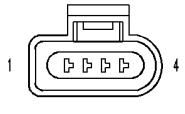
Were any problems found during the above inspections?

Yes >> Perform the necessary repairs.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL).

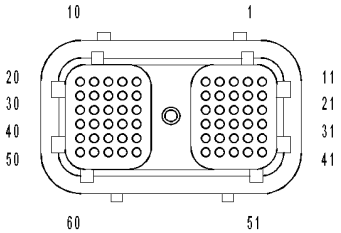
No >> Test Complete.

P0069-BOOST KEY ON RATIONALITY

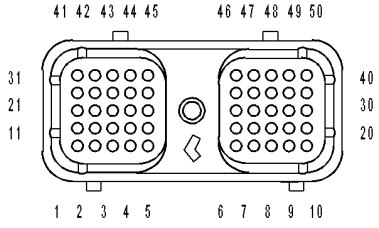




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813c6dea

P0069-BOOST KEY ON RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  The boost pressure recorded at key on is not within a calibrated range from the inlet air pressure sensor.

Possible Causes
OTHER DTC'S PRESENT
INLET AIR PRESSURE SENSOR
BOOST PRESSURE SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Are any DTC's present for Inlet air pressure or boost pressure?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. COMPARE THE INLET AIR PRESSURE

Using the scan tool, compare the inlet air pressure (barometric pressure) sensor reading to the boost pressure sensor reading.

Are the pressure readings within 6 in hg of each other?

Yes >> Go To 5

No >> Go To 3

---

3. INLET AIR PRESSURE SENSOR

Turn the ignition on, engine off.

Using the scan tool, read the inlet air pressure sensor value.

Is the inlet air pressure sensor reading consistent with the barometric pressure for the geographic region?

Yes >> Go To 4

No >> Relace the inlet air pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0069-BOOST KEY ON RATIONALITY (CONTINUED)

4. BOOST PRESSURE SENSOR

Using the scan tool, read the boost pressure sensor value.

Is the Boost pressure sensor reading consistent with the barometric pressure for the geographic region?

Yes >> Go To 5

No >> Relace the Boost pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

5. INTERMITTENT CONDITION

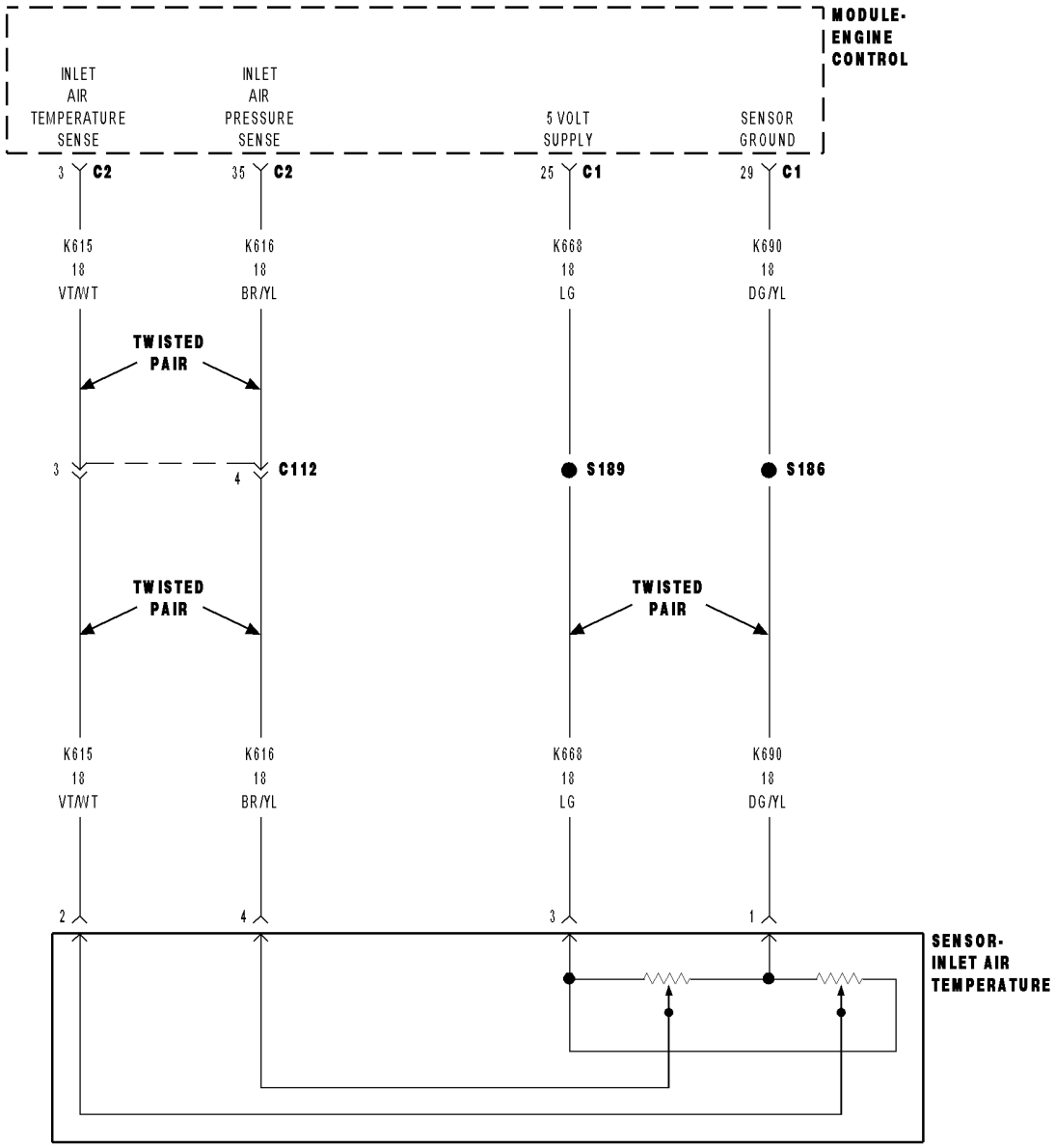
The conditions necessary to set this DTC are not present at this time.
Using the schematics as a guide, inspect the wiring and connectors specific to this circuit.
Wiggle the wiring and connectors while checking for any possible open or shorted circuits.
Check for any Service Information Tune-ups or Technical Service Bulletins that may apply.

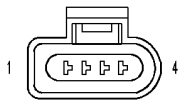
Were there any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

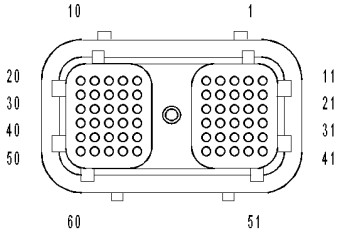
No >> Test Complete.

P0071-INLET AIR TEMP SENSOR RATIONALITY

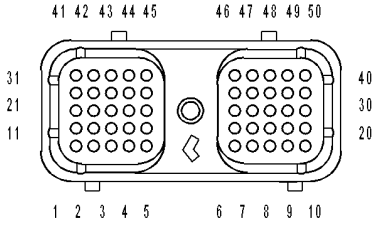




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0071-INLET AIR TEMP SENSOR RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM does not read a change in value from the sensor over time.

Possible Causes
INLET AIR TEMPERATURE SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. INLET AIR TEMPERATURE SENSOR

Remove the temperature sensor and reconnect the wiring to the sensor.

With the scan tool in Sensors, Monitor the inlet Air Temperature.

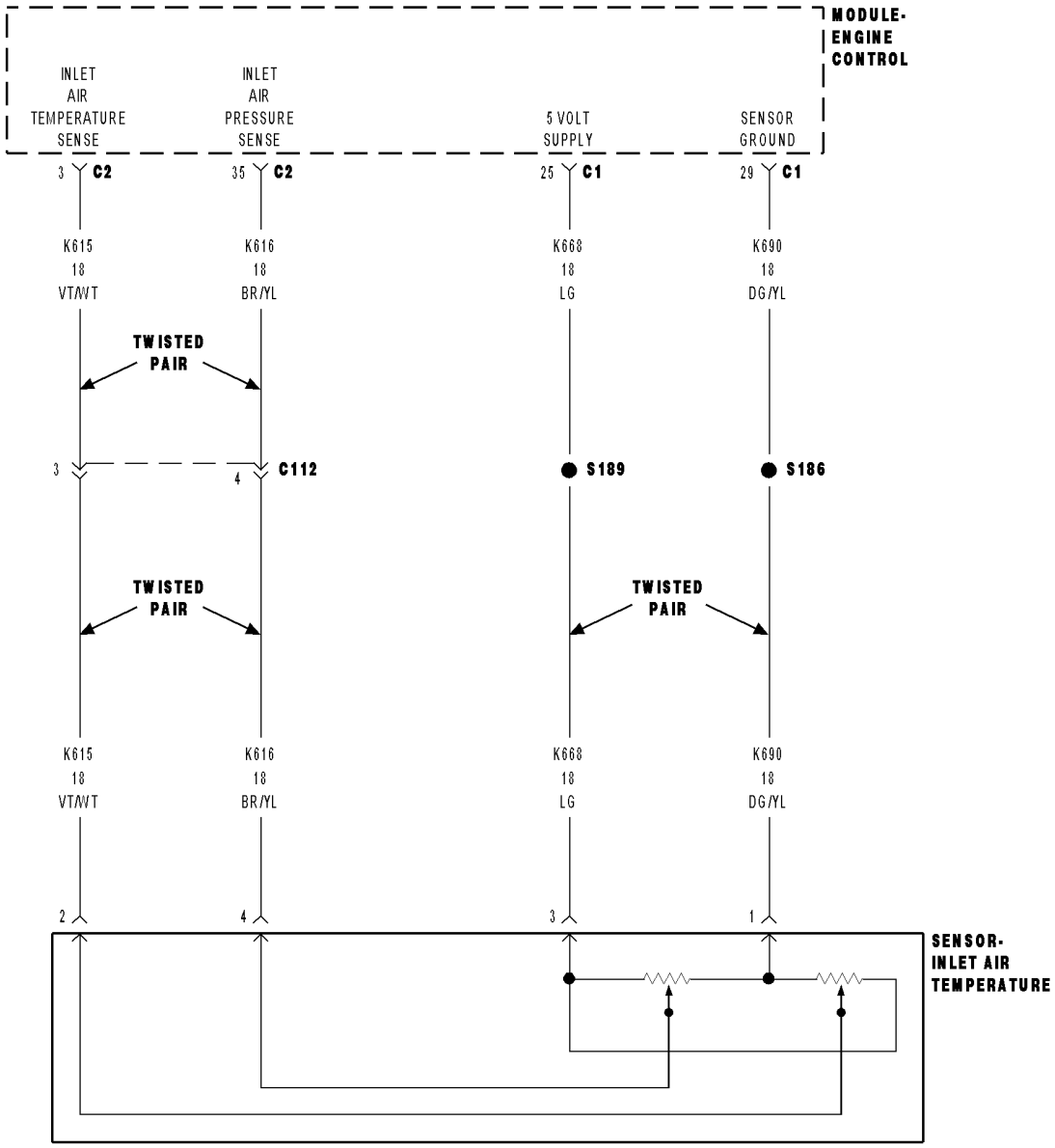
While heating the sensor with an external heat source (DO NOT USE OPEN FLAME).

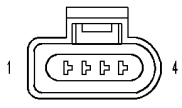
Does the reading from the sensor increase at least 5 degrees F. on the scan tool?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

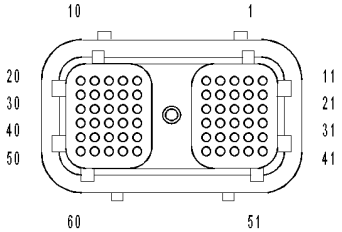
No >> Replace the inlet air temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW

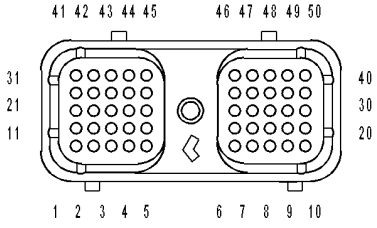




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
SENSOR OUT OF SPEC
HARNESS SHORTED (SENSOR SIDE)
(Y501) 5-VOLT SUPPLY OPEN
HARNESS SHORTED (ECM SIDE)
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. INLET AIR TEMP SENSOR OUT OF SPEC

Turn the ignition off.
Disconnect the Inlet Air Temp sensor harness connector.
Check connectors - Clean/repair as necessary.
Measure the resistance of the temperature sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. INTERMITTENT CONDITION

Reconnect the Inlet Air Temp Sensor harness connector.
Turn the ignition on.
With the scan tool, erase DTCs.
With the scan tool, read DTCs.

Did the DTC return?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

3. HARNESS SHORTED (INLET AIR TEMPERATURE SENSOR SIDE)

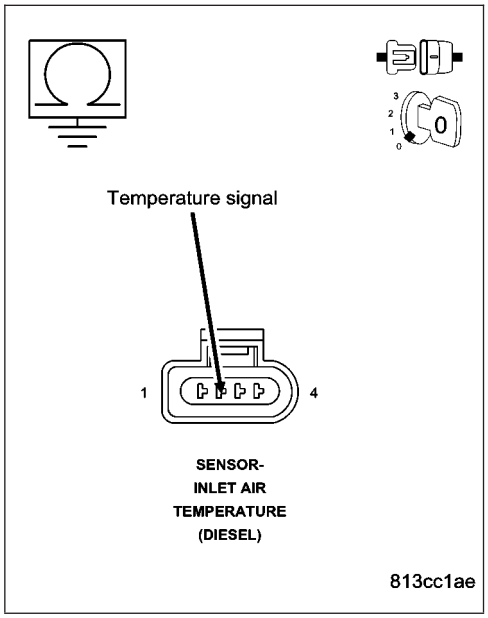
Turn the ignition off.

Disconnect the inlet Air Temp sensor harness connector.

Disconnect the ECM harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the engine ground and the (K615) temperature sensor signal circuit at the sensor connector.



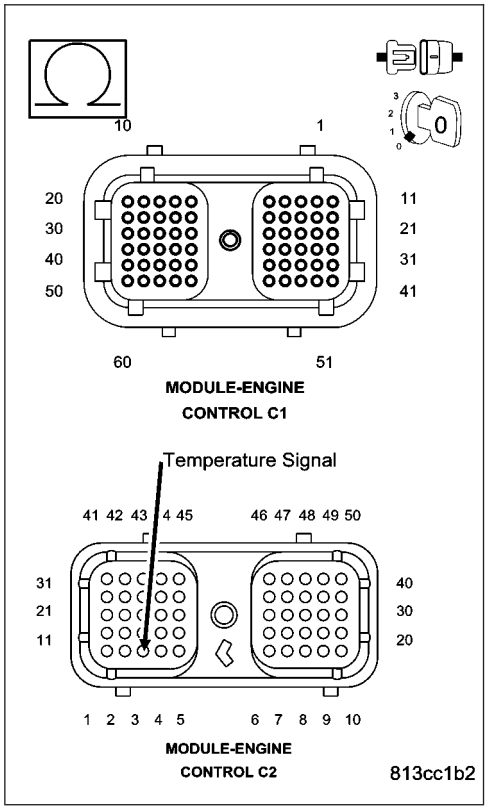
Is the resistance more than 100 k ohms?

Yes >> Go To 4

No >> Repair or replace the Engine harness shorted.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

4. HARNESS SHORTED (ECM SIDE)

Measure the resistance between the (K615) signal circuit and all other circuits at the ECM harness connector.



Is the resistance more than 100 k ohms?

Yes >> Go To 5

No >> Repair or replace the ECM harness shorted.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

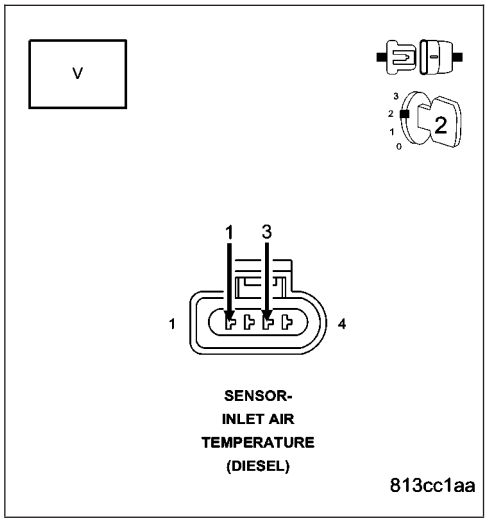
P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

5. (K668) 5-VOLT SUPPLY CIRCUIT

Reconnect the ECM harness connector.

Turn the ignition on.

Measure the voltage between the (K668) supply circuit and the (K690) return circuit in the Air Temp sensor harness connector.



Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 6

No >> Go To 7

6. ECM

Reconnect the Air Temp sensor harness connector.

Reconnect the ECM harness connector.

With the scan tool, erase DTCs.

While monitoring with scan tool, disconnect the Air Temp sensor harness connector.

Did the DTC P0073 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure) (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

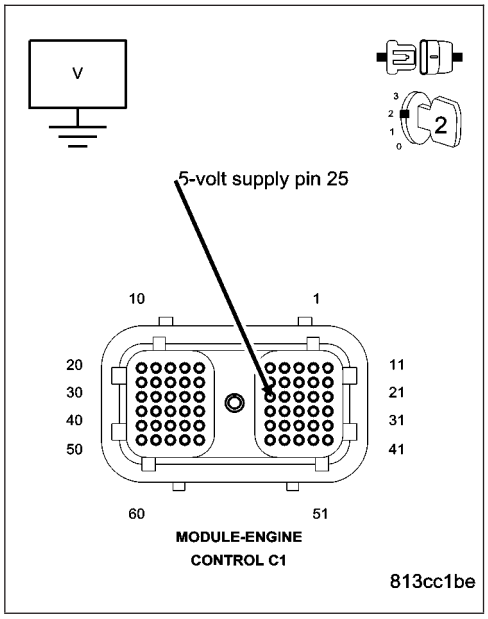
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0072-INLET AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

7. (K668) 5-VOLT SUPPLY OPEN

Disconnect the ECM harness connectors.

Measure the voltage at the (K668) 5-volt supply circuit at the ECM harness connector.



Is the voltage between 4.5 and 5.5 volts?

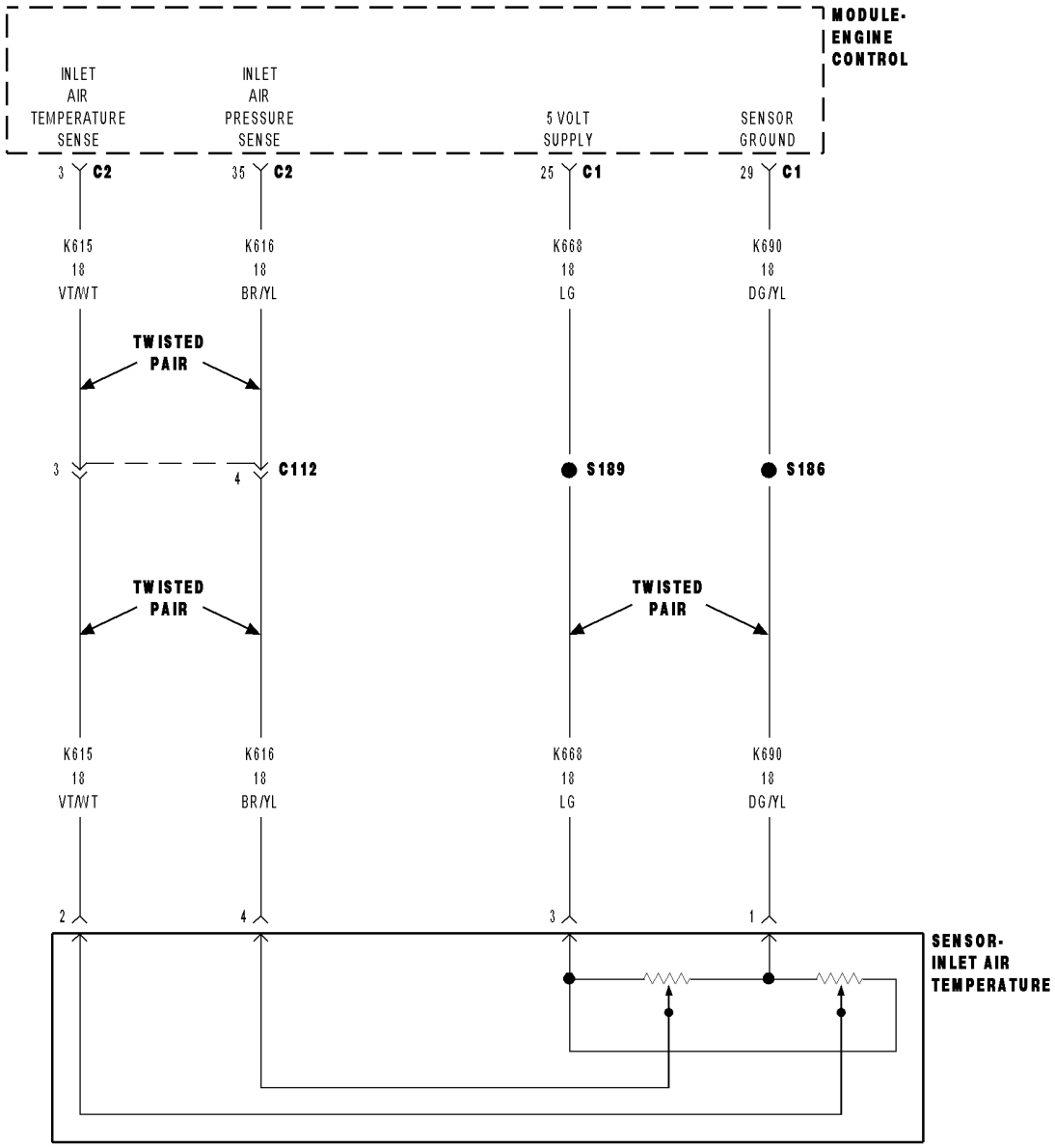
Yes >> Fix or repair the (K668) 5-volt supply circuit shorted to voltage.

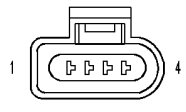
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

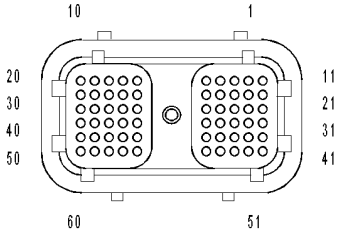
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH

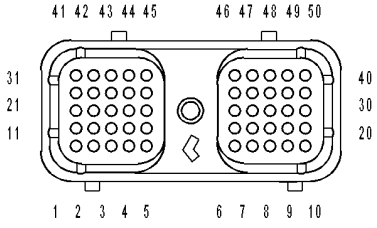




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
DTC RETURNS
INLET AIR TEMPERATURE SENSOR
(K69) SIGNAL CIRCUIT OPEN
(Y502) RETURN CIRCUIT OPEN
(K69) SIGNAL CIRCUIT SHORTED
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC RETURNS

Turn the ignition on.
With the scan tool, erase DTCs.
With the scan tool, read DTCs.
With the scan tool, record all Freeze frame data.

Did the DTC return?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. INLET AIR TEMPERATURE SENSOR

Turn the ignition off.
Disconnect the Inlet Air Temp sensor harness connector.
Check connectors - Clean/repair as necessary.
Measure the resistance of the Inlet Air temp sensor

Is the resistance between 300 and 90k ohms?

Yes >> Go To 3

No >> Replace the Inlet air temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING).

P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. RESISTANCE CHECK

Disconnect the ECM harness connector.

Check connectors - Clean/repair as necessary.

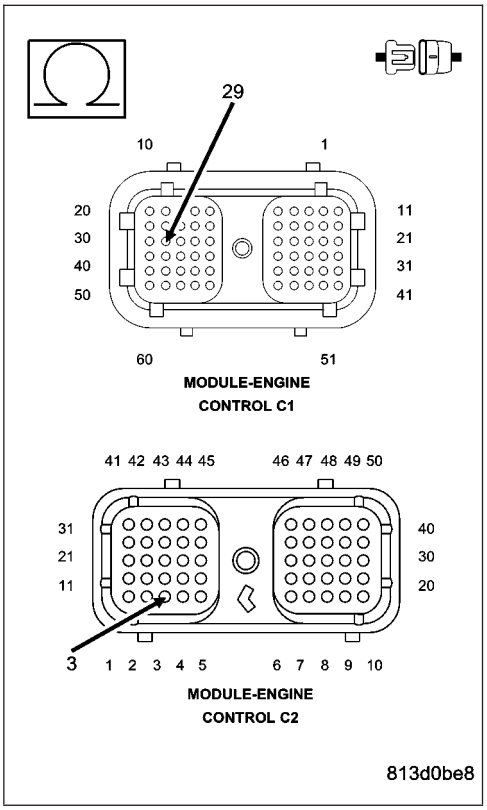
Reconnect the Inlet Air Temp sensor harness connector.

Measure the resistance between the (K615) inlet air temperature sensor signal circuit and (K690) return circuit at the ECM connector.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 6

No >> Go To 4



4. (K615) INLET AIR TEMPERATURE SIGNAL CIRCUIT OPEN

Disconnect the inlet Air Temp sensor harness connector.

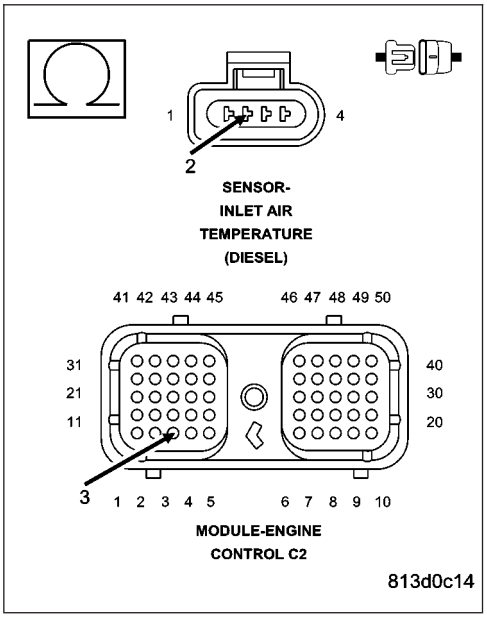
Measure the resistance of the (K615) inlet air temperature sensor signal circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair or replace the harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

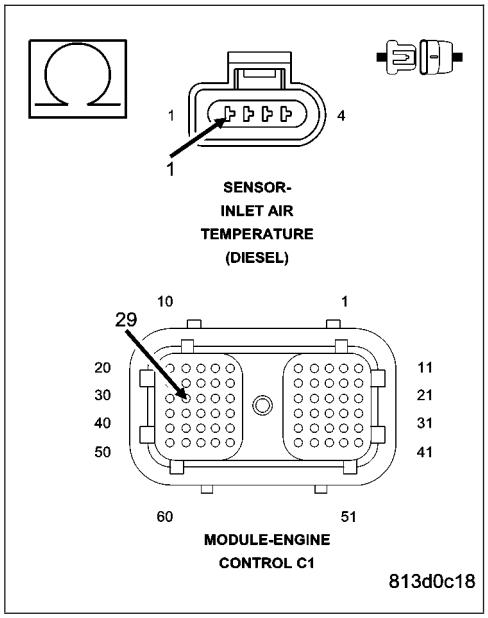
5. (K690) RETURN CIRCUIT OPEN

Measure the resistance of the sensor (K690) return circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair or replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



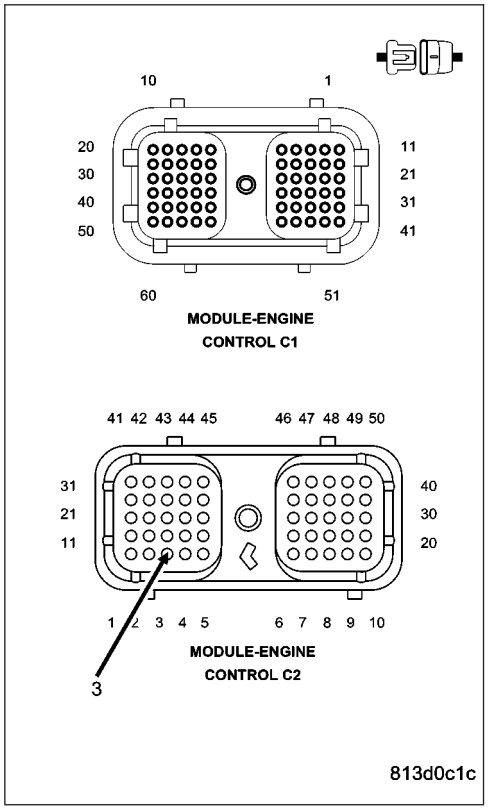
6. (K615) SIGNAL CIRCUIT SHORTED

Check for a short circuit from the (K615) signal circuit to all other circuits at the ECM harness connector.

Is the resistance more than 100 k ohms?

Yes >> Go To 7

No >> Repair or replace the harness for a short to ground in the signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0073-INLET AIR TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

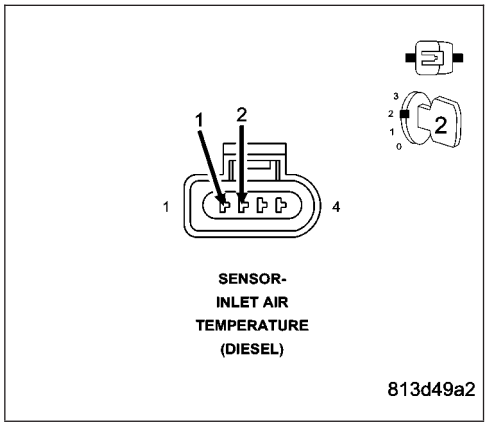
7. ECM

Reconnect the ECM harness connector.

Turn the ignition on.

With the scan tool, erase DTCs.

While monitoring with scan tool, use a jumper wire and connect the sensor (K615) signal circuit to the sensor (K690) return circuit at the sensor connector.



Did the DTC P0072 set?

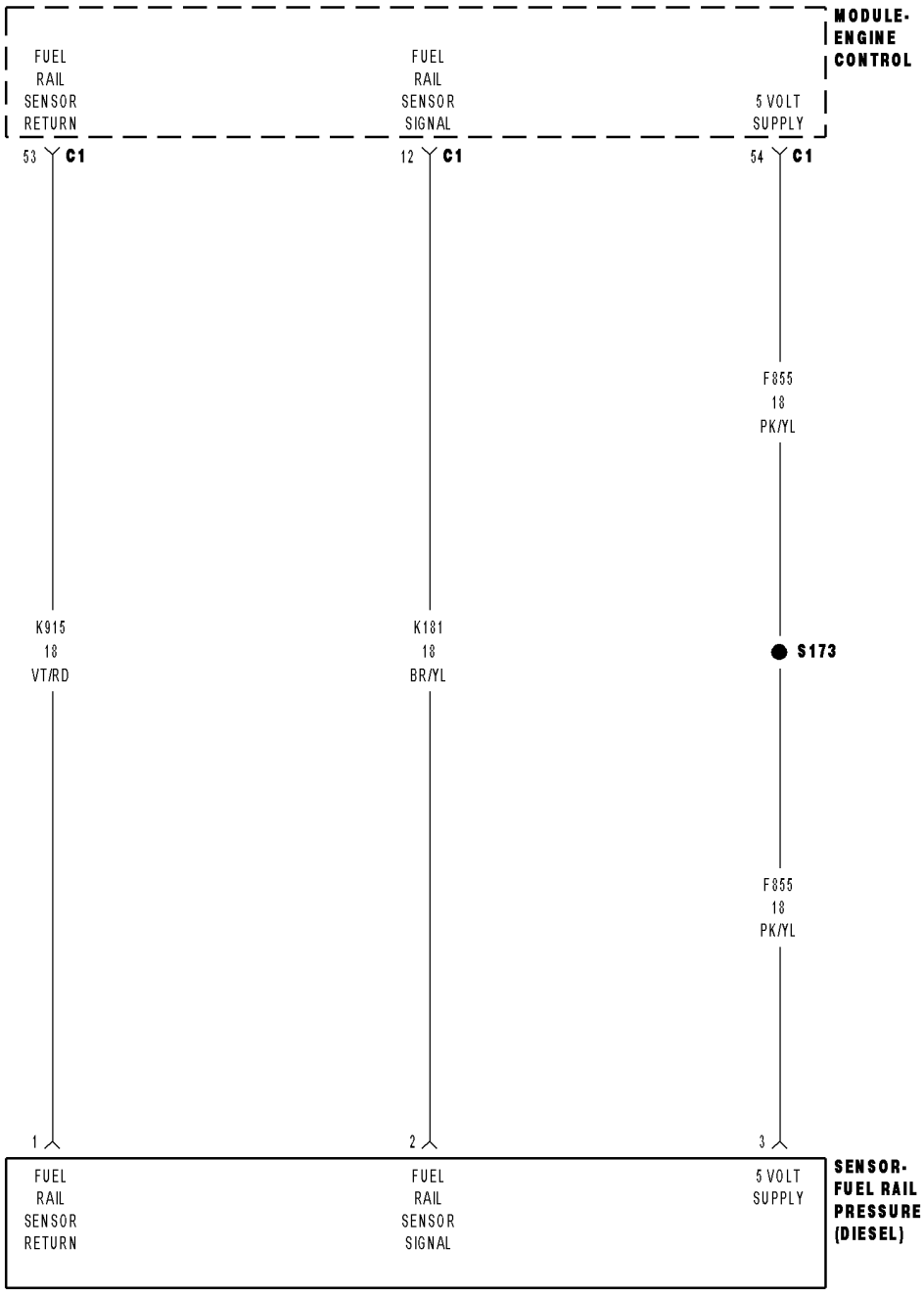
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

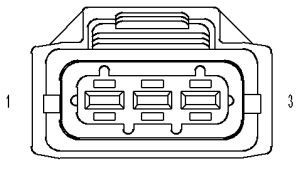
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

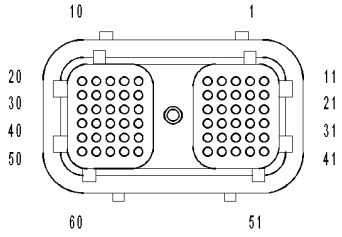
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0088-FUEL RAIL PRESSURE SIGNAL IS ABOVE MAX LIMIT





SENSOR-
FUEL RAIL
PRESSURE
(DIESEL)



MODULE-ENGINE
CONTROL C1

813d4a27

P0088-FUEL RAIL PRESSURE SIGNAL IS ABOVE MAX LIMIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  Fuel pressure is above a calibrated value for a calibrated amount of time.

Possible Causes
FUEL CONTROL ACTUATOR (FCA)
FUEL PRESSURE SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. Fuel Pressure Sensor

Using the scan tool, compare the scan tool reading for fuel pressure set point to the scan tool reading for actual fuel pressure.

Does the actual fuel pressure correlate with the fuel pressure setpoint while operating the engine over various operating conditions?

Yes >> Go To 2

No >> Check the electrical connector of the Fuel Control Actuator, if the connection is tight, replace the fuel control actuator.
Perform POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING).

---

2. FUEL PUMP

Turn the ignition on.

Disconnect the Electronic Fuel Control Actuator connector.

Connect an incandescent test light across the Fuel Control Actuator driver pin and the Fuel Control Actuator return wire at the fuel control actuator connector.

Observe the test light.

The ECM will perform a self test of the circuit which should momentarily flash the test light brightly, one time, approximately 20 seconds after being connected.

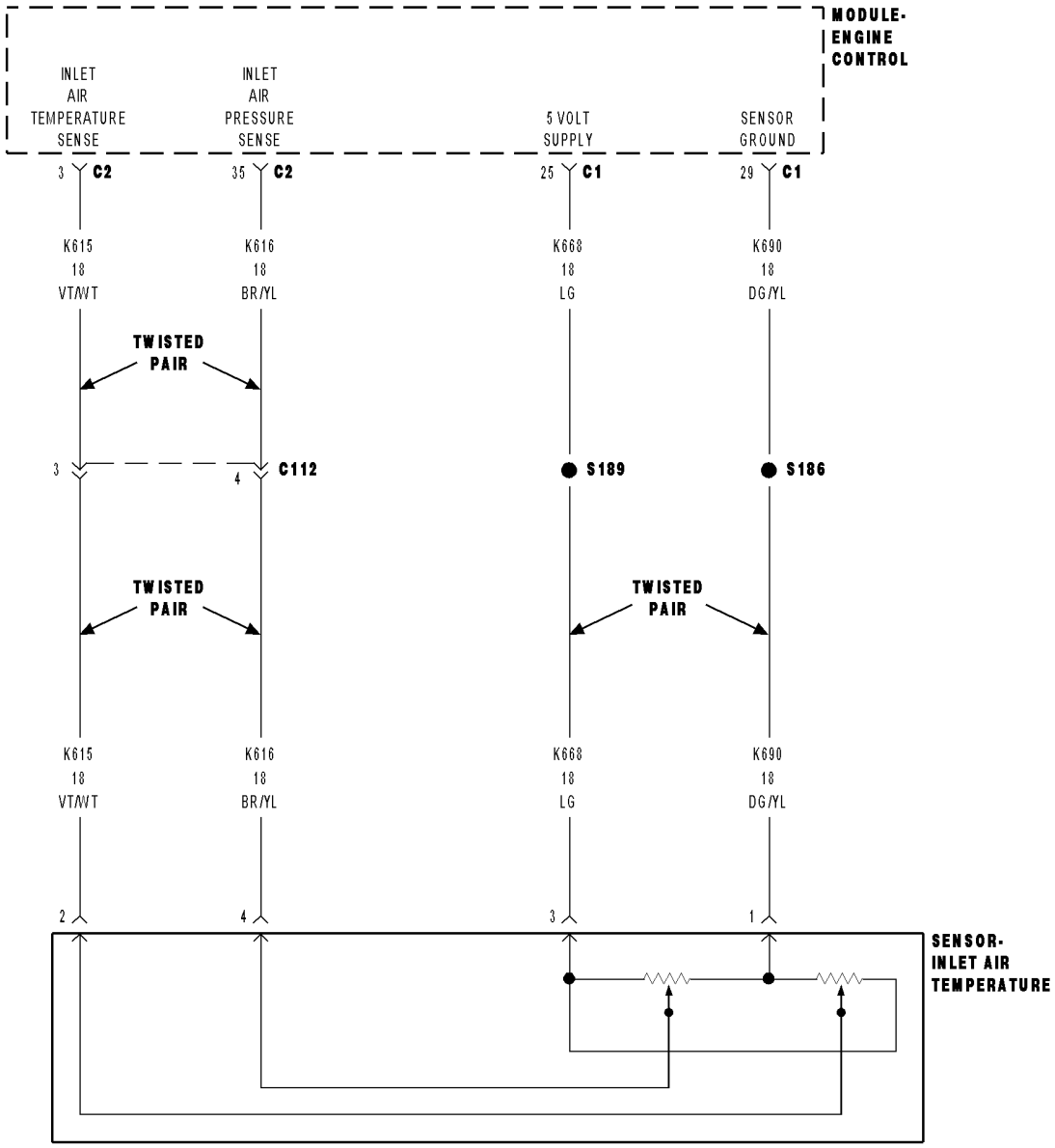
NOTE: Compare test light brightness to that of a direct connection to the battery.

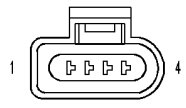
Did the light flash brightly?

Yes >> Replace the fuel pump.
Perform POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

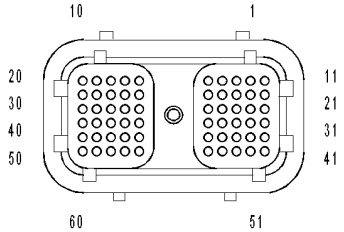
No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0106-INLET AIR PRESSURE SENSOR RATIONALITY

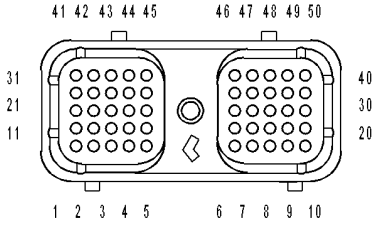




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0106-INLET AIR PRESSURE SENSOR RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The Inlet air pressure is above a calibrated threshold.

Possible Causes
INLET AIR PRESSURE SENSOR
INTERMITTENT CONDITION
TROUBLESHOOT OTHER DTC'S FIRST

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. Troubleshoot other DTC's First

Using the Scan tool, check for additional DTC's.

Do you have any other air pressure related DTC's?

Yes >> Troubleshoot other DTC's First.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. INLET AIR PRESSURE SENSOR

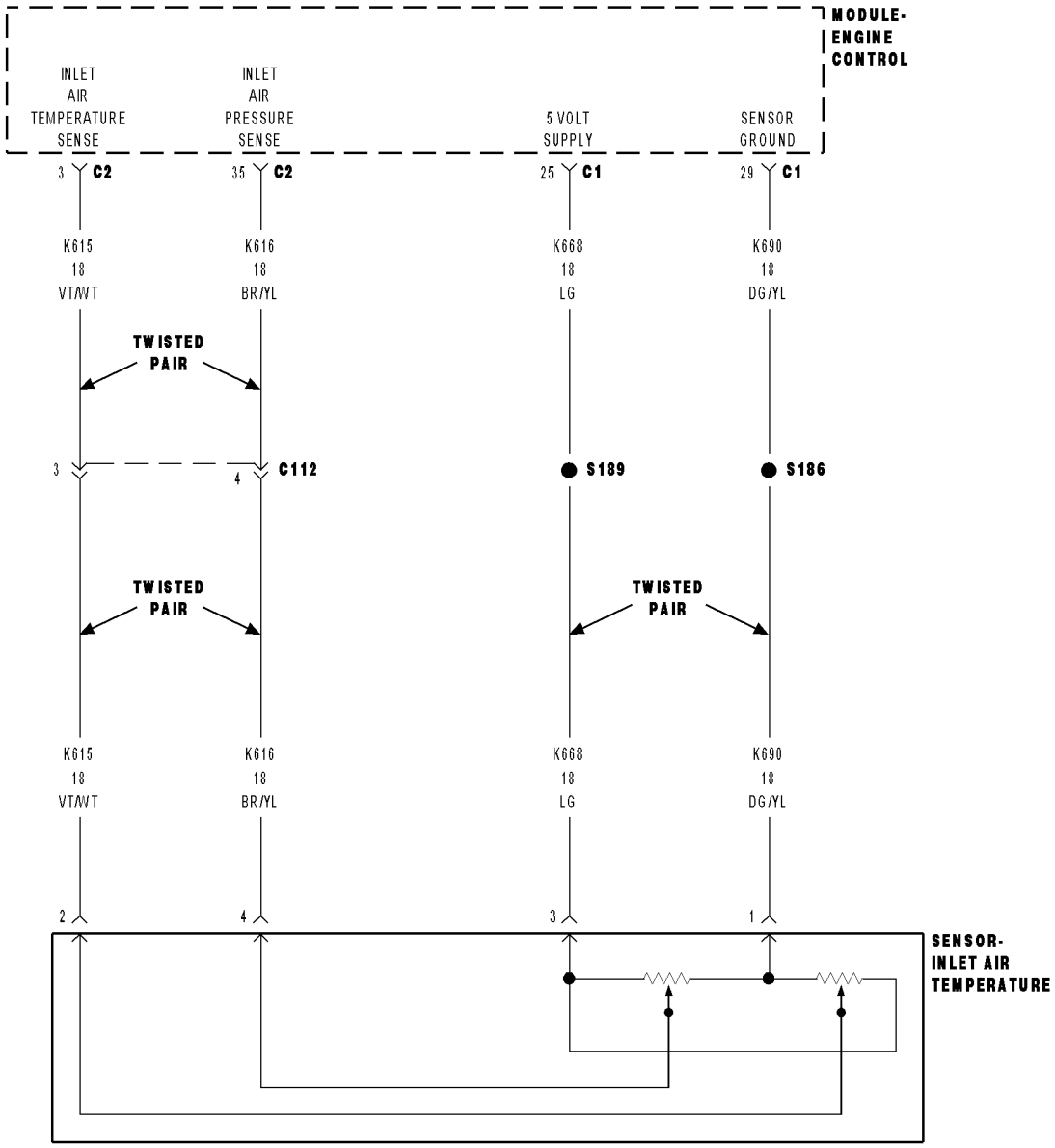
Using the scan tool, monitor the Inlet air pressure sensor values.

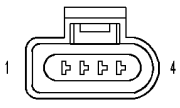
Do the readings on the scan tool fluctuate slightly?

No >> Replace the Inlet Air Temperature/ Pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

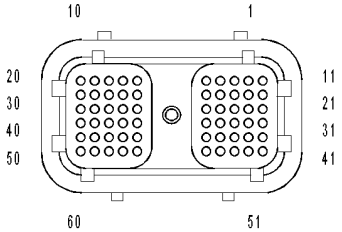
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW

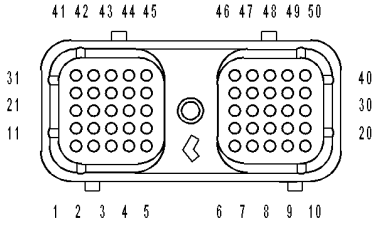




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S PRESENT
INLET AIR PRESSURE SENSOR
INLET AIR SENSOR (K616) SIGNAL CIRCUIT SHORTED TO THE (Y502) RETURN CIRCUIT
INLET AIR PRESSURE SENSOR (K668) SUPPLY CIRCUIT SHORTED TO THE RETURN CIRCUIT
(K616) SIGNAL CIRCUIT OPEN
(K668) 5-VOLT SUPPLY CIRCUIT OPEN
(K616) SIGNAL CIRCUIT SHORTED TO GROUND
(K668) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

Ignition on, engine not running.
With the scan tool, read DTCs.

Do you have multiple DTC's?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

2. SENSOR VOLTAGE

Disconnect the Inlet Air Pressure sensor harness connector.

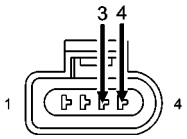
Check connectors - Clean/repair as necessary.

Measure the voltage between the (K668) 5-volt supply circuit and (Y502) return circuit of the sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

No >> Go To 5



SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)

813d7133

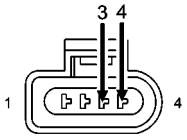
3. INLET AIR PRESSURE SENSOR

While monitoring scan tool, use a jumper wire to connect the (K668) 5-volt supply circuit with the (K616) signal circuit at the sensor harness connector.

Does the scan tool show a pressure sensor out of range high DTC?

Yes >> Replace the Inlet Air Temperature/Pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)

813d7133

P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

4. INLET AIR PRESSURE SENSOR SIGNAL CIRCUIT SHORTED TO THE RETURN CIRCUIT

Turn the ignition off.

Disconnect the ECM harness connector.

Check connectors - Clean/repair as necessary.

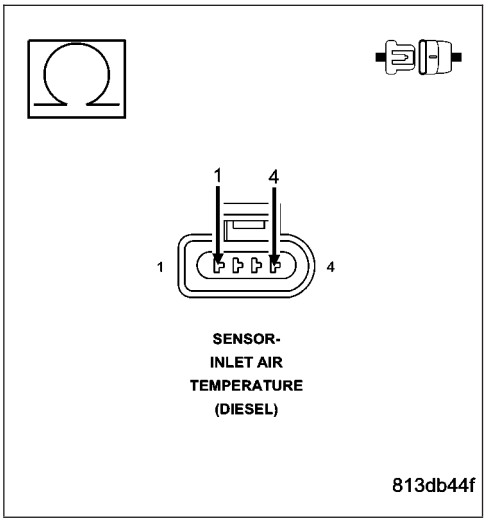
Measure the resistance between the (K616) signal circuit and (Y502) return circuit in the Inlet Air pressure sensor harness connector.

Is the resistance greater than 100K Ohms?

Yes >> Go To 5

No >> Repair or replace wiring harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. SENSOR (K668) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (Y502) RETURN CIRCUIT

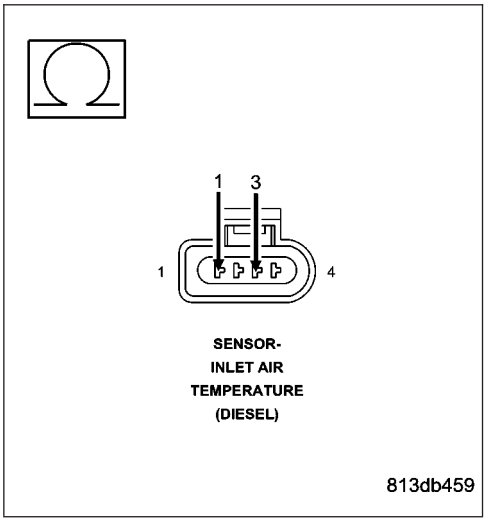
Measure the resistance between the (K668) 5-volt supply circuit and (Y502) return circuit in the Inlet Air Pressure sensor harness connector.

Is the resistance greater than 100K Ohms?

Yes >> Go To 6

No >> Repair the short or replace the harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

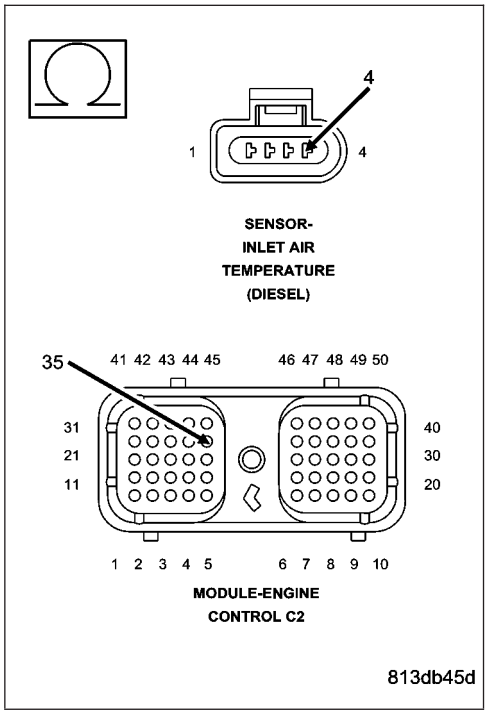
6. (K616) SIGNAL CIRCUIT OPEN

Measure the resistance between the (K616) signal circuit in the Inlet Air Pressure sensor harness connector and the (K616) signal circuit in the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 7

No >> Repair or replace the open wiring harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



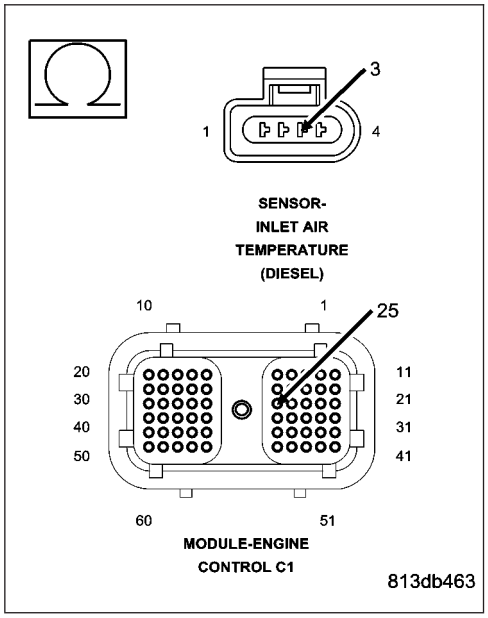
7. (K668) 5-VOLT SUPPLY CIRCUIT OPEN

Measure the resistance between the (K668) 5-volt supply circuit in the Inlet Air Pressure sensor harness connector with the (K668) 5-volt supply circuit in the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 8

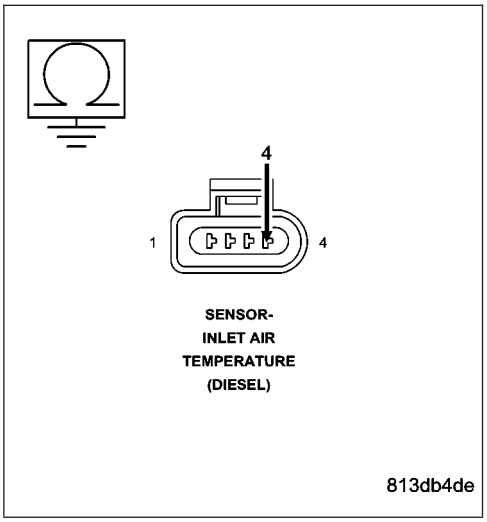
No >> Repair or replace the Engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

8. (K616) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K616) signal circuit in the inlet Air Pressure sensor connector and battery negative.



Is the resistance greater than 100 K Ohms?

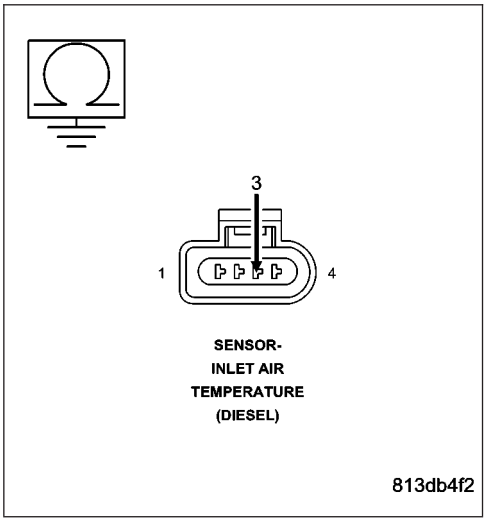
Yes >> Go To 9

No >> Repair the (K616) signal circuit shorted to ground or replace the wire harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

9. (K668) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K668) 5-volt supply Circuit in the Inlet Air Pressure sensor harness connector and battery negative.



Is the resistance greater than 100 K Ohms?

Yes >> Go To 10

No >> Repair the (K668) 5-volt supply circuit shorted to ground or replace the wire harness. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0107-INLET AIR PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

10. ECM

Install the ECM harness connector.

Turn the ignition on.

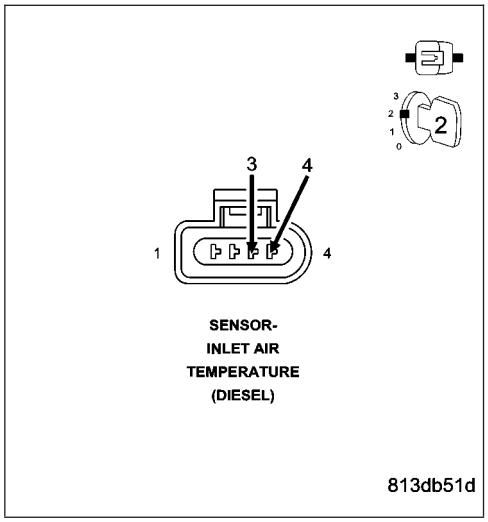
While monitoring scan tool, use a jumper wire to connect the (K668) 5-volt supply circuit with the (K616) signal circuit at the sensor harness connector.

Does the scan tool show a pressure sensor out of range high DTC?

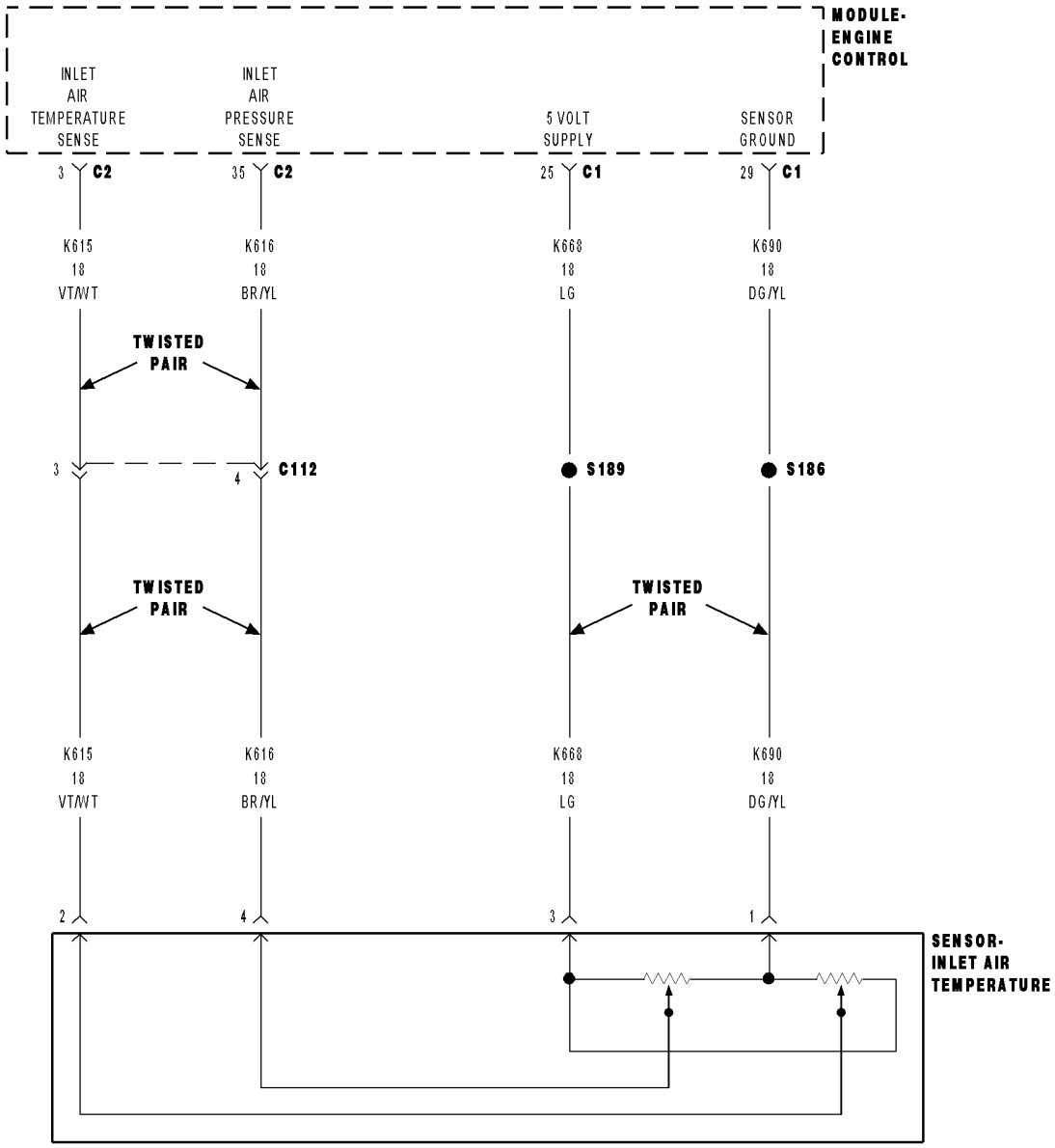
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

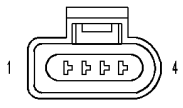
No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

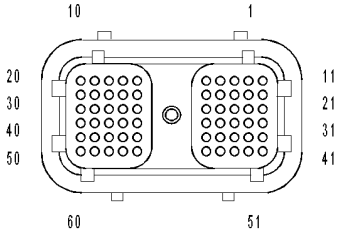


P0108-INLET AIR Pressure Sensor Voltage Too high

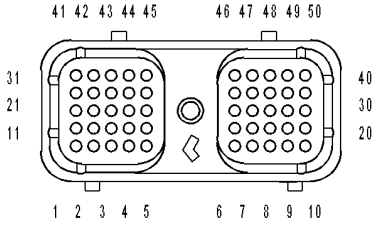




SENSOR-
INLET AIR
TEMPERATURE
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

813cc1a2

P0108-INLET AIR Pressure Sensor Voltage Too high (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S PRESENT
INLET AIR PRESSURE SENSOR
INLET AIR PRESSURE SENSOR (K616) SIGNAL CIRCUIT SHORTED TO VOLTAGE
INLET AIR SENSOR (K668) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K616) SIGNAL CIRCUIT SHORTED TO (K668) 5-VOLT SUPPLY
(K690) RETURN CIRCUIT OPEN
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

Ignition on, engine not running.
With the scan tool, read DTCs.

Do you have multiple DTC's?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0108-INLET AIR Pressure Sensor Voltage Too high (CONTINUED)

2. CHECKING (K668) 5-VOLT SUPPLY CIRCUIT AND THE (K690) RETURN CIRCUIT

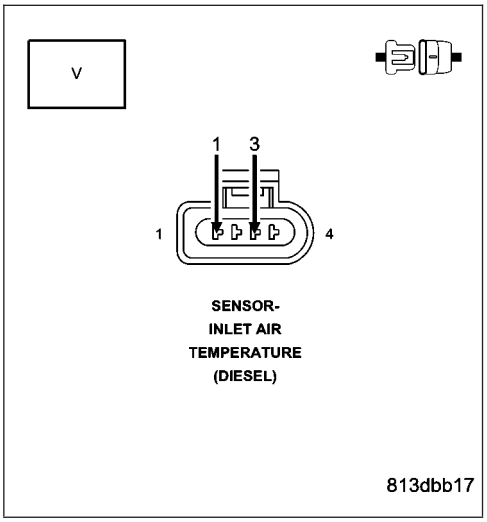
Disconnect the Inlet Air Pressure sensor harness connector.

Measure the voltage between the (K668) 5-volt supply circuit and (K690) return circuit of the Inlet Air Pressure sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

No >> Go To 4



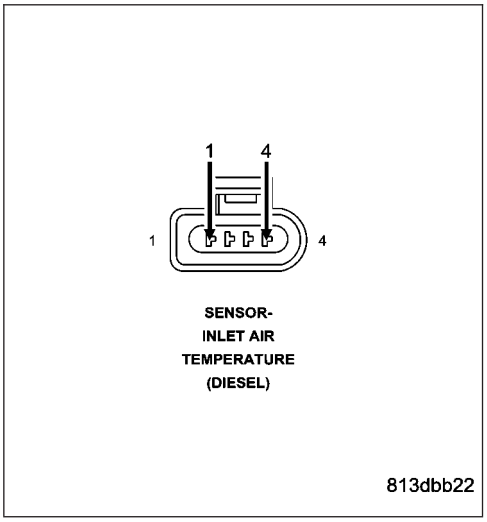
3. INLET AIR PRESSURE SENSOR

While monitoring scan tool, use a jumper wire to connect the (K690) Return circuit to the (K616) signal circuit at the Inlet Air Pressure sensor harness connector.

Does the scan tool show a P0107 Inlet Air Pressure Sensor Low DTC.

Yes >> Replace the Inlet Air Temperature/Pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0108-INLET AIR Pressure Sensor Voltage Too high (CONTINUED)

4. INLET AIR SENSOR (K616) SIGNAL CIRCUIT SHORTED TO VOLTAGE

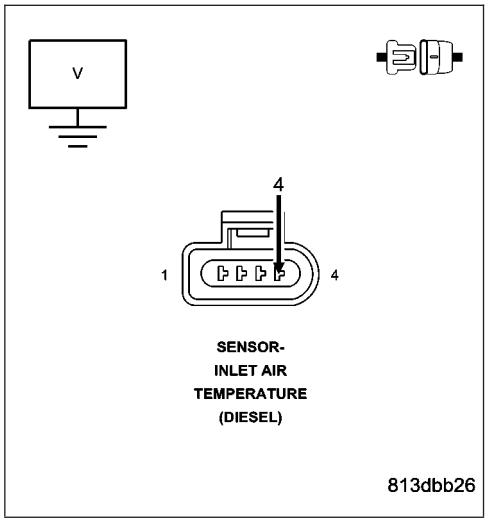
Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the voltage between the (K616) signal circuit of the Inlet Air Pressure sensor connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 5

No >> Repair or replace short to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



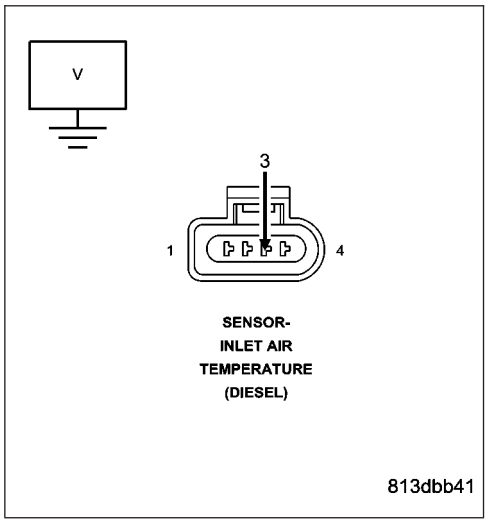
5. (K668) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (K668) 5-volt supply circuit of the sensor connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 6

No >> Repair the short to voltage or replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0108-INLET AIR Pressure Sensor Voltage Too high (CONTINUED)

6. SIGNAL CIRCUIT SORTED TO (K668) 5-VOLT SUPPLY

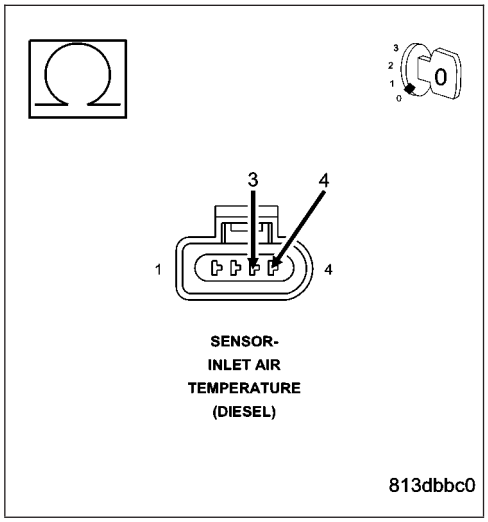
Turn the ignition off.

Measure the resistance between the (K616) signal circuit and the (K668) 5-volt supply circuit of the Inlet Air Pressure sensor harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 7

No >> Repair or replace the shorted wiring harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



7. (K690) RETURN CIRCUIT OPEN

Disconnect the ECM harness connector.

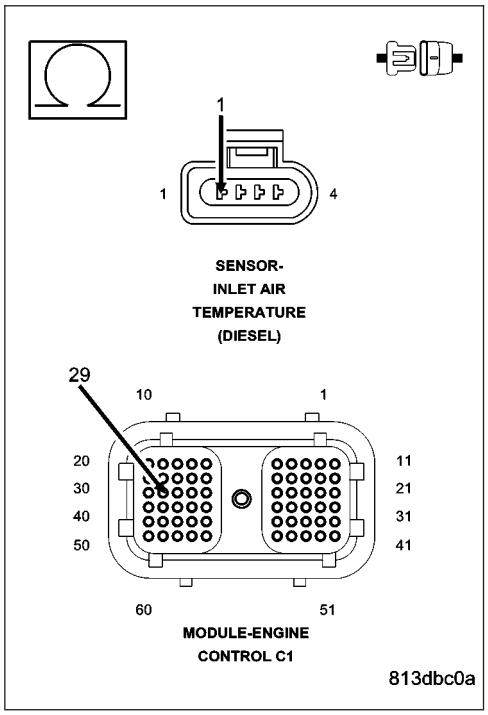
Check connectors - Clean/repair as necessary.

Measure the resistance between the (K690) return circuit in the Inlet Air Pressure sensor harness connector with the (K690) return circuit in the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair or replace the Engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



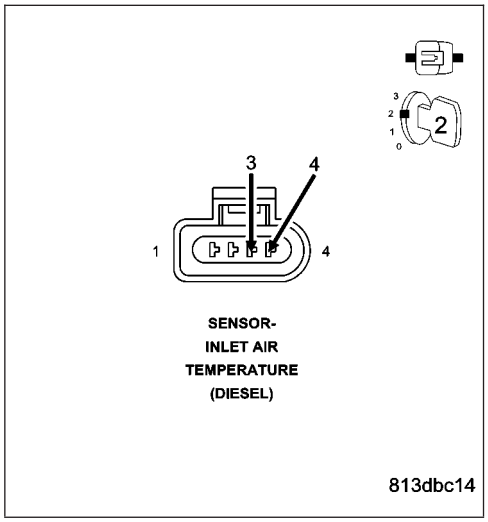
P0108-INLET AIR Pressure Sensor Voltage Too high (CONTINUED)

8. ECM

Install the ECM harness connector.

Turn the ignition on.

While monitoring scan tool, use a jumper wire to connect the (K916) Return circuit with the (K616) signal circuit at the Inlet Air Pressure sensor harness connector.



Did DTC P0107 set?

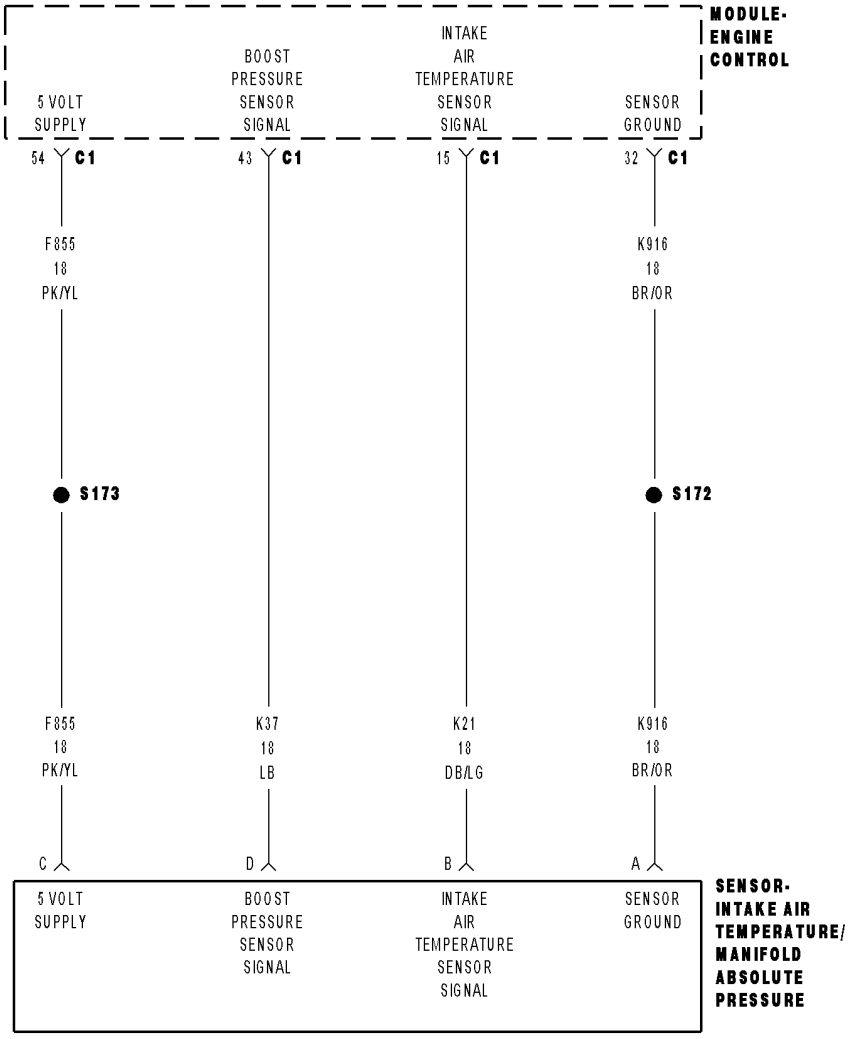
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).

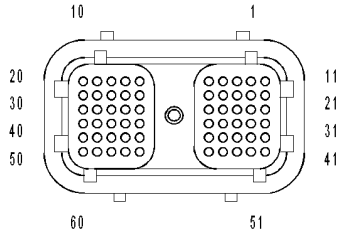
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING) 0

No >> Replace the ECM.

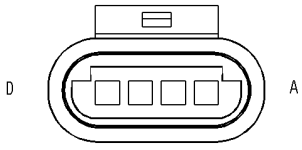
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0111-INTAKE AIR TEMPERATURE (IAT) SENSOR RATIONALITY





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0111-INTAKE AIR TEMPERATURE (IAT) SENSOR RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM does not read a change in value from the sensor over time.

Possible Causes
FAILED IAT SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FAILED IAT SENSOR

Remove the temperature sensor and reconnect the wiring to the sensor. Monitor scan tool, while heating the sensor with an external heat source (DO NOT USE OPEN FLAME).

Does the reading from the sensor increase at least 5 degrees F. on the scan tool?

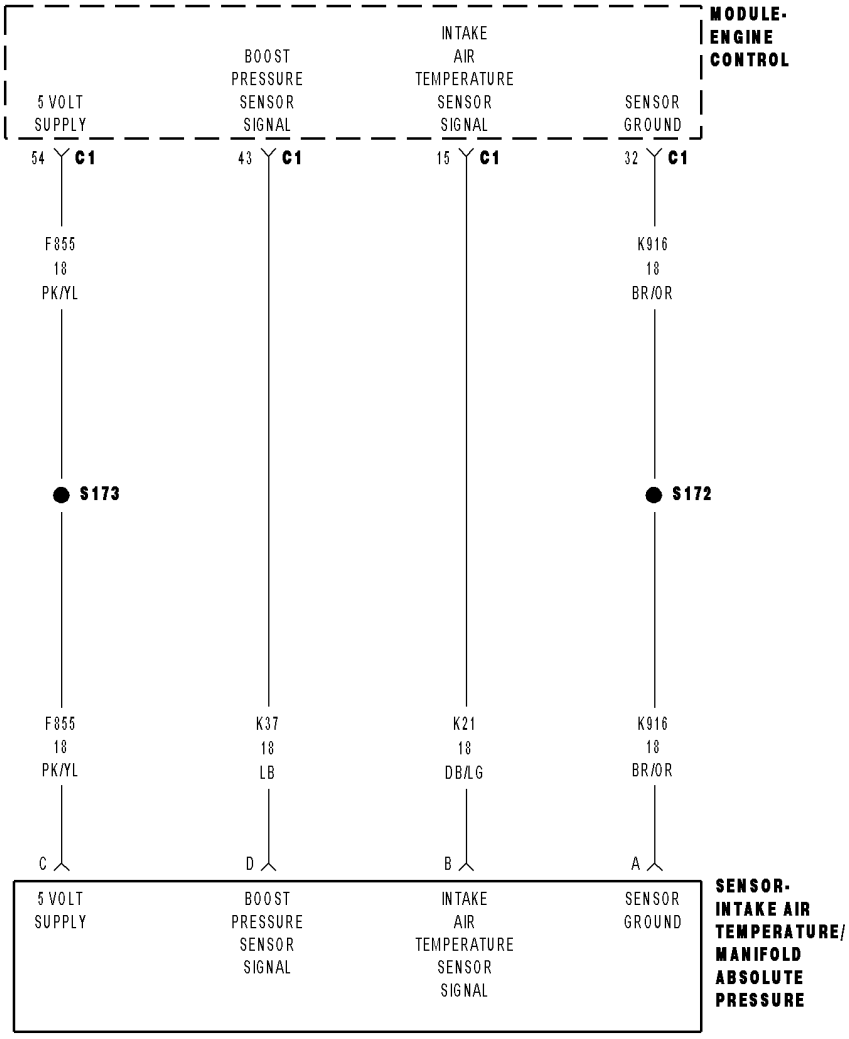
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

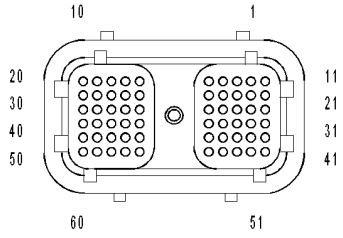
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Intake air temp sensor/MAP sensor.

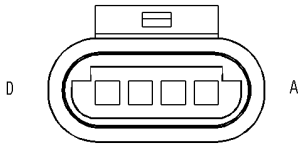
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
INTAKE AIR TEMP SENSOR OUT OF SPEC
INTERMITTENT CONDITION
(K21) SENSOR SIGNAL CIRCUIT SHORTED TO GROUND CIRCUIT
WIRING HARNESS SHORTED
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
ECM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. INTAKE AIR TEMP SENSOR OUT OF SPEC

Disconnect the Intake Air Temperature sensor harness connector.
Check connectors - Clean/repair as necessary.
Measure the resistance of the Intake Air Temp sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the Intake Air temperature sensor/MAP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. INTERMITTENT CONDITION

Reconnect the circuit.
Turn the ignition on.
With the scan tool, erase DTCs.
With the scan tool, read DTCs.

Did the DTC reappear?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW (CONTINUED)

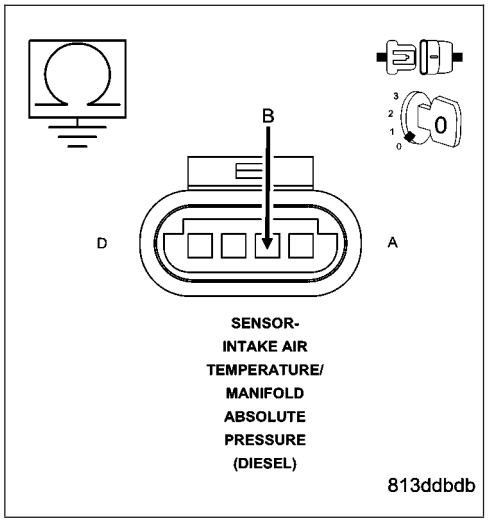
3. (K21) SIGNAL CIRCUIT SHORTED TO GROUND CIRCUIT

Turn the ignition off.

Disconnect the ECM harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the engine ground and the temperature sensor (K21) signal circuit at the sensor harness connector.



Is the resistance more than 100 k ohms?

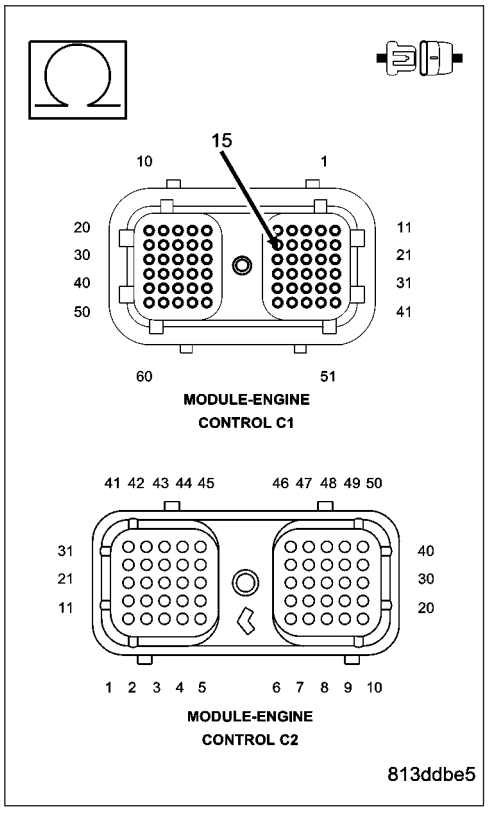
Yes >> Go To 4

No >> Repair or replace the engine wiring harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

4. WIRING HARNESS SHORTED

Measure the resistance between the (K21) signal circuit and all other circuits at the ECM harness connector.



Is the resistance more than 100 k ohms?

Yes >> Go To 5

No >> Repair or replace the shorted wiring harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW (CONTINUED)

5. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (k916) RETURN CIRCUIT

Reconnect the ECM harness connector connected.

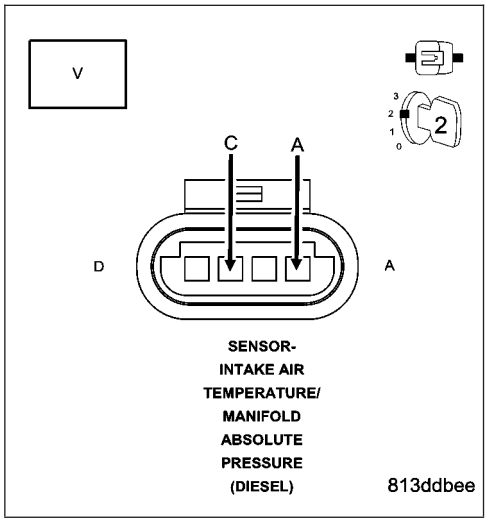
Turn the ignition on.

Measure the voltage between the (F855) 5-volt supply circuit and the (k916) return circuit the sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 7

No >> Go To 6



6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

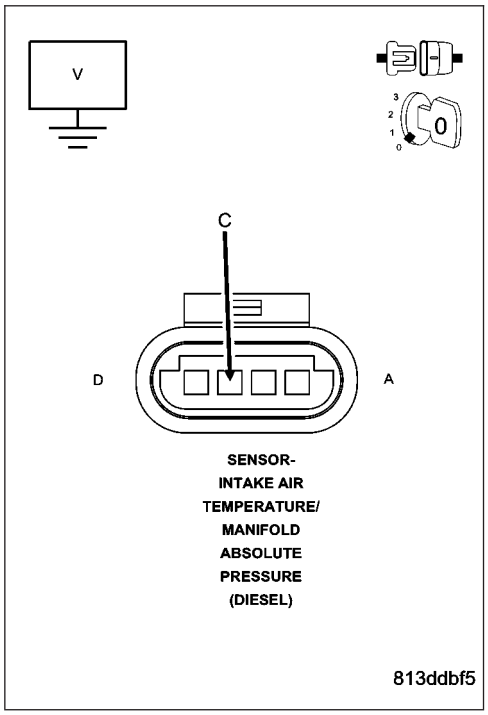
Disconnect the ECM harness connector.

Measure the voltage at the (F855) 5-volt supply circuit of the sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Repair the open (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

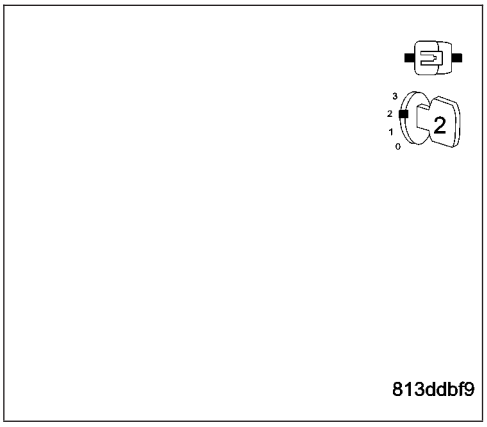
No >> Go To 7



P0112-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO LOW (CONTINUED)

7. ECM

Reconnect the ECM harness connector.
Reconnect the intake air temp sensor harness connector.
Turn the ignition on.
While monitoring with scan tool, disconnect the temperature sensor

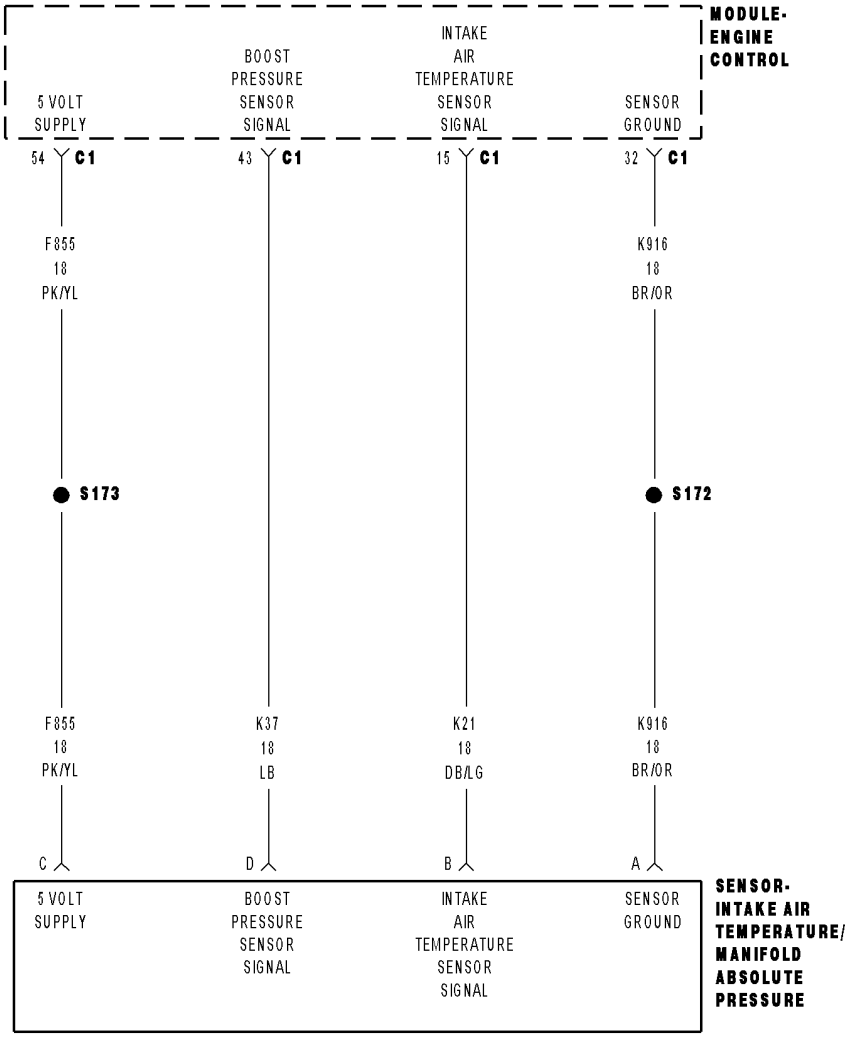


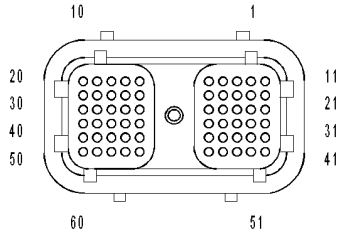
Did the DTC P0113 set?

Yes >> Clear DTC's, repair complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

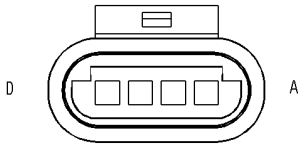
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
FAILED SENSOR
INTERMITTENT CONDITION
(K21) SENSOR SIGNAL CIRCUIT OPEN
(K916) RETURN CIRCUIT OPEN
SHORT IN HARNESS
ECM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. Failed sensor

Turn the ignition off.
Disconnect the IAT sensor harness connector.
Check connectors - Clean/repair as necessary.
Measure the resistance of the IAT sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the Intake Air Temperature Sensor/map sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. INTERMITTENT CONDITION

Reconnect the IAT harness connector.
Turn the ignition on.
With the scan tool, erase DTCs.
With the scan tool, read DTCs.

Is P0113 still set?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. HIGH RESISTANCE OF SENSOR CONNECTOR

Turn the ignition off.

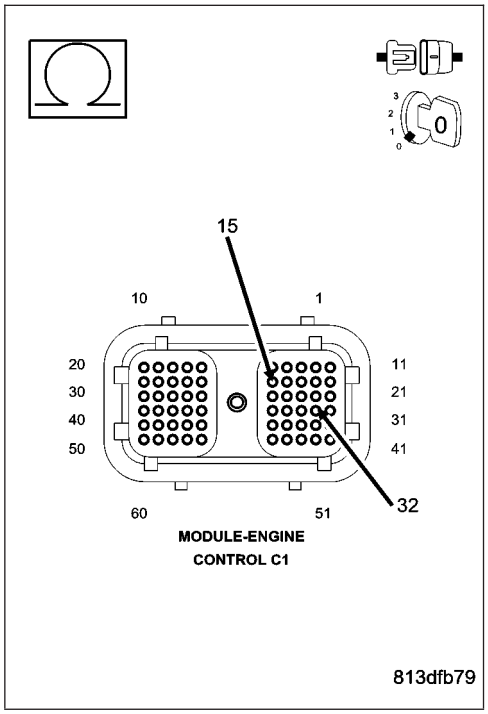
Disconnect the ECM harness connector(s).

Measure the resistance between the temperature sensor (K21) signal and (K916) return circuit at the ECM harness connector with the sensor connected

Is the resistance between 300 and 90k ohms?

Yes >> Go To 6

No >> Go To 4



4. (K21) SIGNAL CIRCUIT OPEN

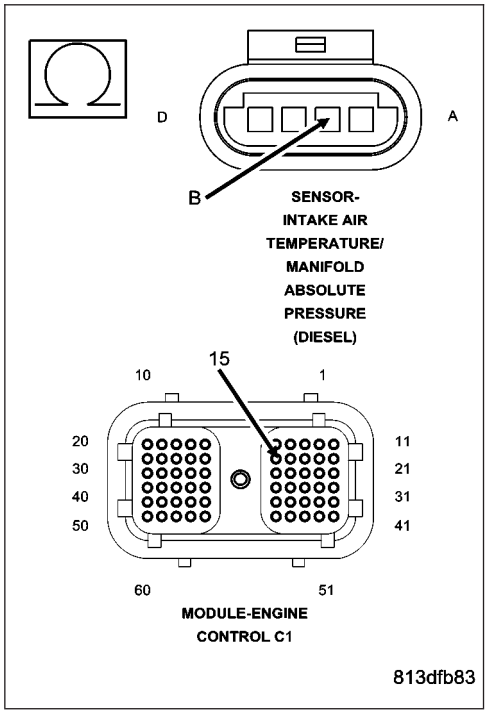
Measure the resistance of the sensor (K21) signal circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open Sensor (K21) signal circuit or the harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

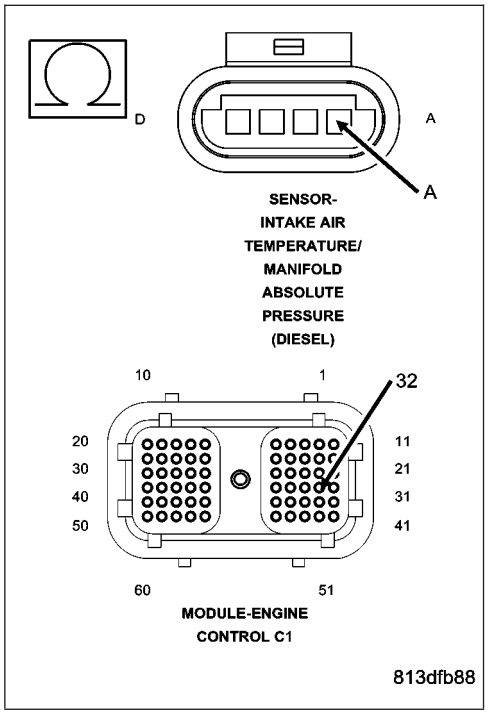
5. (K916) RETURN CIRCUIT OPEN

Measure the resistance of the sensor (K916) Return circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair the open (K916) return circuit or the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



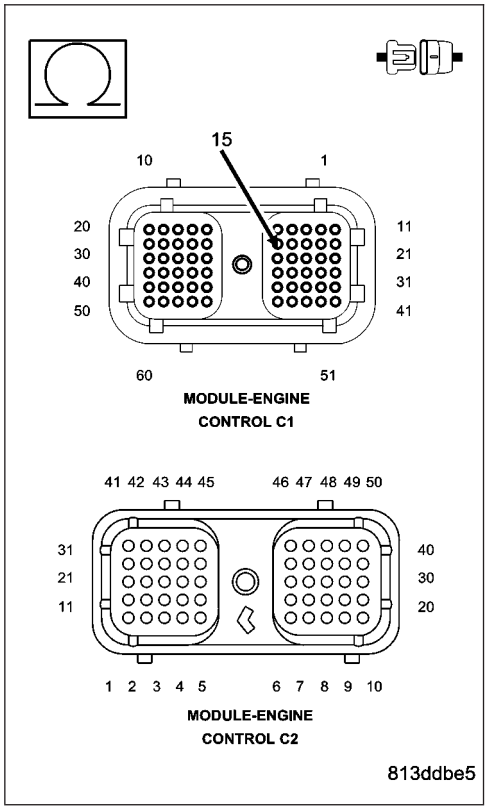
6. SHORT IN HARNESS

Check for a short circuit from (K21) signal circuit to all other circuits at the ECM harness connector.

Is the resistance more than 100 k ohms?

Yes >> Go To 7

No >> Repair the short in the wiring harness or replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0113-INTAKE AIR TEMPERATURE (IAT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

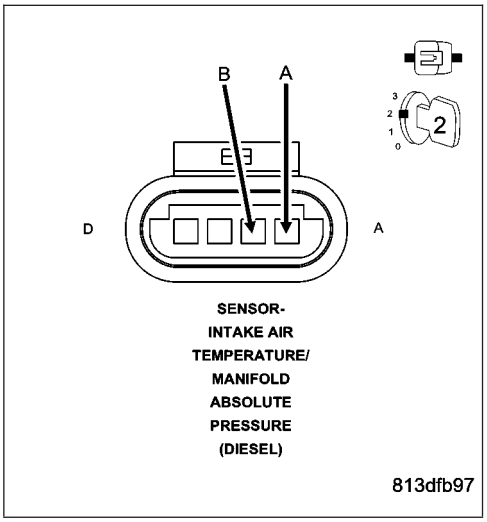
7. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

With the scan tool, erase DTCs.

While monitoring with scan tool, use a jumper wire and connect the sensor (K21) signal circuit to the sensor (K916) return circuit at the sensor harness connector.



Did the DTC P0112 set?

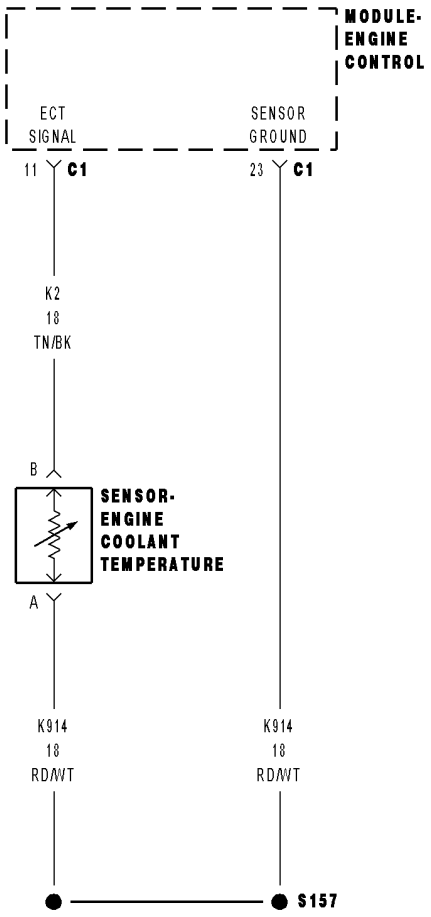
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

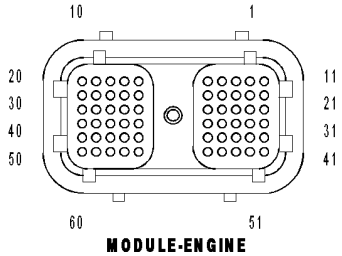
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

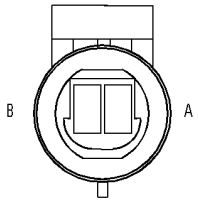
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0116-ENGINE COOLANT TEMPERATURE (ECT) SENSOR RATIONALITY





MODULE-ENGINE
CONTROL C1



SENSOR-
ENGINE
COOLANT
TEMPERATURE
(DIESEL)

813e2e6b

P0116-ENGINE COOLANT TEMPERATURE (ECT) SENSOR RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM does not read a change in value from the sensor over time.

Possible Causes
LOW COOLANT LEVEL
COOLANT TEMPERATURE SENSOR
THERMOSTAT
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW COOLANT LEVEL

With the engine cold, verify the level of coolant in the radiator.

Is the radiator full of coolant?

Yes >> Go To 2

No >> Fill the radiator with coolant- refer to the owners manual for assistance.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. COOLANT TEMPERATURE SENSOR

Remove the temperature sensor and reconnect the wiring to the sensor.

Turn the ignition on.

Monitor scan tool, while heating the sensor with an external heat source (DO NOT USE OPEN FLAME).

Does the reading from the sensor increase at least 5 degrees F. on the scan tool?

Yes >> Go To 3

No >> Replace the coolant temp sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0116-ENGINE COOLANT TEMPERATURE (ECT) SENSOR RATIONALITY (CONTINUED)

3. THERMOSTAT

NOTE: refer to the no trouble code test" *Thermostat Test" to ensure the thermostat is operating properly.

Is the thermostat operating properly?

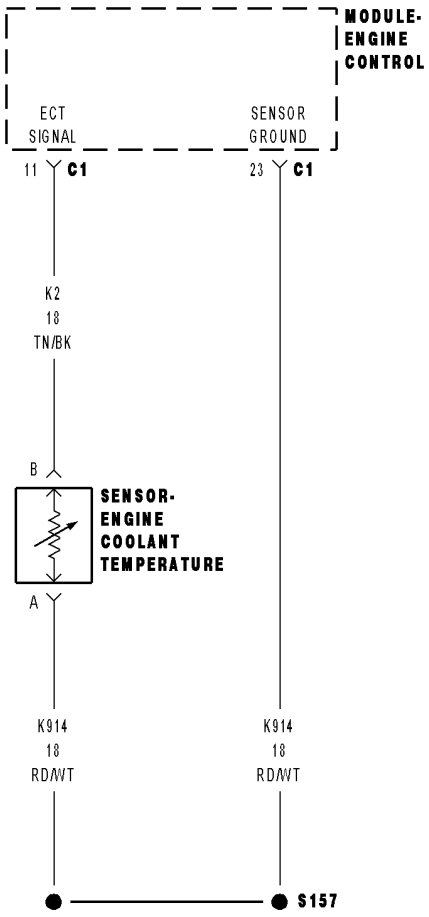
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

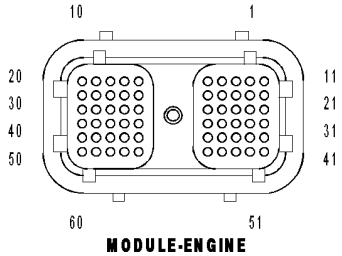
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the Thermostat.

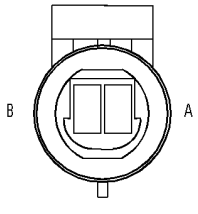
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0117-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO LOW





MODULE-ENGINE
CONTROL C1



SENSOR-
ENGINE
COOLANT
TEMPERATURE
(DIESEL)

813e2e6b

P0117-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
COOLANT TEMPERATURE SENSOR
INTERMITTENT CONDITION
(K2) SENSOR SIGNAL CIRCUIT SHORTED TO GROUND OR (K104) RETURN CIRCUIT
WIRING HARNESS SHORTED
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. COOLANT TEMPERATURE SENSOR

Turn the ignition off.

Disconnect the Coolant Temp sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance of the Temp sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the Coolant Temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. INTERMITTENT CONDITION

Reconnect the coolant temp sensor connected.

Turn the ignition on.

With the scan tool, erase DTCs.

With the scan tool, read DTCs.

Did the DTC reset?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0117-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO LOW (CONTINUED)

3. (K2) SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connector.

Check connectors - Clean/repair as necessary.

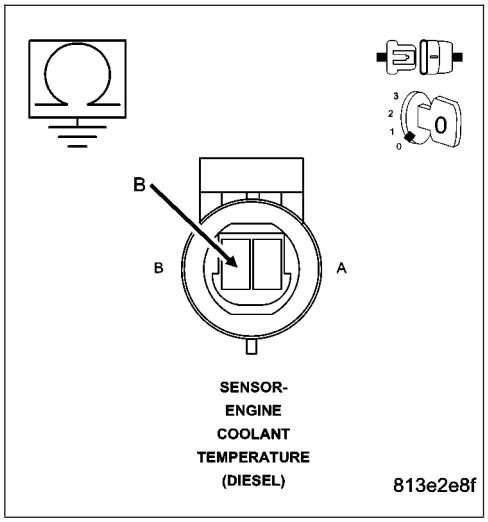
Measure the resistance between the engine ground and the (K2) temperature sensor signal circuit at the sensor harness connector.

Is the resistance more than 100 k ohms?

Yes >> Go To 4

No >> Repair or replace the short harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



4. WIRING HARNESS SHORTED

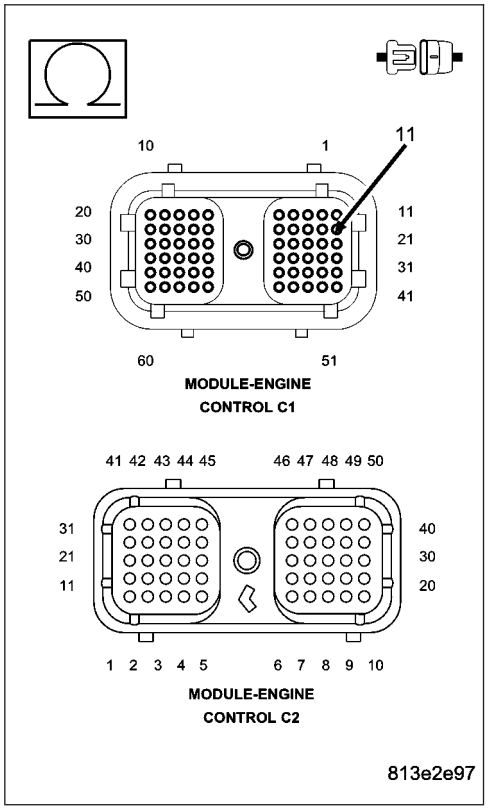
Measure the resistance between the (K2) signal circuit and all other circuits at the ECM harness connector.

Is the resistance more than 100k ohms?

Yes >> Go To 5

No >> Repair or replace shorted wiring harness

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0117-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO LOW (CONTINUED)

5. **ECM**

Reconnect the ECM harness connectors.

Turn the ignition on.

With the scan tool, erase DTCs.

While monitoring the scan tool, Disconnect the temperature sensor harness connector.

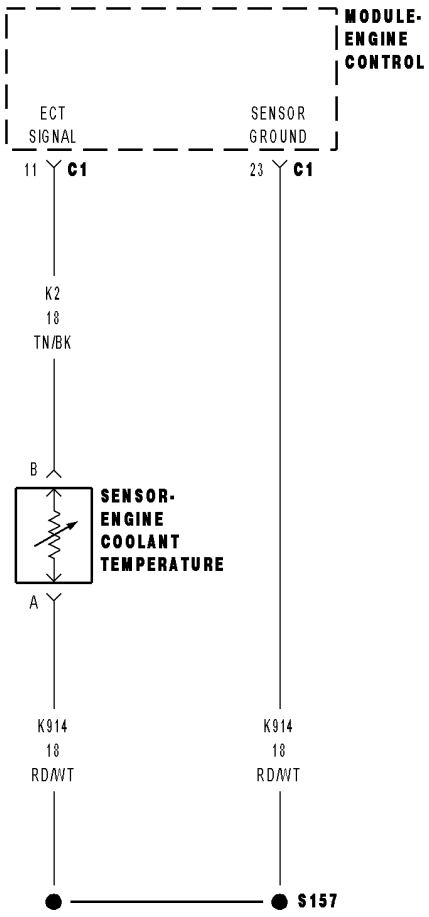
Did the DTC P0118 set?

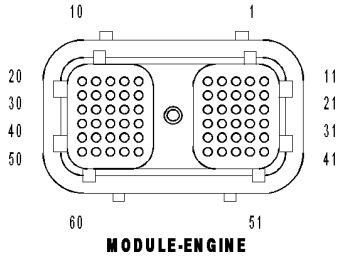
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

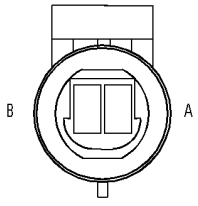
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH





MODULE-ENGINE
CONTROL C1



SENSOR-
ENGINE
COOLANT
TEMPERATURE
(DIESEL)

813e2e6b

P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
COOLANT TEMPERATURE SENSOR
INTERMITTENT CONDITION
(K2) SIGNAL CIRCUIT OPEN
(K914) SENSOR RETURN CIRCUIT OPEN
(K2) SIGNAL CIRCUIT SHORTED
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. COOLANT TEMPERATURE SENSOR

Disconnect the coolant temperature sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance of the coolant temperature sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the coolant temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. INTERMITTENT CONDITION

Reconnect the disconnected coolant temp sensor harness connector.

With the scan tool, erase DTCs.

With the scan tool, read DTCs.

Did the DTC return?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. HIGH RESISTANCE IN CIRCUIT

Turn the ignition off.

Disconnect the ECM harness connector.

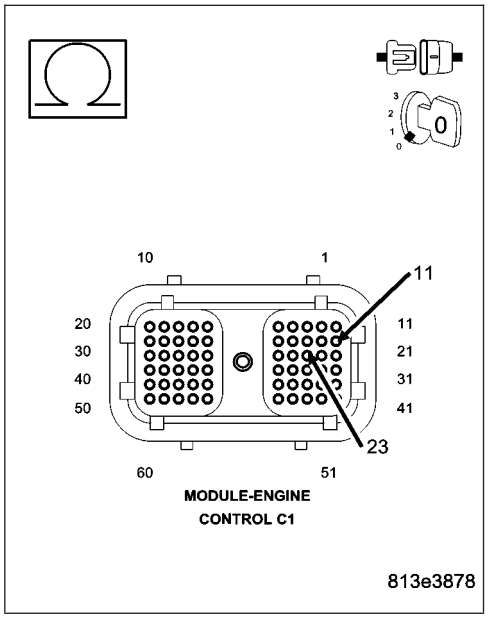
Check connectors - Clean/repair as necessary.

Measure the resistance between the (K2) temperature sensor signal and (K914) return circuit at the ECM harness connector with the coolant temp sensor harness connected.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 6

No >> Go To 4



4. (K2) SIGNAL CIRCUIT OPEN

Disconnect the coolant temperature sensor harness connector.

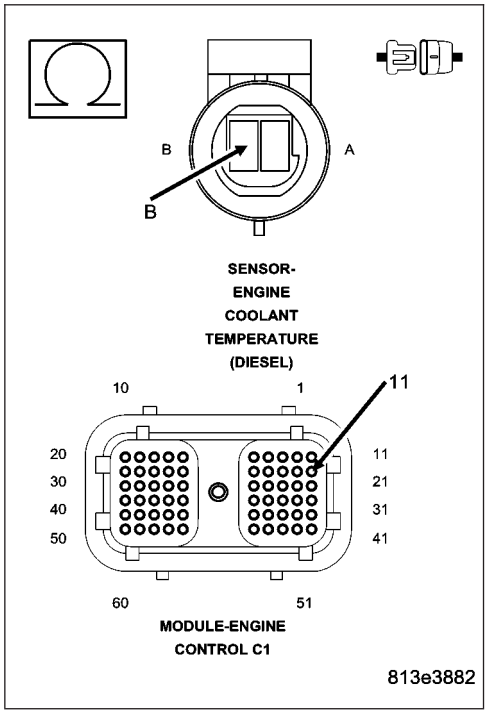
Measure the resistance of the (K2) coolant temperature sensor signal circuit between the coolant temperature sensor connector and the ECM connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair or replace the open (K2) signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

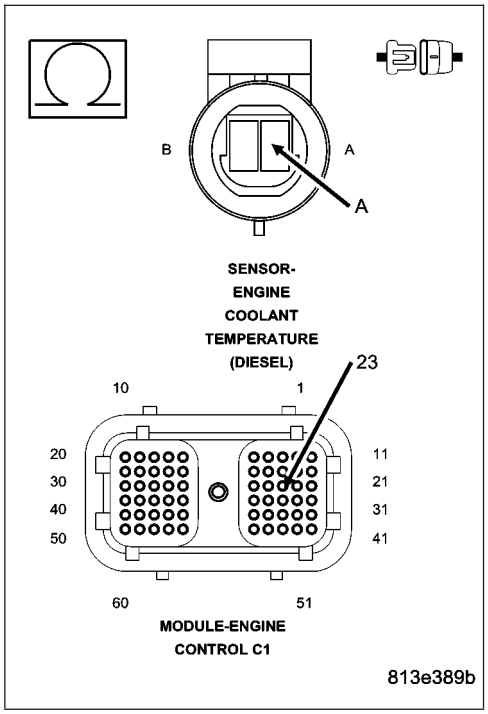
5. (K914) SENSOR RETURN CIRCUIT OPEN

Measure the resistance of the (K914) coolant temperature sensor return circuit between the coolant temperature sensor connector and the ECM connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair or replace the open (K914) sensor return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



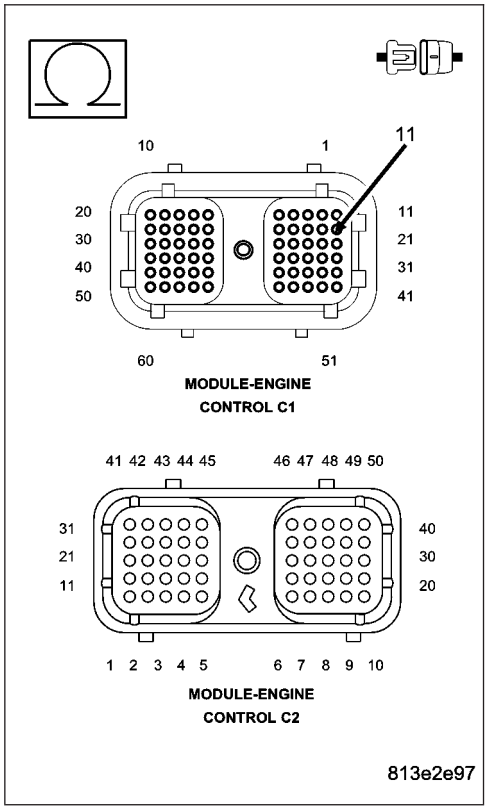
6. (K2) SIGNAL CIRCUIT SHORTED

Measure the resistance of (K2) signal circuit to all other circuits at the ECM harness connector.

Is the resistance more than 100k ohms?

Yes >> Go To 7

No >> Repair or replace the (K2) coolant temperature sensor signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0118-ENGINE COOLANT TEMPERATURE (ECT) SENSOR VOLTAGE TOO HIGH (CONTINUED)

7. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

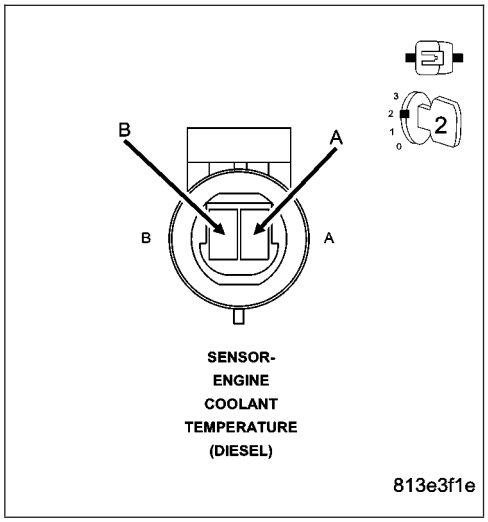
With the scan tool, erase DTCs.

While monitoring with scan tool, use a jumper wire and connect the sensor (K2) signal circuit to the (K914) sensor return circuit at the sensor connector.

Did the DTC P0117 set?

Yes >> Test Complete.

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0128-THERMOSTAT RATIONALITY

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The coolant temperature does not rise by a calibrated amount over a calibrated amount of time.

Possible Causes
COOLING FAN
COOLANT TEMPERATURE SENSOR
THERMOSTAT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. COOLING FAN

NOTE: refer to the no trouble code test"*Fan Operation Test" to ensure the fan is operating properly.

Is the cooling fan operating properly?

Yes >> Go To 2

No >> Repair the cooling fan.
Perform POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. COOLANT TEMPERATURE SENSOR

Operate the engine for 10 minutes while monitoring the coolant temperature with the scan tool.

Did the coolant temperature change over time while the engine was running?

Yes >> Go To 3

No >> Replace the coolant temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. THERMOSTAT

NOTE: refer to the no trouble code test"*Thermostat Test" to ensure the thermostat is operating properly.

is the thermostat operating properly?

Yes >> Test Complete.

No >> Replace the thermostat.
Perform POWERTRAIN VERIFICATION TEST VER - 2 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0148-HIGH PRESSURE COMMON RAIL (HPCR) CHECKSUM

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  A deviation between the fuel pressure set point and the actual fuel pressure.

Possible Causes
OTHERS DTC'S PRESENT
FUEL LEAKS
FUEL CONTROL ACTUATOR
FUEL PRESSURE SENSOR
CASCADE OVERFLOW VALVE
CHECK VALVE DAMAGED OR BLOCKED
FUEL RETURN LINES OBSTRUCTION, DAMAGE, OR DEBRIS.
LIFT PUMP FLOW
AIR IN FUEL SYSTEM
LEAKING FUEL INJECTORS OR HIGH PRESSURE CONNECTORS
PRESSURE LIMITING VALVE
HIGH PRESSURE FUEL PUMP
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHERS DTC'S PRESENT

With the scan tool, read DTCs.

Are any other DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL).

No >> Go To 2

---

2. FUEL LEAKS

Ensure that the fuel level is above 15% using the scan tool.

Visually inspect the low and high pressure side of the fuel system for fuel leaks or damaged components.

Do you have any fuel leaks or damaged components?

Yes >> Repair the fuel leak.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0148-HIGH PRESSURE COMMON RAIL (HPCR) CHECKSUM (CONTINUED)

3. FUEL CONTROL ACTUATOR

Check for a mechanically stuck Fuel Control Actuator (FCA). Using the scan tool, actuate the fuel control actuator.

NOTE: The fuel control actuator will only click when cycled off..

Do you hear a click from the actuator when you cycle the actuator off with the scan tool?

Yes >> Go To 4

No >> Replace the fuel Injector pump.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. FUEL PRESSURE SENSOR

Using the scan tool, monitor the fuel pressure reading from the fuel rail pressure sensor at idle and at 2000 RPM

Is the fuel rail pressure reading higher at 2000 RPM than at idle?

Yes >> Go To 5

No >> Replace the fuel pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. HIGH FUEL PRESSURE

Using the scan tool compare the fuel rail pressure set point with the actual fuel rail pressure.

Is the actual fuel rail pressure higher than the fuel rail pressure set point?

Yes >> Go To 6

No >> Go To 9

---

6. CASCADE OVERFLOW VALVE

Perform the no trouble code test ″*fuel pump return flow test″. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Did the fuel injection pump pass the test?

Yes >> Go To 7

No >> Replace the Fuel pump.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. CHECK VALVE DAMAGED OR BLOCKED

Check the fuel drain line check valve in the rear of the cylinder head for signs of damage, blockage, or debris.

Is the check valve damaged or blocked?

Yes >> Repair the cause of the damaged or blocked check valve or replace the valve.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

P0148-HIGH PRESSURE COMMON RAIL (HPCR) CHECKSUM (CONTINUED)

8. FUEL RETURN LINE OBSTRUCTION, DAMAGED OR DEBRIS

Check the fuel return lines for signs of obstruction, damage, or debris.

Are the fuel drain lines damaged or blocked?

Yes >> Repair cause of high fuel drain line restriction.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. LIFT PUMP FLOW

Perform the no trouble code ″Lift Pump flow test″. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Did the Lift pump pass the test?

Yes >> Go To 10

No >> Replace the Lift Pump.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. PRESSURE LIMITING VALVE

Perform the no trouble code test ″ Pressure Limiting Valve on the Fuel Rail for internal leaks″.

Did the pressure limiting valve pass the test procedure?

Yes >> Go To 11

No >> Replace the Pressure Limiting Valve.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

11. LEAKING FUEL INJECTORS OR HIGH PRESSURE CONNECTORS

Perform the no trouble test ″*Injector return flow test″. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Are any Injectors leaking or high pressure connectors leaking?

Yes >> Replace or repair the leaking fuel injectors or high pressure connectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 12

---

12. HIGH PRESSURE FUEL PUMP

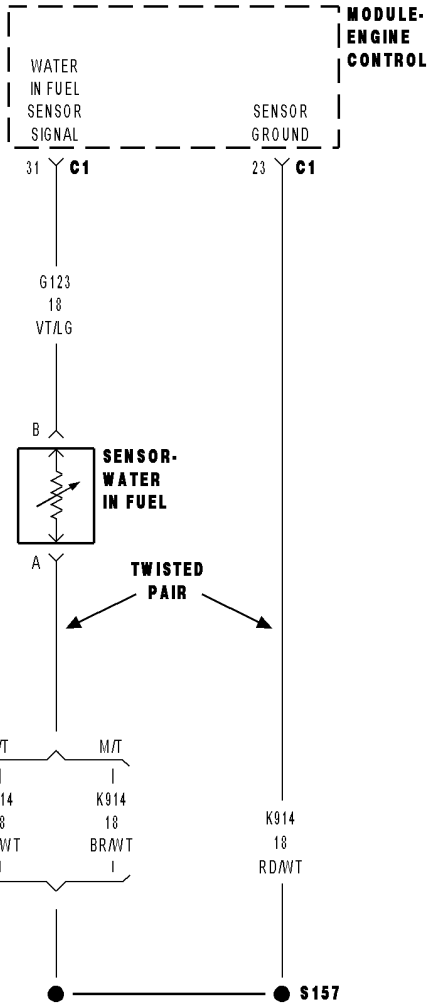
Perform the no trouble code test ″HIGH PRESSURE FUEL PUMP PERFORMANCE TEST″. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

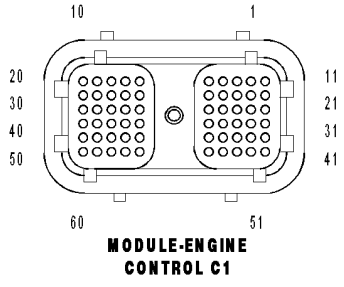
Did the fuel pump pass the high pressure fuel pump performance test?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

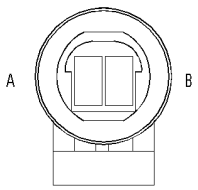
No >> Replace the High pressure fuel pump.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0169-WATER IN FUEL (WIF) LIGHT ON TOO LONG





MODULE-ENGINE
CONTROL C1



SENSOR- WATER
IN FUEL

813e57a2

P0169-WATER IN FUEL (WIF) LIGHT ON TOO LONG (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  Water in fuel light was on for a calibrated amount of time.

Possible Causes
OTHER DTC'S PRESENT
WATER IN FUEL

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

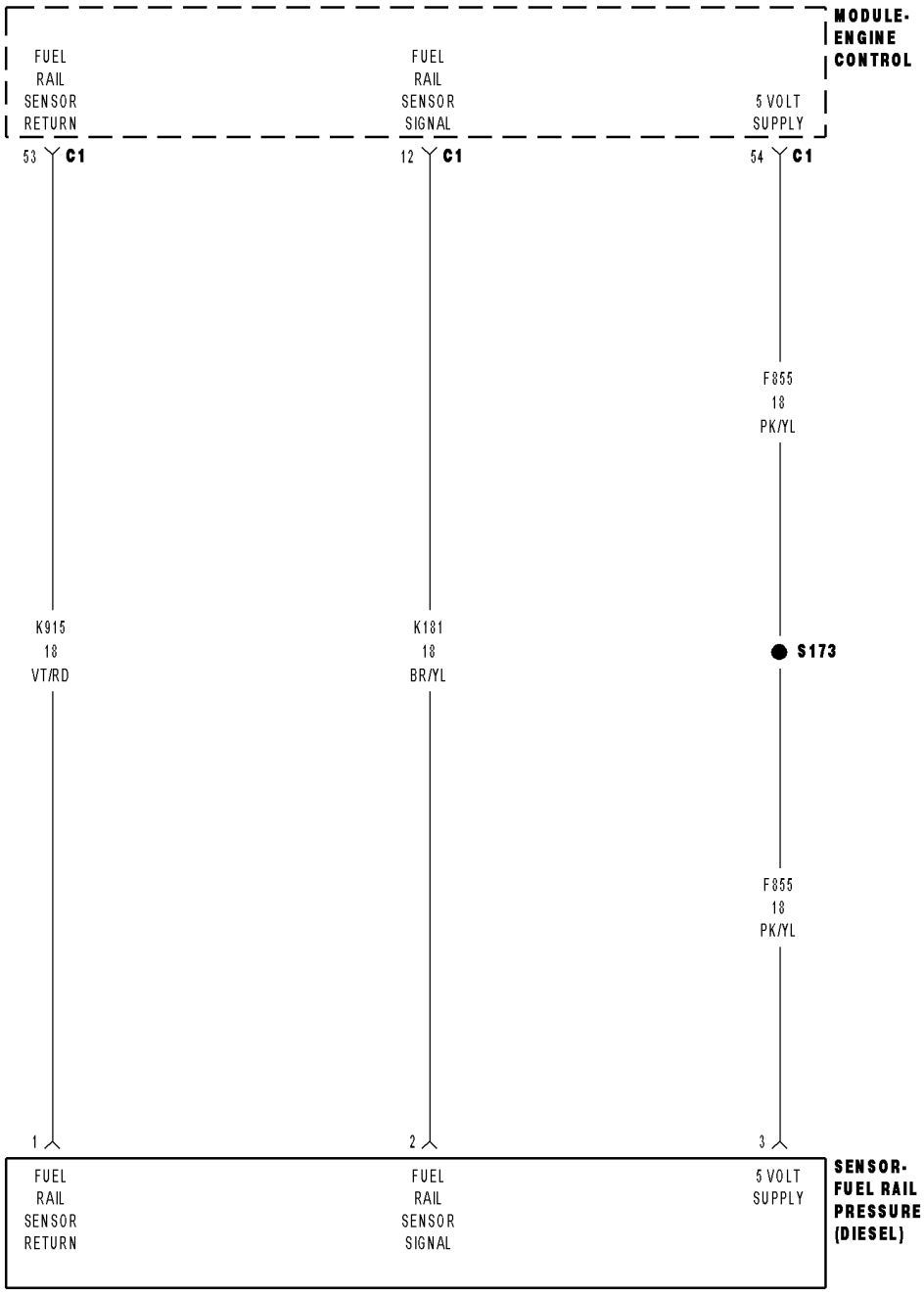
With the scan tool, read DTCs.

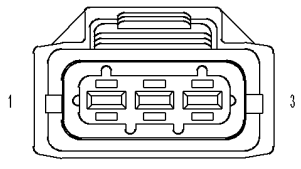
Is P2269 displayed?

Yes >> Repair P2269 DTC first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

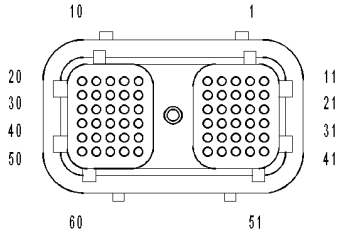
No >> Drain water in fuel.

P0191-FUEL RAIL PRESSURE SENSOR PERFORMANCE





SENSOR-
FUEL RAIL
PRESSURE
(DIESEL)



MODULE-ENGINE
CONTROL C1

813e5a09

P0191-FUEL RAIL PRESSURE SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At key on.
- **Set Condition:**
  The fuel pressure sensor reading at key on does not match the expected fuel pressure reading at key on.

Possible Causes
OTHER DTC'S PRESENT
FUEL RAIL PRESSURE SENSOR
FUEL SYSTEM TAMPERING
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Are any DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. FUEL PRESSURE READING

Using the scan tool, monitor the actual fuel pressure reading while the key is on and engine is not running.

Is the actual fuel pressure reading greater than 870 psi?

Yes >> Go To 3

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0191-FUEL RAIL PRESSURE SENSOR PERFORMANCE (CONTINUED)

3. FUEL RAIL PRESSURE SENSOR

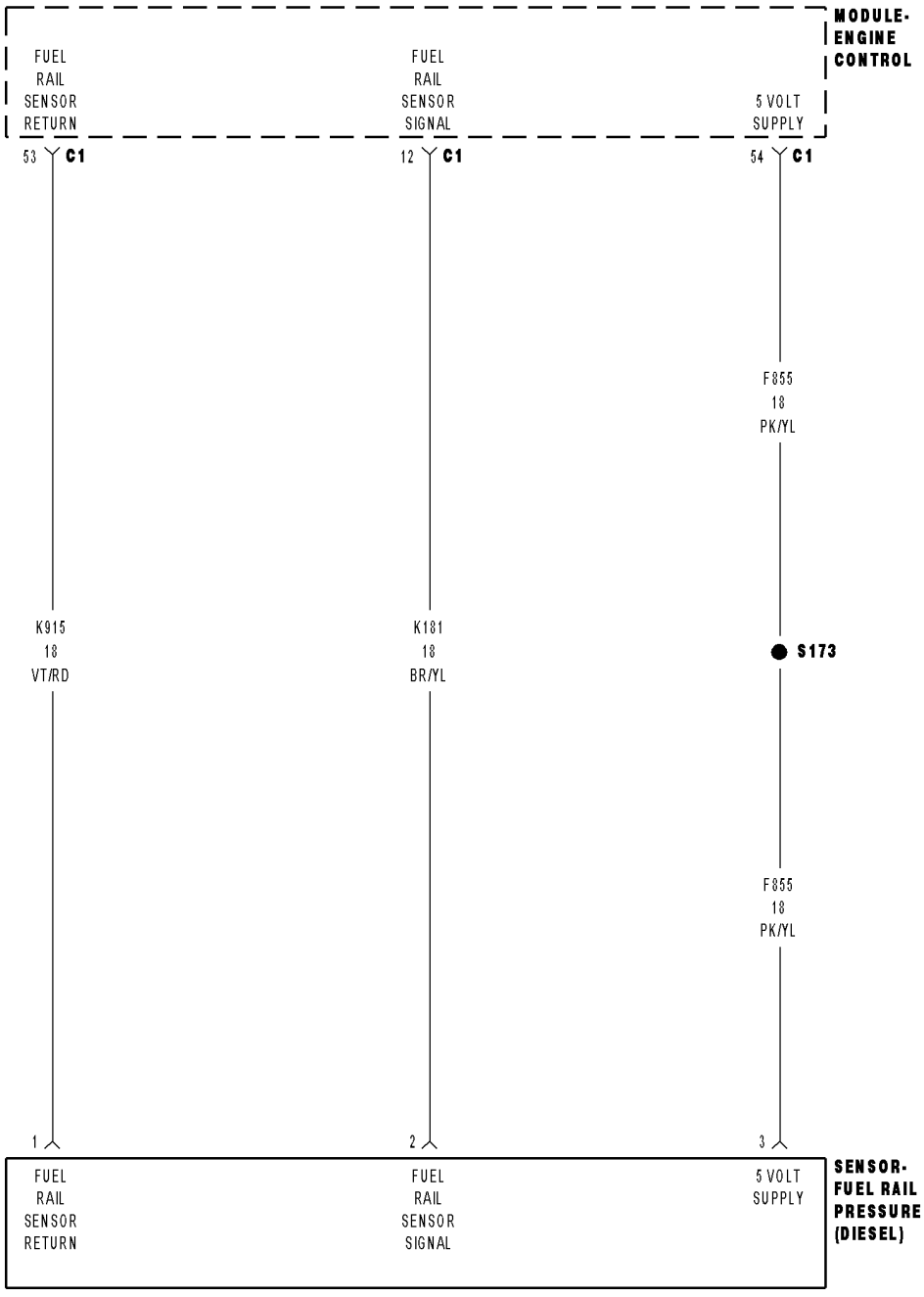
Visually inspect the fuel system components for signs of tampering, pay particular attention to the fuel pressure sensor on the fuel rail and the fuel pressure sensor wiring harness.

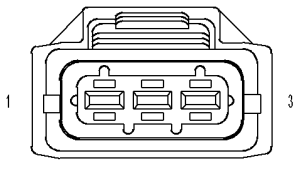
Were any signs of tampering discovered?

No >> Replace the Fuel rail pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

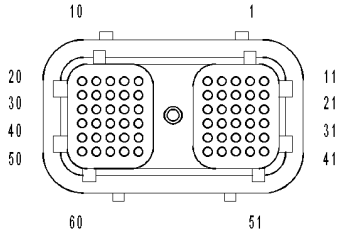
Yes >> Restore Fuel system to original condition.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW





SENSOR-
FUEL RAIL
PRESSURE
(DIESEL)



MODULE-ENGINE
CONTROL C1

813e5a09

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
FUEL PRESSURE SENSOR
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (G910) RETURN CIRCUIT
(K181) SIGNAL CIRCUIT SHORTED TO (G910) RETURN CIRCUIT
(K181) SIGNAL CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(K181) SIGNAL CIRCUIT SHORTED TO GROUND
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Ignition on, engine not running.
With the scan tool, read DTCs.

Do you have multiple DTC's?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

2. (F855) 5-VOLT SUPPLY AND (K915) RETURN CIRCUIT

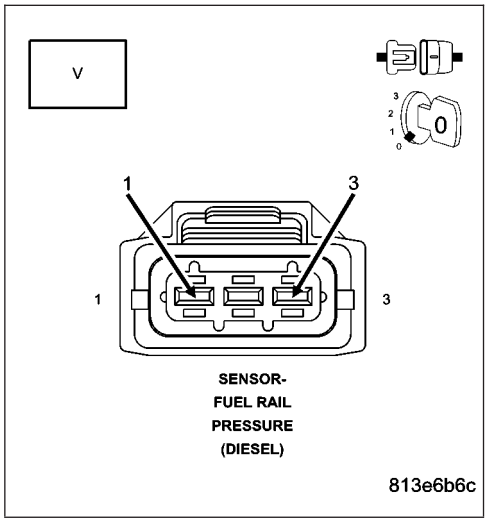
Turn the ignition off.

Disconnect the Fuel Pressure sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Measure the voltage between the (F855) 5-volt supply and (K915) return circuits of the Fuel pressure sensor harness connector.



Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

No >> Go To 4

3. FUEL PRESSURE SENSOR

Reconnect the disconnected Fuel Pressure Sensor harness connector.

While monitoring scan tool, disconnect the Fuel Pressure sensor harness connector.

Does the DTC P0193 set?

Yes >> Replace the Fuel Pressure Sensor.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

4. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K915) RETURN CIRCUIT

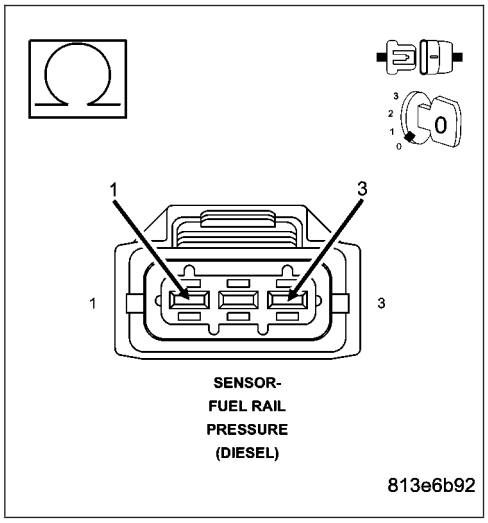
Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Fuel Pressure sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the (F855) 5-volt supply circuit and (K915) return circuit in the sensor harness connector.



Is the resistance greater than 100 K Ohms?

Yes >> Go To 5

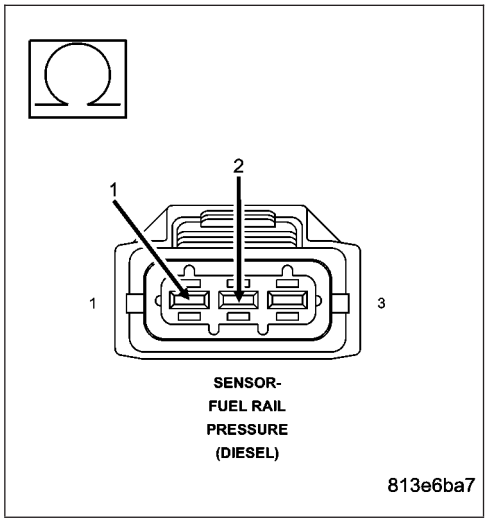
No >> Repair the shorted circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

5. (K181) SIGNAL CIRCUIT SHORTED TO (K915) RETURN CIRCUIT

Measure the resistance between the (K181) signal circuit and (K915) return circuit in the sensor connector.



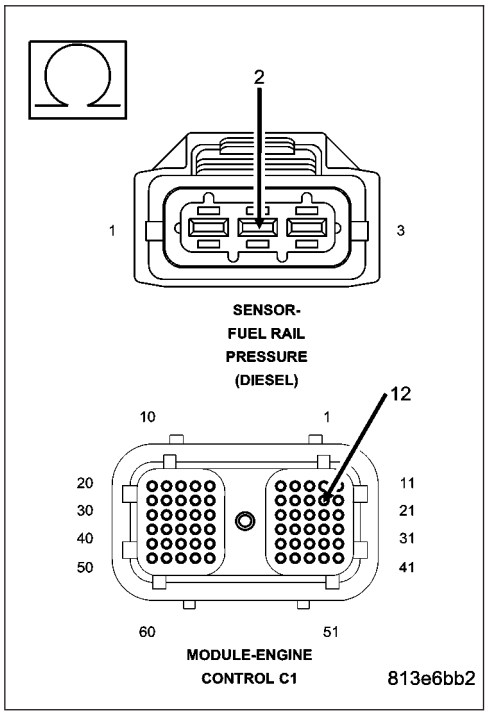
Is the resistance greater than 100 K Ohms?

Yes >> Go To 6

No >> Repair the shorted circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

6. (K181) SIGNAL CIRCUIT OPEN

Measure the resistance between the signal (K181) circuit in the sensor harness connector with the (K181) signal circuit in the ECM harness connector.



Is the resistance less than 10 Ohms?

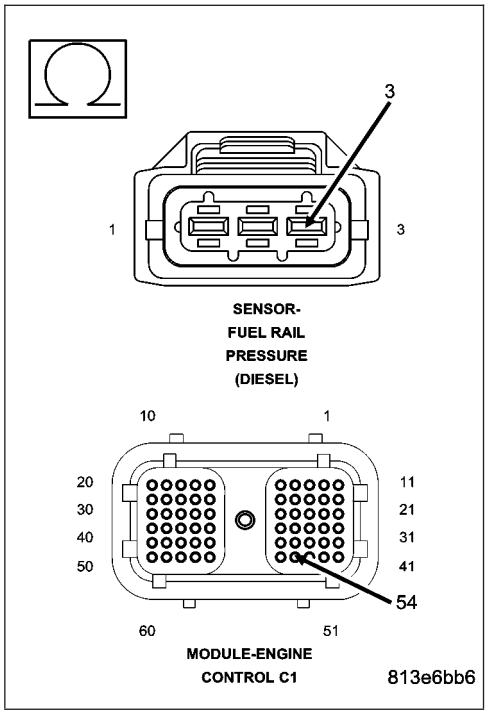
Yes >> Go To 7

No >> Repair the open (K181) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

7. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Measure the resistance between the supply (F855) circuit in the sensor harness connector with the (F855) 5-volt supply circuit in the ECM harness connector.



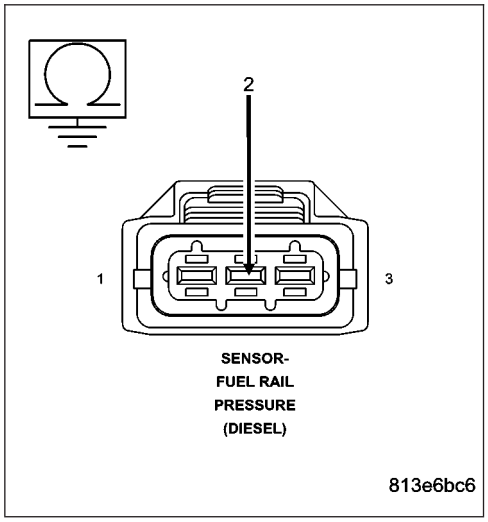
Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair the open (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

8. (K181) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K181) signal circuit in the sensor harness connector and battery negative.



Is the resistance greater than 100 K Ohms?

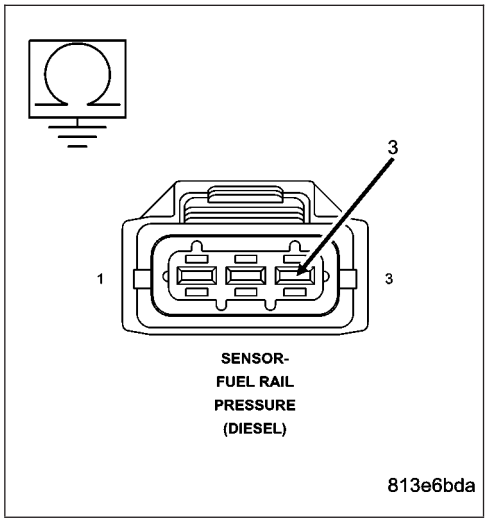
Yes >> Go To 9

No >> Repair (K181) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0192-FUEL PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (F855) 5-volt supply circuit in the sensor harness connector and battery negative.



Is the resistance greater than 100 K Ohms?

Yes >> Go To 10

No >> Repair (F855) 5-volt Supply circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

10. ECM

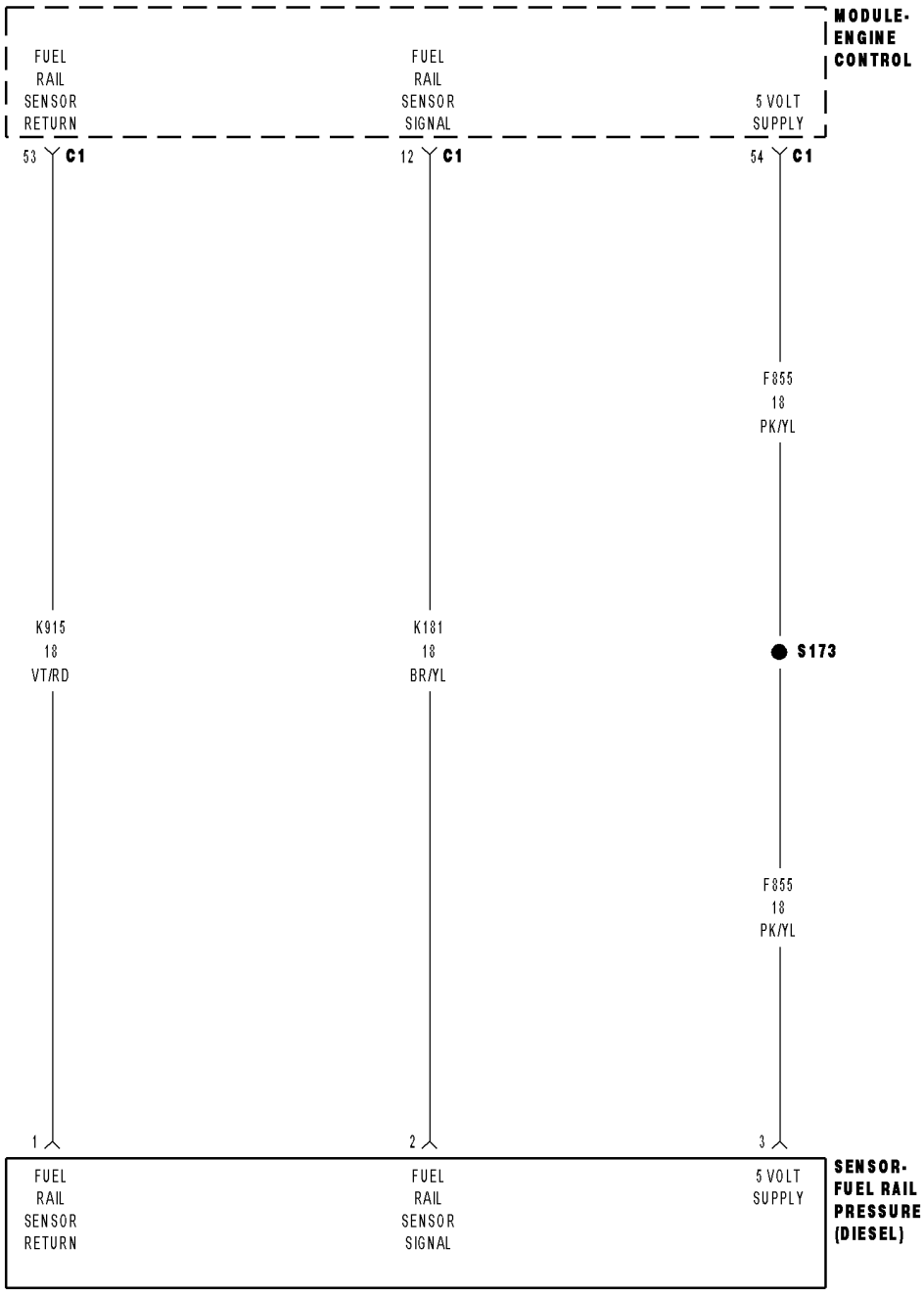
Reconnect the disconnected Fuel pressure sensor harness connector and ECM harness connectors.
While monitoring scan tool, disconnect the Fuel Pressure sensor connector.

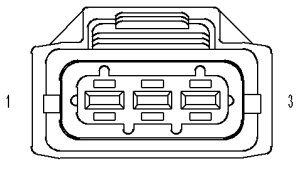
Does the DTC P0193 set?

Yes >> Test Complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

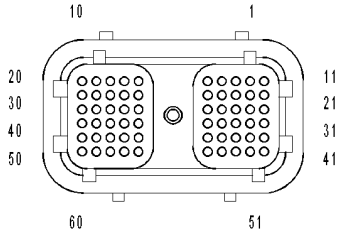
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH





SENSOR-
FUEL RAIL
PRESSURE
(DIESEL)



MODULE-ENGINE
CONTROL C1

813e5a09

P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
FUEL PRESSURE SENSOR
(K181) SIGNAL CIRCUIT SHORTED TO VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
(K181) SIGNAL CIRCUIT SHORTED TO (K72E) 5-VOLT SUPPLY CIRCUIT
(K915) RETURN CIRCUIT OPEN
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Ignition on, engine not running.
With the scan tool, read DTCs.

Do you have multiple DTC's?

Yes >> Refer to multiple fault troubleshooting tree.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. (F855) 5-VOLT SUPPLY AND (K915) RETURN CIRCUIT

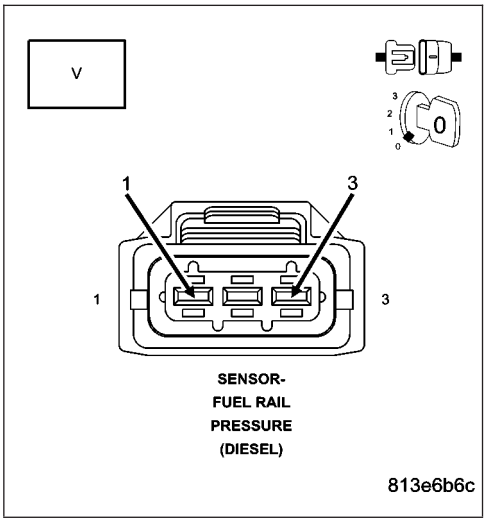
Turn the ignition off.

Disconnect the Fuel Pressure sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Measure the voltage between the (F855) 5-volt supply and (K915) return circuits of the Fuel pressure sensor harness connector.



Is the voltage between 4.5 and 5.5 volts?

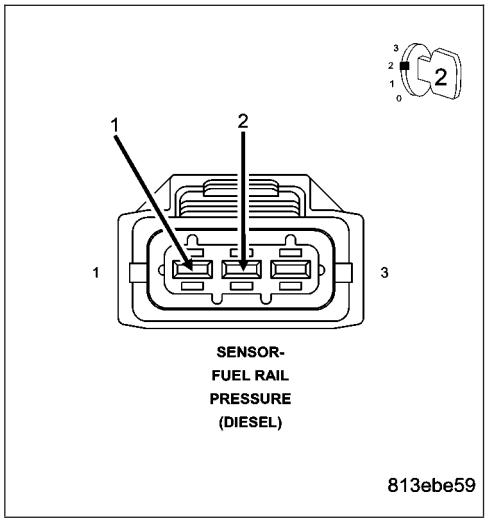
Yes >> Go To 3

No >> Go To 4

P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. FUEL PRESSURE SENSOR

While monitoring scan tool, connect a jumper wire between the (K181) signal circuit and the (K915) return circuit of the Fuel Pressure sensor connector.



Does the DTC P0192 set?

Yes >> Replace the Fuel Pressure Sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

4. (K181) SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

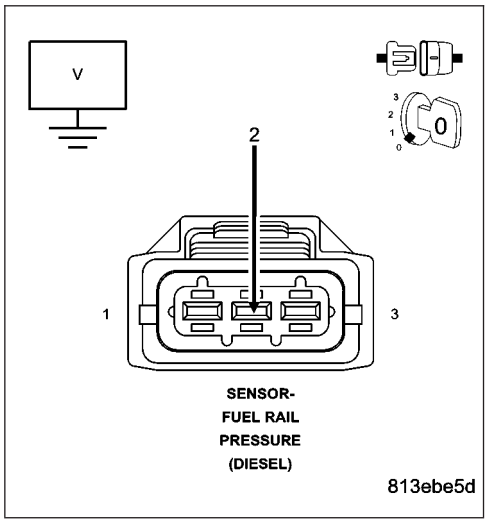
Disconnect the Fuel Pressure sensor harness connector.

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Turn the ignition on.

Measure the voltage between the (K181) signal circuit of the sensor harness connector and battery negative.



Is the voltage less than 1 volt?

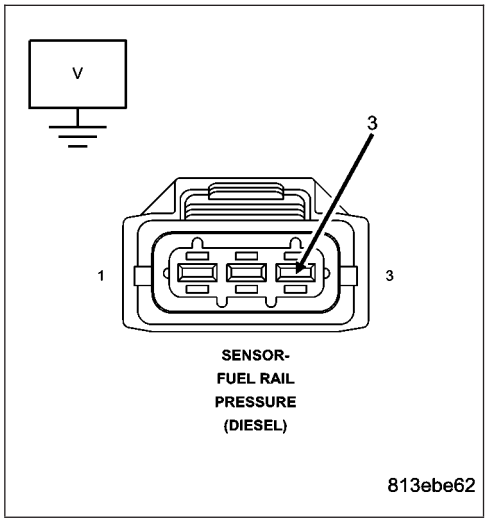
Yes >> Go To 5

No >> Repair the (K181) signal circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

5. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (F855) 5-volt supply circuit of the sensor harness connector and battery negative.



Is the voltage less than 1 volt?

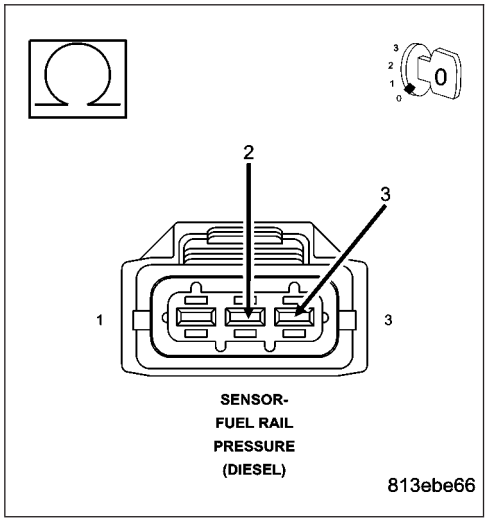
Yes >> Go To 6

No >> Repair the (F855) 5-volt supply circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

6. (K181) SIGNAL CIRCUIT SHORTED TO (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Measure the resistance between the (K181) signal circuit and (F855) 5-volt supply circuit in the sensor connector.



Is the resistance greater than 10 K Ohms?

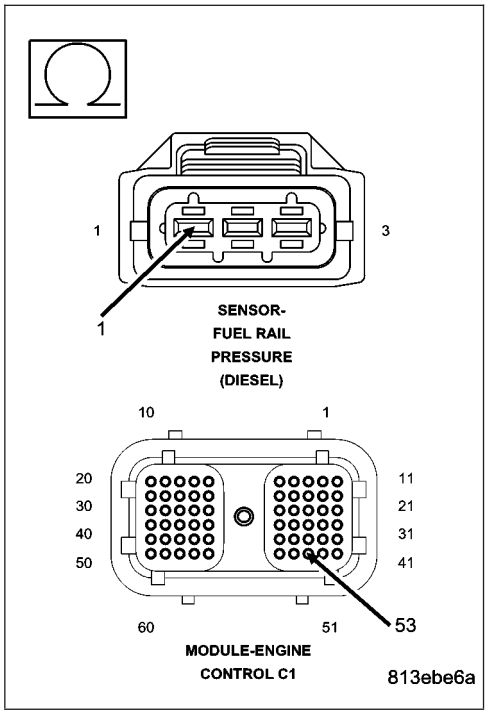
Yes >> Go To 7

No >> Repair the shorted circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0193-FUEL PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

7. (K915) RETURN CIRCUIT OPEN

Measure the resistance between the (K915) return circuit in the sensor harness connector with the (K915) return circuit in the ECM harness connector.



Is the resistance less than 10 Ohms?

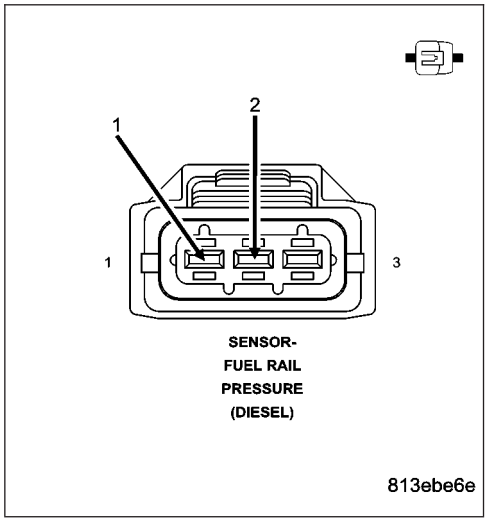
Yes >> Go To 8

No >> Repair the open (K915) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

8. ECM

Reconnect the disconnected ECM harness connectors.

While monitoring scan tool, connect a jumper wire between the (K181) signal circuit of the sensor connector and the (K915) return circuit of the sensor connector.

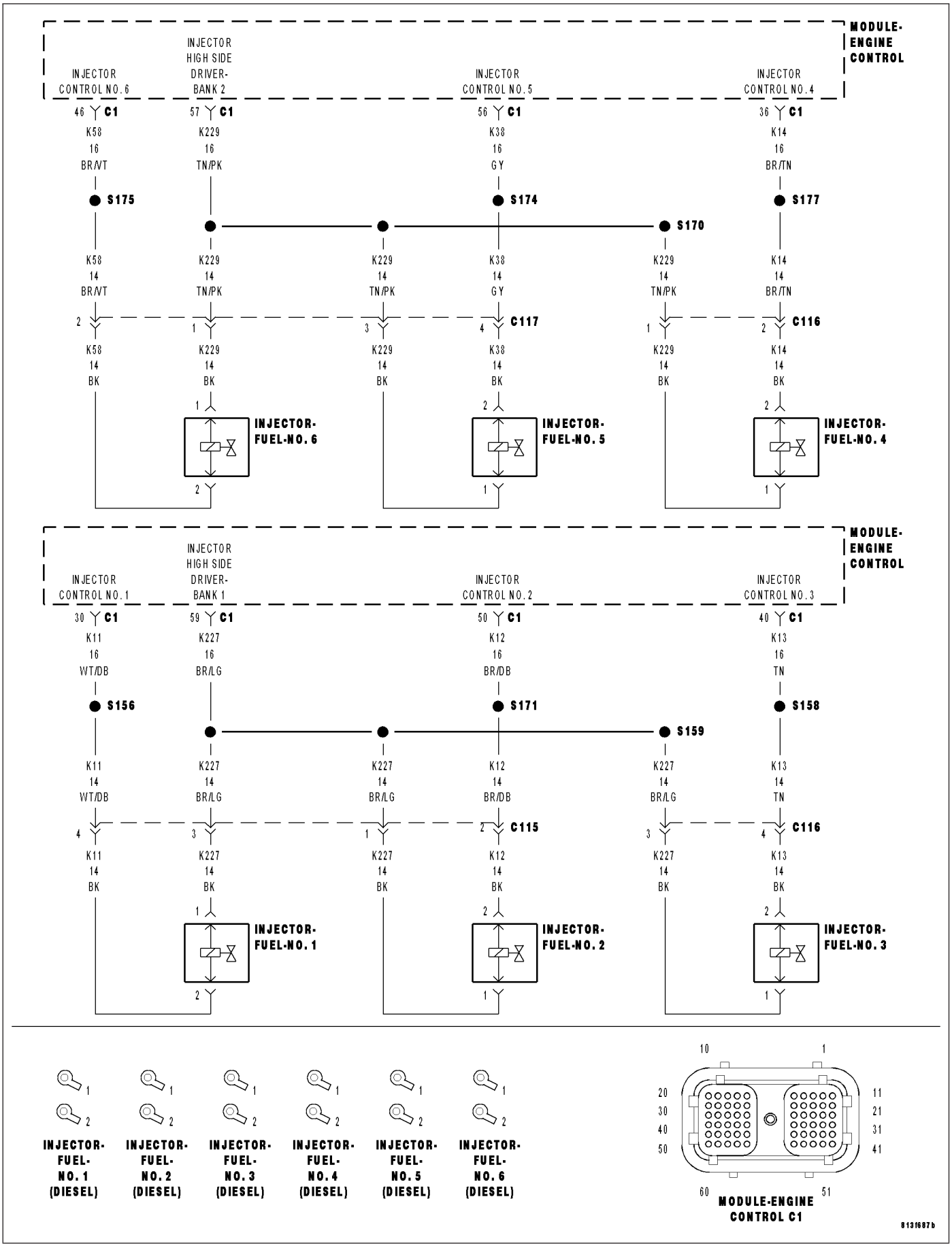


Does the DTC P0192 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0201-INJECTOR #1 CONTROL CIRCUIT



P0201-INJECTOR #1 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0201-INJECTOR #1 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

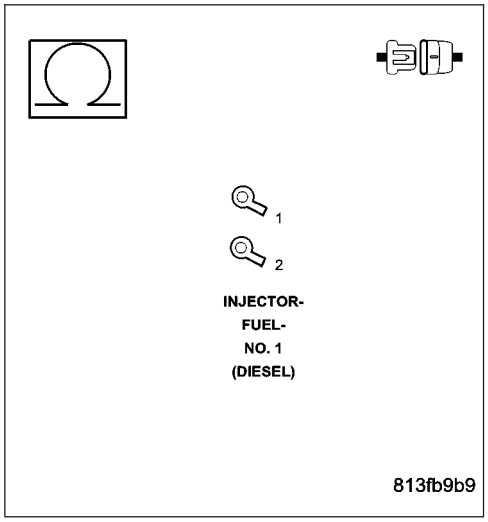
4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.



Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0201-INJECTOR #1 CONTROL CIRCUIT (CONTINUED)

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

Check connectors - Clean/repair as necessary.

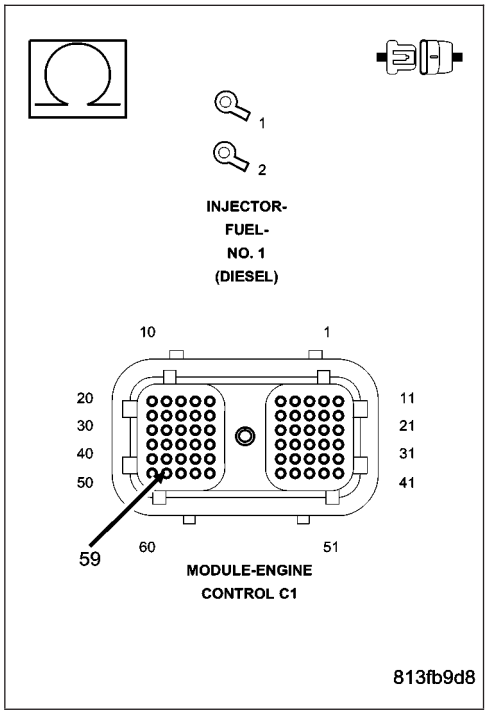
Measure the resistance of the Bank 1 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 1 low side driver circuit between the ECM connector and the injector harness connector.

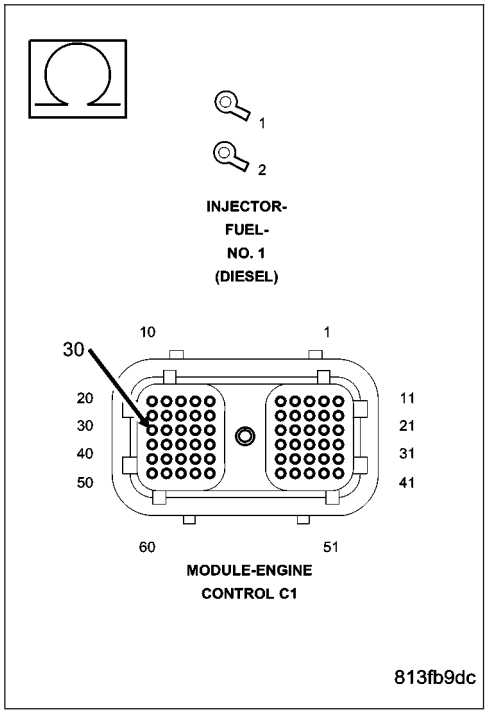
Is the resistance less than 10 Ohms?

Yes >> Test Complete.

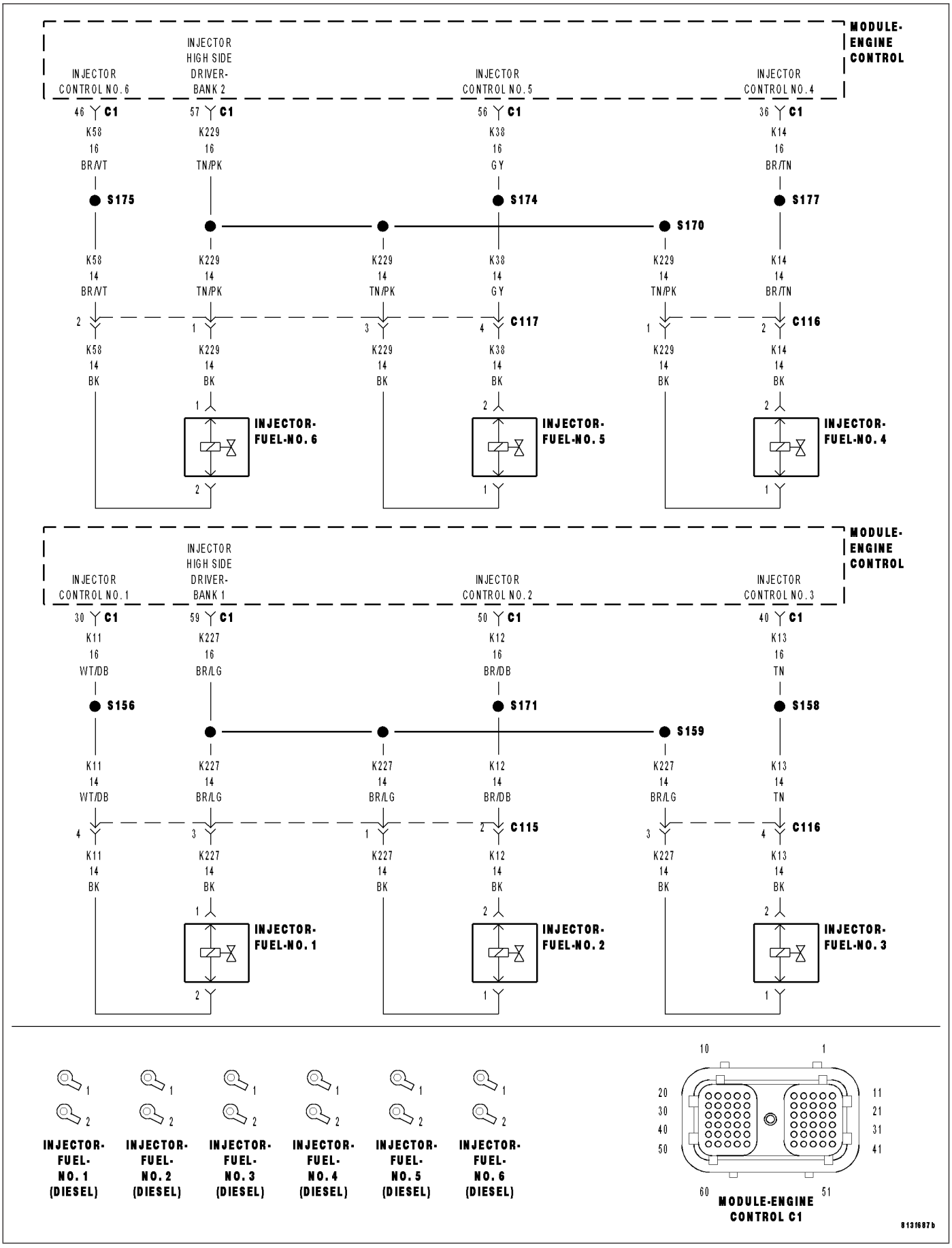
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0202-INJECTOR #2 CONTROL CIRCUIT



P0202-INJECTOR #2 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0202-INJECTOR #2 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

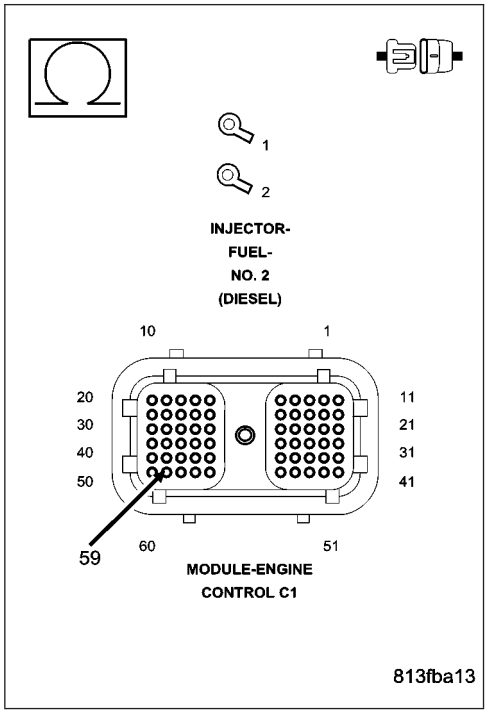
Check connectors - Clean/repair as necessary.

Measure the resistance of the Bank 1 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0202-INJECTOR #2 CONTROL CIRCUIT (CONTINUED)

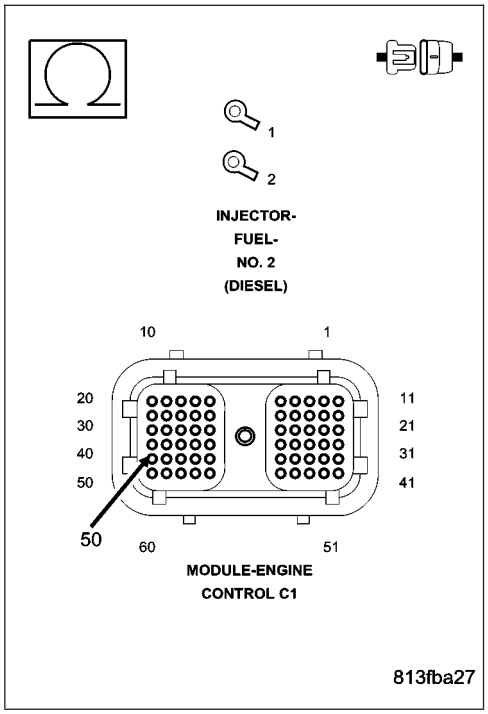
6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 1 low side driver circuit between the ECM connector and the injector harness connector.

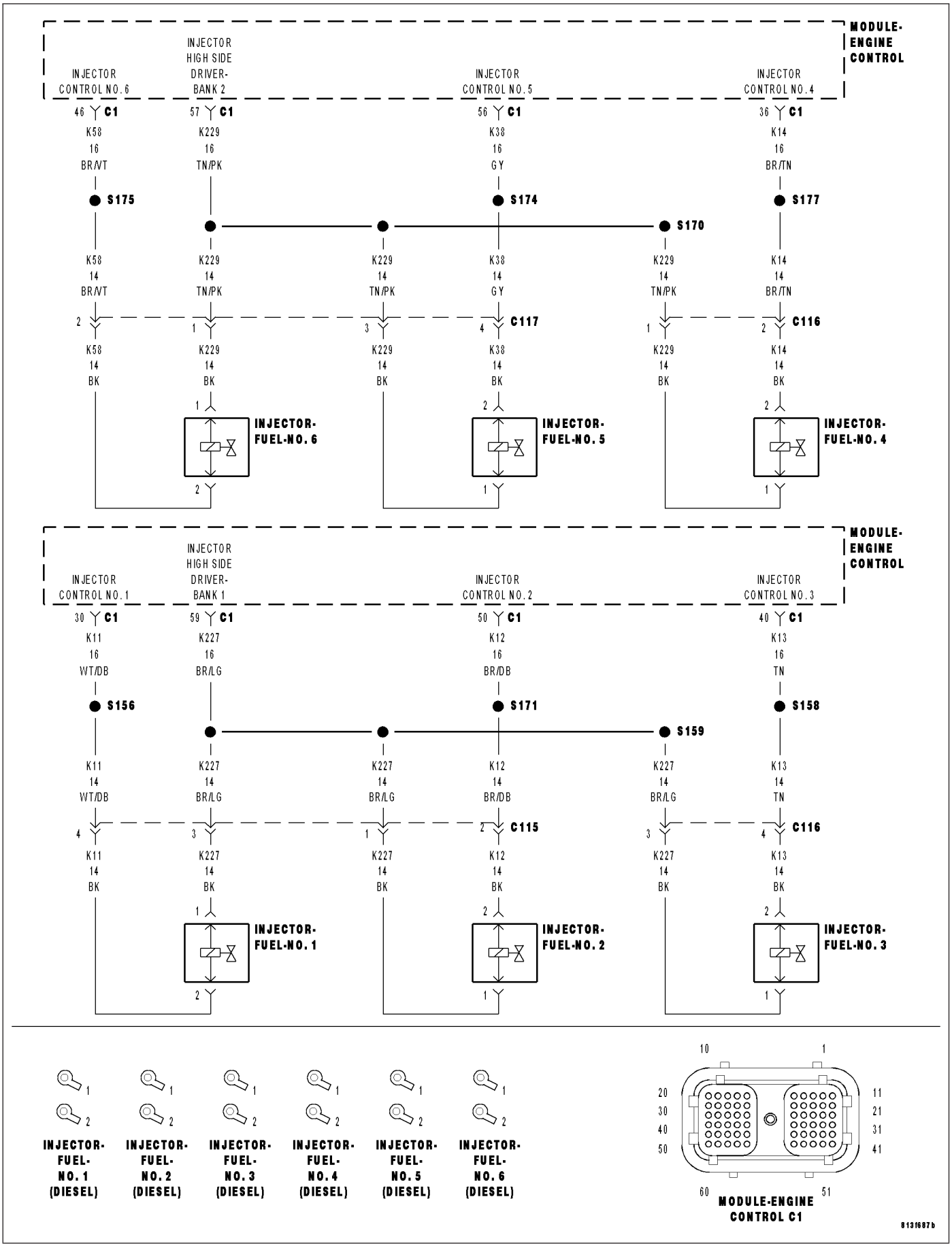
Is the resistance less than 10 Ohms?

Yes >> Test Complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace or repair the open engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0203-INJECTOR #3 CONTROL CIRCUIT



P0203-INJECTOR #3 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0203-INJECTOR #3 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

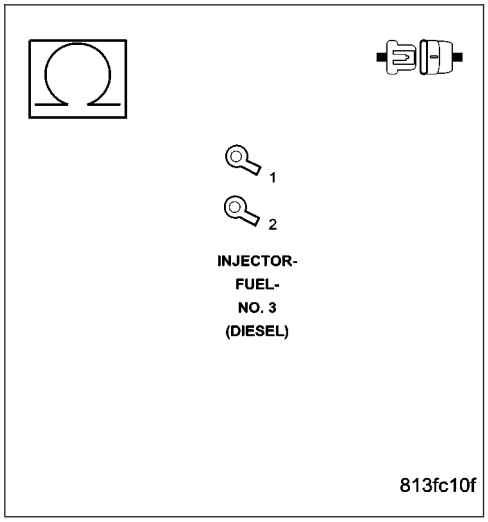
4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.



Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0203-INJECTOR #3 CONTROL CIRCUIT (CONTINUED)

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

Check connectors - Clean/repair as necessary.

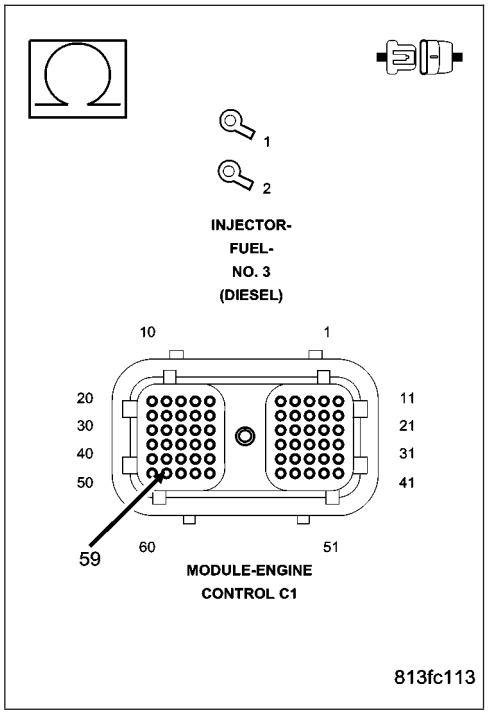
Measure the resistance of the Bank 1 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 1 low side driver circuit between the ECM connector and the injector harness connector.

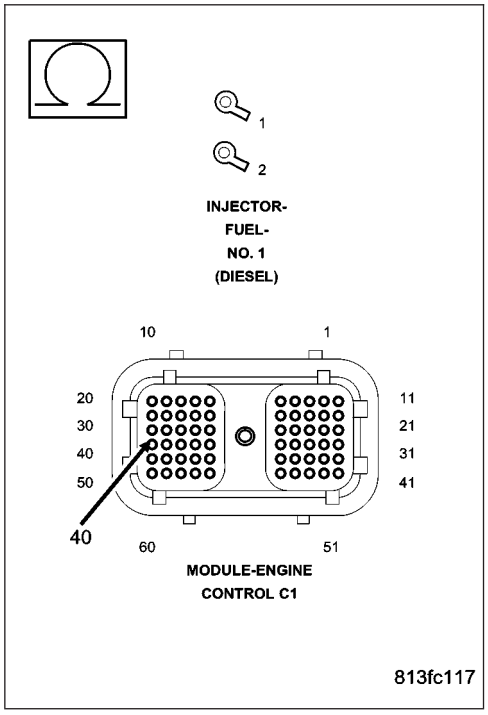
Is the resistance less than 10 Ohms?

Yes >> Test Complete.

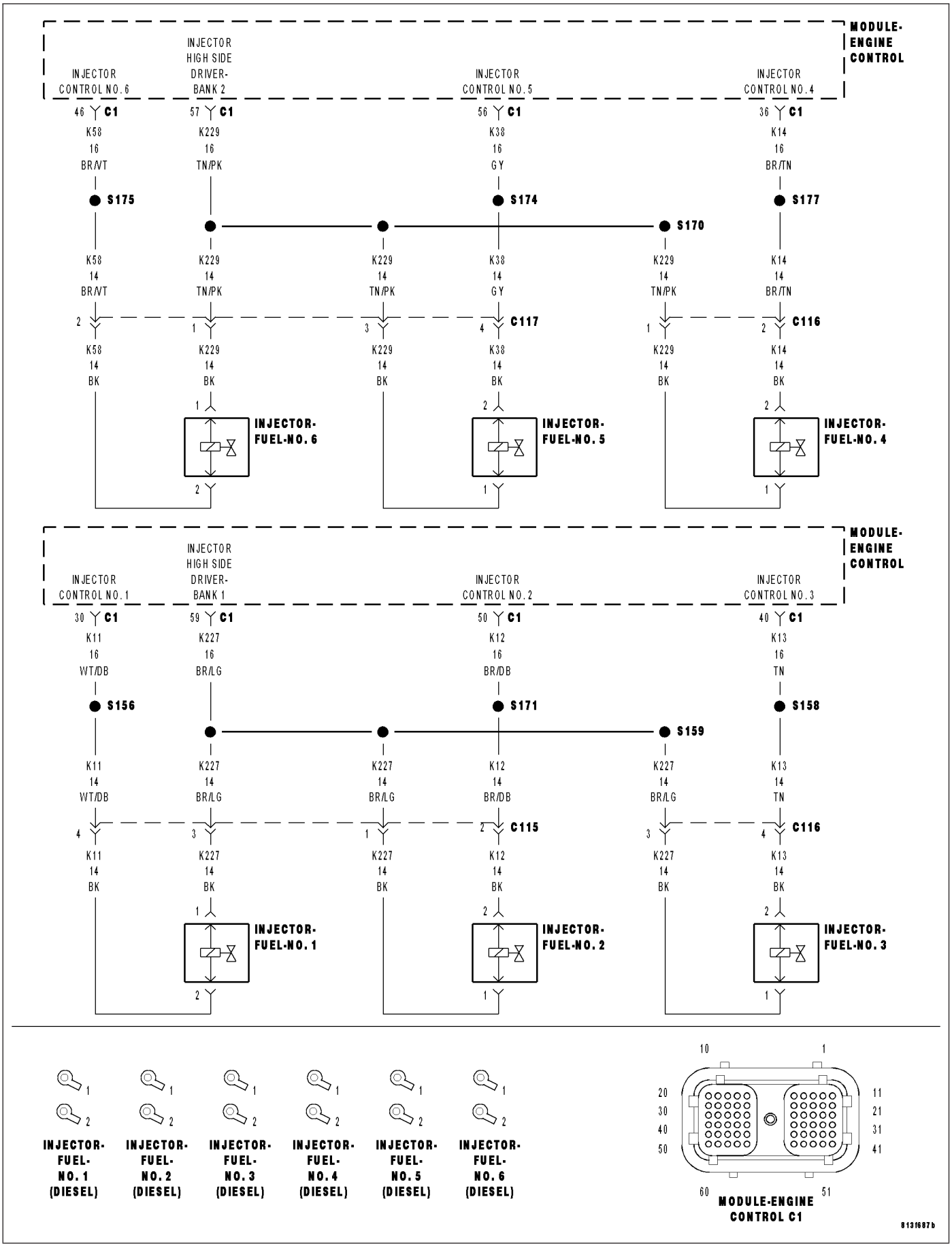
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0204-INJECTOR #4 CONTROL CIRCUIT



P0204-INJECTOR #4 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0204-INJECTOR #4 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

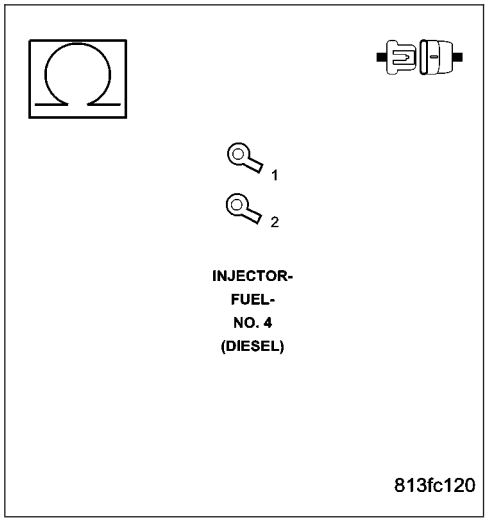
4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.



Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0204-INJECTOR #4 CONTROL CIRCUIT (CONTINUED)

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

Check connectors - Clean/repair as necessary.

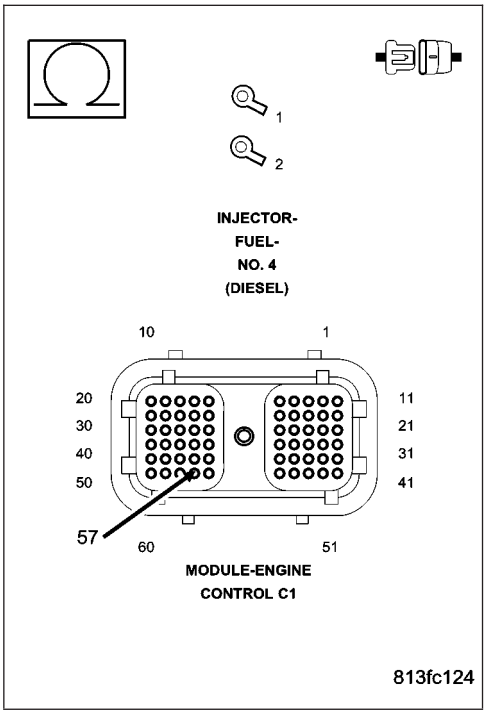
Measure the resistance of the Bank 2 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 2 low side driver circuit between the ECM connector and the injector harness connector.

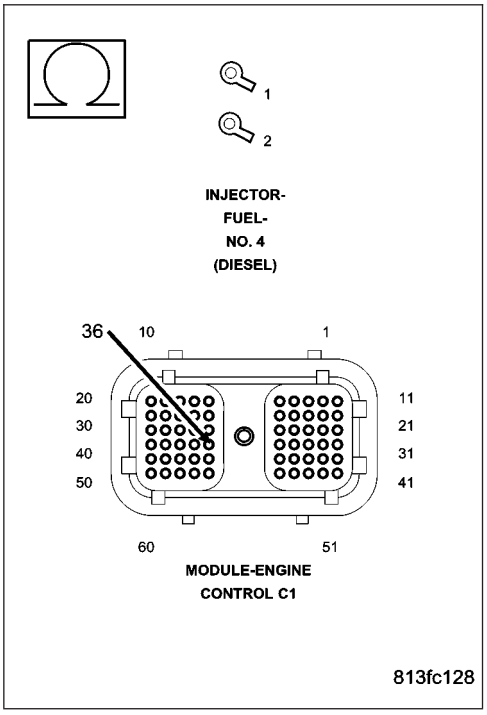
Is the resistance less than 10 Ohms?

Yes >> Test Complete.

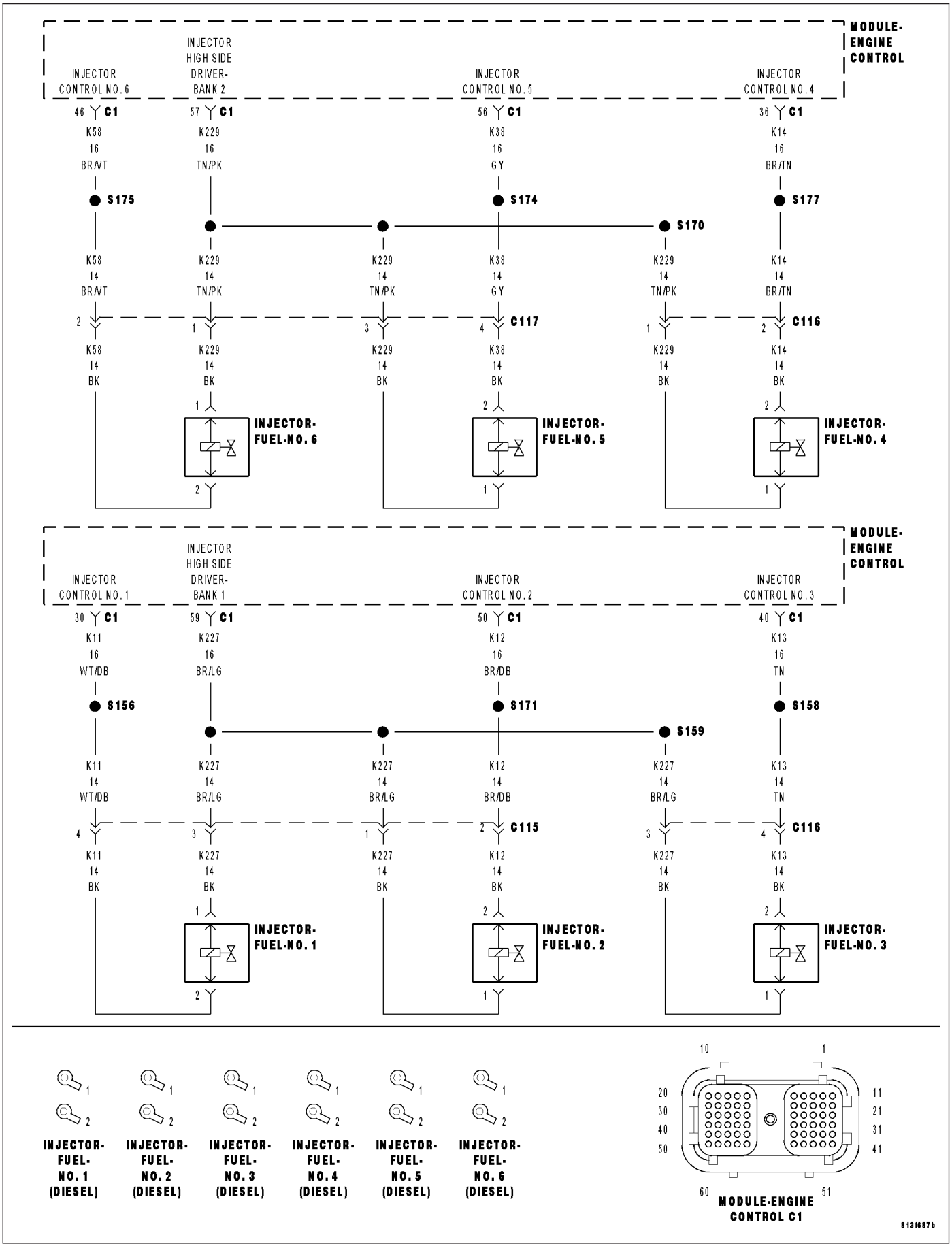
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0205-INJECTOR #5 CONTROL CIRCUIT



P0205-INJECTOR #5 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0205-INJECTOR #5 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

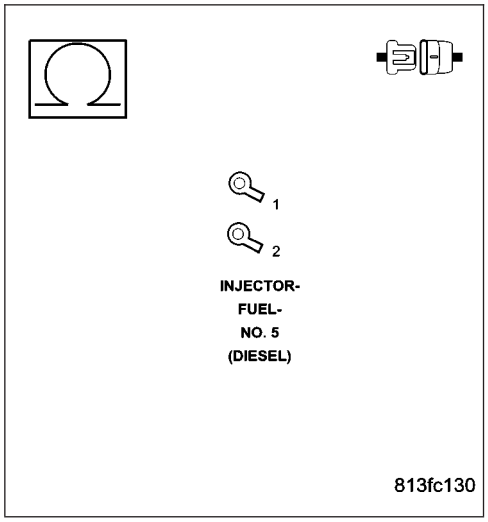
4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.



Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0205-INJECTOR #5 CONTROL CIRCUIT (CONTINUED)

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

Check connectors - Clean/repair as necessary.

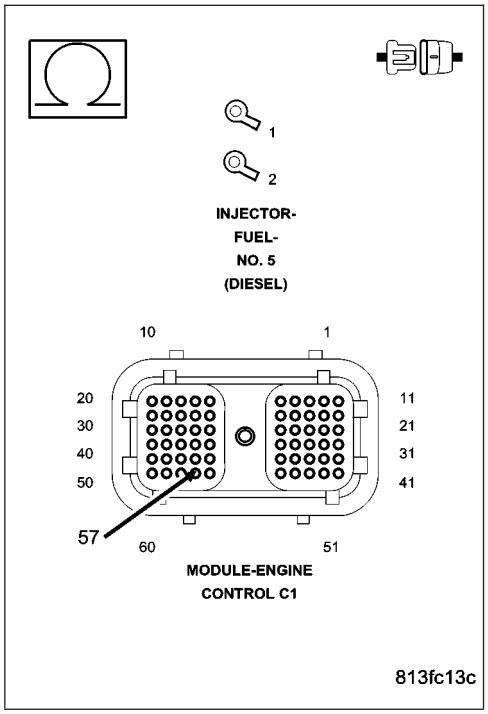
Measure the resistance of the Bank 2 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 2 low side driver circuit between the ECM connector and the injector harness connector.

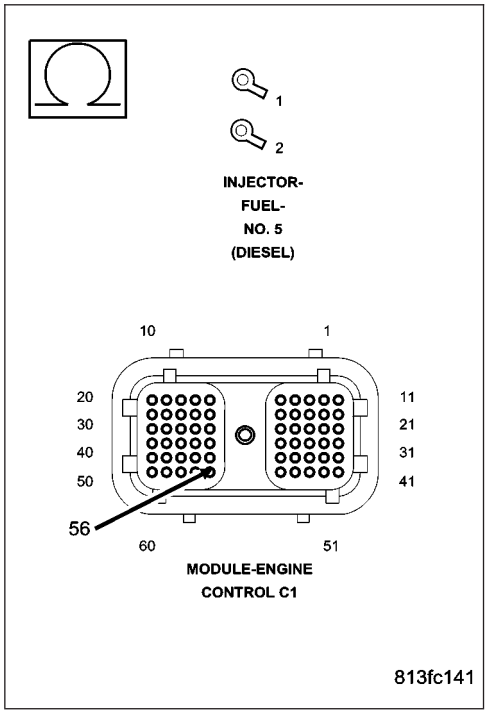
Is the resistance less than 10 Ohms?

Yes >> Test Complete.

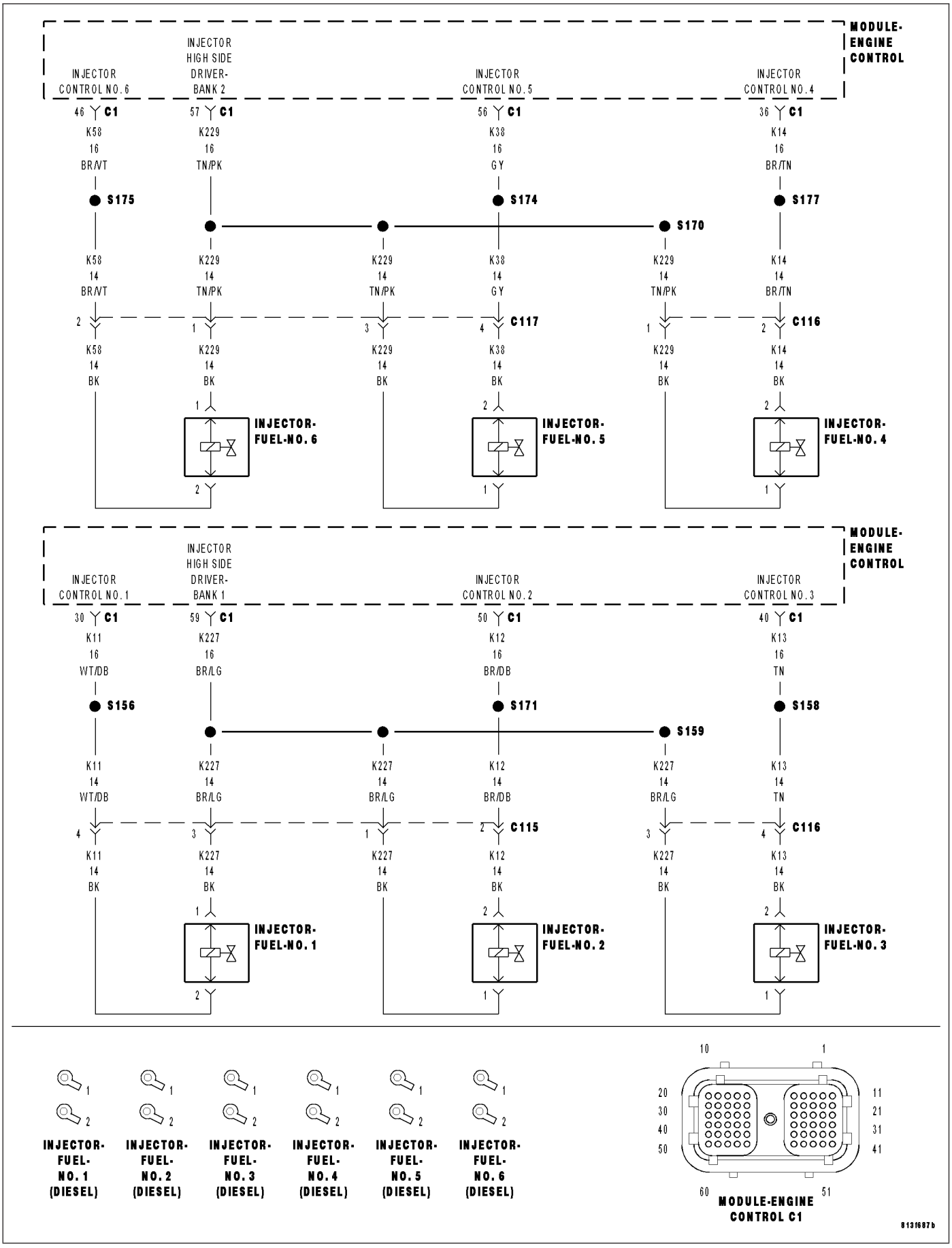
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0206-INJECTOR #6 CONTROL CIRCUIT



P0206-INJECTOR #6 CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  When the injector current falls below a calibrated threshold.

Possible Causes
PASS TROUGH CONNECTORS OPEN
FUEL INJECTOR
INJECTOR HARNESS OPEN
HIGH SIDE DRIVER HARNESS OPEN
LOW SIDE DRIVER HARNESS OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are all 6 of the injector DTC's (P0201 - P0206) present?

Yes >> Go To 2

No >> Go To 3

---

2. PASS TROUGH CONNECTORS OPEN

Inspect wiring harness for signs of multiple open circuits between the ECM and the injector pass through connectors. Inspect the wiring harness between the pass through connectors to the injectors.

Are there open circuits in the wiring harness?

Yes >> Repair or replace the open connectors or wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0206-INJECTOR #6 CONTROL CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Turn the ignition off.

Disconnect the pigtail nuts from the suspect injector. Using an Ohmmeter, measure the resistance between the solenoid posts of the injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 4

No >> Replace the fuel injector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

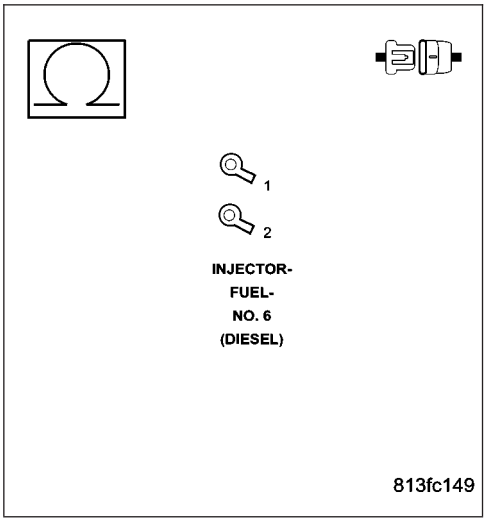
4. INJECTOR HARNESS OPEN

Connect the pigtail nuts for the suspect injector.

Disconnect the injector harness connector for the suspect injector.

Measure the resistance of the injector harness circuit between the high side driver circuit and the low side driver circuit for the suspect injector at the injector harness connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.



Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 5

No >> Replace or repair the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0206-INJECTOR #6 CONTROL CIRCUIT (CONTINUED)

5. HIGH SIDE DRIVER HARNESS OPEN

Disconnect the ECM harness connectors.

Disconnect the Injector harness connector.

Check connectors - Clean/repair as necessary.

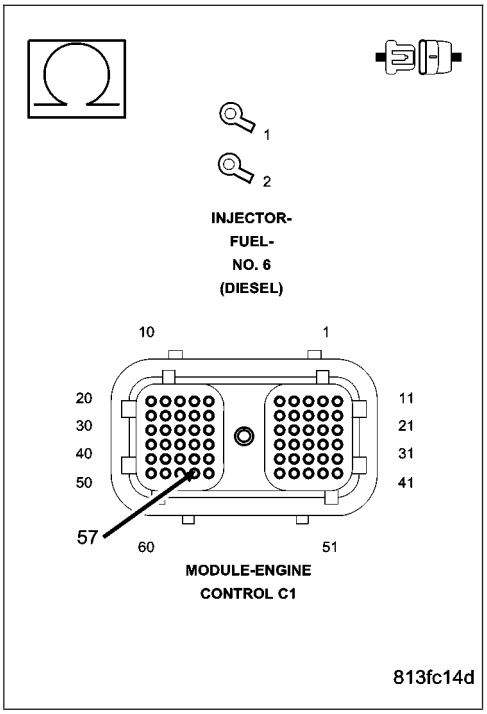
Measure the resistance of the Bank 2 high side driver circuit between the ECM connector and the injector harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. LOW SIDE DRIVER HARNESS OPEN

Measure the resistance of the Bank 2 low side driver circuit between the ECM connector and the injector harness connector.

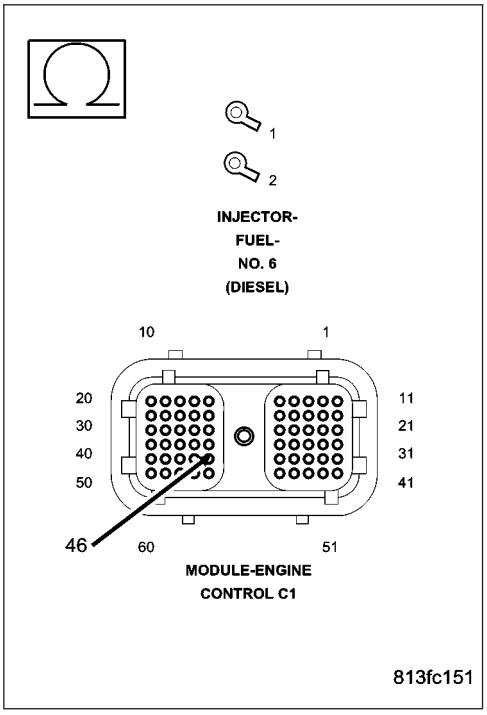
Is the resistance less than 10 Ohms?

Yes >> Test Complete.

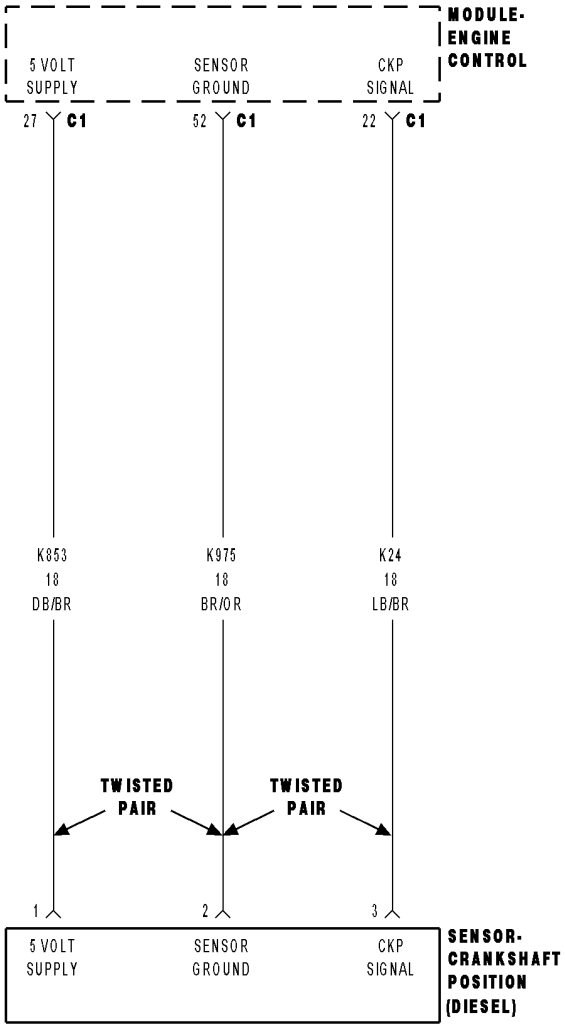
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

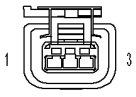
No >> Replace or repair the open engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

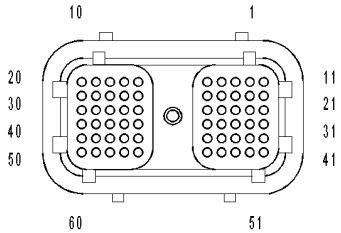


P0217-DECREASED ENGINE PERFORMANCE DUE TO ENGINE OVERHEAT CONDITION





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0217-DECREASED ENGINE PERFORMANCE DUE TO ENGINE OVERHEAT CONDITION (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running. .
- **Set Condition:**
  The engine coolant temperature is above a calibrated value for a calibrated amount of time.

Possible Causes
ECT SENSOR
OTHER DTC'S
MECHANICAL FAILURE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Are other Cooling system DTC's present?

Yes >> Trouble shoot the other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. ECT SENSOR

Allow the engine to reach normal operating temperature.

Use a temperature probe and measure the engine temperature near the ECT Sensor.

With the scan tool, read the Engine Temperature.

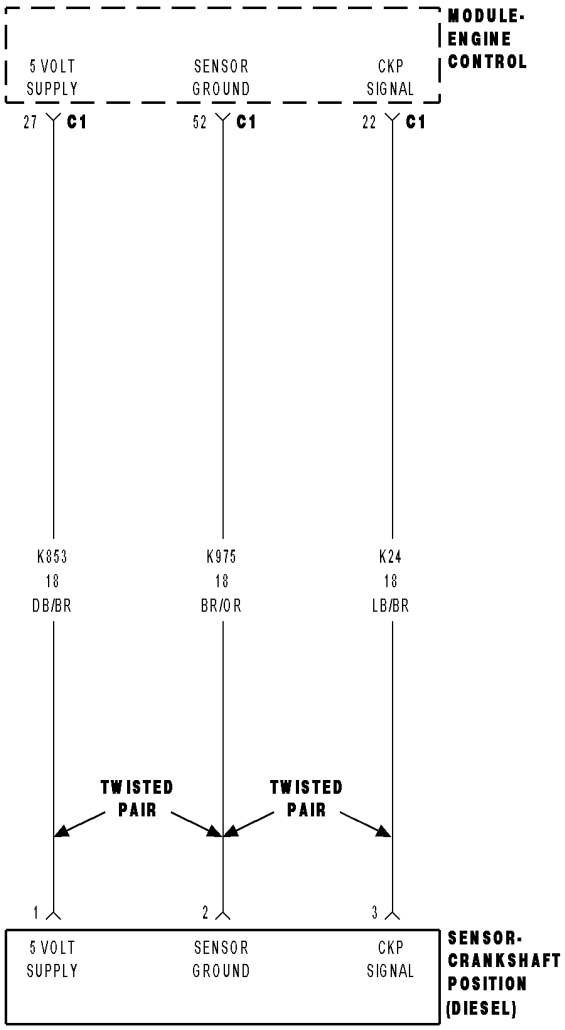
Compare the temperature probe reading with the scan tool reading.

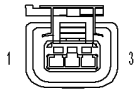
Are the readings within 10°F of each other?

Yes >> Repair the cause of mechanical failure.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

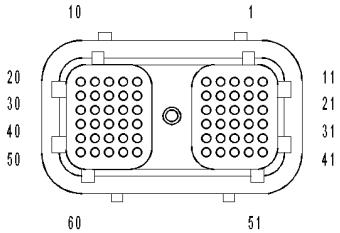
No >> Replace the coolant temp sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0219-CRANKSHAFT POSITION SENSOR OVER SPEED SIGNAL





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0219-CRANKSHAFT POSITION SENSOR OVER SPEED SIGNAL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM detects engine speed is above a calibrated threshold.

Possible Causes
OTHER DTC'S
MECHANICAL OVERSPEED OF ENGINE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.

With the scan tool, read and record the freeze frame data.

With the scan tool, read the Engine DTC's.

Is there other Crankshaft position sensor DTC's set?

Yes >> Refer to symptom list for problems related to the other Crankshaft position sensor DTC's.

No >> Go To 2

---

2. MECHANICAL OVERSPEED OF ENGINE

Visually inspect the engine for signs of mechanical overspeed. Such as, bent push rod, broken rocker arms, bent valves, etc.

Did you notice any overspeed damage?

Yes >> Repair or replace any damaged components.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0234-TURBOCHARGER OVERBOOST CONDITION

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While running.
- **Set Condition:**
  The intake air pressure is above a calibrated value for a calibrated amount of time.

Possible Causes
OTHER DTC'S
WASTEGATE STUCK
TURBOCHARGER AND/OR WASTEGATE DAMAGE
WASTEGATE
TURBOCHARGER
WASTEGATE CONTROL VALVE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Do you have additional DTC's?

Yes >> Repair all other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. TURBOCHARGER AND/OR WASTEGATE DAMAGE

Visually inspect the turbocharger assembly for signs of damage. Pay particular attention to the Wastegate area and linkage.

Was any damage noticed?

Yes >> Repair or replace the Turbocharger or Wastegate.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0234-TURBOCHARGER OVERBOOST CONDITION (CONTINUED)

3. WASTEGATE

Pressure the Intake air system per test *INTAKE AIR SYSTEM PRESSURE TEST.

Pay particular attention to the Wastegate signal line and the Wastegate actuator canister area for leaks.

Were any leaks detected?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. TURBOCHARGER

Disconnect the wiring connector at the Wastegate Control Valve.

Remove the Wastegate Control Valve from the turbo.

Inspect the o-rings and the valve for damage.

Replace any damaged o-rings or a damaged valve.

Using a pressure/vacuum hand pump, apply vacuum to the tip of the Wastegate Control Valve.

Use your fingers to cover and seal the two radial holes located between the two small o-rings on the tip of the valve.

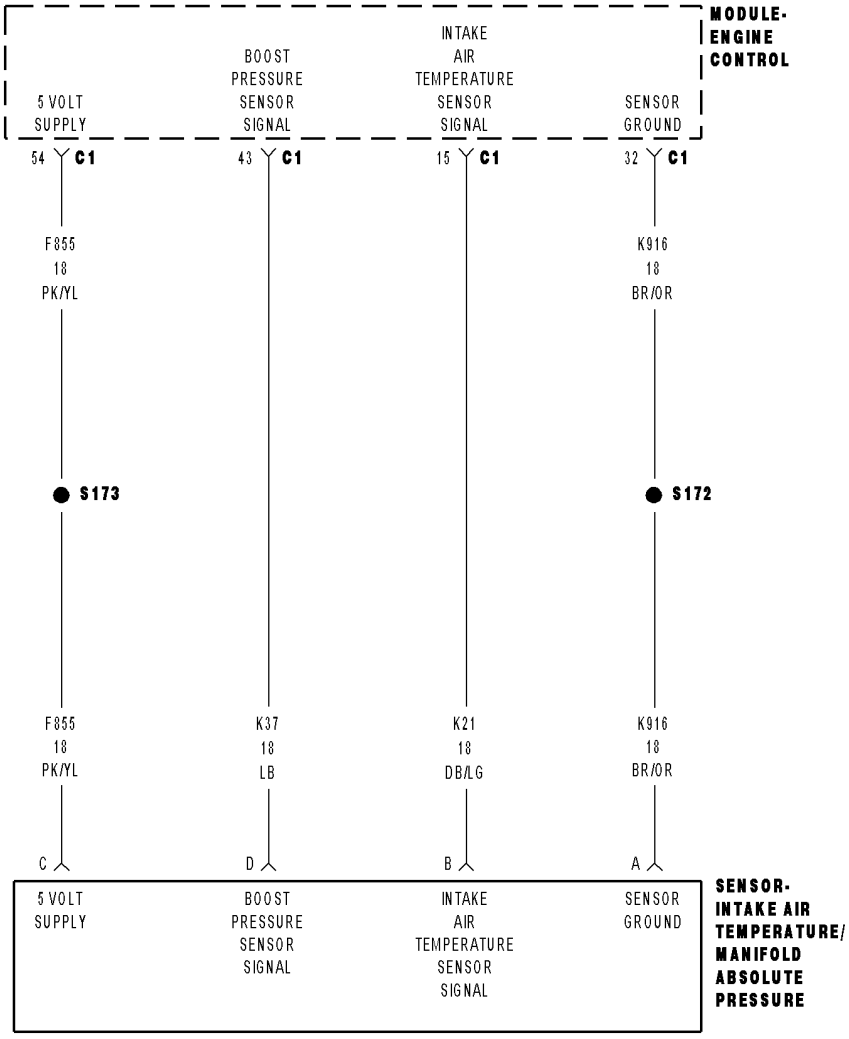
The valve should hold vacuum.

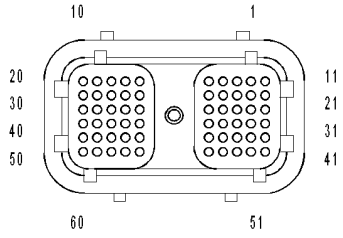
Does the Wastegate Control Valve hold vacuum?

Yes >> Repair or replace the Turbocharger.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

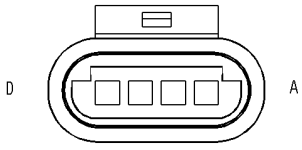
No >> Replace the Wastegate Control Valve.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0236-MAP SENSOR TOO HIGH TOO LONG





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0236-MAP SENSOR TOO HIGH TOO LONG (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The intake air pressure is above a calibrated value past a calibrated amount of time.

Possible Causes
OTHER CODES
MAP SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.

With the scan tool, read the Engine DTC's.

Are there any other MAP Sensor related DTC's.

Yes >> Repair other MAP Sensor DTC's.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. MAP SENSOR

Start the engine.

With the scan tool, read the MAP Sensor voltage.

Is the pressure reading of the MAP sensor less than 17.6 psia?

Yes >> Go To 3

No >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0236-MAP SENSOR TOO HIGH TOO LONG (CONTINUED)

3. MAP SENSOR

Operate the engine under normal driving conditions (no load) for at least 30 seconds.

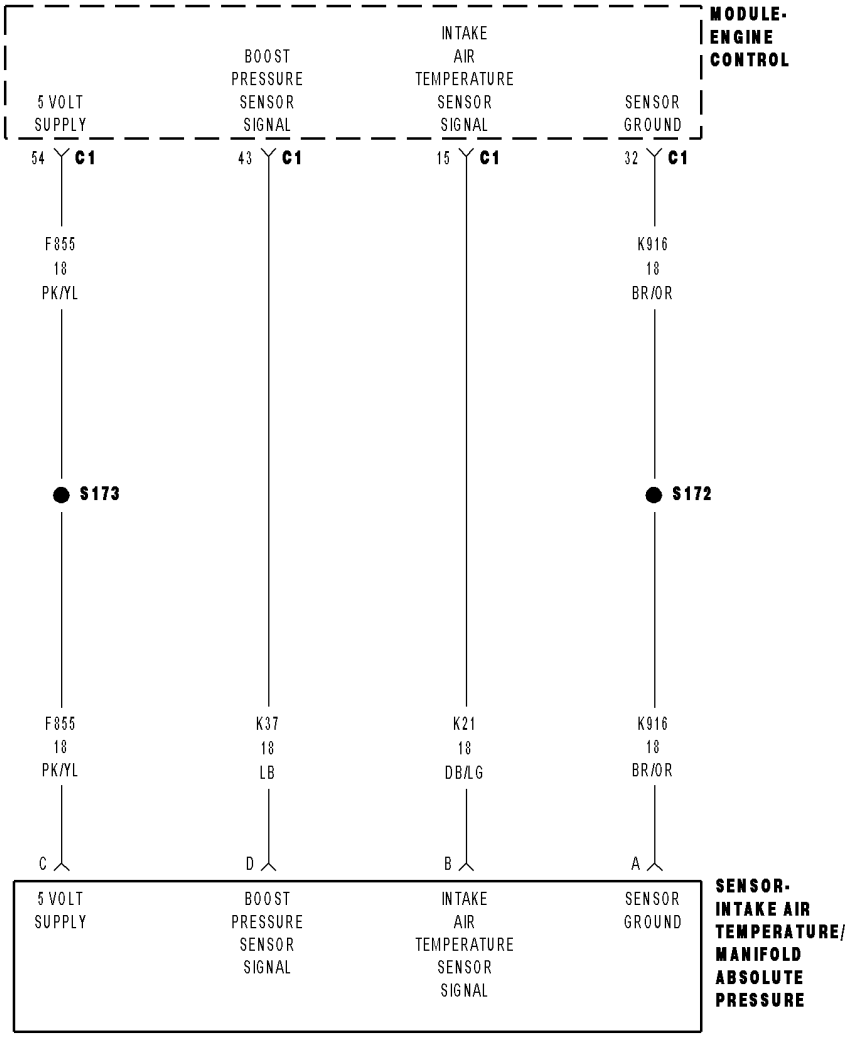
Monitor the MAP sensor reading with the scan tool.

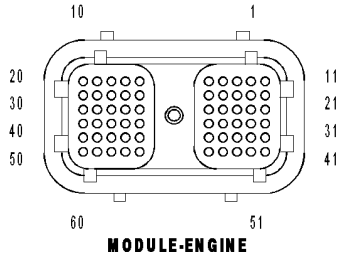
Did the pressure reading from the MAP sensor go above 29.6 psia for more than 2.5 seconds?

Yes >> Replace the Map sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

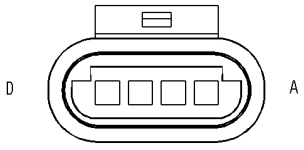
No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0237-MAP SENSOR VOLTAGE TOO LOW





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0237-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
(K37) SIGNAL CIRCUIT SHORTED TO (K916) SENSOR RETURN CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K916) SENSOR RETURN CIRCUIT
MAP SENSOR
(K37) SIGNAL CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
MAP SENSOR (K37) SIGNAL CIRCUIT SHORT TO GROUND
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.

With the scan tool, read the Engine DTC's.

Is there a 5-volt Supply DTC set?

Yes >> Refer to symptom list for problems related to the 5-volt Supply DTC.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. HIGH VOLTAGE

Turn the ignition off.

Disconnect the Map sensor harness connector.

Check connectors - Clean/repair as necessary.

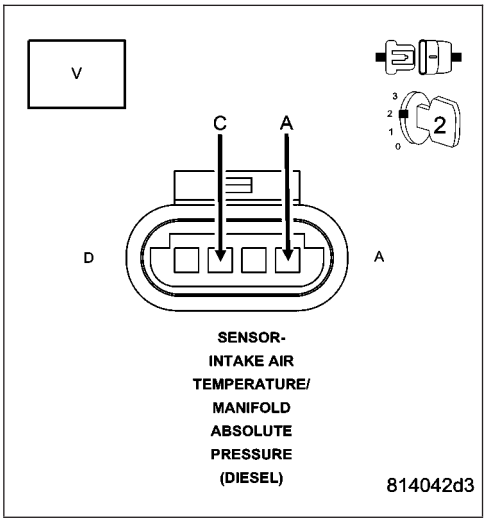
Turn the ignition on.

Measure the voltage between the (F855) 5-volt supply circuit and sensor (K916)) return circuit of the Map sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

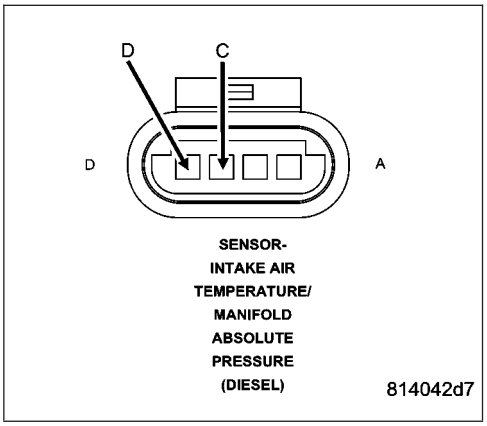
No >> Go To 4



P0237-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

3. MAP SENSOR

While monitoring the scan tool, jumper the (F855) 5-volt supply circuit to the (K37) signal circuit in the Map sensor harness connector.



Did the P0238-MAP SENSOR VOLTAGE TOO HIGH, DTC set?

Yes >> Replace the MAP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

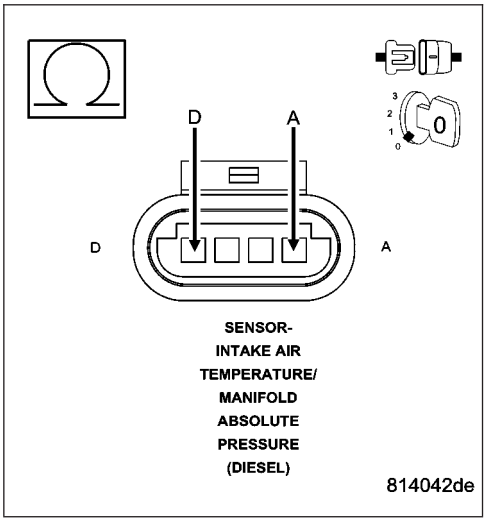
4. (K37) SIGNAL CIRCUIT SHORTED TO (K916)) SENSOR RETURN CIRCUIT

Turn the ignition off.

Disconnect the ECM harness 60 pin connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (K37) signal circuit and (K916)) sensor return circuit in the MAP sensor harness connector.



Is the resistance greater than 100 K Ohms?

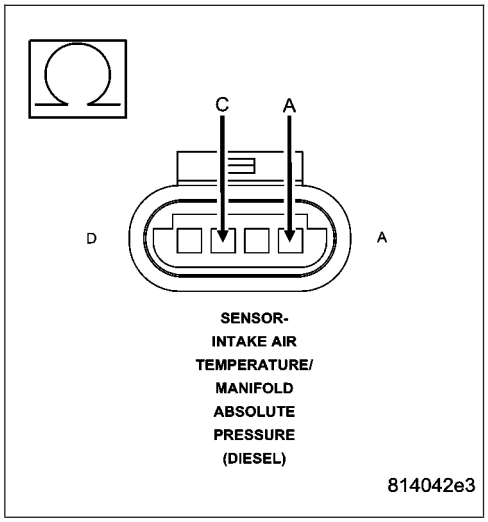
No >> Repair (K37) signal circuit shorted to (K916)) sensor return circuit or replace harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

Yes >> Go To 5

P0237-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

5. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K916)) SENSOR RETURN CIRCUIT

Measure the resistance between the (F855) 5-volt supply circuit and (K916)) sensor return circuit in the MAP sensor harness connector.



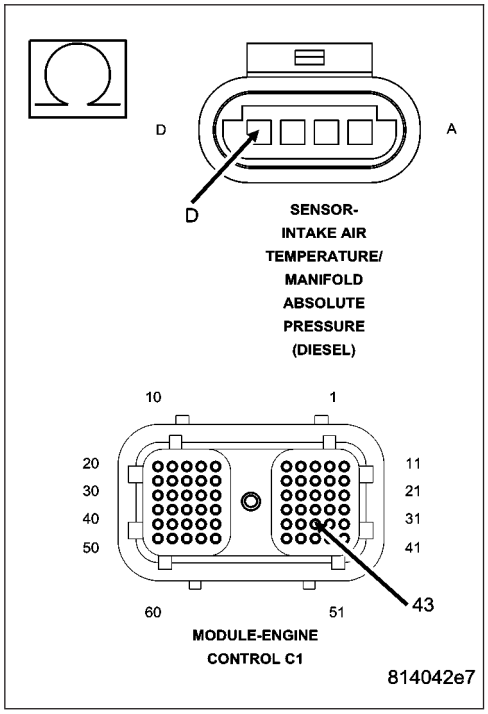
Is the resistance greater than 100 K Ohms?

No >> Repair (F855) 5-volt supply circuit shorted to (K916)) sensor return circuit or replace harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

Yes >> Go To 6

6. (K37) SIGNAL CIRCUIT OPEN

Measure the resistance between the signal (K37) circuit in the Map sensor harness connector with the (K37) signal circuit in the ECM harness connector.



Is the resistance less than 10 Ohms?

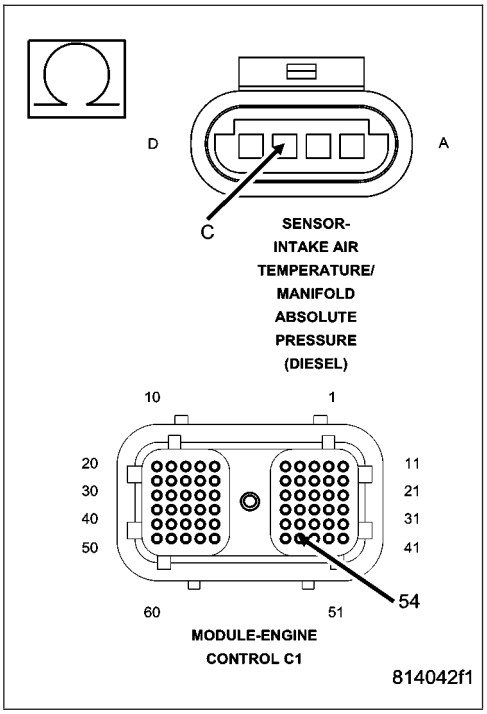
Yes >> Go To 7

No >> Repair or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0237-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

7. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Measure the resistance between the (F855) 5-volt supply circuit in the Map sensor harness connector with the (F855) 5-volt supply circuit in the ECM harness connector.



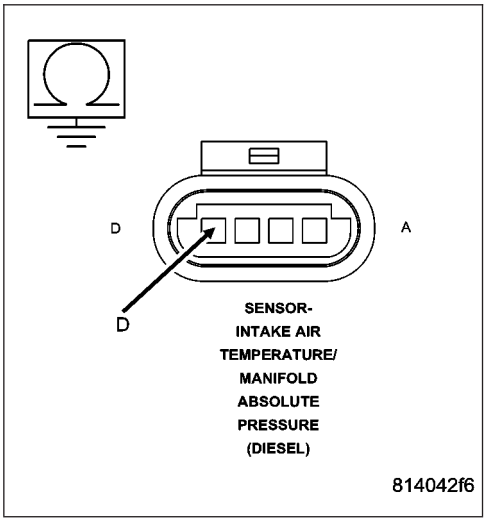
Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

8. MAP SENSOR SIGNAL (K37) CIRCUIT SHORTED TO GROUND

Measure the resistance between the MAP Sensor Signal (K37) circuit and the Battery negative terminal.



Is the resistance above 100k ohms?

Yes >> Go To 9

No >> Repair the MAP Sensor (K37) Signal circuit for a short to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0237-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

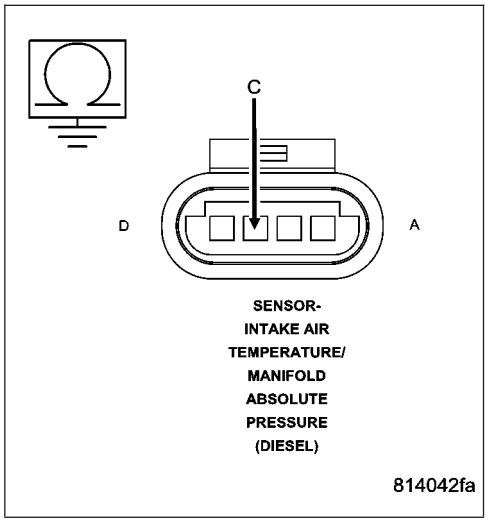
9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K916)) RETURN CIRCUIT OR GROUND

Measure the resistance between the (F855) 5-volt supply circuit in the sensor harness connector and battery negative.

Is the resistance above 100k ohms?

Yes >> Go To 10

No >> Test Complete.



10. ECM

Reconnect the ECM harness 60 pin connector.

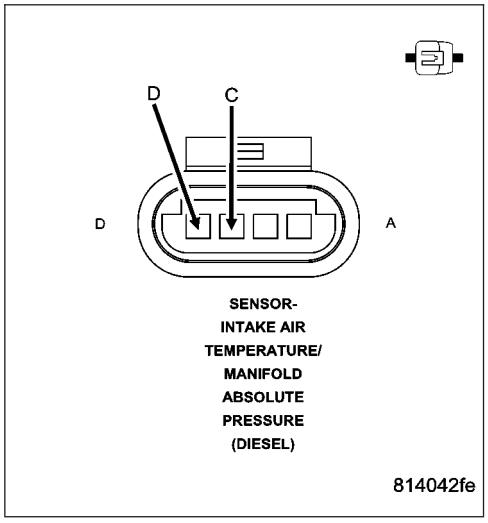
While monitoring the scan tool, jumper the (F855) 5-volt supply circuit to the (K37) signal circuit in the map sensor harness connector.

Did the P0238-MAP SENSOR VOLTAGE TOO HIGH, DTC set?

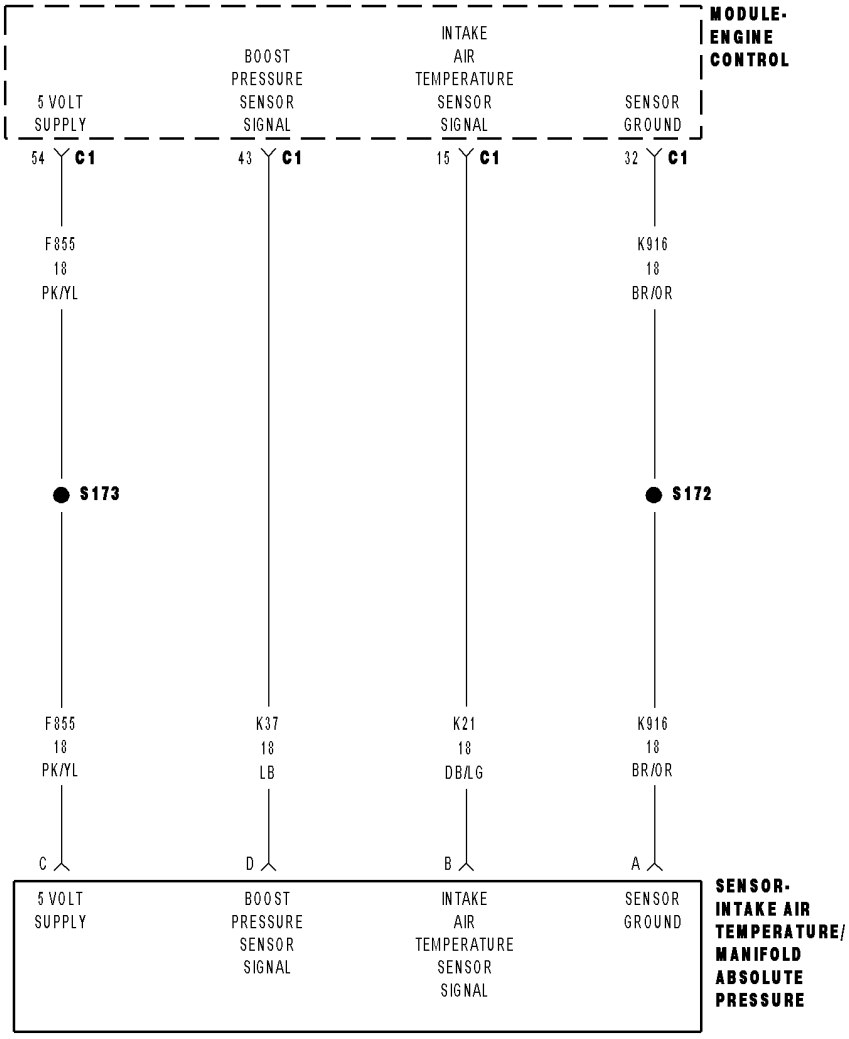
Yes >> Test Complete.

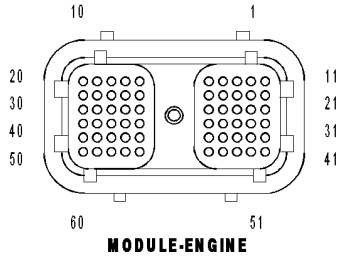
No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

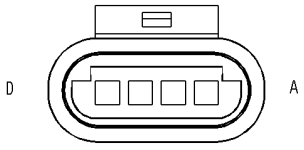


P0238-MAP SENSOR VOLTAGE TOO HIGH





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0238-MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
(K37) SIGNAL CIRCUIT SHORTED TO BATTERY
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY
MAP SENSOR
(K37) SIGNAL CIRCUIT SHORT TO SUPPLY
(F855) 5-VOLT SUPPLY CIRCUIT SHORT TO BATTERY
INTERMITTENT
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.

With the scan tool, read the Engine DTC's.

Is there a 5-volt Supply DTC set?

Yes >> Refer to symptom list for problems related to the 5-volt Supply DTC.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. HIGH VOLTAGE

Turn the ignition off.

Disconnect the Map sensor harness connector.

Check connectors - Clean/repair as necessary.

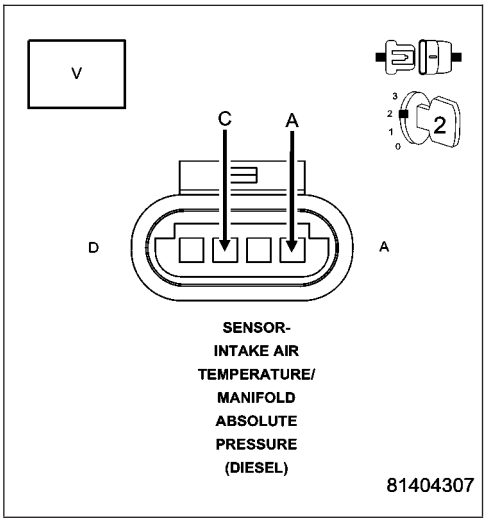
Turn the ignition on.

Measure the voltage between the (F855) 5-volt supply circuit and (K916) sensor return circuit of the Map sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

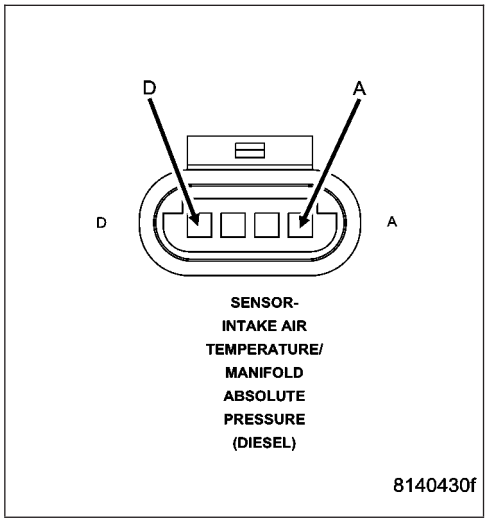
No >> Go To 4



P0238-MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. MAP SENSOR

While monitoring scan tool, use a jumper wire to connect the (K916) return circuit with the (K37) signal circuit at the sensor connector.



Did the P0237-MAP SENSOR VOLTAGE TOO LOW, DTC set?

Yes >> Go To 4

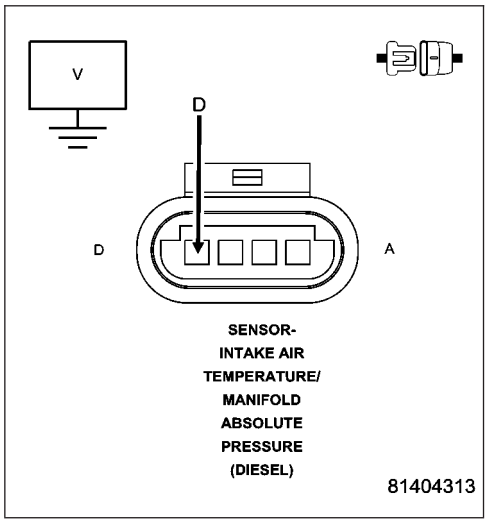
No >> Replace the MAP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

4. (K37) SIGNAL CIRCUIT SHORTED TO BATTERY

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the voltage between the (K37) signal circuit at the MAP sensor harness connector and Battery Negative.



Is the voltage greater than 1 volt?

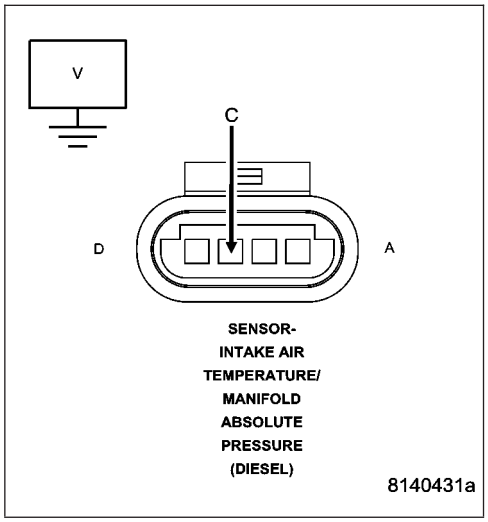
Yes >> Repair (K37) signal circuit shorted to Battery or replace harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

P0238-MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

5. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY

Measure the voltage between the (F855) 5-volt supply circuit at the MAP sensor harness connector and Battery negative.



Is the voltage greater than 1 volt?

Yes >> Repair (F855) 5-volt supply circuit shorted to Battery or replace harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

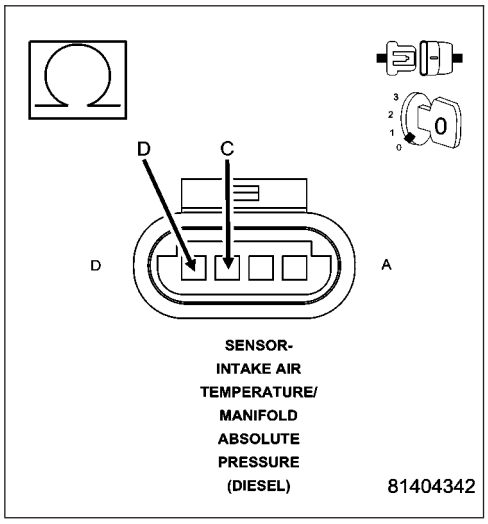
No >> Go To 6

6. (K37) SIGNAL CIRCUIT SHORT TO 5–VOLT SUPPLY

Turn the ignition off.

Disconnect the ECM harness connectors.

Measure the resistance between the (K37) signal circuit of the sensor harness connector and the (F855) 5-volt supply circuit of the sensor harness connector.



Is the resistance less than 10 Ohms?

No >> Go To 7

Yes >> Repair or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0238-MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

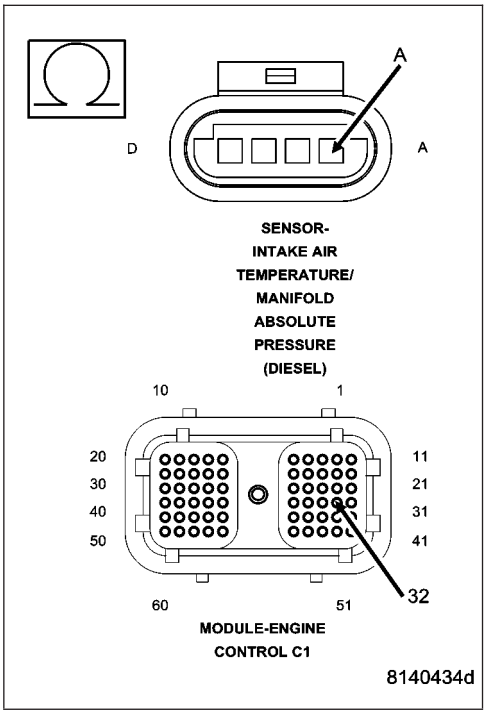
7. (F855) SENSOR RETURN CIRCUIT OPEN

Measure the resistance between the (K916) sensor return circuit in the Map sensor harness connector with the (K916) sensor return circuit in the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



8. INTERMITTENT CONDITION

Reconnect the ECM harness connector.

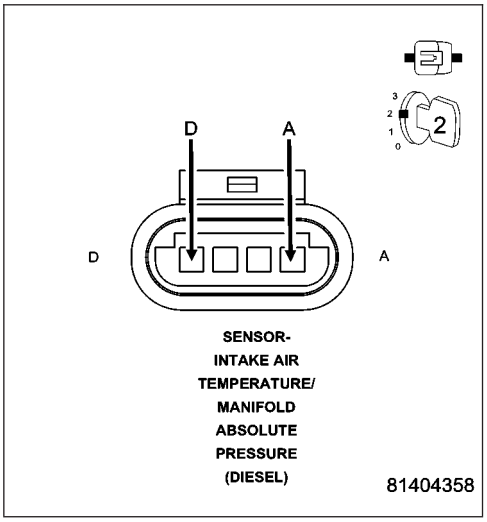
Turn the ignition on.

While monitoring scan tool, connect a jumper wire between the (K37) signal circuit of the sensor harness connector and the (K916) return circuit of the sensor harness connector.

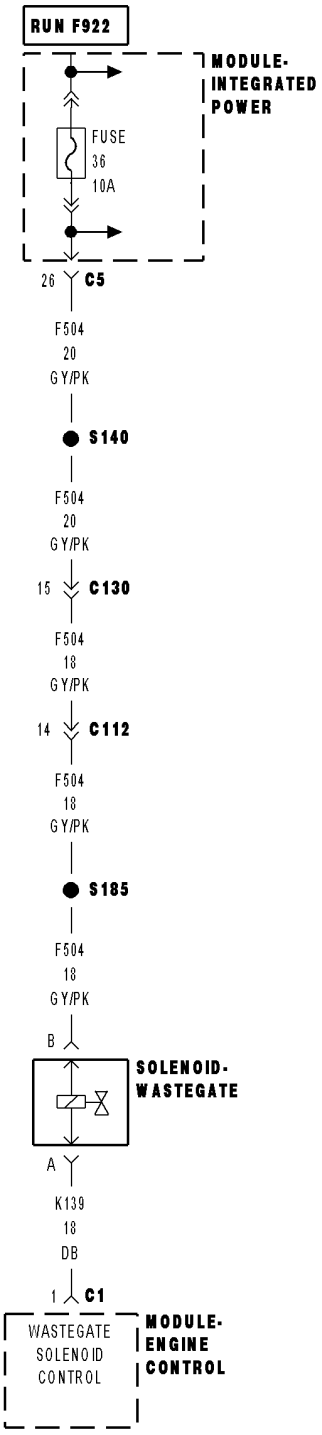
Does the scan tool show P0237-Map Sensor Voltage Too Low DTC?

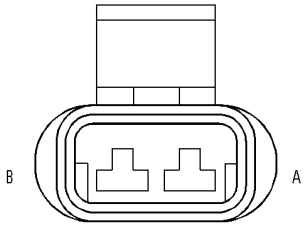
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

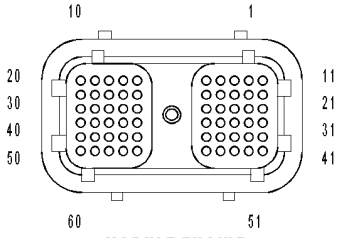


P0243-WASTEGATE PRESSURE CONTROL PWM





SOLENOID-
WASTEGATE
(DIESEL)



MODULE-ENGINE
CONTROL C1

81407eee

P0243-WASTEGATE PRESSURE CONTROL PWM (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The ECM detects an open or short circuit in the Wastegate solenoid circuit.

Possible Causes
DAMAGED WIRING HARNESS OR CONNECTORS
WASTEGATE SOLENOID
(F504) FUSED IGNITION SWITCH OUTPUT OPEN
(K139) WASTEGATE SOLENOID DRIVER CIRCUIT OPEN
(K139) WASTEGATE SOLENOID CIRCUIT SHORTED TO GROUND
(K139) WASTEGATE SOLENOID DRIVER SHORTED TO VOLTAGE
(K139) WASTEGATE SOLENOID DRIVER CIRCUIT SHORTED TO ANOTHER CIRCUIT
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. Damaged wiring harness or connectors

Turn Ignition off.

Disconnect the ECM harness connectors.

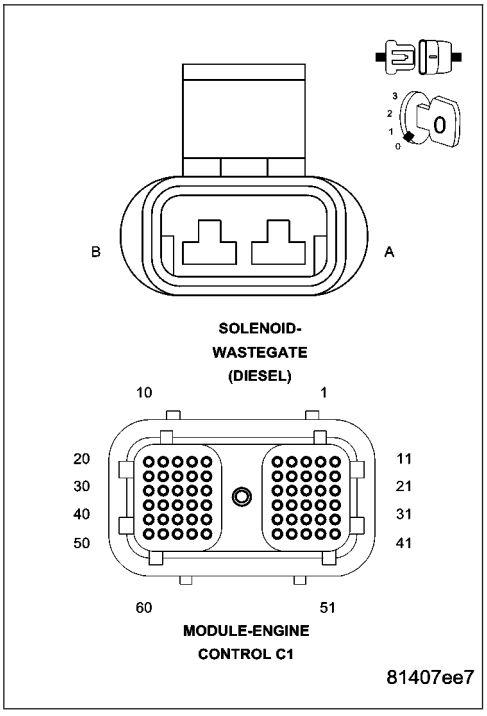
Disconnect the Wastegate Solenoid harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Are any wires or pins damaged?

Yes >> Repair or replace any damaged wire or connectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P0243-WASTEGATE PRESSURE CONTROL PWM (CONTINUED)

2. WASTEGATE SOLENOID

Reconnect the ECM harness connector.

Reconnect the disconnected Wastegate Solenoid harness connector.

Turn the Ignition on, engine not running.

Disconnect the Wastegate Solenoid harness connector.

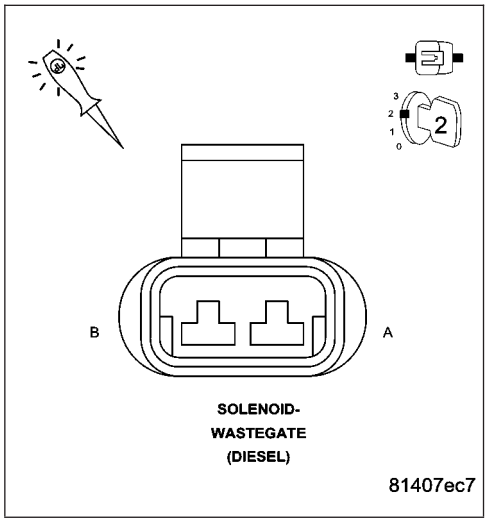
Connect an incandescent test light across the supply and driver pins at the Wastegate Solenoid harness connector.

NOTE: The ECM will perform a self check of the circuit after approximately 30 seconds, which should light the incandescent test light.

Does the light illuminate brightly after 30 seconds of being connected?

Yes >> Replace the Wastegate Solenoid.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. (F504) FUSED IGNITION SWITCH OUTPUT OPEN

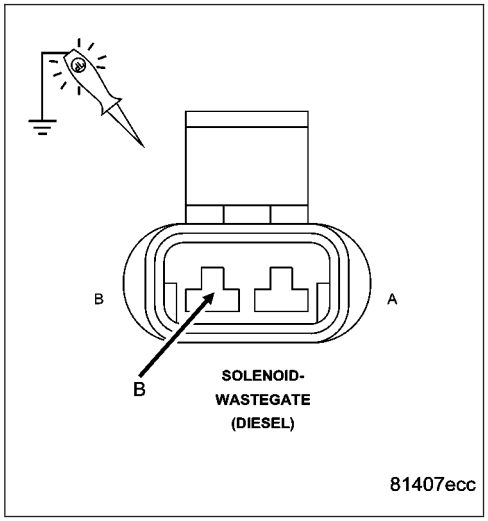
Connect an test light between the Wastegate Solenoid connector Fused ignition switch output circuit and battery negative.

Compare the test light brightness to that of a direct connection to the battery.

Does the light illuminate brightly?

Yes >> Go To 4

No >> Repair the open (F504) Fused Ignition switch output circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

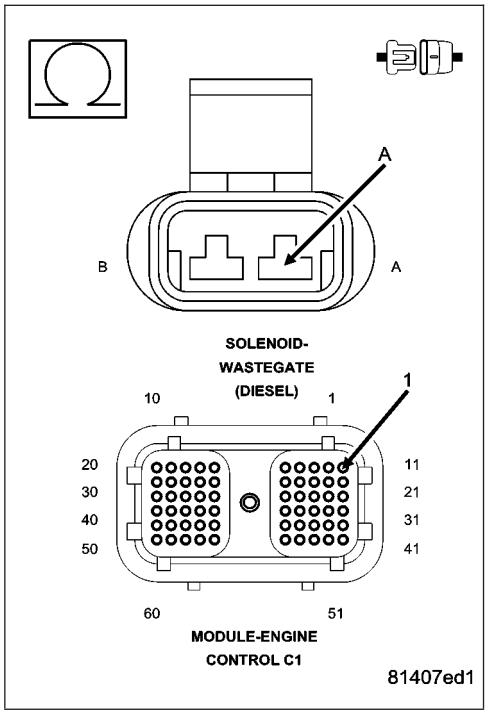


P0243-WASTEGATE PRESSURE CONTROL PWM (CONTINUED)

4. (K139) WASTEGATE SOLENOID DRIVER CIRCUIT OPEN

Disconnect the ECM harness connectors.

Measure the resistance of the Wastegate Solenoid driver circuit between the Wastegate Solenoid harness connector and the ECM harness connector.



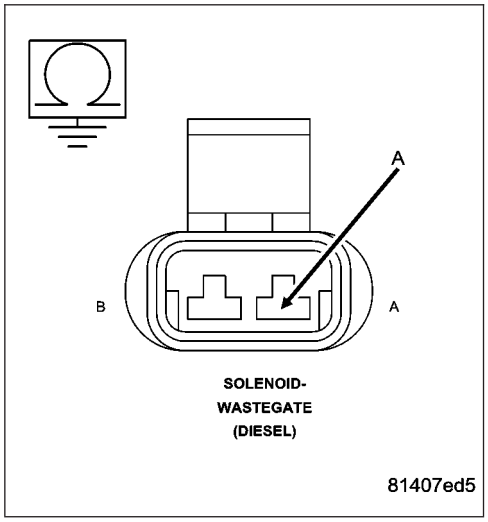
Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open (K139) Wastegate Solenoid control circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

5. (K139) WASTEGATE SOLENOID CIRCUIT SHORTED TO GROUND

Measure the resistance of the (K139) Wastegate Solenoid driver circuit between the Wastegate Solenoid harness connector and battery negative.



Is the resistance less than 10 Ohms?

Yes >> Repair the (K139) Wastegate solenoid circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6

P0243-WASTEGATE PRESSURE CONTROL PWM (CONTINUED)

6. (K139) WASTEGATE SOLENOID DRIVER SHORTED TO VOLTAGE

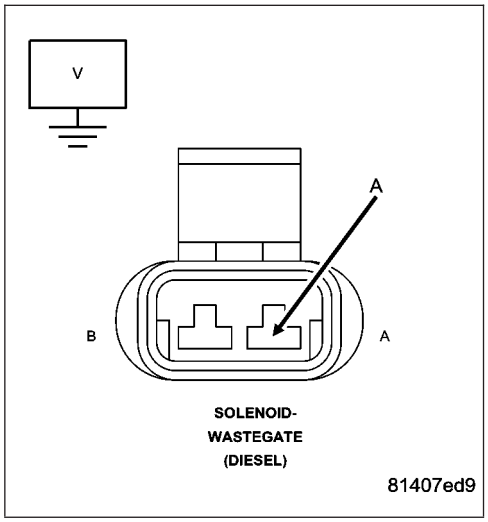
Measure the voltage between the (K139) Wastegate Solenoid driver circuit at the Wastegate Solenoid connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 7

No >> Repair the (K139) Wastegate solenoid driver shorted to voltage.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



7. (K139) WASTEGATE SOLENOID DRIVER CIRCUIT SHORTED TO ANOTHER CIRCUIT

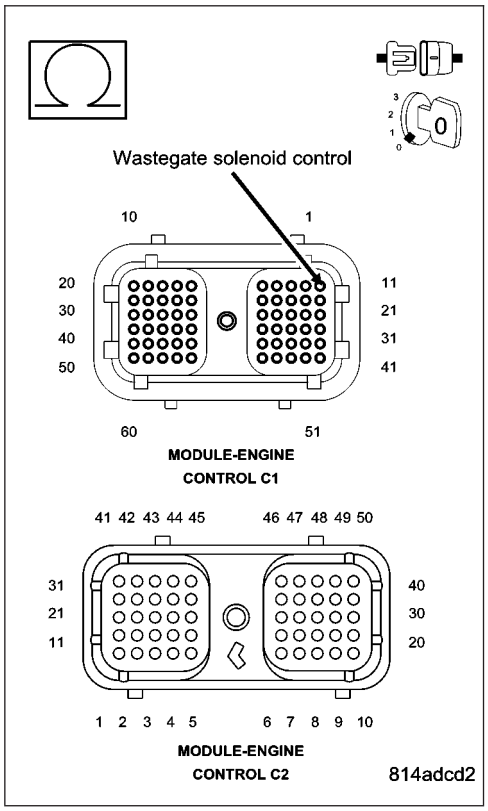
Measure the resistance between the (K139) Wastegate Solenoid driver circuit in the ECM harness connector and all other circuits in the ECM harness connectors.

Is the resistance less than 10 Ohms?

Yes >> Repair the (K139) Wastegate solenoid circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL).

No >> Go To 8



P0243-WASTEGATE PRESSURE CONTROL PWM (CONTINUED)

8. WASTEGATE SOLENOID

Reconnect the ECM harness connector.

Reconnect the disconnected Wastegate Solenoid harness connector.

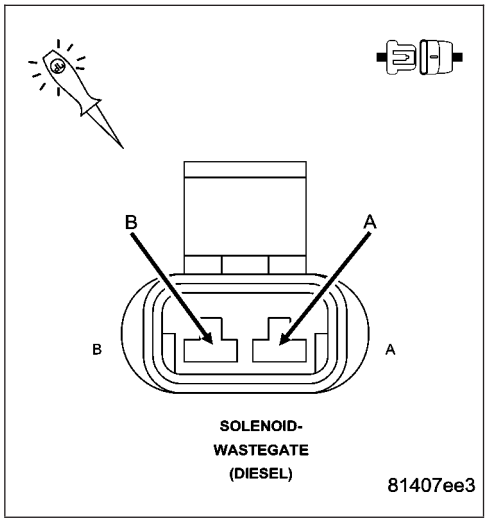
Turn the Ignition on, engine not running.

Disconnect the Wastegate Solenoid harness connector.

Connect an incandescent test light across the supply and driver pins at the Wastegate Solenoid harness connector.

NOTE: The ECM will perform a self check of the circuit after approximately 30 seconds, which should light the incandescent test light.

Does the light illuminate brightly after 30 seconds of being connected?

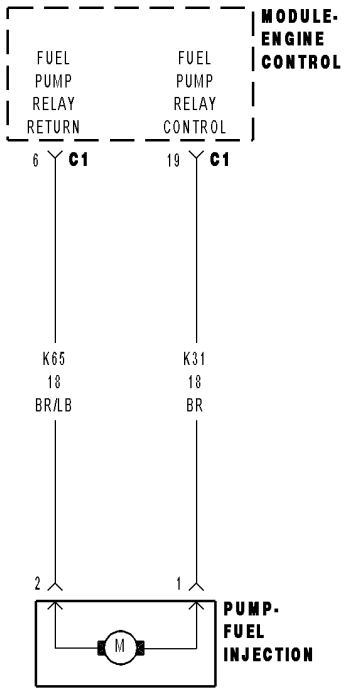


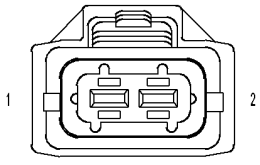
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

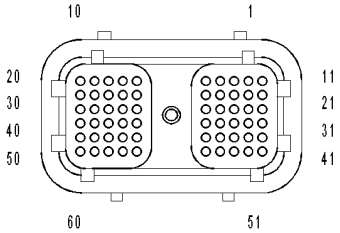
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0251-CP3 PUMP REGULATOR CONTROL





PUMP-
FUEL INJECTION
(DIESEL)



MODULE-ENGINE
CONTROL C1

8140929e

P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The ECM detects a discrepancy between the PWM supplied to the Electronic Fuel Control Actuator and the PWM returned from the Electronic Fuel Control Actuator.

Possible Causes
FUEL PUMP
(K181) FUEL CONTROL ACTUATOR DRIVER OPEN
(K31) RETURN CIRCUIT OPEN FROM FCA TO ECM
(K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO EXTERNAL VOLTAGE
(K31) FUEL CONTROL ACTUATOR RETURN CIRCUIT SHORTED TO EXTERNAL VOLTAGE
(K31) FCA RETURN CIRCUIT SHORTED TO (K181) FCA DRIVER CIRCUIT
(K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO GROUND
(K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO ANOTHER CIRCUIT
(K31) FUEL CONTROL ACTUATOR RETURN CIRCUIT SHORTED TO ANOTHER CIRCUIT
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FUEL PUMP

Ignition on, engine not running.

Disconnect the Fuel Control Actuator (FCA) harness connector.

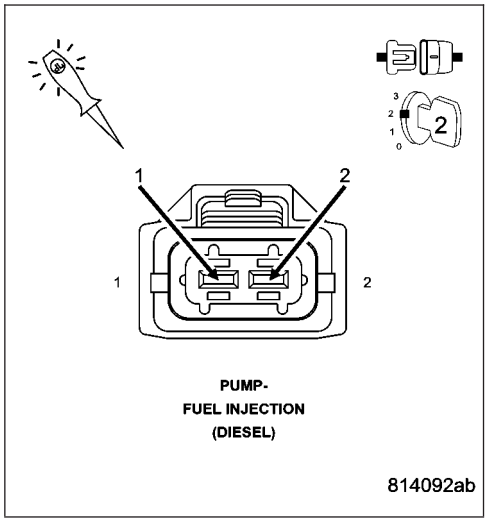
Connect an incandescent test light across the Fuel Control Actuator driver circuit and the Fuel Control Actuator return circuit at the fuel control actuator harness connector.

Observe the test light.

The ECM will perform a self test of the circuit which should momentarily flash the test light brightly, one time, approximately 20 seconds after being connected.

NOTE: Check connectors - Clean/repair as necessary.

NOTE: Compare test light brightness to that of a direct connection to the battery.



Did the light flash brightly?

Yes >> Replace the Fuel Pump.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

2. (K181) FUEL CONTROL ACTUATOR DRIVER OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

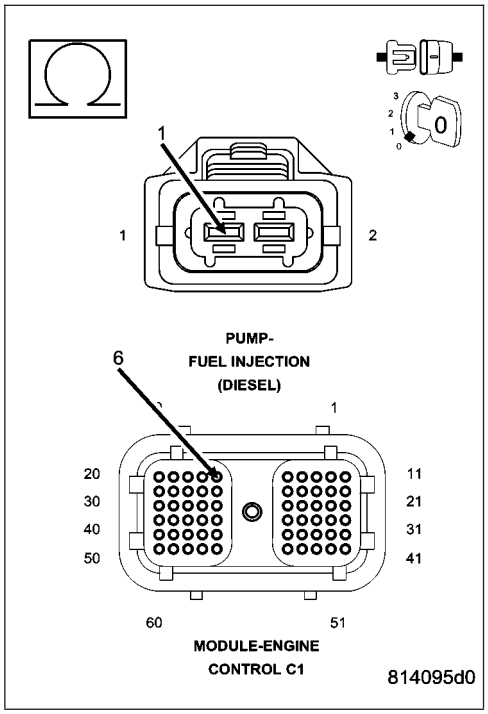
Measure the resistance of the FCA driver circuit between the electronic fuel control actuator harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 3

No >> Repair the (K181) Fuel Control Actuator Driver circuit OPEN.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. (K31) RETURN CIRCUIT OPEN

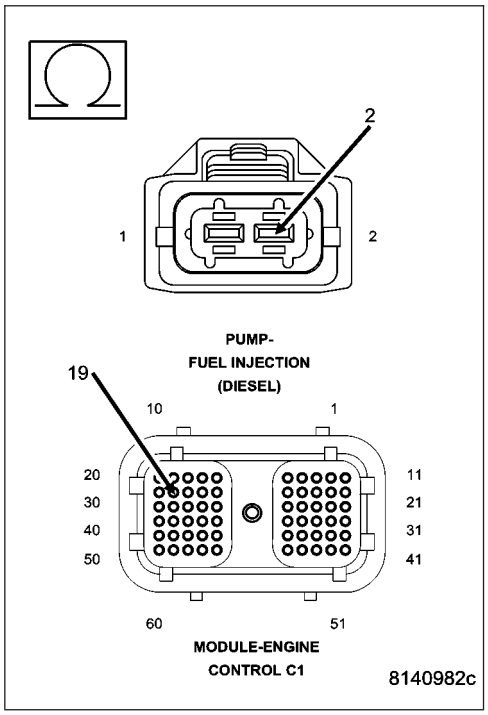
Measure the resistance of the (K31) return circuit between the FCA harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 4

No >> Repair or replace the engine wiring harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

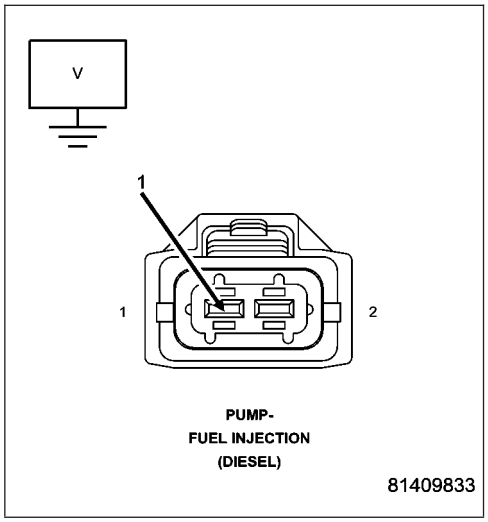
4. (K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO EXTERNAL VOLTAGE

Measure the voltage between the (K181) FCA driver circuit in the FCA harness connector and battery negative.

Is the voltage greater than 1 volts?

Yes >> Repair the (K181) FCA driver circuit shorted to external voltage.

No >> Go To 5



5. (K31) FUEL CONTROL ACTUATOR RETURN CIRCUIT SHORTED TO EXTERNAL VOLTAGE

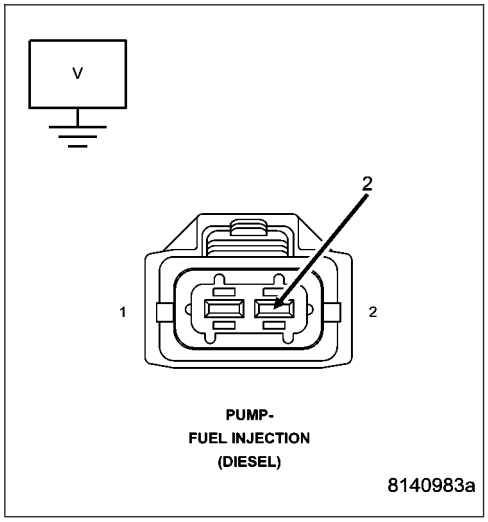
Measure the voltage between the (K31) FCA return circuit in the FCA harness connector and battery negative.

Is the voltage greater than 1 volts?

Yes >> Repair the (K31) FCA return circuit shorted to external voltage.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

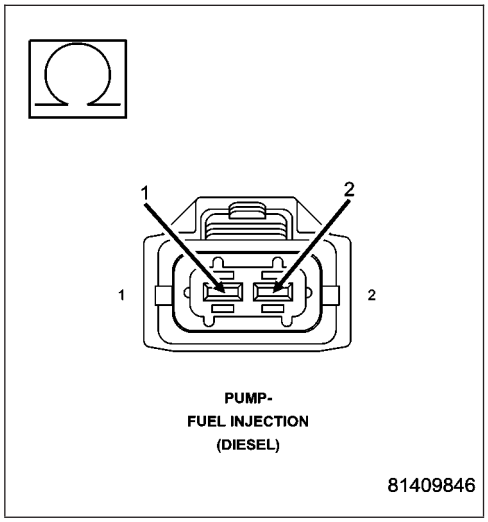
No >> Go To 6



P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

6. (K31) FCA RETURN CIRCUIT SHORTED TO (K181) FCA DRIVER CIRCUIT

Measure the Resistance between the return circuit in the FCA harness connector and Driver circuit.



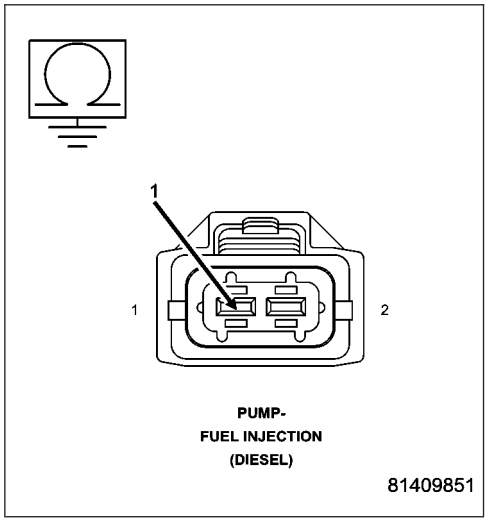
Is the resistance less than 10 Ohms?

Yes >> Repair the (K31) FCA Return circuit shorted to (K181) FCA Driver circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7

7. (K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K181) FCA driver circuit in the FCA harness connector and battery negative.



Is the resistance less than 10 Ohms?

Yes >> Repair the (K181) FCA driver circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

8. (K181) FUEL CONTROL ACTUATOR DRIVER CIRCUIT SHORTED TO ANOTHER CIRCUIT

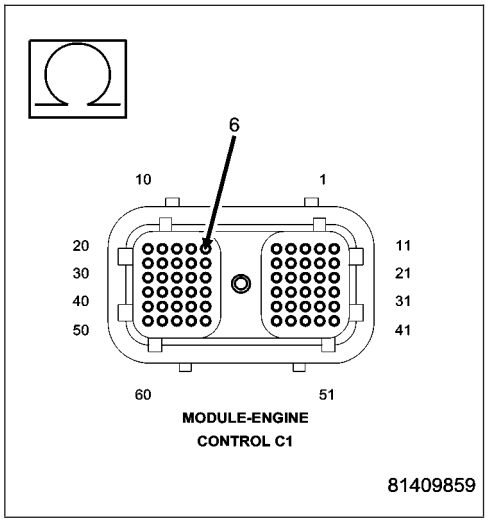
Measure the resistance between the (K181) FCA driver circuit in the ECM harness connector and all other circuits in the ECM connectors.

Is the resistance less than 10 Ohms?

No >> Go To 9

Yes >> Repair the (K181) FCA driver circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



9. (K31) FUEL CONTROL ACTUATOR RETURN CIRCUIT SHORTED TO ANOTHER CIRCUIT

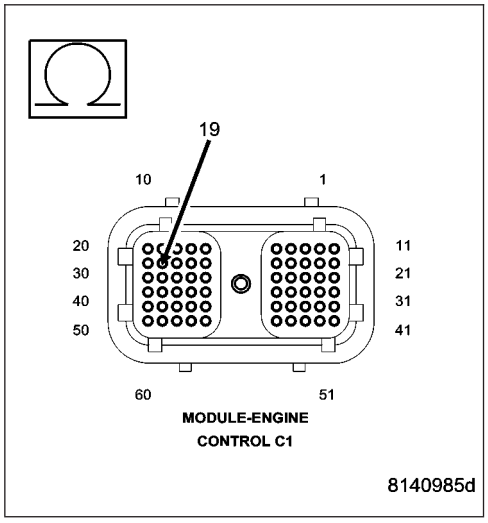
Measure the resistance between the (K31) FCA Return circuit in the ECM harness connector and all other circuits in the ECM connectors.′

Is the resistance less than 10 Ohms?

No >> Go To 10

Yes >> Repair the (K31) FCA Return circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0251-CP3 PUMP REGULATOR CONTROL (CONTINUED)

10. ECM

Reconnect the ECM harness connectors.

Ignition on, engine not running.

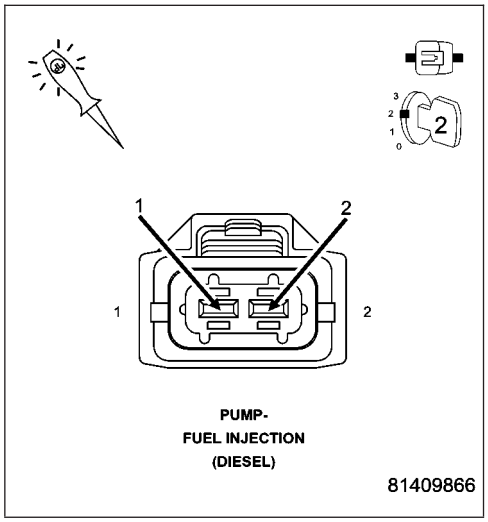
Disconnect the Electronic Fuel Control Actuator connector.

Connect an incandescent test light across the Fuel Control Actuator driver pin and the Fuel Control Actuator return wire at the fuel control actuator connector.

Observe the test light.

The ECM will perform a self test of the circuit which should momentarily flash the test light brightly, one time, approximately 20 seconds after being connected.

NOTE: Compare test light brightness to that of a direct connection to the battery.



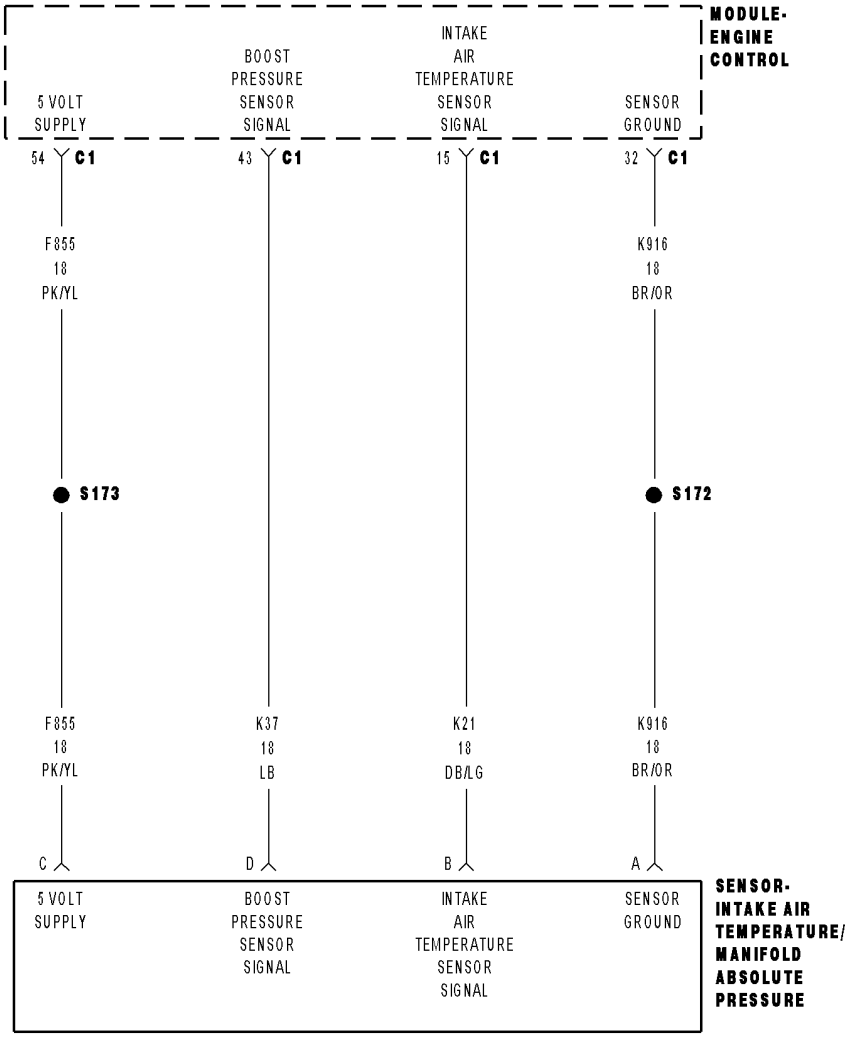
Did the light flash brightly?

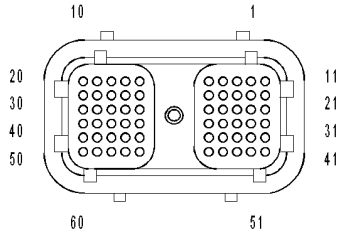
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

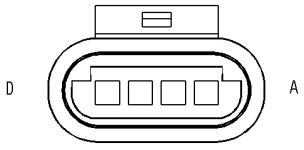
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0299-BOOST IN RANGE LOW





MODULE-ENGINE
CONTROL C1



SENSOR-
INTAKE AIR
TEMPERATURE/
MANIFOLD
ABSOLUTE
PRESSURE
(DIESEL)

813dc004

P0299-BOOST IN RANGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While engine is running.
- **Set Condition:**
  The boost pressure is lower than the expected boost pressure based on engine operating conditions.

Possible Causes
OTHER DTC'S
INTAKE AIR SYSTEM RESTRICTION
TURBO CHARGER DAMAGED
INTAKE AIR SYSTEM LEAK
BOOST PRESSURE SENSOR
BOOST PRESSURE SENSOR
TURBOCHARGER
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.
With the scan tool, read the Engine DTC's.

Do you have other DTC's?

Yes >> Repair other boost related DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. INTAKE AIR SYSTEM RESTRICTION

Inspect the air filter and intake air system for signs of restriction.

Were any restrictions found?

Yes >> Replace the Air Filter or repair the Intake air system for restriction.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0299-BOOST IN RANGE LOW (CONTINUED)

3. TURBO CHARGER DAMAGED

Disconnect the air cleaner connection to the turbo charger.

Using the service manual as a guide, visually inspect the turbo charger blades and turbo housing for signs of damage.

Was any damaged found?

Yes >> Replace The Turbo charger.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. INTAKE AIR SYSTEM LEAK

Using Miller Special tool # 9022, pressurize the intake air system and inspect for leakage.

Use the service manual as a guide.

Were any leaks detected?

Yes >> Repair leaking intake air system.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. BOOST PRESSURE SENSOR

Using the scan tool, compare the boost pressure sensor reading with the ambient air pressure sensor with the ignition turned on.

Are the boost pressure and ambient air pressure sensors within 6 in hg of each other?

Yes >> Go To 6

No >> Replace the Boost pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. BOOST PRESSURE SENSOR

Turn the ignition off.

Install Miller special tool #9022.

Ignition on, engine not running.

Use the scan tool and compare boost pressure reading to the regulated air pressure for tool #9022.

NOTE: The reading on the boost pressure sensor may be slightly lower than the regulated pressure.
Does the boost pressure sensor reading increase with the regulated air pressure?

Does the boost pressure sensor reading increase with the regulated air pressure?

Yes >> Go To 7

No >> Replace the Boost Pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0299-BOOST IN RANGE LOW (CONTINUED)

7. TURBOCHARGER

Disconnect the exhaust outlet connection.

Visually inspect the Wastegate flap in the turbocharger turbine housing

Is the Wastegate seized in the open position?

Yes >> Replace the Turbocharger.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0300-MULTIPLE CYLINDER MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling.
- **Set Condition:**
  Misfire detected on multiple cylinders.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINES
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINES
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTORS
EXTERNAL DAMAGED FUEL INJECTORS
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

3. DAMAGED FUEL LINES

Visually inspect the injector supply lines for damage.

Do you have any kinked or bent fuel lines?

Yes >> Repair or replace damaged fuel lines.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinders.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply lines for the suspect cylinders.
Inspect both ends of the fuel injector supply lines for damage.
Using shop air pressure, blow out the fuel injector supply lines to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply lines.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTORS

Remove the high pressure connectors for the suspect cylinders.
Inspect both ends of the high pressure connectors for signs of damage.
Using shop air pressure, blow out the high pressure connectors to verify that they are not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

7. FUEL INJECTORS

Remove the suspect fuel injectors.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injectors & high pressure connectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injectors & high pressure connectors with injectors & high pressure connectors from cylinders that are firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injectors & high pressure connectors?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0301-CYLINDER # 1 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0301-CYLINDER # 1 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel lines?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply line for the suspect cylinder.
Inspect both ends of the fuel injector supply line for damage.
Using shop air pressure, blow out the fuel injector supply line to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connector for the suspect cylinder.
Inspect both ends of the high pressure connector for signs of damage.
Using shop air pressure, blow out the high pressure connector to verify that it is not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0301-CYLINDER # 1 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injector & high pressure connector with an injector & high pressure connector from a cylinder that is firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injectors & high pressure connectors?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0302-CYLINDER # 2 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0302-CYLINDER # 2 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel line?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply line for the suspect cylinder.
Inspect both ends of the fuel injector supply line for damage.
Using shop air pressure, blow out the fuel injector supply line to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connector for the suspect cylinder.
Inspect both ends of the high pressure connector for signs of damage.
Using shop air pressure, blow out the high pressure connector to verify that it is not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0302-CYLINDER # 2 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Is the fuel injector damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injector & high pressure connector with an injector & high pressure connector from a cylinder that is firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injector & high pressure connector?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0303-CYLINDER # 3 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0303-CYLINDER # 3 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel line?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply line for the suspect cylinder.

Inspect both ends of the fuel injector supply lines for damage.

Using shop air pressure, blow out the fuel injector supply lines to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connector for the suspect cylinder.

Inspect both ends of the high pressure connector for signs of damage.

Using shop air pressure, blow out the high pressure connector to verify that it is not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0303-CYLINDER # 3 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injector & high pressure connector with an injector & high pressure connector from a cylinder that are firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injectors & high pressure connectors?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0304-CYLINDER # 4 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0304-CYLINDER # 4 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel line?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply line for the suspect cylinder.
Inspect both ends of the fuel injector supply line for damage.
Using shop air pressure, blow out the fuel injector supply lines to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connector for the suspect cylinder.
Inspect both ends of the high pressure connector for signs of damage.
Using shop air pressure, blow out the high pressure connectors to verify that it is not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0304-CYLINDER # 4 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injectors & high pressure connector with an injector & high pressure connector from a cylinder that is firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injectors & high pressure connectors?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0305-CYLINDER # 5 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0305-CYLINDER # 5 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel line?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply lines for the suspect cylinder.
Inspect both ends of the fuel injector supply lines for damage.
Using shop air pressure, blow out the fuel injector supply lines to verify that they are not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply lines.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connectors for the suspect cylinder.
Inspect both ends of the high pressure connector for signs of damage.
Using shop air pressure, blow out the high pressure connector to verify that they are not obstructed.

Are the high pressure connector free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0305-CYLINDER # 5 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injector & high pressure connector with an injector & high pressure connector from a cylinder that is firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injector & high pressure connector?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

Perform engine leak down test

Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0306-CYLINDER # 6 MISFIRE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is idling at operating temperature.
- **Set Condition:**
  Misfire detected on this cylinder.

Possible Causes
LOW FUEL
OTHER DTC'S
DAMAGED FUEL LINE
VALVE TRAIN
OBSTRUCTED FUEL INJECTOR SUPPLY LINE
DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR
EXTERNAL DAMAGED FUEL INJECTOR
INTERNAL DAMAGED FUEL INJECTOR
NO COMPRESSION
EXCESSIVE ENGINE LEAK DOWN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW FUEL

Using the scan tool, verify that the fuel level is above 15%.

Is the fuel level above 15%?

Yes >> Go To 2

No >> Add fuel go to step 2.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. OTHER DTC'S

Read the Freeze frame data.

Is the DTC equal to the freeze frame DTC?

Yes >> Go To 3

No >> Repair any other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0306-CYLINDER # 6 MISFIRE (CONTINUED)

3. DAMAGED FUEL LINE

Visually inspect the injector supply line for damage.

Do you have any kinked or bent fuel line?

Yes >> Repair or replace the damaged fuel line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. VALVE TRAIN

Visually inspect the valve train and check the valve lash on the suspect cylinder.

Is the valve train functional and the lash within the specifications listed in the service manual?

Yes >> Go To 5

No >> Adjust the lash or fix or repair any damaged component(s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. OBSTRUCTED FUEL INJECTOR SUPPLY

Remove the fuel injector supply line for the suspect cylinder.
Inspect both ends of the fuel injector supply lines for damage.
Using shop air pressure, blow out the fuel injector supply line to verify that it is not obstructed.

Are the fuel lines free of debris or damage?

Yes >> Go To 6

No >> Replace the damaged or obstructed fuel injector supply line.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. DAMAGED OR OBSTRUCTED HIGH PRESSURE CONNECTOR

Remove the high pressure connector for the suspect cylinder.
Inspect both ends of the high pressure connectors for signs of damage.
Using shop air pressure, blow out the high pressure connector to verify that they are not obstructed.

Are the high pressure connectors free of debris or damage?

Yes >> Go To 7

No >> Replace the damaged or obstructed high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0306-CYLINDER # 6 MISFIRE (CONTINUED)

7. FUEL INJECTOR

Remove the suspect fuel injector.

Are the fuel injectors damaged?

Yes >> Replace the external damaged fuel injector & high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. INTERNAL DAMAGED FUEL INJECTOR

With the scan tool, erase DTCs.

Switch the misfiring injector & high pressure connector with an injector & high pressure connector from a cylinder that is firing properly.

Operate the vehicle.

Did the misfire DTC follow the suspect injectors & high pressure connectors?

Yes >> Replace the internal damaged fuel injector and high pressure connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9

---

9. INTERNAL ENGINE DAMAGE

Perform engine compression test

Did the suspect cylinders pass the compression test?

Yes >> Go To 10

No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

10. INTERNAL ENGINE DAMAGE

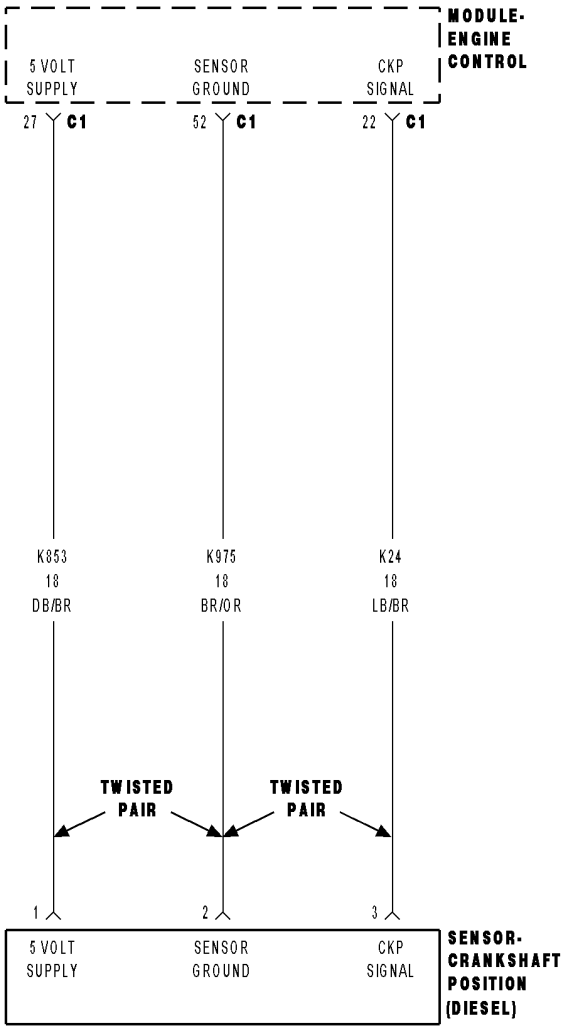
Perform engine leak down test

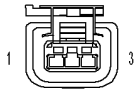
Did the suspect cylinders pass the leak down test?

Yes >> Test Complete.

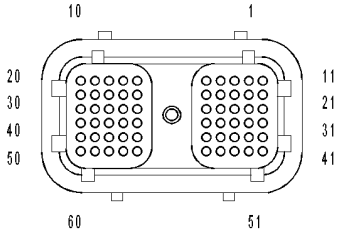
No >> Repair the internal damage to the engine.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0335-CRANKSHAFT POSITION (CKP) LOST





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM no longer detects a signal from the Crankshaft Position Sensor.

Possible Causes
OTHER DTC'S
P0337 PRESENT
CKP SENSOR
VISUAL DAMAGE
(K24) SIGNAL CIRCUIT OPEN
(K853) 5-VOLT SUPPLY CIRCUIT OPEN
(K167) RETURN CIRCUIT OPEN
(K24) SIGNAL CIRCUIT SHORTED TO (K975) RETURN CIRCUIT
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT
(K24) SIGNAL CIRCUIT SHORTED TO (K853) 5-VOLT SUPPLY CIRCUIT
(K24) SIGNAL CIRCUIT SHORTED TO GROUND
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY NEGATIVE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Is DTC P2146 and/or P2149 present?

Yes >> Repair other DTC's.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. P0337 PRESENT

With the scan tool, read DTCs.

Is P0337 present?

Yes >> Repair P0337 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

3. VISUAL DAMAGE

Visually inspect the sensor, engine belt, sensor connector, and the ECM connector.

Is there any damage?

Yes >> Repair or replace the sensor, engine belt, harness, or the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. CKP SENSOR

Disconnect the CKP sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the (K853) 5-volt supply circuit and the (K24) signal circuit of the sensor.

Is the resistance between 900 and 1100 ohms?

Yes >> Go To 5

No >> Replace the CKP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

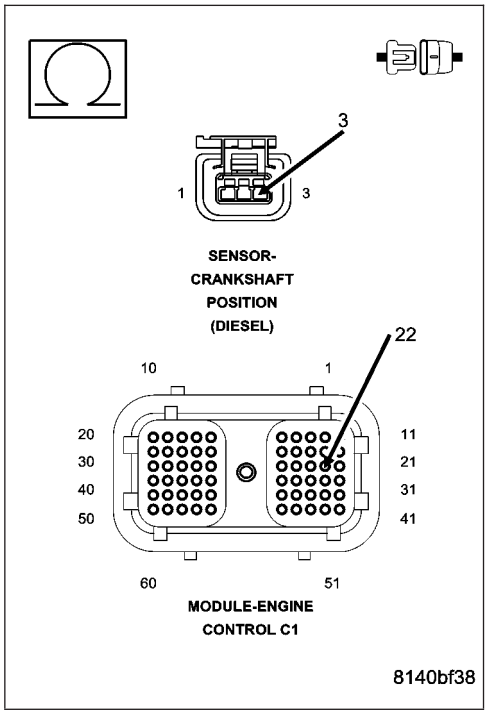
5. (K24) SIGNAL CIRCUIT OPEN

Disconnect the ECM harness connectors.

Disconnect the CKP sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance of the (K24) signal circuit between the ECM harness connector and the CKP sensor harness connector.



Is the resistance less than 10 ohms?

Yes >> Go To 6

No >> Repair the open (K24) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

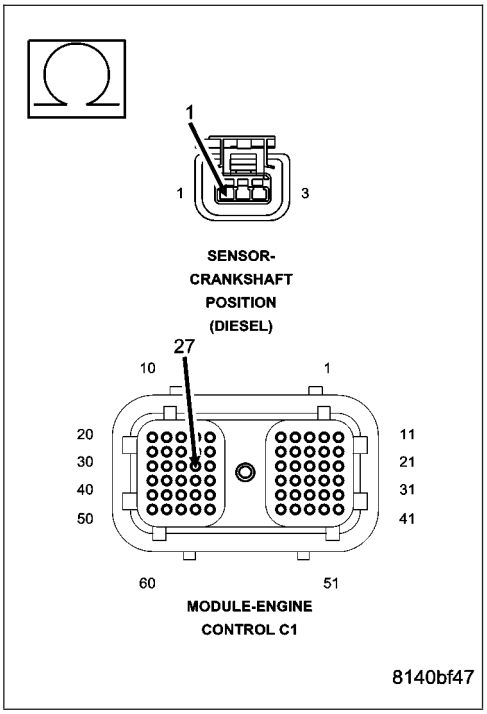
6. (K853) 5-VOLT SUPPLY CIRCUIT OPEN

Measure the resistance of the (K853) 5-volt supply circuit between the ECM harness connector and the CKP sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 7

No >> Repair the open (K853) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



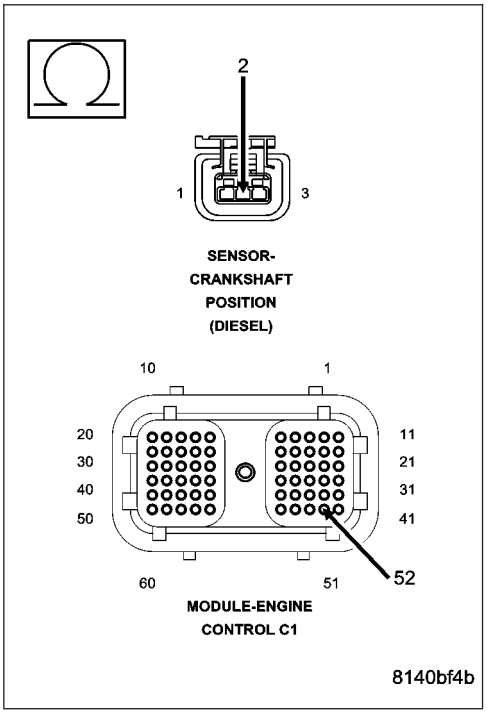
7. (K975) RETURN CIRCUIT OPEN

Measure the resistance of the (K975) return circuit between the ECM harness connector and the CKP sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 8

No >> Repair the open (K975) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

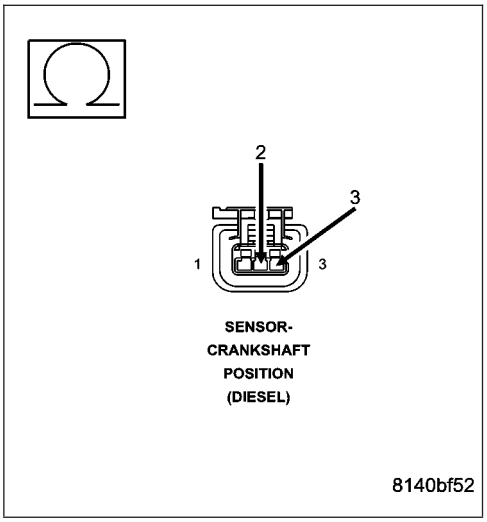
8. (K24) SIGNAL CIRCUIT SHORTED TO (K975) RETURN CIRCUIT

Measure the resistance between the (K24) signal circuit and the (K975) return circuit in the sensor connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 9

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



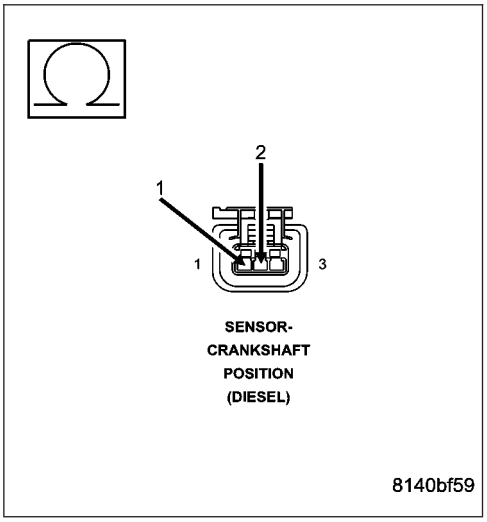
9. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT

Measure the resistance between the (K853) 5-volt supply circuit and the (K975) return circuit in the sensor connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 10

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

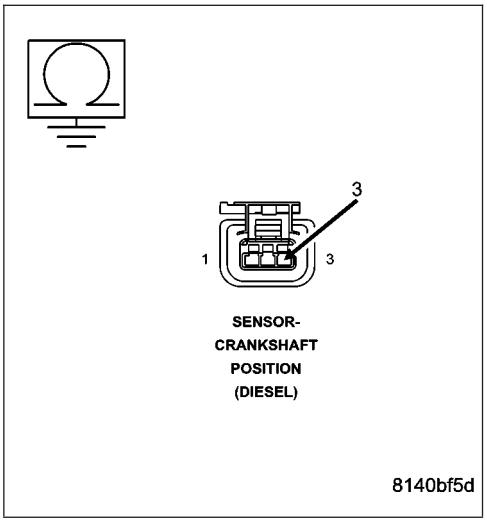
10. (K24) SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between the (K24) signal circuit and ground.

Is the resistance greater than 100k Ohms?

Yes >> Go To 11

No >> Repair the short circuit or replace the engine harness. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



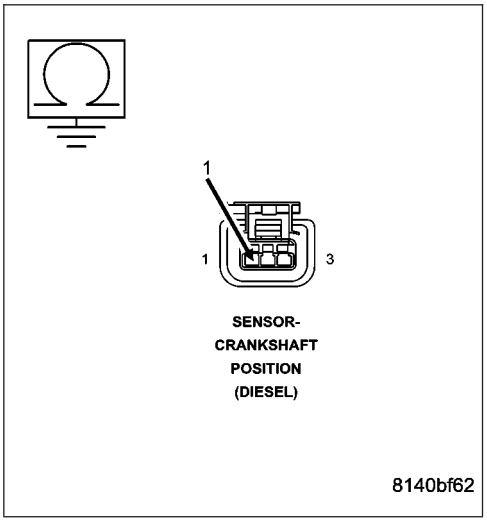
11. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K853) 5-volt supply circuit and ground.

Is the resistance greater than 100k Ohms?

Yes >> Go To 12

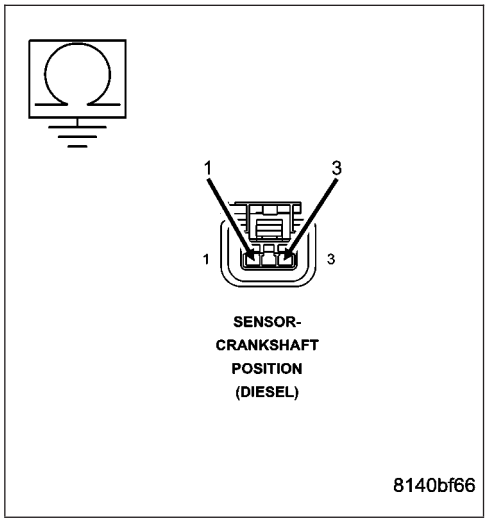
No >> Repair the short circuit or replace the engine harness. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0335-CRANKSHAFT POSITION (CKP) LOST (CONTINUED)

12. (K24) SIGNAL CIRCUIT SHORTED TO (K853) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) signal circuit and the (K853) 5-volt supply circuit in the sensor connector.



Is the resistance greater than 100k Ohms?

Yes >> Go To 13

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

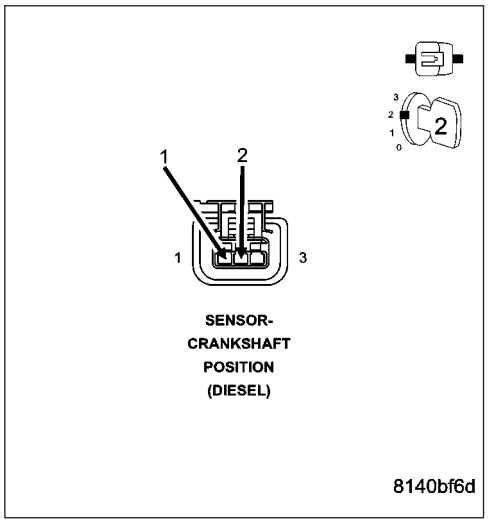
13. ECM

Reconnect the ECM harness connectors.

Ignition on, engine not running.

With the scan tool, erase DTCs.

Connect a jumper wire between the sensor supply circuit and the sensor return circuit in the sensor harness connector.

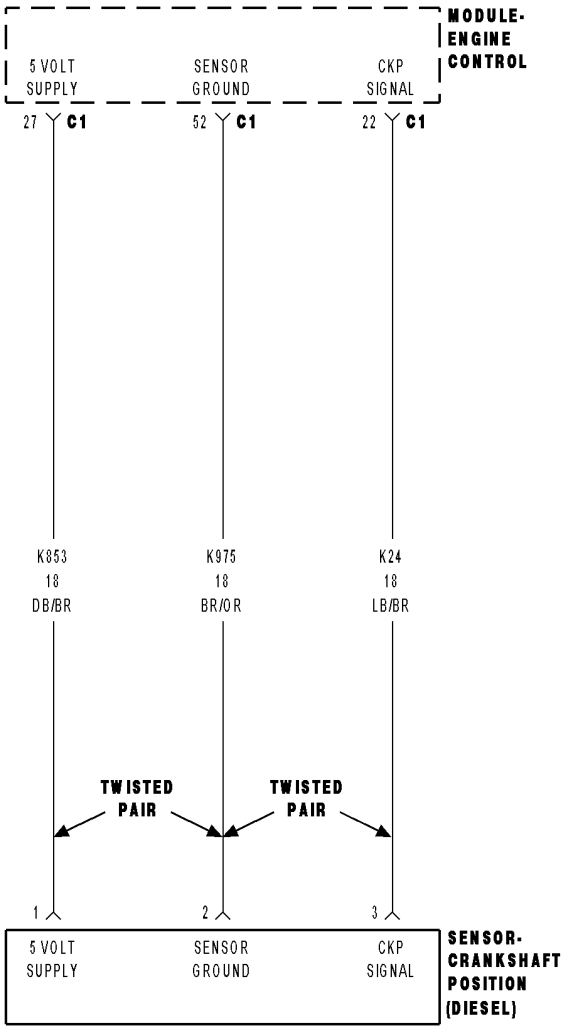


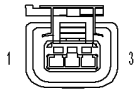
Did DTC P0337 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

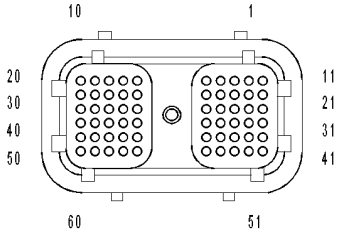
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  The voltage detected at the Crankshaft position sensor is below a calibrated value.

Possible Causes
CKP SENSOR
(K24) SIGNAL CIRCUIT OPEN
(K853) 5-VOLT SUPPLY CIRCUIT OPEN
(K975) RETURN CIRCUIT OPEN
(K24) SIGNAL CIRCUIT SHORTED TO (K975) RETURN CIRCUIT
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT
(K24) SIGNAL CIRCUIT SHORTED TO (K853) 5-VOLT SUPPLY CIRCUIT
(K24) SIGNAL CIRCUIT SHORTED TO GROUND
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY NEGATIVE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CKP SENSOR

Disconnect the CKP sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (K853) 5-volt supply circuit and the (K24) signal circuit of the sensor.

Is the resistance between 900 and 1100 ohms?

Yes >> Go To 2

No >> Replace the CKP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

2. (K24) SIGNAL CIRCUIT OPEN

Disconnect the ECM harness connectors.

Disconnect the CKP sensor harness connector.

Check connectors - Clean/repair as necessary.

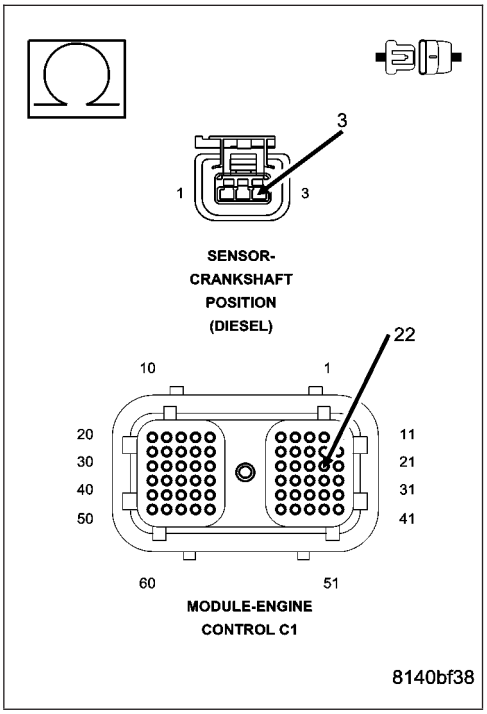
Measure the resistance of the (K24) signal circuit between the ECM harness connector and the CKP sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 3

No >> Repair the open (K24) signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. (K853) 5-VOLT SUPPLY CIRCUIT OPEN

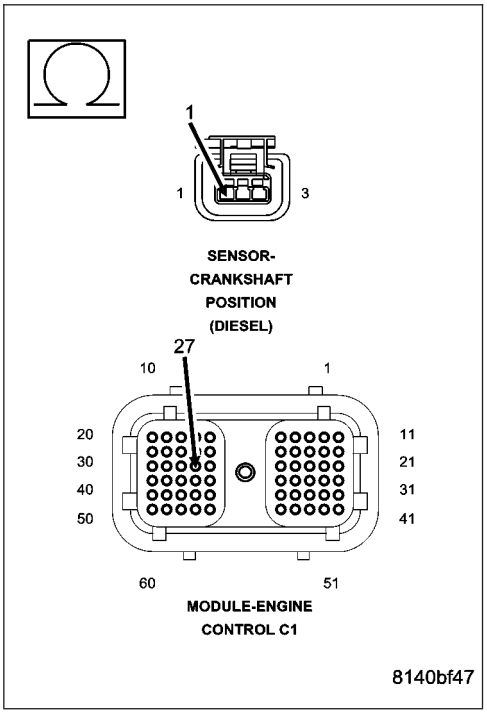
Measure the resistance of the (K853) 5-volt supply circuit between the ECM harness connector and the CKP sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 4

No >> Repair the open (K853) 5-volt supply circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

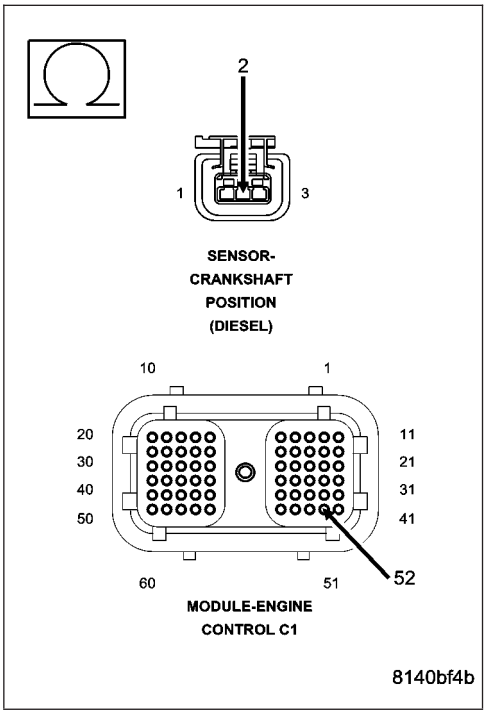
4. (K975) RETURN CIRCUIT OPEN

Measure the resistance of the (K975) return circuit between the ECM harness connector and the CKP sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 5

No >> Repair the open (K975) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



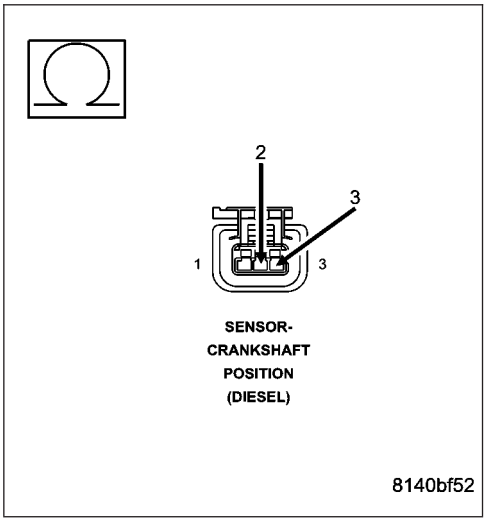
5. (K24) SIGNAL CIRCUIT SHORTED TO (K975) RETURN CIRCUIT

Measure the resistance between the (K24) signal circuit and the (K975) return circuit in the sensor connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 6

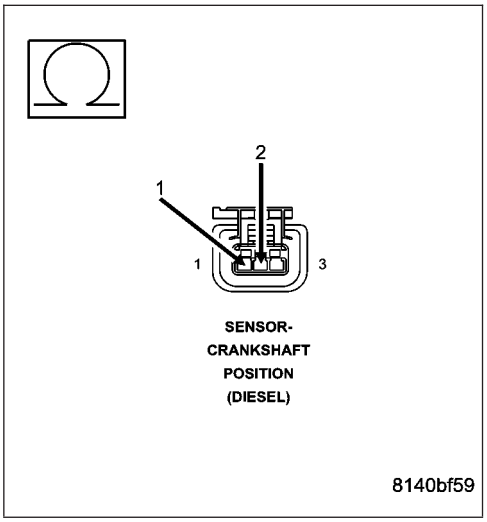
No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

6. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT

Measure the resistance between the (K853) 5-volt supply circuit and the (K975) return circuit in the sensor connector.



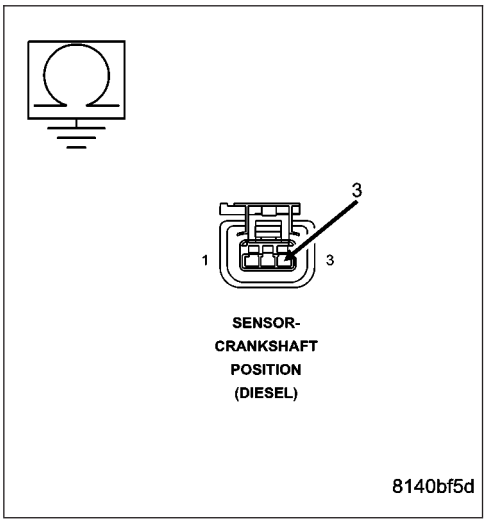
Is the resistance greater than 100k Ohms?

Yes >> Go To 7

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

7. (K24) SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between the (K24) signal circuit and ground.



Is the resistance greater than 100k Ohms?

Yes >> Go To 8

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

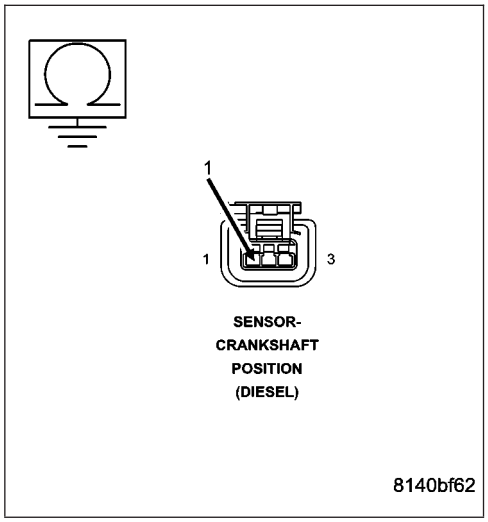
8. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K853) 5-volt supply circuit and ground.

Is the resistance greater than 100k Ohms?

Yes >> Go To 9

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



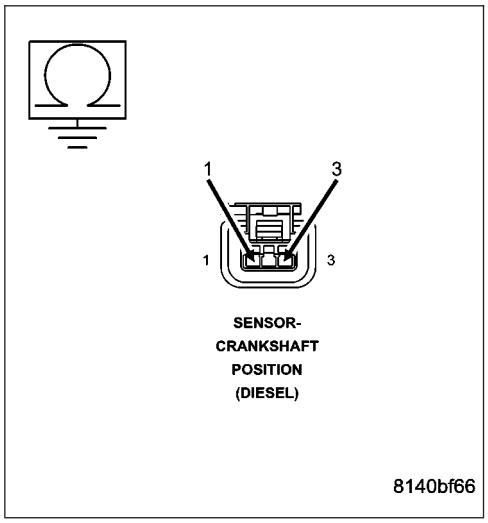
9. (K24) SIGNAL CIRCUIT SHORTED TO (K853) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) signal circuit and the (K853) 5-volt supply circuit in the sensor connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 10

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0336-CRANKSHAFT POSITION (CKP) SENSOR SIGNAL (CONTINUED)

10. ECM

Reconnect the ECM harness connectors.

Ignition on, engine not running.

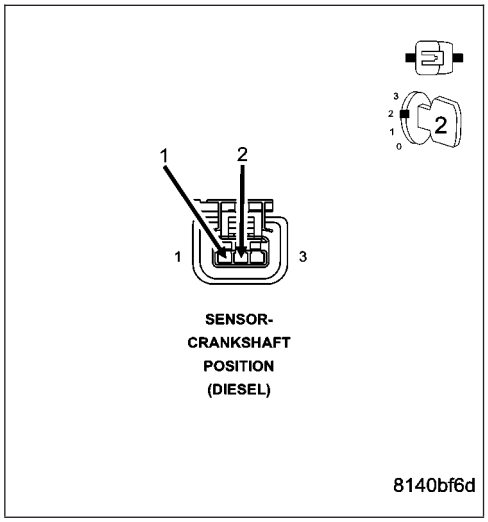
With the scan tool, erase DTCs.

Connect a jumper wire between the sensor supply circuit and the sensor return circuit in the sensor harness connector.

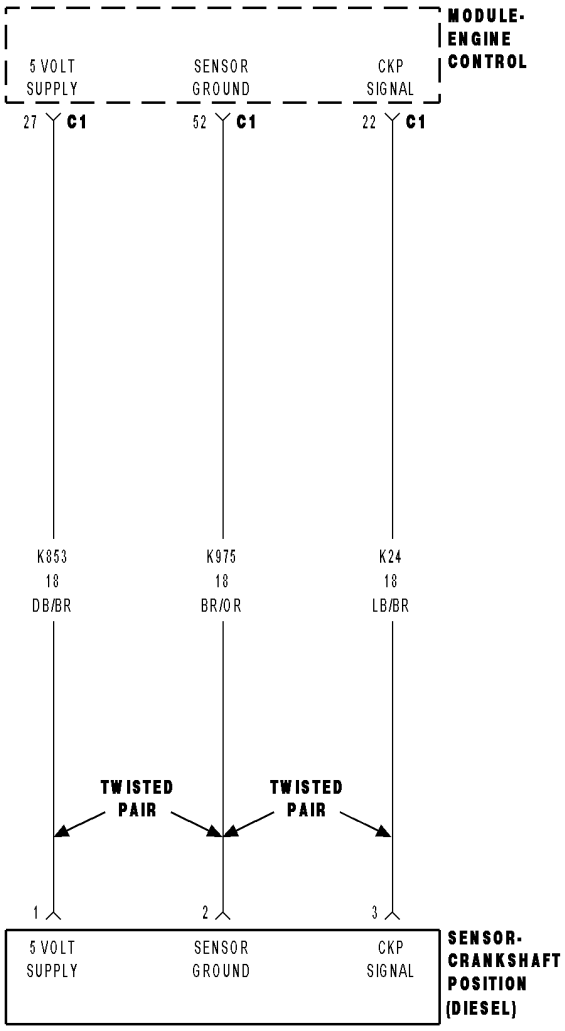
Did DTC P0337 set?

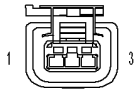
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

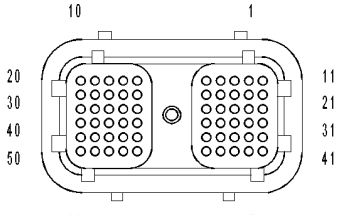


P0337-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO LOW





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0337-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  Voltage detected at the CKP is below a calibrated value for a calibrated amount of time.

Possible Causes
CKP SENSOR
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED BATTERY NEGATIVE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CKP SENSOR

Disconnect the CKP sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the (K853) 5-volt supply circuit and the (K24) signal circuit of the sensor.

Is the resistance between 900 and 1100 ohms?

Yes >> Go To 2

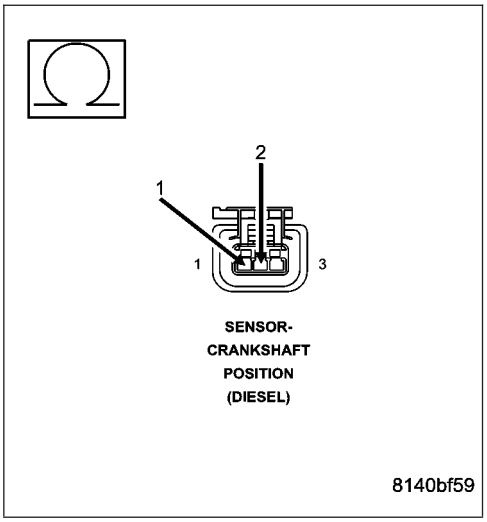
No >> Replace the CKP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K975) RETURN CIRCUIT

Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the (K853) 5-volt supply circuit and the (K975) return circuit in the sensor connector.



Is the resistance greater than 100k Ohms?

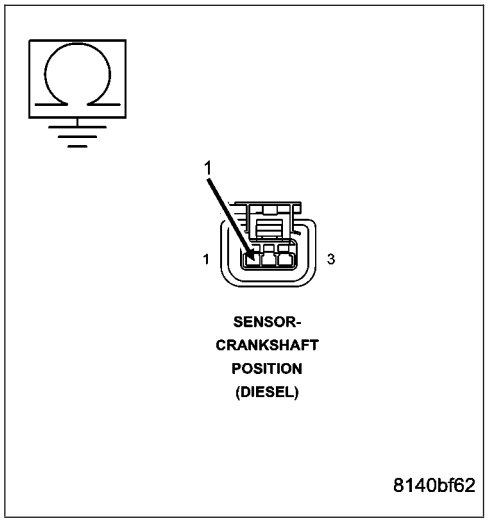
Yes >> Go To 3

No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0337-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO LOW (CONTINUED)

3. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED BATTERY NEGATIVE

Measure the resistance between the (K853) 5-volt supply circuit and battery negative.



Is the resistance greater than 100k Ohms?

Yes >> Go To 4

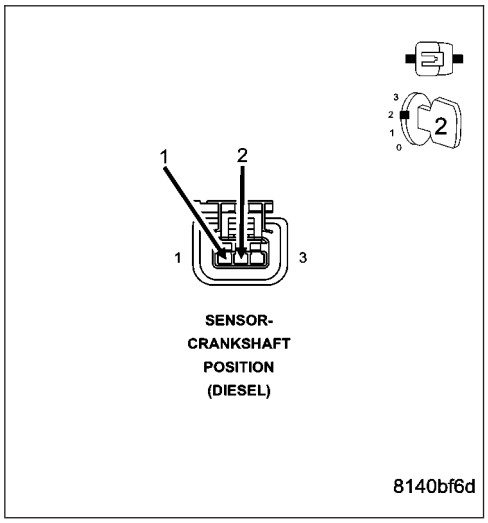
No >> Repair the short circuit or replace the engine harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

4. ECM

Reconnect the ECM harness connectors.

Ignition on, engine not running.

Connect a jumper wire between the sensor (K853) 5-volt supply circuit in the sensor harness connector 12-volts.

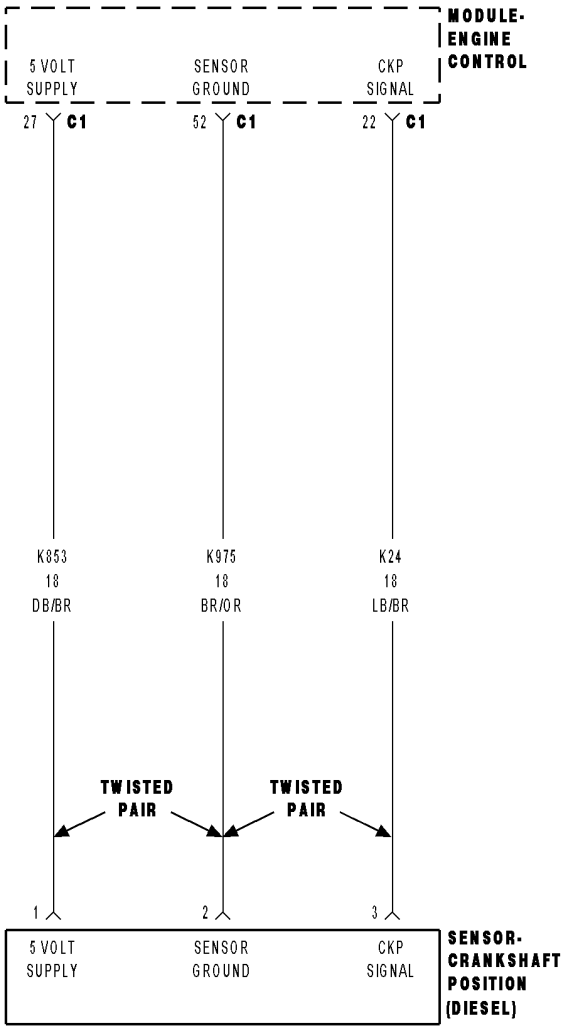


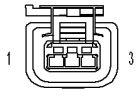
Did DTC P0338 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

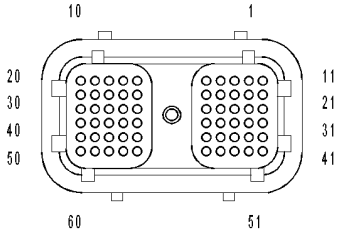
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0338-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO HIGH





SENSOR-
CRANKSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

813fc1d1

P0338-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  Voltage detected at the CKP is above a calibrated value for a calibrated amount of time.

Possible Causes
(K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. (K853) 5-VOLT SUPPLY CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connector(s).

Disconnect the CKP sensor harness connector.

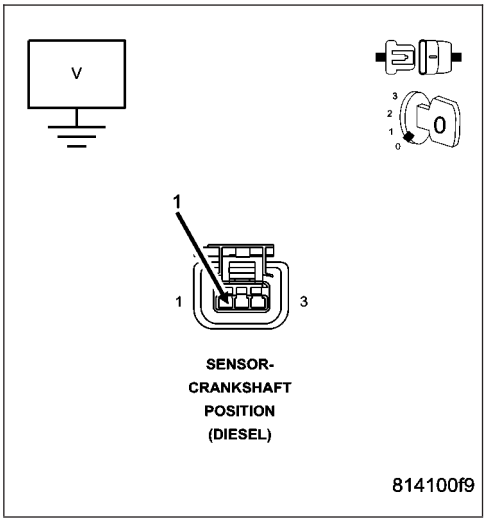
Check connectors - Clean/repair as necessary.

Measure voltage between the (K853) 5-volt supply circuit in the sensor harness connector and battery negative.

Is the voltage greater than 1 volt?

Yes >> Repair or replace the shorted wiring harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P0338-CRANKSHAFT POSITION (CKP) SENSOR VOLTAGE TOO HIGH (CONTINUED)

2. ECM

Reconnect the ECM harness connectors.

Ignition on, engine not running.

Connect a jumper wire between the sensor (K853) 5-volt supply circuit and the sensor (K975) return in the sensor harness connector.

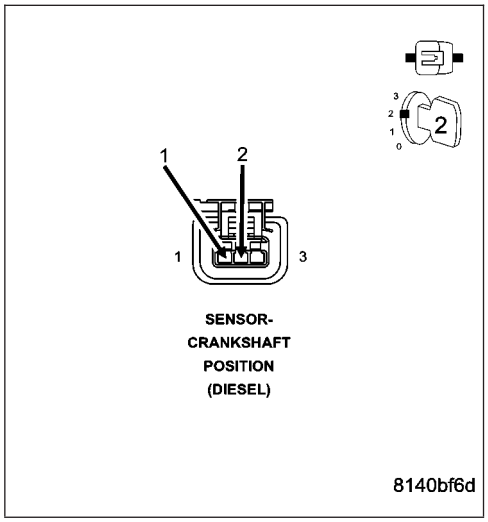
Did DTC P0337 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).

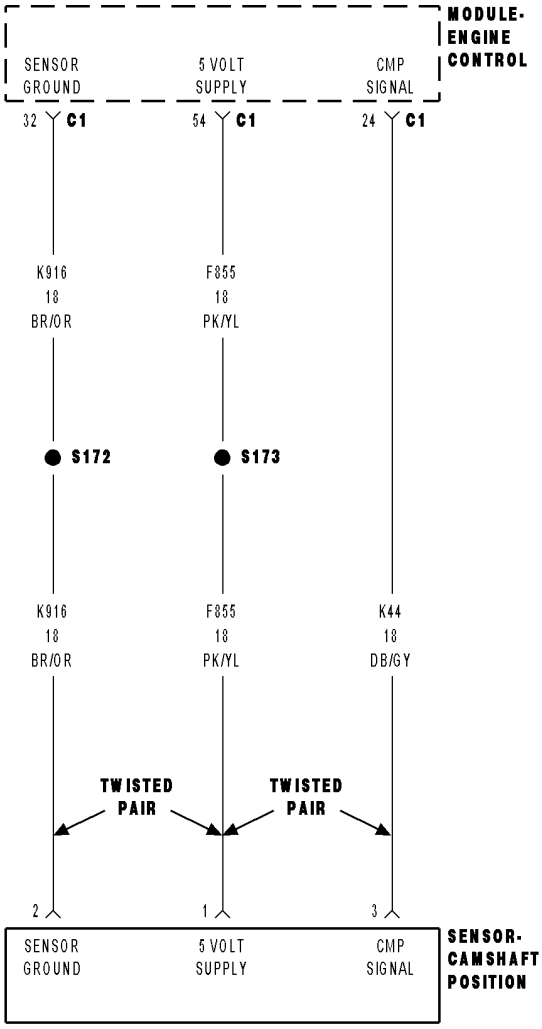
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

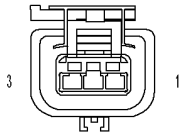
No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

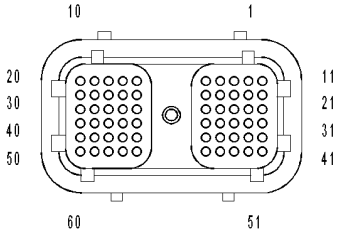


P0340-CAMSHAFT POSITION (CMP) LOST





SENSOR-
CAMSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

81413b02

P0340-CAMSHAFT POSITION (CMP) LOST (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM no longer detects a signal from the Engine Position Sensor.

Possible Causes
INJECTOR DTC'S PRESENT
OTHER DTC'S
CAMSHAFT SENSOR
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(K916) RETURN CIRCUIT OPEN
(K44) SIGNAL CIRCUIT SHORTED TO GROUND
(K44) SIGNAL CIRCUIT SHORTED TO SUPPLY (F855) CIRCUIT
(K44) SIGNAL CIRCUIT SHORTED TO (K916) RETURN CIRCUIT
(K44) SIGNAL CIRCUIT SHORT TO VOLTAGE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. INJECTOR DTC'S PRESENT

With the scan tool, read DTCs.

Do you have a DTC for P2146 or P2149?

Yes >> Repair injector DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. OTHER DTC'S

With the scan tool, read DTCs.

Is any other DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0340-CAMSHAFT POSITION (CMP) LOST (CONTINUED)

3. CAMSHAFT SENSOR

Turn the ignition off.

Disconnect the cam sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the (F855) 5-volt supply circuit and the (K44) signal circuit of the sensor.

Is the resistance between 900 and 1100 ohms?

Yes >> Go To 4

No >> Replace the camshaft sensor.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

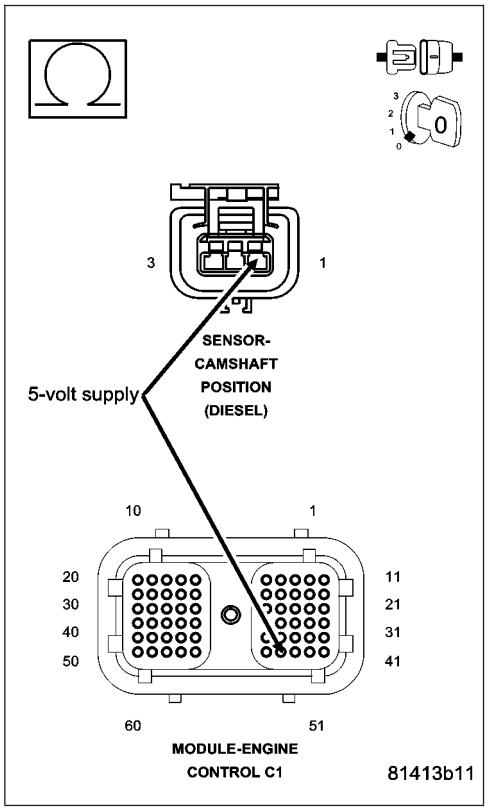
---

4. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the resistance of the (F855) 5-volt supply circuit between the ECM harness connector and the cam sensor harness connector.



Is the resistance less than 10 ohms?

Yes >> Go To 5

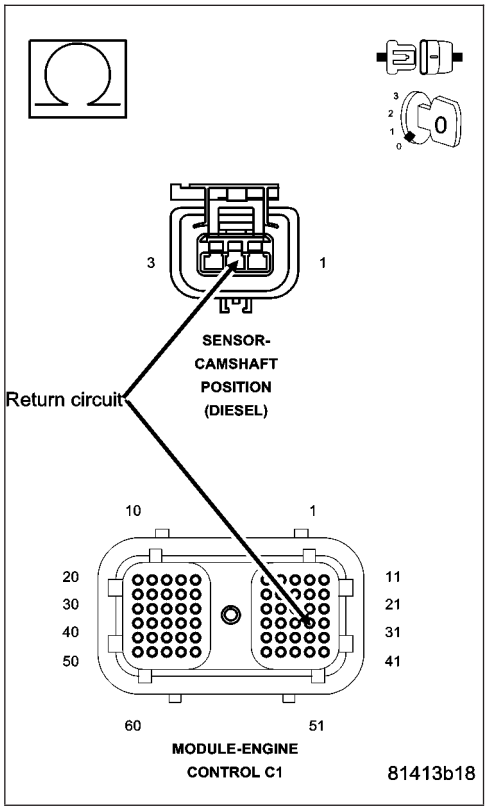
No >> Repair the open (F855) 5-volt supply circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0340-CAMSHAFT POSITION (CMP) LOST (CONTINUED)

5. (K916) RETURN CIRCUIT OPEN

Measure the resistance of the (K916) return circuit between the ECM harness connector and the cam sensor harness connector.



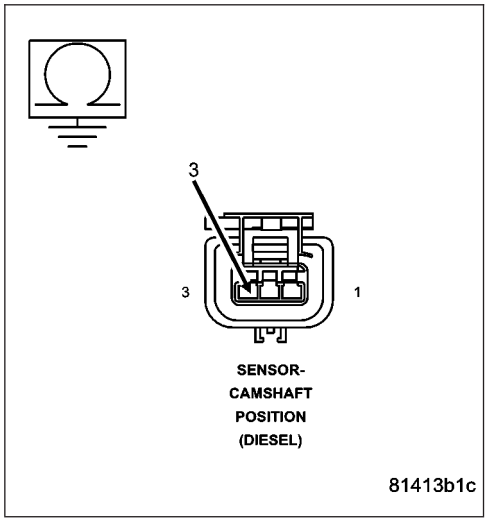
Is the resistance less than 10 ohms?

Yes >> Go To 6

No >> Repair the open (K916) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

6. (K44) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K44) signal circuit in the sensor harness connector and battery negative.



Is the resistance greater than 100k ohms?

Yes >> Go To 7

No >> Repair (K44) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0340-CAMSHAFT POSITION (CMP) LOST (CONTINUED)

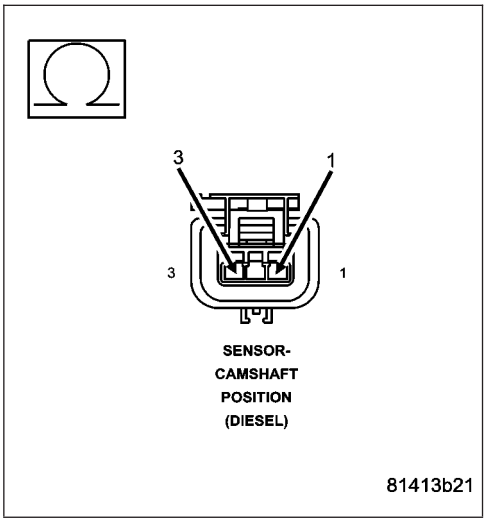
7. (K44) SIGNAL CIRCUIT SHORTED TO (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) signal circuit and the (F855) 5-volt supply circuit in the sensor harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 8

No >> Repair (K44) signal circuit shorted to the (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



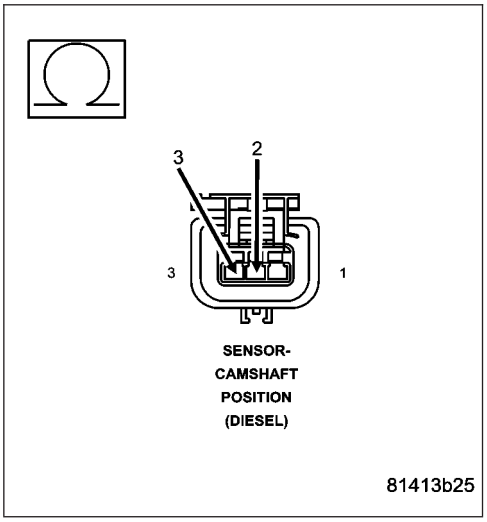
8. (K44) SIGNAL CIRCUIT SHORTED TO (K916) RETURN CIRCUIT

Measure the resistance between the (K44) signal circuit and the (K916) return circuit in the sensor harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 9

No >> Repair (K44) signal circuit shorted to the (K916) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0340-CAMSHAFT POSITION (CMP) LOST (CONTINUED)

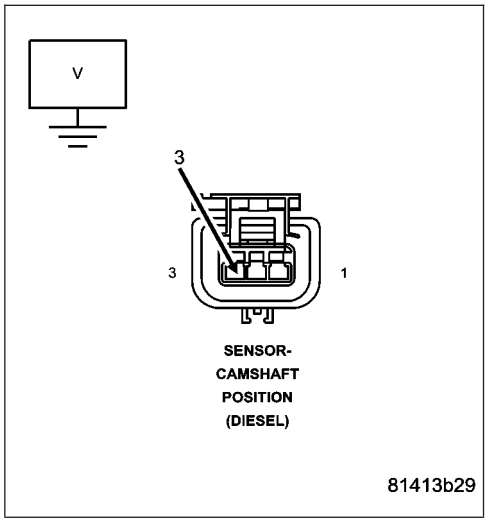
9. (K44) SIGNAL CIRCUIT SHORT TO VOLTAGE

Measure the voltage between the (K44) signal circuit in the sensor harness connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 10

No >> Repair (K44) signal circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



10. ECM

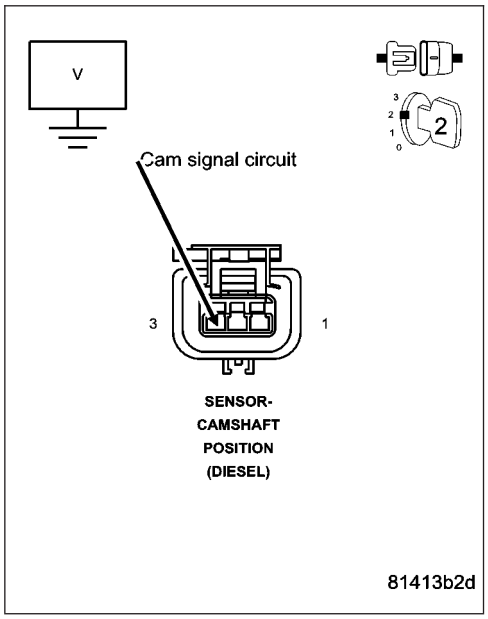
Reconnect the ECM harness connectors.

Measure the voltage between the (K44) signal circuit in the sensor harness connector and battery negative.

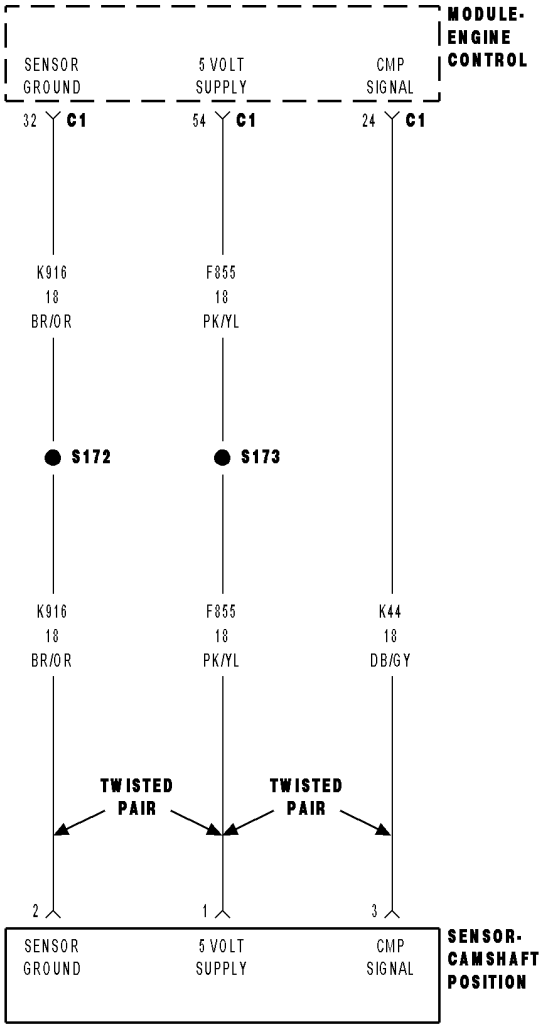
Is the voltage less than 1 volt?

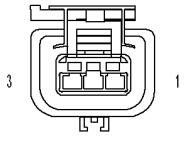
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

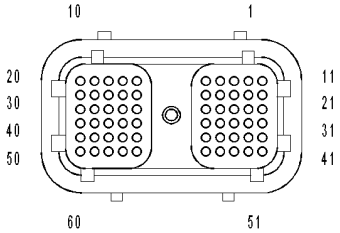


P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL





SENSOR-
CAMSHAFT
POSITION
(DIESEL)



MODULE-ENGINE
CONTROL C1

81413b02

P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM no longer detects a signal from the Engine Position Sensor.

Possible Causes
INJECTOR DTC'S PRESENT
OTHER DTC'S
CAMSHAFT SENSOR
(K44) SIGNAL CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(K916) RETURN CIRCUIT OPEN
(K44) SIGNAL CIRCUIT SHORTED TO GROUND
(K44) SIGNAL CIRCUIT SHORTED TO (F855) 5-VOLT SUPPLY CIRCUIT
(K44) SIGNAL CIRCUIT SHORTED TO (K916) RETURN CIRCUIT
(K44) SIGNAL CIRCUIT SHORT TO VOLTAGE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. INJECTOR DTC'S PRESENT

With the scan tool, read DTCs.

Do you have a DTC for P2146 or P2149?

Yes >> Repair injector DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. OTHER DTC'S

With the scan tool, read DTCs.

Is any other DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

3. CAMSHAFT SENSOR

Turn the ignition off.

Disconnect the cam sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the (F855) 5-volt supply circuit and the (K44) signal circuit of the sensor.

Is the resistance between 900 and 1100 ohms?

Yes >> Go To 4

No >> Replace the camshaft sensor.

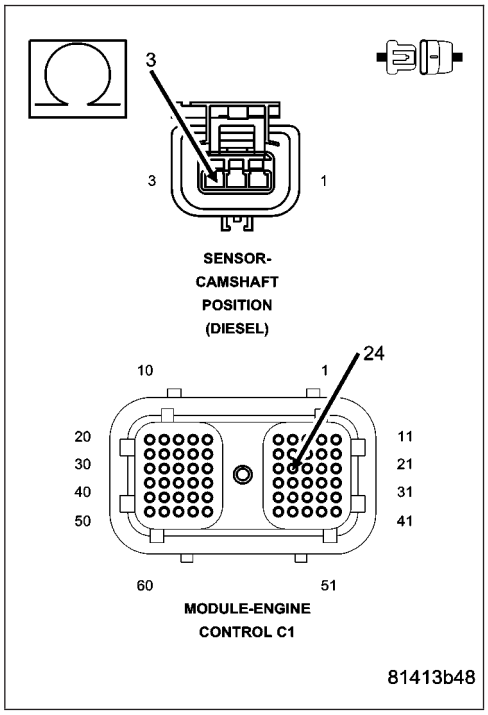
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. (K44) SIGNAL CIRCUIT OPEN

Disconnect the ECM harness connectors.

Measure the resistance of the (K44) signal circuit between the ECM harness connector and the sensor harness connector.



Is the resistance less than 10 ohms?

Yes >> Go To 5

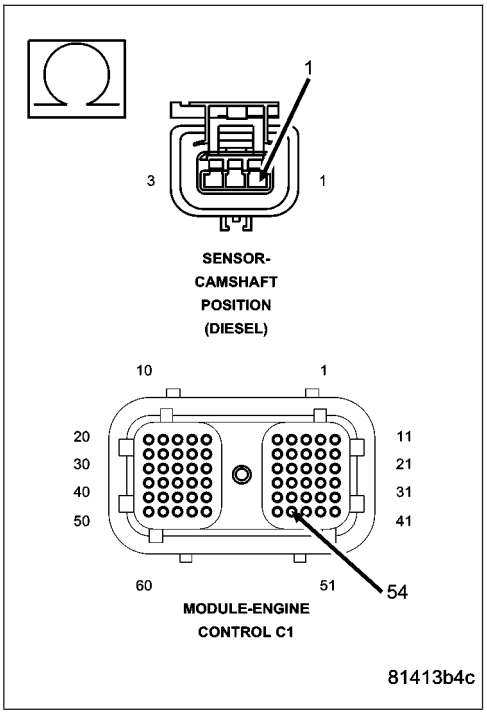
No >> Repair the open (K44) signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

5. Diagnostic Test Topic Goes Here

Measure the resistance of the (F855) 5-volt supply circuit between the ECM harness connector and the sensor harness connector.



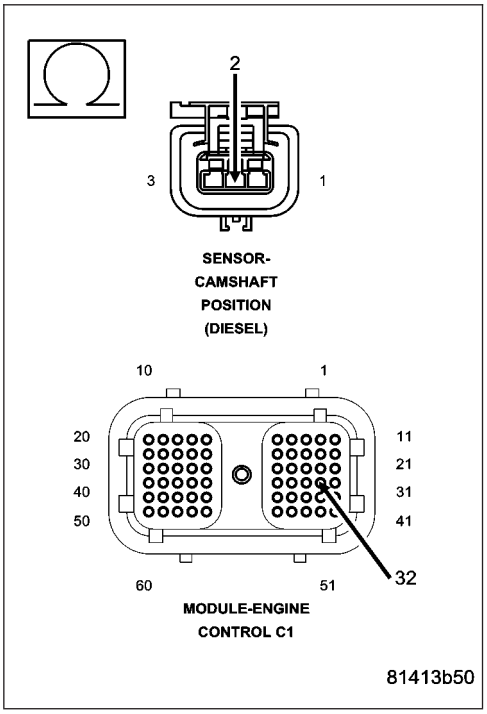
Is the resistance less than 10 ohms?

Yes >> Go To 6

No >> Repair the open (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

6. (K916) RETURN CIRCUIT OPEN

Measure the resistance of the (K916) return circuit between the ECM harness connector and the sensor harness connector.



Is the resistance less than 10 ohms?

Yes >> Go To 7

No >> Repair the open (K916) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

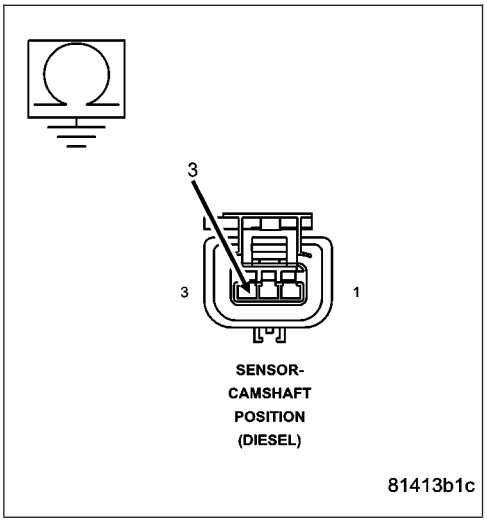
7. (K44) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K44) signal circuit in the sensor harness connector and battery negative.

Is the resistance greater than 100k ohms?

Yes >> Go To 8

No >> Repair (K44) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



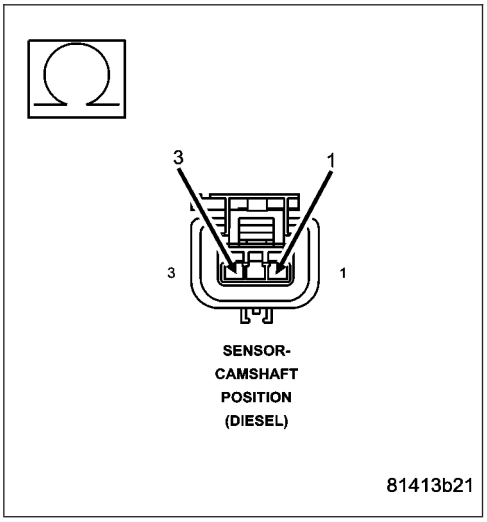
8. (K44) SIGNAL CIRCUIT SHORTED TO (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) signal circuit and the (F855) 5-volt supply circuit in the sensor harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 9

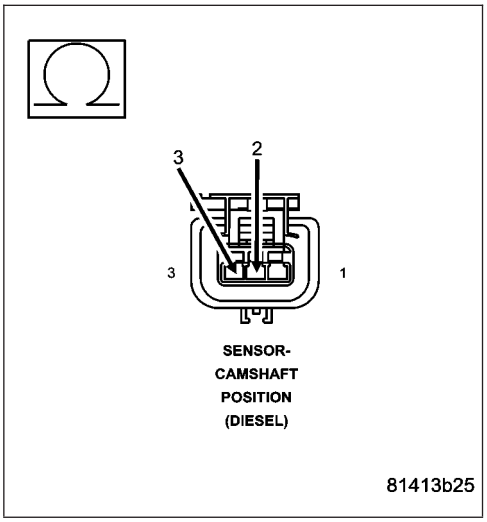
No >> Repair (K44) signal circuit shorted to the (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

9. (K44) SIGNAL CIRCUIT SHORTED TO (K916) RETURN CIRCUIT

Measure the resistance between the (K44) signal circuit and the (K916) return circuit in the sensor harness connector.



Is the resistance greater than 100k ohms?

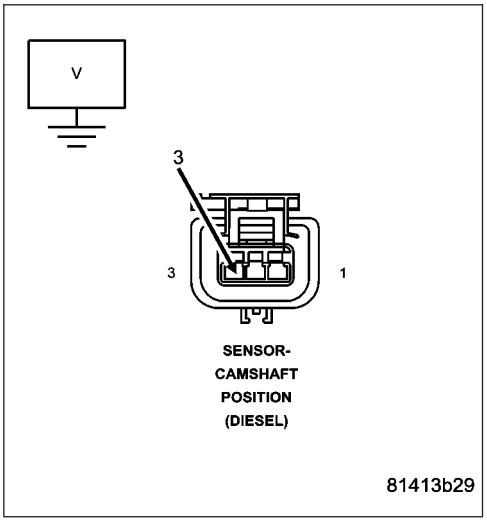
Yes >> Go To 10

No >> Repair (K44) signal circuit shorted to the (K916) return circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

10. (K44) SIGNAL CIRCUIT SHORT TO VOLTAGE

Measure the voltage between the (K44) signal circuit in the sensor harness connector and battery negative.



Is the voltage less than 1 volt?

Yes >> Go To 11

No >> Repair (K44) signal circuit shorted to voltage.

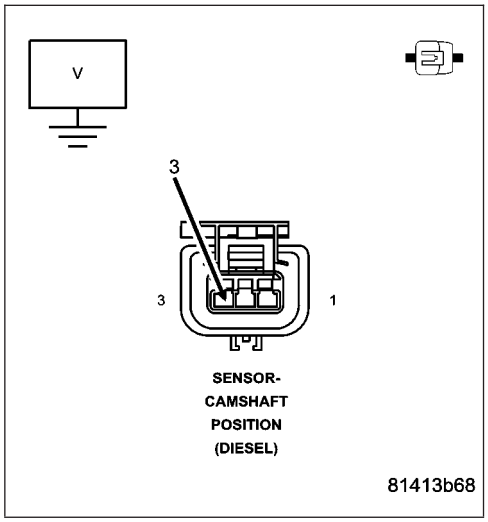
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0341-CAMSHAFT POSITION (CMP) SENSOR SIGNAL (CONTINUED)

11. ECM

Reconnect the ECM harness connectors.

Measure the voltage between the (K44) signal circuit in the sensor harness connector and battery negative.



Is the voltage less than 1 volt?

Yes >> Test Complete.

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0381-WAIT TO START LAMP INOPERATIVE

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  The cluster sends a signal to the ECM that it has detected a failed wait to start lamp.

Possible Causes
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
WAIT-TO-START LIGHT BULB
WIRING/CONNECTOR PROBLEM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. WAIT-TO-START LAMP DOES NOT COME ON

Turn the ignition off.

While watching the wait-to-start lamp, turn the ignition key on.

Did the wait-to-start lamp light?

Yes >> Go To 2

No >> Go To 3

---

2. WAIT-TO-START LAMP STAYS ON ALL THE TIME

Turn the ignition off.

While watching the wait-to-start lamp, turn the ignition key on.

Does the wait-to-start lamp stay on all the time?

Yes >> Go To 3

No >> Wait-to-start Lamp operating normally. Test passed.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0381-WAIT TO START LAMP INOPERATIVE (CONTINUED)

3. FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

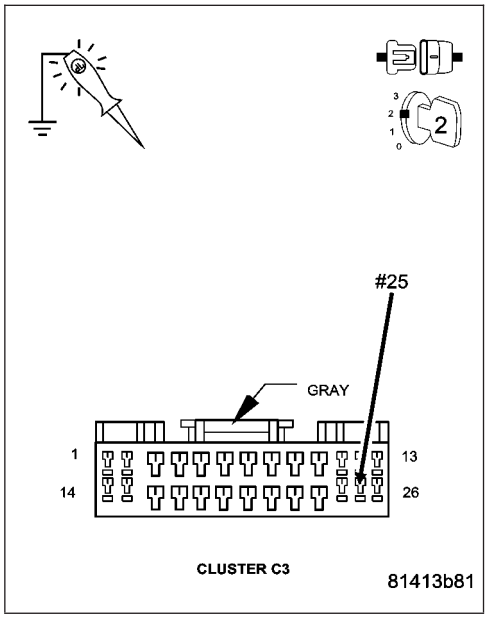
Turn the ignition off.

Remove the cluster.

NOTE: Check connectors - Clean/repair as necessary.

Turn the ignition on.

Using a 12-Volt test Light, check the Fused Ignition Switch Run/Start circuit.



Is the light illuminated and bright?

Yes >> Go To 4

No >> Repair the open fused Ignition Switch Output circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

4. WAIT-TO-START LIGHT BULB

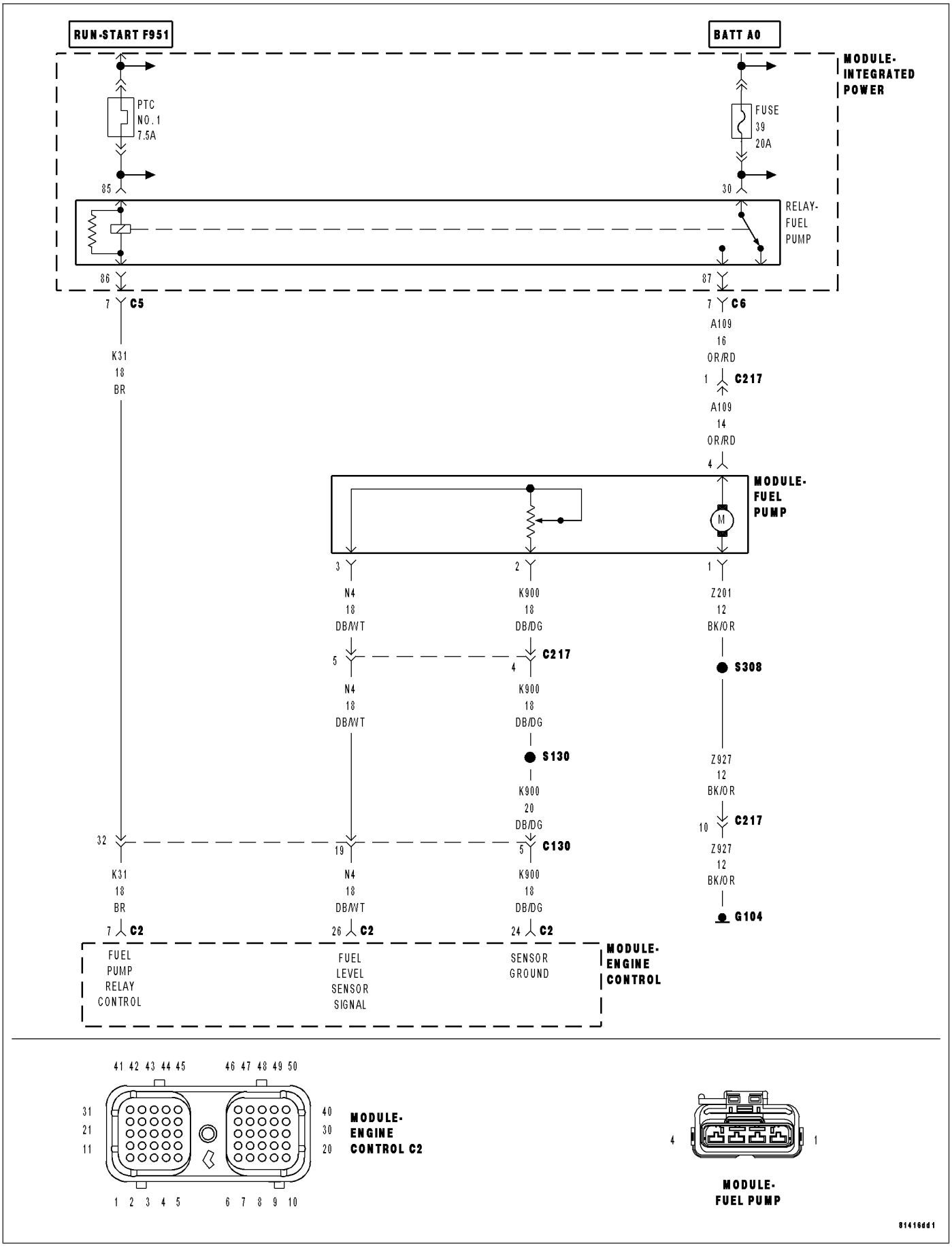
Remove and inspect the Wait-to-Start Bulb.

Is the Bulb Ok?

Yes >> Test complete.

No >> Replace the Wait-to-Start Bulb.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0461-Fuel Level Unit No Change Over Time



P0461-Fuel Level Unit No Change Over Time (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  Fuel level does not change by a calibrated amount over a calibrated amount of time.

Possible Causes
EXTERNAL DAMAGE TO FUEL TANK
FUEL LEVEL SENSOR
INSIDE OF FUEL TANK OBSTRUCTED DAMAGED
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. EXTERNAL DAMAGE TO FUEL TANK

Visually inspect the fuel tank for external damage.

Is the fuel tank damaged from the outside?

Yes >> Fix or replace the fuel tank.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. FUEL LEVEL SENSOR

Disconnect the wiring harness from the fuel level sensor.

NOTE: Check connectors - Clean/repair as necessary.
Remove the fuel level sensor from the fuel tank.

Does the fuel level float move freely?

Yes >> Go To 3

No >> Replace the fuel level sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0461-Fuel Level Unit No Change Over Time (CONTINUED)

3. FUEL LEVEL SENSOR

Measure the resistance between the sensor (N4) signal circuit and (K900) return circuit while moving the sensor float arm.

Does the resistance level change as you move the sensor arm?

Yes >> Go To 4

No >> Replace the fuel level sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. INSIDE OF FUEL TANK OBSTRUCTED DAMAGED

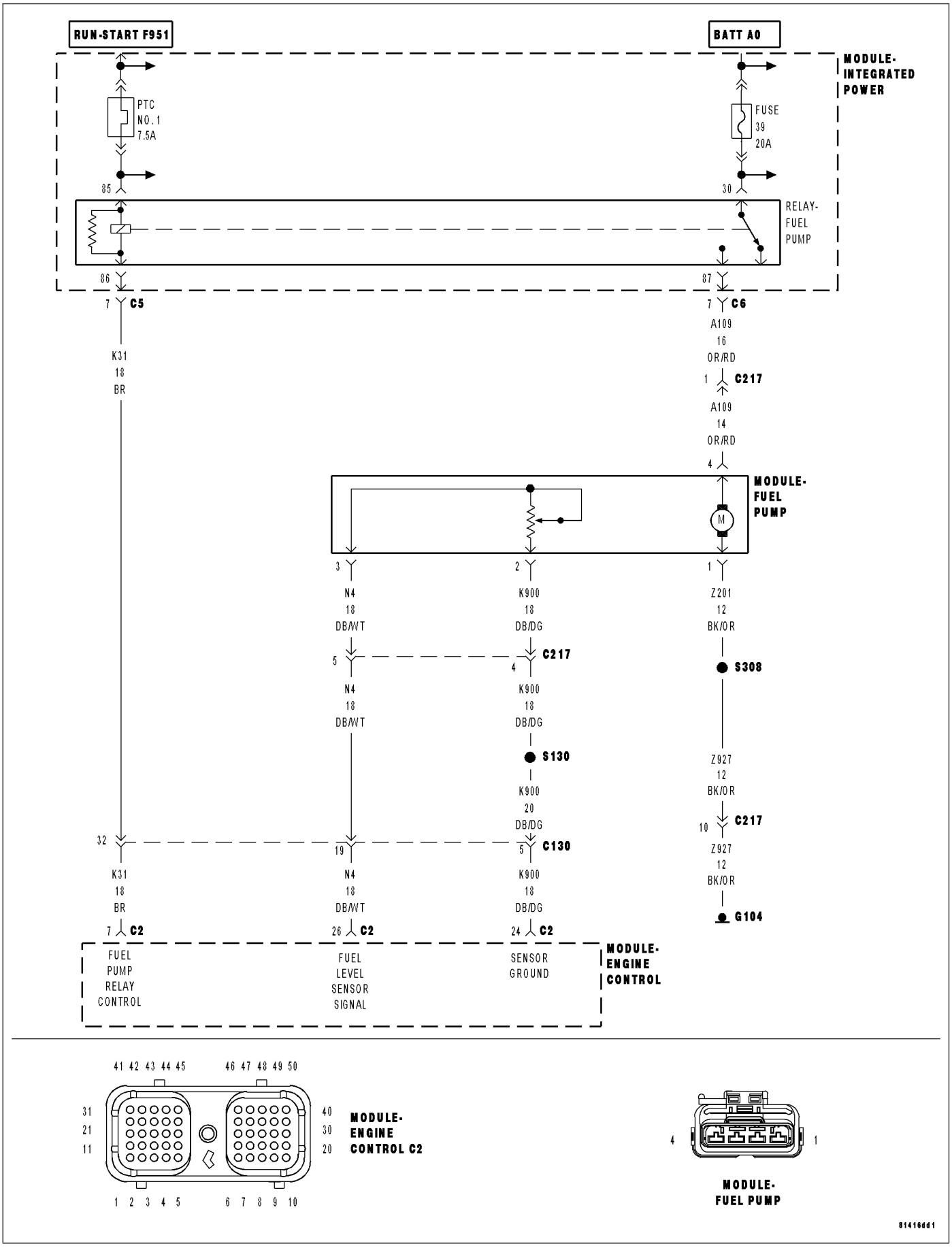
Visually inspect the inside of the fuel tank for obstructions.

Is the inside of the fuel tank damaged or obstructing the fuel level sensor?

Yes >> Test Complete.

No >> Replace the fuel tank.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0462-LOW VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR



P0462-LOW VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The signal voltage from the sensor falls below a calibrated value for a calibrated amount of time.

Possible Causes
FUEL LEVEL SENSOR
(N4) SIGNAL CIRCUIT OPEN
(N4) SIGNAL CIRCUIT SHORTED TO VOLTAGE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FUEL LEVEL SENSOR

Turn the ignition off.

Disconnect the Fuel Level Sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the sensor across the (N4) signal circuit and (K900) return circuit.

Is the resistance less than 10 ohms?

Yes >> Go To 2

No >> Replace the fuel level sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0462-LOW VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR (CONTINUED)

2. (G8) SIGNAL CIRCUIT OPEN

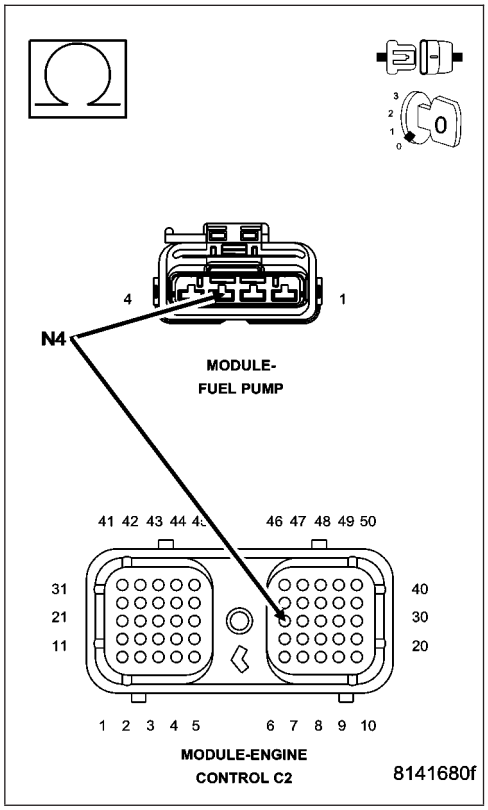
Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the (N4) signal circuit between the ECM harness connector and the sensor harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 3

No >> Repair the open (N4) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



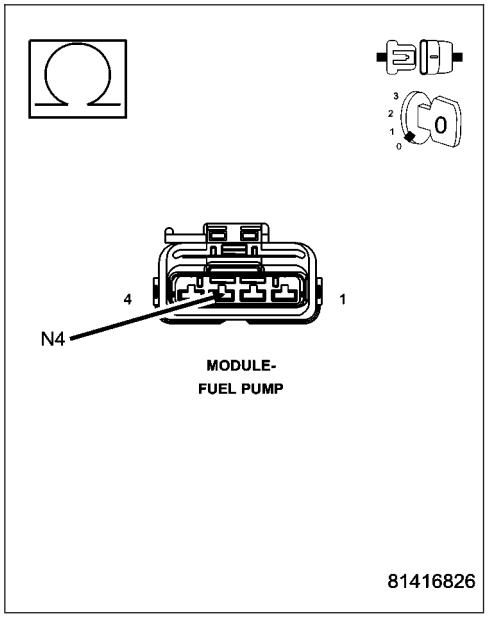
3. (G8) SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (N4) signal circuit and battery negative.

Is the voltage greater than 1 volt?

Yes >> Repair the (N4) signal circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0462-LOW VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR (CONTINUED)

4. ECM

Reconnect the ECM harness connector.

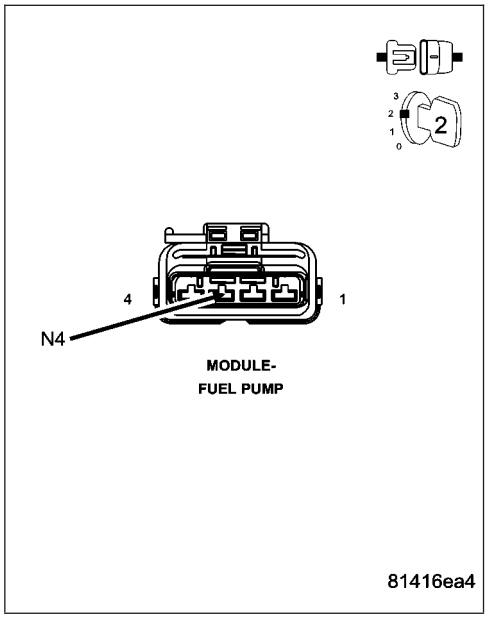
While monitoring with the scan tool, connect a jumper wire between the (N4) signal circuit in the sensor harness connector and battery negative.

Did the DTC P0463 set?

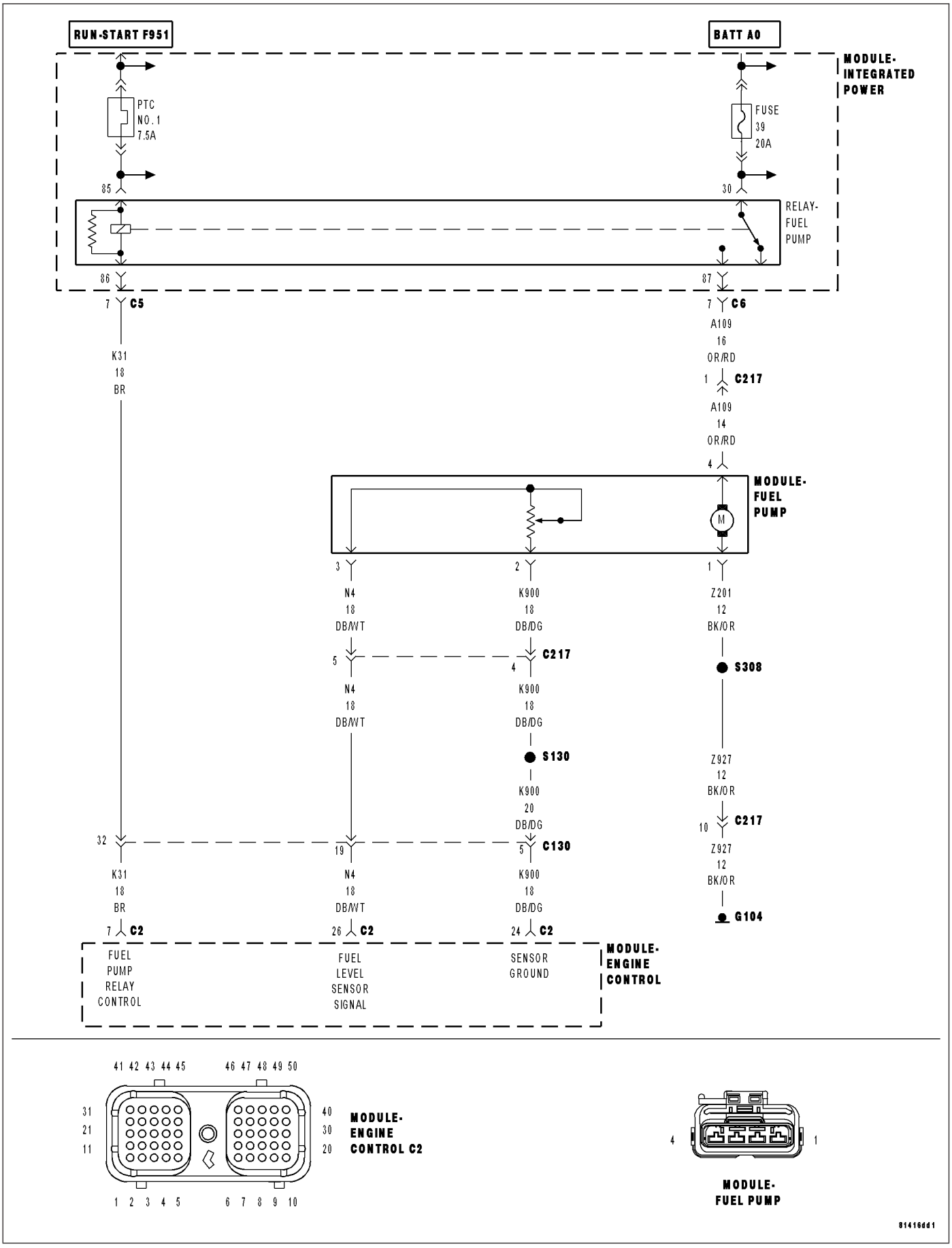
Yes >> Test Complete.

No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0463-HIGH VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR



P0463-HIGH VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The signal voltage from the sensor goes above a calibrated value for a calibrated amount of time.

Possible Causes
FUEL LEVEL SENSOR
(N4) SIGNAL CIRCUIT SHORTED TO GROUND
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FUEL LEVEL SENSOR

Disconnect the ECM harness connectors.

Disconnect the Fuel level sensor harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the Fuel level sensor across the (N4) signal circuit and (K900) return circuit.

Is the resistance less than 10 ohms?

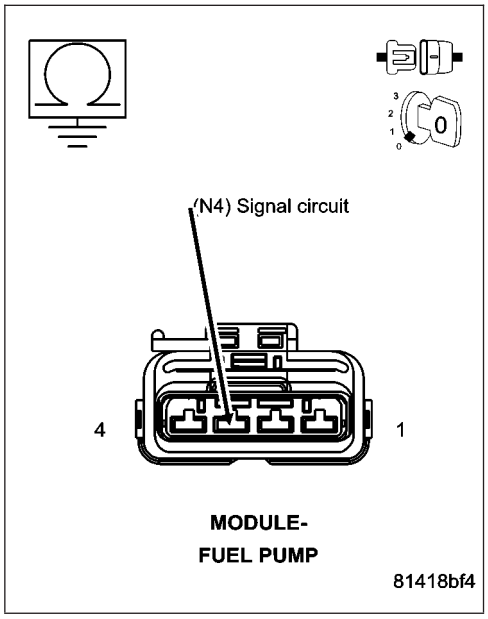
Yes >> Go To 2

No >> Replace the Fuel level sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0463-HIGH VOLTAGE DETECTED AT THE FUEL LEVEL SENSOR (CONTINUED)

2. (N4) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (N4) signal circuit in the sensor harness connector and battery negative.



Is the resistance less than 10 Ohms?

Yes >> Repair the (N4) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

3. ECM

Reconnect the ECM harness connector.

While monitoring with the scan tool, disconnect the Fuel level sensor harness connector.

Did the DTC P0462 set?

Yes >> Test Complete.

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0477-LOW VOLTAGE ON THE ENGINE BRAKE DRIVER

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the engine brake driver output does not match the signal from the engine brake driver feedback.

Possible Causes
WIRING HARNESS
ENGINE BRAKE DRIVER RELAY
FUSED B+ OPEN
ENGINE BRAKE DRIVER SIGNAL CIRCUIT OPEN
INTERMITTENT CONDITION
ENGINE BRAKE DRIVER SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY CLICKING

Turn the engine off (ignition on).

With the scan tool, actuate the exhaust brake relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. WIRING HARNESS

With the scan tool, actuate the exhaust brake relay.

While the relay is clicking, wiggle the wiring harness and connectors throughout the circuit.

Does this interrupt the clicking?

Yes >> Repair or replace the wiring harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0477-LOW VOLTAGE ON THE ENGINE BRAKE DRIVER (CONTINUED)

3. Engine Brake Driver Relay

Remove the Engine Brake Driver Relay.

Check connectors - Clean/repair as necessary.

Measure the resistance between terminals 86 and 85 of the engine brake relay.

Is the resistance less than 100 Ohms?

Yes >> Go To 4

No >> Replace the Engine Brake Driver Relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. FUSED B+ OPEN

Ignition on, engine not running.

Measure the voltage of the Fused B+ Supply circuit at the Engine Brake Relay.

Is the voltage within 10% of battery voltage?

Yes >> Go To 5

No >> Repair the open B+ circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. ENGINE BRAKE DRIVER SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the resistance of the Engine Brake Driver signal circuit between the Relay harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair the open Engine Brake driver circuit open from relay to ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. ENGINE BRAKE DRIVER SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Measure the resistance of the Engine Brake Driver signal circuit between the Relay connector and battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 7

No >> Repair Engine brake driver shorted to Battery negative.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0477-LOW VOLTAGE ON THE ENGINE BRAKE DRIVER (CONTINUED)

7. ECM

Reconnect the ECM harness connectors.

Using the scan tool, actuate the Engine Brake Driver Relay.

While monitoring with the scan tool, use a jumper wire to connect 12 volts to the relay signal circuit with the relay disconnected.

Did the DTC P0478?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0478-HIGH VOLTAGE ON THE ENGINE BRAKE DRIVER

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the engine brake driver output does not match the signal from the engine brake driver feedback.

Possible Causes
RELAY LOOSE
ENGINE BRAKE DRIVER CONTROL CIRCUIT SHORTED TO VOLTAGE
ENGINE BRAKE RELAY
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY

Ignition on, engine not running.

With the scan tool, actuate the Engine Brake Driver Relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. RELAY LOOSE

While the relay is clicking, wiggle the wiring harness and connectors.

Does this interrupt the clicking?

Yes >> Repair the loose connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0478-HIGH VOLTAGE ON THE ENGINE BRAKE DRIVER (CONTINUED)

3. Engine Brake Driver Control Circuit

Turn the ignition off.
Remove the Engine Brake Driver Relay.
Disconnect the ECM harness connectors.
Check connectors - Clean/repair as necessary.
Measure the voltage of the Engine Brake Driver Control Circuit between the relay terminal and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 4

No >> Repair Engine Brake Driver Control Circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. Engine brake relay

Measure the resistance between terminals 85 and 86 of the engine brake relay.

Is the resistance less than 10 ohms?

Yes >> Replace the engine brake relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. ECM

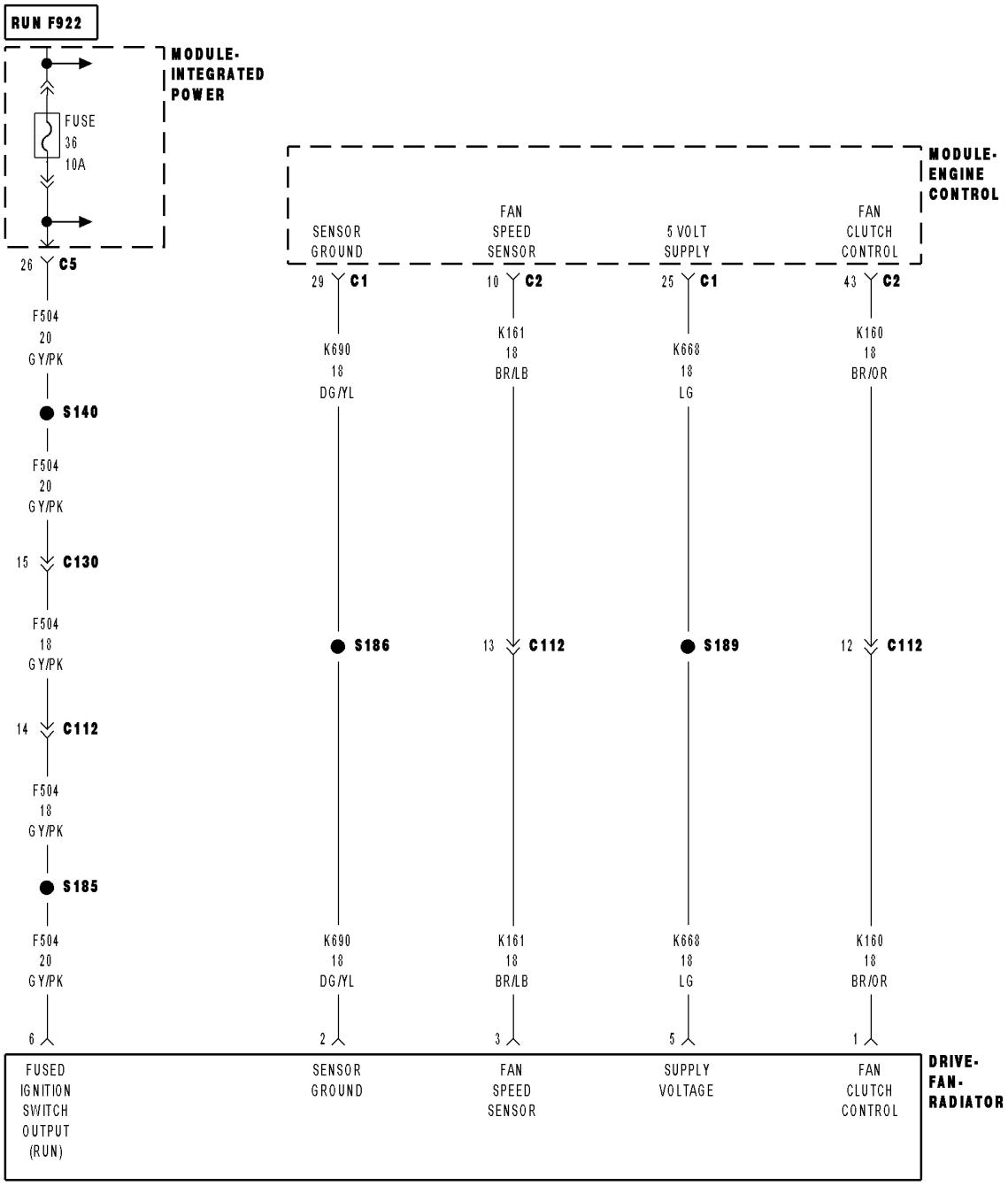
Reconnect the ECM harness connectors.
Reinstall the Engine Brake relay.
Ignition on, engine not running.
While monitoring with the scan tool, remove the Engine Brake Driver Relay.

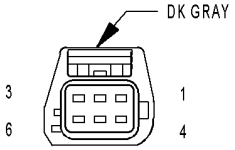
Did P0477 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

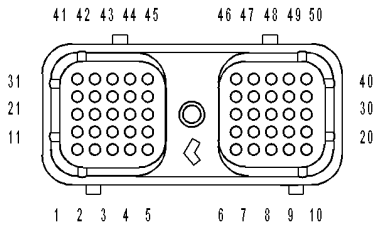
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0480-FAN CLUTCH





DRIVE-FAN-
RADIATOR
(DIESEL)



MODULE-ENGINE
CONTROL C2

814191a2

P0480-FAN CLUTCH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The PWM signal to the fan clutch does not match the PWM signal from the fan clutch.

Possible Causes
FAN CLUTCH
WIRE HARNESS DAMAGED
OPEN FAN CLUTCH (K160) DRIVER CIRCUIT
(K160) DRIVER CIRCUIT SHORTED TO (K690) RETURN CIRCUIT
(K160) DRIVER CIRCUIT SHORTED TO BATTERY NEGATIVE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FAN CLUTCH

Disconnect the fan clutch harness connector.

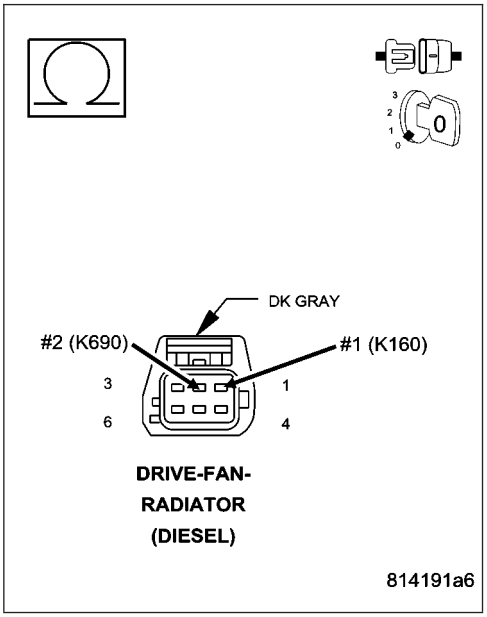
Check connectors - Clean/repair as necessary.

Measure the resistance between the fan clutch (K160) driver circuit and the fan speed (K690) sensor return circuit on the fan clutch assembly.

Is the resistance less than 10 Ohms?

Yes >> Replace the fan clutch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P0480-FAN CLUTCH (CONTINUED)

2. FAN CLUTCH

Disconnect the Fan Clutch harness connectors.

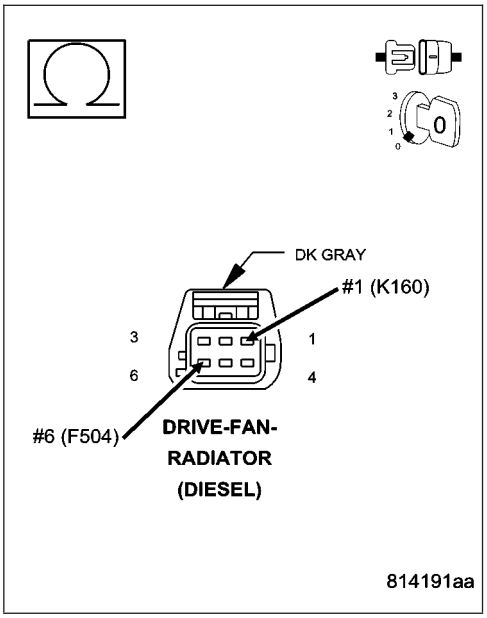
NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the fan clutch (K160) driver circuit and the fan clutch (F504) battery supply circuit on the fan clutch assembly.

Is the resistance less than 6 Ohms or greater than 10 Ohms?

Yes >> Replace the fan clutch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. OPEN FAN CLUTCH (K160) DRIVER CIRCUIT

Disconnect the ECM harness connectors.

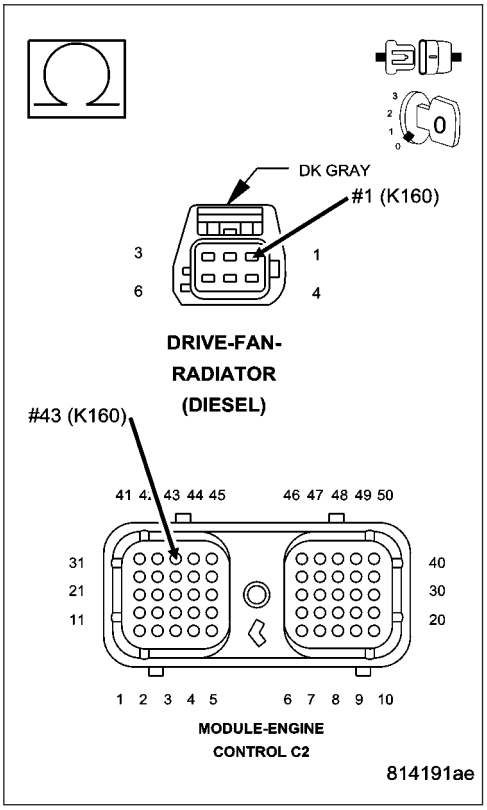
Check connectors - Clean/repair as necessary.

Measure the resistance of the fan clutch (K160) driver circuit between the ECM harness connector and the fan clutch harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 4

No >> Repair the open fan clutch (K160) river circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0480-FAN CLUTCH (CONTINUED)

4. (K160) DRIVER CIRCUIT SHORTED TO (K690) RETURN CIRCUIT

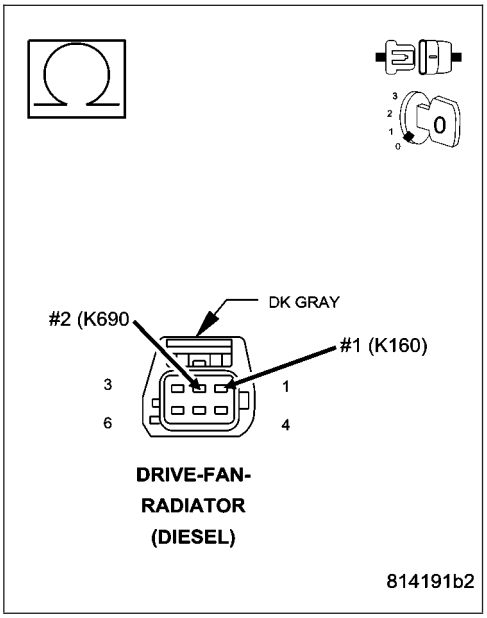
Measure the resistance between the fan clutch (K160) driver circuit and the fan speed sensor (K690) return circuit at the sensor harness connector.

Is the resistance greater than 100K Ohms?

Yes >> Go To 5

No >> Repair the (K160) Driver circuit shorted to (K690) Return circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. (K160) DRIVER CIRCUIT SHORTED TO BATTERY NEGATIVE

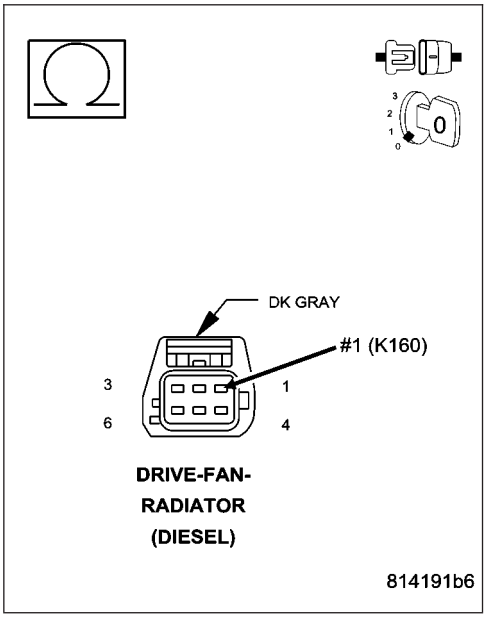
Measure the resistance between the fan clutch (K160) driver circuit and the battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 6

No >> Repair the (K160) Driver circuit shorted to battery negative.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0480-FAN CLUTCH (CONTINUED)

6. ECM

Reconnect the ECM harness connectors.

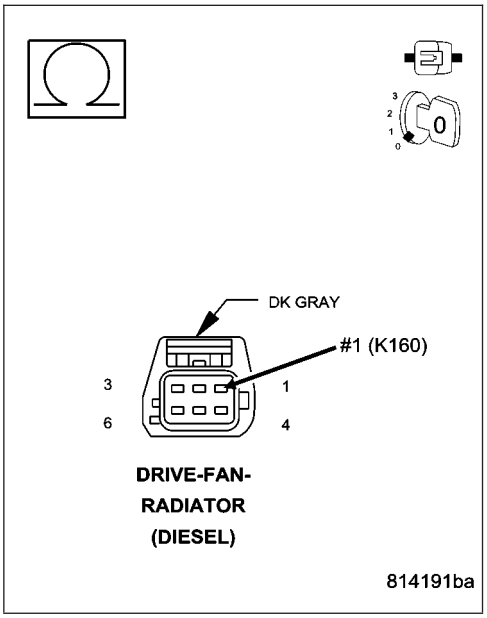
Measure the resistance of the fan clutch (K160) driver circuit between the fan clutch connector and battery negative.

Is the resistance greater than 100k Ohms?

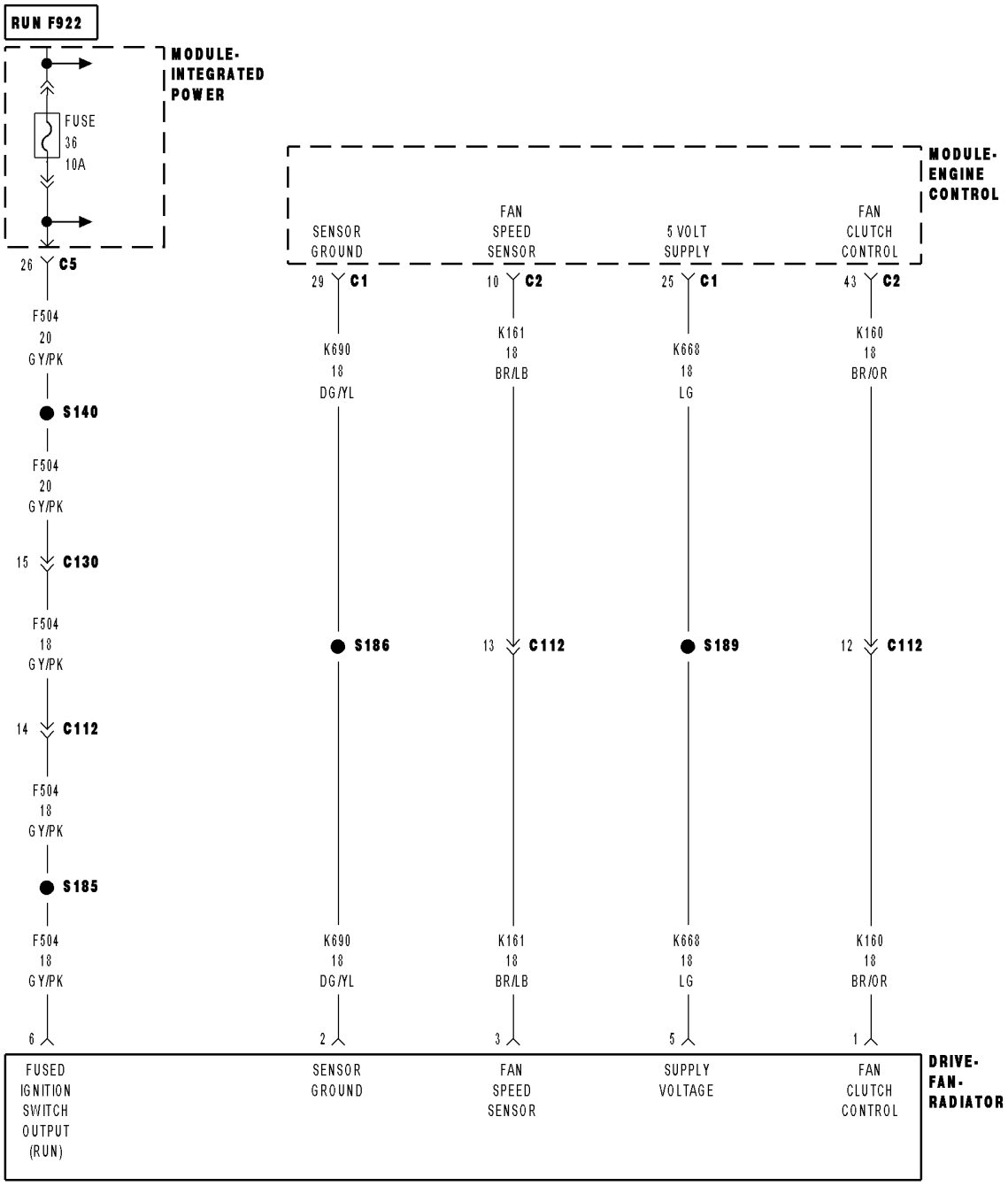
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

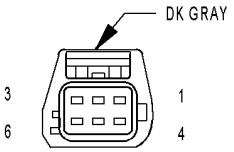
No >> replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

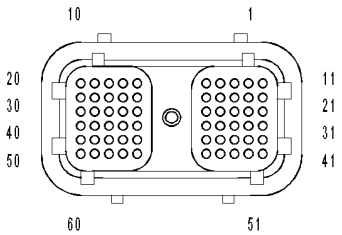


P0483-FAN SPEED

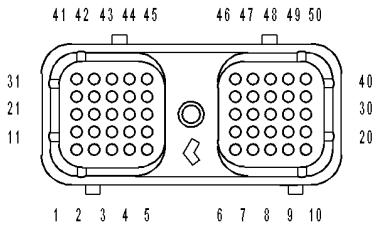




DRIVE-FAN-
RADIATOR
(DIESEL)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

8141d1d0

P0483-FAN SPEED (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The actual fan speed is less than 75 RPM or more than 4000 RPM.

Possible Causes
OTHER DTC'S
(K161) SIGNAL CIRCUIT SHORT TO (K668) 5-VOLT SUPPLY CIRCUIT
(K161) SIGNAL CIRCUIT OPEN FROM ECM TO FAN CLUTCH ASSEMBLY
(K668) 5-VOLT SUPPLY CKT OPEN FROM ECM HARNESS CONNECTOR TO FAN CLUTCH HARNESS CONNECTOR
INTERMITTENT CONDITION
(K161) SIGNAL CIRCUIT SHORTED TO (690) RETURN IN THE HARNESS
(K161) SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K161) SIGNAL CIRCUIT IN ECM SHORTED TO GROUND INSIDE ECM
(K161) SIGNAL CIRCUIT SHORTED TO VOLTAGE IN THE ECM
(K668) 5-VOLT SUPPLY CIRCUIT IN ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Is DTC P0480 present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. FAN CLUTCH SHORTED

Disconnect the wiring harness from the fan clutch assembly.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the signal circuit in the fan clutch assembly and the return circuit in the fan clutch assembly.

Is the resistance less than 10 Ohms?

Yes >> Replace the fan clutch assembly.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0483-FAN SPEED (CONTINUED)

3. FAN CLUTCH ASSEMBLEY SHORTED TO GROUND

Measure the resistance between the signal circuit in the fan clutch assembly and battery negative.

Is the resistance less than 10 Ohms?

Yes >> Replace the fan clutch assembly.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

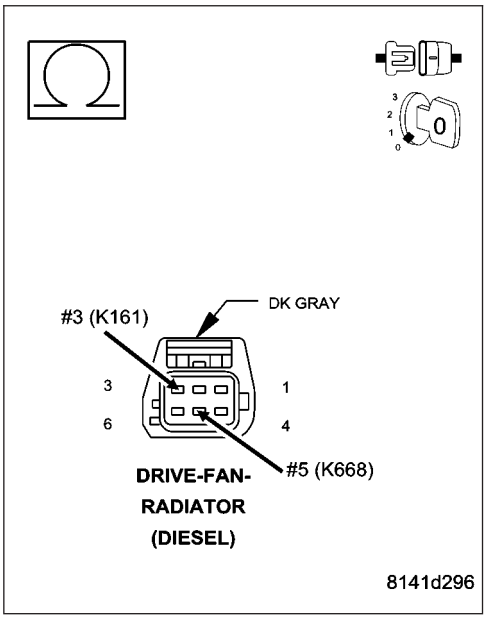
No >> Go To 4

---

4. (K161) SIGNAL CIRCUIT SHORT TO (K668) 5-VOLT SUPPLY CIRCUIT

Disconnect the Fan clutch connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the (K161) signal circuit in the fan clutch assembly and the battery (K668) 5-volt supply circuit in the fan clutch assembly.



Is the resistance less than 10 Ohms?

Yes >> Replace the Fan clutch assembly.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

P0483-FAN SPEED (CONTINUED)

5. (K161) SIGNAL CIRCUIT OPEN FROM ECM TO FAN CLUTCH ASSEMBLY

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

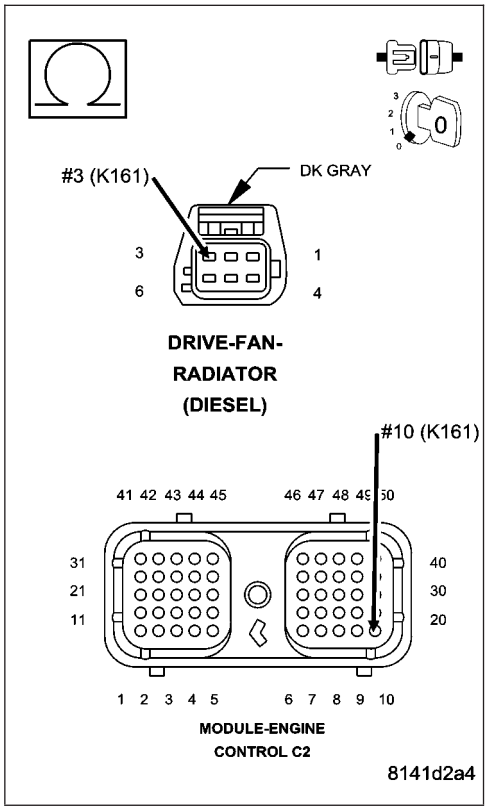
Measure the resistance of the (K161) signal circuit between the ECM harness connector and the fan clutch assembly harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair the open (K161) circuit from the ECM harness connector to the Fan clutch harness connector.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0483-FAN SPEED (CONTINUED)

6. (K668) 5-VOLT SUPPLY CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO FAN CLUTCH HARNESS

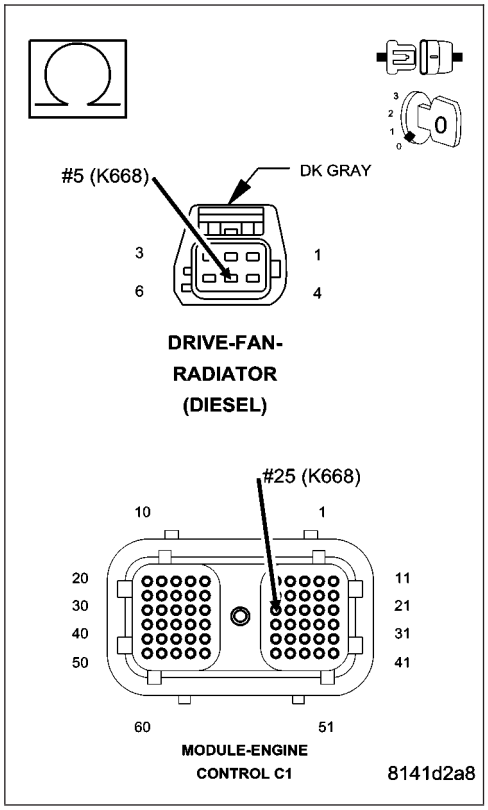
Measure the resistance of the (K668) 5-volt supply circuit between the ECM harness connector and the fan clutch assembly harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 7

No >> Repair the open (K668) circuit from ECM harness connector to Fan clutch connector.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



7. (K161) SIGNAL CIRCUIT SHORTED TO RETURN IN THE HARNESS

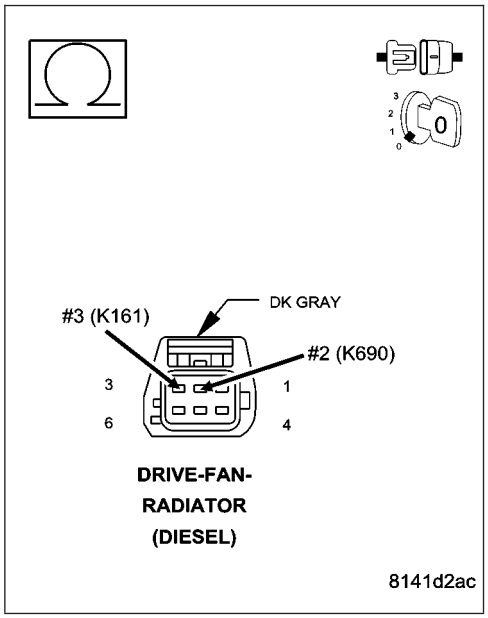
Measure the resistance between the (K161) signal circuit in the fan clutch assembly harness connector and the return circuit in the fan clutch assembly harness connector.

Is the resistance less than 10 Ohms?

Yes >> Repair the shorted (K161) circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8



P0483-FAN SPEED (CONTINUED)

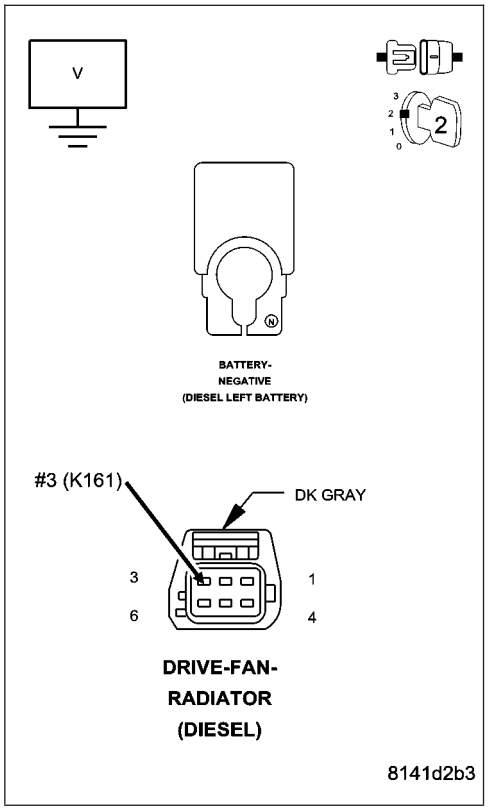
8. (K161) SIGNAL CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (K161) signal circuit in the fan clutch assembly harness connector and battery negative.

Is the voltage greater than 1 volt?

Yes >> Repair the (K161) signal circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 9



9. (K161) SIGNAL CIRCUIT IN ECM SHORTED TO GROUND INSIDE ECM

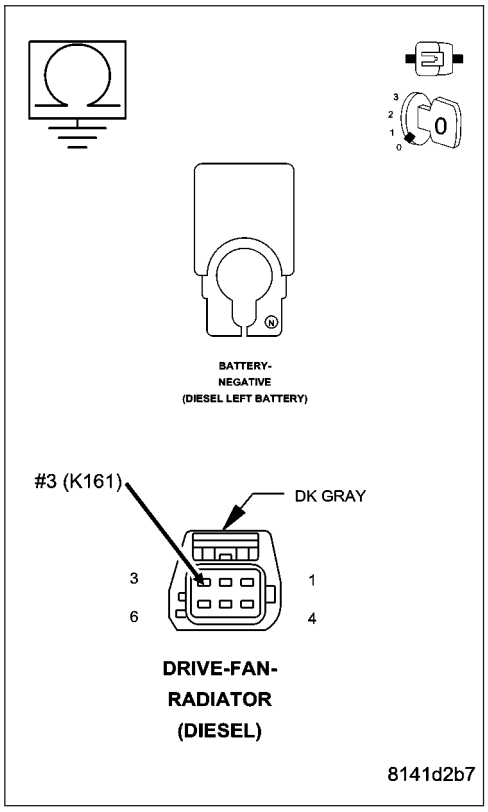
Reconnect the ECM harness connectors.

Measure the resistance between the (K161) signal circuit in the fan clutch assembly harness connector and battery negative.

Is the resistance less than 10 Ohms?

Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 10



P0483-FAN SPEED (CONTINUED)

10. (K161) SIGNAL CIRCUIT SHORTED TO VOLTAGE IN THE ECM

Reconnect the fan harness connector.

Turn the ignition on.

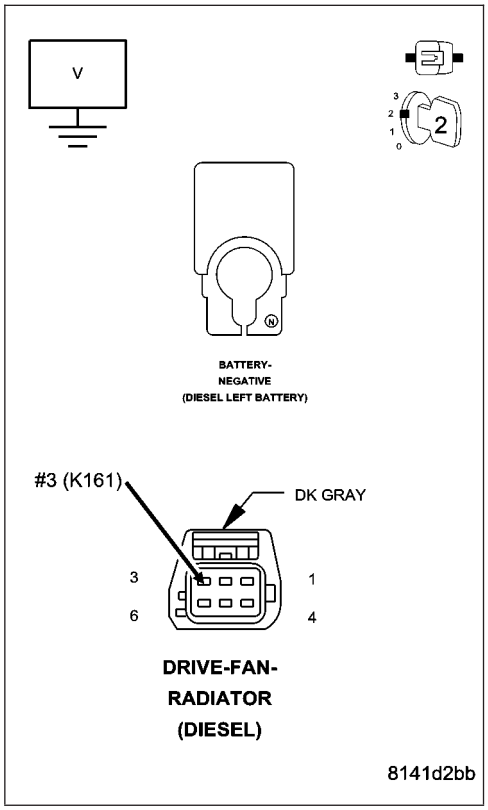
While back probing the fan connector measure the voltage between the fan speed (K161) signal circuit in the fan clutch assembly harness connector and battery negative while manually rotating the fan blade.

Did voltage go from less than 0.7 volts to 4.7 to 5.7 volts?

Yes >> Repair the Fan Speed (K161) Signal circuit in the engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 11



P0483-FAN SPEED (CONTINUED)

11. (K668) 5-VOLT SUPPLY CIRCUIT IN ECM

Turn the ignition on.

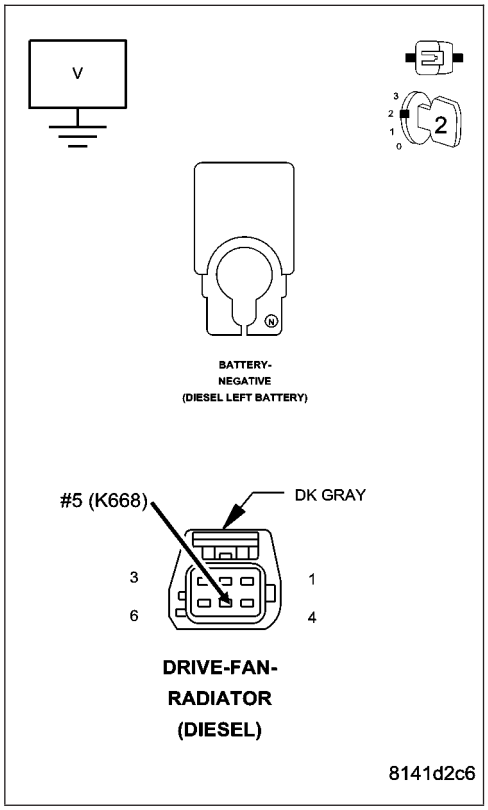
Measure the voltage between the (K668) 5-volt supply circuit in the fan clutch assembly harness connector and battery negative.

Is the voltage between 4.5 and 5.5 volts?

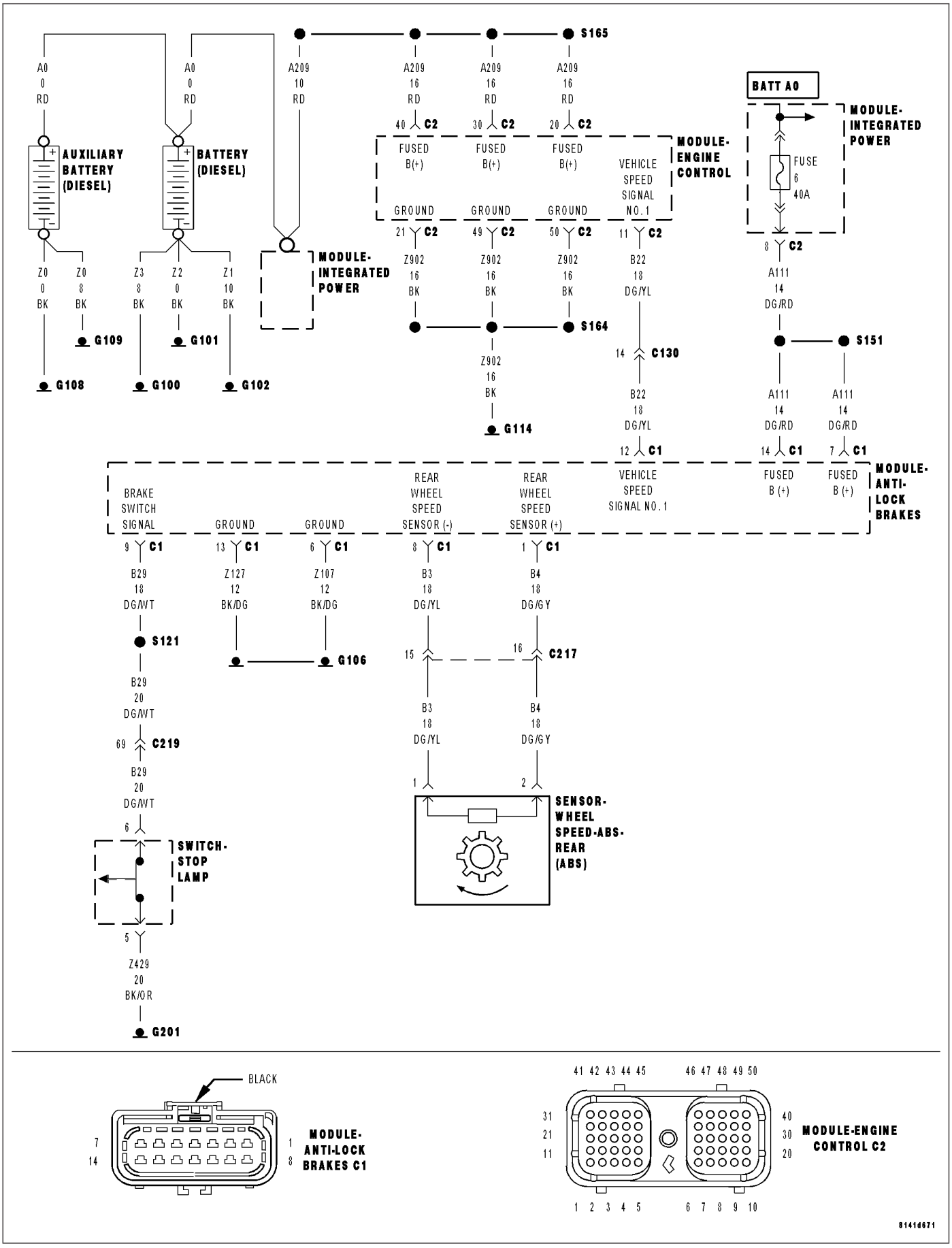
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0500-NO VEHICLE SPEED SENSOR SIGNAL



P0500-NO VEHICLE SPEED SENSOR SIGNAL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM indicates signals of motion; however, the VSS does not.

Possible Causes
VEHICLE SPEED (B22) SIGNAL CIRCUIT SHORTED TO VOLTAGE
VEHICLE SPEED (B22) SIGNAL CIRCUIT OPEN BETWEEN CAB AND ECM
VEHICLE SPEED (B22) SIGNAL CIRCUIT SHORTED TO GROUND
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VEHICLE SPEED SENSOR (B22) SIGNAL CIRCUIT SHORT TO VOLTAGE

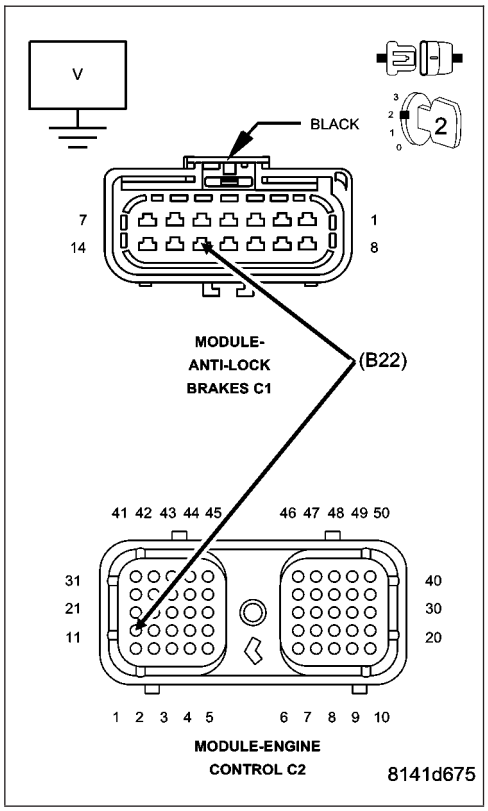
Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the ABS/RWAL Module harness connector.

Ignition on, engine not running.

Measure the voltage of the Vehicle Speed (B22) signal circuit in the ABS/RWAL or ECM harness connector.



Is the voltage above 4.9 volts?

Yes >> Repair the short to voltage in the Vehicle Speed (B22) Signal circuit between the CAB and ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0500-NO VEHICLE SPEED SENSOR SIGNAL (CONTINUED)

2. VEHICLE SPEED SENSOR (B22) SIGNAL CIRCUIT OPEN BETWEEN CAB AND ECM

Turn the ignition off.

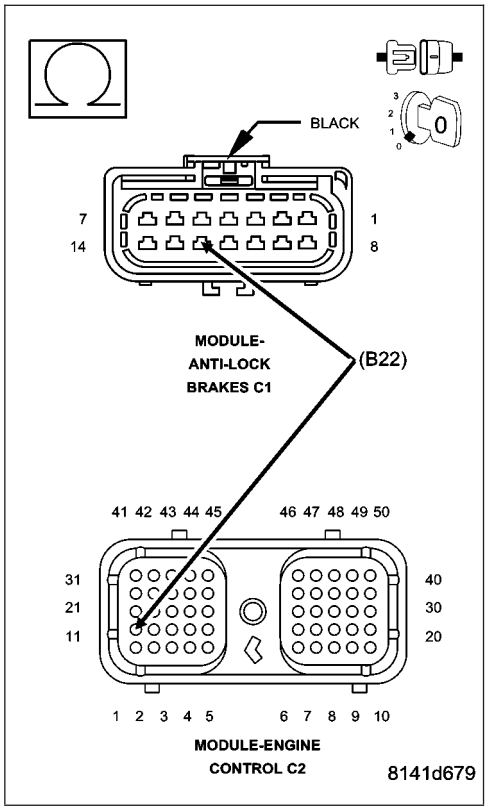
Measure the resistance of the Vehicle Speed (B22) signal circuit between the ECM harness connector and the ABS/RWAL harness connector.

Is the resistance above 5.0 ohms?

Yes >> Repair the open in the Vehicle Speed (B22) signal circuit between the CAB and ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. VEHICLE SPEED SENSOR (B22) SIGNAL CIRCUIT SHORT TO GROUND

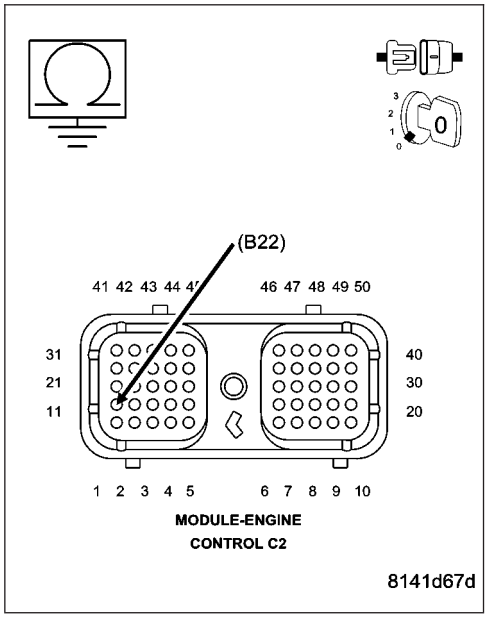
Measure the resistance between ground and the Vehicle Speed (B22) signal circuit at the ECM harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the Vehicle Speed (B22) signal circuit between the CAB and ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0500-NO VEHICLE SPEED SENSOR SIGNAL (CONTINUED)

4. **ECM**

NOTE: Before continuing, check the ECM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

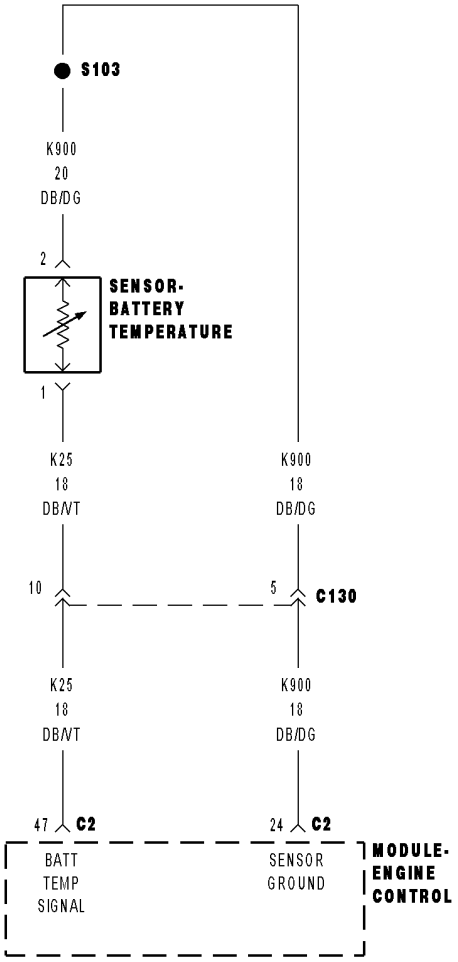
If there are no possible causes remaining, view repair.

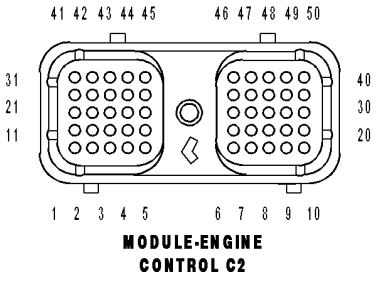
Repair

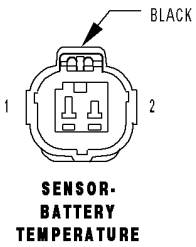
Replace and program the ECM per Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0514-BAT TEMPERATURE SENSOR RATIONALITY







8141d6b5

P0514-BAT TEMPERATURE SENSOR RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM does not read a change in value from the sensor over time.

Possible Causes
BATTERY TEMP SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. BATTERY TEMP SENSOR

Remove the temperature sensor and reconnect the wiring harness connector to the sensor.

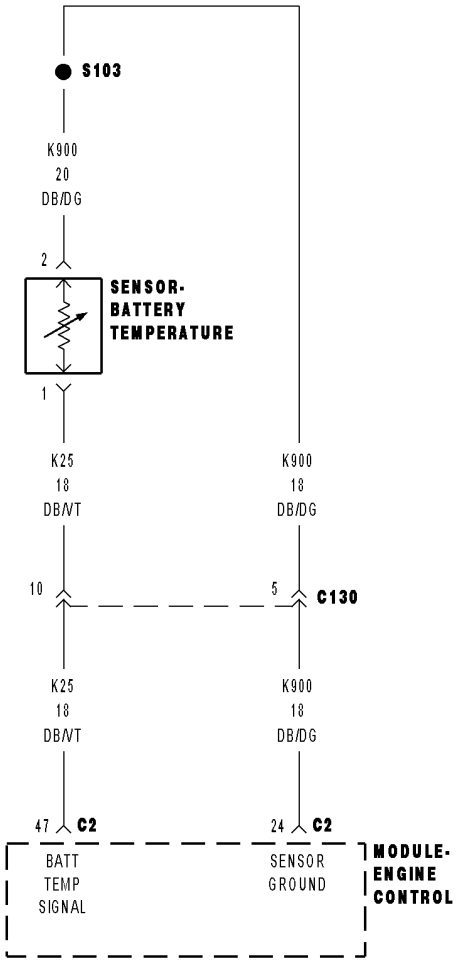
Monitor scan tool, while heating the sensor with an external heat source (DO NOT USE OPEN FLAME).

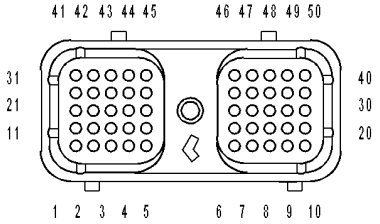
Does the reading from the sensor increase at least 5 degrees F. on the scan tool?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

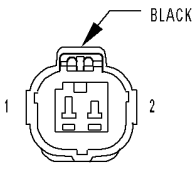
No >> Replace the battery temperature sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0516-LOW VOLTAGE AT THE BAT TEMP SENSOR





MODULE-ENGINE
CONTROL C2



SENSOR-
BATTERY
TEMPERATURE

8141d6bc

P0516-LOW VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
BATTERY TEMP SENSOR
(K25) SIGNAL CIRCUIT SHORTED TO GROUND
(K25) SIGNAL CIRCUIT SHORTED
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. BATTERY TEMP SENSOR

Turn the ignition off.

Disconnect the Battery temp sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance of the Battery temp sensor.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the battery temp sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0516-LOW VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

2. (K25) SIGNAL CIRCUIT SHORTED TO GROUND

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

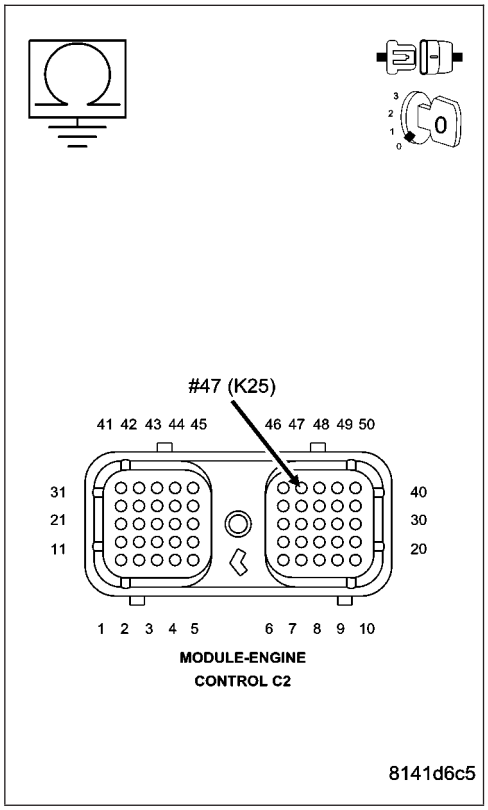
Measure the resistance between the engine ground and the temperature sensor (K25) signal circuit at the sensor connector.

Is the resistance more than 100 k ohms?

Yes >> Go To 3

No >> Repair the Battery temp sensor (K25)signal circuit shorted to ground.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. (K25) SIGNAL CIRCUIT SHORTED

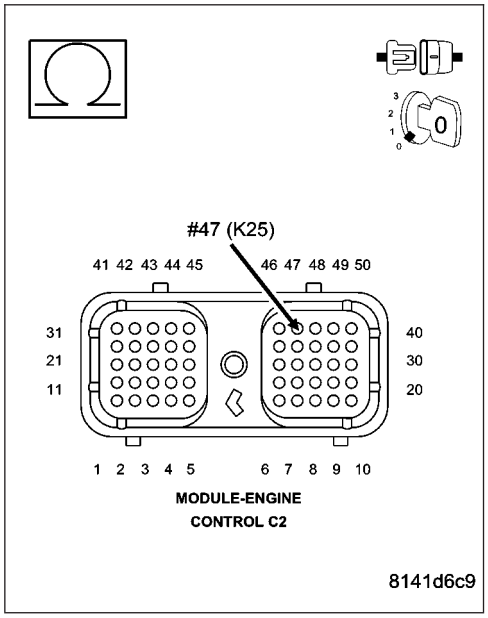
Measure the resistance between the Battery temp sensor (K25) signal circuit and all other circuits in the ECM harness connector of the engine harness.

Is the resistance more than 100k ohms?

Yes >> Go To 4

No >> Repair the (K25) signal circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0516-LOW VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

4. INTERMITTENT CONDITION

Reconnect the disconnected Battery temp sensor harness connector.

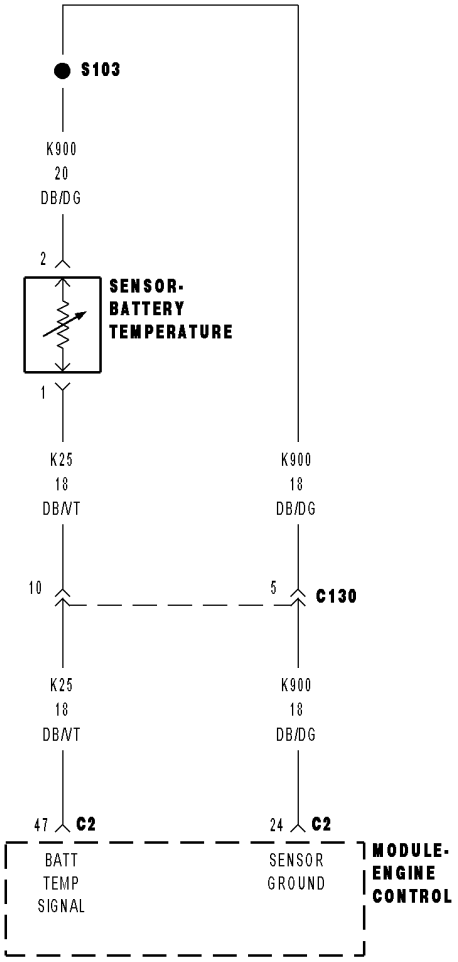
While monitoring with scan tool, disconnect the temperature sensor harness connector.

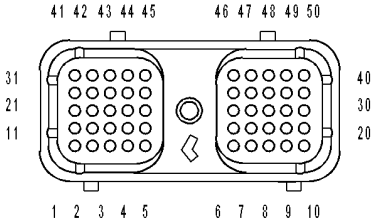
Did P0517 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

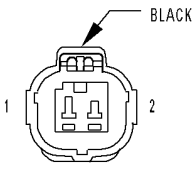
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR





MODULE-ENGINE
CONTROL C2



SENSOR-
BATTERY
TEMPERATURE

8141d6bc

P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
BATTERY TEMP SENSOR
(K25) SIGNAL CIRCUIT OPEN
(K900) RETURN CIRCUIT OPEN
(K25) SIGNAL CIRCUIT SHORTED
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. BATTERY TEMP SENSOR

Disconnect the Battery temp sensor harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance of the Battery temp sensor

Is the resistance between 300 and 90k ohms?

Yes >> Go To 2

No >> Replace the Battery temp sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

2. OPEN CIRCUIT

Reconnect the disconnected Battery temp sensor harness connector.

Disconnect the ECM harness connectors.

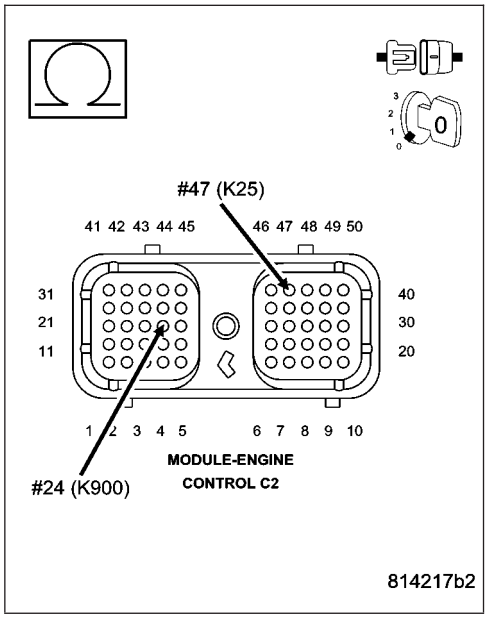
Check connectors - Clean/repair as necessary.

Measure the resistance between the temperature sensor (K25) signal and (K900) return circuits at the ECM harness connector.

Is the resistance between 300 and 90k ohms?

Yes >> Go To 5

No >> Go To 3



3. (K25) SIGNAL CIRCUIT OPEN

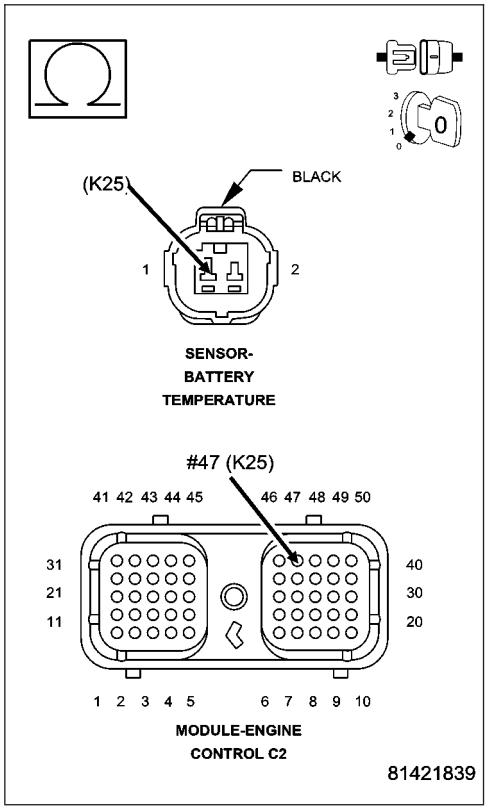
Disconnect the Battery temp sensor harness connector.

Measure the resistance of the sensor (K25) signal circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 4

No >> Repair the open (K25) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

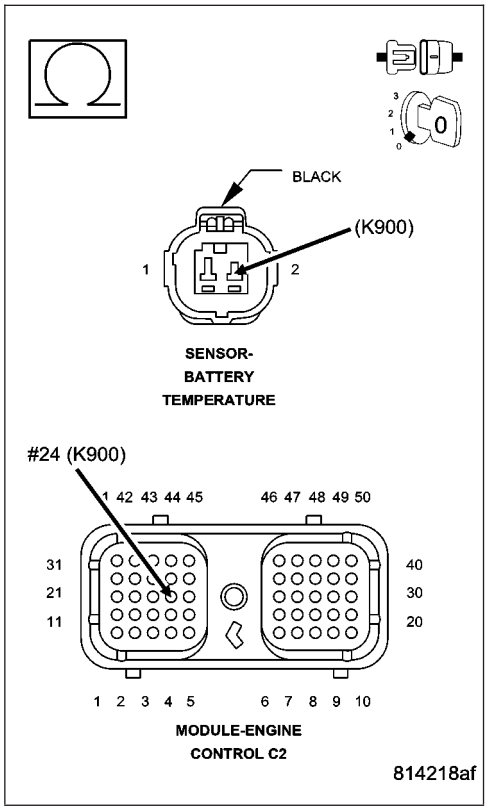
4. (K900) RETURN CIRCUIT OPEN

Measure the resistance of the sensor (K900) return circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open (K900) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



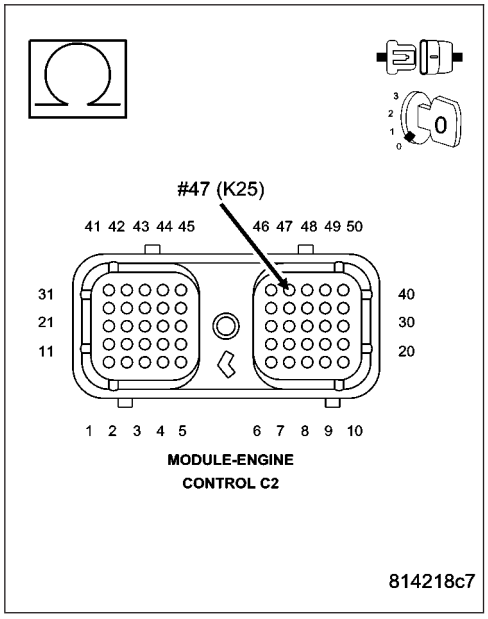
5. (K25) SIGNAL CIRCUIT SHORTED

Check for a short circuit from (K25) signal circuit to all other circuits at the ECM harness connector.

Is the resistance more than 100k ohms?

Yes >> Go To 6

No >> Repair the shorted (K25) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0517-HIGH VOLTAGE AT THE BAT TEMP SENSOR (CONTINUED)

6. ECM

Reconnect the ECM harness connectors.

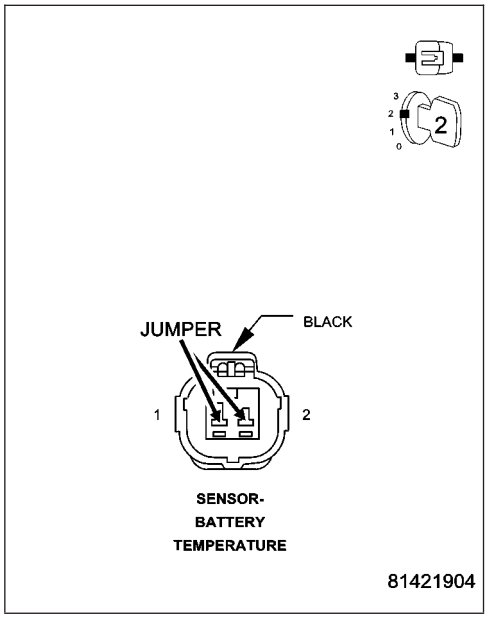
While monitoring with the scan tool, use a jumper wire and connect the sensor (K25) signal circuit to the sensor (K900) return circuit at the sensor harness connector.

Did P0516 set?

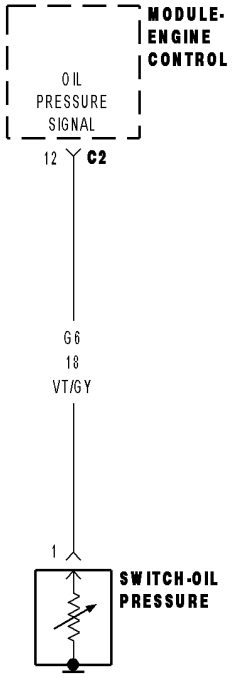
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

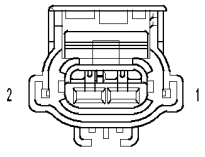
No >> Replace the ECM.

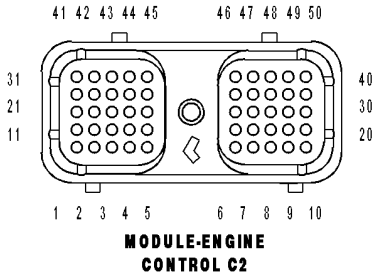
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0521-OIL PRESSURE SWITCH RATIONALITY







81427838

P0521-OIL PRESSURE SWITCH RATIONALITY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  Oil pressure is detected with engine RPM = 0 for 30 seconds.

Possible Causes
OIL PRESSURE SWITCH
(G6) SIGNAL CIRCUIT OPEN
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OIL PRESSURE SWITCH

Turn the ignition off.

Disconnect the Oil pressure switch harness connector.

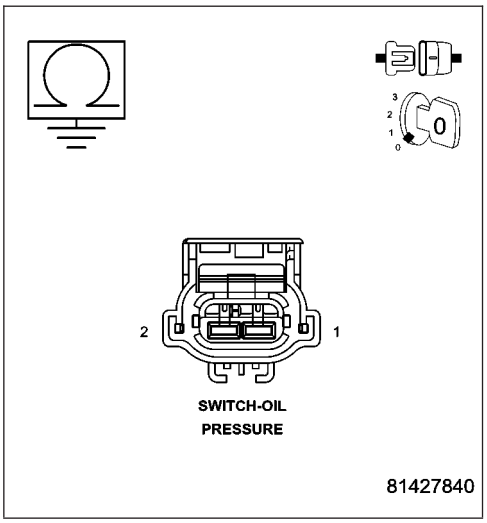
Check connectors - Clean/repair as necessary.

Measure the resistance between the oil pressure switch terminal and ground.

Is the resistance less than 10 ohms?

Yes >> Go To 2

No >> Replace the oil pressure switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



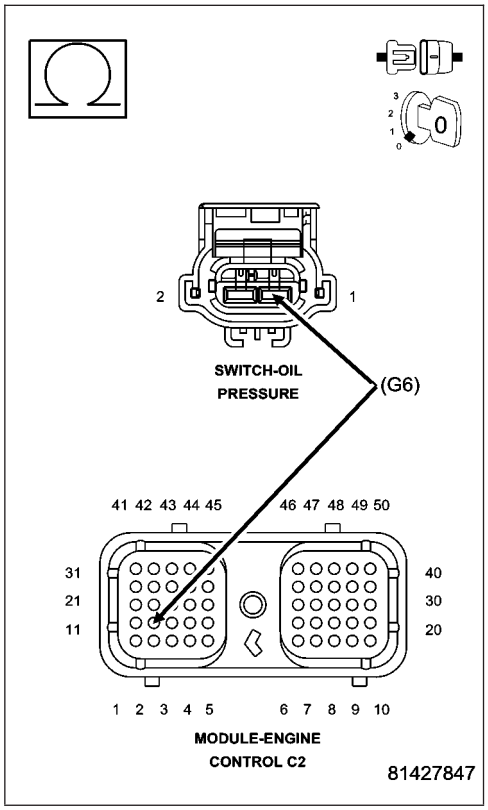
P0521-OIL PRESSURE SWITCH RATIONALITY (CONTINUED)

2. (G6) SIGNAL CIRCUIT OPEN

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the resistance of the oil pressure switch (G6) signal circuit between the oil pressure switch harness connector and the ECM harness connector.



Is the resistance less than 10 ohms?

Yes >> Go To 3

No >> Repair the open Oil pressure (G6) signal circuit.

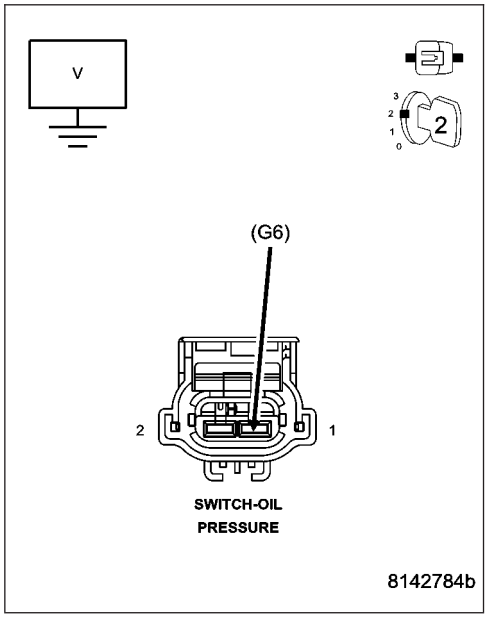
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

3. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

Measure the voltage between the oil pressure (G6) signal circuit at the oil pressure switch harness connector and ground.



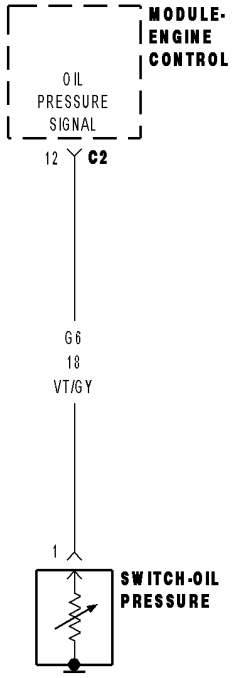
Is the voltage between 4.5 and 5.5 volts?

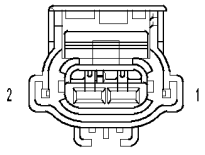
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

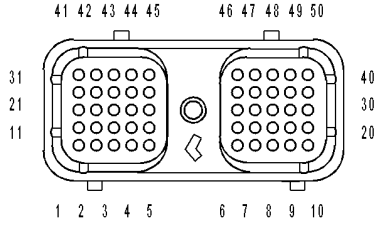
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0524-OIL PRESSURE TOO LOW





SWITCH-OIL
PRESSURE



MODULE-ENGINE
CONTROL C2

81427838

P0524-OIL PRESSURE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The oil pressure detected by the ECM is less than a calibrated value.

Possible Causes
LOW OIL LEVEL
(G6) SIGNAL CIRCUIT SHORT TO GROUND
OIL PRESSURE SWITCH
INTERNAL ENGINE DAMAGE

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LOW OIL LEVEL

Check the engine oil level.

Is the engine oil in the safe operating range?

Yes >> Go To 2

No >> Repair any condition that may cause the oil level to be above or below the safe operating range.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. SIGNAL CIRCUIT SHORT TO GROUND

With the scan tool, erase DTCs.
Turn the ignition off.
Disconnect the oil pressure switch harness connector.
Turn the ignition on for 1 minute.

Did DTC P0521 set?

Yes >> Go To 3

No >> Repair the (G6) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0524-OIL PRESSURE TOO LOW (CONTINUED)

3. OIL PRESSURE SWITCH

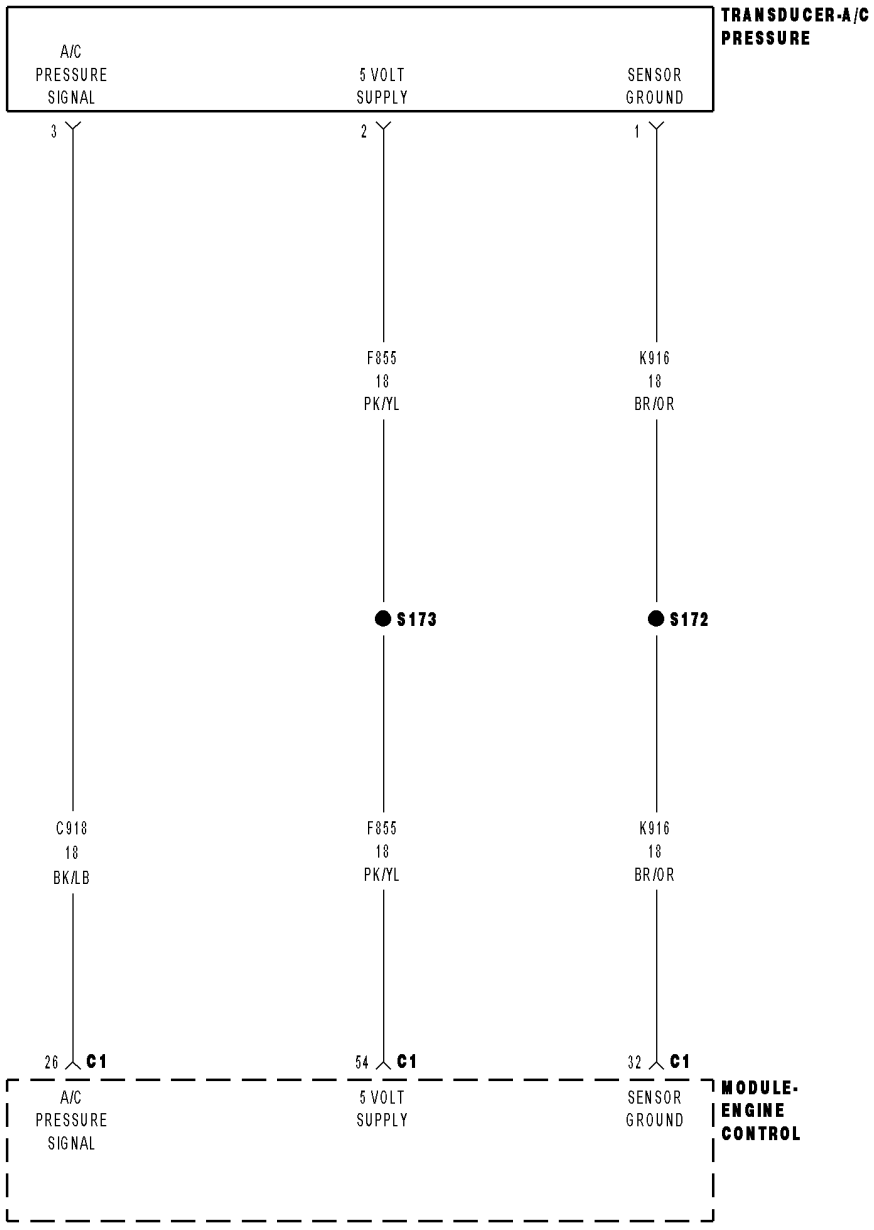
Measure the engine oil pressure with a mechanical gauge.

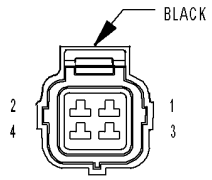
Is the oil pressure within the acceptable operating range?

Yes >> Replace the oil pressure switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

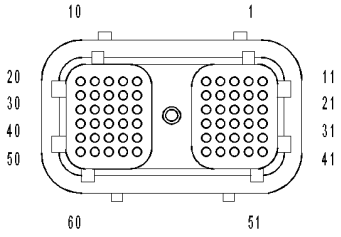
No >> Repair internal engine damage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0532-A/C SENDING UNIT VOLTS TOO LOW





TRANSDUCER-A/C PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1

81427c48

P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM falls below a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
A/C PRESSURE SENSOR
(C918) SIGNAL CIRCUIT SHORTED TO (K55) RETURN CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K55) RETURN CIRCUIT
(C918) SIGNAL CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO A/C HARNESS CONNECTOR
(F855) 5-VOLT SUPPLY CIRCUIT OPEN FROM ECM HARNESS TO A/C HARNESS CONNECTORS
(C918) SIGNAL CIRCUIT SHORTED TO GROUND
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.
With the scan tool, read DTCs.

Are other DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

2. HARNESS OPEN

Disconnect the A/C pressure sending unit harness connector.

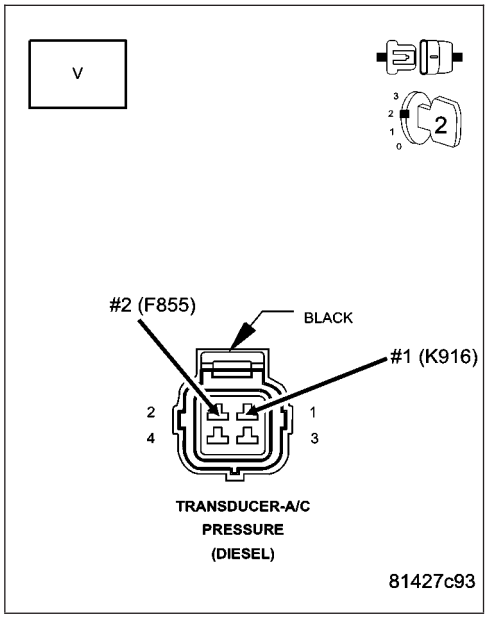
Check connectors - Clean/repair as necessary.

Measure the voltage between the (F855) 5-volt supply and (K916) return circuits of the sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

No >> Go To 4



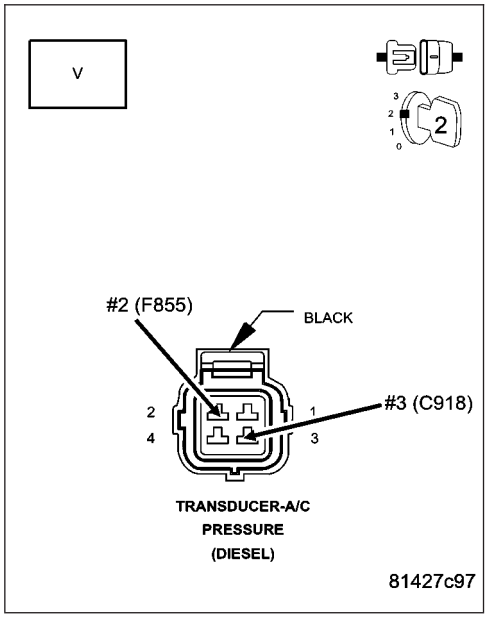
3. A/C PRESSURE SENSOR

While monitoring scan tool, use a jumper wire to connect the (F855) 5-volt supply circuit to the (C918) signal circuit at the sensor harness connector.

Did P0533 set?

Yes >> Replace the A/C pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

4. (C918) SIGNAL CIRCUIT SHORTED TO THE (K916) RETURN CIRCUIT

Turn the ignition off.

Disconnect the ECM harness connectors.

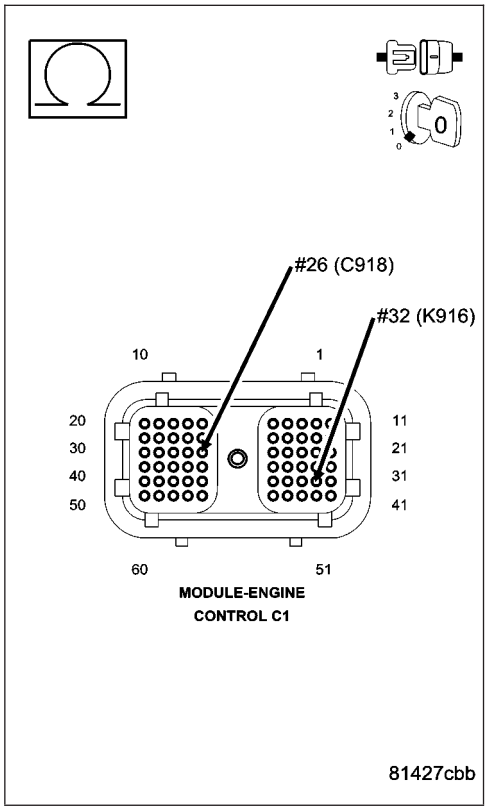
Measure the resistance between the (C918) signal circuit and (K916) return circuit in the sensor harness connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 5

No >> Repair the (C918) signal circuit shorted to the (K916) return circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO THE (K916) RETURN CIRCUIT

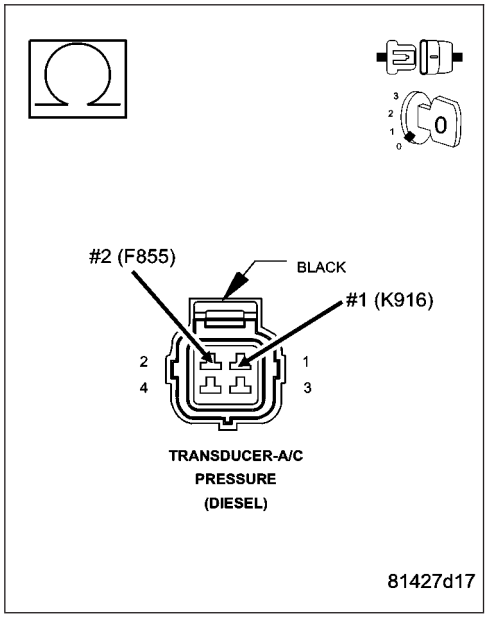
Measure the resistance between the (F855) 5-volt supply circuit and (K916) return circuit in the sensor harness connector.

Is the resistance greater than 100k Ohms?

Yes >> Go To 6

No >> Repair the (F855) 5-volt supply circuit shorted to the (K916) return circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

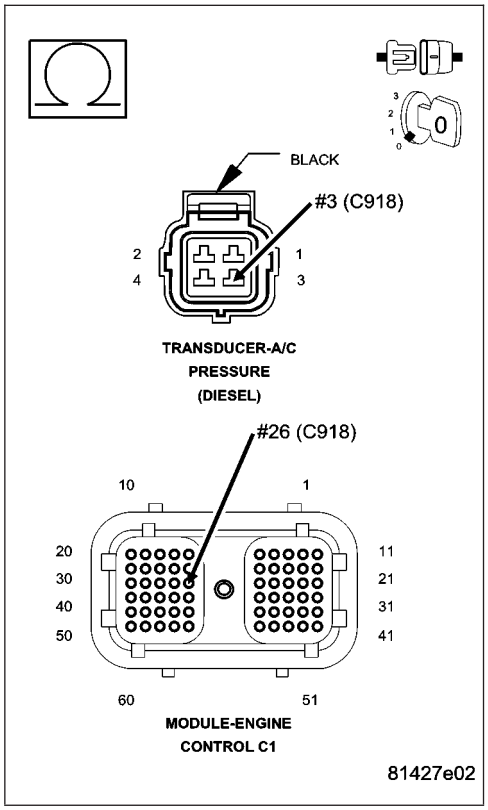
6. (C918) SIGNAL CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO A/C HARNESS CONNECTOR

Measure the resistance of the (C918) signal circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 7

No >> Repair the open (C918) signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



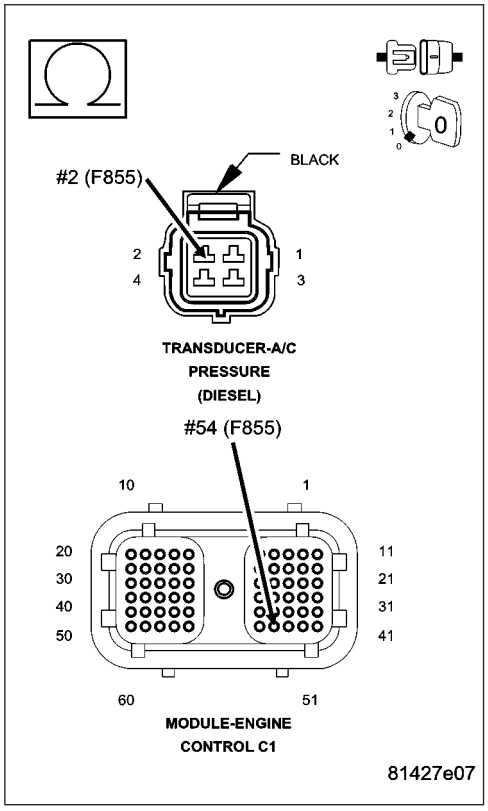
7. (F855) 5-VOLT SUPPLY CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO A/C HARNESS CONN

Measure the resistance of the (F855) 5-volt supply circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair the open (F855) 5-volt supply circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

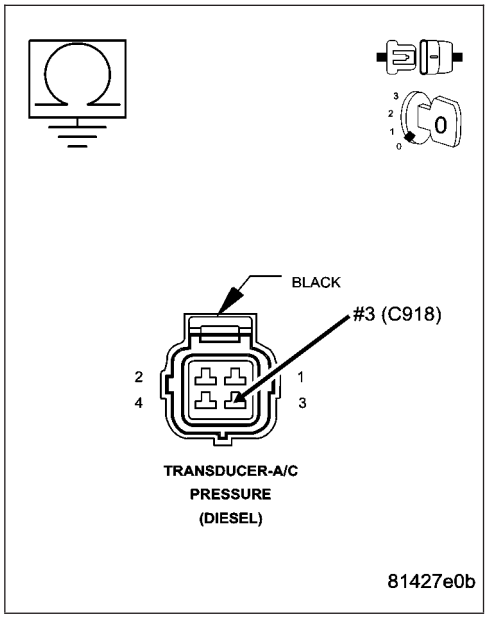
8. (C918) SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (C918) signal circuit in the sensor harness connector and battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 9

No >> Repair the (C918) signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



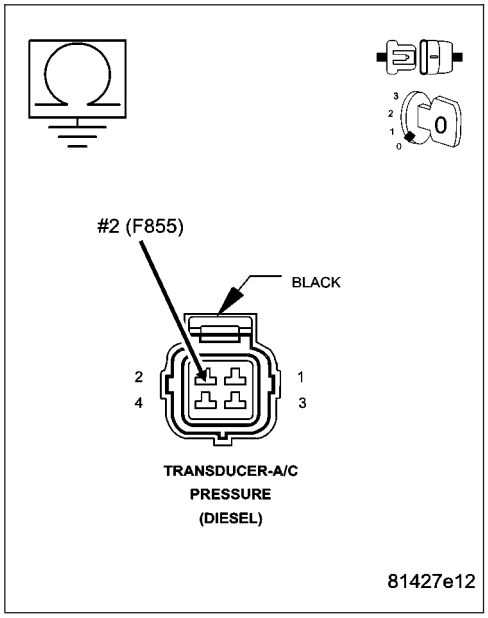
9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (F855) 5-volt supply circuit in the sensor harness connector and battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 10

No >> Repair the (F855) 5-volt supply circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0532-A/C SENDING UNIT VOLTS TOO LOW (CONTINUED)

10. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

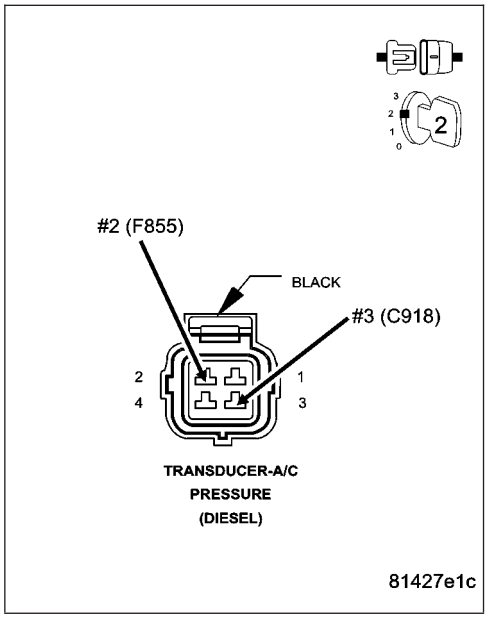
While monitoring scan tool, use a jumper wire to connect the (F855) 5-volt supply circuit with the (C918) signal circuit at the sensor harness connector.

Did DTC P0533 set?

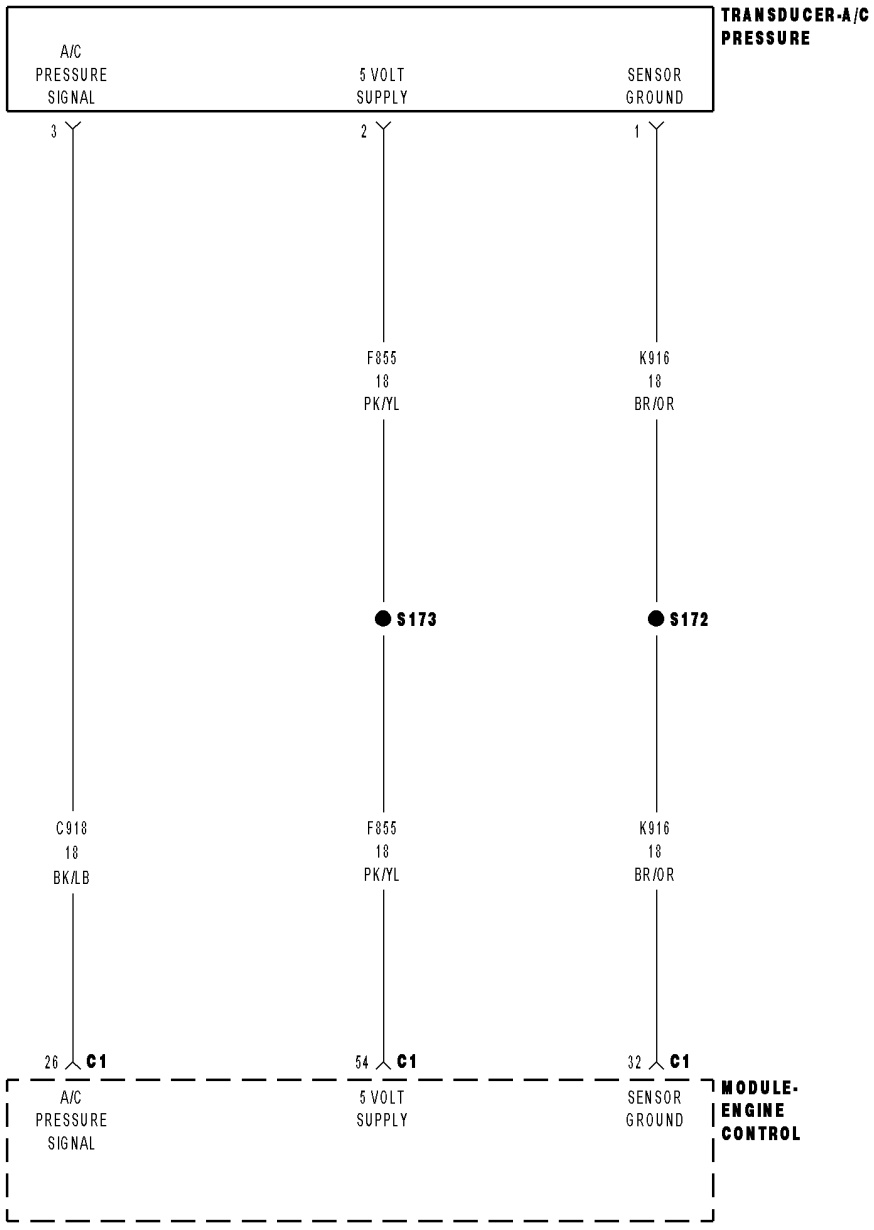
Yes >> Test Complete.

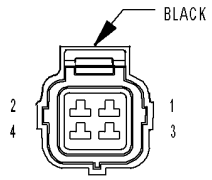
No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

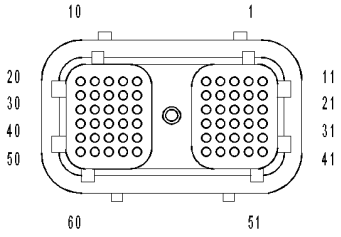


P0533-A/C SENDING UNIT VOLTS TOO HIGH





TRANSDUCER-A/C PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1

81427c48

P0533-A/C SENDING UNIT VOLTS TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The circuit voltage to the ECM is above a calibrated threshold for a certain period of time.

Possible Causes
OTHER DTC'S
A/C PRESSURE SENSOR
(C918) SIGNAL CIRCUIT SHORTED TO BATTERY POSITIVE
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY POSITIVE
(K916) RETURN CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO A/C HARNESS CONNECTOR
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

Turn the ignition on.
With the scan tool, read DTCs.

Are other DTC's present?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0533-A/C SENDING UNIT VOLTS TOO HIGH (CONTINUED)

2. HARNESS OPEN

Turn the ignition off.

Disconnect the A/C pressure sensing unit harness connector.

Check connectors - Clean/repair as necessary.

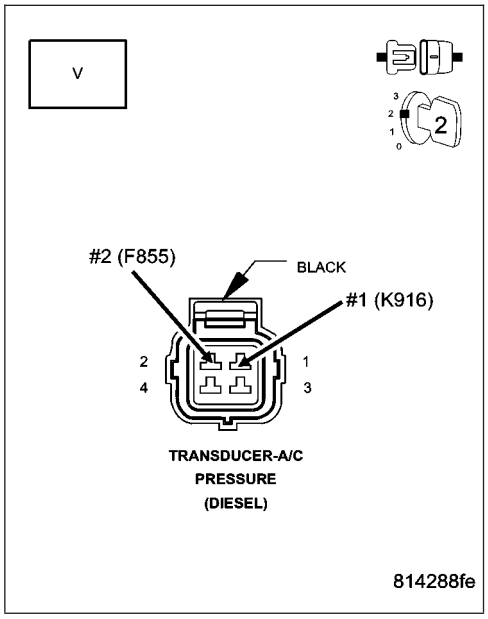
Turn the ignition on.

Measure the voltage between the (F855) 5-volt supply circuit and (K916) return circuit of the sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 3

No >> Go To 4



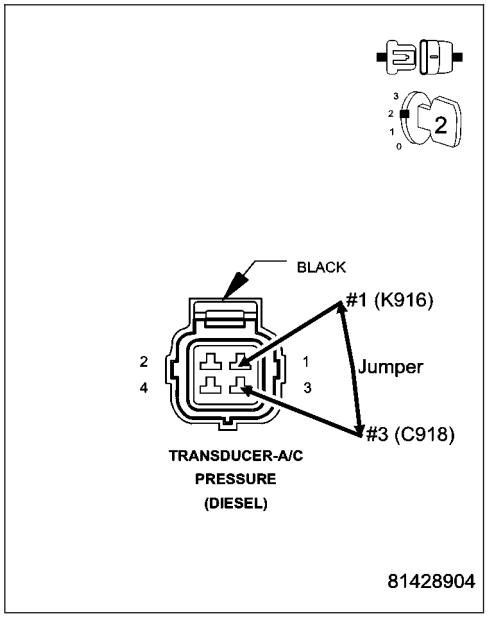
3. A/C PRESSURE SENSOR

While monitoring scan tool, use a jumper wire to connect the (K916) return circuit to the (C918) signal circuit at the sensor harness connector.

Did P0532 set?

Yes >> Replace the A/C pressure sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0533-A/C SENDING UNIT VOLTS TOO HIGH (CONTINUED)

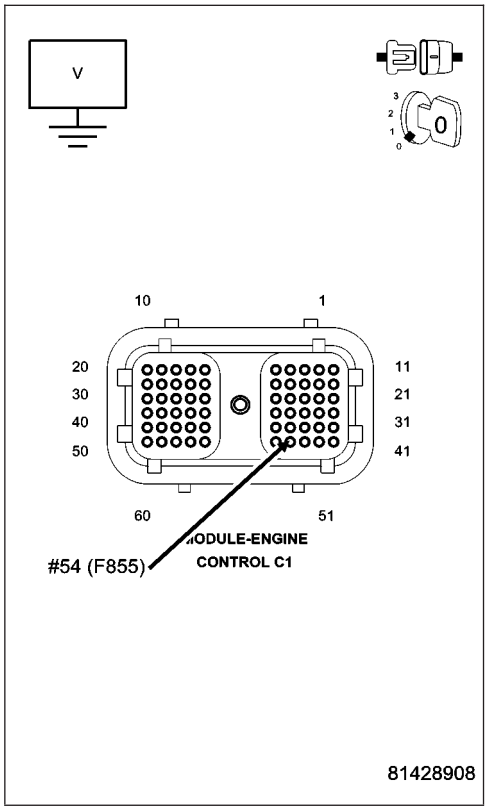
4. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY NEGATIVE

Turn the ignition off.

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the voltage between the (F855) 5-volt supply circuit at the harness connector and battery negative.



Is the voltage less than 1 volt?

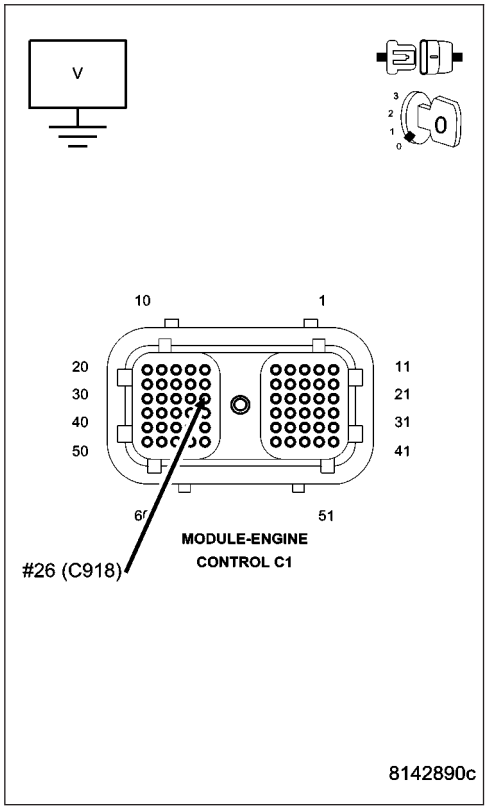
Yes >> Go To 5

No >> Repair the (F855) 5-volt supply circuit shorted to the battery negative.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

5. (C918) SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Measure the voltage between the (C918) signal circuit at the harness connector and battery negative.



Is the voltage less than 1 volt?

Yes >> Go To 6

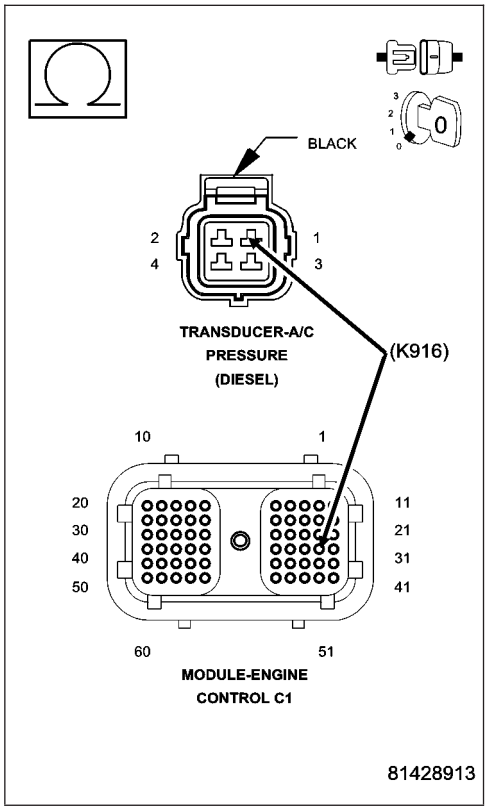
No >> Repair the (C918) signal circuit shorted to the battery negative.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0533-A/C SENDING UNIT VOLTS TOO HIGH (CONTINUED)

6. (K916) RETURN CIRCUIT OPEN FROM ECM HARNESS CONNECTOR TO A/C HARNESS CONNECTOR

Measure the resistance of the (K916) return circuit between the sensor harness connector and the ECM harness connector.



Is the resistance less than 10 Ohms?

Yes >> Go To 7

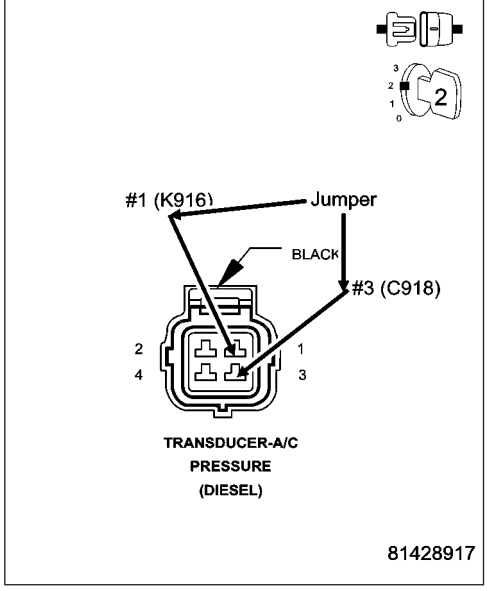
No >> Repair the open (K916) return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

7. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

While monitoring scan tool, use a jumper wire to connect the (K916) return circuit with the (C918) signal circuit at the sensor harness connector.

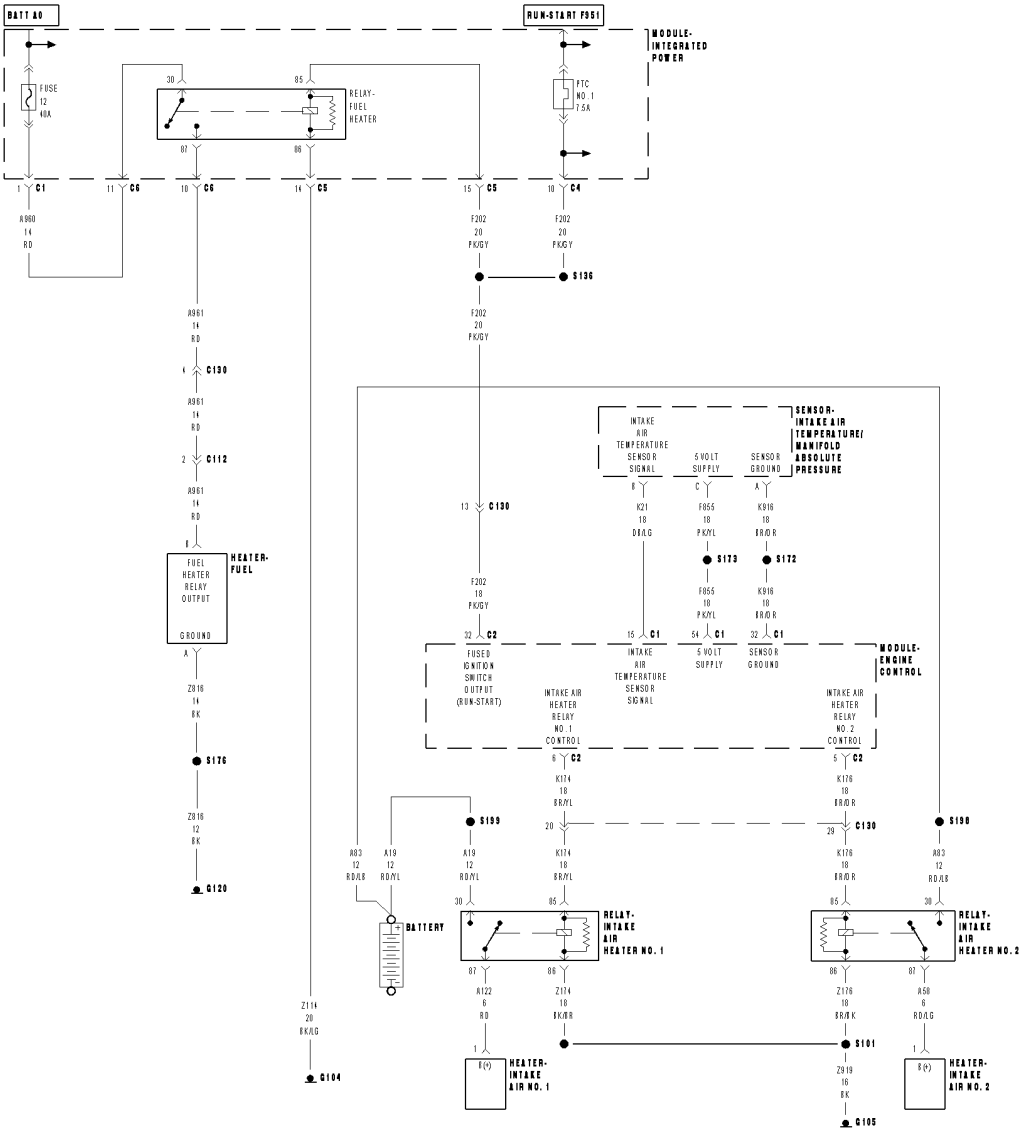


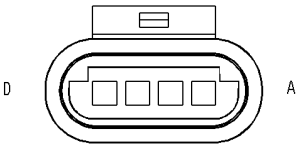
Did DTC P0532 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

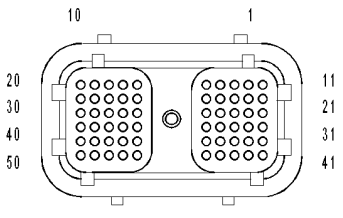
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0541-LOW VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY

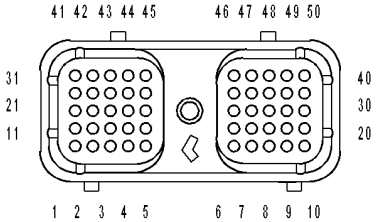




SENSOR-INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81429064

P0541-LOW VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the #1 intake air heater output does not match the signal from the #1 intake air heater feedback.

Possible Causes
LOOSE CONNECTION
INTAKE AIR HEATER RELAY
SIGNAL CIRCUIT OPEN FROM RELAY TO ECM
SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY CLICKING

Ignition on, engine not running.

With the scan tool, actuate the #1 Intake Air Heater.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

While the relay is clicking , wiggle the wiring harness and connectors.

Does this interrupt the clicking?

Yes >> Repair the poor connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0541-LOW VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY (CONTINUED)

3. INTAKE AIR HEATER RELAY

Turn the ignition off.

Remove the Intake Air Heater #1 Relay.

Check connectors - Clean/repair as necessary.

Measure the resistance between the signal and return posts of the intake air heater relay.

Is the resistance between 15 and 25 Ohms?

Yes >> Go To 4

No >> Replace the Intake Air Heater #1 relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. SIGNAL CIRCUIT OPEN FROM RELAY TO ECM

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the resistance of the intake air heater relay signal circuit between the ECM connector and the intake air heater relay connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open signal circuit from PDC to ECM harness connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Measure the voltage between the signal circuit of the intake air heater relay and battery negative.

Is the voltage greater than 1 volts?

Yes >> Repair the signal circuit shorted to Battery negative.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6

---

6. ECM

Reconnect the ECM harness connectors.

Disconnect the intake air heater relay signal wire and use a jumper to connect it to battery negative.

Turn the ignition on.

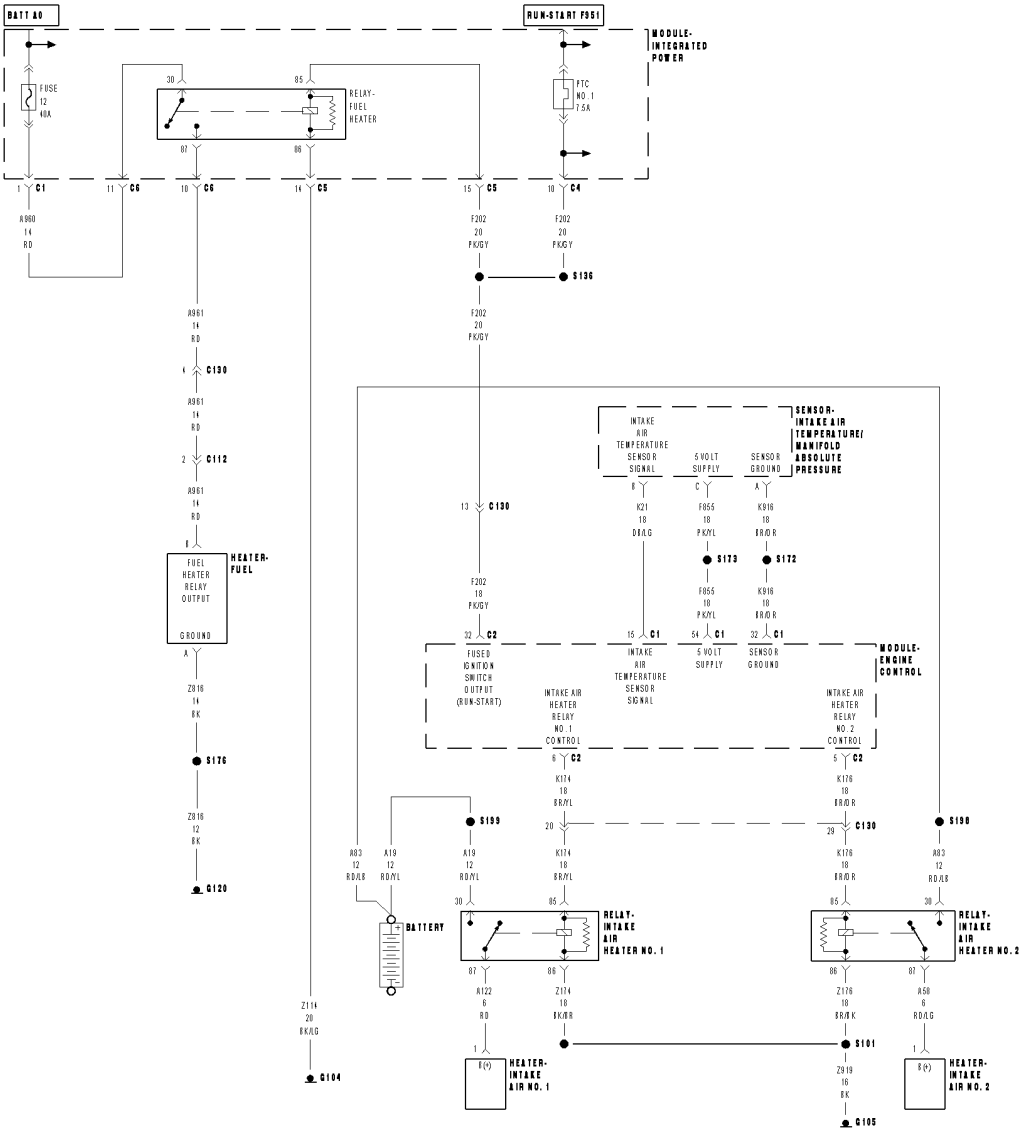
With the scan tool, read DTCs.

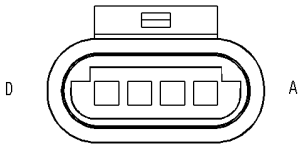
Did DTC P0542 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

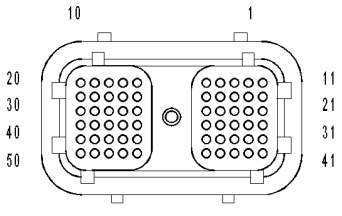
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0542-HIGH VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY

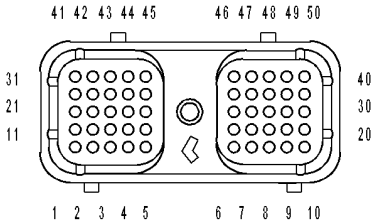




SENSOR-INTAKE AIR TEMPERATURE/MANIFOLD ABSOLUTE PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81429064

P0542-HIGH VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the #1 Intake Air Heater output does not match the signal from the #1 Intake Air Heater feedback.

Possible Causes
LOOSE CONNECTION
INTAKE AIR HEATER RELAY
SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY CLICKING

Ignition on, engine not running.

With the scan tool, actuate the Intake Air Heater relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

While the relay is clicking , wiggle the wiring harness and connectors.

Does this interrupt the clicking?

Yes >> Repair the poor connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0542-HIGH VOLTAGE ON THE #1 INTAKE AIR HEATER RELAY (CONTINUED)

3. INTAKE AIR HEATER RELAY

Turn the ignition off.

Remove the Intake Air Heater Relay.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the signal and return posts of the intake air heater relay.

Is the resistance between 15 and 25 Ohms?

Yes >> Go To 4

No >> Replace the Intake Air Heater relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Disconnect the ECM harness connector(s).

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the signal circuit of the intake air heater relay and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 5

No >> Repair signal circuit shorted to battery negative.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the signal circuit of the intake air heater relay and all other circuits in the ECM harness connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 6

No >> Repair signal circuit shorted to other circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

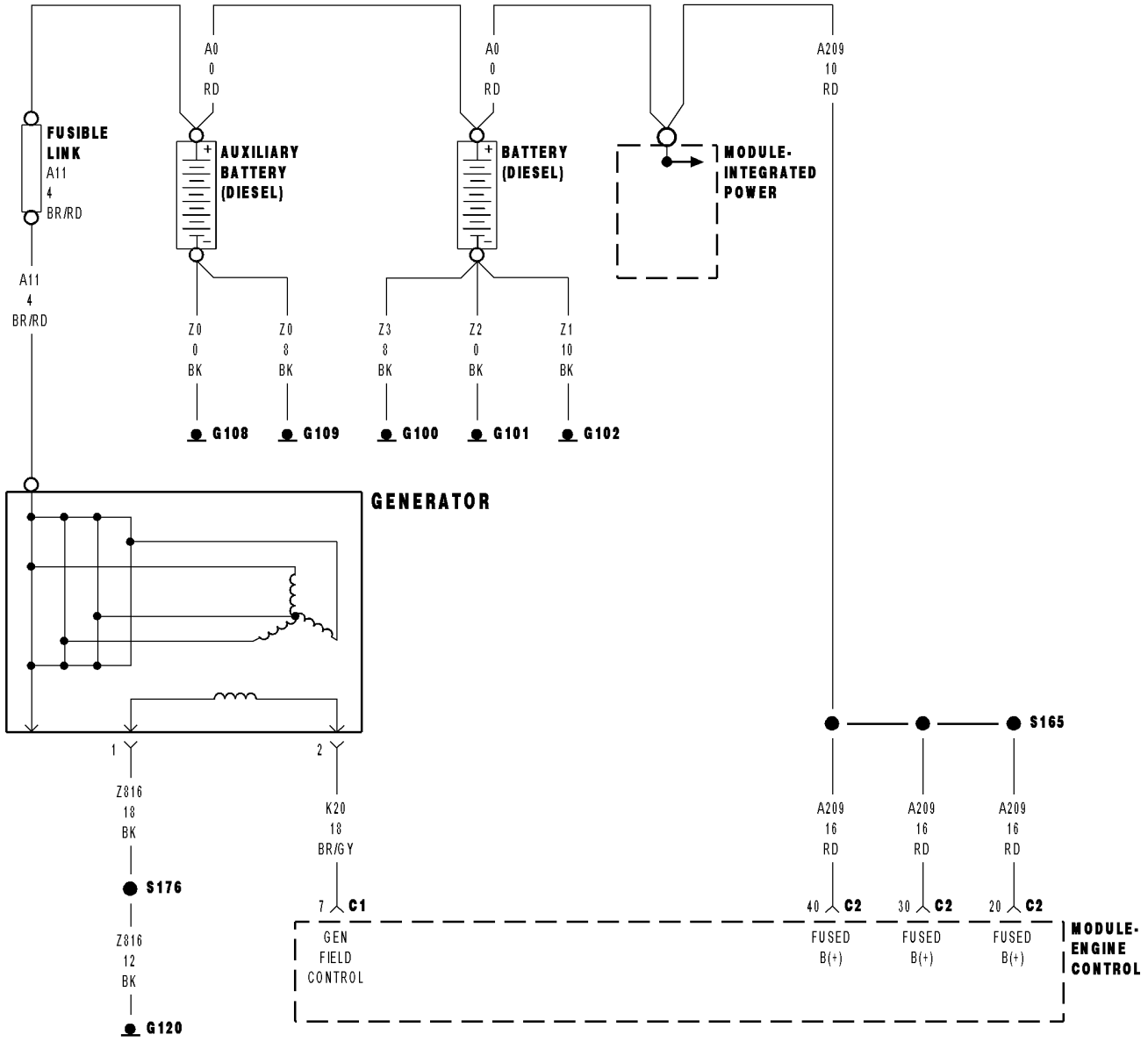
Disconnect the intake air heater relay signal wire.

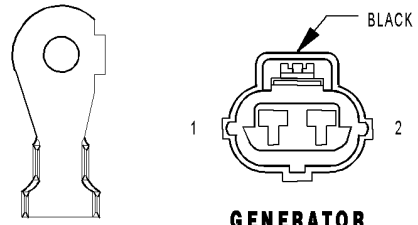
Did DTC P0542 or 2608 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

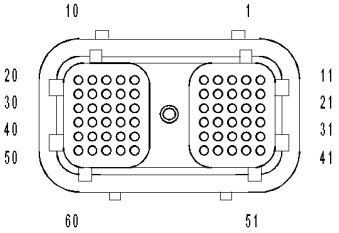
P0562-BATTERY VOLTAGE LOW



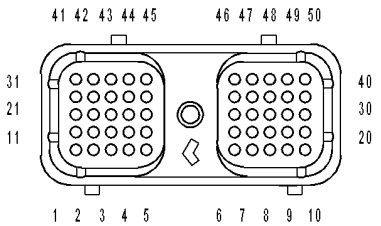


GENERATOR
(DIESEL/3.7L/4.7L/SRT)

GENERATOR
(EXCEPT SRT)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

8142cf39

P0562-BATTERY VOLTAGE LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on or the engine running.
- **Set Condition:**
  The battery voltage detected by the ECM is less than a calibrated value.

Possible Causes
P0622 PRESENT
P2502 PRESENT
P2503 PRESENT
BATTERY TERMINAL CONNECTIONS
ACCESSORY WIRING
BATTERY
HIGH RESISTANCE IN WIRE HARNESS
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. P0622 PRESENT

With the scan tool, read DTCs.

Is P0622 set?

Yes >> Repair P0622 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. P2502 PRESENT

With the scan tool, read DTCs.

Is P2502 set?

Yes >> Repair P2502 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0562-BATTERY VOLTAGE LOW (CONTINUED)

3. P2503 PRESENT

With the scan tool, read DTCs.

Is P2503 set?

Yes >> Repair P2503 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. BATTERY TERMINAL CONNECTIONS

Visually inspect the positive and negative connections at the batteries and inspect the battery negative connections at the engine block.

Are the connections free of corrosion and are they tight?

Yes >> Go To 5

No >> Repair the poor connections.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. ACCESSORY WIRING

Check for add-on or accessory wiring at positive (+) terminal of the battery

Are there any damaged wires at the battery?

Yes >> Repair accessory wiring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6

---

6. BATTERY(S)

Perform battery load test using the Midtronics Micro 420 battery system tester.

Did the battery(s) pass the test?

Yes >> Go To 7

No >> Replace the weak battery or batteries.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0562-BATTERY VOLTAGE LOW (CONTINUED)

7. HIGH RESISTANCE IN WIRE HARNESS

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the battery terminals.

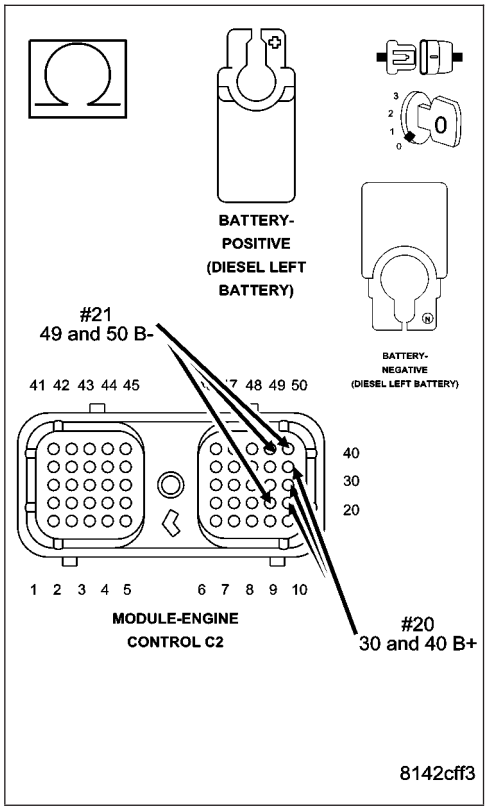
Measure the resistance from the positive and negative battery posts to the appropriate circuits in the ECM harness connector

Is the resistance less than 10 Ohms?

Yes >> Go To 8

No >> Repair the high resistance in the wire harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



8. ECM

Reconnect the battery terminals.

Measure and record the voltage between battery positive pins of the ECM connector and the battery negative circuits of the ECM harness connector.

Reconnect the ECM harness connectors.

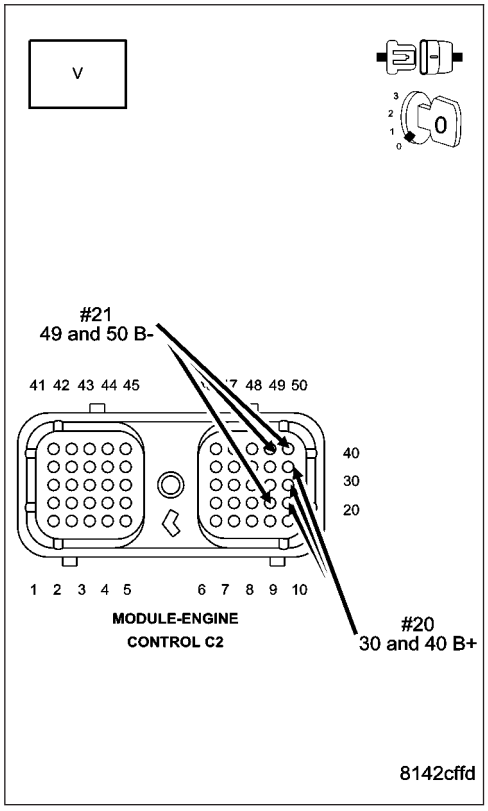
Use the scan tool to measure and record battery voltage.

Are the readings within 3 volts of each other?

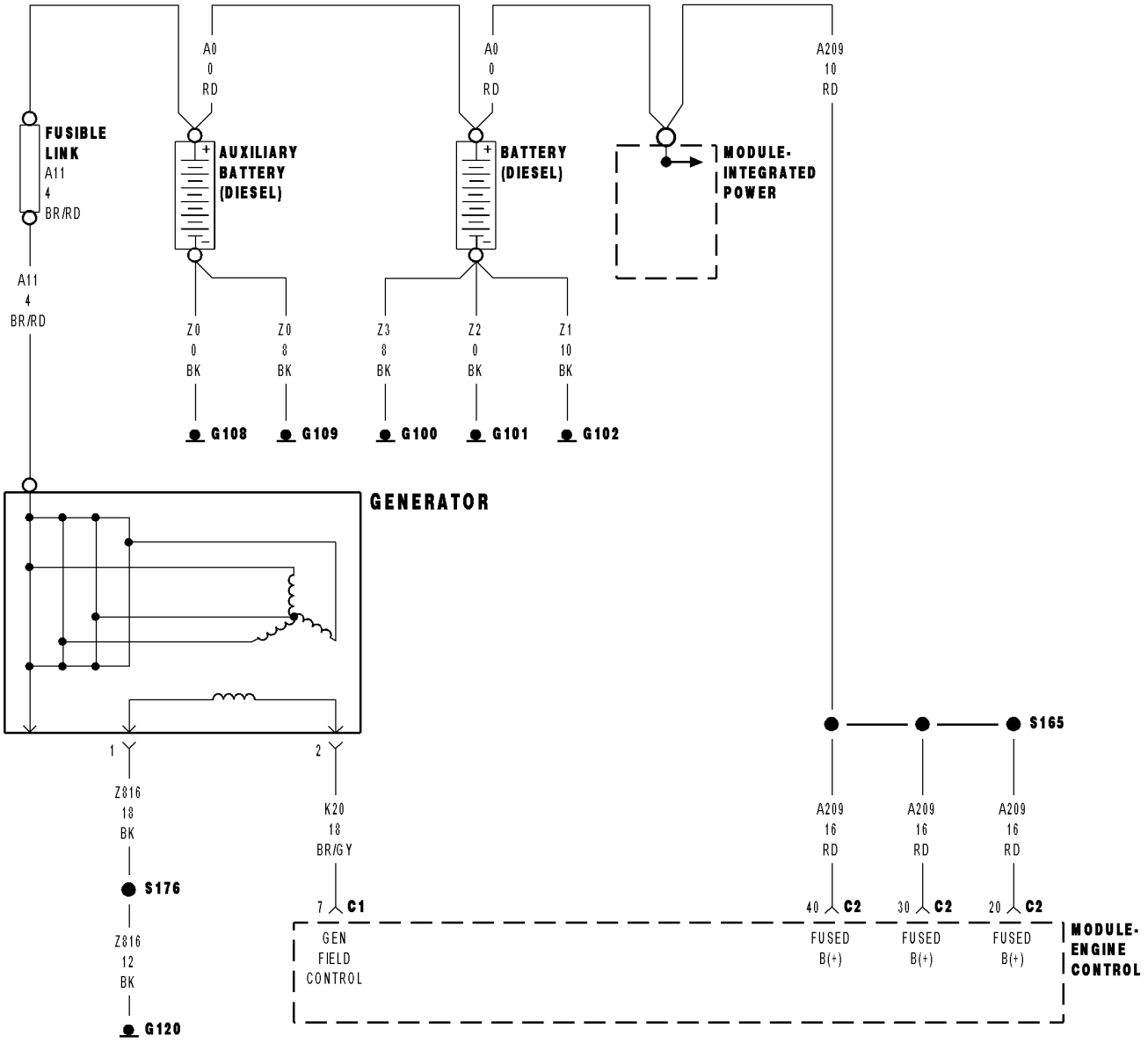
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

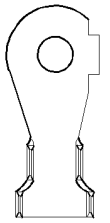
No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

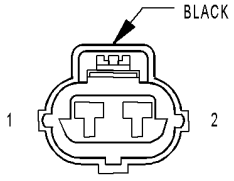


P0563-BATTERY VOLTAGE HIGH

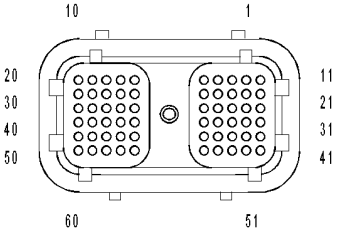




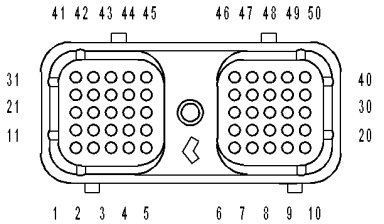
GENERATOR
(DIESEL/3.7L/4.7L/SRT)



GENERATOR
(EXCEPT SRT)



MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

8142cf39

P0563-BATTERY VOLTAGE HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on or the engine running.
- **Set Condition:**
  The battery voltage detected by the ECM is greater than a calibrated value.

Possible Causes
P0622 PRESENT
P2502 PRESENT
P2504 PRESENT
BATTERIES IMPROPERLY INSTALLED
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. P0622 PRESENT

With the scan tool, read DTCs.

Is P0622 set?

Yes >> Repair P0622 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. P2502 PRESENT

With the scan tool, read DTCs.

Is P2502 set?

Yes >> Repair P2502 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

---

3. P2504 PRESENT

With the scan tool, read DTCs.

Is P2504 set?

Yes >> Repair P2504 first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

P0563-BATTERY VOLTAGE HIGH (CONTINUED)

4. BATTERIES IMPROPERLY INSTALLED

Disconnect the ECM harness connectors.

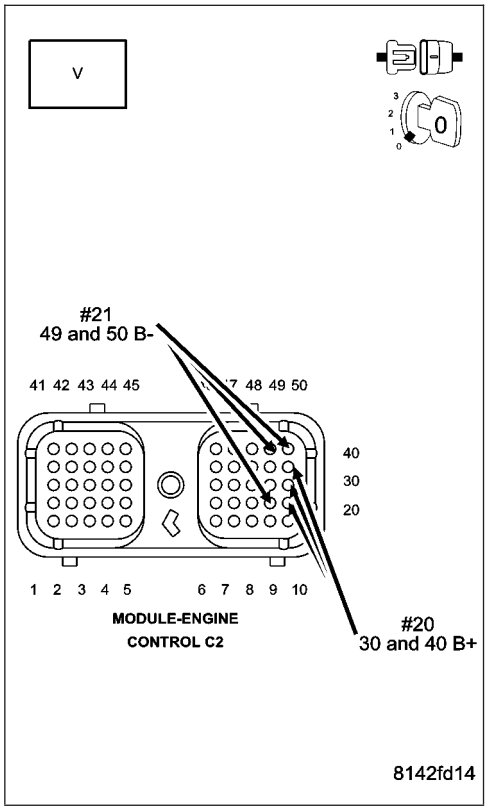
Measure the battery voltage between the positive circuits and ground of the ECM harness connector.

Is the voltage less than 19 volts?

Yes >> Go To 5

No >> Install the battery system correctly.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. ECM

Reconnect the battery terminals.

Measure and record the voltage between battery positive pins of the ECM connector and the battery negative circuits of the ECM harness connector.

Reconnect the ECM harness connectors.

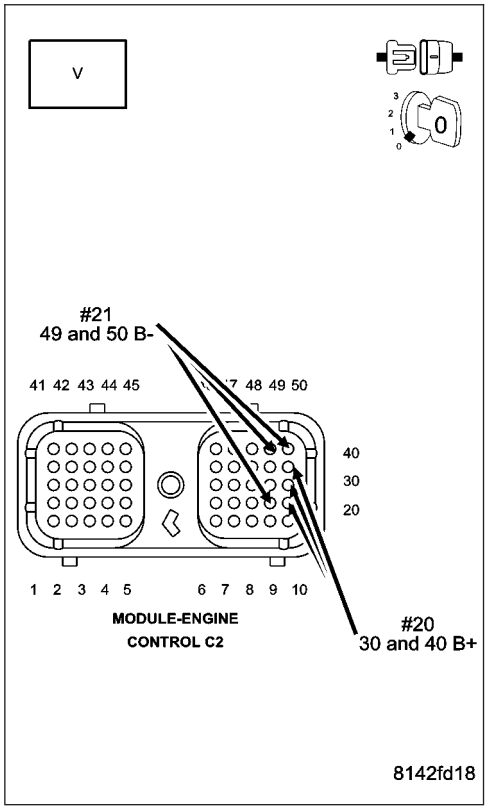
Use the scan tool to measure and record battery voltage.

Are the readings within 3 volts of each other?

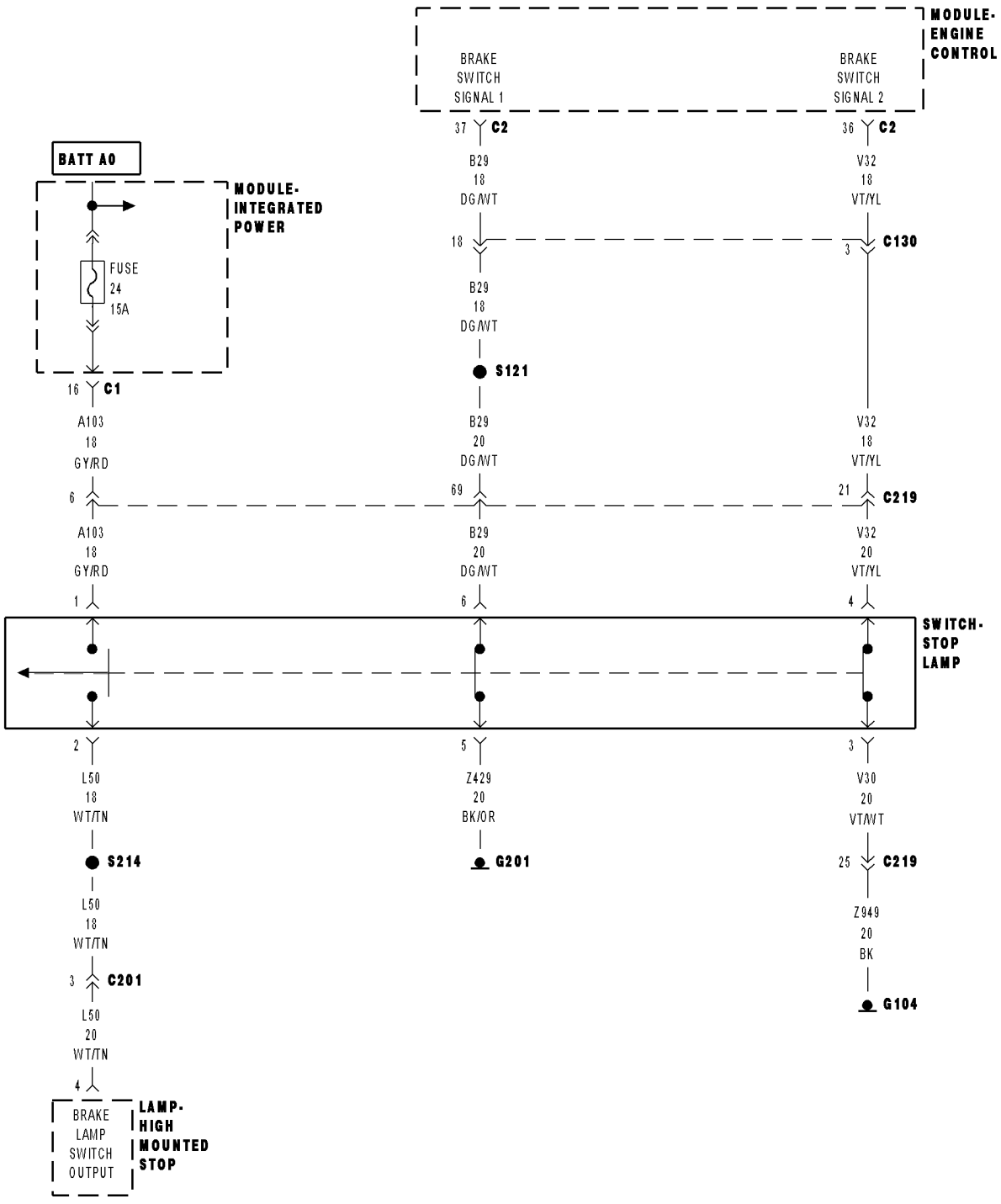
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

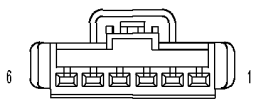
No >> Replace the ECM.

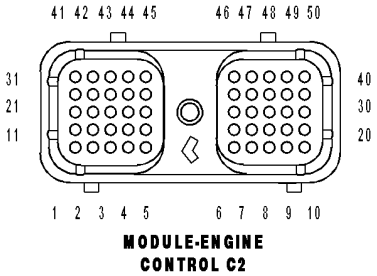
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0572-LOW VOLTAGE DETECTED AT THE BRAKE SWITCH







8142fe89

P0572-LOW VOLTAGE DETECTED AT THE BRAKE SWITCH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the ignition is on
- **Set Condition:**
  The brake switch status is = to OFF and the not brake switch status is = to ON for a calibrated amount of time..

Possible Causes
DAMAGED WIRING HARNESS OR CONNECTORS
BRAKE SWITCH CIRCUIT SHORTED TO GROUND (BRAKE SWITCH WILL ALWAYS BE OFF)
BRAKE SWITCH
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. BRAKE SWITCH CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the brake switch connection. Inspect the pins and connector for damage, corrosion, etc.

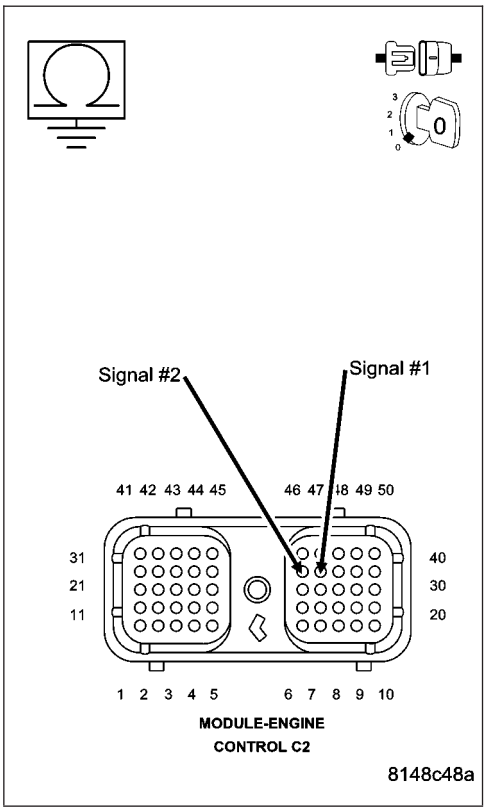
Disconnect the ECM connectors. Inspect the pins and connector for damage, corrosion, etc.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the brake switch circuit in the ECM connector and battery negative.

Is the resistance less than 10 ohms?

Yes >> Repair the Brake switch circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P0572-LOW VOLTAGE DETECTED AT THE BRAKE SWITCH (CONTINUED)

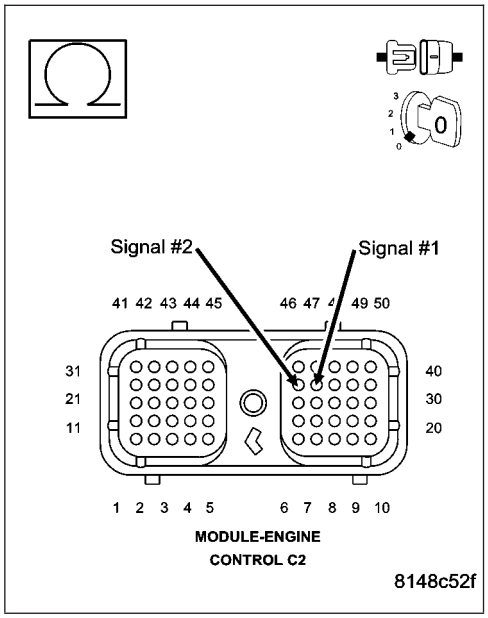
2. BRAKE SWITCH CIRCUIT SHORTED TO OTHER CIRCUITS IN HARNESS

Measure the resistance between the brake switch wire in the ECM connector and all other pins in the ECM connector.

Is the resistance less than 10 ohms?

Yes >> Repair or replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. ECM

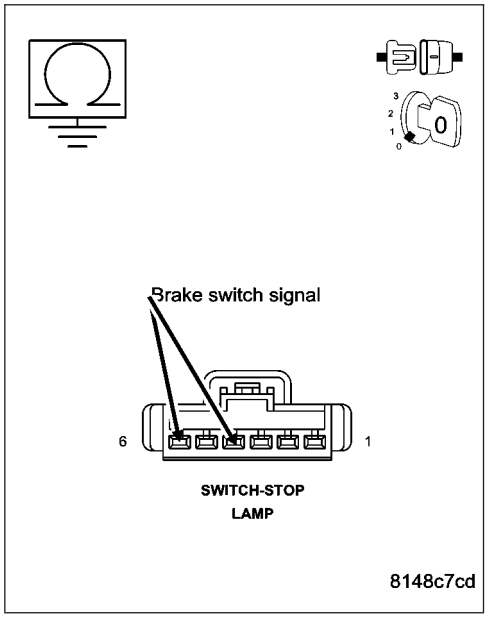
Reconnect the ECM connectors.

Measure the resistance between the brake switch circuit at the switch connector and battery negative.

Is the resistance less than 10 ohms?

Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4



P0572-LOW VOLTAGE DETECTED AT THE BRAKE SWITCH (CONTINUED)

4.

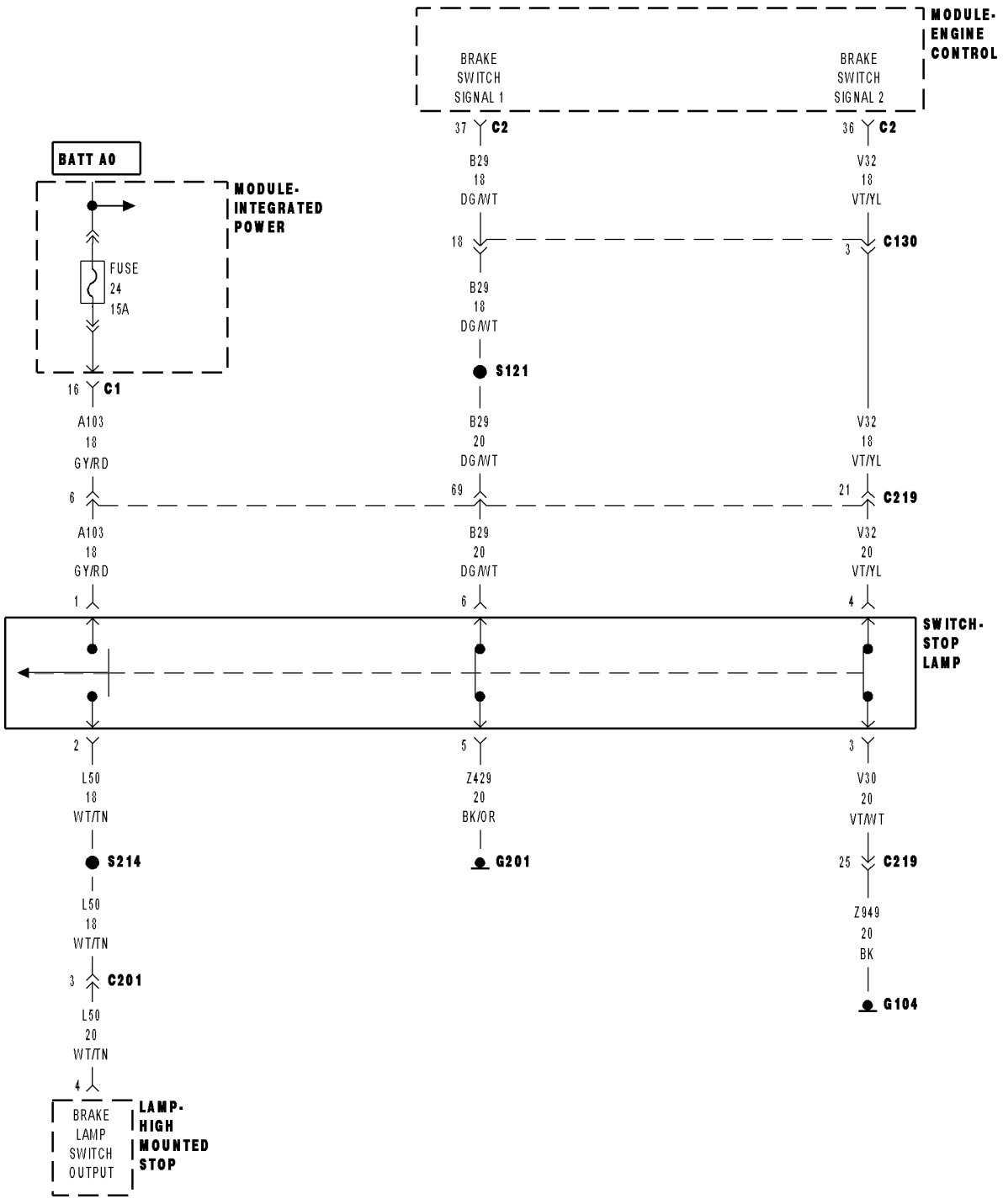
Reconnect the brake switch connector.
Using the scan tool, clear the DTC's.
Turn the ignition on.
Cycle the brake pedal several times.
Using the scan tool, read the DTC's.

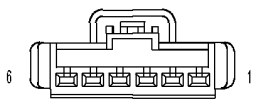
Has the brake switch low DTC returned?

Yes >> Replace the brake switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

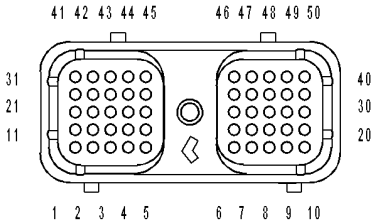
No >> Perform Intermittent condition test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0573-HIGH VOLTAGE DETECTED AT THE BRAKE SWITCH





SWITCH-STOP LAMP



MODULE-ENGINE CONTROL C2

8142fe89

P0573-HIGH VOLTAGE DETECTED AT THE BRAKE SWITCH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the ignition is on.
- **Set Condition:**
  The brake switch status is = to ON and the not brake switch status is = to OFF for a calibrated amount of time.

Possible Causes
DAMAGED WIRING HARNESS OR CONNECTORS
BRAKE SWITCH CIRCUIT OPEN (BRAKE SWITCH WILL ALWAYS BE ON)
BRAKE SWITCH CIRCUIT SHORTED TO BATTERY VOLTAGE (BRAKE SWITCH WILL ALWAYS BE ON)
BRAKE SWITCH
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. BRAKE SWITCH CIRCUIT OPEN

Turn the ignition off.

Disconnect the brake switch connection. Inspect the pins and connector for damage, corrosion, etc.

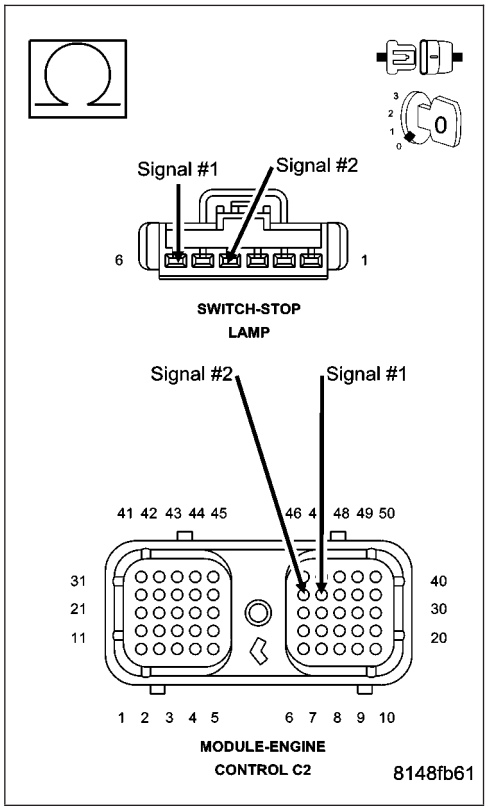
Disconnect the ECM connectors. Inspect the pins and connector for damage, corrosion, etc.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the brake switch signal circuits in the ECM connector and the brake switch connector.

Is the resistance less than 10 ohms?

Yes >> Go To 2

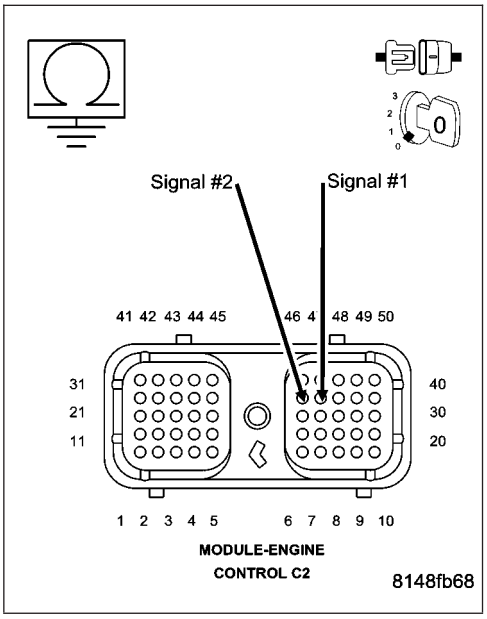
No >> Repair the open brake switch circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0573-HIGH VOLTAGE DETECTED AT THE BRAKE SWITCH (CONTINUED)

2. BRAKE SWITCH CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the brake switch circuits in the ECM connector and battery negative.



Is the voltage less than 1 volt?

Yes >> Go To 3

No >> Repair the open circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. ECM

Reconnect the ECM connectors.
Install a jumper wire in the brake switch connector between signal circuit and to ground.
Turn the ignition on.
Cycle the brake pedal several times.
Using the scan tool, read the DTC's.

Is the DTC for brake switch low voltage present?

Yes >> Go To 4

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. BRAKE SWITCH

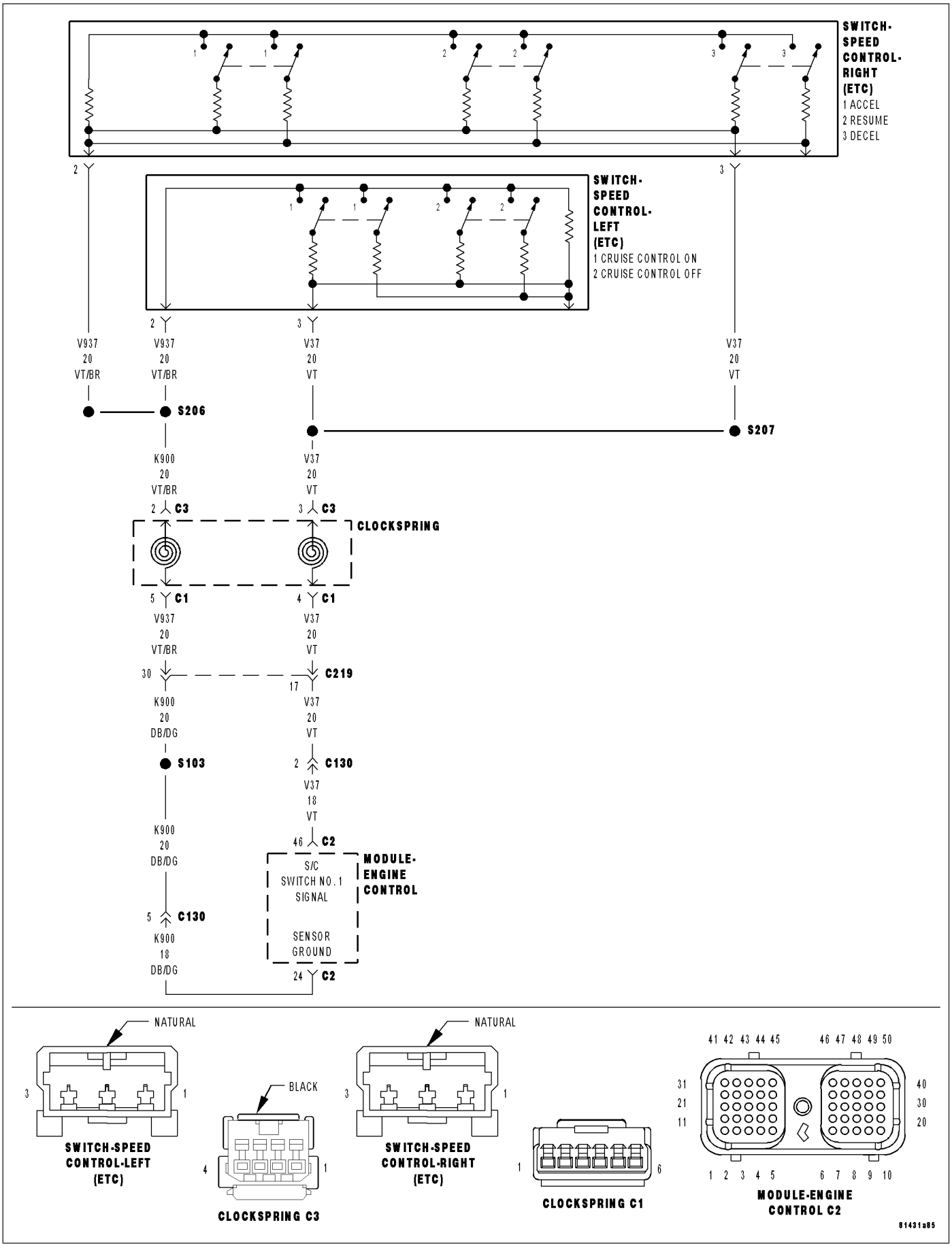
Reconnect the brake switch connector.
Using the scan tool, clear the DTC's.
Turn the ignition on.
Cycle the brake pedal several times.
Using the scan tool, read the DTC's.

Has the brake switch High DTC returned?

Yes >> Replace the brake switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Perform Intermittent condition test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0580-LOW VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH



P0580-LOW VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the ignition is on
- **Set Condition:**
  Speed control MUX switch below 1.0 volts for 5 seconds.

Possible Causes
S/C WIRING HARNESS OBSERVABLE PROBLEM
S/C SWITCH (ON/OFF)
CLOCKSPRING SHORTED TO GROUND
S/C SWITCH (RESUME/ACCEL)
S/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
S/C SIGNAL CIRCUIT SHORTED TO SENSOR GROUND
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. S/C SWITCH VOLTAGE BELOW 1.0 VOLT

Turn the ignition on.

With the scan tool, read the S/C Switch volts status in the ECM.

Is the S/C Switch voltage below 1.0 volt?

Yes >> Go To 3

No >> Go To 2

---

2. S/C WIRING HARNESS OBSERVABLE PROBLEM

Turn the ignition off.

Using the Schematics as a guide, inspect the Wiring and Connectors.

Were any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0580-LOW VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

3. S/C SWITCH (ON/OFF)

Turn the ignition off.

Disconnect the S/C ON/OFF Switch harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Turn the ignition on.

With the scan tool in Sensors, read the S/C Switch volts in the ECM.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the S/C ON/OFF Switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. S/C SWITCH (RESUME/ACCEL)

Turn the ignition off.

Disconnect the S/C RESUME/ACCEL Switch harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

With the scan tool in Sensors, read the S/C Switch volts in the ECM.

Did the S/C Switch volts go above 4.0 volts?

Yes >> Replace the Resume/Accel Switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. CLOCKSPRING SHORTED TO GROUND

Turn the ignition off.

Disconnect the clockspring 6-way harness connector (instrument panel wiring side).

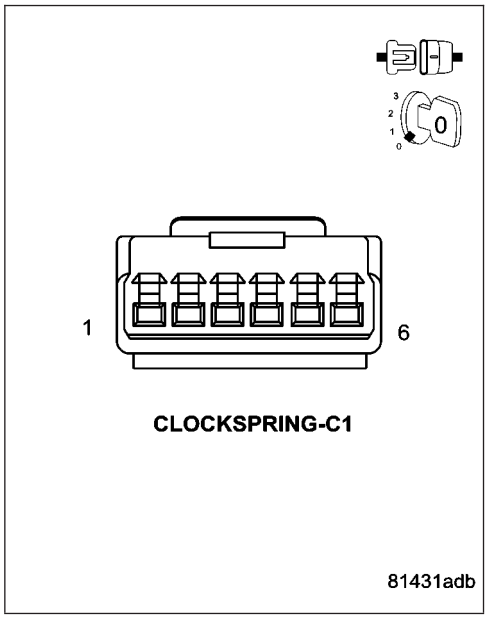
Turn the ignition on.

With the scan tool in Sensors, read the S/C Switch volts in the ECM.

Did the S/C Switch volts change to 5.0 volts?

Yes >> Replace the Clockspring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6



P0580-LOW VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

6. S/C SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the S/C ON/OFF Switch harness connector.

Disconnect the ECM harness connectors.

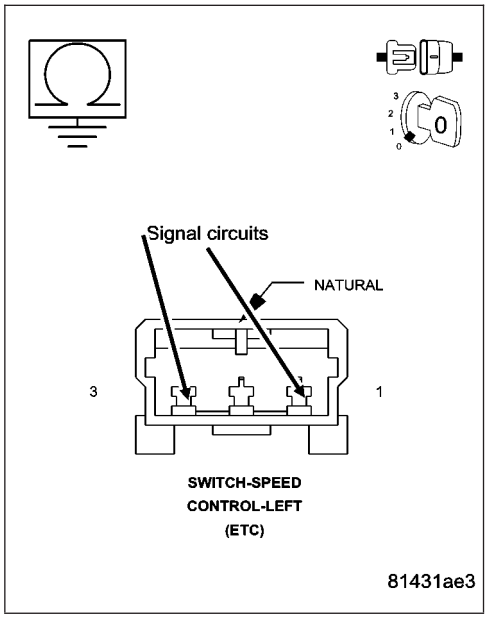
NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the S/C Switch Signal circuit and ground (B-) at S/C ON/OFF Switch harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair S/C Switch Signal Circuit for a short to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7



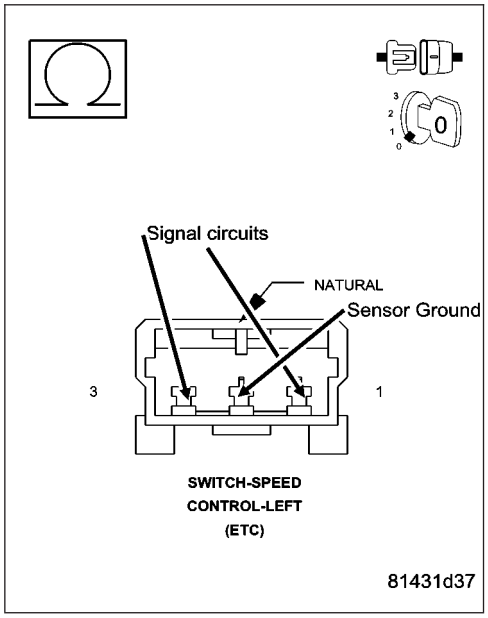
7. S/C SIGNAL CIRCUIT SHORTED TO SENSOR GROUND

Measure the resistance between the S/C Signal Circuit and the Sensor Ground Circuit at the ON/OFF switch harness connector.

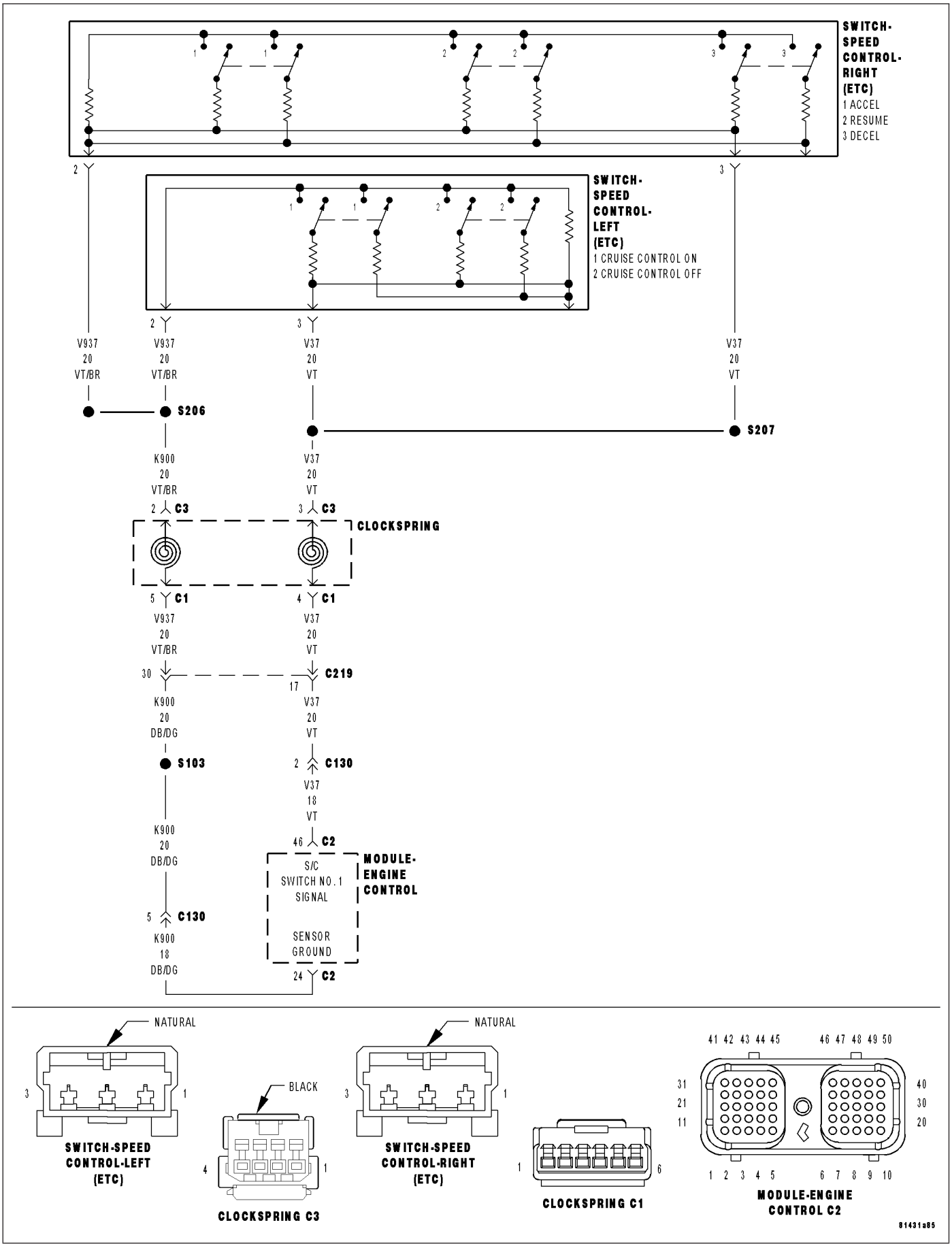
Is the resistance below 5.0 ohms?

Yes >> Repair S/C Signal Circuit shorted to Sensor Ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH



P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Key on or Engine running.
- **Set Condition:**
  Speed Control MUX switch above 11.5 volts for 5 seconds.

Possible Causes
S/C WIRING HARNESS OBSERVABLE PROBLEM
CLOCKSPRING SIGNAL/GROUND CIRCUIT OPEN
SPEED CONTROL ON/OFF SWITCH
S/C SWITCH SIGNAL CKT SHORTED TO VOLTAGE
S/C SWITCH SIGNAL CIRCUIT OPEN ECM TO CLOCK SPRING
S/C SWITCH SIGNAL CIRCUIT OPEN CLOCKSPRING TO S/C SWITCH
S/C SWITCH GROUND CIRCUIT OPEN CLOCKSPRING TO S/C SWITCH
S/C SWITCH GROUND CIRCUIT OPEN ECM TO CLOCKSPRING
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. Scan tool SHOWS SPEED CONTROL SWITCH ON/OFF

Turn the ignition on.
With the scan tool in Inputs/Outputs, read the Speed Control inputs state in ECM.
While monitoring the scan tool, push the Speed Control On/Off Switch several times, then leave it on.

Did the scan tool show Speed Control Switch off and on?

Yes >> Go To 2

No >> Test Complete.

---

2. S/C WIRING HARNESS OBSERVABLE PROBLEM

Turn the ignition off.
Using the Schematics as a guide, inspect the Wiring and Connectors.

Were any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

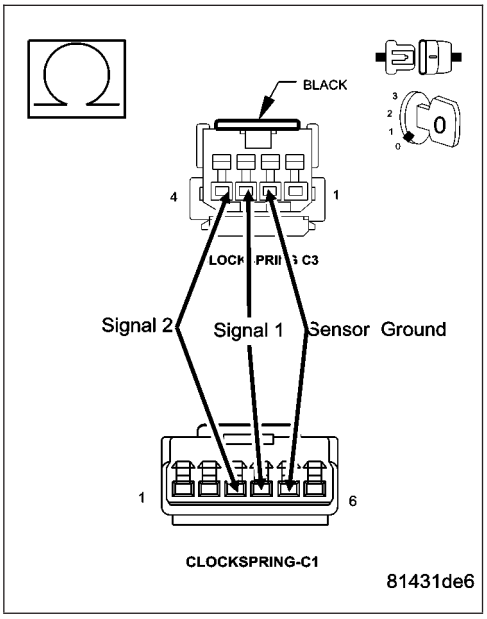
P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

3. CLOCKSPRING SIGNAL/GROUND CIRCUIT OPEN

Disconnect the upper and lower clockspring harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the sensor ground circuit between the upper and lower clockspring harness connectors.

Measure the resistance of the speed control switch signal circuit between the upper and lower clockspring harness connectors.



Was the resistance above 5.0 ohms for either circuit?

Yes >> Replace the clockspring.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

4. SPEED CONTROL ON/OFF SWITCH

Disconnect the Speed Control On/Off Switch 2-way harness connector only.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance across the S/C On/Off Switch.

Is the resistance between 20.3K and 20.7K ohms?

Yes >> Go To 5

No >> Replace the On/Off Switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

5. S/C SWITCH SIGNAL CKT SHORTED TO VOLTAGE

Turn the ignition on.

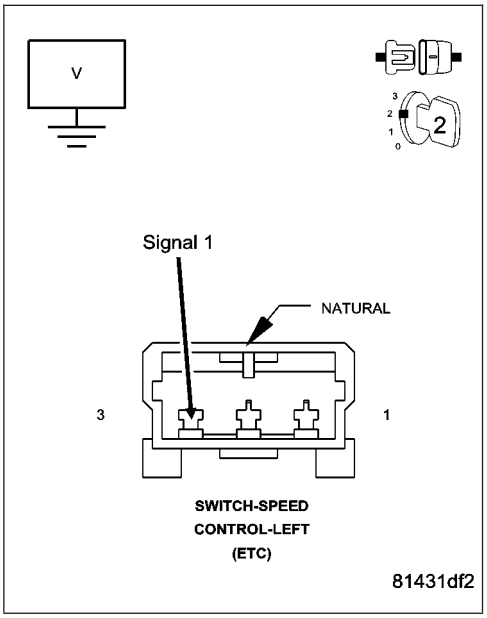
Measure the voltage of the S/C Switch Signal Circuit at the On/Off Switch 2-way connector.

Is the voltage above 6.0 volts?

Yes >> Repair the Speed Control Switch Signal Circuit for a short to voltage.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6



6. S/C SWITCH SIGNAL CIRCUIT OPEN ECM TO CLOCK SPRING

Turn the ignition off.

Disconnect the ECM harness connector.

NOTE: Check connectors - Clean/repair as necessary.

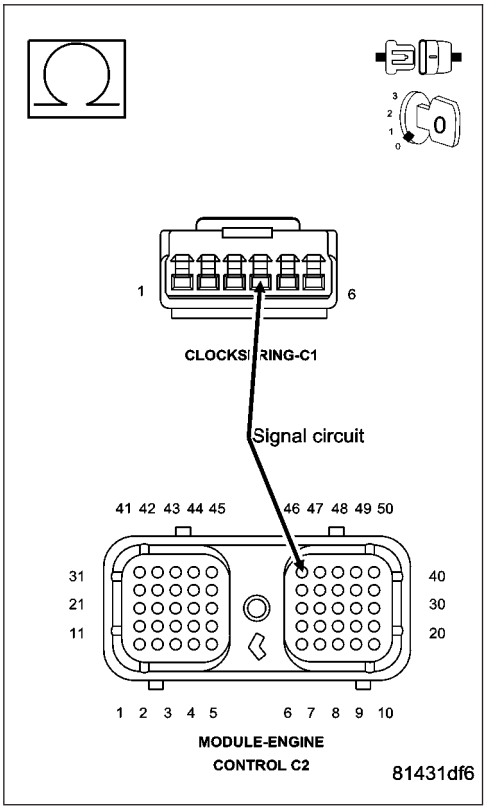
Measure the resistance of the S/C Switch Signal Circuit between the ECM connector and the Clockspring Connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair open Speed Control Switch Signal Circuit ECM to Clockspring.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

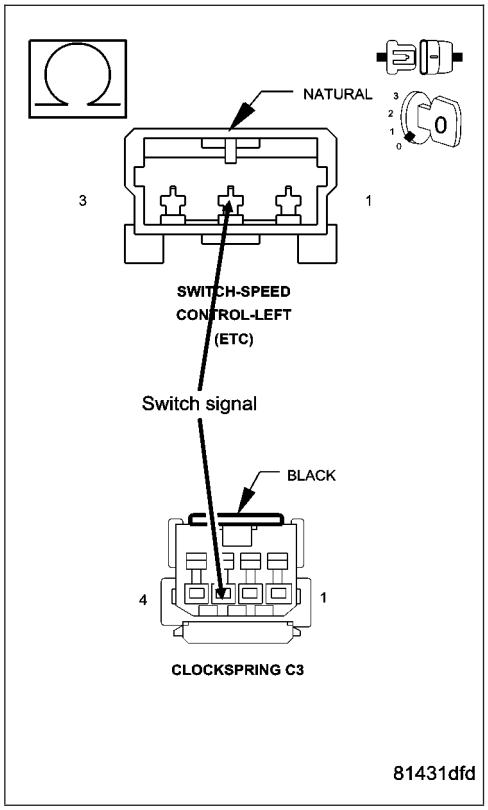
7. S/C SWITCH SIGNAL CIRCUIT OPEN CLOCKSPRING TO S/C SWITCH

Measure the resistance of the S/C Switch Signal Circuit from the clockspring harness connector to the On/Off switch harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open Speed Control Switch Signal Circuit Clockspring to S/C switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



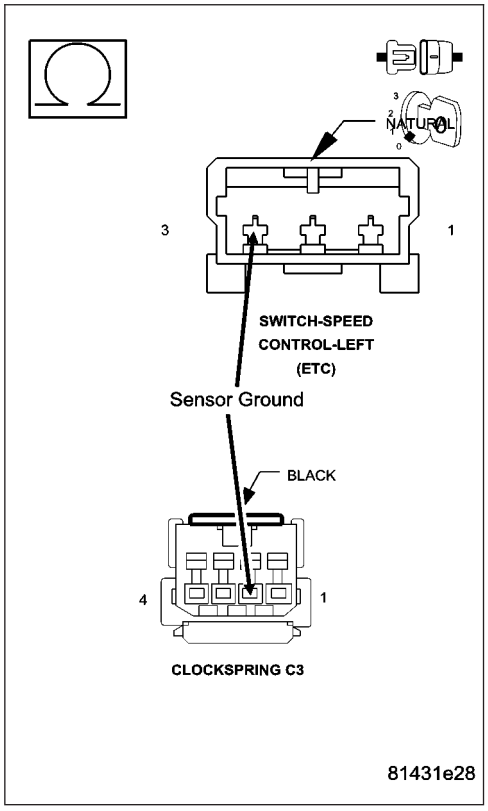
8. S/C SWITCH GROUND CIRCUIT OPEN CLOCKSPRING TO S/C SWITCH

Measure the resistance of the S/C Switch Sensor Ground Circuit between the On/Off Switch 2-way harness connector to the clockspring harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair open ground circuit from clockspring to S/C switch.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0581-HIGH VOLTAGE DETECTED AT THE SPEED CONTROL SWITCH (CONTINUED)

9. S/C SWITCH GROUND CIRCUIT OPEN ECM TO CLOCKSPRING

Measure the resistance of the S/C Switch Sensor Ground Circuit between the ECM harness connector to the clockspring harness connector.

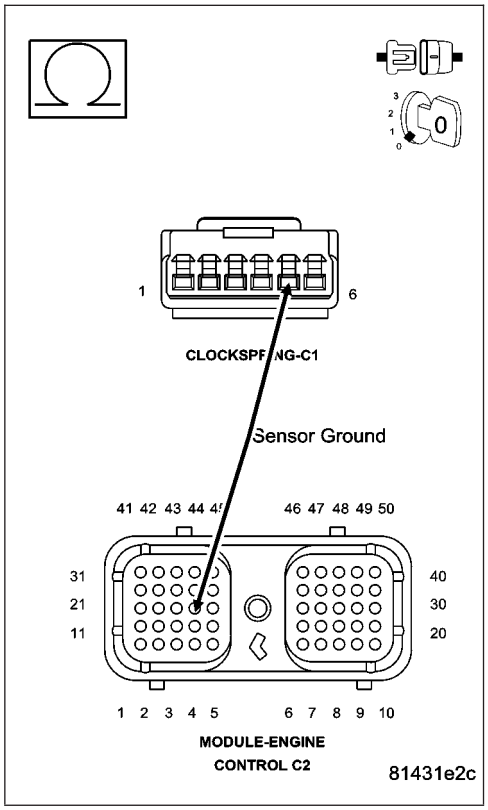
Is the resistance below 5.0 ohms?

Yes >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair open ground circuit from ECM to clockspring.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0602-CHECKSUM ERROR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the ignition is on.
- **Set Condition:**
  A deviation between the ECM memory and a stored calibration.

Possible Causes
FLASH ECM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FLASH ECM

Using the scan tool, reflash the ECM with the proper calibration for the particular truck.

Is the flash successful?

Yes >> Repair complete.

No >> Go To 2

---

2. ECM

With the scan tool, read DTCs.

Did P0602 set after the reflash?

Yes >> Replace the ECM.

No >> Test Complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0604-ECM SOFTWARE ERROR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  Internal ECM software error.

Possible Causes
REFLASH ECM
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. REFLASH ECM

Using the scan tool, reflash the module with latest calibration

Was the flash successful?

Yes >> Go To 2

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. ECM

Run the engine for one minute and shut off.

With the scan tool, read DTCs.

Did P0604 set?

Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0606-ECM HARDWARE ERROR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on or engine running.
- **Set Condition:**
  ECM had detected internal failures.

Possible Causes
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM

Turn the ignition on.

NOTE: This DTC is caused by an internal Engine Control Module failure. Repairs are not possible to the ECM.
With the scan tool, erase DTCs.

Is the DTC still set?

Yes >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0607-ECM INTERNAL FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on or engine running.
- **Set Condition:**
  ECM had detected internal failures.

Possible Causes
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM

Turn the ignition on.

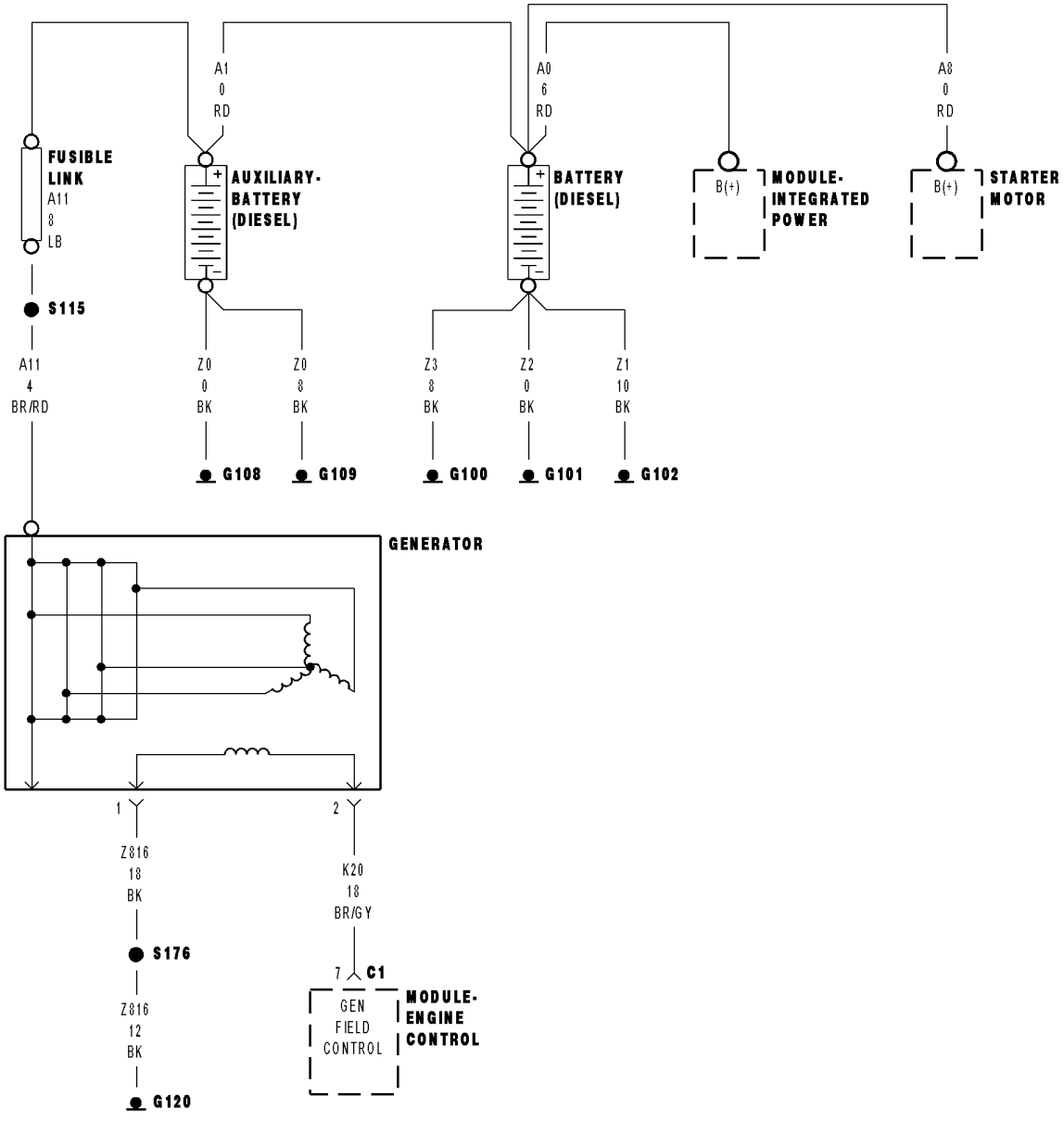
NOTE: This DTC is caused by an internal Engine Control Module failure. Repairs are not possible to the ECM.

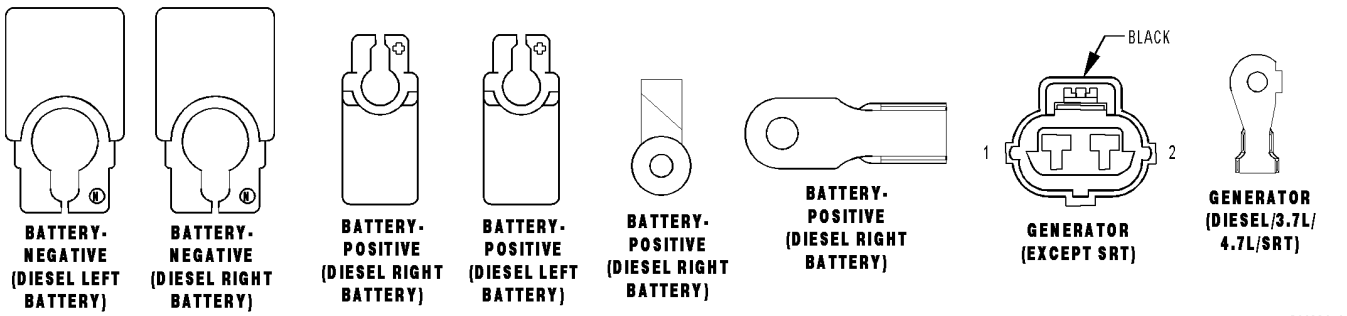
Is the DTC P0606 set?

Yes >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY





P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  The feedback signal does not match the commanded signal for the voltage regulator.

Possible Causes
GENERATOR
OPEN DRIVER CIRCUIT
GEN SOURCE SHORTED TO BATTERY NEGATIVE
(K20) FIELD DRIVER CIRCUIT SHORTED TO VOLTAGE
GEN SOURCE OPEN
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. GENERATOR

Turn the ignition off.

Disconnect the Generator field harness connector.

Check connectors - Clean/repair as necessary.

Measure the resistance between the generator field terminals.

Is the resistance between .5 and 15 Ohms?

Yes >> Go To 2

No >> Replace the Generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

2. OPEN DRIVER CIRCUIT

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

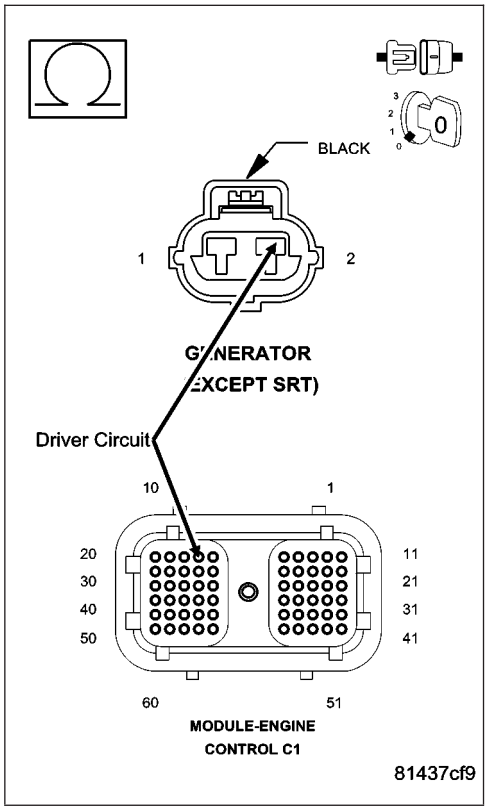
Measure the resistance of the generator driver wire between the generator harness connector and the ECM harness connector.

Is the resistance less than 10 ohms.

Yes >> Go To 3

No >> Repair the open driver circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. GENERATOR FIELD CIRCUIT OPEN

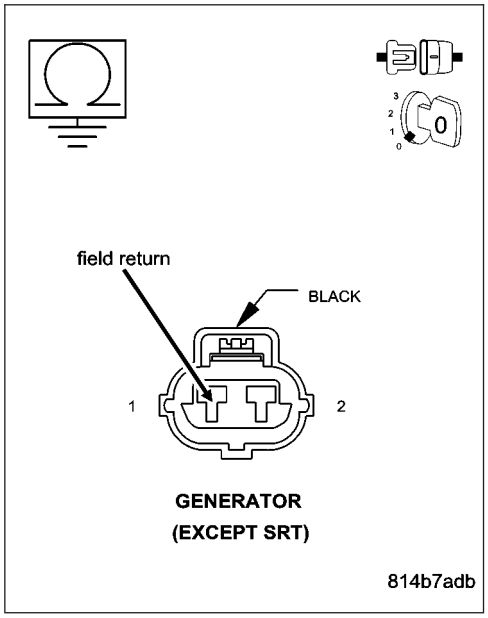
Measure the resistance of the generator field return circuit between the generator harness connector and battery negative.

Is the resistance less than 10 ohms.

No >> Repair the Generator field return shorted to Battery negative.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

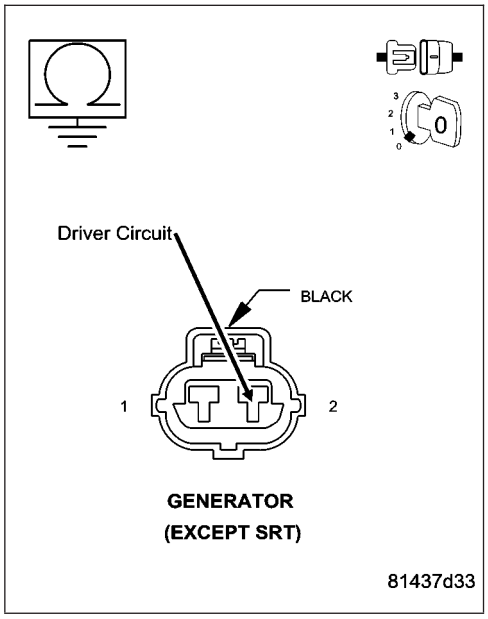
Yes >> Go To 4



P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

4. FIELD DRIVER CIRCUIT SHORTED TO VOLTAGE

Measure the voltage between the (K20) generator field driver circuit in the generator harness connector and battery negative.



Is the voltage greater than 1 volt?

Yes >> Repair the (K20) Generator field driver circuit shorted to voltage.

No >> Go To 5

5. ECM

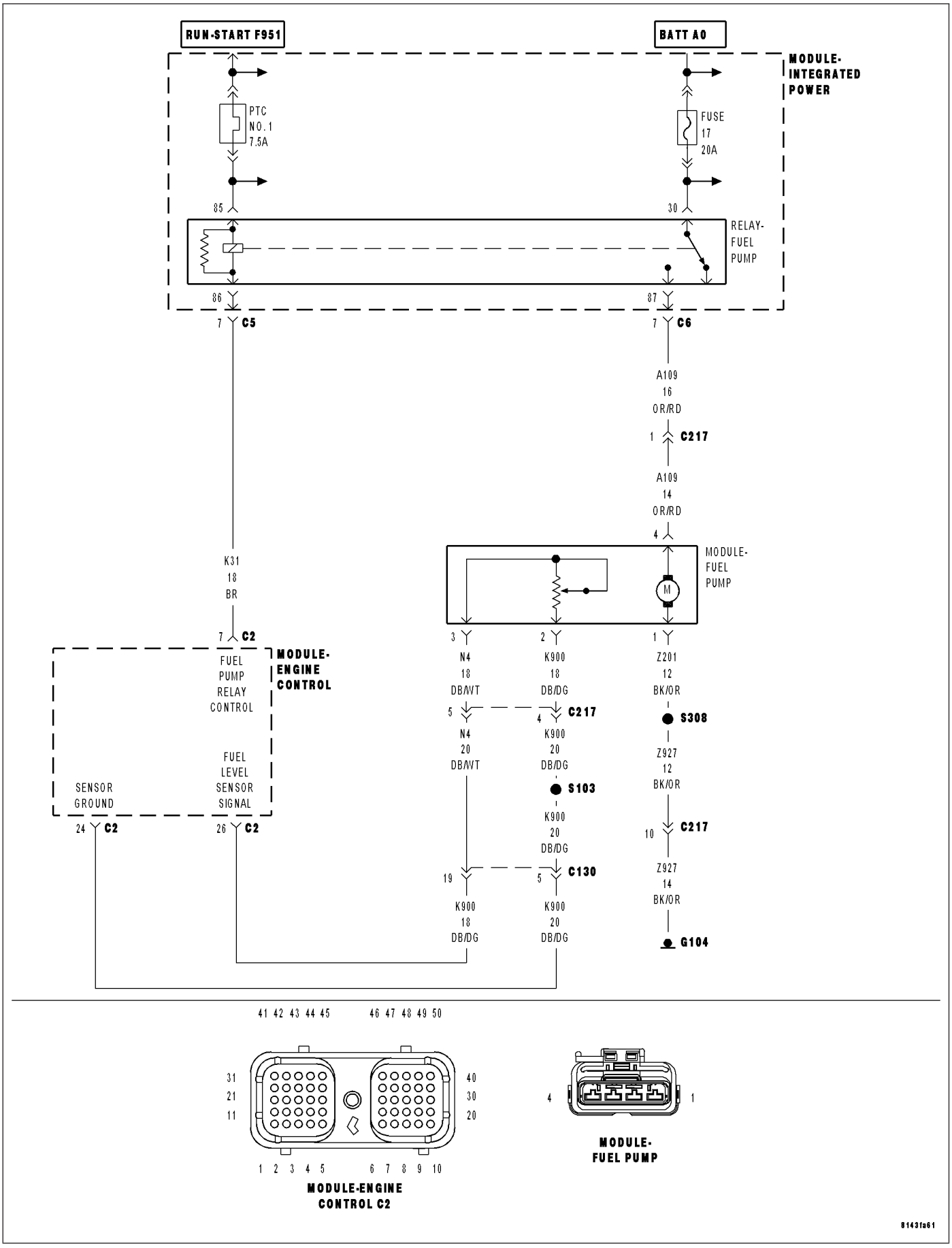
While monitoring with scan tool, connect a jumper wire between the driver circuit and the return circuit in the alternator connector.

Did the DTC return?

Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0628-LOW VOLTAGE DETECTED AT THE FUEL LIFT PUMP



P0628-LOW VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  The commanded signal to the fuel lift pump relay does not match the feedback signal from the fuel lift pump relay.

Possible Causes
WIRING HARNESS
FUEL LIFT PUMP RELAY
FUEL LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO EXTERNAL VOLTAGE
FUEL LIFT PUMP RELAY DRIVER CIRCUIT OPEN
FUEL LIFT PUMP RELAY GROUND CIRCUIT OPEN
FUEL LIFT PUMP RELAY GROUND CIRCUIT SHORTED TO EXTERNAL VOLTAGE
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LIFT PUMP RUNS

Remove the cover to the PDC.
Turn the ignition on, engine off.
With the scan tool, in system test actuate the lift pump relay.

Does the fuel lift pump relay click when the lift pump is actuated?

Yes >> Test complete.
Perform Intermittent Condition test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. LIFT PUMP RELAY DOES NOT CLICK

Turn Ignition off.
Remove the lift pump relay from the PDC.
Turn the ignition on.
Connect one end of an incandescent test light to battery negative.
Connect the other end of the test light to the relay driver pin in the PDC.
With the scan tool, in system test actuate the lift pump relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Go To 5

P0628-LOW VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

3. FUEL LIFT PUMP GROUND CIRCUIT OPEN

Connect one end of an incandescent test light to battery postive.

Connect the other end of the test light to the relay ground pin in the PDC.

Is the resistance less than 1 Ohms?

Yes >> Go To 4

No >> Repair the open ground circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. LIFT PUMP RELAY

Install a know good relay in place of the fuel lift pump relay.

With the scan tool, in system test actuate the lift pump relay.

Does the fuel lift pump relay click when the lift pump is actuated?

No >> Go To 5

Yes >> Replace the lift pump relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. FUEL LIFT PUMP DRIVER CIRCUIT OPEN

Turn Ignition off.

Disconnect the ECM connectors.

NOTE: Check connectors - Clean/repair as necessary.

Using an ohmmeter, measure the resistance of the lift pump relay driver wire between the ECM connector and the PDC.

Is the resistance less than 10 Ohms?

No >> Repair the Fuel lift pump driver circuit open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

Yes >> Go To 6

---

6. FUEL LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO EXTERNAL VOLTAGE

Measure the voltage between battery negative and the relay driver circuit in the PDC.

Is the voltage greater than 1 volt?

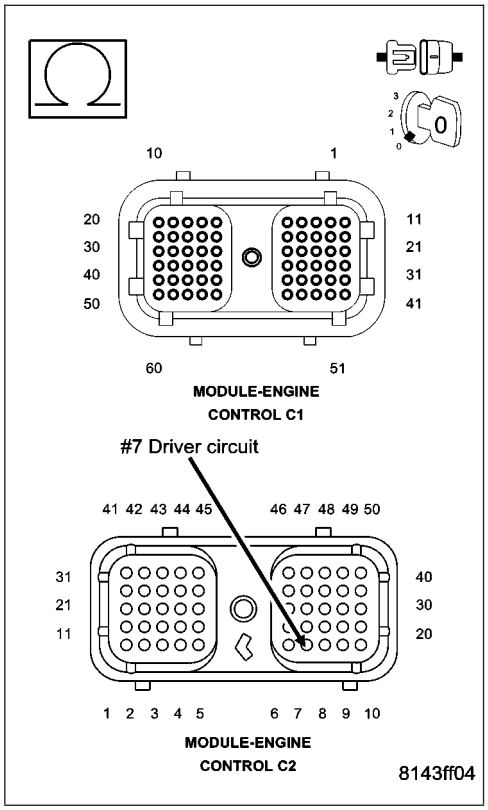
Yes >> Repair the Fuel lift pump Relay driver circuit shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7

P0628-LOW VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

7. FUEL LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the lift pump relay driver circuit in the ECM connector and all other circuits in the ECM connectors.



Is the resistance less than 10 Ohms?

Yes >> Repair the Fuel lift pump Relay driver circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 8

---

8. ECM

Reconnect the ECM connectors.

Turn the ignition on, engine off.

Connect one end of an incandescent test light to battery negative.

Connect the other end of the test light to the relay driver pin in the PDC.

Using the scan tool, actuate the lift pump.

Does the test light illuminate brightly?

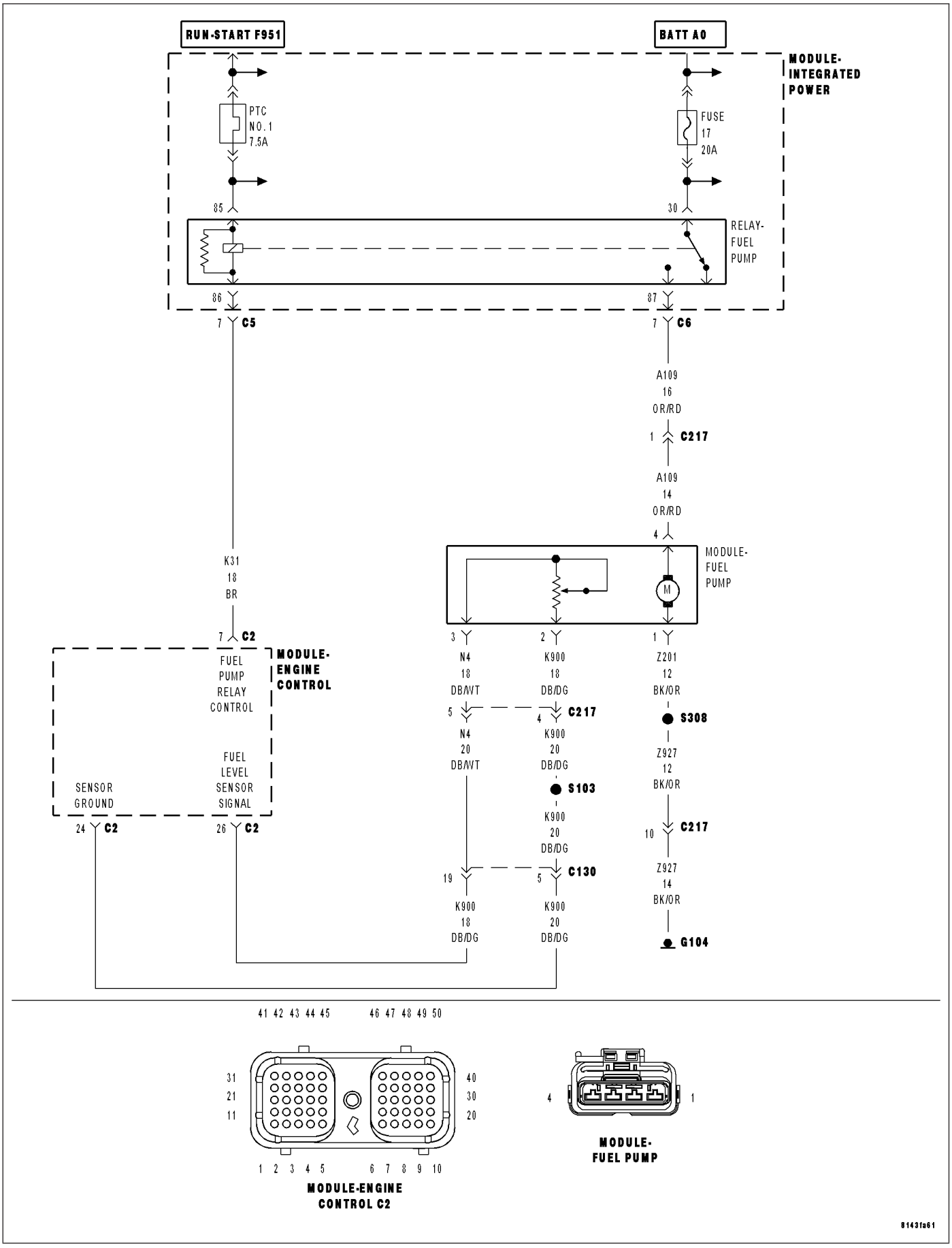
Yes >> Repair complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0629-HIGH VOLTAGE DETECTED AT THE FUEL LIFT PUMP



P0629-HIGH VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  The commanded signal to the fuel lift pump relay does not match the feedback signal from the fuel lift pump relay.

Possible Causes
DAMAGED WIRRING HARNESS
LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO GROUND
LIFT PUMP RELAY
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. LIFT PUMP RUNS

Remove the cover to the PDC.
Turn the ignition on, engine off.
With the scan tool, in system test actuate the lift pump relay.

Does the fuel lift pump relay click when the lift pump is actuated?

Yes >> Test complete.
Perform Intermittent Condition test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. LIFT PUMP RELAY DOES NOT CLICK

Turn Ignition off.
Remove the lift pump relay from the PDC.
Turn the ignition on.
Connect one end of an incandescent test light to battery negative.
Connect the other end of the test light to the relay driver pin in the PDC.
With the scan tool, in system test actuate the lift pump relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Go To 5

P0629-HIGH VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

3. LIFT PUMP RELAY

Install a know good relay in place of the fuel lift pump relay.

With the scan tool, in system test actuate the lift pump relay.

Does the fuel lift pump relay click when the lift pump is actuated?

No >> Go To 4

Yes >> Replace the lift pump relay.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. FUEL LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO GROUND

Measure the resistance between battery negative and the relay driver circuit in the PDC.

Is the resistance less than 10 ohms?

Yes >> Repair the Fuel lift pump Relay driver circuit shorted to ground.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. FUEL LIFT PUMP RELAY DRIVER CIRCUIT SHORTED TO OTHER CIRCUITS

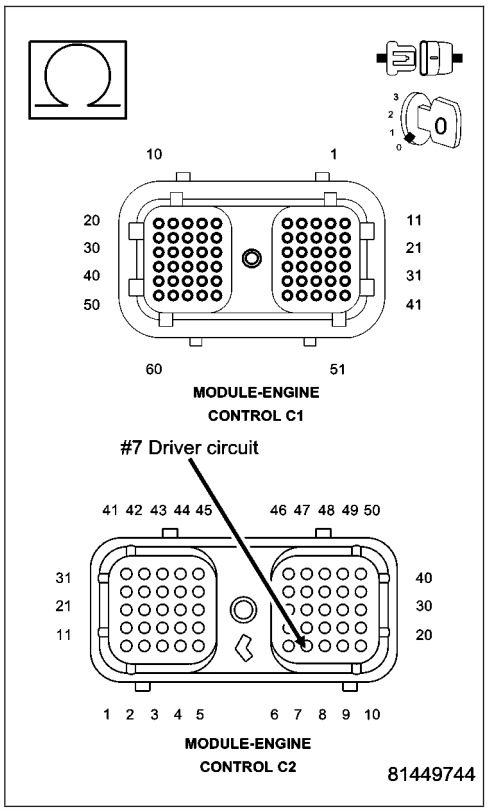
Measure the resistance between the lift pump relay driver circuit in the ECM connector and all other circuits in the ECM connectors.

Is the resistance less than 10 Ohms?

Yes >> Repair the Fuel lift pump Relay driver circuit shorted to another circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6



P0629-HIGH VOLTAGE DETECTED AT THE FUEL LIFT PUMP (CONTINUED)

6. ECM

Reconnect the ECM connectors.

Turn the ignition on, engine off.

Connect one end of an incandescent test light to battery negative.

Connect the other end of the test light to the relay driver pin in the PDC.

Using the scan tool, actuate the lift pump.

Does the test light illuminate brightly?

Yes >> Repair complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0630-VIN NOT ENTERED ERROR

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  The VIN was not calibrated into the ECM.

Possible Causes
VIN NOT CALIBRATED INTO ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. VIN NOT CALIBRATED INTO ECM

Using the scan tool, recalibrate the ECM with the proper VIN.

Did the DTC P0630 reset?

Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Test Complete.

P0633-SKIM SECRET KEY NOT ENTERED

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on.
- **Set Condition:**
  The SKIM secret key was not calibrated into the ECM.

Possible Causes
IMPROPER IGNITION KEY IS BEING USED
SKIM DTC'S
SKIM NOT CALIBRATED PROPERLY

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. SKIM DTC'S

With the scan tool, read SKIM DTCs.

Are any SKIM DTC's present?

Yes >> Repair all SKIM DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. IMPROPER IGNITION KEY IS BEING USED

Verify that the proper ignition key is in the ignition lock on the steering column.

Are the proper keys being used?

Yes >> Go To 3

No >> Use the proper key for the vehicle.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. SKIM NOT CALIBRATED PROPERLY

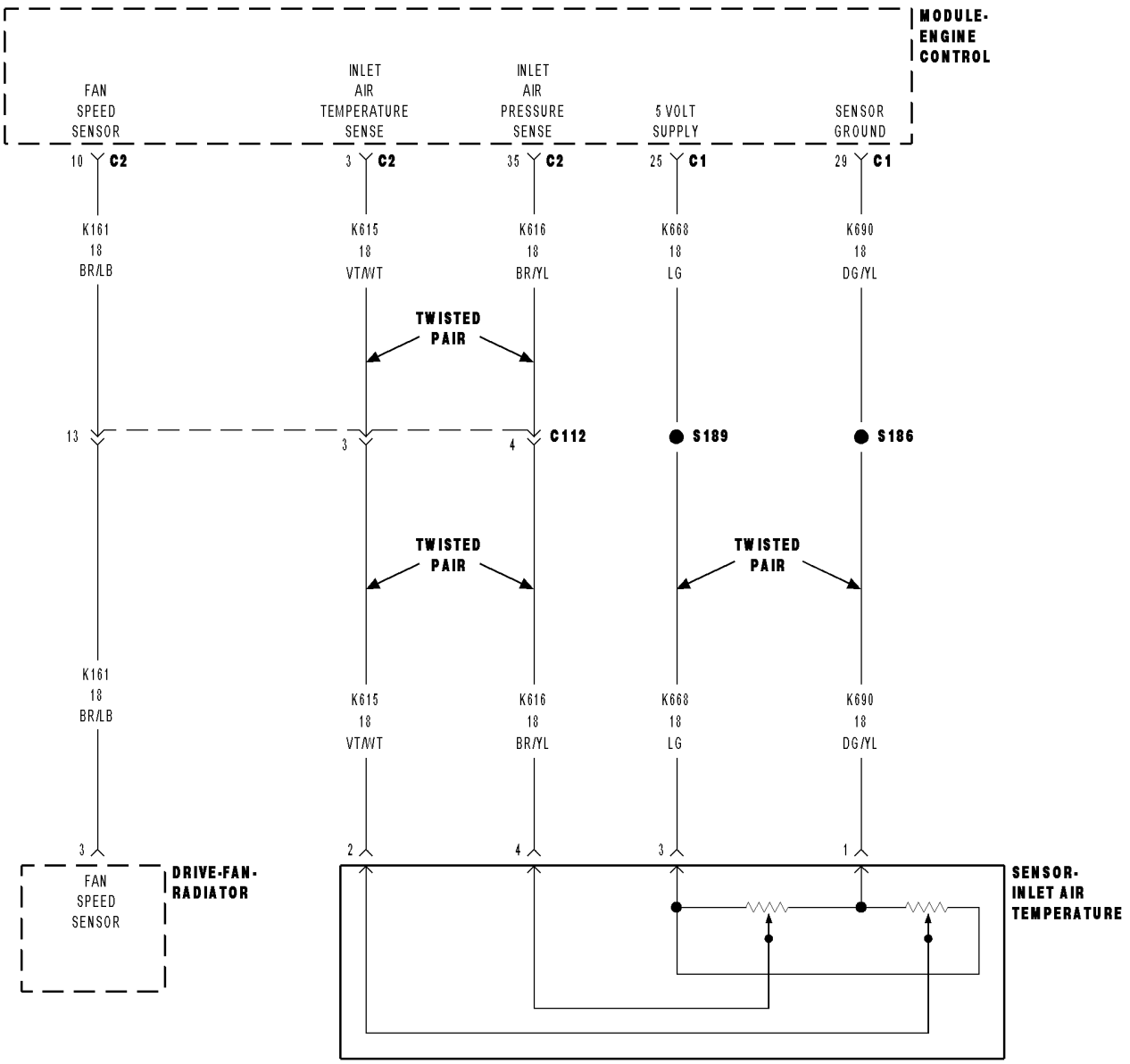
Using the scan tool, recalibrate the ECM with the proper SKIM secret key.
With the scan tool, erase DTCs.
Cycle the ignition switch from on to off to on.
With the scan tool, read DTCs.

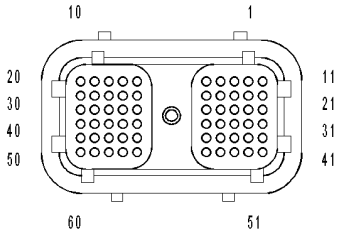
Did the DTC reset?

No >> Test Complete.

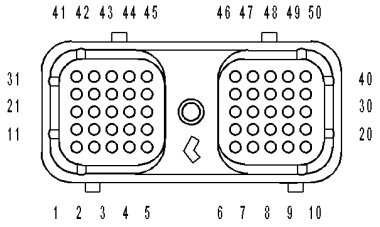
Yes >> Verify information is correct and replace ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0642-LOW VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT





MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

81449944

P0642-LOW VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  Voltage detected on the #2 sensor supply circuit is below a calibrated value.

Possible Causes
FAN CLUTCH ASSEMBLY
(K668) 5-VOLT SHORTED TO GROUND
(K668) 5-VOLT SUPPLY SHORTED TO ANOTHER CIRCUIT
FAN DTC
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FAN CLUTCH ASSEMBLY

Disconnect the Fan clutch harness connector.

NOTE: Check connectors - Clean/repair as necessary.
With the scan tool, read DTCs.

Did P0483 set?

Yes >> Replace the Fan clutch assembly.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0642-LOW VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT (CONTINUED)

2. (K668) 5-VOLT SHORTED TO GROUND

Turn the ignition off.

Disconnect the ECM harness connector.

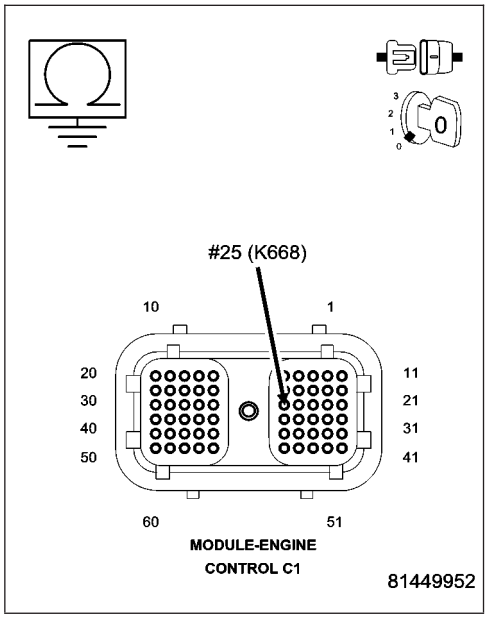
NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the (K668) #2 5-volt supply (fan speed sensor power) circuit in the sensor harness connector and battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 3

No >> Repair the #2 (K668) 5-volt supply shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



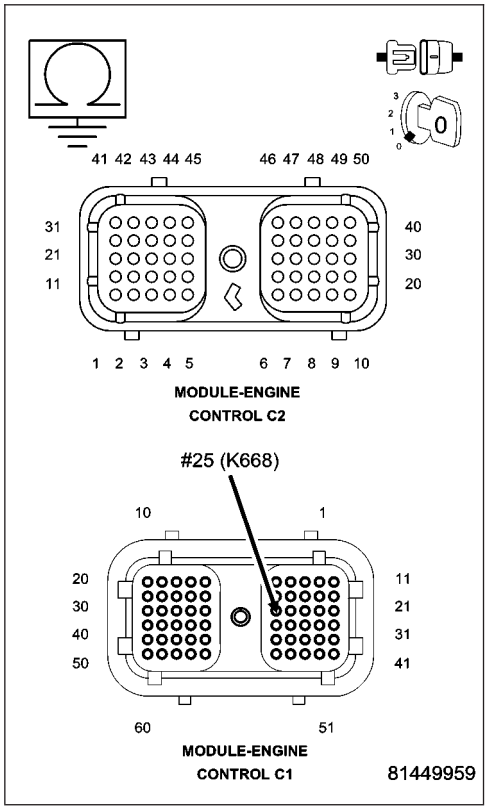
3. (K668) 5-VOLT SUPPLY SHORTED TO ANOTHER CIRCUIT

Measure the resistance between the sensor (K668) #2 5-volt supply (fan speed sensor power) circuit in the ECM harness connector to all other circuits in the ECM harness connectors

Is the resistance greater than 100k Ohms?

Yes >> Go To 4

No >> Repair the 5-volt supply shorted to another circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0642-LOW VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT (CONTINUED)

4. FAN DTC

Reconnect the ECM harness connectors.

Reconnect the disconnected Fan harness connector.

Turn the ignition on.

With the scan tool, read DTCs.

Is DTC P0483 set?

Yes >> Repair the Fan DTC.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

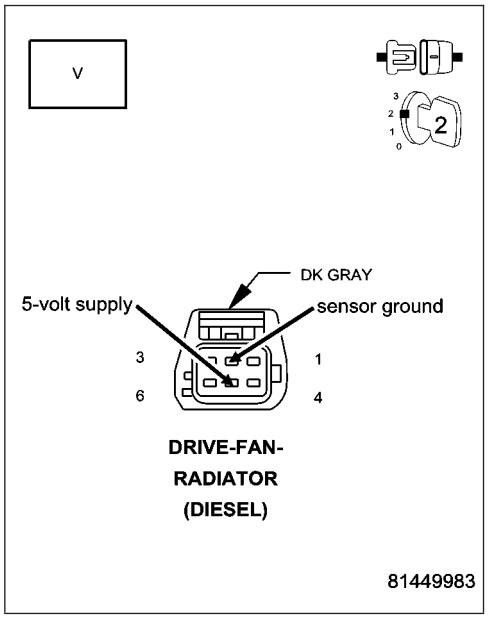
5. ECM

Turn the ignition off.

Disconnect the Fan harness connector.

Turn the ignition on.

Measure the voltage between the sensor (K668) #2 5-volt supply (fan speed sensor power) circuit at the fan clutch harness connector and the fan speed sensor ground.

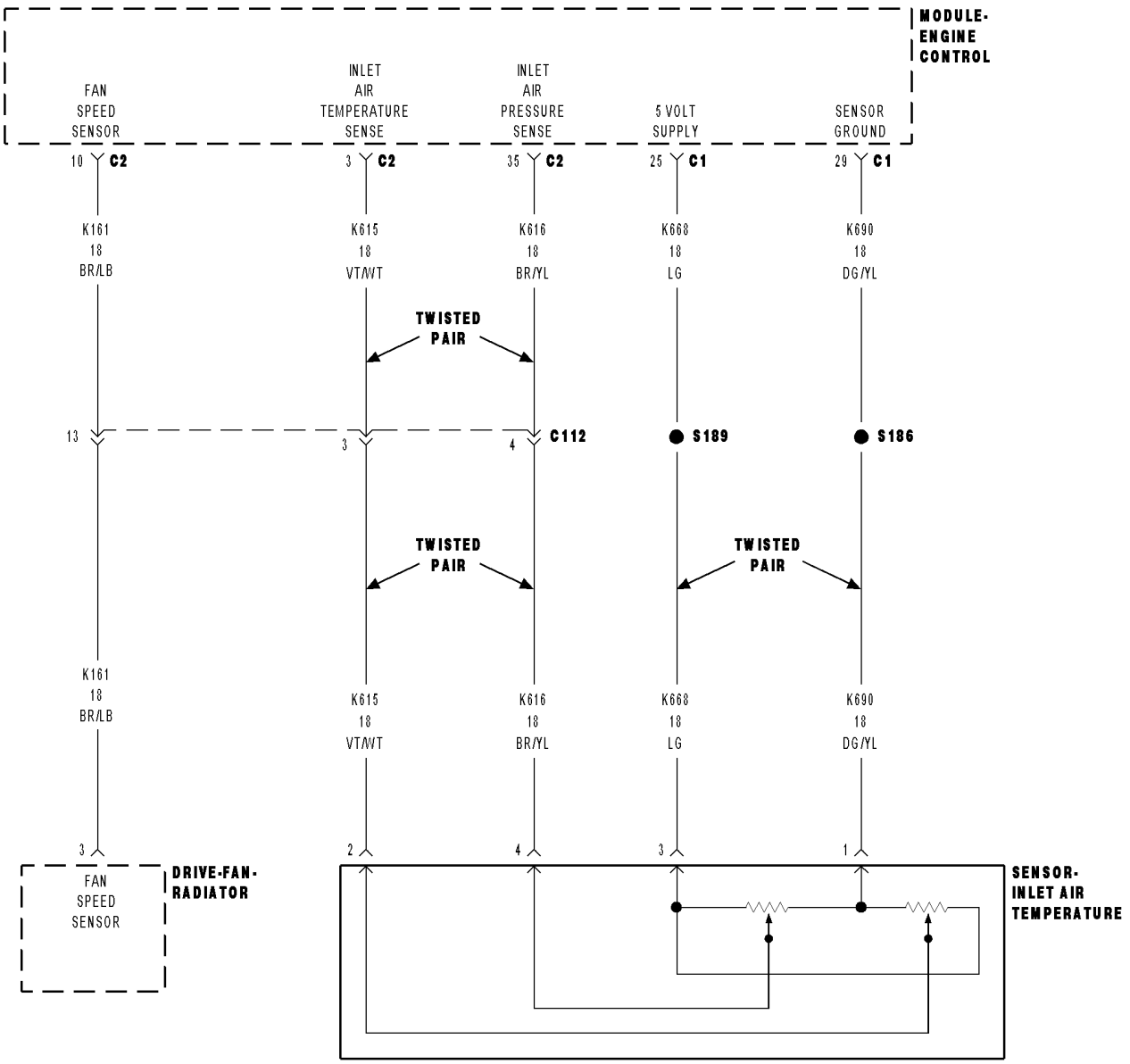


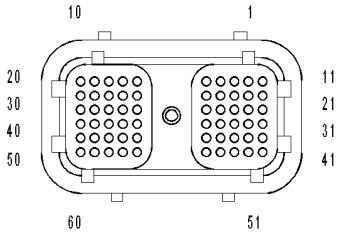
Is the voltage between 4.5 and 5.5 volts?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

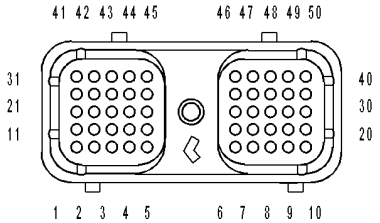
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0643-HIGH VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT





MODULE-ENGINE
CONTROL C1



MODULE-ENGINE
CONTROL C2

81449944

P0643-HIGH VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  Voltage detected on the #2 sensor supply circuit was above a calibrated value.

Possible Causes
FAN CLUTCH ASSEMBLY
(K668) 5-VOLT SHORTED TO VOLTAGE
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FAN CLUTCH ASSEMBLY

Disconnect the Fan clutch harness connector.

NOTE: Check connectors - Clean/repair as necessary.
With the scan tool, read DTCs.

Did P0483 set?

Yes >> Replace the Fan clutch assembly.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P0643-HIGH VOLTAGE AT THE #2 SENSOR SUPPLY CIRCUIT (CONTINUED)

2. (K668) 5-VOLT SHORTED TO VOLTAGE

Disconnect the ECM harness connectors.

Disconnect the Fan harness connector.

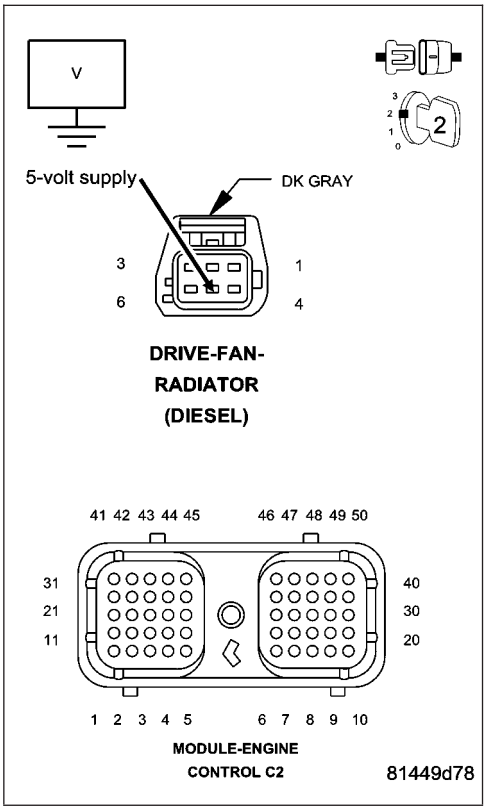
NOTE: Check connectors - Clean/repair as necessary.

Measure the voltage between the fan speed sensor (K668) 5-volt supply circuit and battery negative.

Is the voltage greater than 1 volt?

Yes >> Repair the (K668) 5-volt supply shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. ECM

Turn the ignition off.

Reconnect the ECM harness connectors.

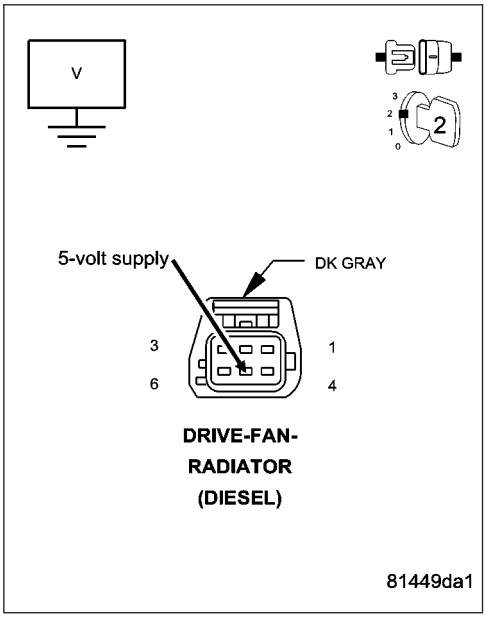
Turn the ignition on.

Measure the voltage between the (K668) 5-volt supply circuit in the sensor harness connector and battery negative.

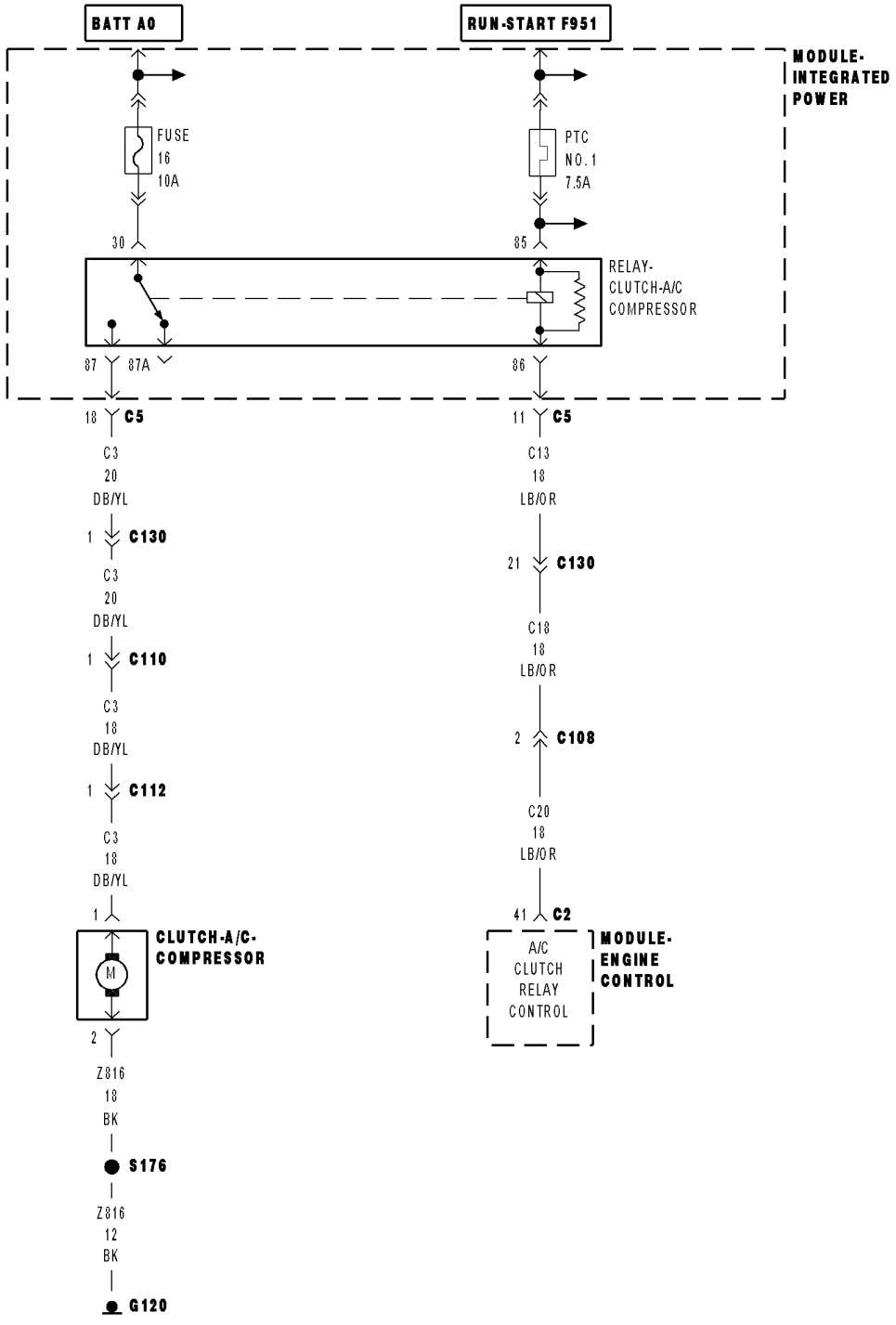
Is the voltage greater than 6 volts?

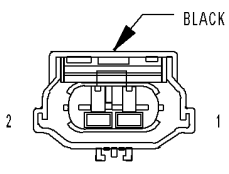
Yes >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

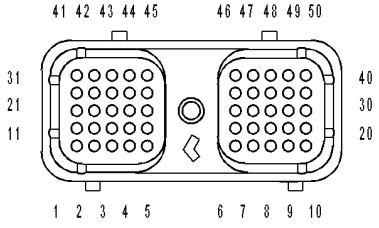


P0646-LOW VOLTAGE DETECTED AT THE A/C CLUTCH RELAY





CLUTCH-A/C COMPRESSOR (DIESEL)



MODULE-ENGINE CONTROL C2

81449e87

P0646-LOW VOLTAGE DETECTED AT THE A/C CLUTCH RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the A/C Clutch output does not match the signal from the A/C Clutch feedback.

Possible Causes
A/C CLUTCH RELAY
LOOSE CONNECTION
FUSED BATTERY SUPPLY
(C13) A/C SIGNAL CIRCUIT OPEN
(C13) A/C SIGNAL CIRCUIT SHORTED TO GROUND
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CLUTCH CLICKING

Ignition on, engine not running.

With the scan tool, actuate the A/C clutch relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

Actuation still running.

While the relay is clicking, wiggle the wiring harness and connectors throughout the circuit.

Does this interrupt the clicking?

Yes >> Repair the loose connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0646-LOW VOLTAGE DETECTED AT THE A/C CLUTCH RELAY (CONTINUED)

3. A/C CLUTCH RELAY

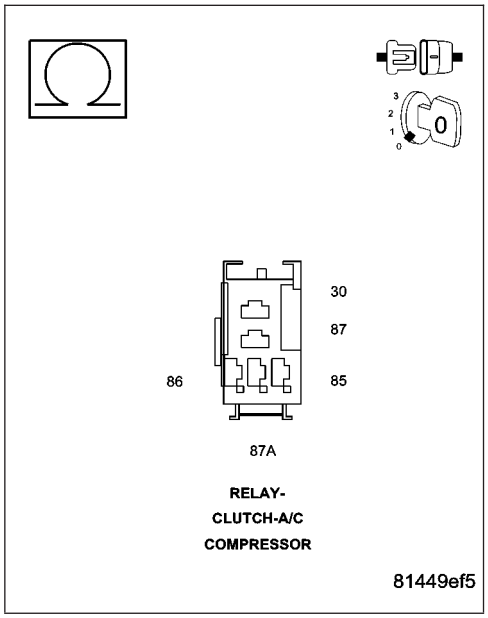
Remove the A/C Clutch Relay from the PDC.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between terminals 85 and 86 of the A/C Clutch Relay.

Is the resistance less than 100 Ohms?

Yes >> Go To 4

No >> Replace the A/C clutch relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



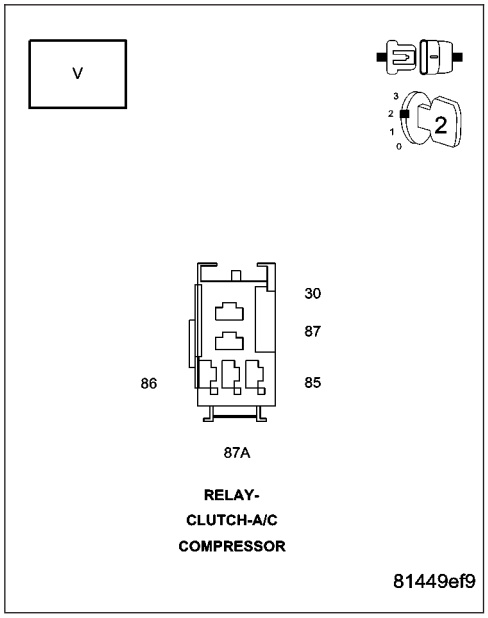
4. FUSED BATTERY SUPPLY

Ignition on, engine not running.
Measure the voltage on the Fused Battery Supply circuit in the PDC.

Is the voltage within 1 volt of battery voltage?

Yes >> Go To 5

No >> Repair the open Fused battery supply.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0646-LOW VOLTAGE DETECTED AT THE A/C CLUTCH RELAY (CONTINUED)

5. (C13) A/C SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the (C13) A/C Clutch signal circuit between the PDC and the ECM harness connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 6

No >> Repair the open (C13) A/C signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. (C13) A/C SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance of the (C13) A/C Clutch signal circuit between the PDC and battery negative.

Is the resistance greater than 100k Ohms?

Yes >> Go To 7

No >> Repair the (C13) A/C signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. ECM

Reconnect the ECM harness connectors.

Using the scan tool, actuate the A/C Clutch Relay

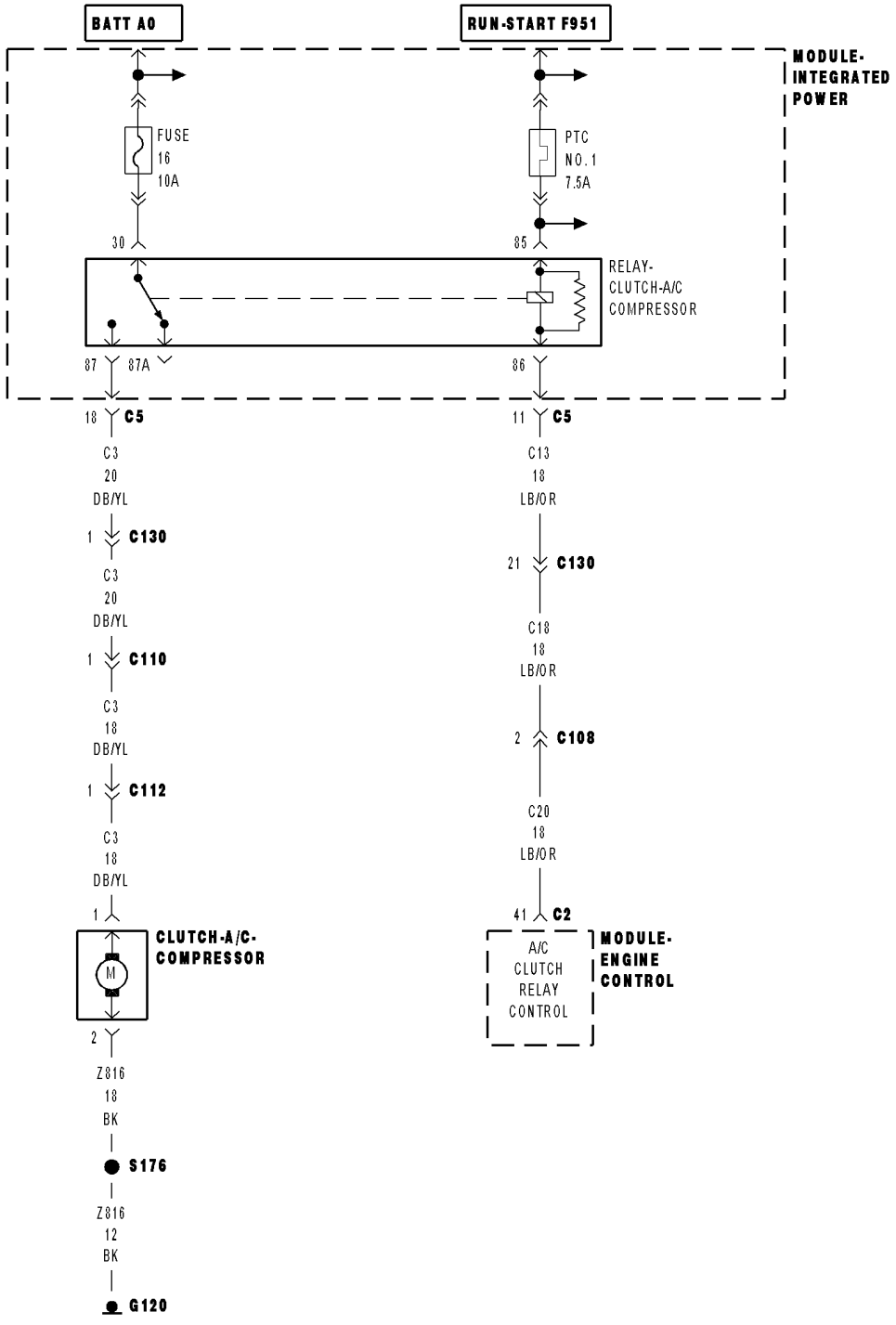
While monitoring with the scan tool, use a jumper wire to connect 12 volts to the relay signal cavity (85) in the PDC with the relay disconnected.

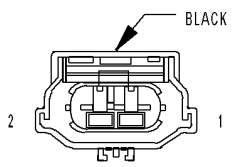
Did DTC P0647 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

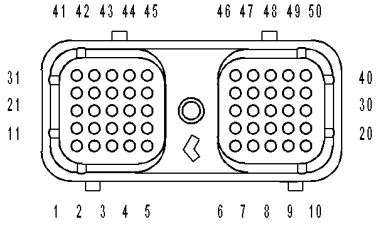
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0647-HIGH VOLTAGE DETECTED AT THE A/C CLUTCH RELAY





CLUTCH-A/C
COMPRESSOR
(DIESEL)



MODULE-ENGINE
CONTROL C2

81449e87

P0647-HIGH VOLTAGE DETECTED AT THE A/C CLUTCH RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the A/C Clutch output does not match the signal from the A/C Clutch feedback.

Possible Causes
LOOSE CONNECTION
SHORTED TO EXTERNAL VOLTAGE
FUSED BATTERY SUPPLY
A/C CLUTCH RELAY
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CLUTCH CLICKING

Ignition on, engine not running.

With the scan tool, actuate the A/C clutch relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

Actuation still running.

While the relay is clicking, wiggle the wiring harness and connectors throughout the circuit.

Does this interrupt the clicking?

Yes >> Repair the loose connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P0647-HIGH VOLTAGE DETECTED AT THE A/C CLUTCH RELAY (CONTINUED)

3. FUSED BATTERY SUPPLY

Ignition off.

Disconnect the ECM connectors.

Remove the A/C clutch relay.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Measure the voltage on the Fused Battery Supply circuit between the PDC and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 4

No >> Repair the short to voltage.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

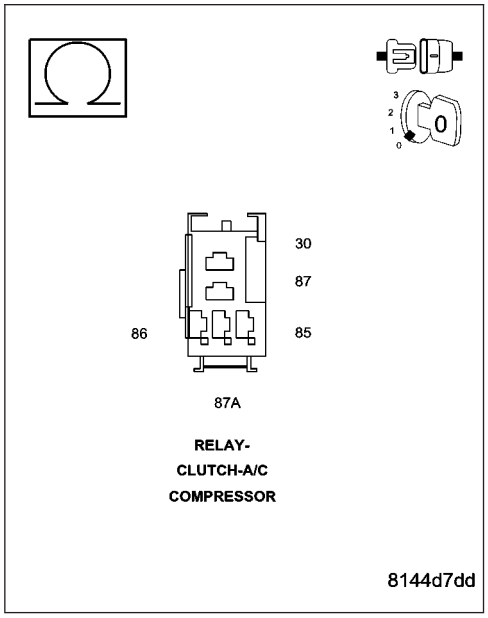
---

4. A/C CLUTCH RELAY

Remove the A/C Clutch Relay from the PDC.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between terminals 85 and 86 of the A/C Clutch Relay.



Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Replace the A/C clutch relay.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. ECM

Reconnect the ECM harness connectors.

Reinstall the A/C clutch relay.

With the scan tool, actuate the A/C clutch relay.

Turn the ignition on.

While monitoring with the scan tool, disconnect the A/C Clutch Relay from the PDC.

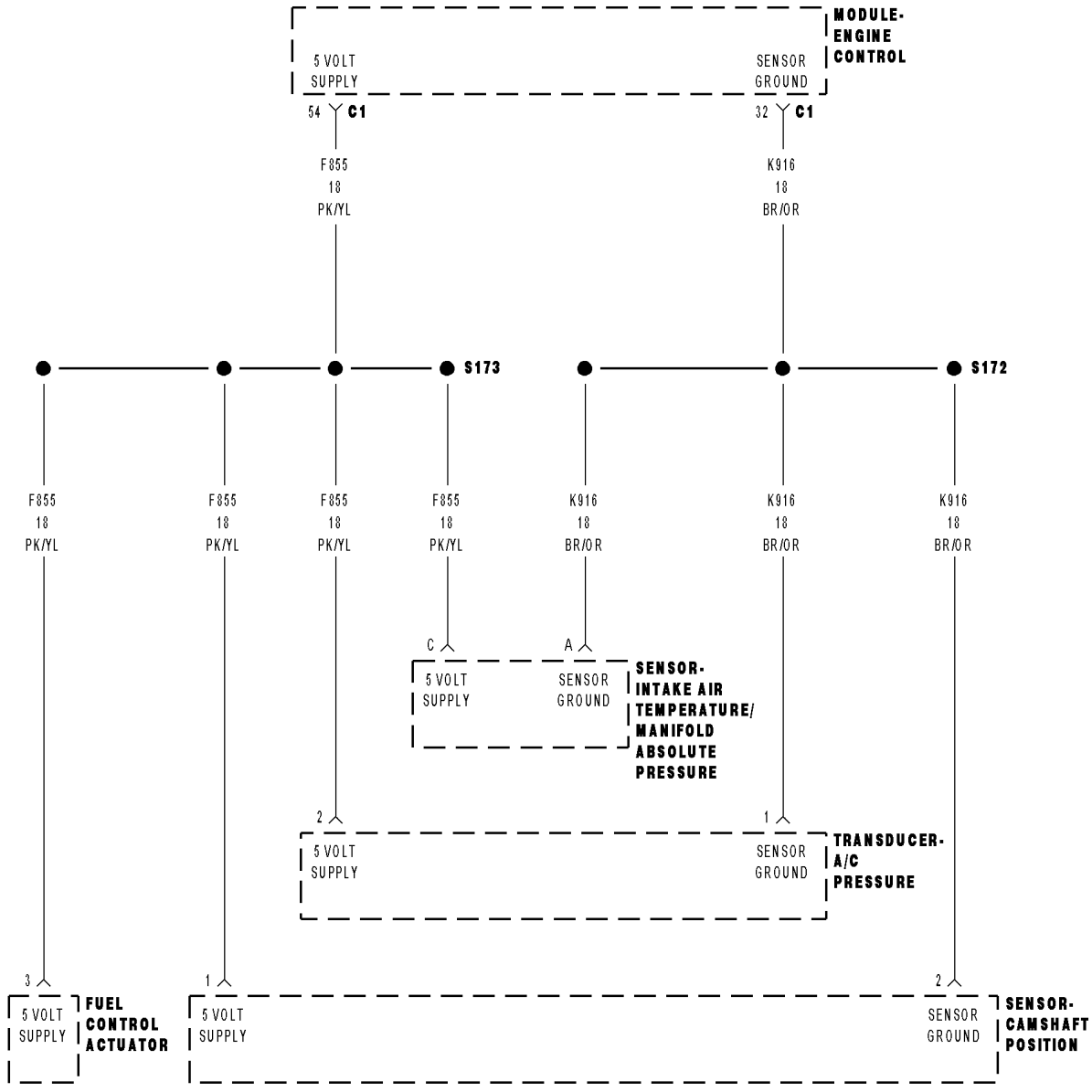
Did DTC P0646 set?

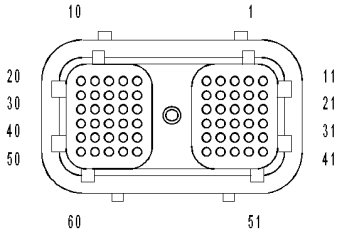
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0652-LOW VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT





MODULE-ENGINE
CONTROL C1

8144e883

P0652-LOW VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the key on.
- **Set Condition:**
  Voltage detected on the sensor supply is below a calibrated value.

Possible Causes
ECM
(F855) #1 5-VOLT SUPPLY SHORTED TO GROUND
(F855) #1 5-VOLT SUPPLY SHORTED
FUEL RAIL PRESSURE
A/C PRESSURE SENSOR
MAP SENSOR
CAMSHAFT POSITION SENSOR
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM

Turn the ignition off.

Disconnect the ECM 60 pin harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Turn the ignition on.

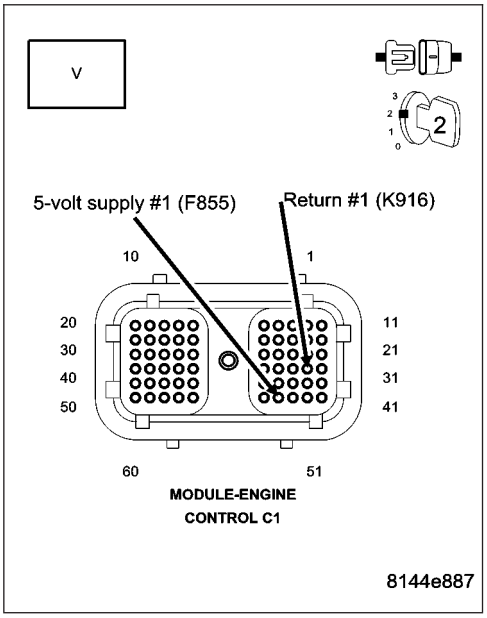
Measure the voltage between the Sensor (F855) #1 5-volt Supply and the Sensor (K916) #1 Return pin at the ECM.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 2

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

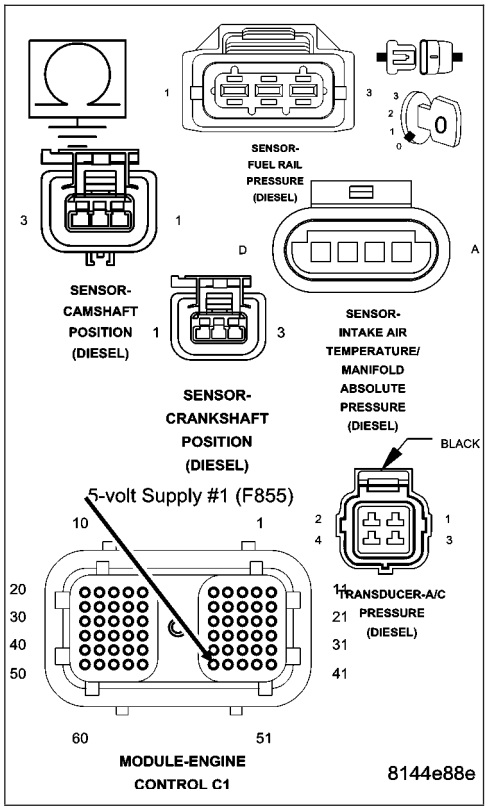


P0652-LOW VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT (CONTINUED)

2. (F855) #1 5-VOLT SUPPLY SHORTED TO GROUND

Disconnect the Pressure sensors harness connectors and the engine position sensor.

Measure the resistance between the (F855) #1 sensor supply circuits at the ECM harness connector and battery negative.



Is the resistance greater than 100K Ohms?

Yes >> Go To 3

No >> Repair the harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. FUEL RAIL PRESSURE

Reconnect the ECM harness connector.

While monitoring with the scan tool, disconnect the fuel rail pressure sensor.

Is DTC P0652 set?

Yes >> Go To 4

No >> Replace the Fuel rail pressure sensor.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. A/C PRESSURE SENSOR

While monitoring with the scan tool, disconnect the A/C pressure sensor.

Is DTC P0652 set?

Yes >> Go To 5

No >> Replace the A/C pressure sensor.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0652-LOW VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT (CONTINUED)

5. MAP SENSOR

While monitoring with the scan tool, disconnect the map sensor.

Is DTC P0652 set?

Yes >> Go To 6

No >> Replace the MAP sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. CAMSHAFT POSITION SENSOR

While monitoring with the scan tool, disconnect the Camshaft position sensor.

Is DTC P0652 set?

Yes >> Go To 7

No >> Replace the Camshaft position sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

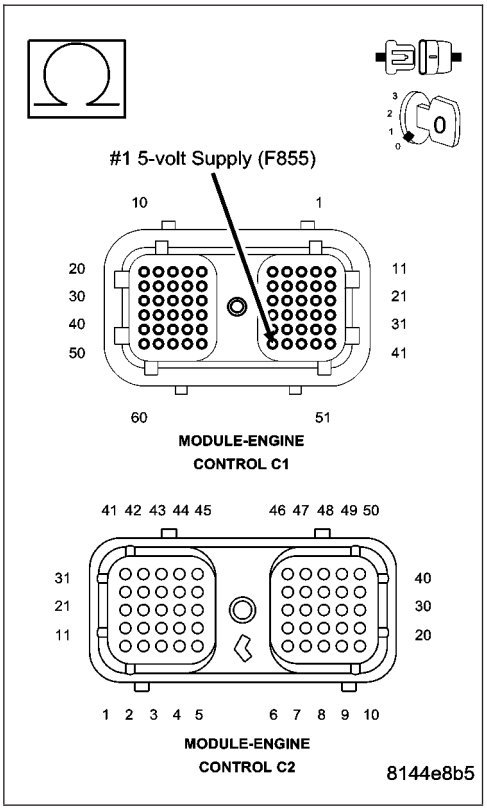
7. (F855) #1 5-VOLT SUPPLY SHORTED

Measure the resistance between the (F855) #1 sensor supply circuit of the ECM harness connector and all other circuits in both ECM harness connectors.

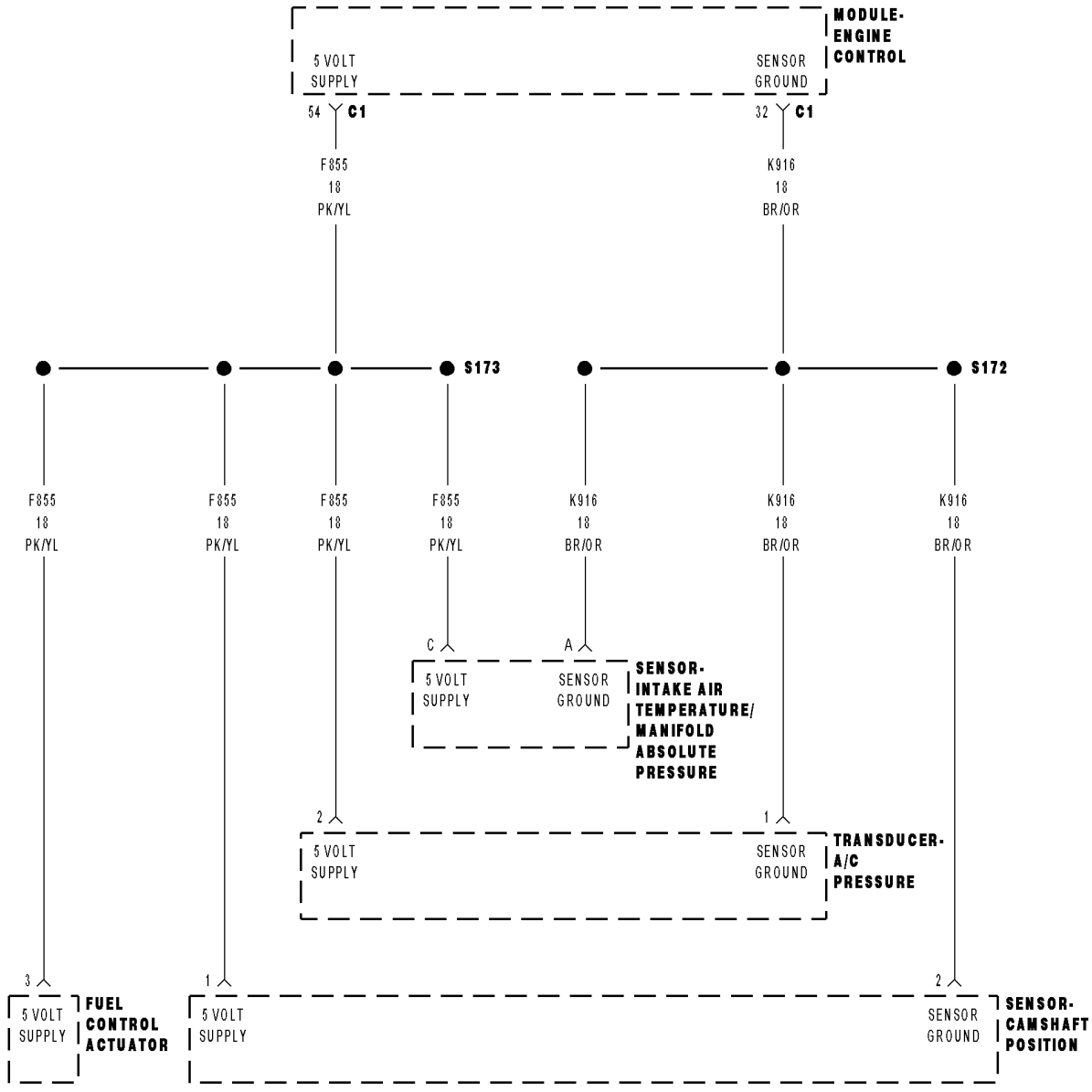
Is the resistance greater than 100K Ohms?

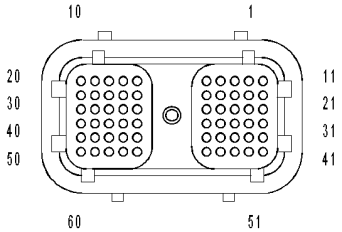
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Repair the shorted circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0653-HIGH VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT





MODULE-ENGINE CONTROL C1

8144e883

P0653-HIGH VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  Voltage detected on the sensor supply is above a calibrated value.

Possible Causes
ECM
(F855) 5-VOLT SUPPLY SHORTED TO VOLTAGE
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM

Turn the ignition off.

Disconnect the ECM 60 pin harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Turn the ignition on.

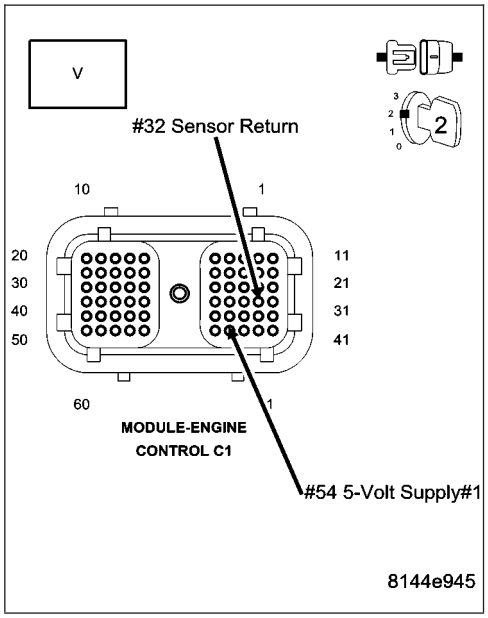
Measure the voltage between the Sensor (F855) #1 5-volt Supply and the Sensor #1 Return pin at the ECM.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Go To 2

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0653-HIGH VOLTAGE AT THE #1 SENSOR SUPPLY CIRCUIT (CONTINUED)

2. (F855) 5-VOLT SUPPLY SHORTED TO VOLTAGE

Key off.

Disconnect the sensor connectors for each pressure sensor, and the engine position sensor.

Disconnect the ECM 50 way harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine off.

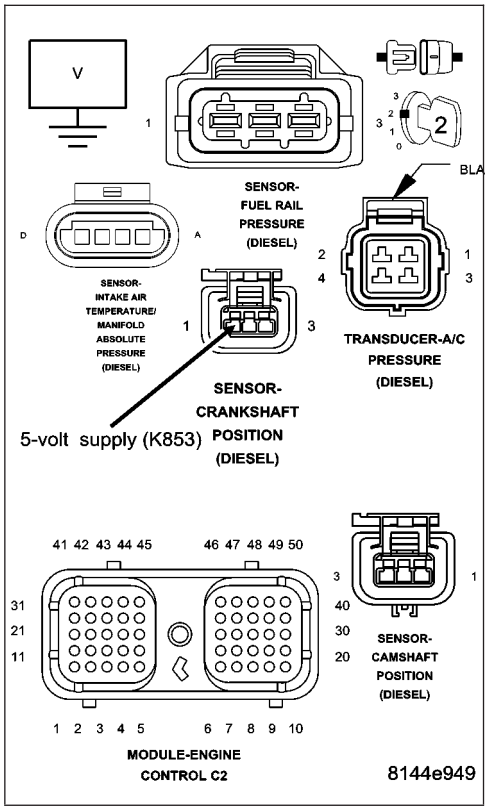
Measure the voltage between the supply circuit at each pressure sensor harness connector and battery negative.

Measure voltage between the (F853) 5-volt supply circuit at the engine position sensor harness connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 3

No >> Repair the (F855) 5-volt supply shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



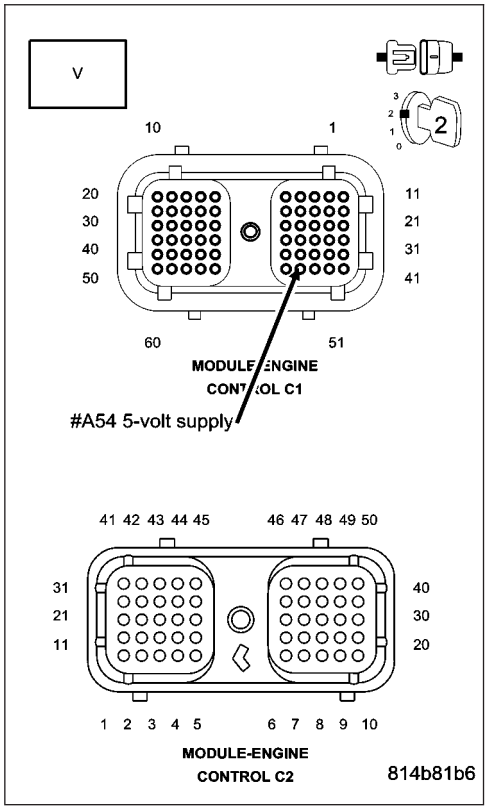
3. SENSOR SUPPLY SHORTED TO VOLTAGE IN HARNESS

Measure the resistance between the #1 sensor supply circuit and all other circuit in the ECM connectors.

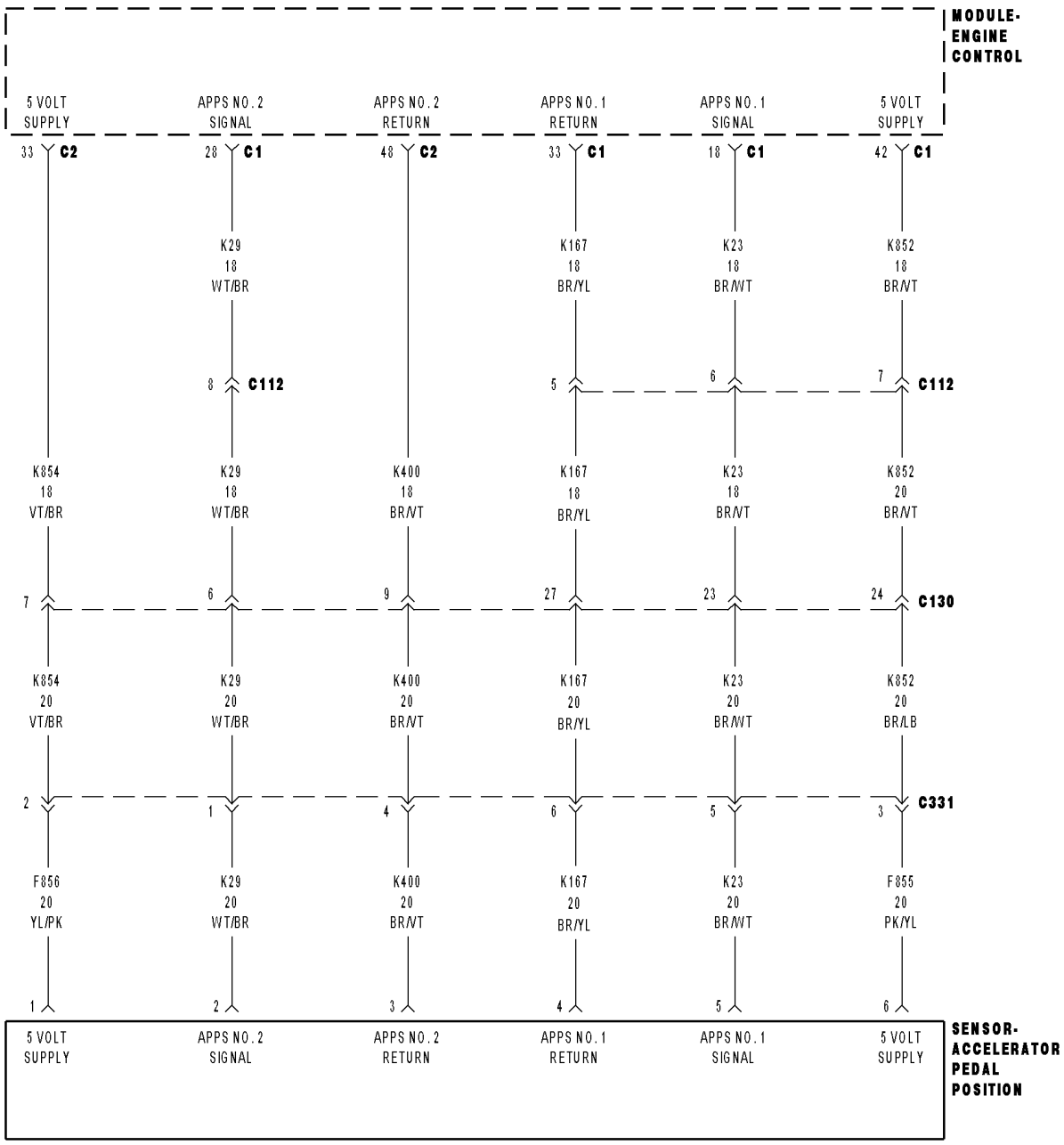
Is the resistance less than 10 ohms?

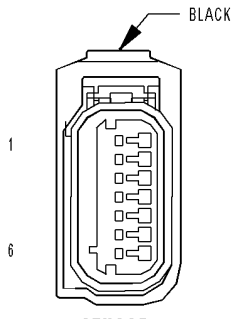
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

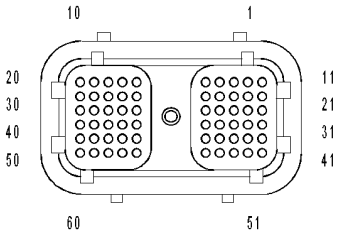
No >> Repair the harness shorted to voltage.

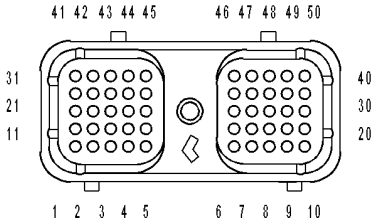


P0698-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO LOW









8144ca54

P0698-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With engine running.
- **Set Condition:**
  Low voltage detected at the APPS supply circuit or low voltage detected at the APPS 1 5–volt supply.

Possible Causes
(F855) APPS 5-VOLT SUPPLY OPEN
APPS HIGH RESISTANCE
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO (K922) RETURN CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM
INTERMITTENT CONDITION
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS
APPS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY NEGATIVE

Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the APPS harness connector.

Check connectors - Clean/repair as necessary.

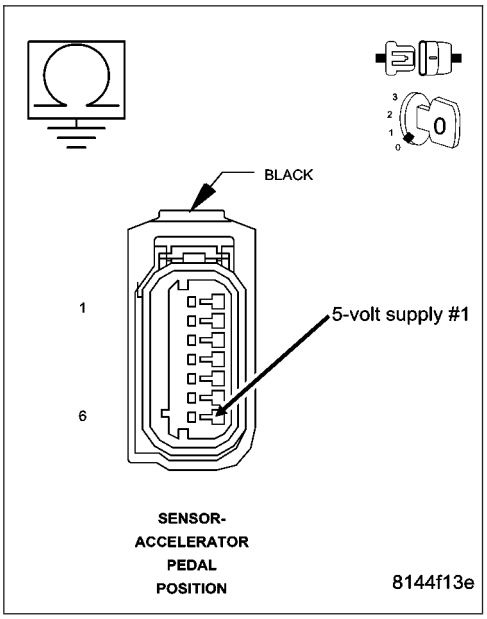
Measure the resistance of the APPS 1 (F855) 5-volt supply circuit between the sensor harness connector and battery negative

Is the resistance greater than 100 k ohms?

Yes >> Go To 2

No >> Repair the (F855) 5-volt supply circuit shorted to battery negative.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0698-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO LOW (CONTINUED)

2. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS

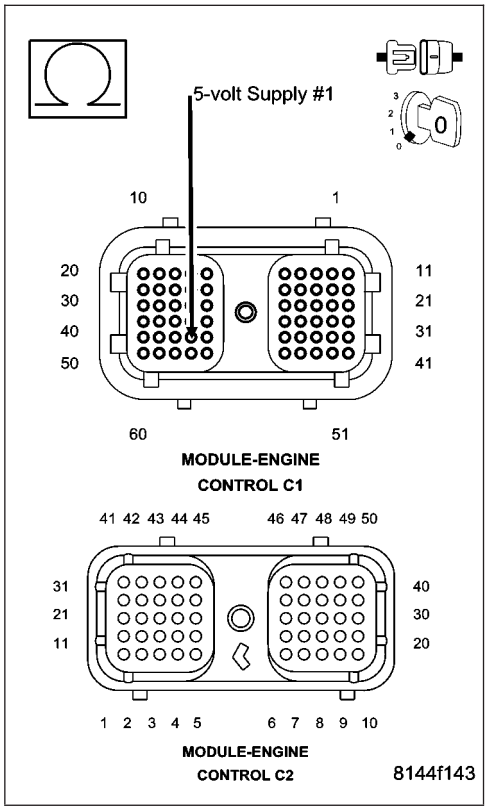
Measure the resistance between the (F855) APPS 1 5-volt supply circuit at the ECM harness connector and all other circuits in the ECM connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 3

No >> Repair the APPS #1 (F855) 5-volt supply circuit shorted to other circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. INTERNAL ECM

Reconnect the ECM harness connectors.

Turn ignition on, engine off.

While monitoring with the scan tool, connect a jumper wire between the (K23) APPS 1 signal circuit at the sensor harness connector and the (F855) APPS 1 supply circuit at the sensor harness connector.

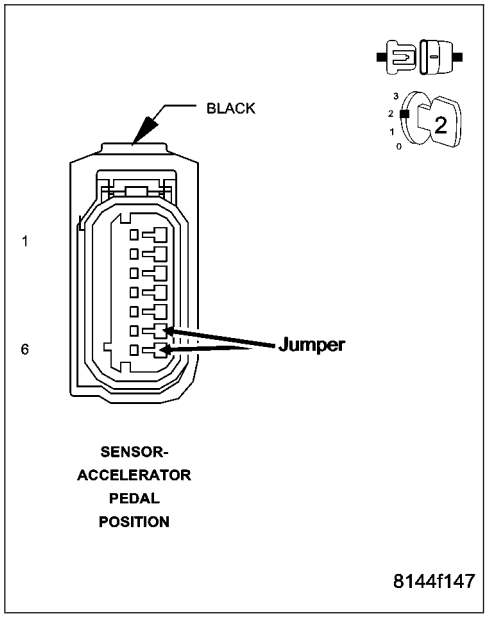
NOTE: With the APPS disconnected it is normal to have a APPS 1 and APPS 2 low voltage DTC set.

Did a APPS 1 voltage too high DTC set?

Yes >> Go To 4

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P0698-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO LOW (CONTINUED)

4. APPS

Reconnect the APPS harness connector.

Ignition on, engine not running.

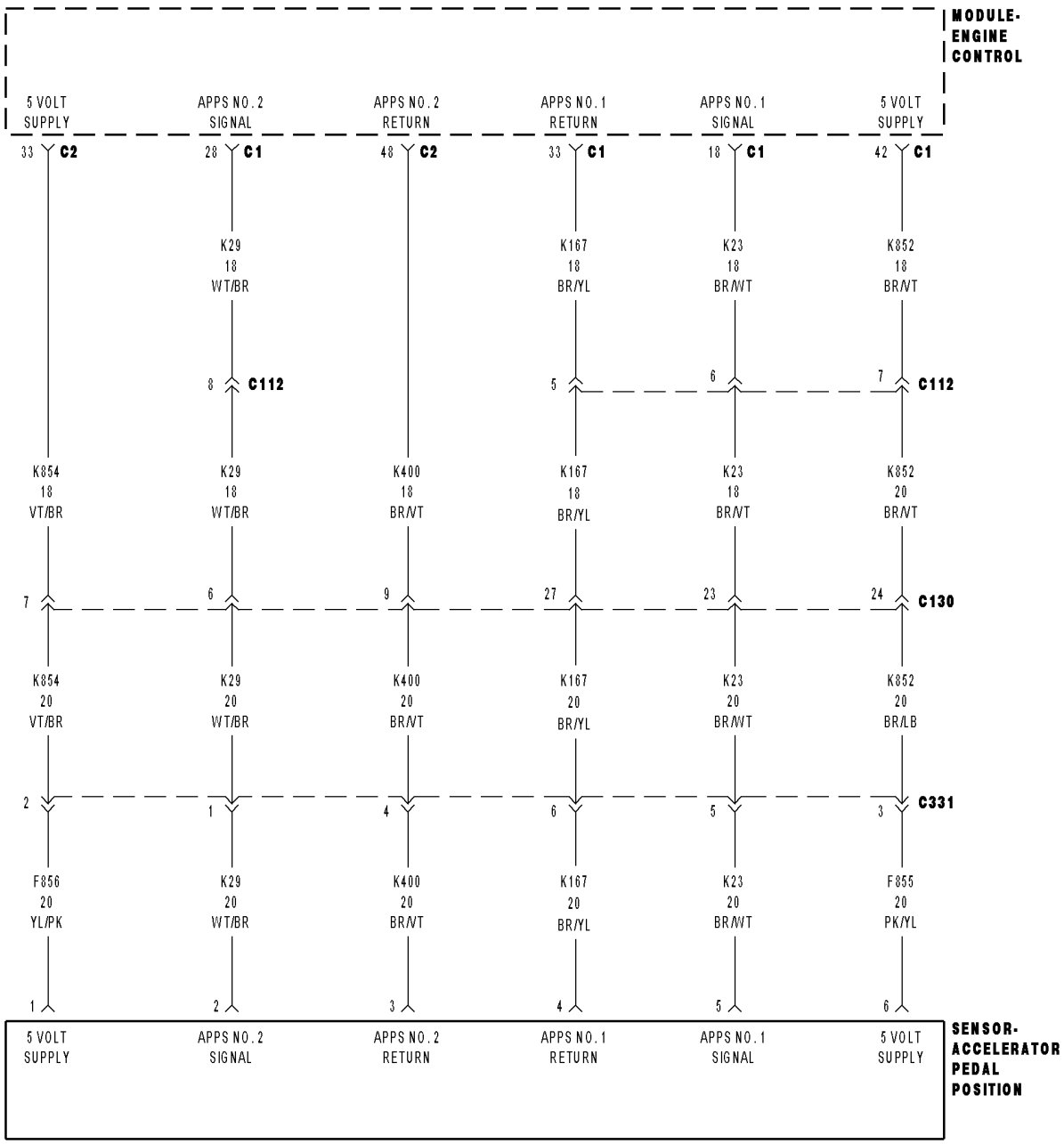
Monitor the APPS 1 and APPS 2 voltage with the scan tool while depressing the throttle pedal.

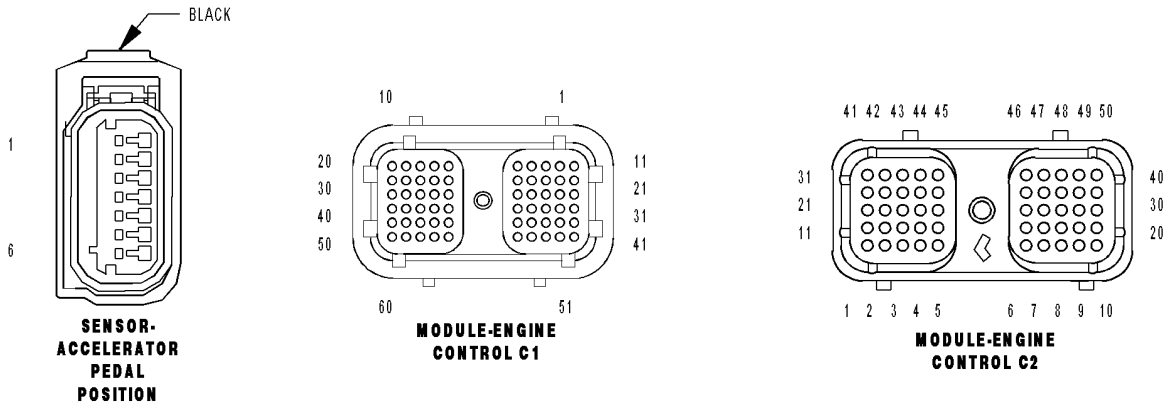
Is the voltage transition shown on the scan tool smooth while depressing the throttle and is the volt swing smooth?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P0699-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO HIGH





8144ca54

P0699-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While engine is running.
- **Set Condition:**
  High voltage detected at the APPS supply circuit.

Possible Causes
(F855) 5-VOLT SUPPLY OPEN
(F855) 5-VOLT SUPPLY SHORT TO VOLTAGE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. (F855) 5-VOLT SUPPLY OPEN

Turn the ignition off.

Disconnect the APPS harness connector.

NOTE: Check connectors - Clean/repair as necessary.

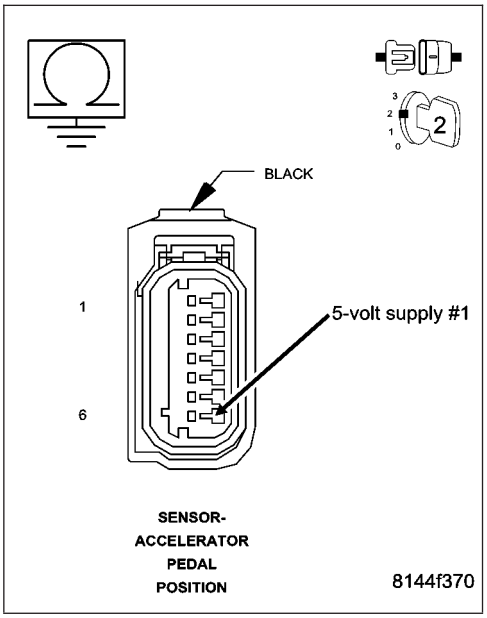
Ignition on, engine not running.

Measure the voltage between the (F855) APPS #1 5-volt supply circuit at the sensor connector and battery negative.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P0699-ACCELERATOR PEDAL POSITION SENSOR (APPS) SUPPLY VOLTAGE TOO HIGH (CONTINUED)

2. (F855) 5-VOLT SUPPLY SHORT TO VOLTAGE

Turn the ignition off.

Disconnect the ECM harness connector(s).

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

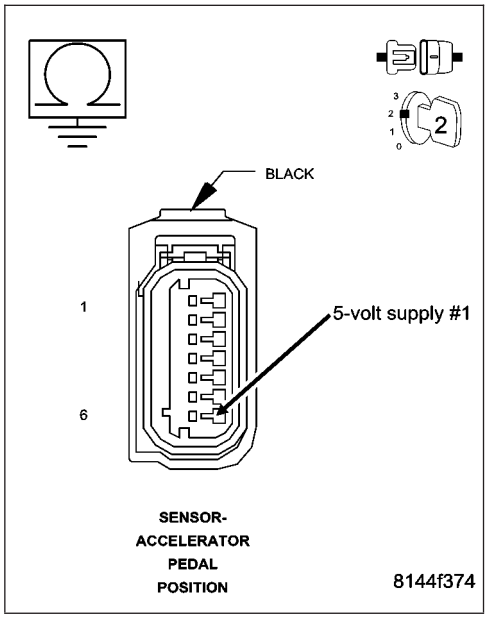
Measure the voltage between the (F855) APPS #1 5-volt supply circuit in the sensor harness connector and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 3

No >> Repair or replace the wiring harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



3. ECM

Turn the ignition off.

Reconnect the ECM harness connector(s).

Ignition on, engine not running.

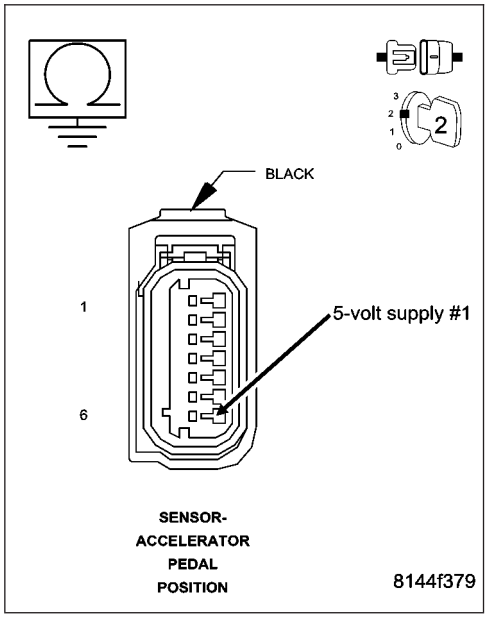
Measure the voltage between the (F855) APPS #1 5-volt supply circuit at the sensor harness connector and battery negative.

Is the voltage greater than 6 volts?

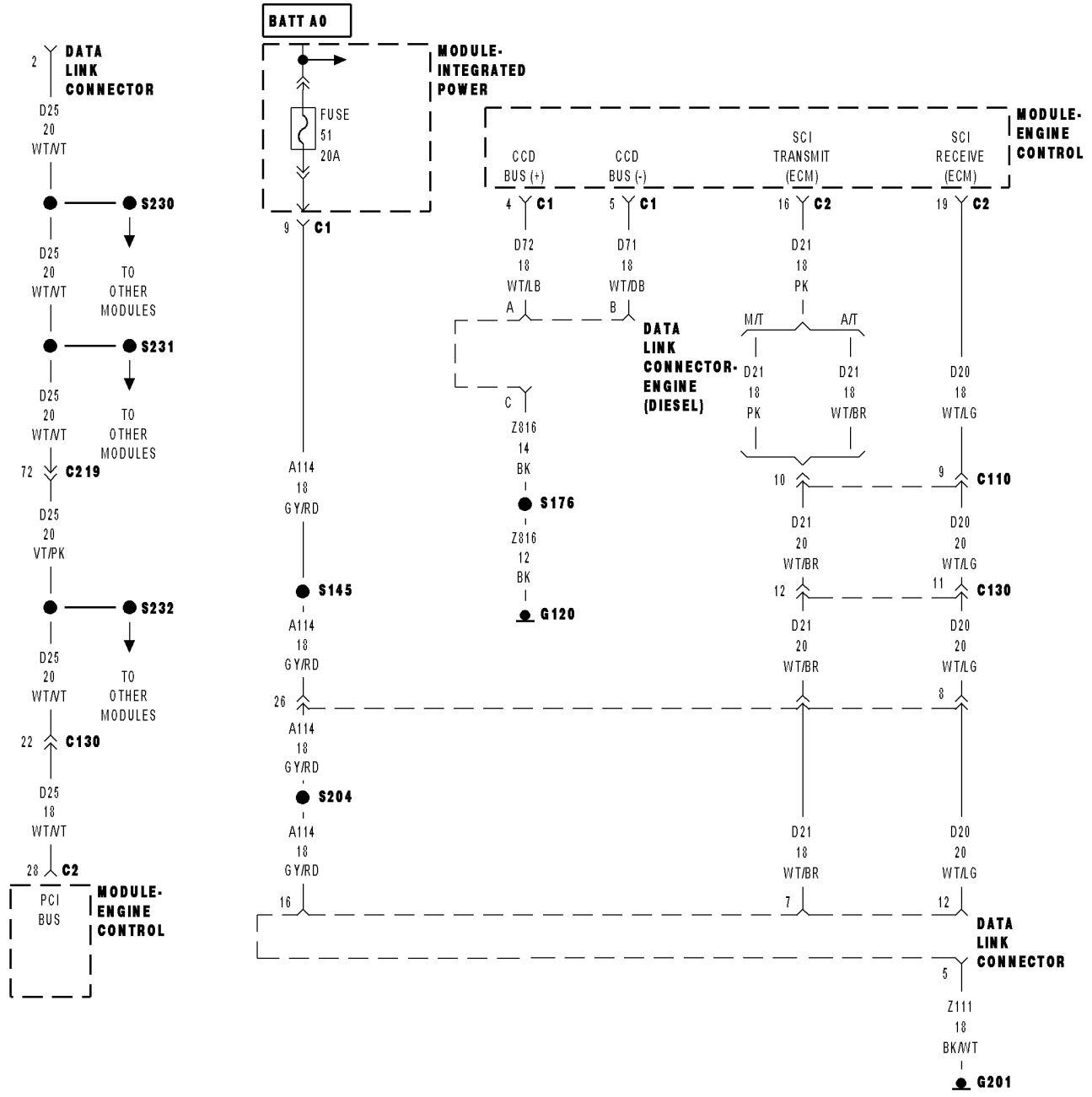
Yes >> Replace and program the ECM in accordance with the Service Information.

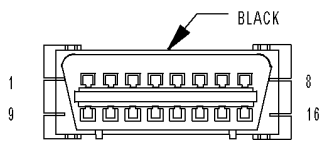
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

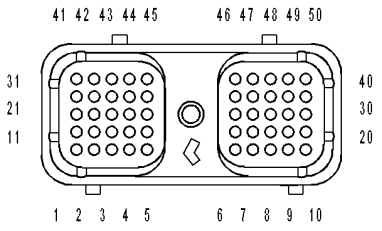


P1652-J1850 SHORT TO GROUND

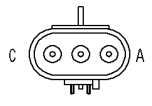




DATA LINK CONNECTOR



MODULE-ENGINE CONTROL C2



DATA LINK CONNECTOR (DIESEL)

81441f3e4

P1652-J1850 SHORT TO GROUND (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the ignition is on.
- **Set Condition:**
  The ECM detects a short to ground on the J1850.

Possible Causes
ECM
(D25) J1850 SHORTED
COMMUNICATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM

Turn the ignition off.

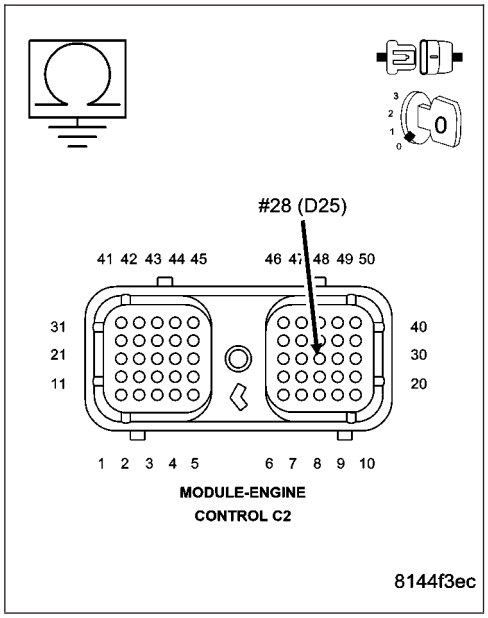
Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the (D25) J1850 circuit in the ECM harness connector and battery negative.

Is the resistance less than 10 Ohms?

Yes >> Go To 2

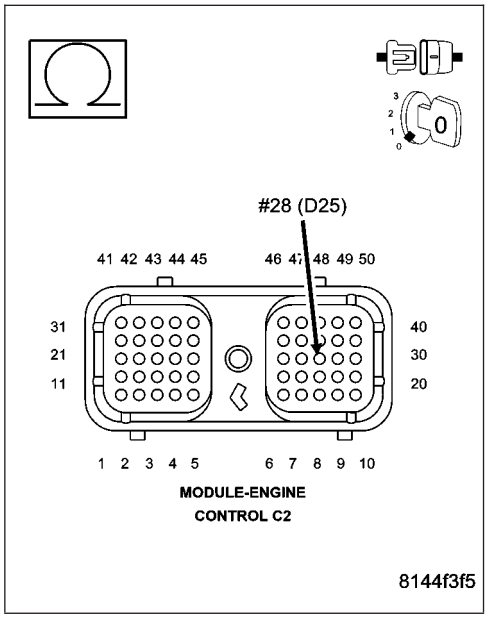
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P1652-J1850 SHORT TO GROUND (CONTINUED)

2. (D25) J1850 SHORTED

Measure the resistance between the (D25) J1850 circuit and all other circuits in both ECM connectors.



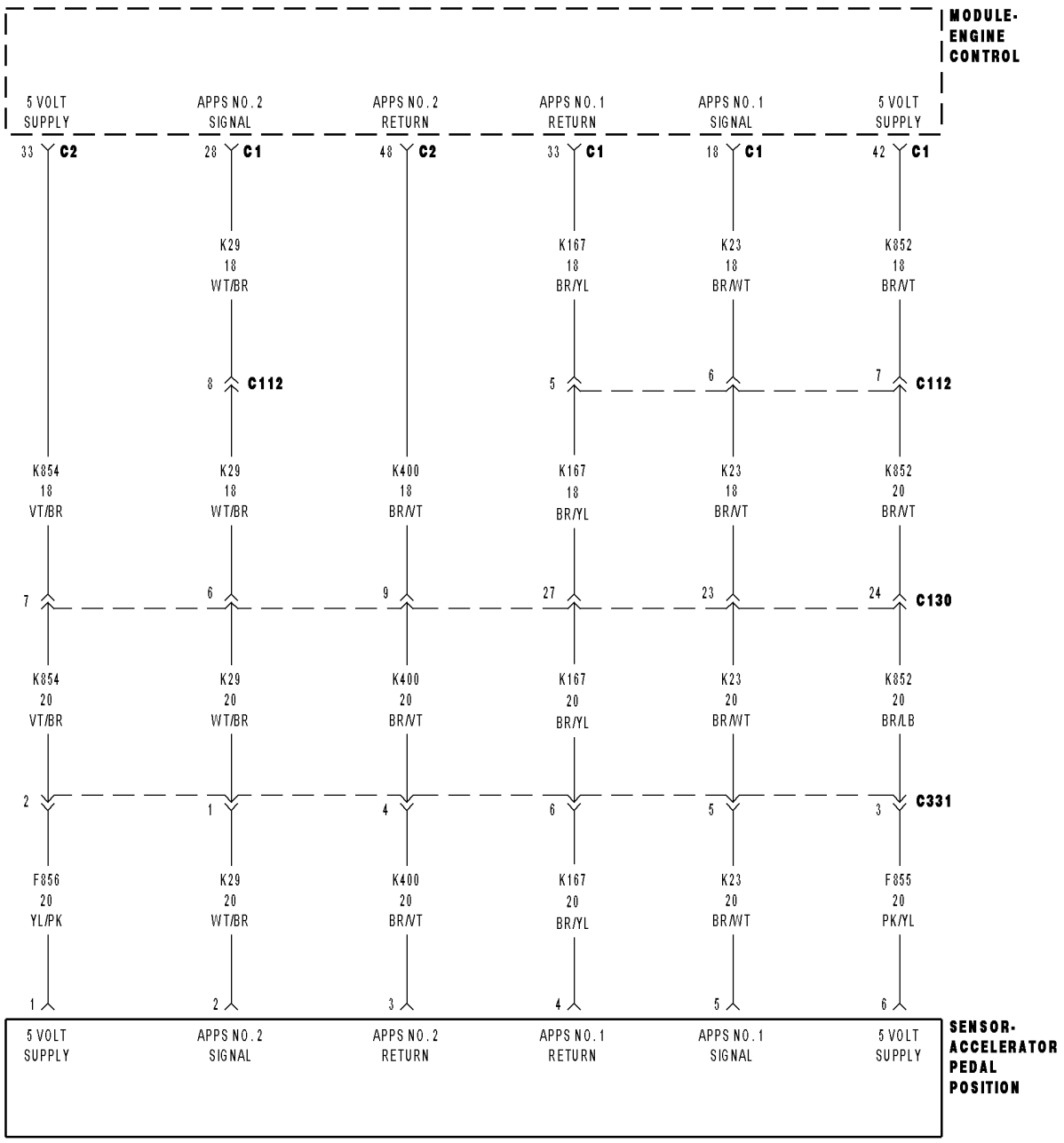
Is the resistance greater than 100k ohms?

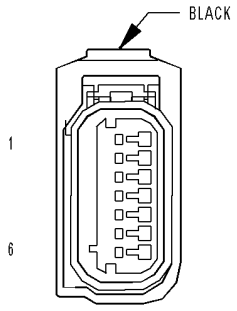
Yes >> Refer to the Body Diagnostic book Communications section.

No >> Repair (D25) J1850 shorted to another circuit.

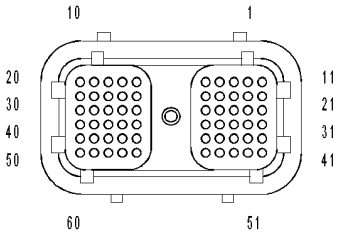
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2121-PPS CONFORMANCE ERROR

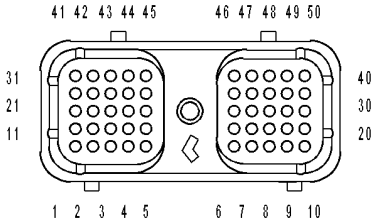




SENSOR-ACCELERATOR PEDAL POSITION



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81450680

P2121-PPS CONFORMANCE ERROR (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running
- **Set Condition:**
  The ECM detected a conformance error between PPS 1 and PPS 2

Possible Causes
OTHER DTC'S
WIRING HARNESS OR CONNECTOR DAMAGED
APPS
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

Using the scan tool, check for any additional APPS fault codes

Do you have any additiona APPS faults?

Yes >> troubleshoot other DTC's first, Go To 2

No >> Go To 12

---

2. APPS HARNESS

Verify that the APPS is connected.

Inspect the harness and the APPS connector.

Are any pins damaged?

Yes >> Repair or replace the harness.

No >> Go To 3

---

3. APPS

Monitor the APPS 1 and APPS 2 voltage with the scan tool while depressing the acceralator pedal.

Is the voltage transition shown on the scan tool smooth while depressing the acceralator pedal and is the voltage from APPS 1 twice as much as the voltage from APPS 2?

Yes >> Go To 4

No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2121-PPS CONFORMANCE ERROR (CONTINUED)

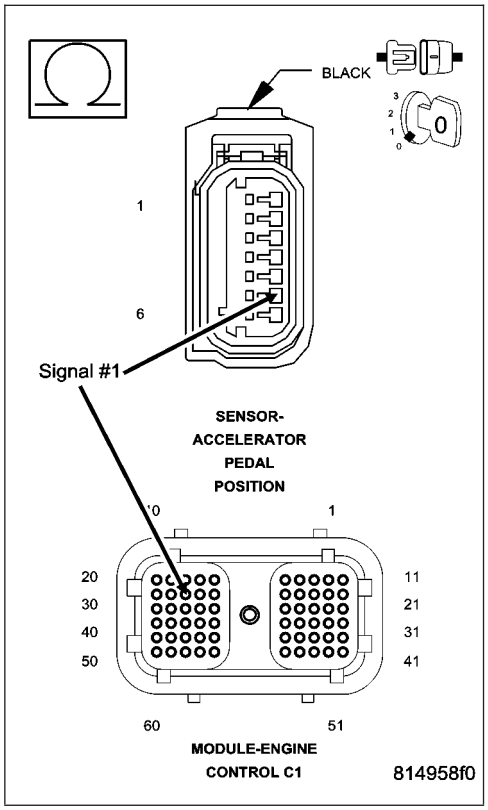
4. OPEN SIGNAL CIRCUIT

Disconnect the ECM connectors.

Disconnect the APPS connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the APPS 1 signal circuit between the APPS sensor connector and the ECM connector.



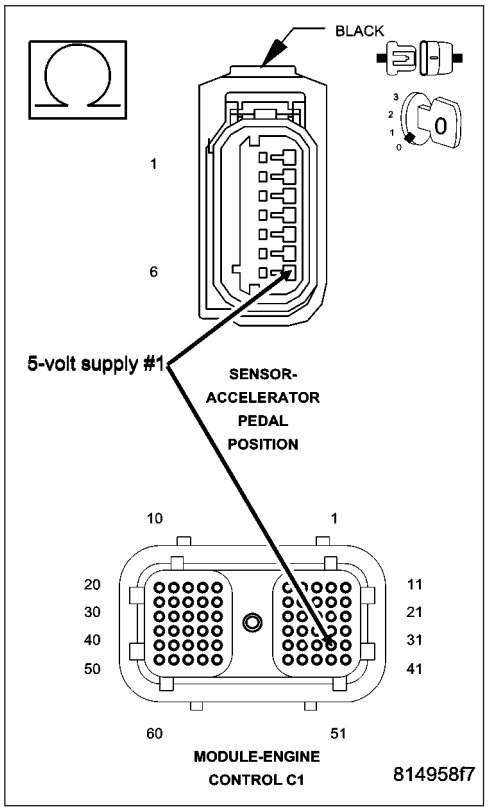
Yes >> Go To 5

No >> Repair or Replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

5. OPEN SUPPLY CIRCUIT

Measure the resistance of the APPS 1 supply circuit between the APPS sensor connector and the ECM connector.

Is the resistance less than 10 ohms?



Yes >> Go To 6

No >> Repair or replace the open harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2121-PPS CONFORMANCE ERROR (CONTINUED)

6. SIGNAL CIRCUIT SHORTED TO GROUND

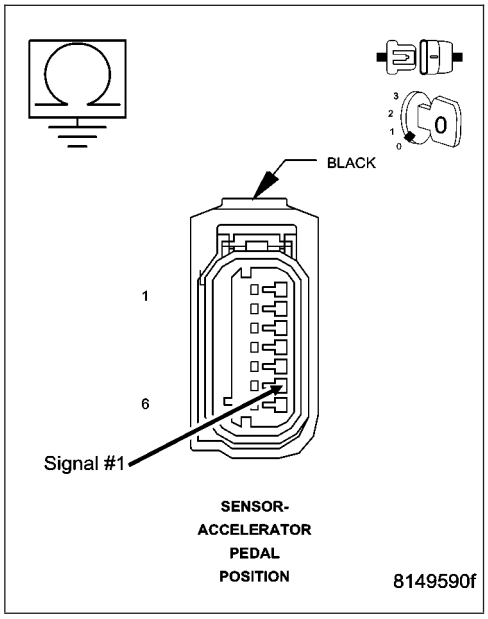
Measure the resistance between the APPS 1 signal circuit at the sensor connector and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 7

No >> Repair the shorted harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



7. SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS

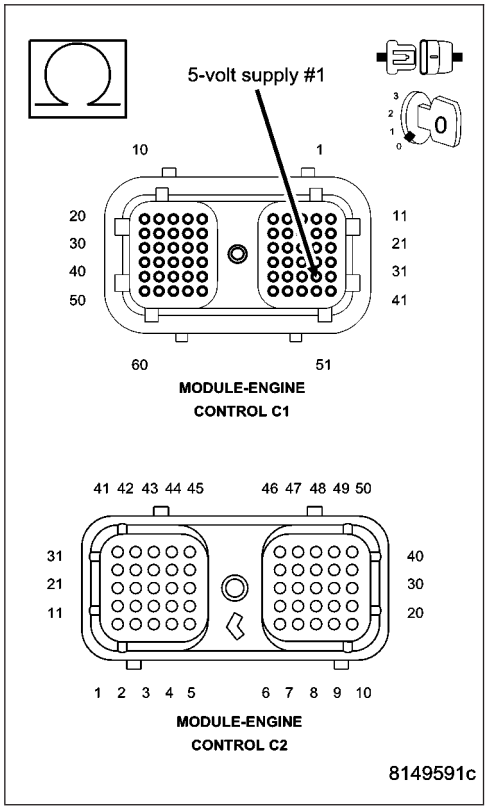
Measure the resistance between the APPS 1 signal circuit at the ECM connector and all other circuits in the ECM connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 8

No >> Repair the shorted signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

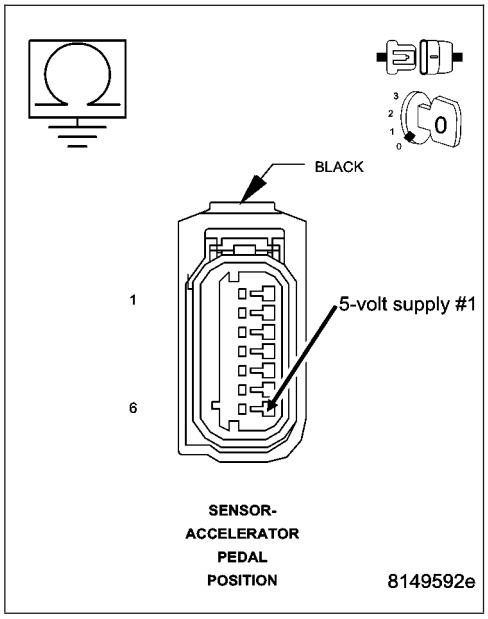
8. SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the APPS 1 supply circuit at the sensor connector and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 9

No >> Repair the Supply circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



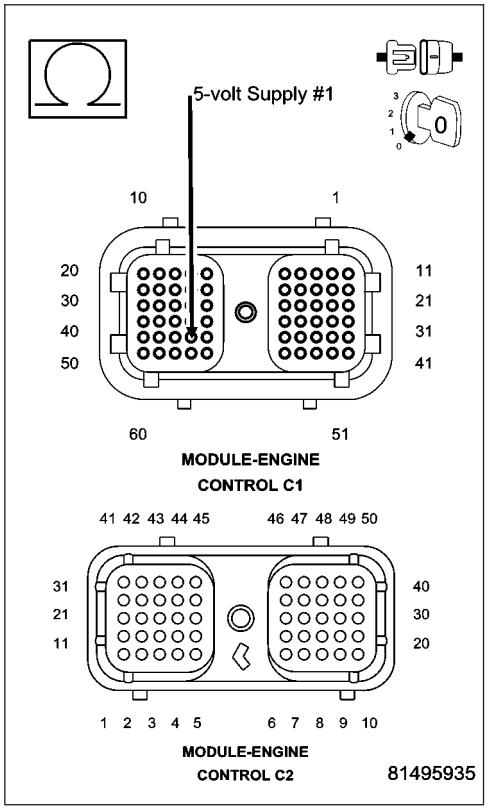
9. SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the APPS 1 supply circuit at the ECM connector and all other circuits in the ECM connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 10

No >> Repair the supply circuit shorted to other circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

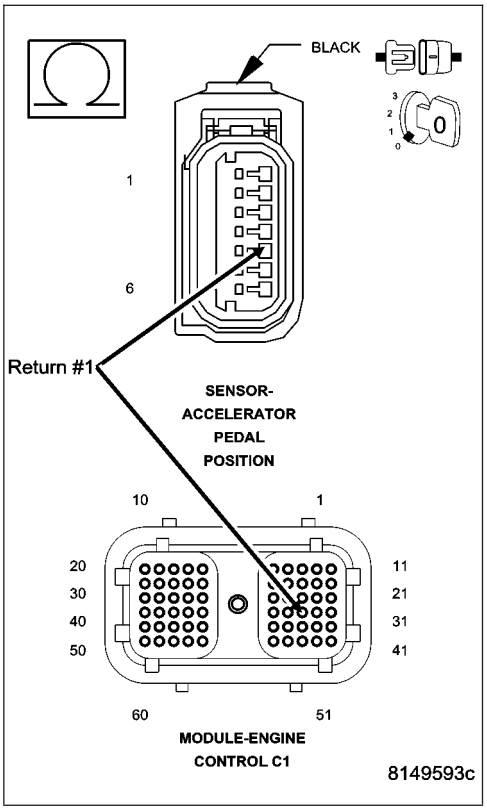
10. RETURN CIRCUIT OPEN

Measure the resistance on the APPS 1 return circuit between the sensor connector and the ECM connector.

Is the resistance less than 10 ohms?

Yes >> Go To 11

No >> Repair the open return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



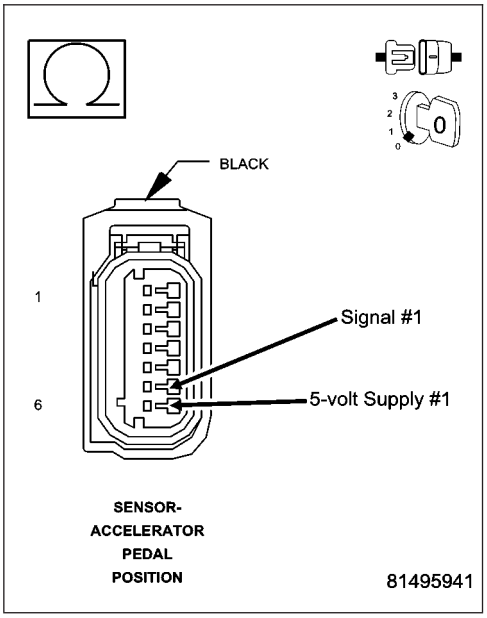
11. SIGANAL CIRCUIT SHORTED TO SUPPLY CIRCUIT

Measure the resistance between the APPS 1 signal circuit in the sensor connector and the PPS 1 supply circuit in the sensor connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 12

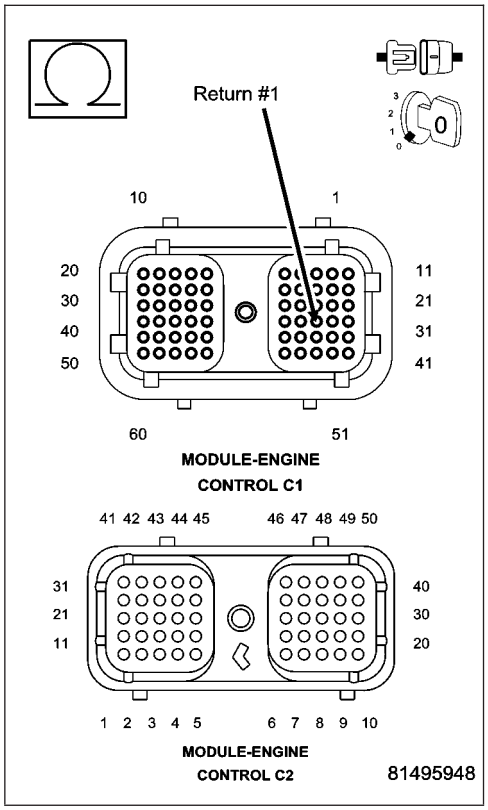
No >> Repair the signal circuit shorted to the supply.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

12. RETURN CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the APPS 1 return circuit at the ECM connector and all other circuits in the ECM connector.

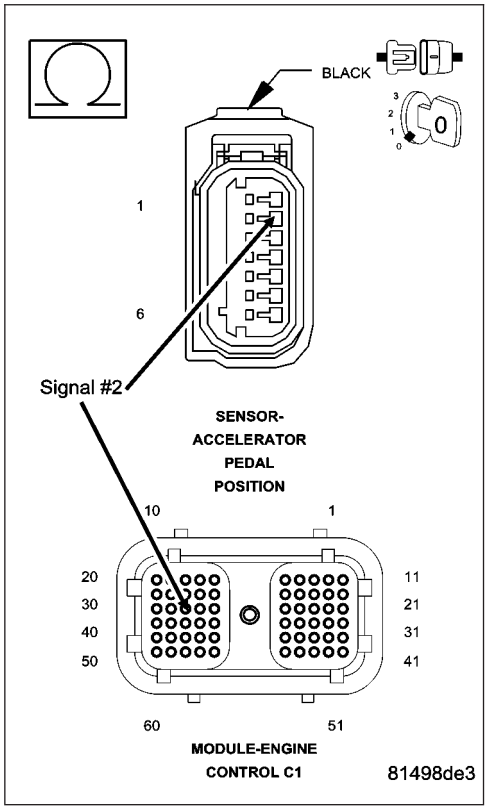


Yes >> Go To 13

No >> Repair the return circuit shorted to other circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

13. OPEN SIGNAL CIRCUIT

Measure the resistance of the APPS 2 signal circuit between the APPS sensor connector and the ECM connector.



Yes >> Go To 14

No >> Repair or Replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2121-PPS CONFORMANCE ERROR (CONTINUED)

14. OPEN SUPPLY CIRCUIT

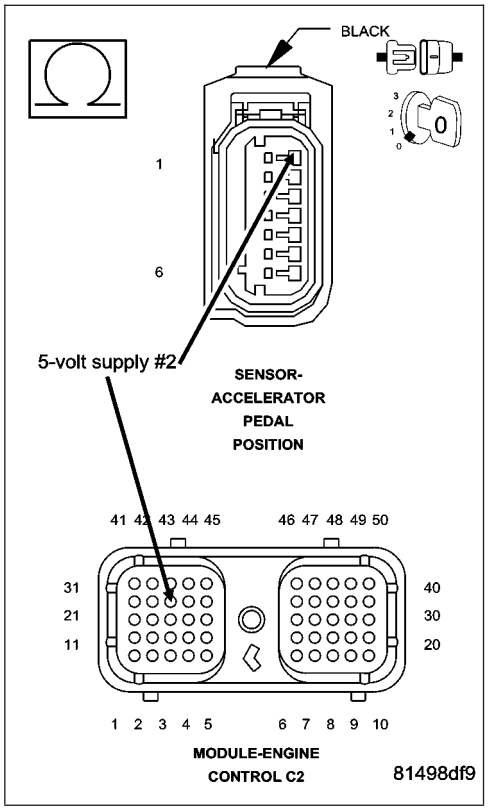
Measure the resistance of the APPS 2 supply circuit between the APPS sensor connector and the ECM connector.

Is the resistance less than 10 ohms?

Yes >> Go To 15

No >> Repair or replace the open harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



15. SIGNAL CIRCUIT SHORTED TO GROUND

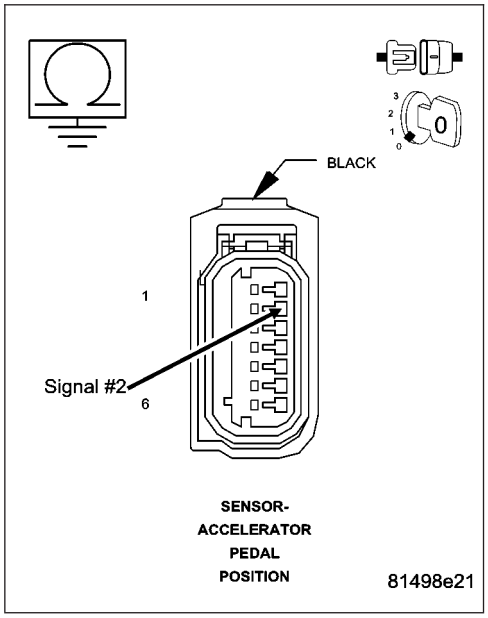
Measure the resistance between the APPS 2 signal circuit at the sensor connector and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 16

No >> Repair the shorted harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

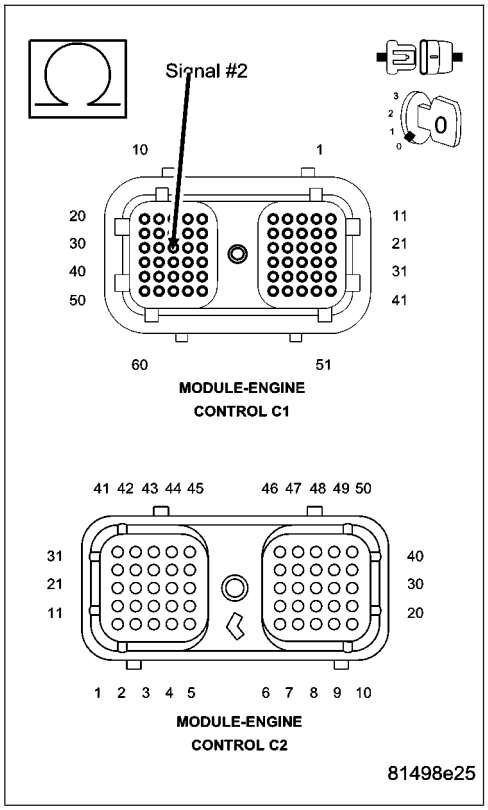
16. SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the APPS 2 signal circuit at the ECM connector and all other circuits in the ECM connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 17

No >> Repair the shorted signal circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



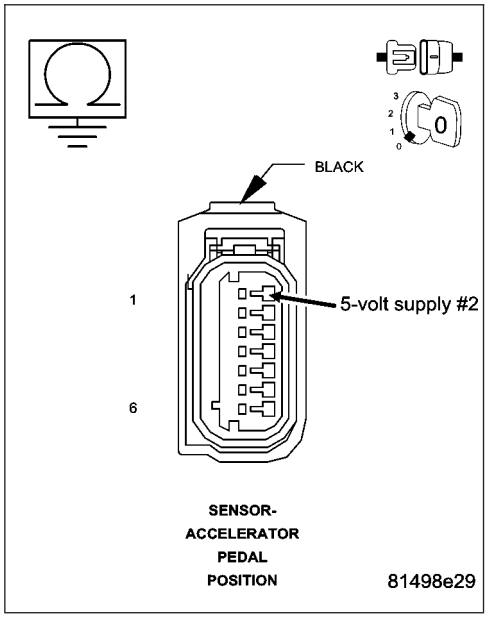
17. SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the APPS 2 supply circuit at the sensor connector and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 18

No >> Repair the Supply circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

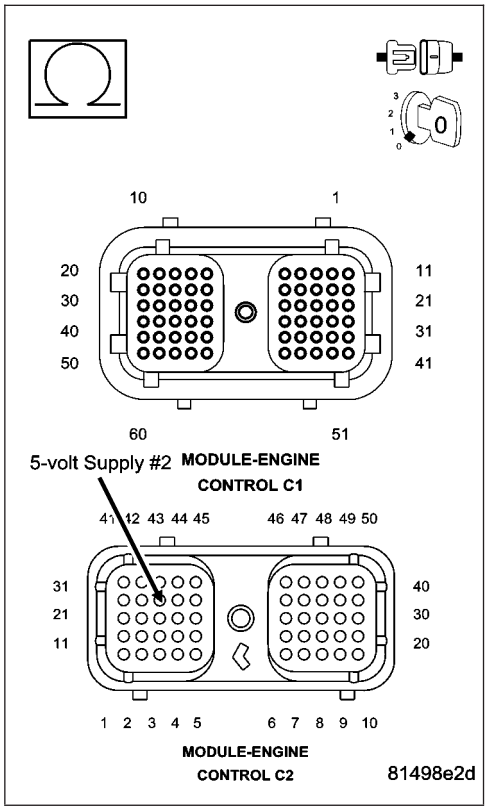
18. SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the APPS 2 supply circuit at the ECM connector and all other circuits in the ECM connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 19

No >> Repair the supply circuit shorted to other circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



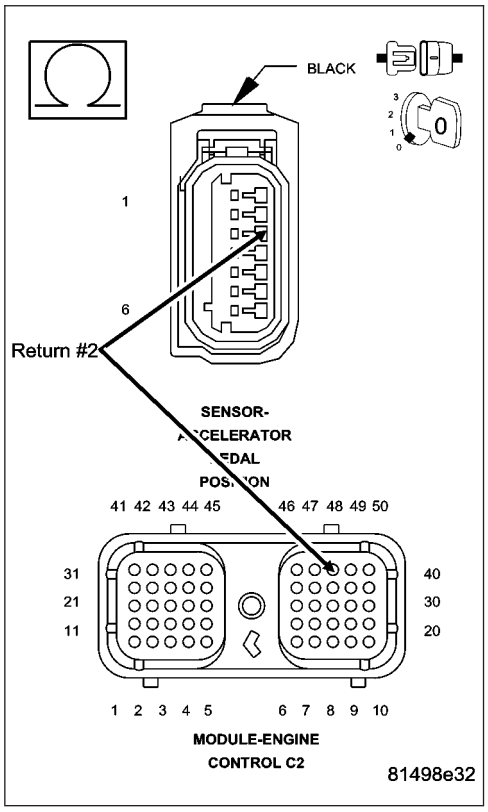
19. RETURN CIRCUIT OPEN

Measure the resistance on the APPS 2 return circuit between the sensor connector and the ECM connector.

Is the resistance less than 10 ohms?

Yes >> Go To 20

No >> Repair the open return circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

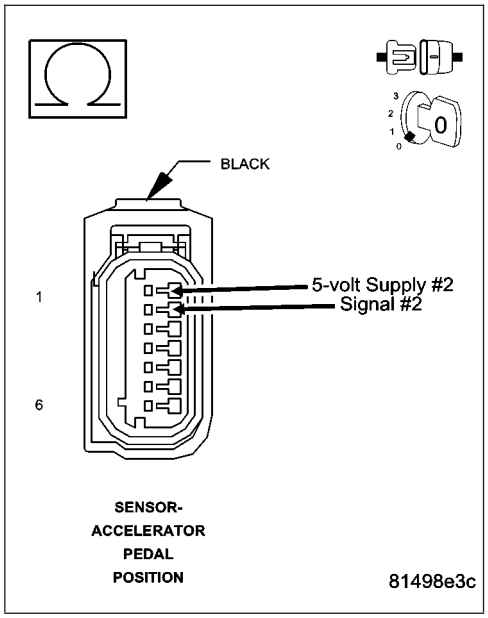
20. SIGANAL CIRCUIT SHORTED TO SUPPLY CIRCUIT

Measure the resistance between the APPS 2 signal circuit in the sensor connector and the PPS 2 supply circuit in the sensor connector.

Is the resistance greater than 100 K ohms?

Yes >> Go To 21

No >> Repair the signal circuit shorted to the supply.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

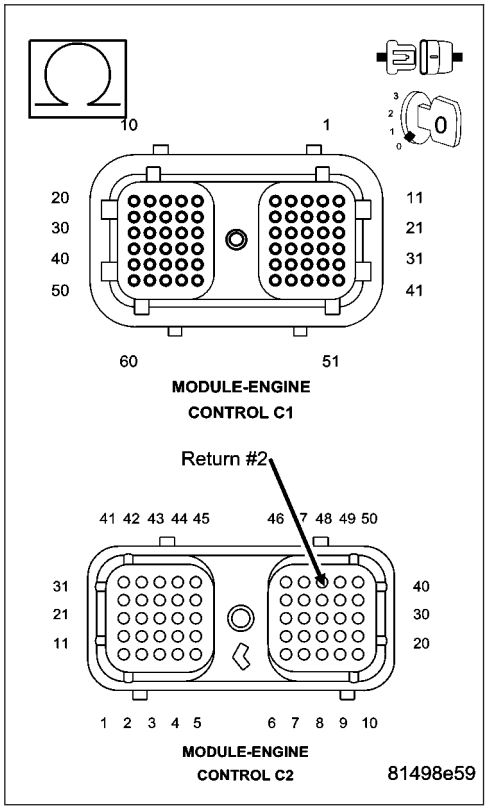


21. RETURN CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the APPS 2 return circuit at the ECM connector and all other circuits in the ECM connector.

Yes >> Go To 22

No >> Repair the return circuit shorted to other circuits.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2121-PPS CONFORMANCE ERROR (CONTINUED)

22. ECM

Reconnect the ECM connectors.

Reconnect the APPS connector.

Turn Ignition on, engine off.

While monitoring with the scan tool, disconnect the sensor connector.

Did a APPS 1 and APPS 2 voltage too low DTC set?

Yes >> Go To 23

No >> Replace the ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

23. APPS

Reconnect the APPS connector.

Monitor the APPS 1 and APPS 2 voltage with the scan tool while depressing the acceralator pedal.

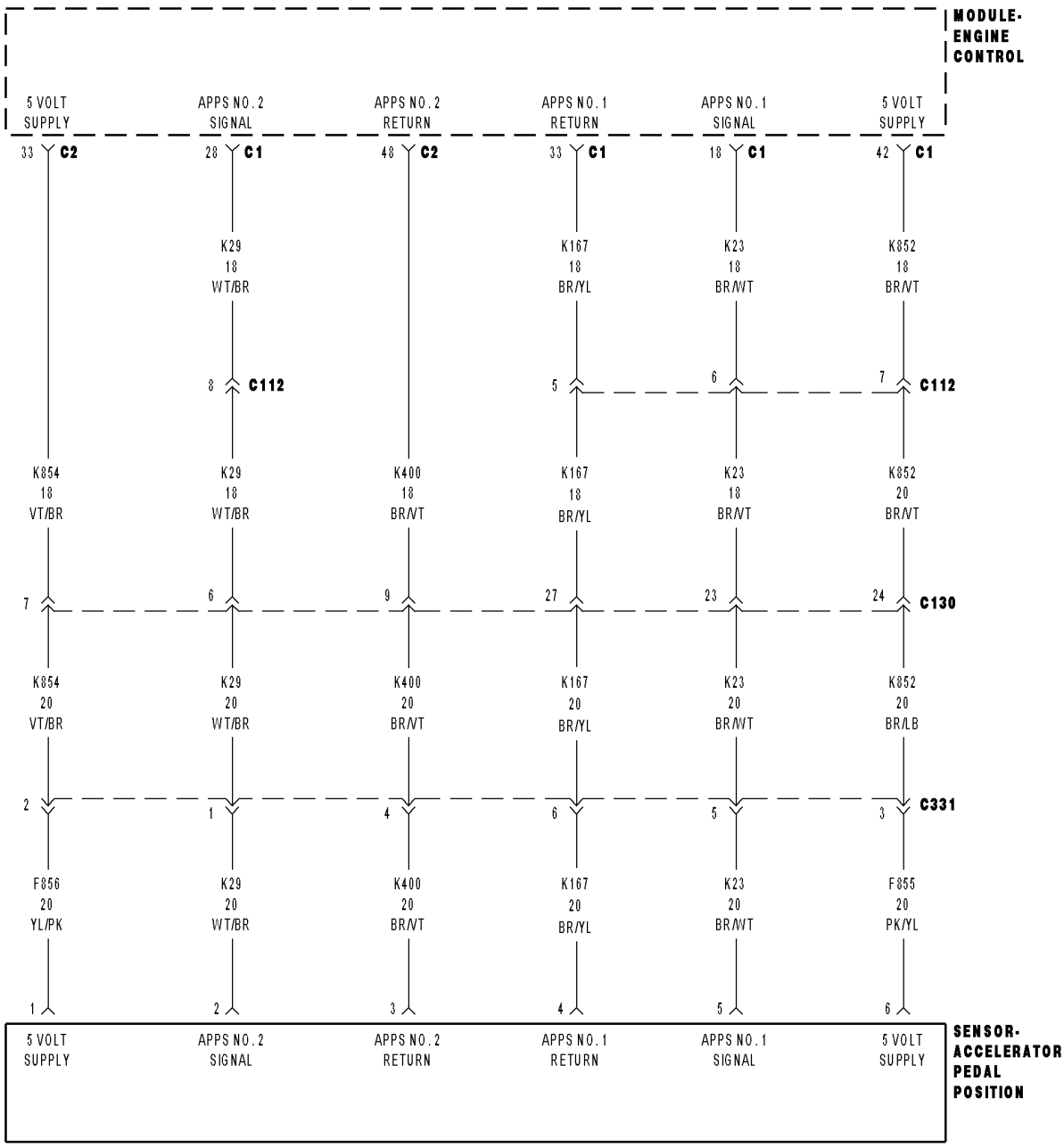
Is the voltage transition shown on the scan tool smooth while depressing the acceraaltor and is the voltage from APPS 1 twice as much as the voltage from APPS 2?

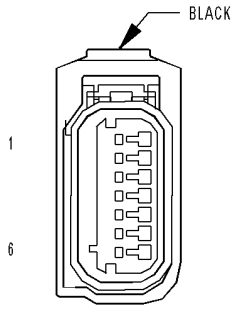
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the APPS.

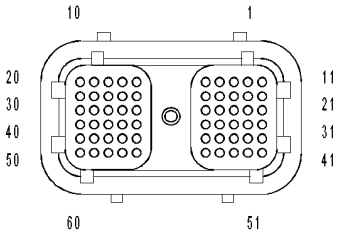
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2122-PPS 1 VOLTAGE TOO LOW

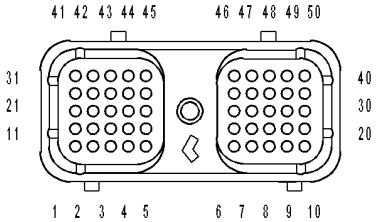




SENSOR-ACCELERATOR PEDAL POSITION



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81450680

P2122-PPS 1 VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on and during engine operation.
- **Set Condition:**
  The APPS circuit voltage at the ECM goes below 0.13 volt for more than 2 seconds.

Possible Causes
APPS
ECM
(K23) APPS NO. 1 SIGNAL CIRCUIT OPEN
(F855) APPS NO. 1 5-VOLT SUPPLY OPEN
(K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO GROUND
(K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS
(F855) APPS NO. 1 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F855) APPS NO. 1 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. (K23) APPS NO. 1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

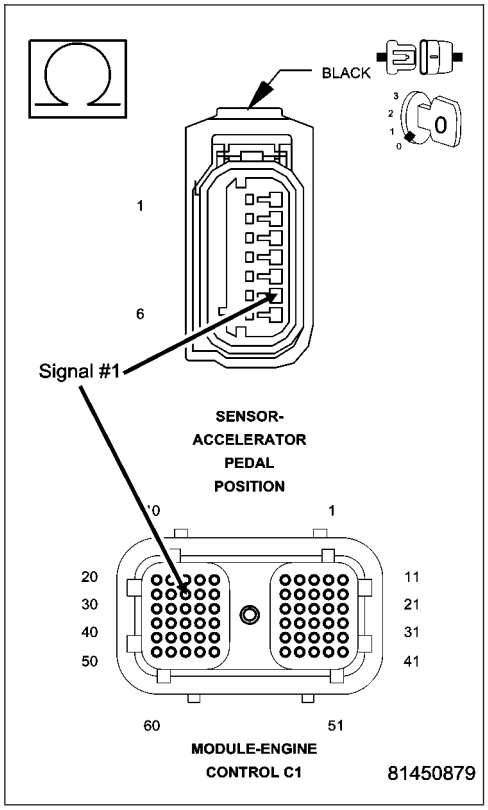
Disconnect the APPS harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the (K23) APPS No. 1 signal circuit between the APPS sensor harness connector and the ECM harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 2

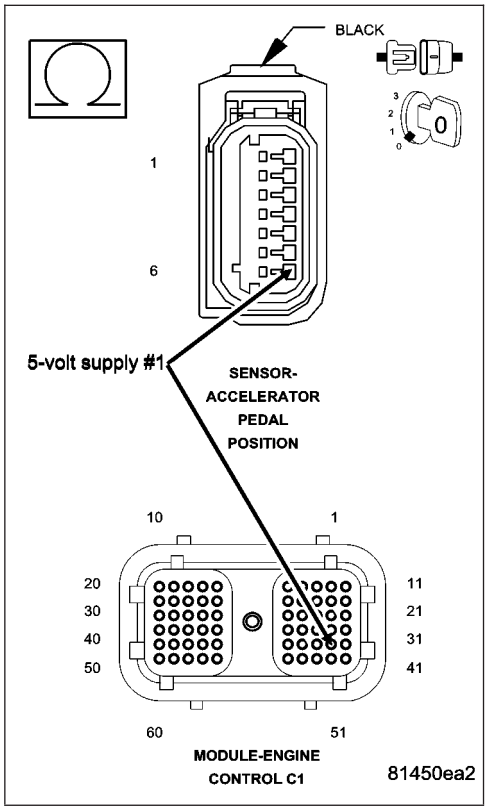
No >> Repair the (K23) APPS No. 1 signal circuit open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2122-PPS 1 VOLTAGE TOO LOW (CONTINUED)

2. (F855) APPS NO. 1 5-VOLT SUPPLY OPEN

Measure the resistance of the (F855) APPS No. 1 5-volt supply circuit between the APPS sensor harness connector and the ECM harness connector.



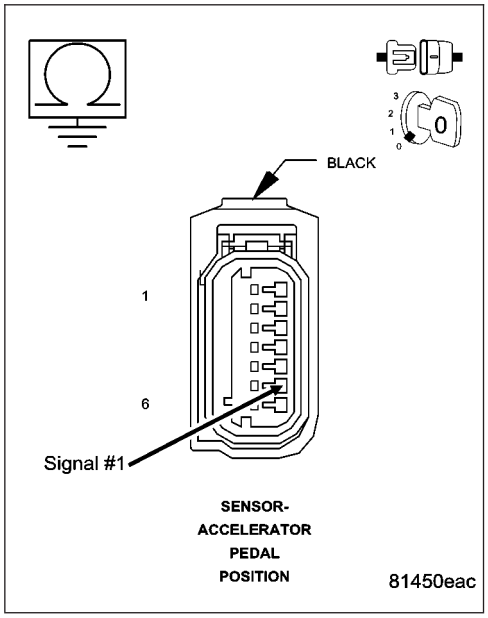
Is the resistance less than 10 ohms?

Yes >> Go To 3

No >> Repair the (F855) APPS No. 1 5-volt supply open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

3. (K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K23) APPS No. 1 signal circuit at the sensor harness connector and battery negative.



Is the resistance greater than 100 k ohms?

Yes >> Go To 4

No >> Repair the (K23) APPS No. 1 signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2122-PPS 1 VOLTAGE TOO LOW (CONTINUED)

4. (K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS

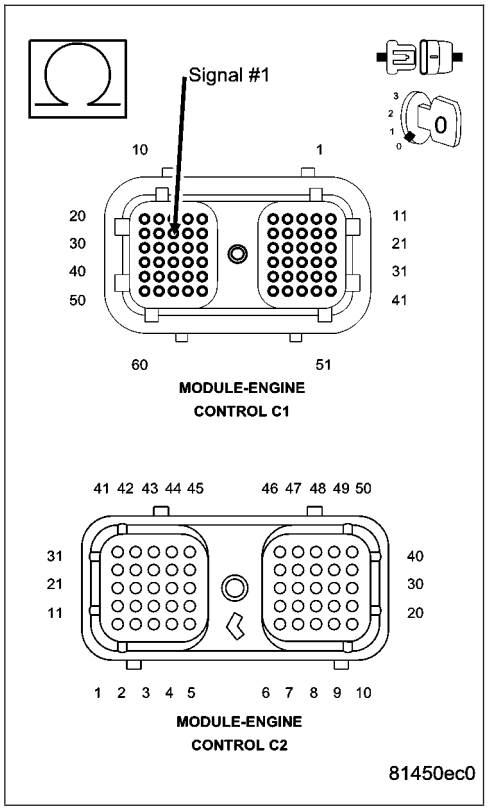
Measure the resistance between the (K23) APPS No. 1 signal circuit at the sensor harness connector and all other circuits in the ECM harness connector.

Is the resistance greater than 100 k ohms?

Yes >> Go To 5

No >> Repair the (K23) APPS No. 1 signal circuit shorted to other circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. (F855) APPS NO. 1 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

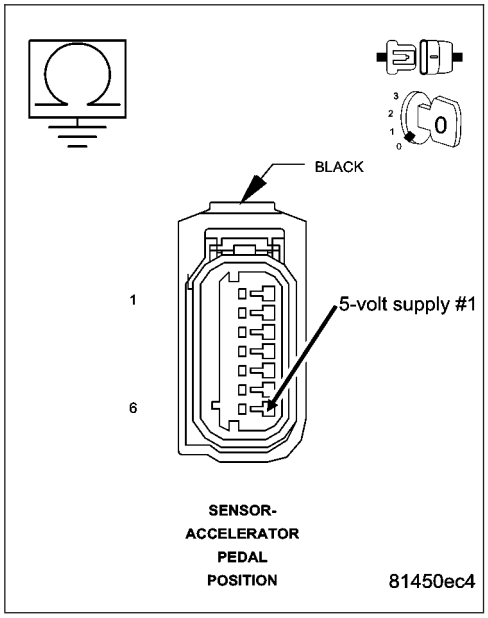
Measure the resistance between the (F855) APPS No. 1 5-volt supply circuit at the sensor harness connector and battery negative.

Is the resistance greater than 100 k ohms?

Yes >> Go To 6

No >> Repair the (F855) APPS No. 1 5-volt supply circuit shorted to ground.

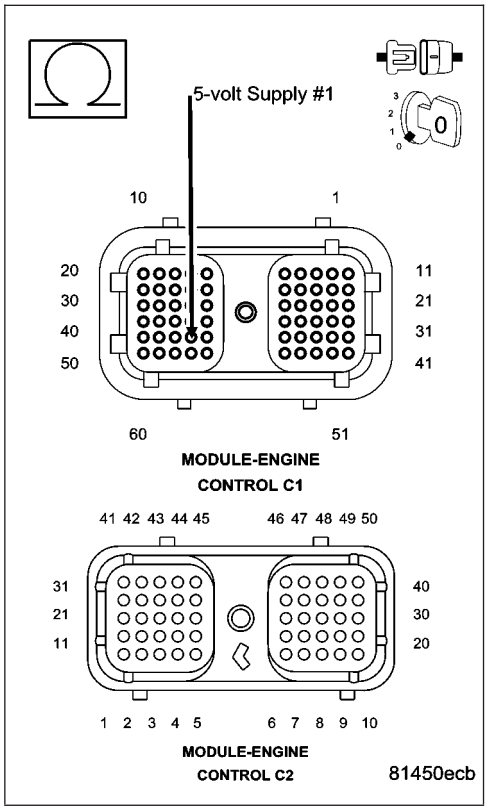
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2122-PPS 1 VOLTAGE TOO LOW (CONTINUED)

6. (F855) APPS NO. 1 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the (F855) APPS No. 1 5-volt supply circuit at the sensor harness connector and all other circuits in the ECM harness connector.



Is the resistance greater than 100 k ohms?

Yes >> Go To 7

No >> Repair the (F855) APPS No. 1 5-volt supply circuit shorted to other circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

While monitoring with the scan tool, connect a jumper wire between the (K23) APPS No. 1 signal circuit at the sensor harness connector and the (F855) APPS No. 1 5-volt supply circuit at the sensor harness connector.

NOTE: With the sensor disconnected it is normal to have a APPS 1 and APPS 2 low voltage DTC set.

Did DTC P2123 set?

Yes >> Go To 8

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2122-PPS 1 VOLTAGE TOO LOW (CONTINUED)

8. APPS

Reconnect the APPS harness connector.

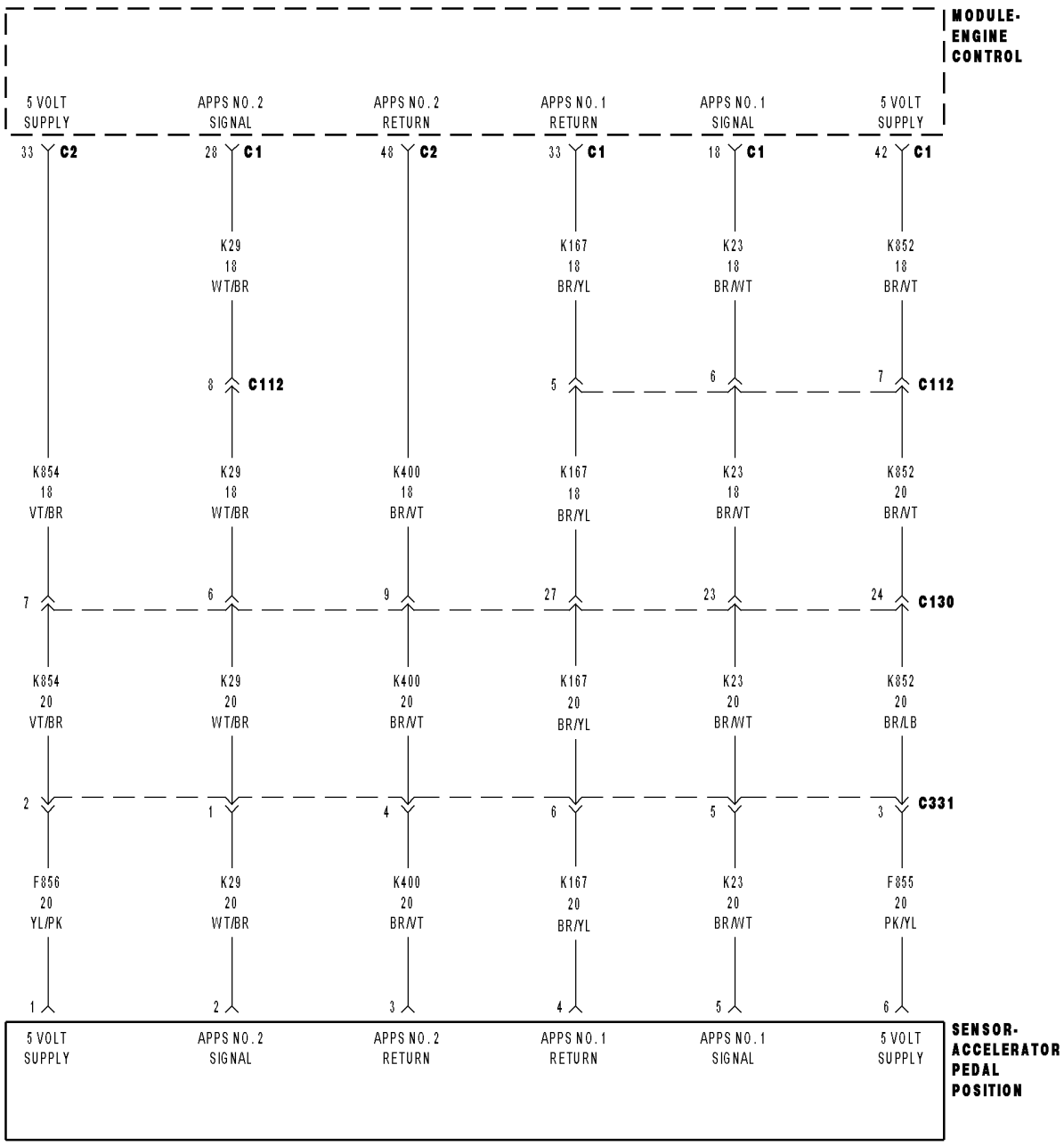
Monitor the APPS 1 and APPS 2 voltage with the scan tool while depressing the throttle pedal.

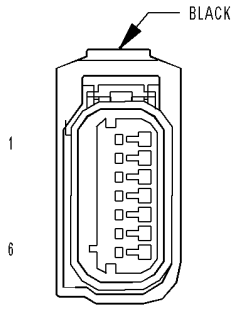
Is the voltage transition shown on the scan tool smooth while depressing the throttle and is the volta

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

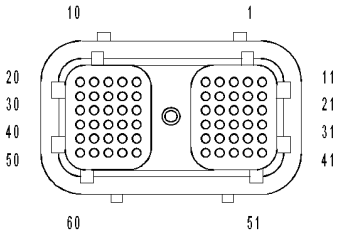
No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2123-PPS 1 VOLTAGE TOO HIGH

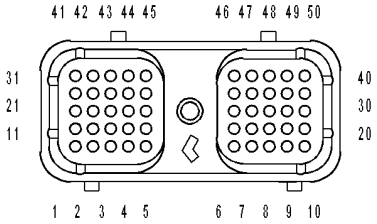




SENSOR-ACCELERATOR PEDAL POSITION



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81450680

P2123-PPS 1 VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on and during engine operation.
- **Set Condition:**
  The APPS signal circuit voltage at the ECM goes above 4.24 volts for more than 2 seconds.

Possible Causes
(K167) APPS NO. 1 RETURN CIRCUIT OPEN
(K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO (K852) APPS NO. 1 5-VOLT SUPPLY
(K23) APPS SIGNAL CIRCUIT SHORTED TO ANOTHER CIRCUIT
ECM
APPS
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. (K167) APPS NO. 1 RETURN CIRCUIT OPEN

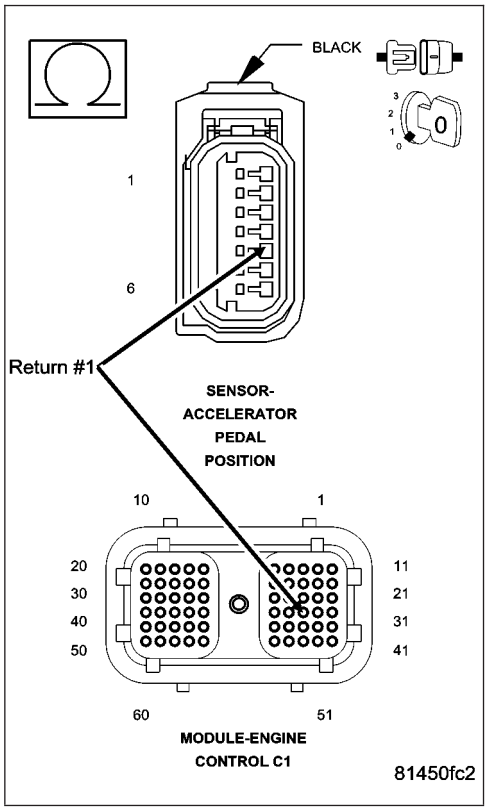
Turn the ignition off.

Disconnect the APPS harness connector.

Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance on the (K167) APPS No. 1 return circuit between the sensor harness connector and the ECM harness connector.



Is the resistance less than 10 ohms?

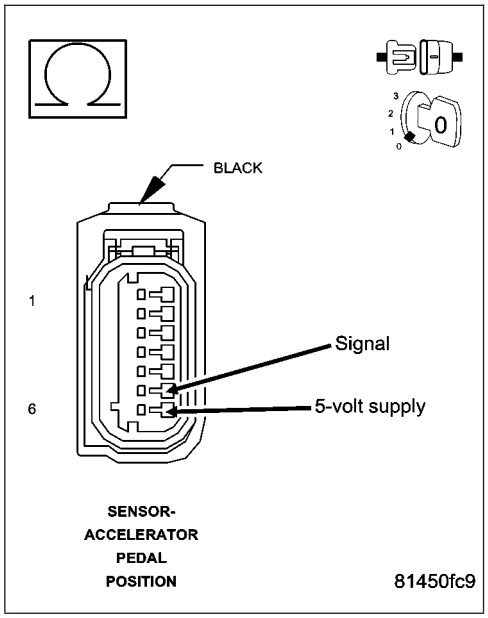
Yes >> Go To 2

No >> Repair the (K167) APPS No. 1 return circuit open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2123-PPS 1 VOLTAGE TOO HIGH (CONTINUED)

2. (K23) APPS NO. 1 SIGNAL CIRCUIT SHORTED TO (K852) APPS NO. 1 5-VOLT SUPPLY

Measure the resistance between the (K23) APPS No. 1 signal circuit in the sensor harness connector and the (K852) APPS No. 1 5-volt supply circuit in the sensor harness connector.



Is the resistance greater than 100 K ohms?

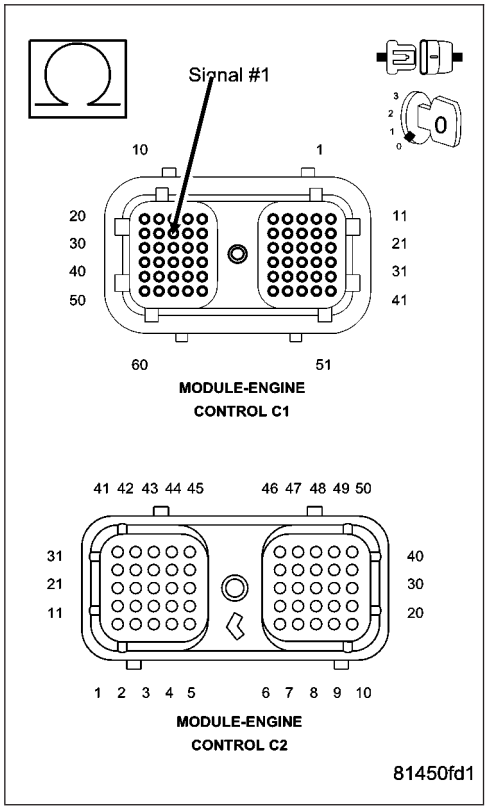
Yes >> Go To 3

No >> Repair the (K23) APPS No. 1 signal circuit shorted to the (K852) 5-volt supply circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

3. (K23) APPS SIGNAL CIRCUIT SHORTED TO ANOTHER CIRCUIT

Measure the resistance between the APPS No. 1 signal circuit at the ECM harness connector and all other circuits in the ECM harness connector.



Is the resistance greater than 100 k ohms?

Yes >> Go To 4

No >> Repair the (K23) APPS No. 1 signal circuit shorted to another circuit in the engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2123-PPS 1 VOLTAGE TOO HIGH (CONTINUED)

4. ECM

Reconnect the ECM harness connectors.

Reconnect the APPS harness connector.

While monitoring with the scan tool, disconnect the sensor connector.

Did a APPS No. 1 and APPS No. 2 voltage too low DTC set?

Yes >> Go To 5

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. APPS

Reconnect the APPS harness connector.

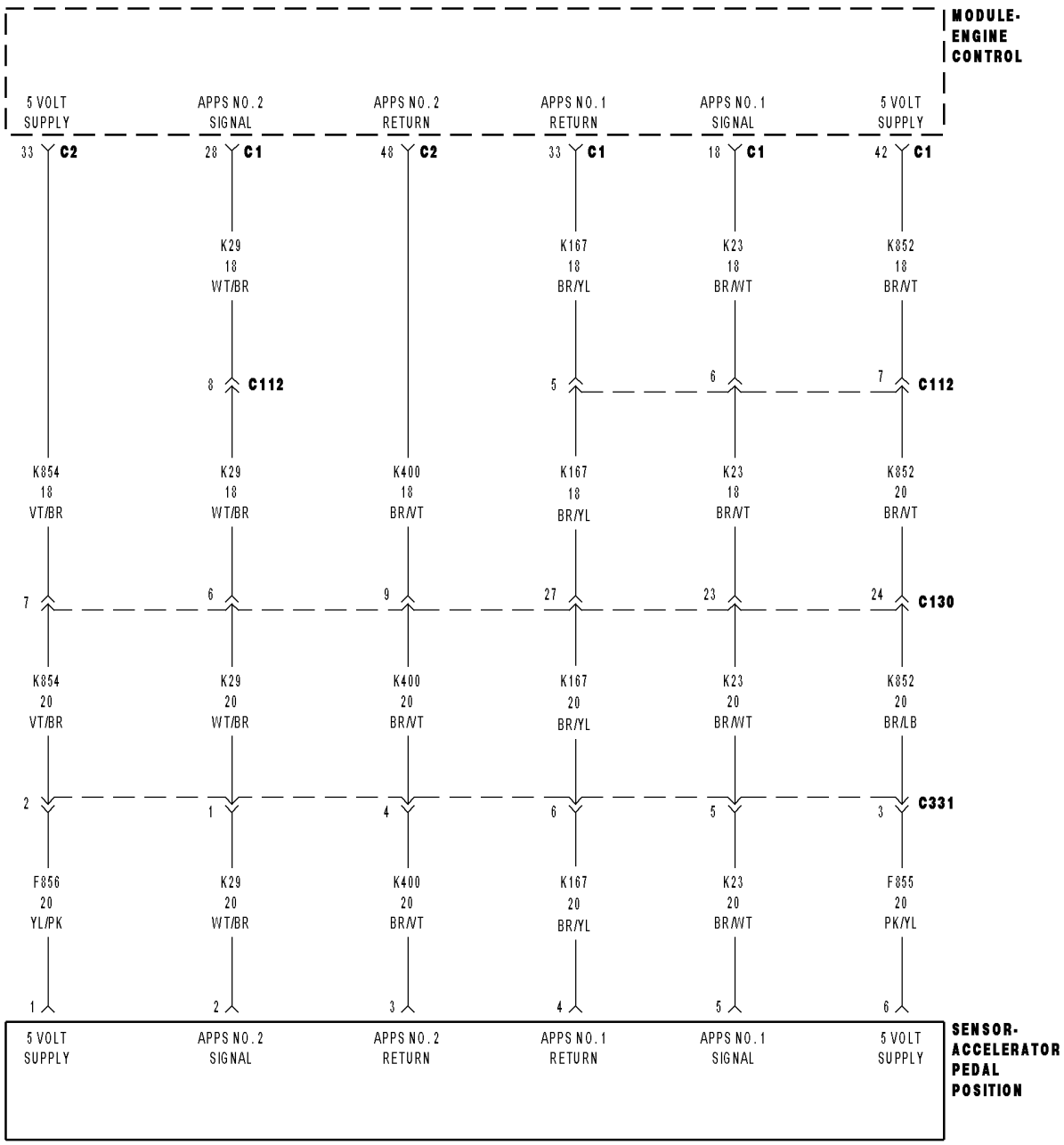
Monitor the APPS No. 1 and APPS No. 2 voltage with the scan tool while depressing the throttle pedal.

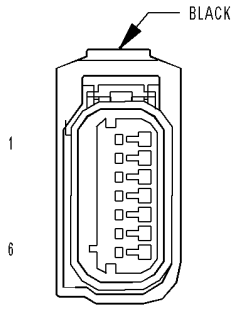
Is the voltage transition shown on the scan tool smooth while depressing the throttle and is the voltage from APPS 1 twice as much as from APPS2?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

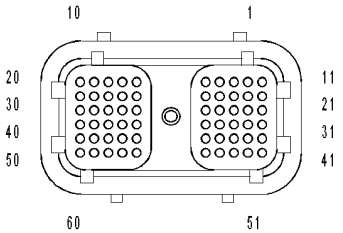
No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2127-PPS 2 VOLTAGE TOO LOW

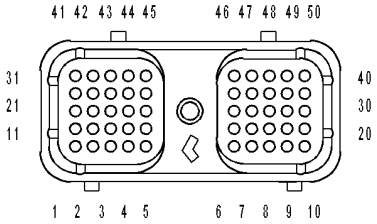




SENSOR-ACCELERATOR PEDAL POSITION



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81450680

P2127-PPS 2 VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on and during engine operation.
- **Set Condition:**
  The APPS circuit voltage at the ECM goes below 0.13 volt for more than 2 seconds.

Possible Causes
APPS
ECM
(K29) APPS NO. 2 SIGNAL CIRCUIT OPEN
(F856) APPS NO. 2 5-VOLT SUPPLY OPEN
(K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO GROUND
(K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS
(F856) APPS NO. 2 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(F856) APPS NO. 2 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. (K29) APPS NO. 2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

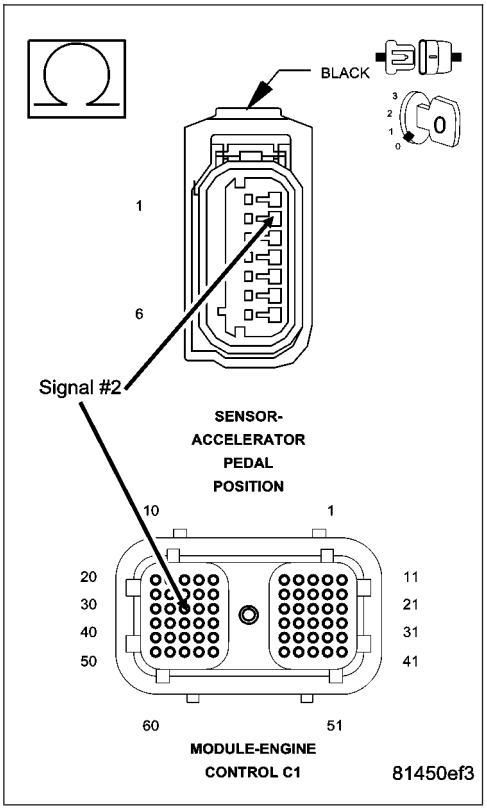
Disconnect the APPS harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the (K29) APPS No. 2 signal circuit between the APPS sensor harness connector and the ECM harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 2

No >> Repair the (K29) APPS No. 2 signal circuit open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2127-PPS 2 VOLTAGE TOO LOW (CONTINUED)

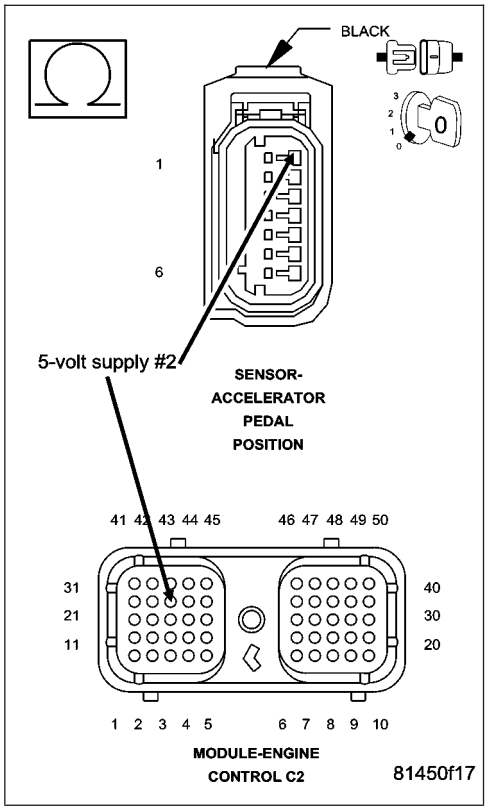
2. (F856) APPS NO. 2 5-VOLT SUPPLY OPEN

Measure the resistance of the (F856) APPS No. 2 5-volt supply circuit between the APPS sensor harness connector and the ECM harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 3

No >> Repair the (F856) APPS No. 2 5-volt supply open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



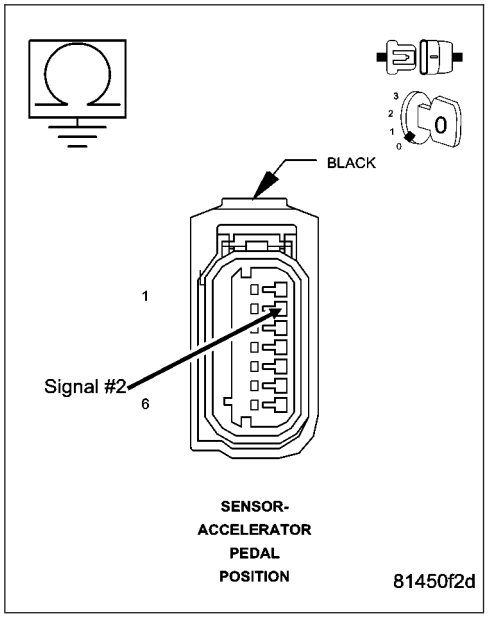
3. (K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between the (K29) APPS No. 2 signal circuit at the sensor harness connector and battery negative.

Is the resistance greater than 100 k ohms?

Yes >> Go To 4

No >> Repair the (K29) APPS No. 2 signal circuit shorted to ground.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2127-PPS 2 VOLTAGE TOO LOW (CONTINUED)

4. (K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO OTHER CIRCUITS

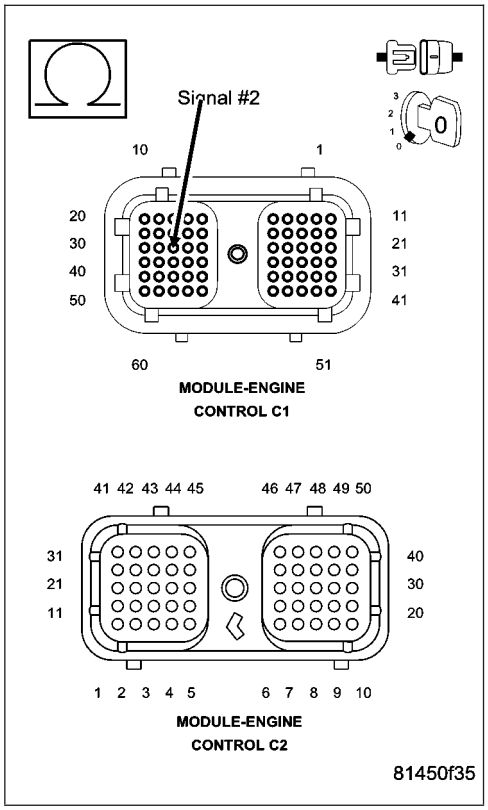
Measure the resistance between the (K29) APPS No. 2 signal circuit at the ECM harness connector and all other circuits in the ECM harness connectors.

Is the resistance greater than 100 k ohms?

Yes >> Go To 5

No >> Repair the (K29) APPS No. 2 signal circuit shorted to other circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



5. (F856) APPS NO. 2 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

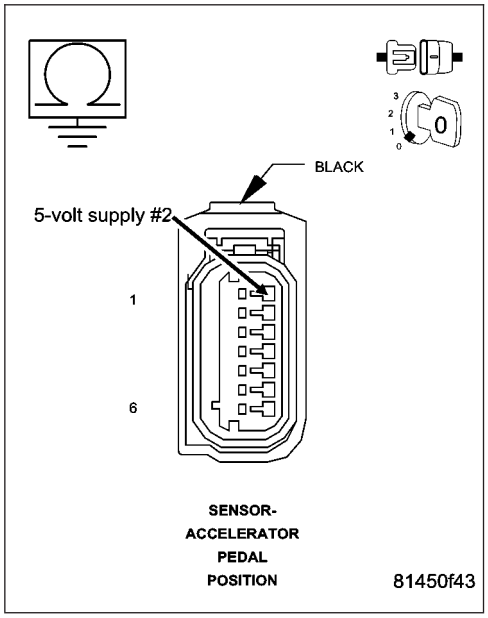
Measure the resistance between the (F856) APPS No. 2 5-volt supply circuit at the sensor harness connector and battery negative.

Is the resistance greater than 100 k ohms?

Yes >> Go To 6

No >> Repair the (F856) APPS No. 2 5-volt supply circuit shorted to ground.

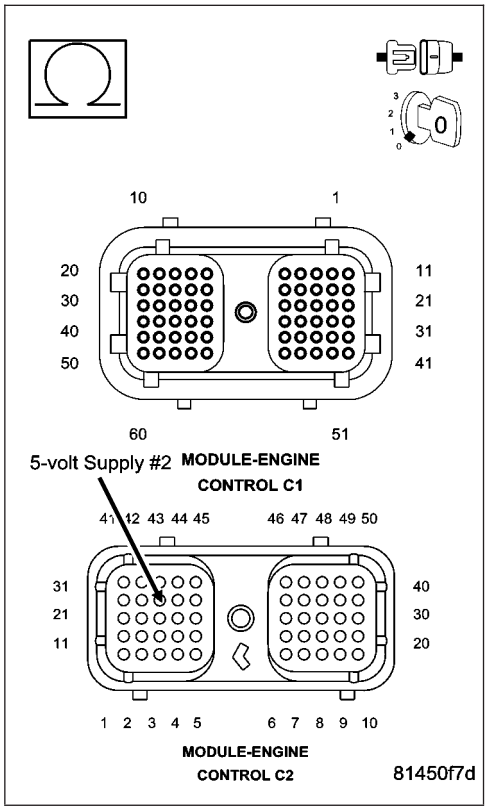
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2127-PPS 2 VOLTAGE TOO LOW (CONTINUED)

6. (F856) APPS NO. 2 5-VOLT SUPPLY CIRCUIT SHORTED TO OTHER CIRCUITS

Measure the resistance between the (F856) APPS No. 2 5-volt supply circuit at the sensor harness connector and all other circuits in the ECM harness connector.



Is the resistance greater than 100 k ohms?

Yes >> Go To 7

No >> Repair the (F856) APPS No. 2 5-volt supply circuit shorted to other circuits.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

7. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

While monitoring with the scan tool, connect a jumper wire between the (K29) APPS No. 2 signal circuit at the sensor harness connector and the (F856) APPS No. 2 5-volt supply circuit at the sensor harness connector.

NOTE: With the sensor disconnected it is normal to have a APPS 1 and APPS 2 low voltage DTC set.

Did DTC P2128 set?

Yes >> Go To 8

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2127-PPS 2 VOLTAGE TOO LOW (CONTINUED)

8. APPS

Reconnect the APPS harness connector.

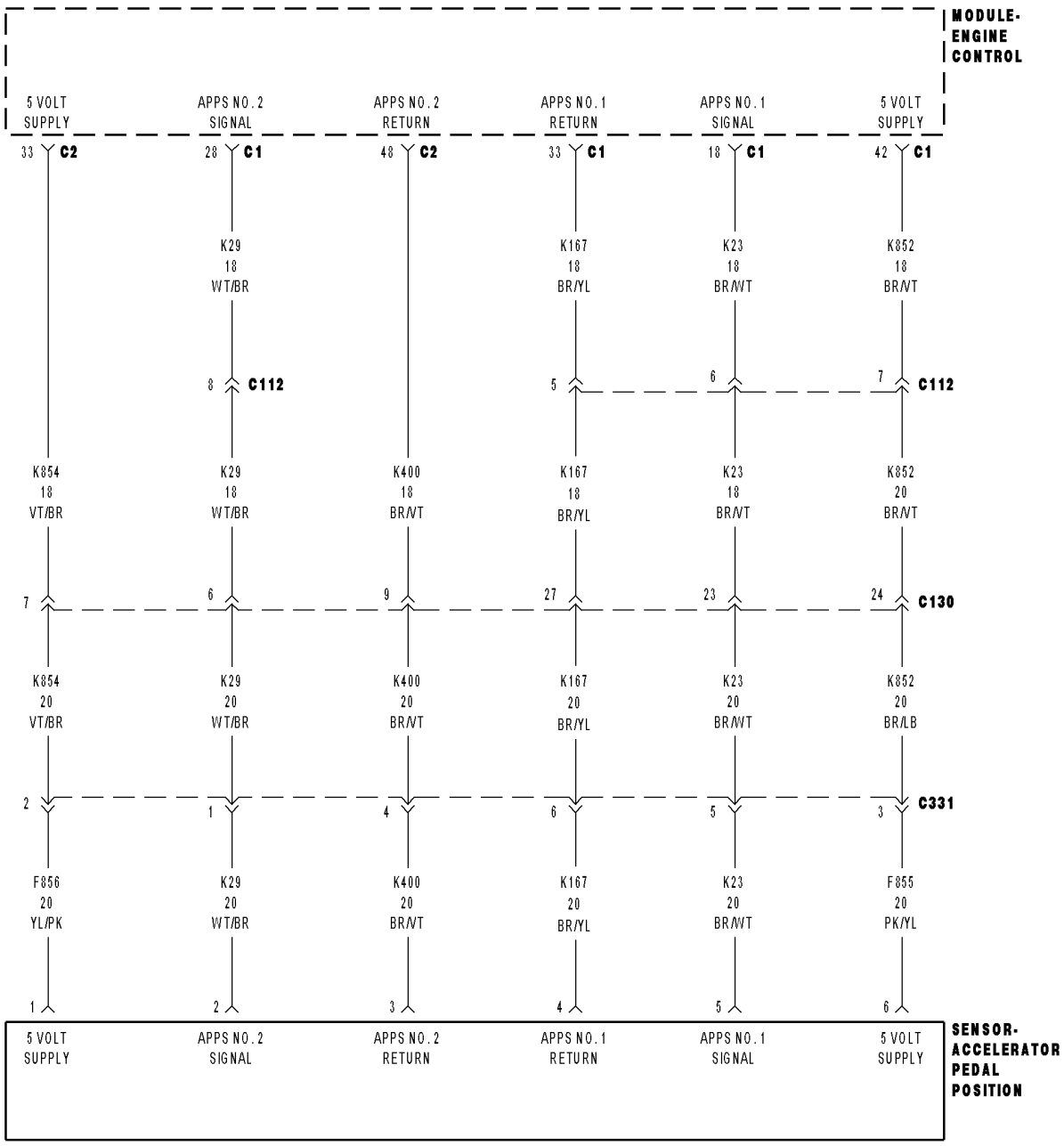
Monitor the APPS 1 and APPS 2 voltage with the scan tool while depressing the throttle pedal.

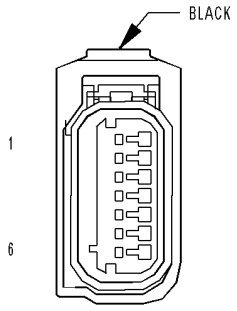
Is the voltage transition shown on the scan tool smooth while depressing the throttle and is the voltage swing smooth?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

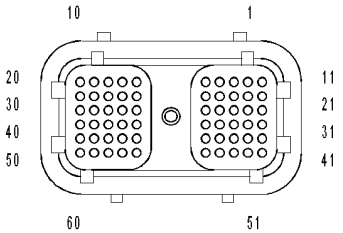
No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2128-PPS 2 VOLTAGE TOO HIGH

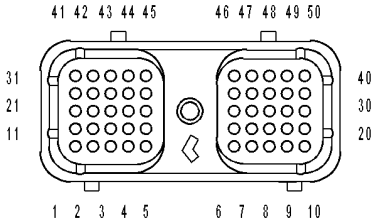




SENSOR-ACCELERATOR PEDAL POSITION



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81450680

P2128-PPS 2 VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the key is on and during engine operation.
- **Set Condition:**
  The APPS signal circuit voltage at the ECM goes above 4.24 volts for more than 2 seconds.

Possible Causes
(K400) APPS NO. 1 RETURN CIRCUIT OPEN
(K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO (K854) APPS NO. 2 5-VOLT SUPPLY
(K29) APPS SIGNAL CIRCUIT SHORTED TO ANOTHER CIRCUIT
ECM
APPS
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. (K400) APPS NO. 2 RETURN CIRCUIT OPEN

Turn the ignition off.

Disconnect the APPS harness connector.

Disconnect the ECM harness connectors.

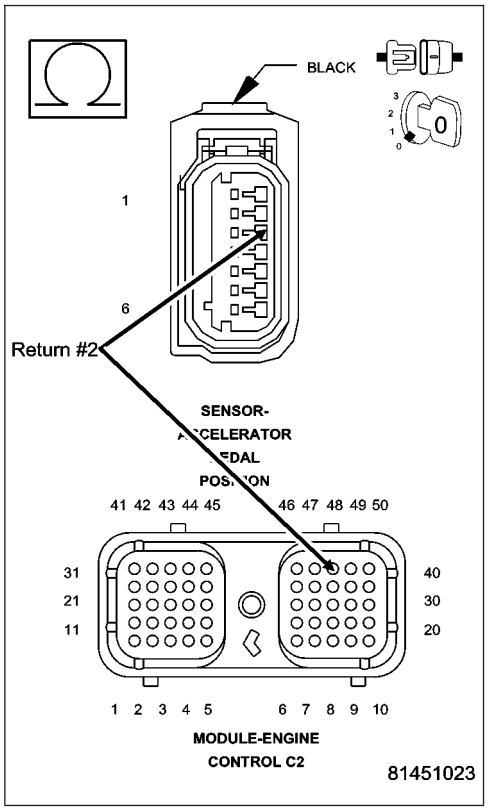
NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance on the (K400) APPS No. 2 return circuit between the sensor harness connector and the ECM harness connector.

Is the resistance less than 10 ohms?

Yes >> Go To 2

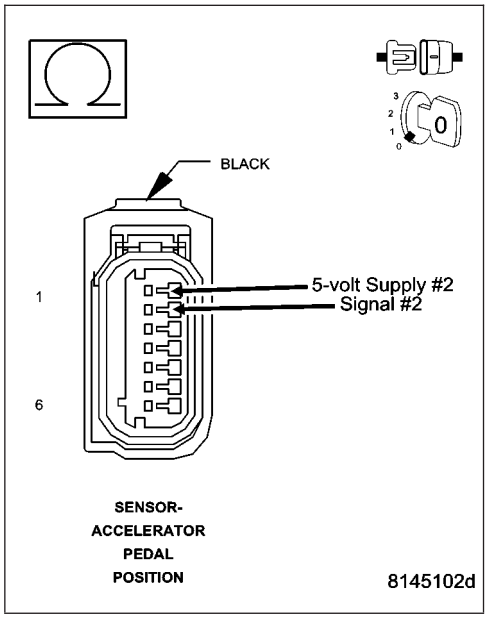
No >> Repair the (K400) APPS No. 2 return circuit open.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2128-PPS 2 VOLTAGE TOO HIGH (CONTINUED)

2. (K29) APPS NO. 2 SIGNAL CIRCUIT SHORTED TO (F856)APPS NO. 1 5-VOLT SUPPLY

Measure the resistance between the (K29) APPS No. 2 signal circuit in the sensor harness connector and the (F856)APPS No. 2 5-volt supply circuit in the sensor harness connector.



Is the resistance greater than 100 K ohms?

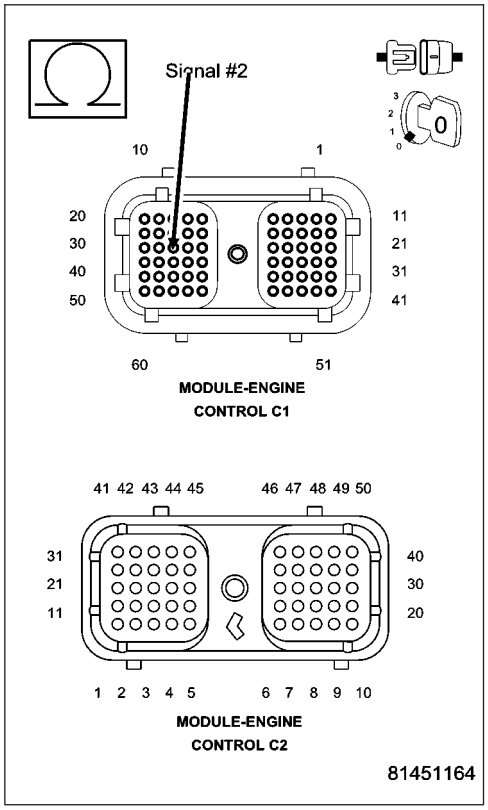
Yes >> Go To 3

No >> Repair the (K29) APPS No. 2 signal circuit shorted to the (F856)5-volt supply circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

3. (K29) APPS SIGNAL CIRCUIT SHORTED TO ANOTHER CIRCUIT

Measure the resistance between the APPS No. 2 signal circuit at the ECM harness connector and all other circuits in the ECM harness connector.



Is the resistance greater than 100 k ohms?

Yes >> Go To 4

No >> Repair the (K29) APPS No. 2 signal circuit shorted to another circuit in the engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2128-PPS 2 VOLTAGE TOO HIGH (CONTINUED)

4. ECM

Reconnect the ECM harness connectors.

Reconnect the APPS harness connector.

While monitoring with the scan tool, disconnect the sensor connector.

Did a APPS No. 1 and APPS No. 2 voltage too low DTC set?

Yes >> Go To 5

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. APPS

Reconnect the APPS harness connector.

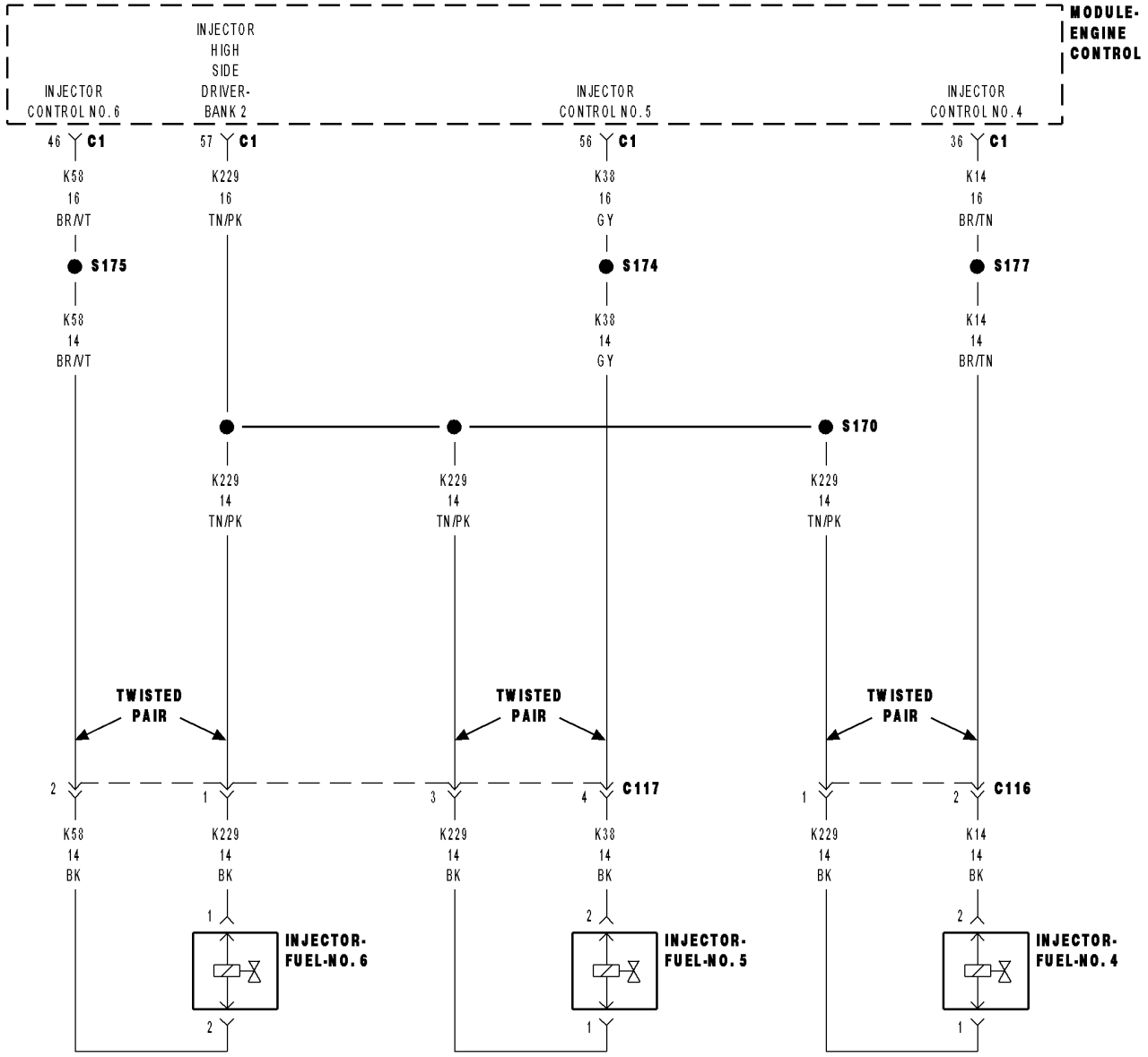
Monitor the APPS No. 1 and APPS No. 2 voltage with the scan tool while depressing the throttle pedal.

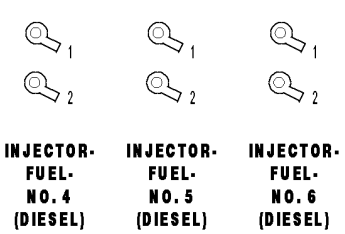
Is the voltage transition shown on the scan tool smooth while depressing the throttle and is the voltage from APPS 1 twice as much as from APPS2

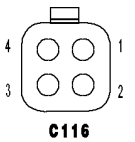
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

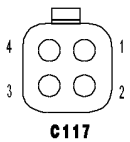
No >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW



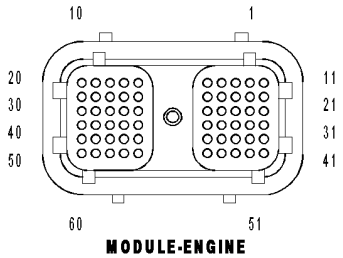












81453955

P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  A circuit failure detected at cylinders 1,2, or 3 or any combination of cylinders 1,2, or 3.

Possible Causes
OTHER DTC'S
HIGH SIDE DRIVER CIRCUIT OPEN
LOW SIDE DRIVER CIRCUIT OPEN
HIGH SIDE DRIVER SHORTED TO LOW SIDE DRIVER
HIGH SIDE DRIVERS SHORTED LOW
LOW SIDE DRIVER CIRCUIT SHORTED OTHER LOW SIDE DRIVER CIRCUIT
LOW SIDE DRIVERS SHORTED LOW
HIGH SIDE DRIVER SHORTED TO VOLTAGE
LOW SIDE DRIVER SHORTED TO VOLTAGE
LOW SIDE DRIVER CIRCUIT SHORTED IN INJECTOR HARNESS
INJECTOR
INJECTOR HARNESS
INTERMITTENT CONDITION
ECM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Do you have any combination of DTC's P0201, P0202, or P0203?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

2. HIGH SIDE DRIVER CIRCUIT OPEN

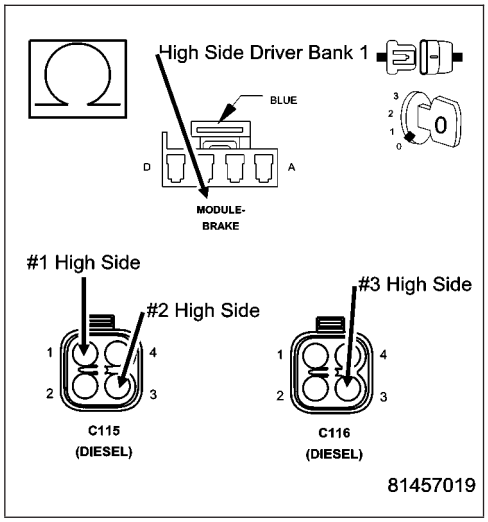
Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Injector 1-3 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the injector high side driver circuit between the Bank 1 high side driver circuit in the ECM harness connector and the high side driver circuit in the injector harness connectors for cylinders 1-3.



Is the resistance less than 10 Ohms?

Yes >> Go To 3

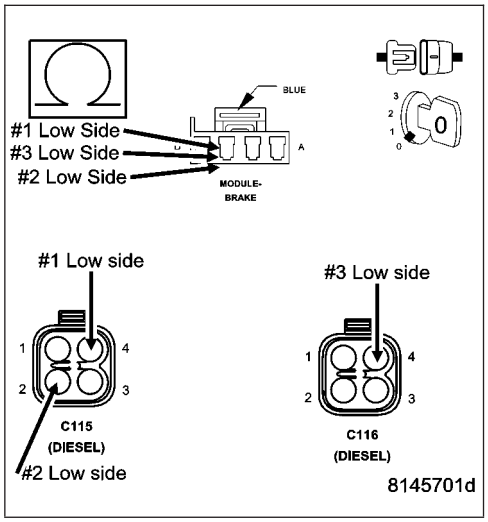
No >> Repair the open high side driver circuit from ECM harness connector to the Injector harness connector.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. LOW SIDE DRIVER CIRCUIT OPEN

Measure the resistance of the #1,#2, and #3 injector low side driver circuits between the ECM harness connector and the injector harness connectors.



Is the resistance less than 10 Ohms?

Yes >> Go To 4

No >> Repair the open low side driver circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

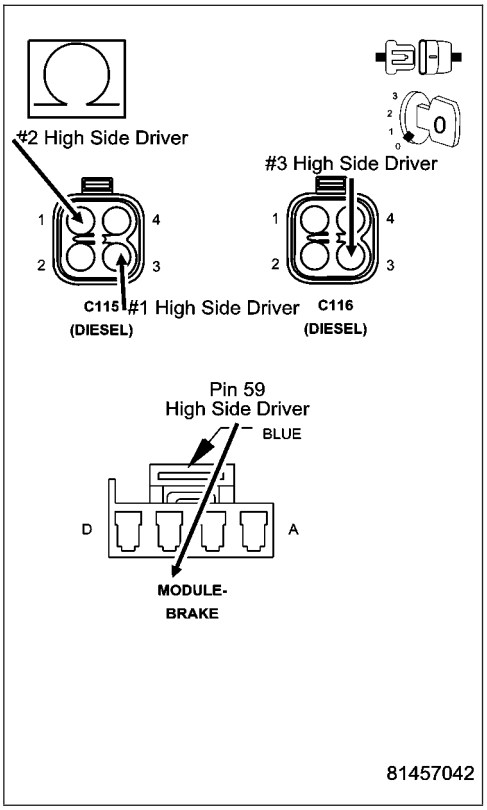
4. HIGH SIDE DRIVER SHORTED TO LOW SIDE DRIVER

Measure the resistance between the Bank 1 high side driver circuit at the ECM harness connector and the low side driver circuit for injectors 1-3 at the ECM harness connector.

Is the resistance more than 100k Ohms?

Yes >> Go To 5

No >> Repair the High side circuit shorted to the low side circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



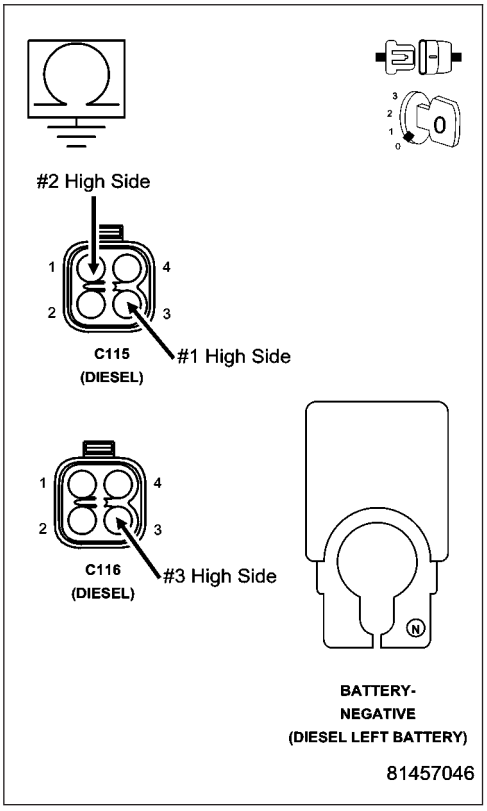
5. HIGH SIDE DRIVERS SHORTED LOW

Measure the resistance of the injector harness connector high side driver circuits to battery negative for injectors 1-3.

Is the resistance more than 100k Ohms?

Yes >> Go To 6

No >> Repair the High side driver shorted low in the harness. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

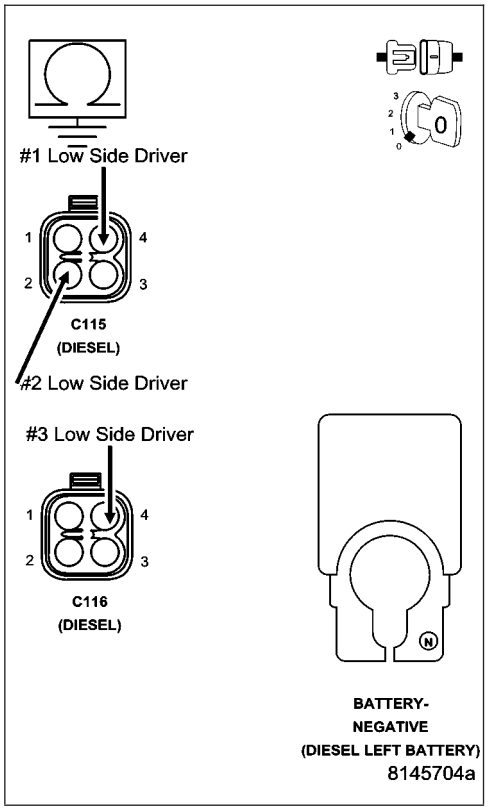
6. LOW SIDE DRIVERS SHORTED LOW

Measure the resistance of the injector harness connector Low side driver circuits to battery negative for injectors 1-3.

Is the resistance more than 100k Ohms?

Yes >> Go To 7

No >> Repair the Low side driver shorted low in the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



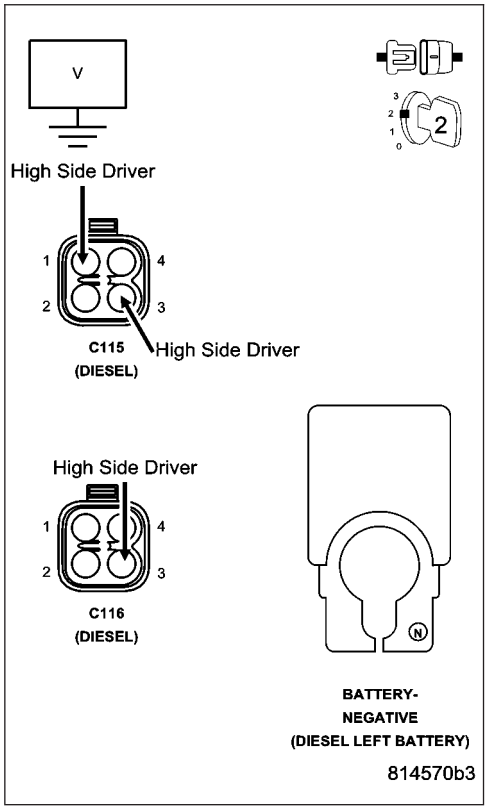
7. HIGH SIDE DRIVER SHORTED TO VOLTAGE

Measure the voltage between the high side driver circuit in the engine harness and battery negative.

Is the voltage less than 1 volt?

Yes >> Go To 8

No >> Repair the high side driver shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

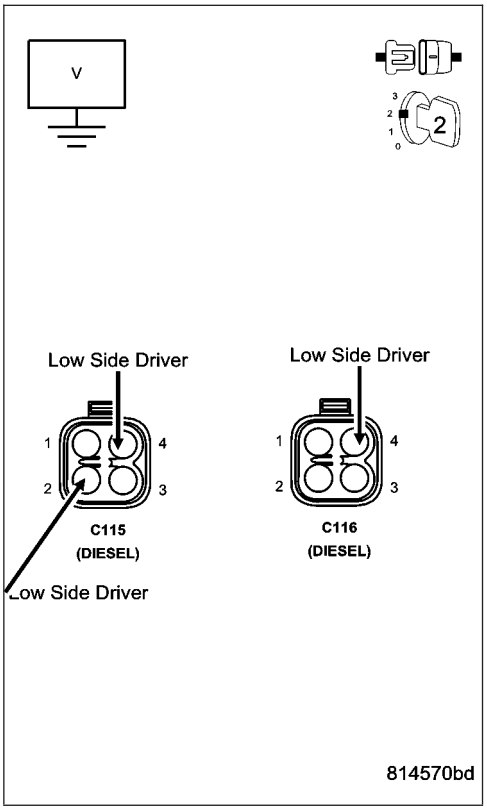
8. LOW SIDE DRIVER SHORTED TO VOLTAGE

Measure the voltage between the low side driver circuit in the engine harness and battery negative for cylinders 1-3.

Is the voltage less than 1 volt?

Yes >> Go To 9

No >> Repair the low side driver shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



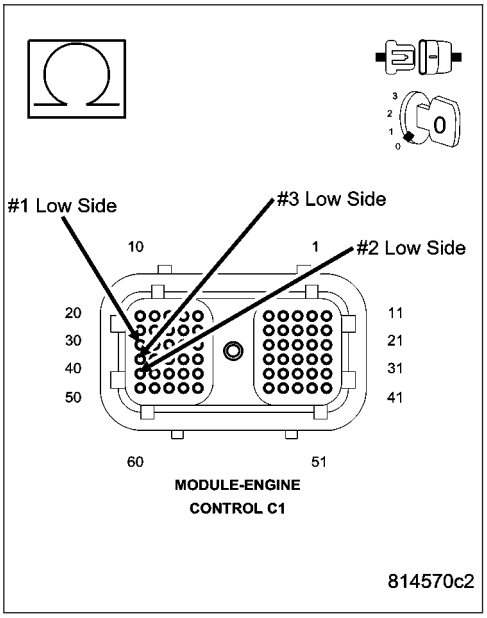
9. LOW SIDE DRIVER CIRCUIT SHORTED OTHER LOW SIDE DRIVER CIRCUIT

Measure the resistance of each of the Bank 1 low side driver circuit to all other Bank 1 low side driver circuits at the ECM harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 10

No >> Repair Low side driver circuit shorted to other Low side driver circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

10. LOW SIDE DRIVER CIRCUIT SHORTED IN INJECTOR HARNESS

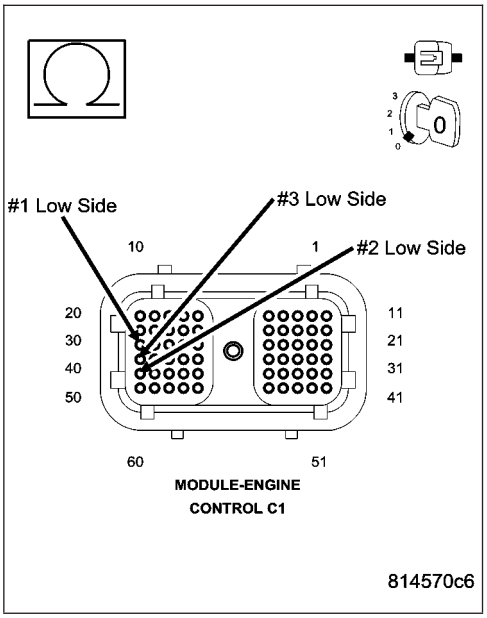
Reconnect the disconnected injector harness connector.

Measure the resistance of each of the Bank 1 low side driver circuit to all other Bank 1 low side driver circuit at the ECM harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 11

No >> Replace the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



11. INJECTOR CIRCUITS SHORTED INSIDE ENGINE

Disconnect the injector through head harness connector.

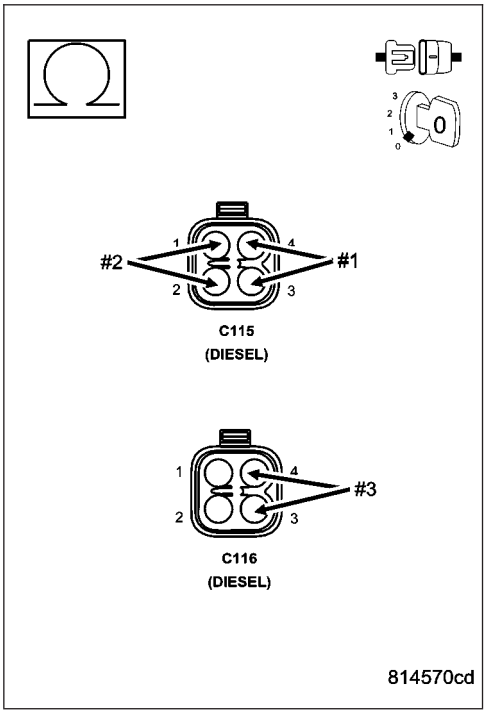
Measure the resistance of each injector from the through head connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance greater than 0 ohms and less than 1 ohm?

Yes >> Go To 12

No >> Go To 14



P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

12. INJECTOR

Disconnect the pigtail nuts from injectors 1-3.

NOTE: Check connectors - Clean/repair as necessary.

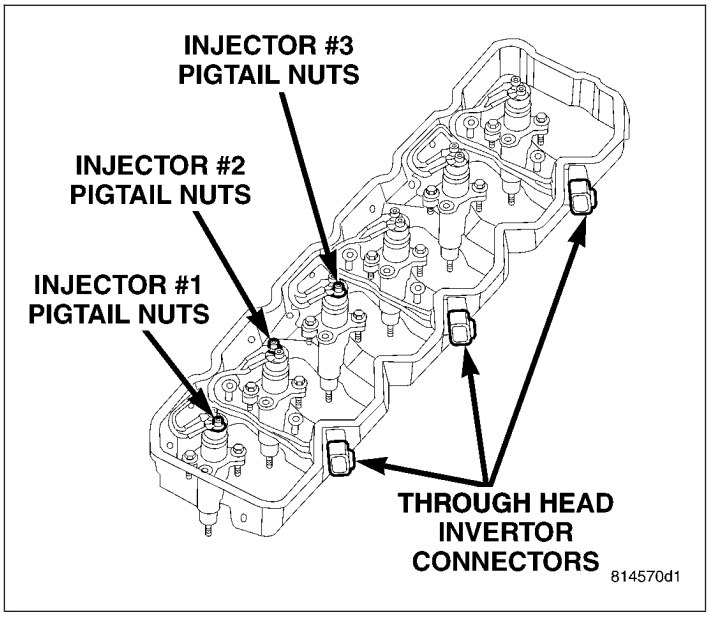
Measure the resistance between the solenoid posts of each injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 13

No >> Replace the fuel injector or injectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



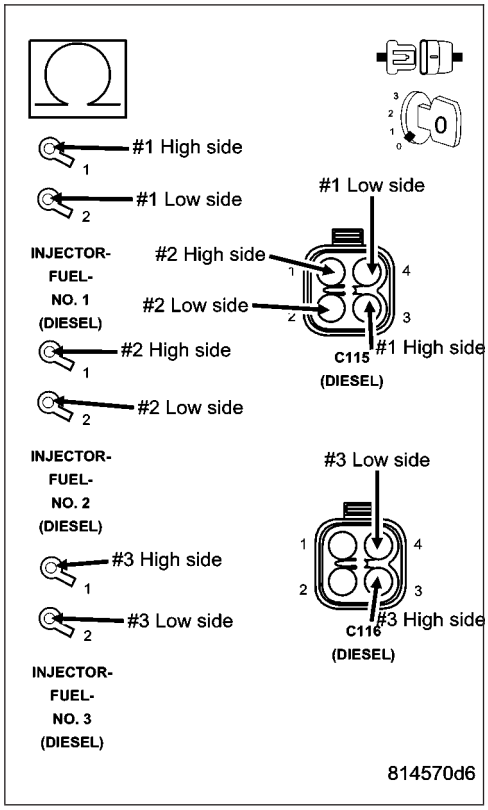
13. INJECTOR HARNESS

Measure resistance of each circuit in the injector harness from pigtail side to injector harness connector.

Is resistance above 1 ohm?

Yes >> Replace the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)



P2146-BANK 1 (CYLINDERS 1-3) SHORTED HIGH OR LOW (CONTINUED)

14. ECM

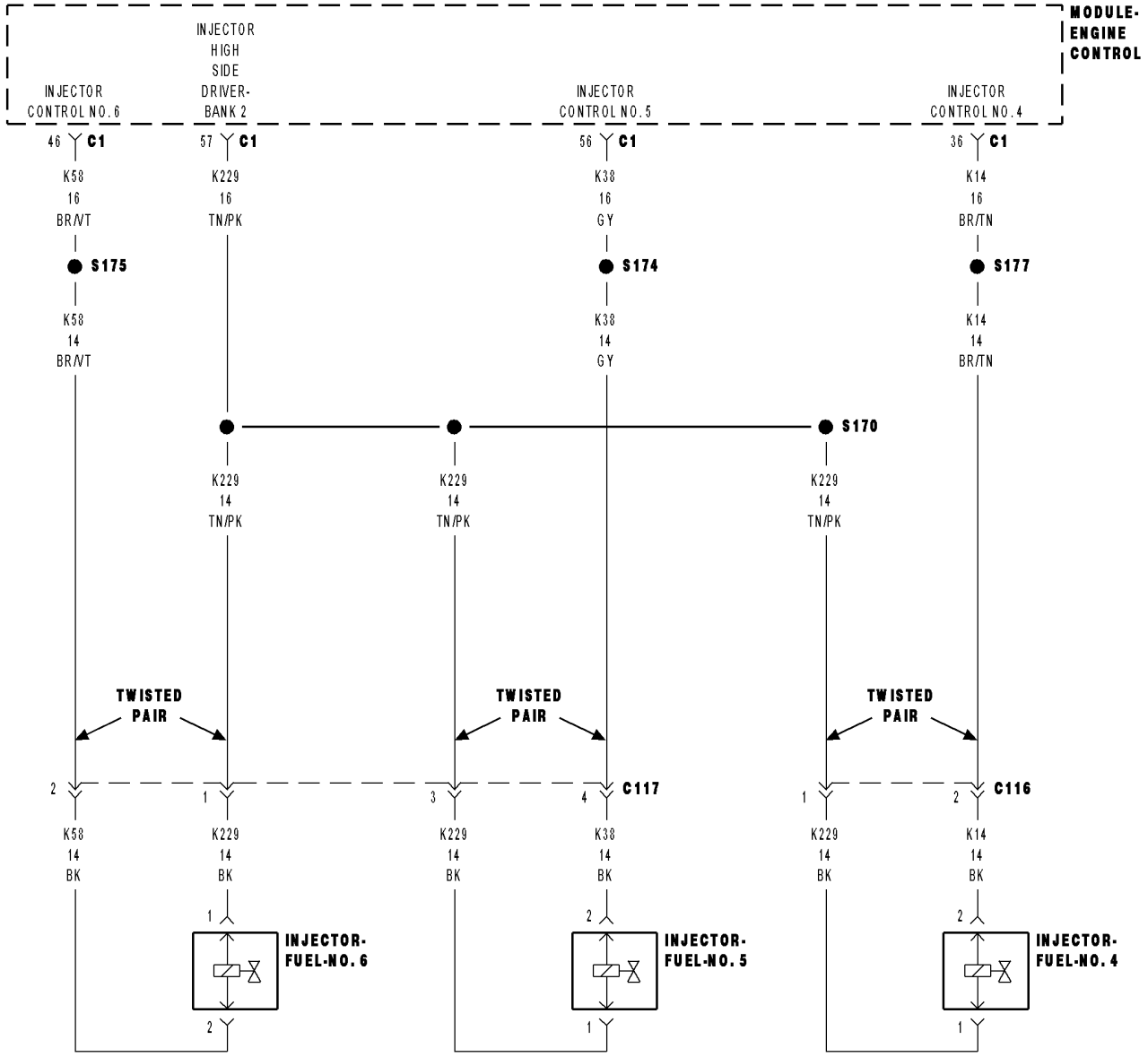
Reconnect the all injector pig tails harness connector.
Reconnect the ECM harness connector.
Reconnect the Injector harness connector.
Start the engine.
With the scan tool, read DTCs.

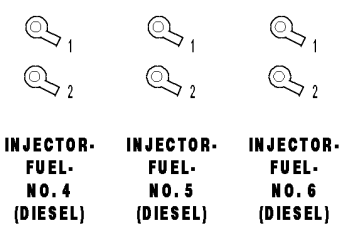
Did the DTC return?

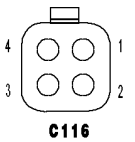
Yes >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

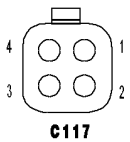
No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW



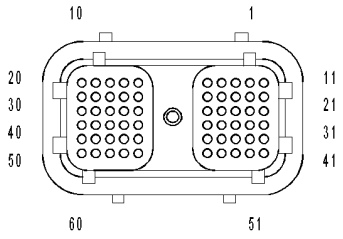












81453955

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  A misfire detected at cylinders 4,5, or 6 or any combination of cylinders 4,5, or 6.

Possible Causes
OTHER DTC'S
HIGH SIDE DRIVER CIRCUIT OPEN
LOW SIDE DRIVER CIRCUIT OPEN
HIGH SIDE DRIVER SHORTED TO LOW SIDE DRIVER
HIGH SIDE DRIVERS SHORTED LOW
LOW SIDE DRIVER CIRCUIT SHORTED OTHER LOW SIDE DRIVER CIRCUIT
LOW SIDE DRIVERS SHORTED LOW
HIGH SIDE DRIVER SHORTED TO VOLTAGE
LOW SIDE DRIVER SHORTED TO VOLTAGE
LOW SIDE DRIVER CIRCUIT SHORTED IN INJECTOR HARNESS
INJECTOR
INJECTOR HARNESS
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S

With the scan tool, read DTCs.

Do you have any combination of DTC's P0204, P0205, or P0206?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

2. HIGH SIDE DRIVER CIRCUIT OPEN

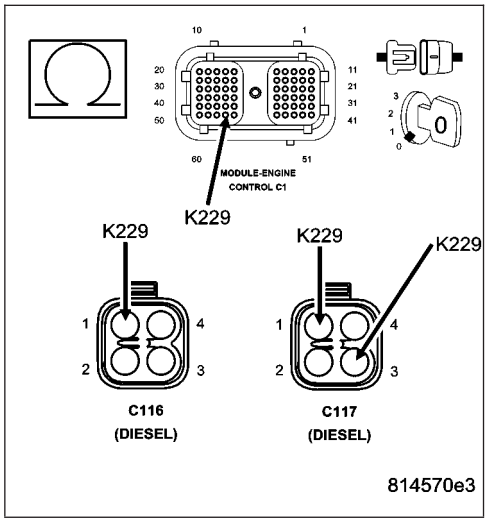
Turn the ignition off.

Disconnect the ECM harness connectors.

Disconnect the Injector 4-6 harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the injector high side driver circuit between the Bank 2 high side driver circuit in the ECM harness connector and the high side driver circuit in the injector harness connectors for cylinders 4-6.



Is the resistance less than 10 Ohms?

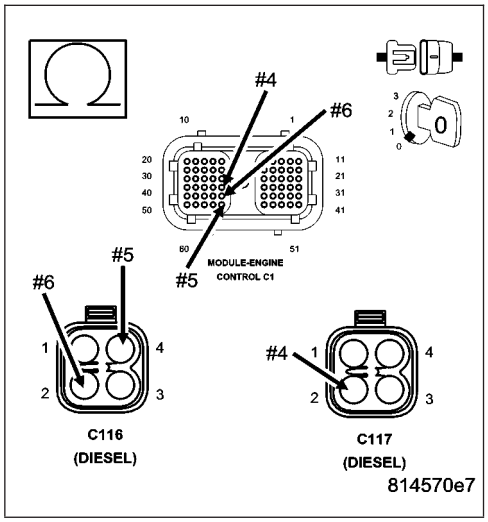
Yes >> Go To 3

No >> Repair the open high side driver circuit from ECM harness connector to the Injector harness connector.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

3. LOW SIDE DRIVER CIRCUIT OPEN

Measure the resistance of the #4,#5, and #6 injector low side driver circuits between the ECM harness connector and the injector harness connectors.



Is the resistance less than 10 Ohms?

Yes >> Go To 4

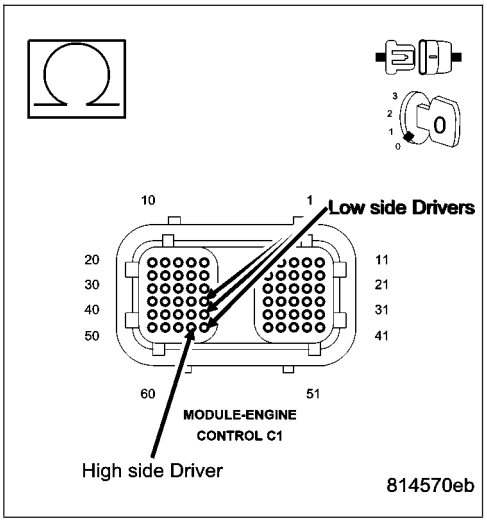
No >> Repair the open low side driver circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

4. HIGH SIDE DRIVER SHORTED TO LOW SIDE DRIVER

Measure the resistance between the Bank 2 high side driver circuit at the ECM harness connector and the low side driver circuit for injectors 4-6 at the ECM harness connector.



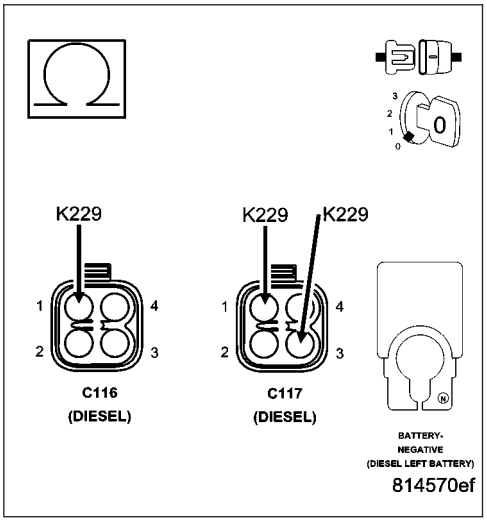
Is the resistance more than 100k Ohms?

Yes >> Go To 5

No >> Repair the High side circuit shorted to the low side circuit. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

5. HIGH SIDE DRIVERS SHORTED LOW

Measure the resistance of the injector harness connector high side driver circuits to battery negative for injectors 4-6.



Is the resistance more than 100k Ohms?

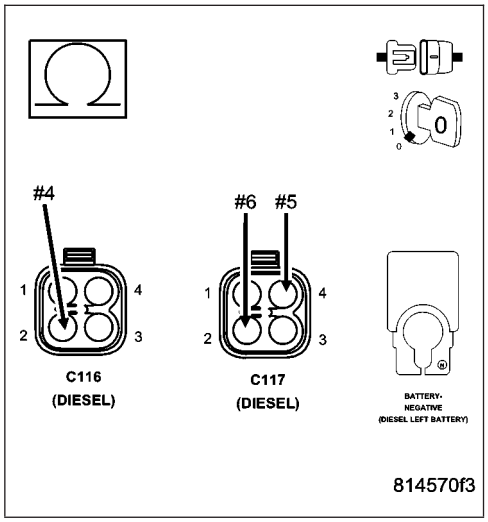
Yes >> Go To 6

No >> Repair the High side driver shorted low in the harness. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

6. LOW SIDE DRIVERS SHORTED LOW

Measure the resistance of the injector harness connector Low side driver circuits to battery negative for injectors 4-6.



Is the resistance more than 100k Ohms?

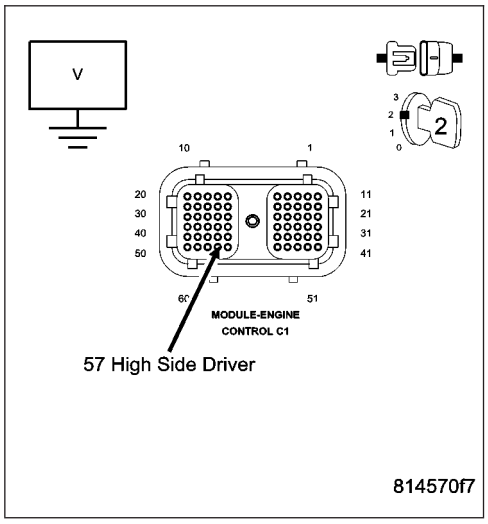
Yes >> Go To 7

No >> Repair the Low side driver shorted low in the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

7. HIGH SIDE DRIVER SHORTED TO VOLTAGE

Turn Ingition on, engine off.

Measure the voltage between the high side driver circuit in the engine harness and battery negative.



Is the voltage less than 1 volt?

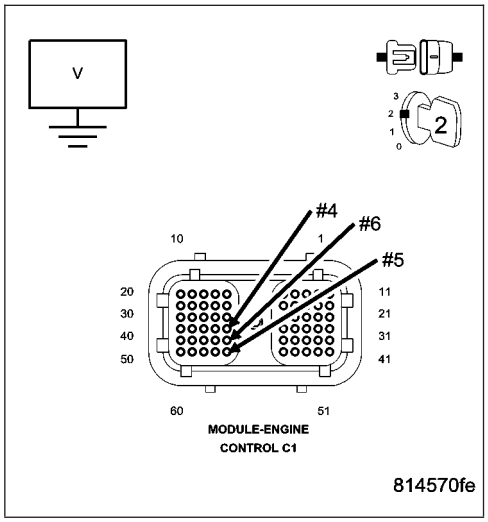
Yes >> Go To 8

No >> Repair the high side driver shorted to voltage.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

8. LOW SIDE DRIVER SHORTED TO VOLTAGE

Measure the voltage between the low side driver circuit in the engine harness and battery negative for cylinders 4-6.



Is the voltage less than 1 volt?

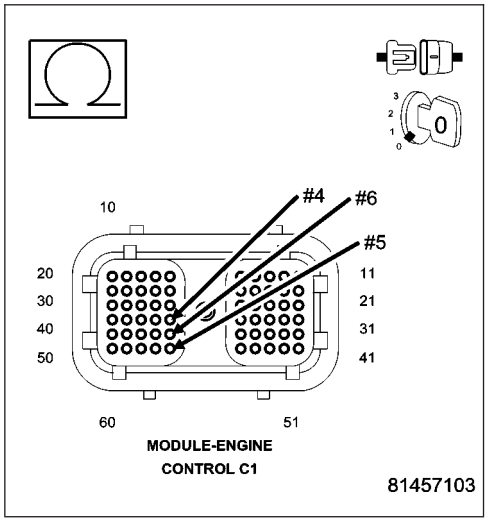
Yes >> Go To 9

No >> Repair the low side driver shorted to voltage.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

9. LOW SIDE DRIVER CIRCUIT SHORTED OTHER LOW SIDE DRIVER CIRCUIT

Measure the resistance of each of the Bank 2 low side driver circuit to all other Bank 2 low side driver circuits at the ECM harness connector.



Is the resistance greater than 100k ohms?

Yes >> Go To 10

No >> Repair Low side driver circuit shorted to other Low side driver circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

10. LOW SIDE DRIVER CIRCUIT SHORTED IN INJECTOR HARNESS

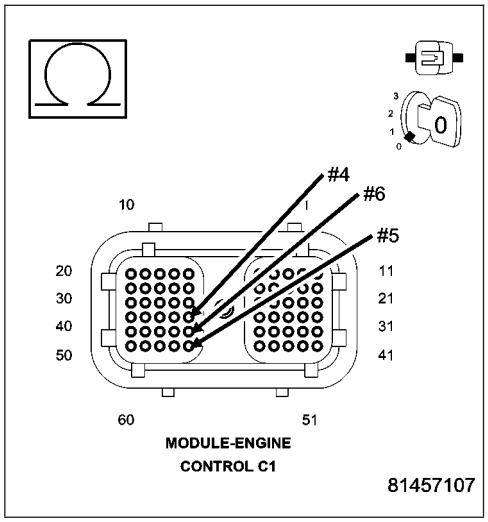
Reconnect the disconnected injector harness connector.

Measure the resistance of each of the Bank 2 low side driver circuit to all other Bank 2 low side driver circuit at the ECM harness connector.

Is the resistance greater than 100k ohms?

Yes >> Go To 11

No >> Replace the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



11. INJECTOR CIRCUITS SHORTED INSIDE ENGINE

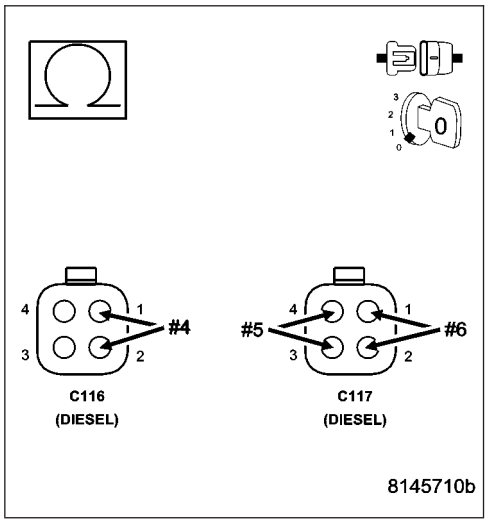
Measure the resistance of each injector from the through head connector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance greater than zero and less than 1 ohm?

Yes >> Go To 12

No >> Go To 14



P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

12. INJECTOR

Disconnect the pigtail nuts from injectors 4-6.

NOTE: Check connectors - Clean/repair as necessary.

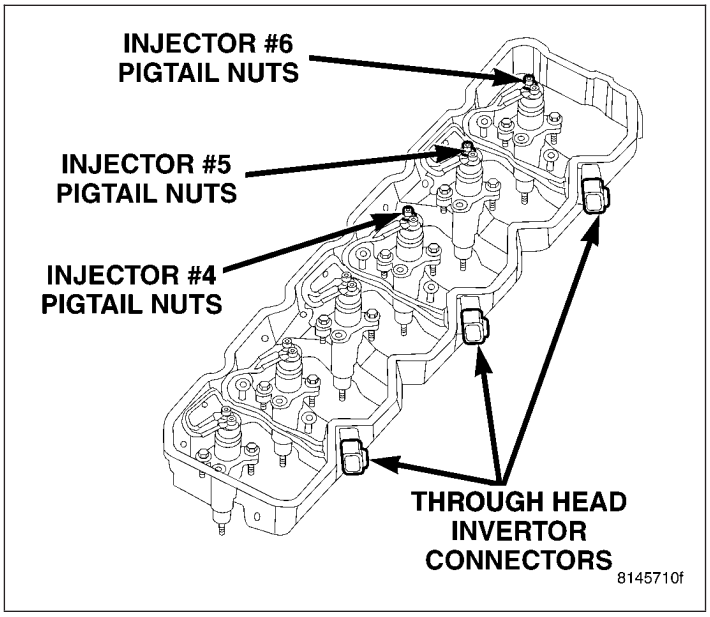
Measure the resistance between the solenoid posts of each injector.

NOTE: Be sure to zero the ohm meter prior to checking the injector circuit.

Is the resistance less than 1 ohm and greater than 0 ohms?

Yes >> Go To 13

No >> Replace the fuel injector or injectors.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



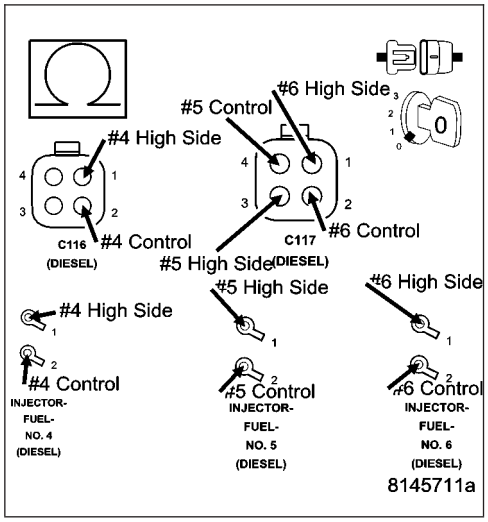
13. INJECTOR HARNESS

Measure resistance of each circuit in the injector harness from pigtail side to injector harness connector.

Is resistance above 1 ohm?

Yes >> Replace the injector harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)



P2149-BANK 2 (CYLINDERS 4-6) SHORTED HIGH OR LOW (CONTINUED)

14. ECM

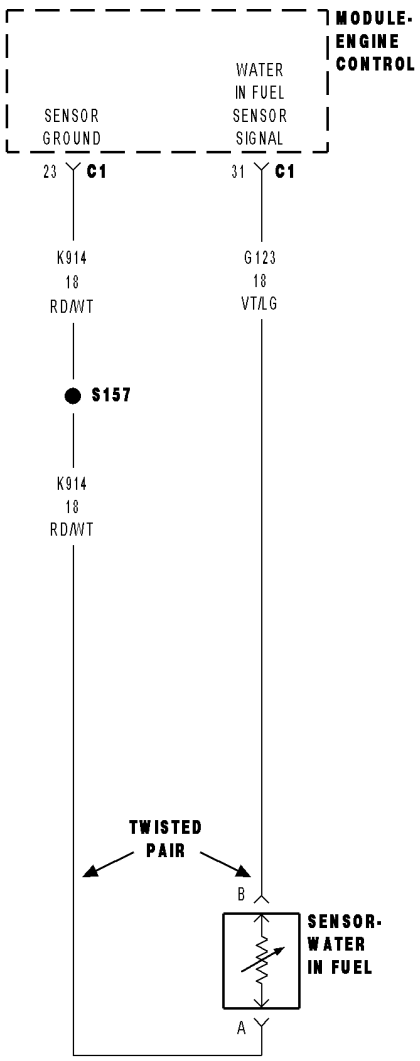
Reconnect all the injector pig tail harness connectors to the Injectors.
Reconnect the ECM harness connector.
Reconnect the Injector harness connector.
Start the engine.
With the scan tool, read DTCs.

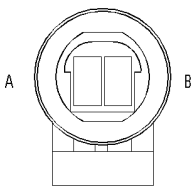
Did the DTC return?

Yes >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

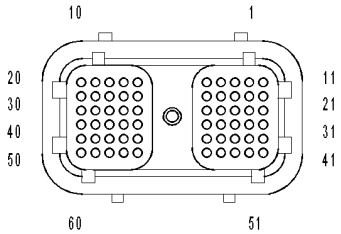
No >> Test Complete.

P2266-WATER IN FUEL (WIF) SENSOR VOLTAGE TOO LOW





SENSOR- WATER
IN FUEL



MODULE-ENGINE
CONTROL C1

8145757b

P2266-WATER IN FUEL (WIF) SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Low voltage detected at the WIF signal circuit at the ECM.

Possible Causes
WATER IN FUEL SENSOR
ECM
(G123) WATER IN FUEL SENSOR SIGNAL CIRCUIT SHORTED TO (K914) RETURN CIRCUIT

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. WATER IN FUEL SENSOR

Turn the ignition off.

Disconnect the Water in fuel sensor harness connector.

Ignition on, engine not running.

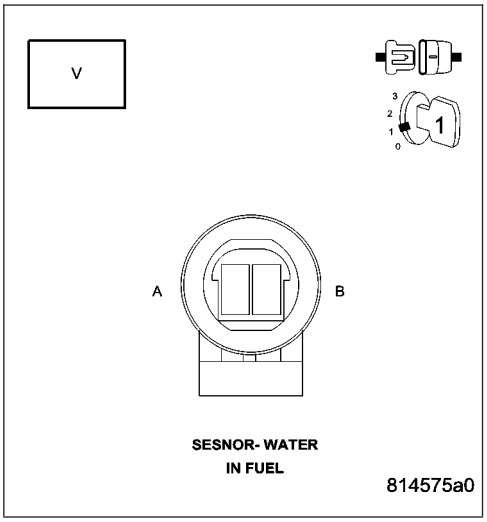
NOTE: Check connectors - Clean/repair as necessary.

Measure the voltage between the signal circuit and return circuit of the WIF sensor harness connector.

Is the voltage between 4.5 and 5.5 volts?

Yes >> Replace the Water in fuel sensor.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2



P2266-WATER IN FUEL (WIF) SENSOR VOLTAGE TOO LOW (CONTINUED)

2. SIGNAL CIRCUIT SHORTED TO RETURN CIRCUIT

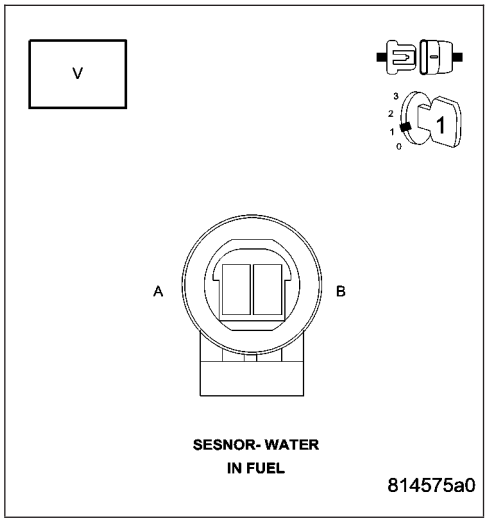
Disconnect the ECM connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the signal circuit of the sensor connector and the return circuit of the sensor connector.

Is the resistance less than 10 ohms?

Yes >> Repair or replace the harness.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3



3. ECM

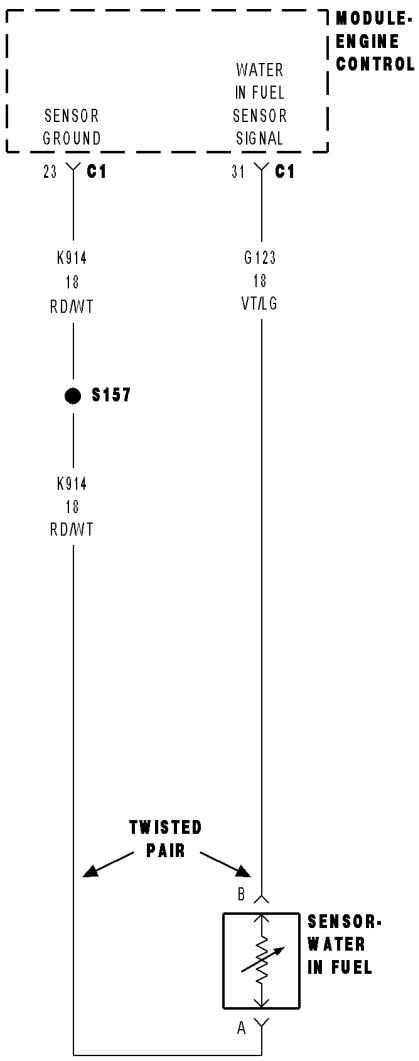
Reconnect the ECM connector.
Measure the resistance between the signal circuit of the sensor connector and the return circuit of the sensor connector.

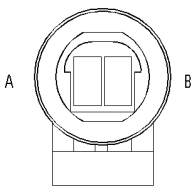
Is the resistance less than 10 ohms?

Yes >> Replace the ECM.

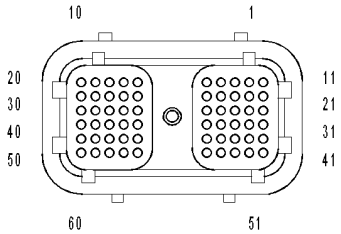
No >> Test Complete.

P2269-WATER IN FUEL (WIF)





SENSOR- WATER
IN FUEL



MODULE-ENGINE
CONTROL C1

8145757b

P2269-WATER IN FUEL (WIF) (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  Low voltage detected at the WIF signal circuit at the ECM.

Possible Causes
OTHER DTC'S PRESENT
WATER IN FUEL
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Do you have any additional water in fuel DTC's?

Yes >> Repair other Water in fuel sensor DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. WATER IN FUEL

Using the service publications as a guide, drain the water in fuel separator.

Did the DTC become inactive after draining the water in fuel separator?

Yes >> Clear DTC, repair complete.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P2269-WATER IN FUEL (WIF) (CONTINUED)

3. ECM

Disconnect the WIF sensor harness connector.

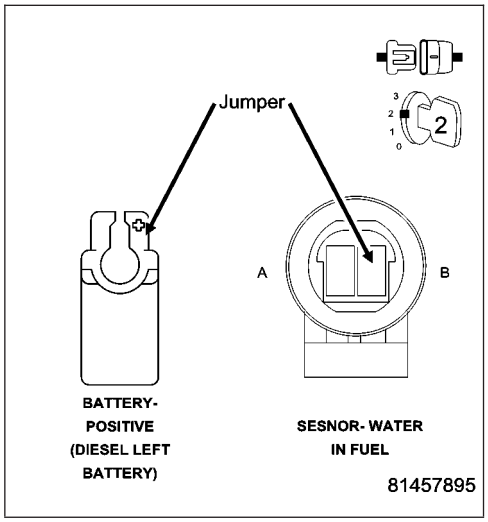
NOTE: Check connectors - Clean/repair as necessary.
Using the scan tool, monitor for DTC's while connecting a jumper wire between the (G123) signal circuit of the water in fuel sensor and battery voltage.

Did the water in fuel light go out?

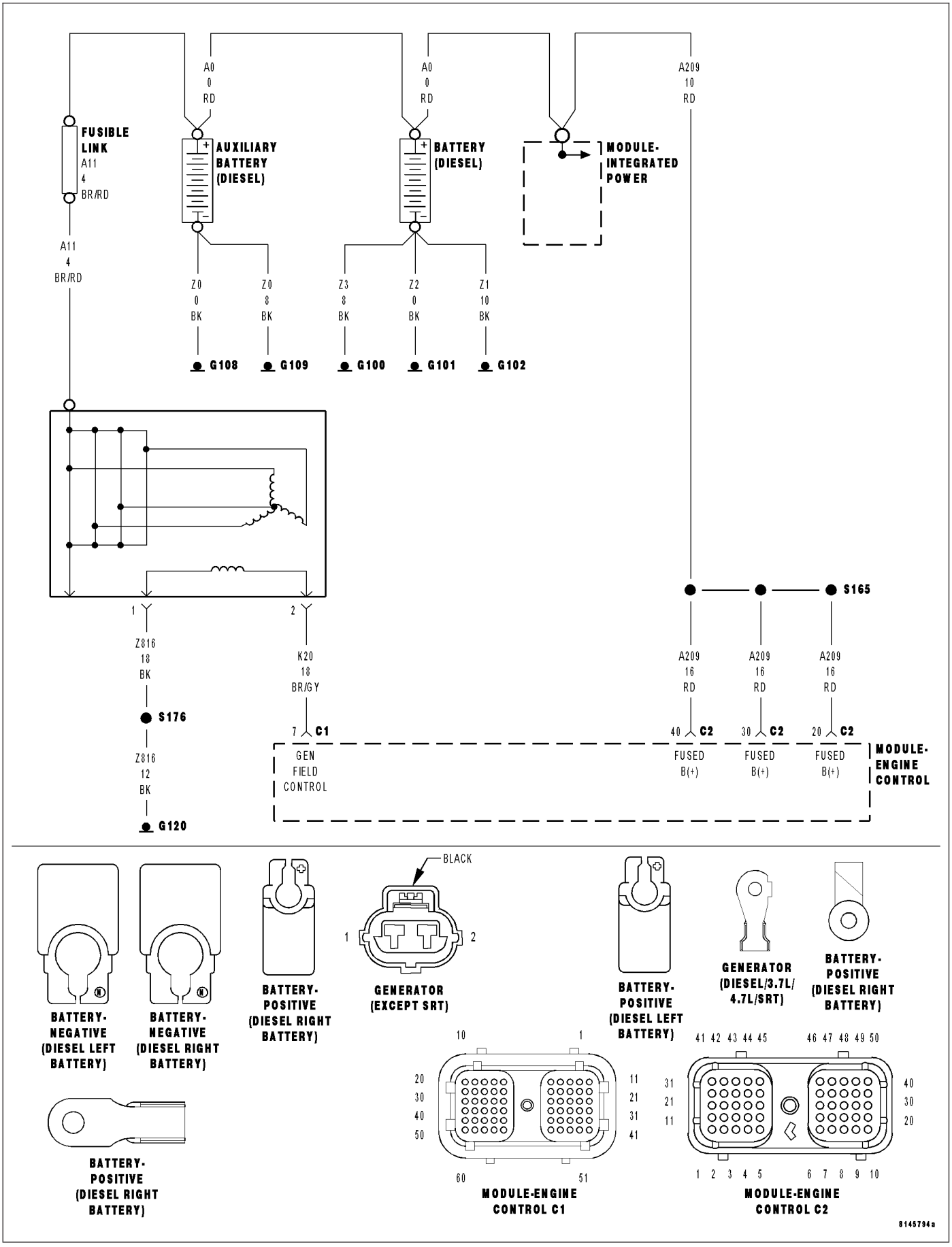
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace and program the ECM in accordance with the Service Information.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2502-CHARGING SYSTEM ERROR



P2502-CHARGING SYSTEM ERROR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The ECM cycles the voltage regulator in the generator while monitoring for a change in output voltage. If the voltage does not drop when the regulator is off, the fault is set.

Possible Causes
DIRTY OR LOOSE CONNECTIONS
HIGH RESISTANCE IN THE B+ CIRCUIT
HIGH RESISTANCE IN THE B+ CROSS OVER CABLE
HIGH RESISTANCE IN THE GROUND CIRCUIT
GENERATOR
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DIRTY OR LOOSE CONNECTIONS

Visually inspect the positive and negative connections at the battery.

Visually inspect the battery negative connections at the engine block.

Are the connections free of corrosion and are they tight?

Yes >> Go To 2

No >> Clean and/or tighten the connections.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. HIGH RESISTANCE IN THE B+ CIRCUIT

Measure the voltage between the B+ post of the generator and the B+ post of the battery while the engine is running.

Is the voltage above .4 volts?

Yes >> Repair the high resistance in the B+ circuit from battery to the generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P2502-CHARGING SYSTEM ERROR (CONTINUED)

3. HIGH RESISTANCE IN THE B+ CROSS OVER CABLE

Measure the voltage between the B+ post of the generator and the B+ post of the right side battery to the left side battery while the engine is running.

Is the voltage above .4 volts?

Yes >> Repair the high resistance in the B+ cross over cable from right side battery to left side battery.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. HIGH RESISTANCE IN THE GROUND CIRCUIT

Measure the voltage between the generator case and the B- post of the battery.

Is the voltage above .1 volts?

Yes >> Repair the high resistance in the ground circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. GENERATOR

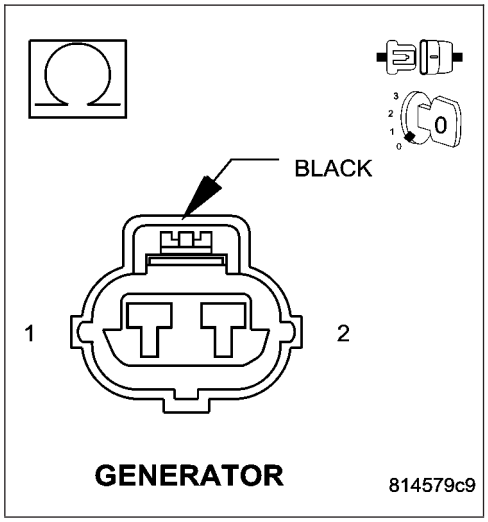
Disconnect the Generator field harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the generator field terminals.

Is the resistance between .5 and 15 Ohms?

Yes >> Go To 6

No >> Replace the generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2502-CHARGING SYSTEM ERROR (CONTINUED)

6. All

Turn the ignition off.

Reconnect the Generator field harness connector.

Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.

Ignition on, engine not running.

Measure and record the voltage between battery positive circuits of the ECM harness connector and the battery negative circuits of the ECM harness connector.

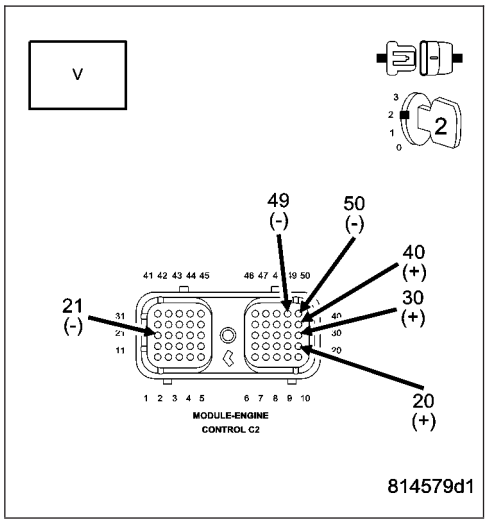
Turn the ignition off.

Reconnect the ECM harness connectors.

Start the engine.

Use the scan tool to measure and record battery voltage.

Compare the voltage reading from the voltmeter with that of the scan tool.

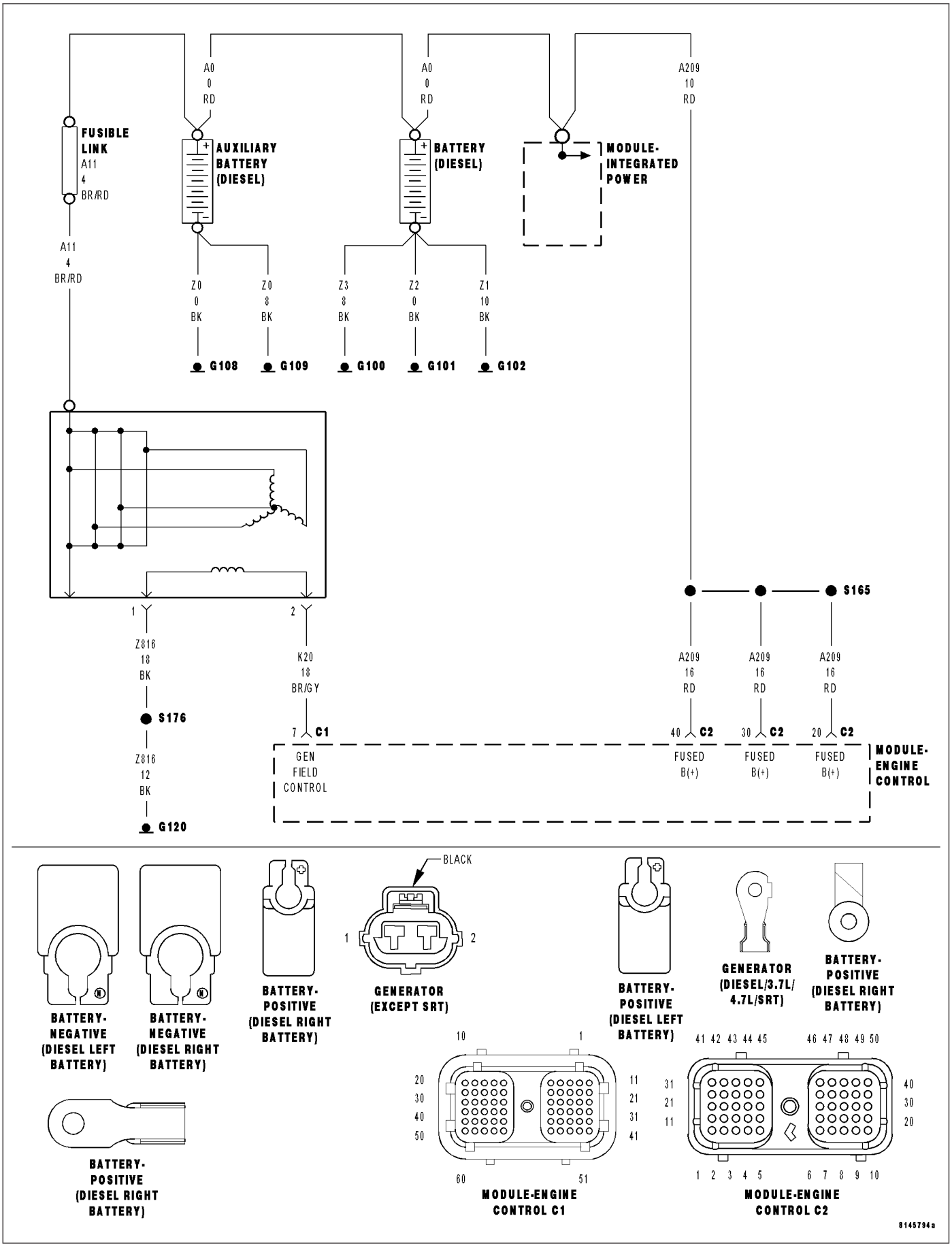


Are the readings within 3 volts of each other?

Yes >> Test Complete.

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2503-CHARGING SYSTEM OUTPUT LOW



P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  The battery voltage exceeds target voltage by more than a calibrated value.

Possible Causes
OTHER DTC'S PRESENT
GENERATOR
FIELD DRIVER CIRCUIT SHORTED TO GROUND
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Is DTC P2502 set?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. GENERATOR

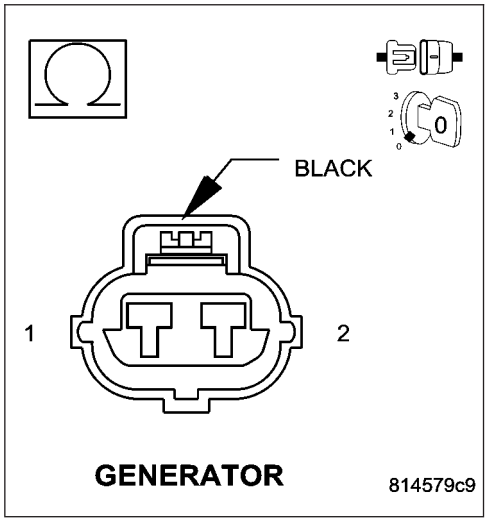
Disconnect the Generator field harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the generator field terminals at the generator.

Is the resistance between .5 and 15 Ohms?

Yes >> Go To 3

No >> Replace the generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2503-CHARGING SYSTEM OUTPUT LOW (CONTINUED)

3. FIELD DRIVER CIRCUIT SHORTED TO GROUND

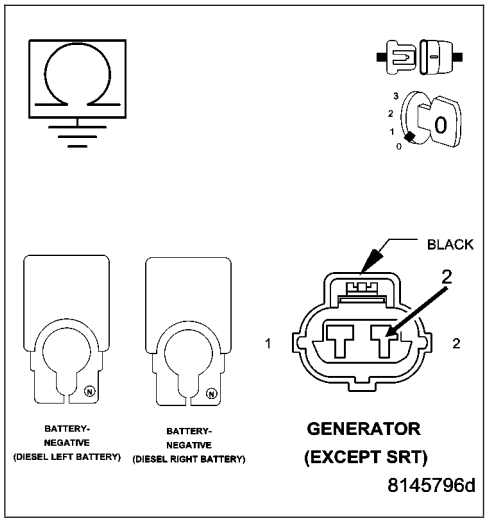
Disconnect the ECM harness connectors.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance of the generator field driver circuit between the generator and battery negative.

Is the resistance greater than 100 ohms?

Yes >> Go To 4

No >> Repair the generator field driver circuit shorted to ground. Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



4. ECM

Measure and record the voltage between battery positive circuit of the ECM harness connector and the battery negative circuits of the ECM harness connector.

Reconnect the ECM connectors.

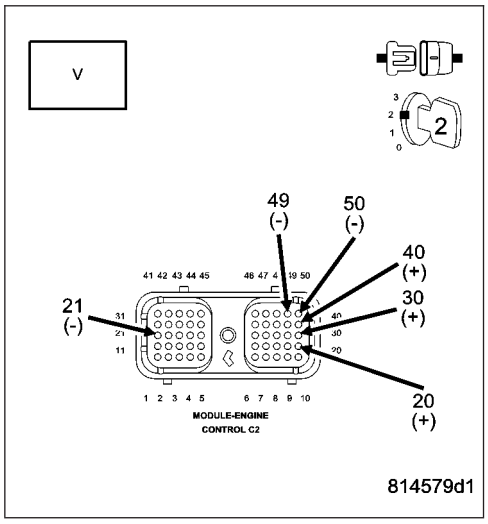
Use the scan tool to measure and record battery voltage.

Compare the voltage reading from the voltmeter with that of the scan tool.

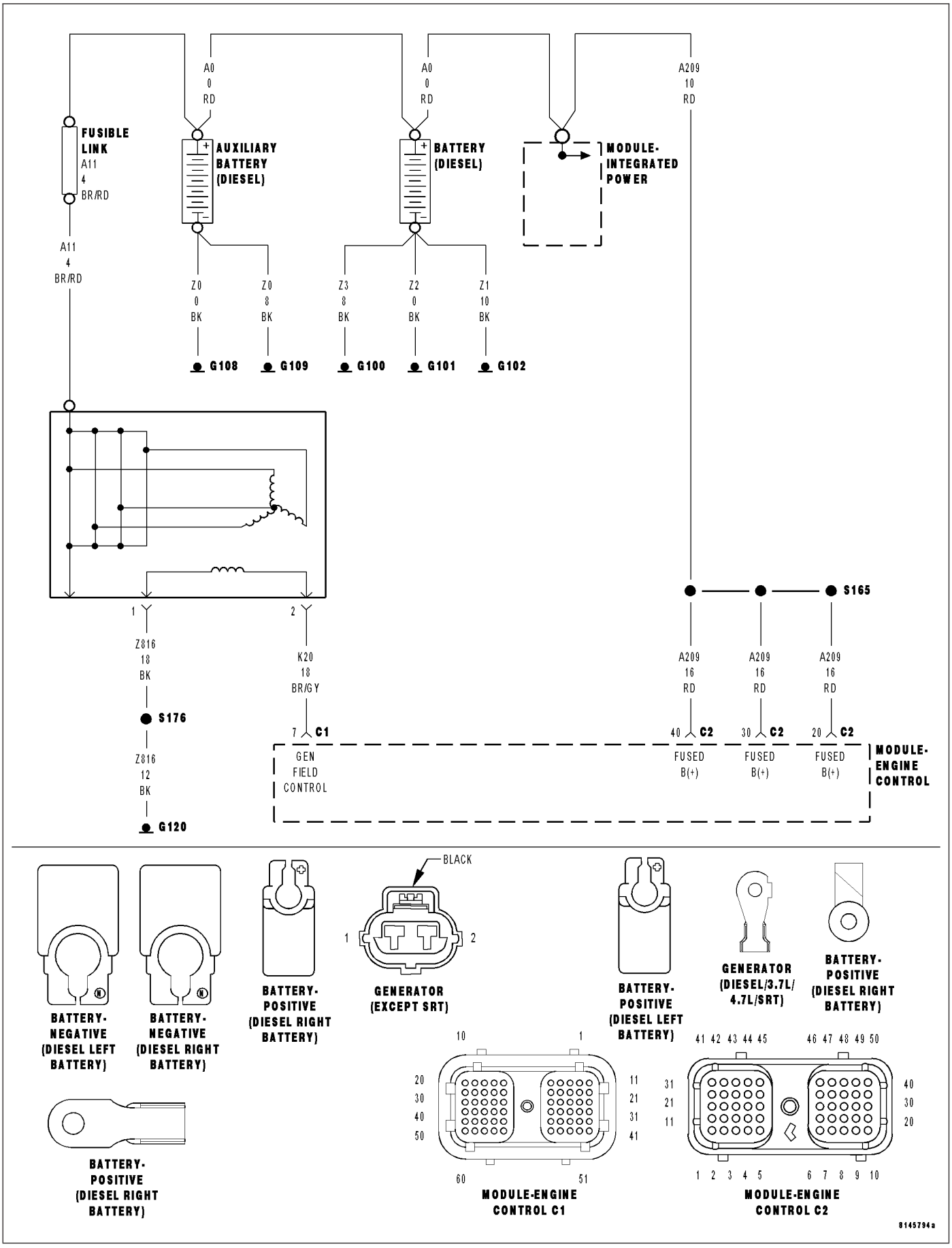
Are the readings within 3 volts of each other?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2504-CHARGING SYSTEM OUTPUT HIGH



P2504-CHARGING SYSTEM OUTPUT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  While the engine is running.
- **Set Condition:**
  Battery voltage is less than 11.5 volts for more than 8 seconds. Battery voltage must exceed 12 volts for more than 5 seconds for fault to become inactive.

Possible Causes
OTHER DTC'S PRESENT
DIRTY OR LOOSE CONNECTIONS
ADD-ON OR ACCESSORY WIRES AT BATTERY TERMINAL
HIGH RESISTANCE IN THE B+ CIRCUIT
HIGH RESISTANCE IN THE B+ CROSS OVER CABLE
HIGH RESISTANCE IN THE GROUND CIRCUIT
GENERATOR
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. OTHER DTC'S PRESENT

With the scan tool, read DTCs.

Is DTC P2502 set?

Yes >> Repair other DTC's first.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 2

---

2. DIRTY OR LOOSE CONNECTIONS

Visually inspect the positive and negative connections at the battery.

Visually inspect the battery negative connections at the engine block.

Are the connections free of corrosion and are they tight?

Yes >> Go To 3

No >> Clean and/or tighten the connections.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2504-CHARGING SYSTEM OUTPUT HIGH (CONTINUED)

3. ADD-ON OR ACCESSORY WIRES AT BATTERY TERMINAL

Check for add-on or accessory wiring at positive (+) terminal of the battery.

Are there any damaged wires at the battery?

Yes >> Remove defective or miss wired add-on or accessory wiring from battery.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 4

---

4. HIGH RESISTANCE IN THE B+ CIRCUIT

Measure the voltage between the B+ post of the generator and the B+ post of the battery while the engine is running.

Is the voltage above .4 volts?

Yes >> Repair the high resistance in the B+ circuit from battery to the generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 5

---

5. HIGH RESISTANCE IN THE B+ CROSS OVER CABLE

Measure the voltage between the B+ post of the generator and the B+ post of the right side battery to the left side battery while the engine is running.

Is the voltage above .4 volts?

Yes >> Repair the high resistance in the B+ cross over cable from right side battery to left side battery.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 6

---

6. HIGH RESISTANCE IN THE GROUND CIRCUIT

Measure the voltage between the generator case and the B- post of the battery.

Is the voltage above .1 volts?

Yes >> Repair the high resistance in the ground circuit.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7

P2504-CHARGING SYSTEM OUTPUT HIGH (CONTINUED)

7. GENERATOR

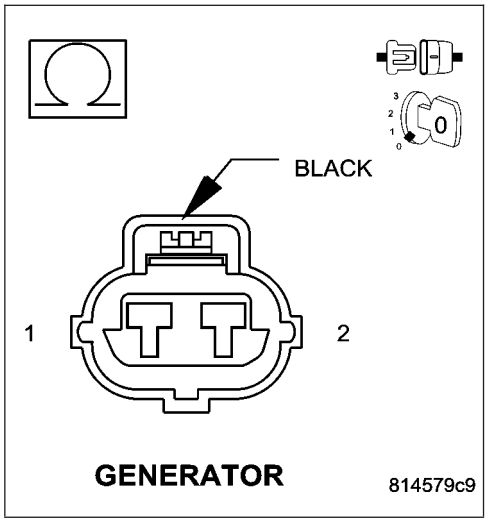
Disconnect the Generator field harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the generator field terminals at the generator.

Is the resistance between .5 and 15 Ohms?

Yes >> Go To 8

No >> Replace the generator.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



8. ECM

Measure and record the voltage between battery positive circuit of the ECM harness connector and the battery negative circuits of the ECM harness connector.

Reconnect the ECM connectors.

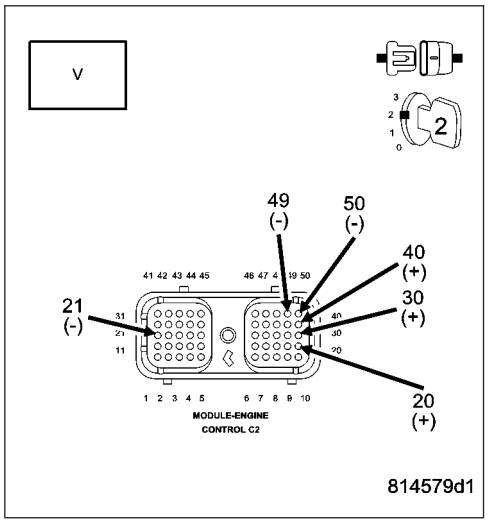
Use the scan tool to measure and record battery voltage.

Compare the voltage reading from the voltmeter with that of the scan tool.

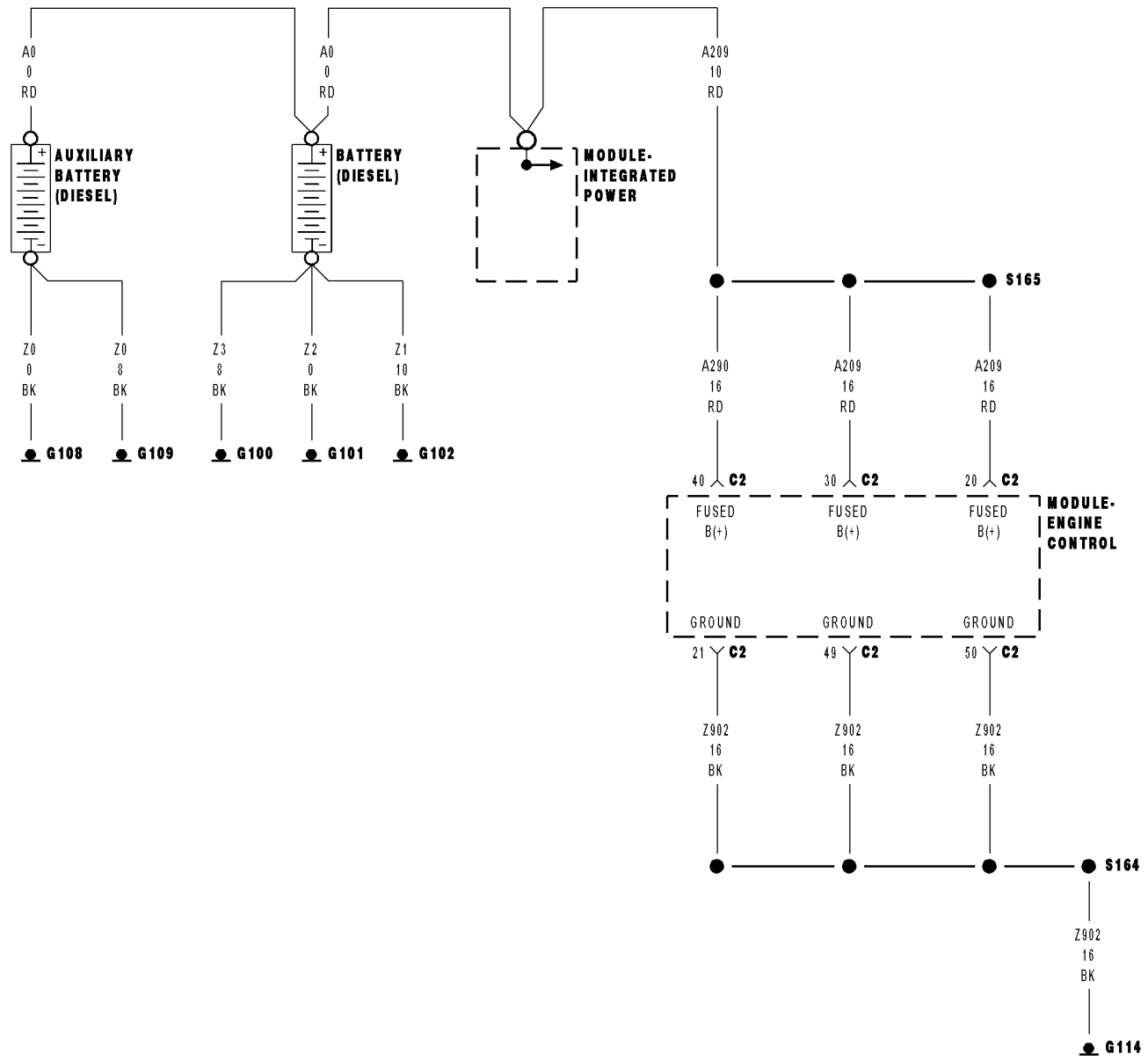
Are the readings within 3 volts of each other?

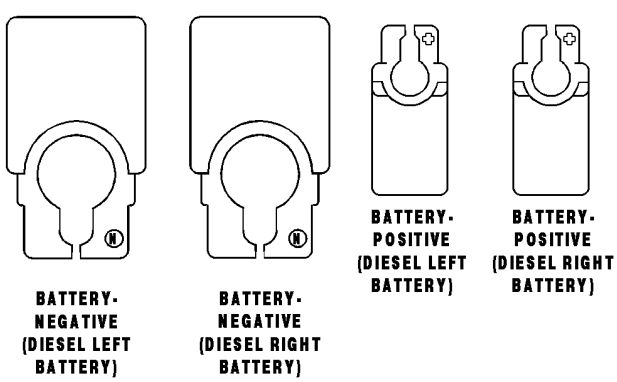
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

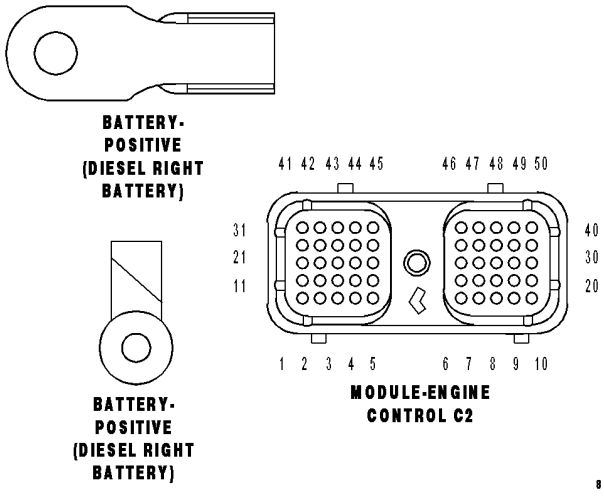
No >> Replace and program the ECM in accordance with the Service Information.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



P2509-POWERDOWN DATA LOST ERROR







814595cd

P2509-POWERDOWN DATA LOST ERROR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuous - key on or key off.
- **Set Condition:**
  Loss of voltage detected at the ECM for a calibrated amount of time.

Possible Causes
POOR CONNECTIONS AT THE BATTERIES
LOW BATTERY VOLTAGE
OPEN FUSED B+ TO ECM
OPEN GROUND CIRCUIT
BATTERY + SHORTED TO OTHER CIRCUITS
RETURN CIRCUIT SHORTED
BATTERY + SHORTED TO GROUND
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. POOR CONNECTIONS AT THE BATTERIES

Visually inspect the wiring at the battery for damaged wires, or corrosion.

Are the connections tight and free of corrosion?

Yes >> Go To 2

No >> Repair the poor connections at the batteries.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. LOW BATTERY VOLTAGE

Measure the voltage between the positive and negative posts of the batteries.

Is the battery voltages both above 12 volts?

Yes >> Go To 3

No >> Recharge or replace the battery (s).
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2509-POWERDOWN DATA LOST ERROR (CONTINUED)

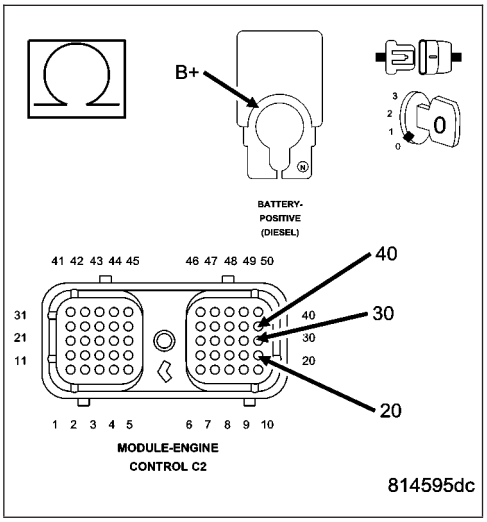
3. OPEN FUSED B+ TO ECM

Turn the ignition off.

Disconnect the ECM harness connectors.

Turn the ignition on.

Measure the resistance between the positive battery post and the ECM supply circuits.



Is the resistance less than 10 Ohms?

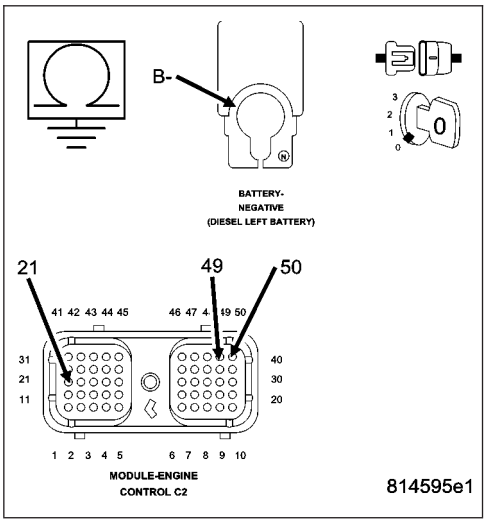
Yes >> Go To 4

No >> Repair the open fused B+ circuit to ECM.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

4. OPEN GROUND CIRCUIT

Measure the resistance between the negative battery post and the ECM ground circuits.



Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open ground circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2509-POWERDOWN DATA LOST ERROR (CONTINUED)

5. BATTERY + SHORTED TO OTHER CIRCUITS

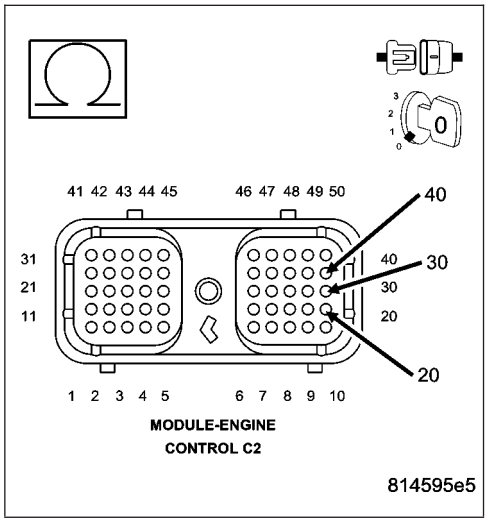
Measure the resistance between the ECM supply circuits and all other circuits in the ECM harness connector, except other supply circuits.

Is the resistance greater than 100k Ohms?

Yes >> Go To 6

No >> Repair the battery circuit short to other circuits in engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



6. RETURN CIRCUIT SHORTED

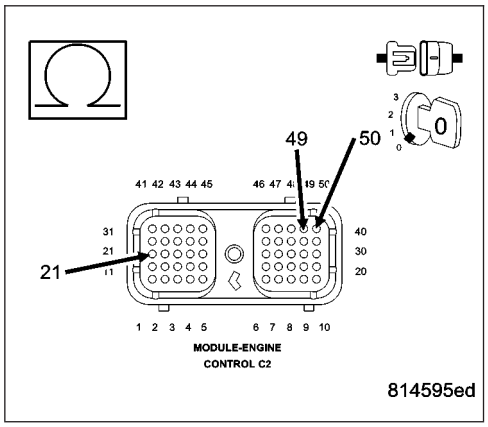
Measure the resistance between the ECM return circuits and all other circuits in the ECM harness connector, except other return circuits.

Is the resistance greater than 100k Ohms?

Yes >> Go To 7

No >> Repair or replace the engine harness.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)



7. BATTERY + SHORTED TO GROUND

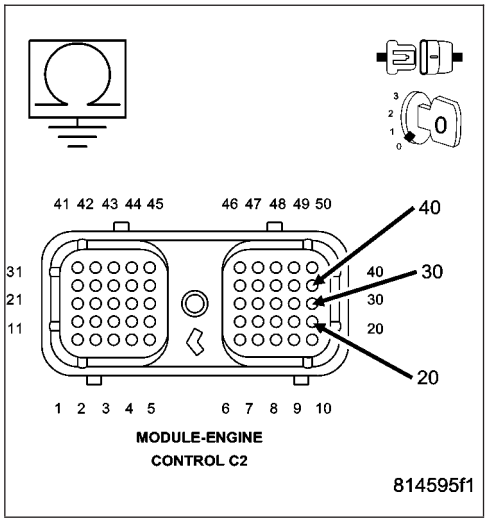
Measure the resistance between the ECM B+ supply circuits and ground.

Is the resistance greater than 100k Ohms?

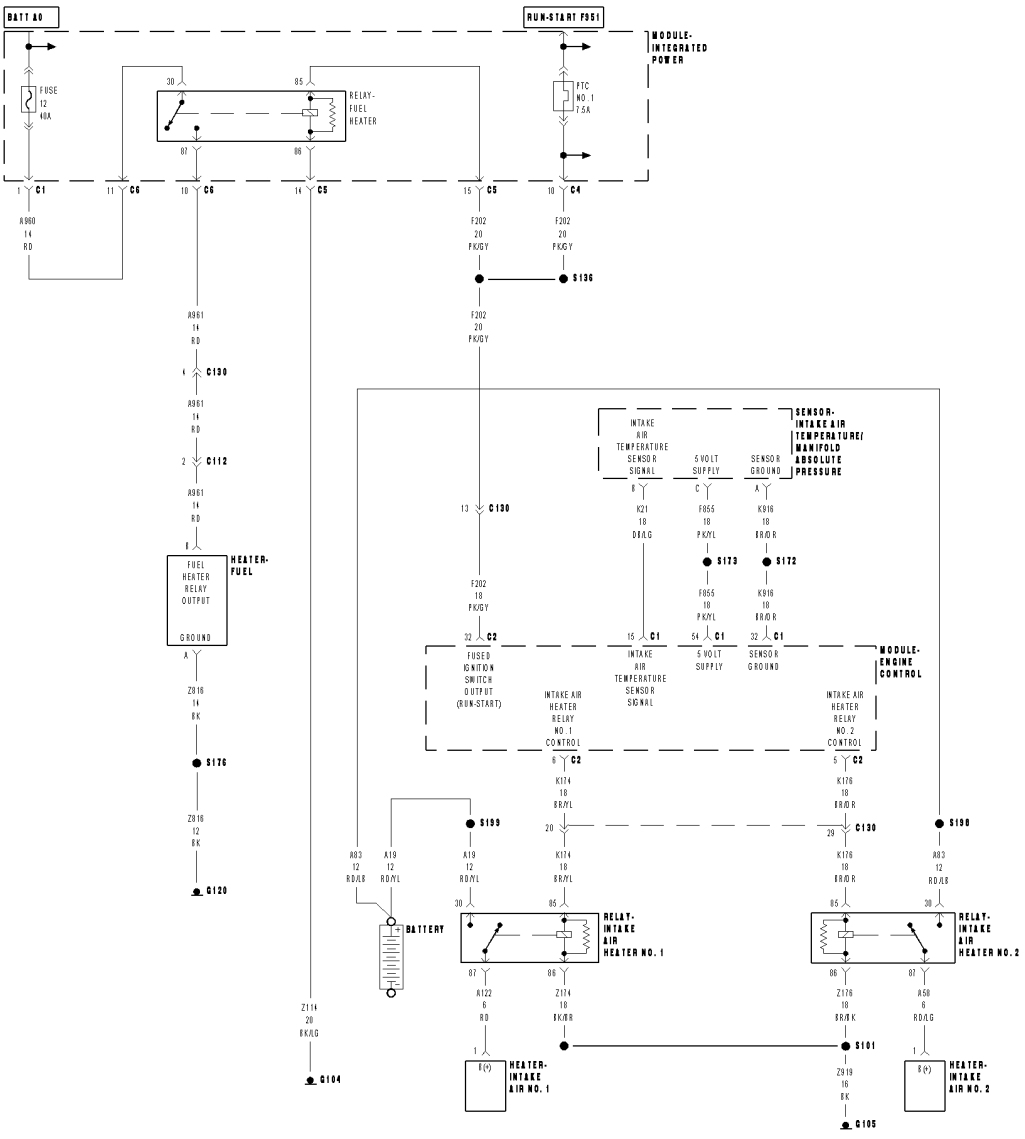
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

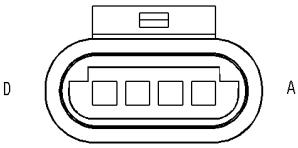
No >> Repair Battery + shorted to ground.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

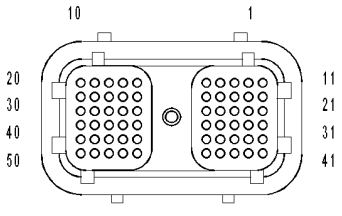


P2607-LOW VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY

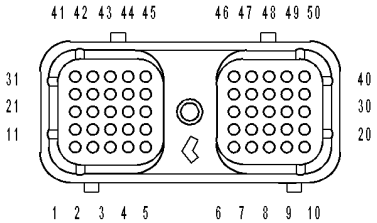




SENSOR-INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81429064

P2607-LOW VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the #2 intake air heater output does not match the signal from the #2 intake air heater feedback.

Possible Causes
LOOSE CONNECTION
INTAKE AIR HEATER RELAY
SIGNAL CIRCUIT OPEN FROM RELAY TO ECM
SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY CLICKING

Ignition on, engine not running.

With the scan tool, actuate the #1 Intake Air Heater.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

While the relay is clicking , wiggle the wiring harness and connectors.

Does this interrupt the clicking?

Yes >> Repair the poor connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P2607-LOW VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY (CONTINUED)

3. INTAKE AIR HEATER RELAY

Turn the ignition off.

Remove the Intake Air Heater #1 Relay.

Check connectors - Clean/repair as necessary.

Measure the resistance between the signal and return posts of the intake air heater relay.

Is the resistance between 15 and 25 Ohms?

Yes >> Go To 4

No >> Replace the Intake Air Heater #1 relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. SIGNAL CIRCUIT OPEN FROM RELAY TO ECM

Disconnect the ECM harness connectors.

Check connectors - Clean/repair as necessary.

Measure the resistance of the intake air heater relay signal circuit between the ECM connector and the intake air heater relay connector.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Repair the open signal circuit from PDC to ECM harness connector.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. RETURN CIRCUIT SHORTED TO BATTERY NEGATIVE

Measure the resistance of the return circuit between the intake air heater relay connector and battery negative.

I s resistance less than 10 ohms?

Yes >> Go To 6

No >> Repair the return circuit shorted to battery negative.

---

6. SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Measure the voltage between the signal circuit of the intake air heater relay and battery negative.

Is the voltage greater than 1 volts?

Yes >> Repair the signal circuit shorted to Battery negative.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 7

P2607-LOW VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY (CONTINUED)

7. ECM

Reconnect the ECM harness connectors.

Disconnect the intake air heater relay signal wire and use a jumper to connect it to battery negative.

Turn the ignition on.

With the scan tool, read DTCs.

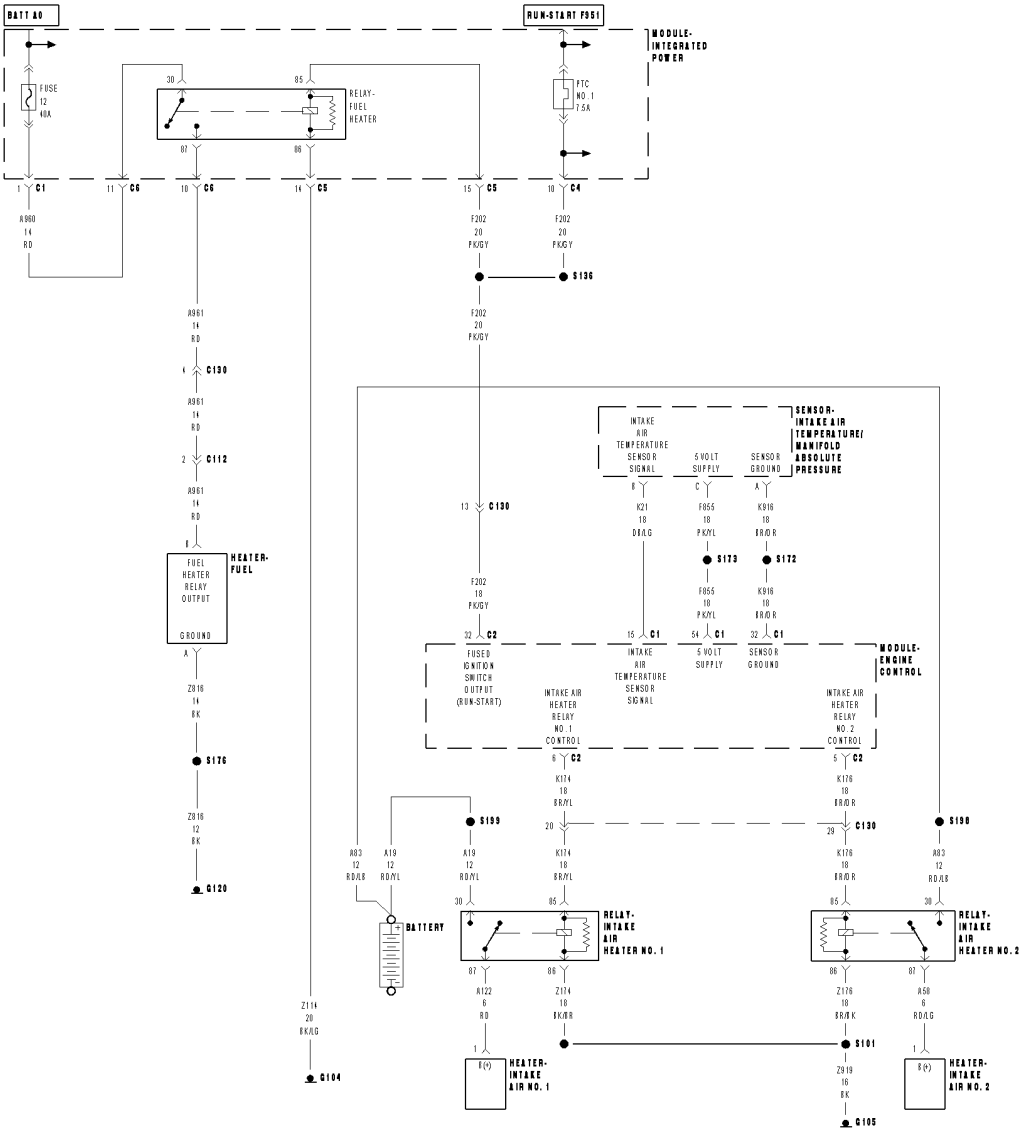
Did DTC P2608?

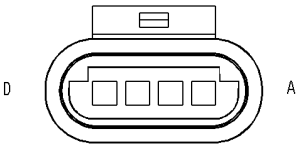
Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

No >> Replace the ECM.

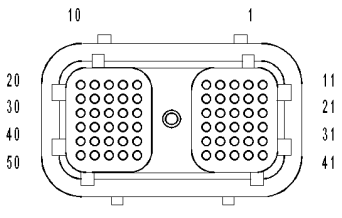
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2608-HIGH VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY

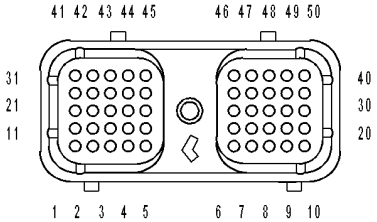




SENSOR-INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81429064

P2608-HIGH VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  When the ignition is on.
- **Set Condition:**
  When the signal from the #2 Intake Air Heater output does not match the signal from the #2 Intake Air Heater feedback.

Possible Causes
LOOSE CONNECTION
INTAKE AIR HEATER RELAY
SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE
ECM
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. RELAY CLICKING

Ignition on, engine not running.

With the scan tool, actuate the Intake Air Heater relay.

Can you hear the Relay clicking?

Yes >> Go To 2

No >> Go To 3

---

2. LOOSE CONNECTION

While the relay is clicking , wiggle the wiring harness and connectors.

Does this interrupt the clicking?

Yes >> Repair the poor connection.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Go To 3

P2608-HIGH VOLTAGE AT THE #2 INTAKE AIR HEATER RELAY (CONTINUED)

3. INTAKE AIR HEATER RELAY

Turn the ignition off.

Remove the Intake Air Heater Relay.

Check connectors - Clean/repair as necessary.

Measure the resistance between the signal and return posts of the intake air heater relay.

Is the resistance between 15 and 25 Ohms?

Yes >> Go To 4

No >> Replace the Intake Air Heater relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. SIGNAL CIRCUIT SHORTED TO BATTERY NEGATIVE

Disconnect the ECM harness connector(s).

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between the signal circuit of the intake air heater relay and battery negative.

Is the resistance greater than 100 K ohms?

Yes >> Go To 5

No >> Repair signal circuit shorted to battery negative.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. HARNESS SHORTED

Measure the resistance between intake air heater relay signal circuit and all other ECM circuits in the ECM connectors.

Is the resistance greater than 100k ohms?

Yes >> Go To 6

No >> Repair the shorted harness.

---

6. ECM

Reconnect the ECM harness connectors.

Turn the ignition on.

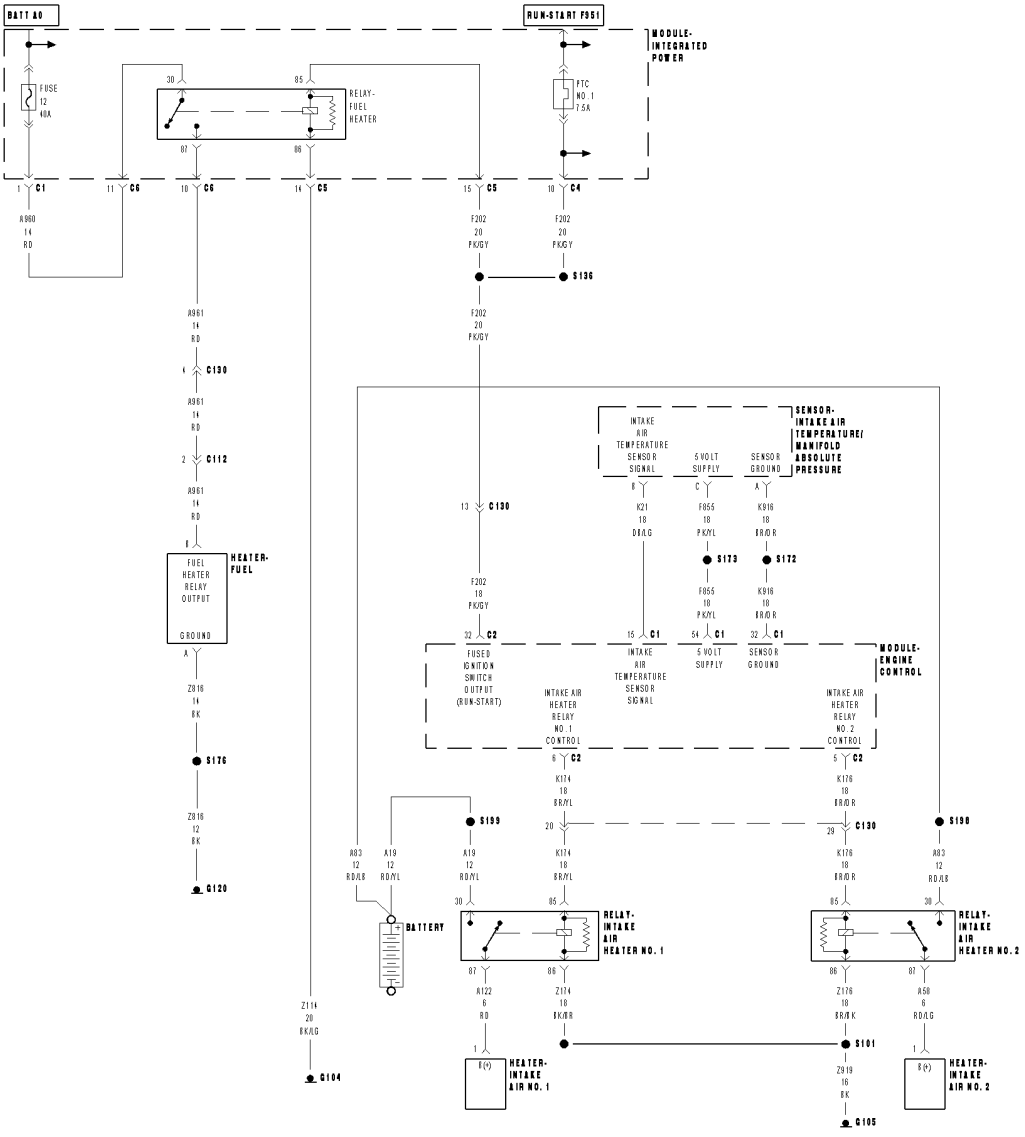
Disconnect the intake air heater relay signal wire.

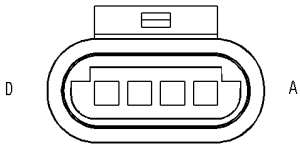
Did DTC P0542 or 2608 set?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure). (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

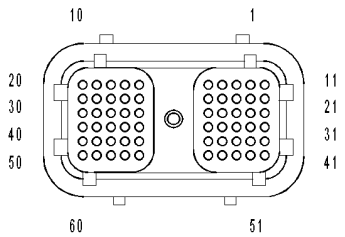
No >> Replace the ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2609-NO VOLTAGE DROP SEEN FROM INTAKE AIR HEATERS

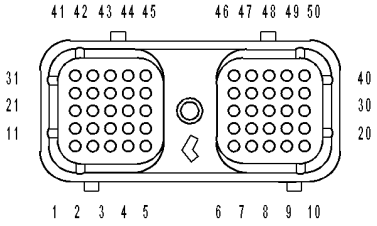




SENSOR-INTAKE AIR TEMPERATURE/ MANIFOLD ABSOLUTE PRESSURE (DIESEL)



MODULE-ENGINE CONTROL C1



MODULE-ENGINE CONTROL C2

81429064

P2609-NO VOLTAGE DROP SEEN FROM INTAKE AIR HEATERS (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  First 15 seconds of engine operation.
- **Set Condition:**
  The ECM does not detect a voltage drop on the intake air heater circuit.

Possible Causes
INTAKE AIR HEATER OPEN
INTAKE AIR HEATER GROUND OPEN
OPEN BATTERY CABLE FROM INTAKE AIR HEATER RELAY
BATTERY CABLE OPEN
#1 INTAKE AIR HEATER RELAY
#2 INTAKE AIR HEATER RELAY
INTERMITTENT CONDITION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. INTAKE AIR HEATER OPEN

Measure the resistance between the intake air heater supply and ground terminal on each intake air heater.

Is the resistance less than 10 Ohms?

Yes >> Go To 2

No >> Replace the open Intake Air Heater.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. INTAKE AIR HEATER GROUND OPEN

Measure the resistance of the intake air heater ground circuit between the intake air heater terminal and the intake manifold cover ground connection.

NOTE: The intake air heater circuit is grounded through a conductive gasket on the top and bottom of the air heater (grey colored gaskets).

Is the resistance less than 10 Ohms?

Yes >> Go To 3

No >> Repair the open Intake Air heater ground or replace both heater gaskets with the proper conductive gaskets..
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

P2609-NO VOLTAGE DROP SEEN FROM INTAKE AIR HEATERS (CONTINUED)

3. OPEN BATTERY CABLE FROM INTAKE AIR HEATER RELAY

Measure the resistance of the battery cable between the intake air heater and the intake air heater relay for both intake air heaters.

Is the resistance less than 10 Ohms?

Yes >> Go To 4

No >> Repair The open or high resistance battery cable from the intake heater relay to heater.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

4. BATTERY CABLE OPEN

Measure the resistance of the battery cable between the battery and the intake air heater relay for both relays.

Is the resistance less than 10 Ohms?

Yes >> Go To 5

No >> Replace the battery cable from the battery to the Intake Air Heater Relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

5. #1 INTAKE AIR HEATER RELAY

Disconnect the #1 intake air heater relay signal wire.

Connect a jumper wire from the signal terminal of the #1 intake air heater relay to battery positive.

Did the relay click when 12 volts was applied?

Yes >> Go To 6

No >> Replace #1 Intake Air Heater Relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

6. #2 INTAKE AIR HEATER RELAY

Disconnect the #2 intake air heater relay signal wire.

Connect a jumper wire from the signal terminal of the #2 intake air heater relay to battery positive.

Did the relay click when 12 volts was applied?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).

No >> Replace #2 Intake Air Heater Relay.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

*ENGINE SPEED SURGES UNDER LOAD OR IN OPERATING RANGE

Possible Causes
POSSIBLE CAUSES

Diagnostic Test

1. POSSIBLE CAUSES

This is a list of possible causes:
Check for any TSBs for ECM calibration updates that my apply.
Fuel level low.
Fuel filter plugged.
Poor quality or improper grade of fuel.
Fuel tank venting.
Low fuel pressure.
Air in fuel system
Fuel Lift Pump malfunctioning.
Fuel Inlet restriction.
Fuel line kinked or restricted.
Fuel return passage or fuel return line kinked or restricted.
Injectors are incorrect.
Injector shim thickness is incorrect.
Injector malfunction.
Fuel connector leaking fuel.
Accelerator pedal is restricted or out of calibration.
Crankshaft position sensor (CKP) or Camshaft position sensor (CMP) and/or circuit malfunction.
Vehicle Speed sensor (VSS) and/or circuit malfunction.
Incorrect Transmission Clutch operation.
Check vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time and engine driven devices.
Check for proper turbocharger, turbo charger wheel clearance is out of specifications, waste gate for correct operation.
Bus communication problems.
Moisture in harness connectors or corroded terminals.
Internal engine damage.
Fuel control actuator
Speed indicator ring
Pressure Limiting valve
Air inlet restriction
External fuel leaks
Injector circuit
High pressure fuel pump

View repair

Repair

Repair as necessary. Refer to Service Information for the related symptom(s).

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*ENGINE SPEED SURGES LOW OR HIGH IDLE

Possible Causes
POSSIBLE CAUSES

Diagnostic Test

1. POSSIBLE CAUSES

This is a list of possible causes:
Check for any TSBs for ECM calibration updates that my apply.
Fuel level low.
Fuel filter plugged.
Poor quality or improper grade of fuel.
Fuel tank venting.
Low fuel pressure.
Air in fuel system
Fuel Lift Pump malfunctioning.
Fuel Inlet restriction.
Fuel line kinked or restricted.
Fuel return passage or fuel return line kinked or restricted.
Injectors are incorrect.
Injector shim thickness is incorrect.
Injector malfunction.
Fuel connector leaking fuel.
High pressure Fuel pump.
Accelerator pedal is restricted or out of calibration.
Vibration damper is damaged.
Crankshaft position sensor (CKP) or Camshaft position sensor (CMP) and/or circuit malfunction.
Vehicle Speed sensor (VSS) and/or circuit malfunction.
Incorrect Transmission Clutch operation.
Check vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time and engine driven devices.
Check for proper turbocharger, turbo charger wheel clearance is out of specifications, waste gate for correct operation.
Bus communication problems.
Moisture in harness connectors or corroded terminals.
Internal engine damage.
Electronic noise.
Idling with excessive load.
Clutch is malfunctioning or incorrect.
Speed indicator ring
Injector circuit

View repair.

Repair

Repair as necessary. Refer to Service Information for the related symptom(s).

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*ENGINE DIFFICULT TO START OR WILL NOT START (NO EXHAUST SMOKE WHILE CRANKING)

Possible Causes
POSSIBLE CAUSES

Diagnostic Test

1. POSSIBLE CAUSES

This is a list of possible causes:
Check for any TSBs for ECM calibration updates that my apply.
Fuel level low.
Poor quality or improper grade of fuel.
Fuel filter plugged.
Fuel tank venting.
Low fuel pressure.
Air in fuel system
Fuel Lift Pump malfunctioning.
Fuel Inlet restriction.
Fuel injection pump supply voltage open or low voltage.
Fuel inlet line kinked or restricted.
Fuel return passage or fuel return line kinked or restricted.
Injectors are incorrect.
Injector shim thickness is incorrect.
Injector malfunction.
Fuel connector leaking fuel.
Crankshaft position sensor (CKP) or Camshaft position sensor (CMP) and/or circuit malfunction.
Moisture in harness connectors or corroded terminals.
Skim issues.
Battery voltage low.
Ignition switch supply voltage low or open.
Battery voltage to ECM is low or open.
Electrical noise.
Fuel injection pump.
Engine Control Module.
Internal engine damage.

View repair.

Repair

Repair as necessary. Refer to Service Information for the related symptom(s).

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*ENGINE DIFFICULT TO START OR WILL NOT START (EXHAUST SMOKE)

Possible Causes
POSSIBLE CAUSES

Diagnostic Test

1. POSSIBLE CAUSES

This is a list of possible causes:
Check for any TSBs for ECM calibration updates that my apply.
Fuel level low.
Battery voltage low.
Fuel filter plugged.
Poor quality or improper grade of fuel.
Fuel tank venting.
Low fuel pressure.
Air in fuel system
Fuel Lift Pump malfunctioning.
Fuel Inlet restriction.
Fuel line kinked or restricted.
Fuel return passage or fuel return line kinked or restricted.
Injectors are incorrect.
Injector shim thickness is incorrect.
Injector malfunction.
Fuel connector leaking fuel.
Crankshaft position sensor (CKP) or Camshaft position sensor (CMP) and/or circuit malfunction.
Moisture in harness connectors or corroded terminals.
Internal engine damage.
Air intake restriction.
Exhaust restriction.
Fuel inlet temperature high.
Overhead adjustments.
Ignition switch output voltage low and/or open.
Starting accessories for cold weather such as engine block heaters, fuel heaters if equipped.
Engine cranking speed is low.
Electrical noise.
Fuel control actuator circuit
Speed indicator ring
Pressure limiting valve
Injector circuit
Air inlet restriction
External fuel leaks

View repair

Repair

Repair as necessary. Refer to Service Information for the related symptom(s).

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*ENGINE SPEED SURGES IN PTO OR CRUISE CONTROL

Possible Causes
POSSIBLE CAUSES

Diagnostic Test

1. POSSIBLE CAUSES

This is a list of possible causes:

Check for any TSBs for ECM calibration updates that my apply.

Fuel filter plugged.

Fuel Inlet restriction.

Fuel line kinked or restricted.

Fuel return passage or fuel return line kinked or restricted.

Accelerator pedal is restricted or out of calibration.

Vehicle Speed sensor (VSS) and/or circuit malfunction.

Transmission gear shift.

Check vehicle brakes for dragging, transmission malfunction, cooling fan operation cycle time and engine driven devices.

Moisture in harness connectors or corroded terminals.

ECM control, PTO speed governor.

Engine overload.

Air Inlet restriction

View repair

Repair

Repair as necessary. Refer to Service Information for the related symptom(s).

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*CHECKING THE ACCELERATOR PEDAL SENSOR CALIBRATION

Possible Causes
MIS-WIRED APPS
VOLTAGE NOT CHANGING DURING SWEEP
THROTTLE PEDAL NOT MOVING FREELY
APPS

Diagnostic Test

1. MIS-WIRED APPS

Turn the ignition off.

Remove the APPS cover.

Inspect both APPS connector and ECM for proper wiring.

Are both connectors wired correctly?

Yes >> Go To 2

No >> Repair mis-wired APPS connector at APPS or ECM.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. THROTTLE PEDAL NOT MOVING FREELY

Ignition on, engine not running.

Look for proper Throttle operation.

Does the Throttle Pedal move freely between the upper and lower stops?

Yes >> Replace the APPS.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

*CHECKING THE ECM POWER AND GROUNDS

Possible Causes
ECM GROUND CIRCUIT(S) OPEN
FUSED B+ CIRCUIT OPEN
FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. ECM GROUND CIRCUIT(S) OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Using a 12-volt test light connected to 12-volts, check each of the ECM ground circuits in ECM harness connector.

Did the test light illuminate for each cavity?

Yes >> Go To 2

No >> Repair the ECM Ground circuit(s) for an open.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

2. FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Turn the ignition on.

Using a 12-volt test light connected to ground, check the Fused Ignition Switch Output circuit in ECM harness connector.

Is the test light on?

Yes >> Go To 3

No >> Repair the Fused Ignition Switch Output circuit for an open.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

3. FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Disconnect the ECM harness connectors.

Using a 12-volt test light connected to ground, check each Fused B+ circuit in the ECM harness connector.

Does the test light illuminate brightly for each circuit?

Yes >> Test Complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

No >> Repair the Fused B+ Output circuit for an open.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

---

*CHECKING PRESSURE LIMITING VALVE ON THE FUEL RAIL FOR INTERNAL LEAKS

Possible Causes
PRESSURE LIMITING VALVE DIAGNOSTICS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. PRESSURE LIMITING VALVE

Using the scan tool, measure the rail pressure and determine if the rail pressure is excessive (above 185,000 kpa/ 26,831 psi), if it is, troubleshoot for excessive rail pressure first.

Remove the banjo bolt from the pressure-limiting valve on the fuel rail.

Install fuel system test fitting (9013) into the pressure-limiting valve.

Attach one end of a fuel hose to the fuel fitting and put the other end of the fuel hose into a container.

Perform the tests listed below to determine if the pressure-limiting valve is leaking.

a. Operate the engine at idle and watch for fuel flow into the fuel container.

b. Operate the engine at idle and actuate the high pressure safety valve test with the scan tool. Watch for fuel flow into the fuel container.

If fuel flows into the fuel container, replace the pressure-limiting valve. If fuel does not leak from the pressure-limiting valve, the test is complete.

NOTE: do not drive the vehicle with any portion of this test kit installed.

view repair

Yes >> Repair complete

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*FUEL HEATER THERMOSTAT TEST

Possible Causes
FUEL HEATER THERMOSTAT TEST

Diagnostic Test

1. FUEL HEATER THERMOSTAT TEST

To check the operating resistance levels on the thermostat and fuel heater perform the following:

1. Unplug the wiring harness from the thermostat.
2. Check the resistance across the two pins of the thermostat with an Ohm meter.
3. The ambient temperature must be below the ″Circuit close temperature; 1° +/- 3° C″ to perform this check.
4. If necessary, induce this ambient temperature by placing ice packs on the thermostat to produce an ″effective ambient temperature″ below the circuit close temperature.
5. The resistance across the two pins should be within the range of 0.3 Ohms to 0.45 Ohms for a properly operating thermostat and heater.
6. If the resistance from step 2 is out of range, remove the thermostat and check the resistance across the terminal connections of the heater (the heater can be checked at room temperatures).
7. The resistance across the terminal pins of the heater should be within the same range of step 2.
8. Replace the heater if resistance is not within the proper operation range.
9. Replace the heater if resistance is not within the proper operation range. Re-install the thermostat with a new o-ring.
10. If the heater resistance is within the proper operating.
11. Circuit close temperature; 1° +/- 3° C
12. Circuit open temperature; 18° +/- 4° C
13. Fuel Heater Thermostat 0.3 - 0.45 Ohms at less than 1 degree C
14. Fuel Heater 0.3 - 0.45 Ohms at room temperature

View Repair

Repair

Test complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*FUEL PUMP RETURN FLOW TEST

Possible Causes
EXCESSIVE FUEL PUMP RETURN FLOW

Diagnostic Test

1. FUEL PUMP RETURN FLOW TEST

Using the scan tool, idle the engine and measure the rail pressure and determine if the rail pressure is excessive (above 185,00 kpa/26,831 psi), if it is, troubleshoot for excessive rail pressure first.

Remove the banjo bolt from the pressure-limiting valve on the fuel rail.

Install fuel system test fitting #9013 into the pressure-limiting valve.

Attach one end of a fuel hose to the fuel fitting and put the other end of the fuel hose into a container

Perform the tests listed below to determine if the pressure-limiting valve is leaking.

a. Operate the engine at idle and watch for fuel flow into the fuel container.

b. Operate the engine at idle and actuate the high pressure safety valve test with the scan tool. Watch for fuel flow into the fuel container.

If fuel flows into the fuel container, replace the pressure-limiting valve. If fuel does not leak from the pressure-limiting valve, the test is complete.

NOTE: do not drive the vehicle with any portion of this test kit installed

Operate the engine until the engine is at operating temperature.

Remove the banjo connector from the fuel drain tube at the rear of the fuel filter housing

Install fuel system test fitting #9012 in place of the banjo connector.

Install a piece of fuel line onto the test fitting and put the open end into the graduated cylinder.

Start the engine and let it idle for one minute.

Measure the amount of fuel in the graduated cylinder.

If the flow is less than 1000-ml/minute at idle, the test has successfully passed.

If the flow is greater than 1000 ml/minute at idle, replace the fuel injection pump.

Retest to confirm repair.

View Repair

Repair

Test Complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*HIGH PRESSURE FUEL PUMP PERFORMANCE TEST

Possible Causes
*HIGH PRESSURE FUEL PUMP PERFORMANCE TEST

Diagnostic Test

1. *HIGH PRESSURE FUEL PUMP PERFORMANCE TEST

Monitor rail pressure with scan tool while cranking the engine

Compare the fuel pressure set point with the actual fuel pressure reading.

If the engine is not generating fuel pressure, use the scan tool to check for fuel pressure sensor fault codes.

If no fuel pressure sensor faults are present, verify that the engine has adequate fuel delivery using the fuel lift pump flow test.

Monitor rail pressure with scan tool while cranking the engine.

If the engine is not generating fuel pressure, check the torque on the fuel pump drive gear. Torque - 105 Nm.

Retest to confirm fix.

Test complete

Repair

Test complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*INJECTOR RETURN FLOW TEST

Possible Causes
*INJECTOR RETURN FLOW TEST

Diagnostic Test

1. * INJECTOR RETURN FLOW TEST

1. Operate the engine until the engine is at operating temperature.
2. Remove the banjo connector from the fuel drain tube at the rear of the fuel filter housing.
3. Install fuel system test fitting (9012) in place of the banjo connector.
4. Remove the vehicle fuel return line from the engine fuel drain tube.
5. Install a piece of fuel line onto the test fitting and into a fuel container or into the fuel tank.
6. Install one end of a test hose onto the fuel drain tube. Place the other end of the test hose into a graduated cylinder.
7. Start the engine and let it idle for one minute.
8. Measure the amount of fuel in the graduated cylinder.
9. If the flow is less than 180-ml/minute, the test has successfully passed.
10. If the flow is greater than 180 ml/minute, shut off the engine and remove all of the fuel injector supply lines. Re torque all of the high-pressure connector nuts. Install all of the fuel injector supply lines.
11. Start the engine and idle for one minute. Measure the amount of fuel in the graduated cylinder.
12. If the flow is less than 180ml/minute, the condition has been fixed.
13. If the flow is greater than 180 ml/minute after step 12, shut off the engine and remove the #1 fuel injector supply line. Re torque the high-pressure connector nut. Cap the #1 fuel port using tool #9011 on the fuel rail and the #1 high pressure connector.
14. Start the engine. Measure the amount of fuel in the graduated cylinder.
15. If the amount of fuel is less than 180 ml/minute, shut off the engine and remove the #1 high pressure connector and the #1 fuel injector. Inspect for damage, repair/replace as necessary.
16. If the amount of fuel is not less than 180-ml/minute, repeat steps 14-16 for cylinders 2-6.
17. Install all high-pressure connectors, fuel injectors, and fuel injector supply lines. Repeat steps 1-8 to confirm repair.

SPECIFICATION:Less than 180 ml/minute total fuel return flow

Repair

Test Complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

*INTAKE AIR SYSTEM PRESSURE TEST

Possible Causes
CHARGE AIR COOLER PRESSURE TEST

Diagnostic Test

1. CHARGE AIR COOLER PRESSURE TEST

Loosen air inlet tube clamp at the turbocharger.

Remove the air filter housing and the inlet tube from the vehicle as an assembly.

Install the CAC Pressure Tester #9022 into the inner diameter of the turbocharger, securing it in place with the supplied three-fingered band clamp, tighten tool clamp to 8n.m (72 in lbs).

NOTE: NEVER ATTEMPT TO START OR RUN THE VEHICLE AT ANY TIME DURING THIS TEST, ENGINE DAMAGE MAY OCCUR.

Fasten the safety chain around a solid surface behind the turbocharger. Warning: Never run CAC Pressure test without the safety chain securely fastened.

Before attaching shop air to the pressure regulator verify that the regulator is at its lowest pressure setting (0 psi).

Attach an air supply to the regulator and slowly increase the pressure until the pressure gauge reads 20 psi.

WARNING: WARNING: Never apply more than 20 PSI.

Using a solution of soap and water spray the Turbocharger, Turbocharger wastegate, Charge Air Cooler Heat Exchange and CAC Hoses while watching for leaks.

Before any attempt to repair the CAC system is made, its necessary to completely discharge the system. This can be accomplished by turning the regulator knob counter-clockwise.

Allow for adequate time to pass before removing the CAC Pressure tester from the turbo charger inlet.

Position the Air Filter Housing over the three mounting studs located on the inside front fender well and press down firmly to lock housing into place.

Install Air Inlet Tube over the Turbocharger inlet and torque the band clamp to 35 in.lbs.

View Repair

Repair

Test complete.

Perform POWERTRAIN VERIFICATION TEST VER - 1 (DIESEL). (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - DIAGNOSIS AND TESTING)

ENGINE - ELECTRICAL DIAGNOSTICS - SRT-10

TABLE OF CONTENTS

page

ENGINE - ELECTRICAL DIAGNOSTICS - SRT-10
DIAGNOSIS AND TESTING
PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE 1488
INTERMITTENT CONDITION 1490
P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW 1491
P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH 1496
P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW 1501
P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH 1506
P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE 1511
P0107-MAP SENSOR VOLTAGE TOO LOW 1516
P0108–MAP SENSOR VOLTAGE TOO HIGH 1521
P0111-INTAKE AIR TEMP PERFORMANCE 1526
P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW 1530
P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH 1534
P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW 1539
P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH 1543
P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP 1548
P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW 1557
P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH 1562
P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL 1567
P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO LOW 1570
P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH 1573
P0133-O2 SENSOR 1/1 SLOW RESPONSE 1579
P0135-O2 SENSOR 1/1 HEATER PERFORMANCE 1582
P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION 1586
P0137-O2 SENSOR 1/2 CIRCUIT LOW . . . 1590
P0138-O2 SENSOR 1/2 CIRCUIT HIGH . . . 1594
P0139-O2 SENSOR 1/2 SLOW RESPONSE 1599
P0141-O2 SENSOR 1/2 HEATER PERFORMANCE 1602
P0151-O2 SENSOR 2/1 CIRCUIT LOW . . . 1606
P0152-O2 SENSOR 2/1 CIRCUIT HIGH . . . 1609
P0153-O2 SENSOR 2/1 SLOW RESPONSE 1615
P0155-O2 SENSOR 2/1 HEATER PERFORMANCE 1618
P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO LOW 1622
P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH 1626
P0159-O2 SENSOR 2/2 SLOW RESPONSE 1631
P0161-O2 SENSOR 2/2 HEATER PERFORMANCE 1634
P0171-FUEL SYSTEM 1/1 LEAN 1638
P0172-FUEL SYSTEM 1/1 RICH 1645
P0174-FUEL SYSTEM 2/1 LEAN 1653
P0175-FUEL SYSTEM 2/1 RICH 1660
P0197-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO LOW 1667
P0198-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO HIGH 1670
P0201-FUEL INJECTOR 1 CIRCUIT 1674
P0202-FUEL INJECTOR 2 CIRCUIT 1678
P0203-FUEL INJECTOR 3 CIRCUIT 1682
P0204-FUEL INJECTOR 4 CIRCUIT 1686
P0205-FUEL INJECTOR 5 CIRCUIT 1690
P0206-FUEL INJECTOR 6 CIRCUIT 1694
P0207-FUEL INJECTOR 7 CIRCUIT 1698
P0208-FUEL INJECTOR 8 CIRCUIT 1702
P0209-FUEL INJECTOR 9 CIRCUIT 1706
P0210-FUEL INJECTOR 10 CIRCUIT 1710
P0300-MULTIPLE CYLINDER MISFIRE . . . 1714
P0301-CYLINDER #1 MISFIRE 1721
P0302-CYLINDER #2 MISFIRE 1731
P0303-CYLINDER #3 MISFIRE 1740
P0304-CYLINDER #4 MISFIRE 1750
P0305-CYLINDER #5 MISFIRE 1760
P0306-CYLINDER #6 MISFIRE 1769
P0307-CYLINDER #7 MISFIRE 1779
P0308-CYLINDER #8 MISFIRE 1789
P0309-CYLINDER #9 MISFIRE 1799
P0310-CYLINDER #10 MISFIRE 1809
P0320–NO CANK REFERENCE SIGNAL AT PCM 1818
P0325-KNOCK SENSOR 1 CIRCUIT 1827
P0330-KNOCK SENSOR 2 CIRCUIT 1832
P0340-CAMSHAFT POSITION SENSOR CIRCUIT 1837

P0351-IGNITION COIL #1 PRIMARY CIRCUIT 1845
P0352-IGNITION COIL #2 PRIMARY CIRCUIT 1849
P0353-IGNITION COIL #3 PRIMARY CIRCUIT 1853
P0354-IGNITION COIL #4 PRIMARY CIRCUIT 1857
P0355-IGNITION COIL #5 PRIMARY CIRCUIT 1861
P0420-1/1 CATALYTIC CONVERTER EFFICIENCY 1865
P0432-2/1 CATALYTIC CONVERTER EFFICIENCY 1868
P0441-EVAP PURGE FLOW MONITOR . . . 1871
P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED 1875
P0443-EVAP PURGE SOLENOID CIRCUIT . 1879
P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED 1883
P0460-FUEL LEVEL SENDING UNIT NO CHANGE OVER MILES 1887
P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW 1888
P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH 1891
P0500-NO VEHICLE SPEED SIGNAL 1896
P0505-IDLE AIR CONTROL MOTOR CIRCUITS 1899
P0522-OIL PRESSURE CIRCUIT LOW 1904
P0523-OIL PRESSURE CIRCUIT HIGH . . . 1908
P0601-PCM INTERNAL CONTROLLER FAILURE 1911
P0622-GENERATOR FIELD NOT SWITCHING PROPERLY 1912
P0645-A/C CLUTCH RELAY CIRCUIT 1916
P0801-REVERSE GEAR LOCKOUT CIRCUIT OPEN OR SHORTED 1920
P1195-O2 SENSOR 1/1 SLOW DURING CATALYST MONITOR 1924
P1196-O2 SENSOR 2/1 SLOW DURING CATALYST MONITOR 1927
P1281-ENGINE IS COLD TOO LONG 1930
P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT 1931
P1294-TARGET IDLE NOT REACHED 1934
P1296-NO 5-VOLTS TO MAP SENSOR . . . 1938
P1297-NO CHANGE IN MAP FROM START TO RUN 1943
P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT 1949
P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM 1952
P1391-INTERMITTENT LOSS OF CMP OR CKP 1956
P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT 1960
P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND 1963
P1492-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH 1966
P1493-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW 1970
P1494-LEAK DETECTION PUMP SWITCH OR MECHANICAL FAULT 1973
P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT 1977
P1499-HYDRAULIC FAN SOLENOID CIRCUIT 1982
P1594-CHARGING SYSTEM VOLTAGE TOO HIGH 1986
P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH 1989
P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW 1994
P1682-CHARGING SYSTEM VOLTAGE TOO LOW 1999
P1687-NO CLUSTER BUS MESSAGE 2004
P1695-BUS MESSAGE FROM BODY CONTROL MODULE 2007
P1696-PCM FAILURE EEPROM WRITE DENIED 2010
*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON THE SCAN TOOL 2012
*CANNOT SHIFT INTO REVERSE 2016
*CHECKING A/C SYSTEM OPERATION WITH NO DTCS 2018
*CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS 2023
*CHECKING RADIATOR FAN OPERATION 2028
*CHECKING THE PCM POWER AND GROUNDS 2030
STANDARD PROCEDURE
POWERTRAIN VERIFICATION TEST 2033

ENGINE - ELECTRICAL DIAGNOSTICS - SRT-10

DIAGNOSIS AND TESTING

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. NO RESPONSE

Make sure the scan tool will communicate with the appropriate modules.

Are you currently experiencing a NO RESPONSE condition?

Yes >> The NO RESPONSE condition must be properly diagnosed before continuing.
Refer to the appropriate BUS Communication test in Section 8 ELECTRONIC CONTROL MODULES - ELECTRICAL DIAGNOSTICS.

No >> Go To 2

---

2. NO START

Is the customer complaint a NO START condition?

Yes >> Check the vehicle for any NO START related PCM DTC(s) or Vehicle Theft Security related DTC(s).
If no Theft related DTC(s) are present, refer to the Non DTC Diagnostic Procedures that relate to Fuel and Starting.

No >> Go To 3

---

3. VEHICLE HISTORY AND TSB(s)

Continue by reading PCM DTC(s) and record the related Freeze Frame data if any DTC(s) are present.

Whether or not any DTC(s) are present you will want to check the following items which may assist in repairing the customers complaint successfully.

Check the vehicles repair history.

If the vehicle has a repair history that pertains to the customer's current complaint, review the repair.

Inpect the vehicle for any aftermarket accessories that may have been installed incorrectly.

Check for any TSB(s) related to the customer's complaint or DTC(s).

If a TSB applies, follow the instructions per the TSB.

Choose the following scenario that best applies.

The TSB repaired the customers complaint.
Testing complete.

A DTC is present, no TSB applies, or the TSB didn't repair the customers complaint.
Go To 4

No DTC(s) are present.
Refer to the INTERMITTENT CONDITION Diagnostic Procedure.

PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE (CONTINUED)

4. WIRE HARNESS INSPECTION

Clear the DTC(s).

Attempt to duplicate the customer complaint.

Whether the customer complaint can be duplicated or not, make a quick wire harness inspection related to the DTC(s) that were previously cleared.

Check the Powertrain Control Module connectors, the suspected component connection, in-line connectors, wire harness splices, PCM power and ground circuits, and any related fuses.

If the DTC(s) are fuel or air related, check the fuel level and quality.

Were any repairs made that fixed the customer's complaint?

Yes >> Testing complete.

No >> Refer to the diagnostic test procedure related to the DTC.

INTERMITTENT CONDITION

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

POSSIBLE CAUSES
INTERMITTENT CONDITION

Diagnostic Test

1. INTERMITTENT CONDITION

NOTE: The conditions that set the DTC are not present at this time. The following list may help in identifying the intermittent condition.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Refer to any Technical Service Bulletins (TSBs) that may apply.

Review the scan tool Freeze Frame information. If possible, try to duplicate the conditions under which the DTC set.

With the engine running at normal operating temperature, monitor the scan tool parameters related to the DTC while wiggling the wire harness. Look for parameter values to change and/or a DTC to set.

Turn the ignition off.

Visually inspect the related wire harness. Disconnect all the related harness connectors. Look for any chafed, pierced, pinched, partially broken wires and broken, bent, pushed out, or corroded terminals.

Perform a voltage drop test on the related circuits between the suspected faulty component and the PCM.

Inspect and clean all PCM, engine, and chassis grounds that are related to the most current DTC.

If numerous trouble codes were set, use a wire schematic and look for any common ground or supply circuits.

For any Relay DTCs, actuate the Relay with the scan tool and wiggle the related wire harness to try to interrupt the actuation.

For intermittent Evaporative Emission trouble codes perform a visual and physical inspection of the related parts including hoses and the Fuel Filler cap.

For intermittent Misfire DTC's check for restrictions in the Intake and Exhaust system, proper installation of Sensors, vacuum leaks, and binding components that are run by the accessory drive belt.

Use the scan tool to perform a System Test if one applies to failing component.

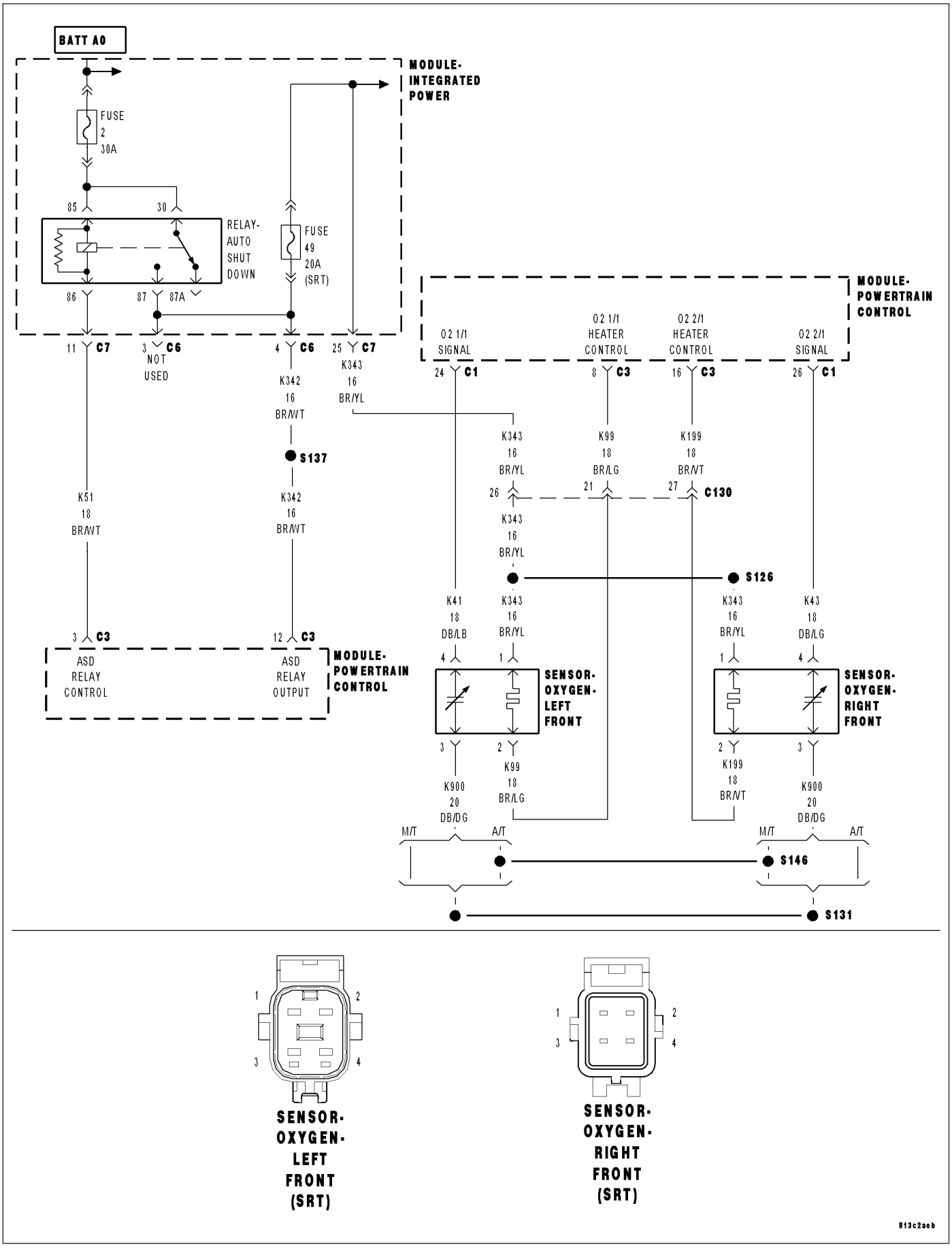
A co-pilot, data recorder, and/or lab scope should be used to help diagnose intermittent conditions.

Were any problems found during the above inspections?

Yes >> Perform the necessary repairs.
Perform POWERTRAIN VERIFICATION TEST VER - 1.

No >> Test Complete.

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state.

Possible Causes
O2 HEATER TEST
O2 SENSOR HEATER ELEMENT
(K343) FUSED ASD RELAY OUTPUT CIRCUIT
(K99) HEATER CONTROL CIRCUIT OPEN
(K99) HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. O2 HEATER TEST

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the O2 Heater test.
Monitor the O2 Heater Voltage for 5 minutes.

Did the voltage drop down close to zero during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

NOTE: Stop the actuation before continuing.

P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

2. O2 HEATER ELEMENT

Turn the ignition off.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater element at the O2 Sensor connector (component side).

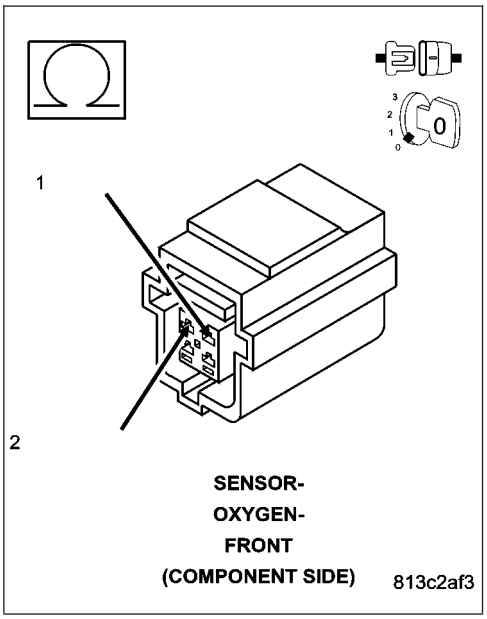
On a four O2 Sensor system the resistance value for 1/1 and 2/1 O2 Heater elements is between 3.3 and 4.1 ohms and the 1/2 and 2/2 O2 Heater elements is between 4.0 and 5.0 ohms at 70° F(21.1°C).

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance within the listed specifications?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K343) FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

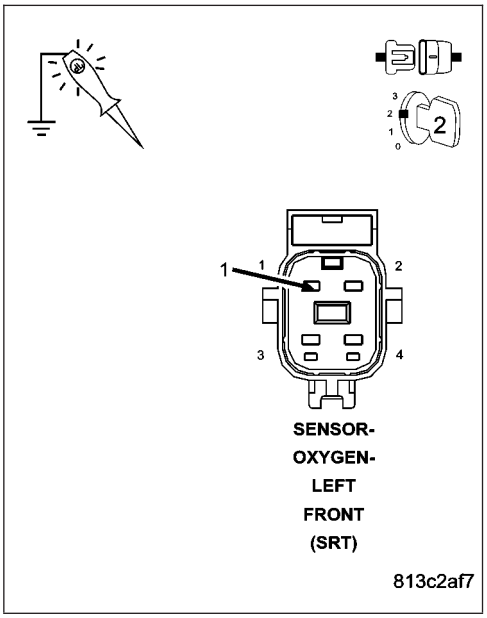
Using a 12-volt test light connected to ground, probe the (K343) Fused ASD Relay Output circuit at the O2 Sensor harness connector.

Did the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (K343) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop the actuation before continuing.



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

4. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

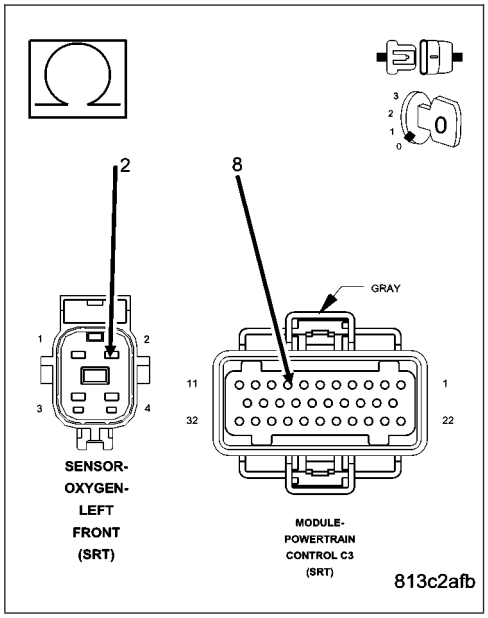
Measure the resistance of the (K99) O2 Heater Control circuit (PWM) from the O2 Sensor to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K99) O2 Heater Control (PWM) circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



5. (K99) HEATER CONTROL CIRCUIT SHORTED TO GROUND

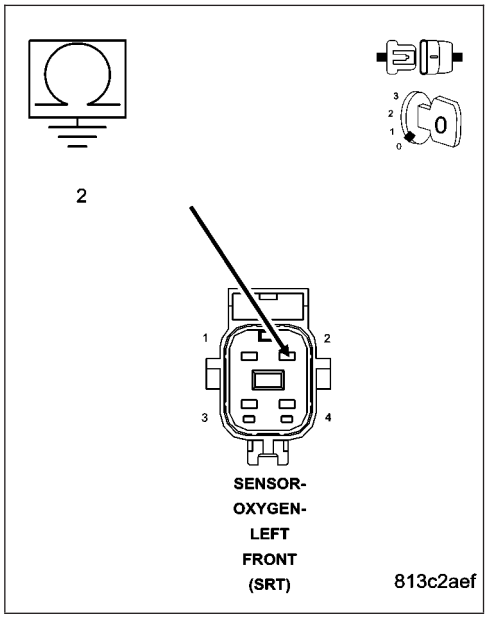
Measure the resistance between ground and the (K99) O2 Heater Control (PWM) circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the Heater Control (PWM) circuit or the Heater Relay Control circuit depending on the O2 Sensor being tested.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0031-O2 SENSOR 1/1 HEATER CIRCUIT LOW (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

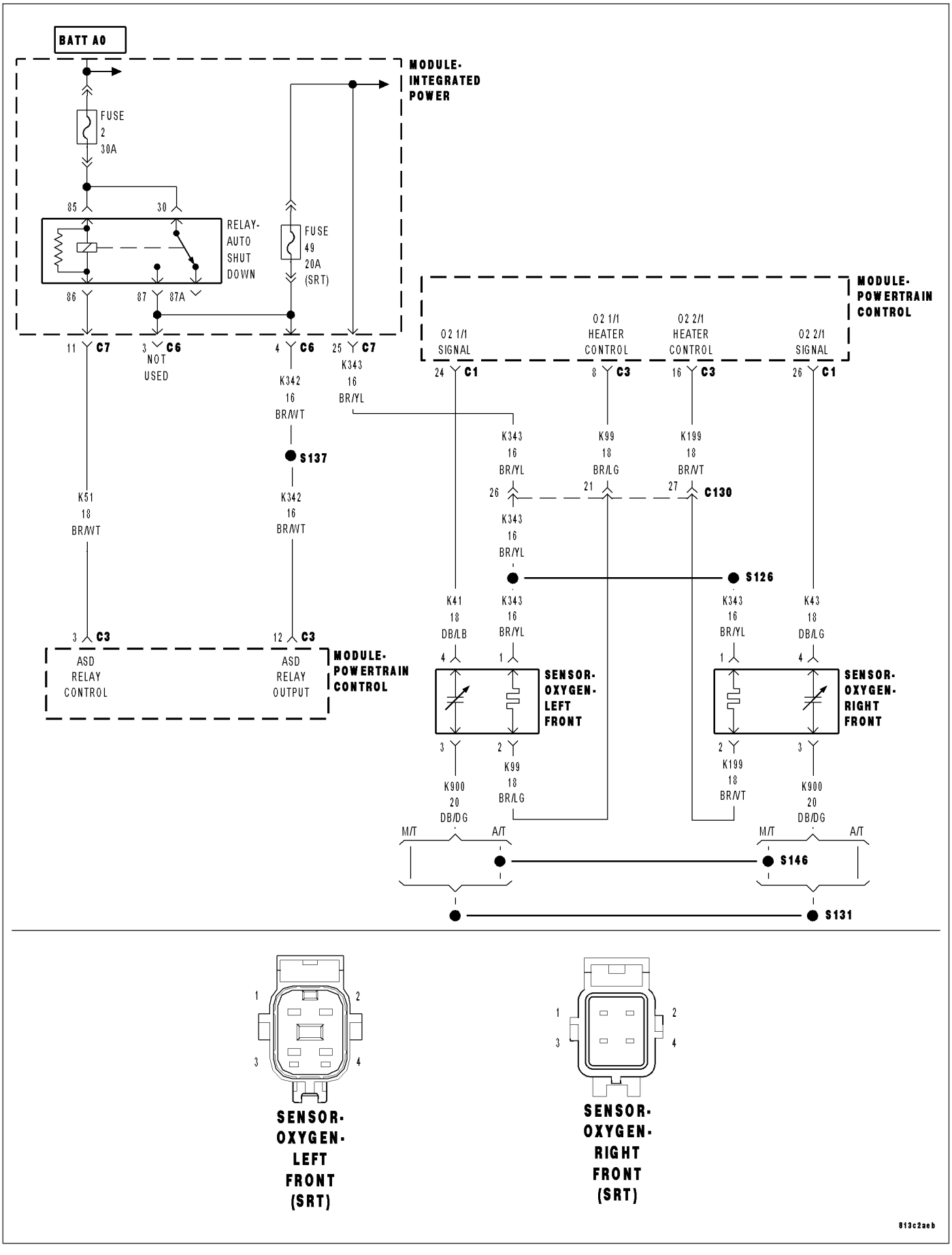
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state.

Possible Causes
O2 HEATER TEST
O2 SENSOR HEATER ELEMENT
(K343) FUSED ASD RELAY OUTPUT CIRCUIT
HEATER CONTROL CIRCUIT OPEN
HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. O2 HEATER TEST

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the O2 Heater test.
Monitor the O2 Heater Voltage for 5 minutes.

Did the voltage drop down close to zero during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

NOTE: Stop the actuation before continuing.

P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

2. O2 HEATER ELEMENT

Turn the ignition off.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater element at the O2 Sensor connector (component side).

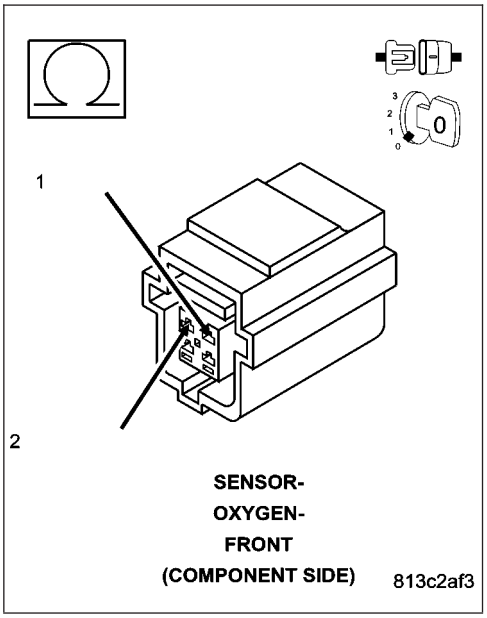
On a four O2 Sensor system the resistance value for 1/1 and 2/1 O2 Heater elements is between 3.3 and 4.1 ohms and the 1/2 and 2/2 O2 Heater elements is between 4.0 and 5.0 ohms at 70° F(21.1°C).

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance within the listed specifications?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K342) FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

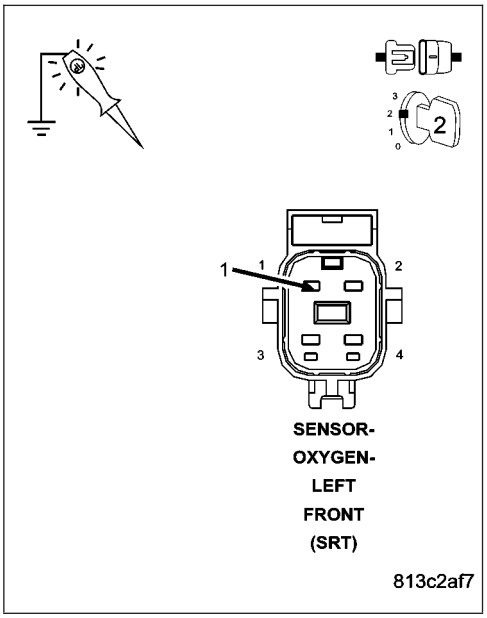
Using a 12-volt test light connected to ground, probe the (K342) Fused ASD Relay Output circuit at the O2 Sensor harness connector.

Did the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (K342) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop the actuation before continuing.



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

4. HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

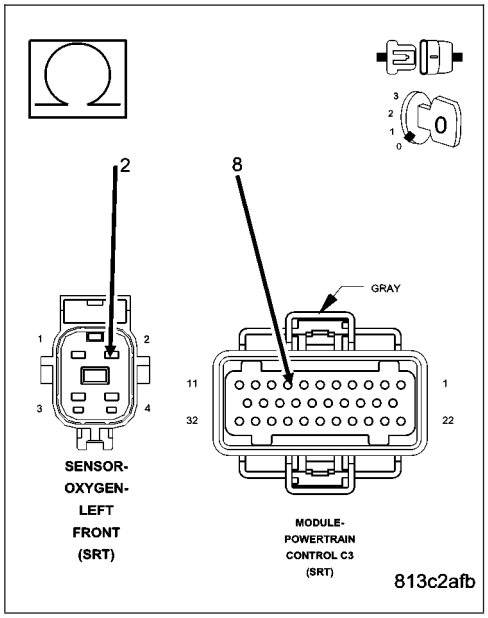
Disconnect the PCM harness connectors.

Measure the resistance of the O2 Heater Control circuit (PWM) from the O2 Sensor to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the O2 Heater Control (PWM) circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



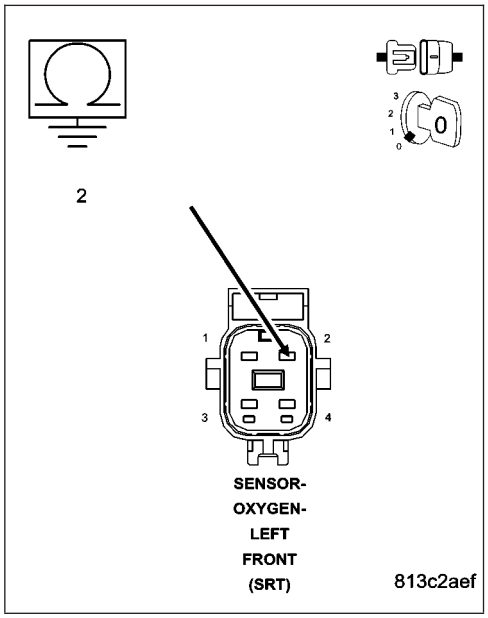
5. HEATER CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the O2 Heater Control (PWM) circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the Heater Control (PWM) circuit or the Heater Relay Control circuit depending on the O2 Sensor being tested.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0032-O2 SENSOR 1/1 HEATER CIRCUIT HIGH (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

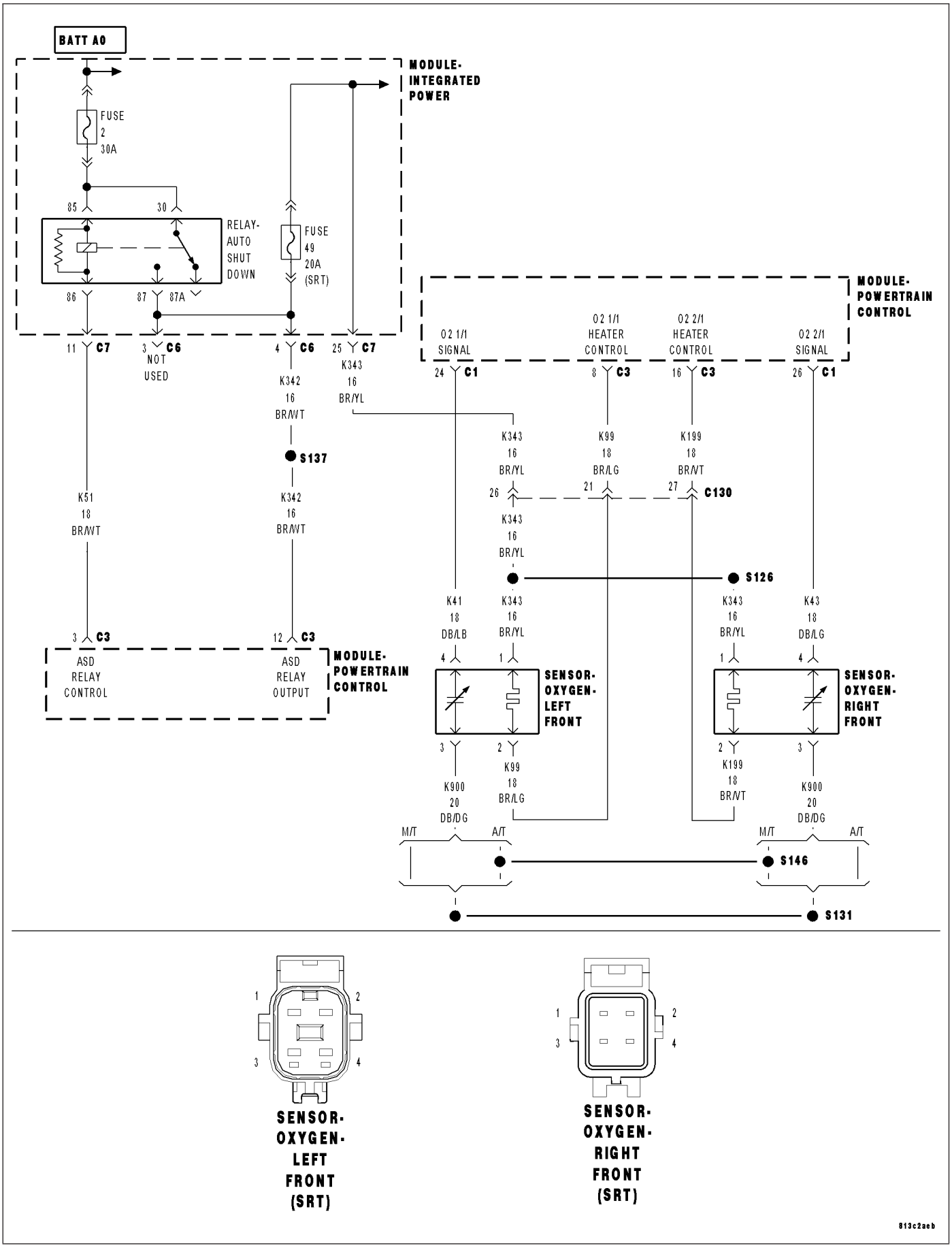
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state.

Possible Causes
O2 HEATER TEST
O2 SENSOR HEATER ELEMENT
(K343) FUSED ASD RELAY OUTPUT CIRCUIT
(K199) HEATER CONTROL CIRCUIT OPEN
(K199) HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. O2 HEATER TEST

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the O2 Heater test.
Monitor the O2 Heater Voltage for 5 minutes.

Did the voltage drop down close to zero during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

NOTE: Stop the actuation before continuing.

P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

2. O2 HEATER ELEMENT

Turn the ignition off.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater element at the O2 Sensor connector (component side).

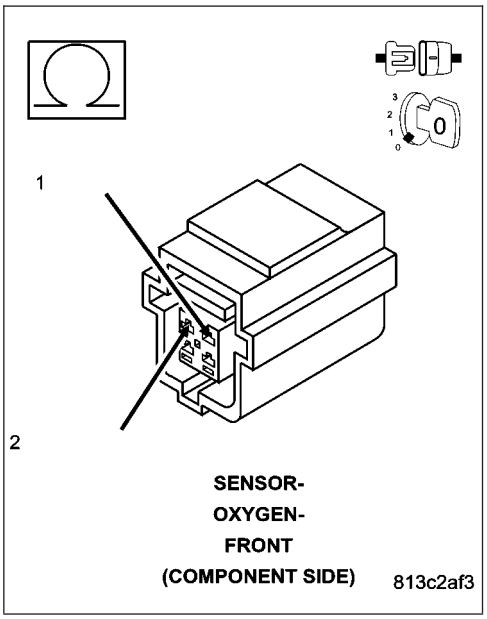
On a four O2 Sensor system the resistance value for 1/1 and 2/1 O2 Heater elements is between 3.3 and 4.1 ohms and the 1/2 and 2/2 O2 Heater elements is between 4.0 and 5.0 ohms at 70° F(21.1°C).

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance within the listed specifications?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K343) FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

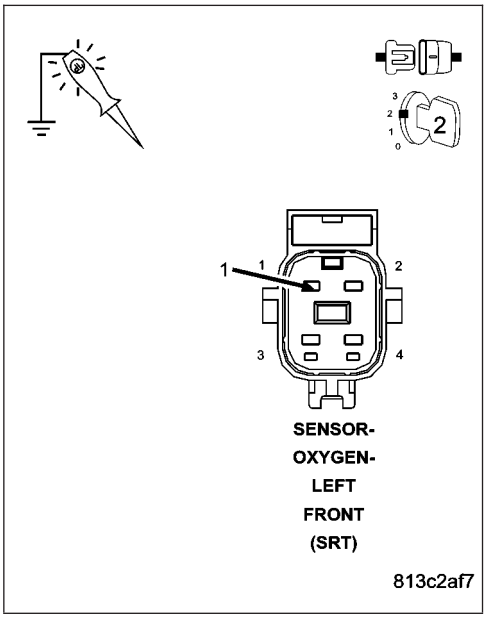
Using a 12-volt test light connected to ground, probe the (K343) Fused ASD Relay Output circuit at the O2 Sensor harness connector.

Did the test light illuminate brightly?

Yes >> Go To 4

NOTE: Stop the actuation before continuing.

No >> Repair the open or short to ground in the (K343) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

4. (K199) HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

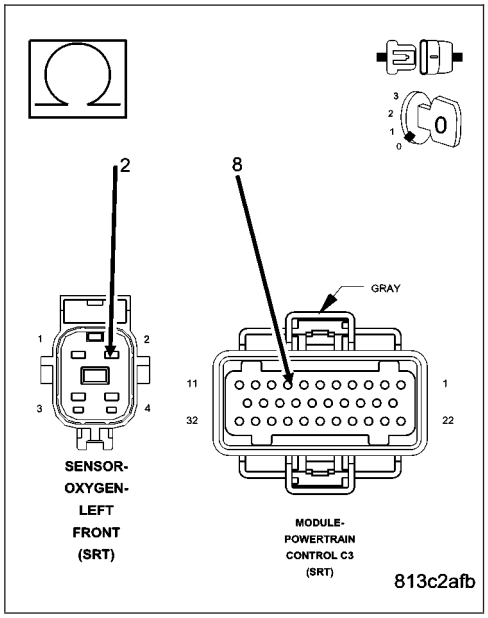
Disconnect the PCM harness connectors.

Measure the resistance of the (K199) O2 Heater Control circuit from the O2 Sensor to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K199) O2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



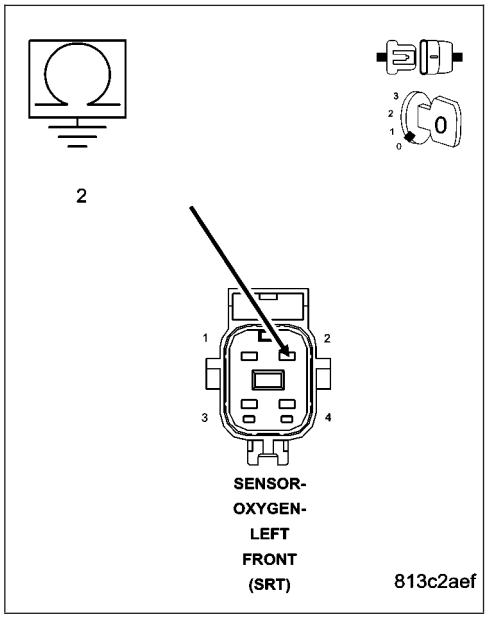
5. (K199) HEATER CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K199) O2 Heater Control (PWM) circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K199) Heater Control (PWM) circuit or the Heater Relay Control circuit depending on the O2 Sensor being tested.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0051-O2 SENSOR 2/1 HEATER CIRCUIT LOW (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

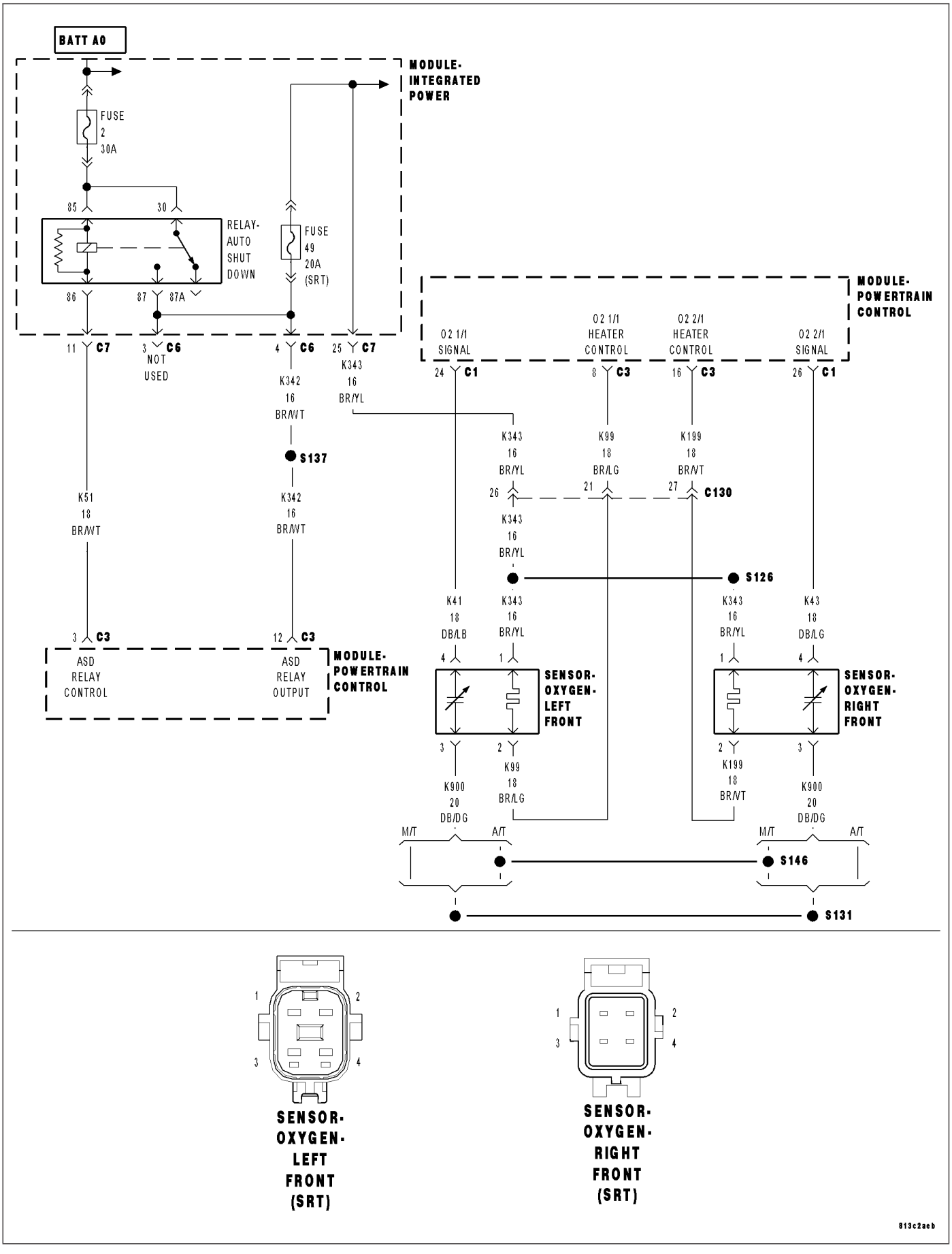
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH



P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Battery voltage above 10.6 volts, ASD is powered up, and O2 heater is on.
- **Set Condition:**
  Desired state does not match Actual state.

Possible Causes
O2 HEATER TEST
O2 SENSOR HEATER ELEMENT
(K343) FUSED ASD RELAY OUTPUT CIRCUIT
(K199) HEATER CONTROL CIRCUIT OPEN
(K199) HEATER CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. O2 HEATER TEST

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the O2 Heater test.
Monitor the O2 Heater Voltage for 5 minutes.

Did the voltage drop down close to zero during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

NOTE: Stop the actuation before continuing.

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

2. O2 HEATER ELEMENT

Turn the ignition off.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater element at the O2 Sensor connector (component side).

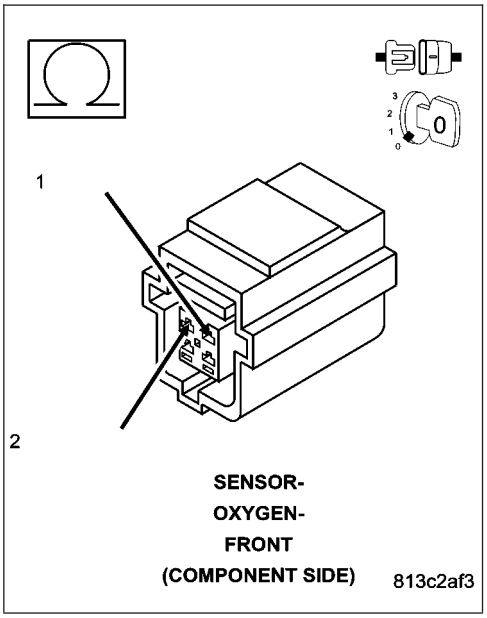
On a four O2 Sensor system the resistance value for 1/1 and 2/1 O2 Heater elements is between 3.3 and 4.1 ohms and the 1/2 and 2/2 O2 Heater elements is between 4.0 and 5.0 ohms at 70° F(21.1°C).

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance within the listed specifications?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



3. (K343) FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

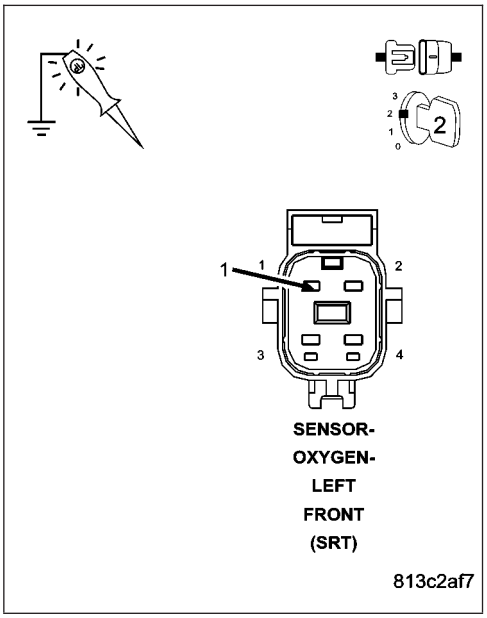
Using a 12-volt test light connected to ground, probe the (K343) Fused ASD Relay Output circuit at the O2 Sensor harness connector.

Did the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (K343) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Stop the actuation before continuing.



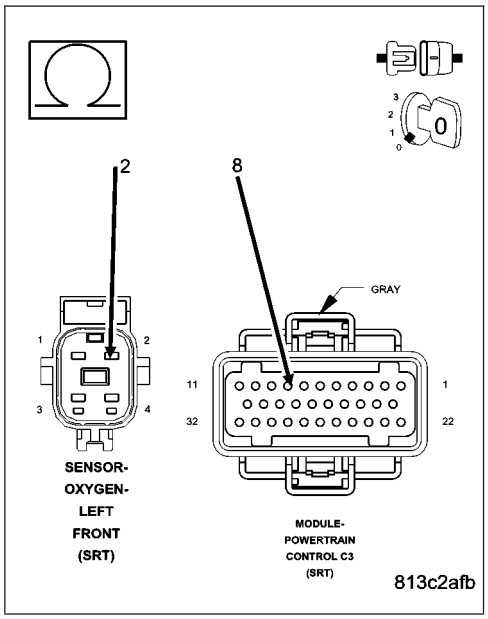
P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

4. HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K199) O2 Heater Control circuit from the O2 Sensor to the PCM harness connector.



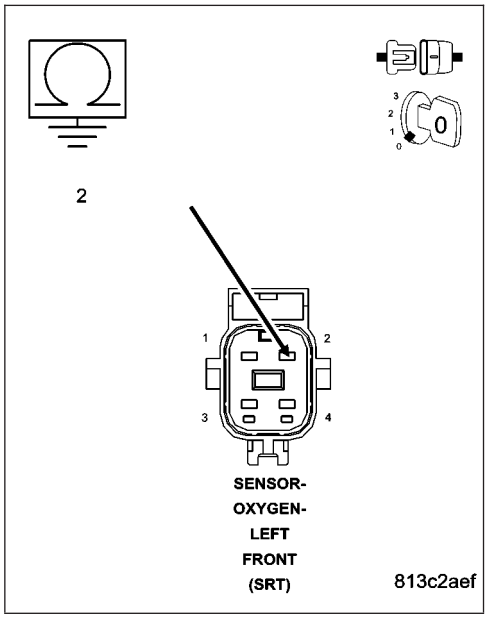
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K199) O2 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K199) HEATER CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K199) O2 Heater Control (PWM) circuit.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K199) Heater Control (PWM) circuit or the Heater Relay Control circuit depending on the O2 Sensor being tested.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0052-O2 SENSOR 2/1 HEATER CIRCUIT HIGH (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

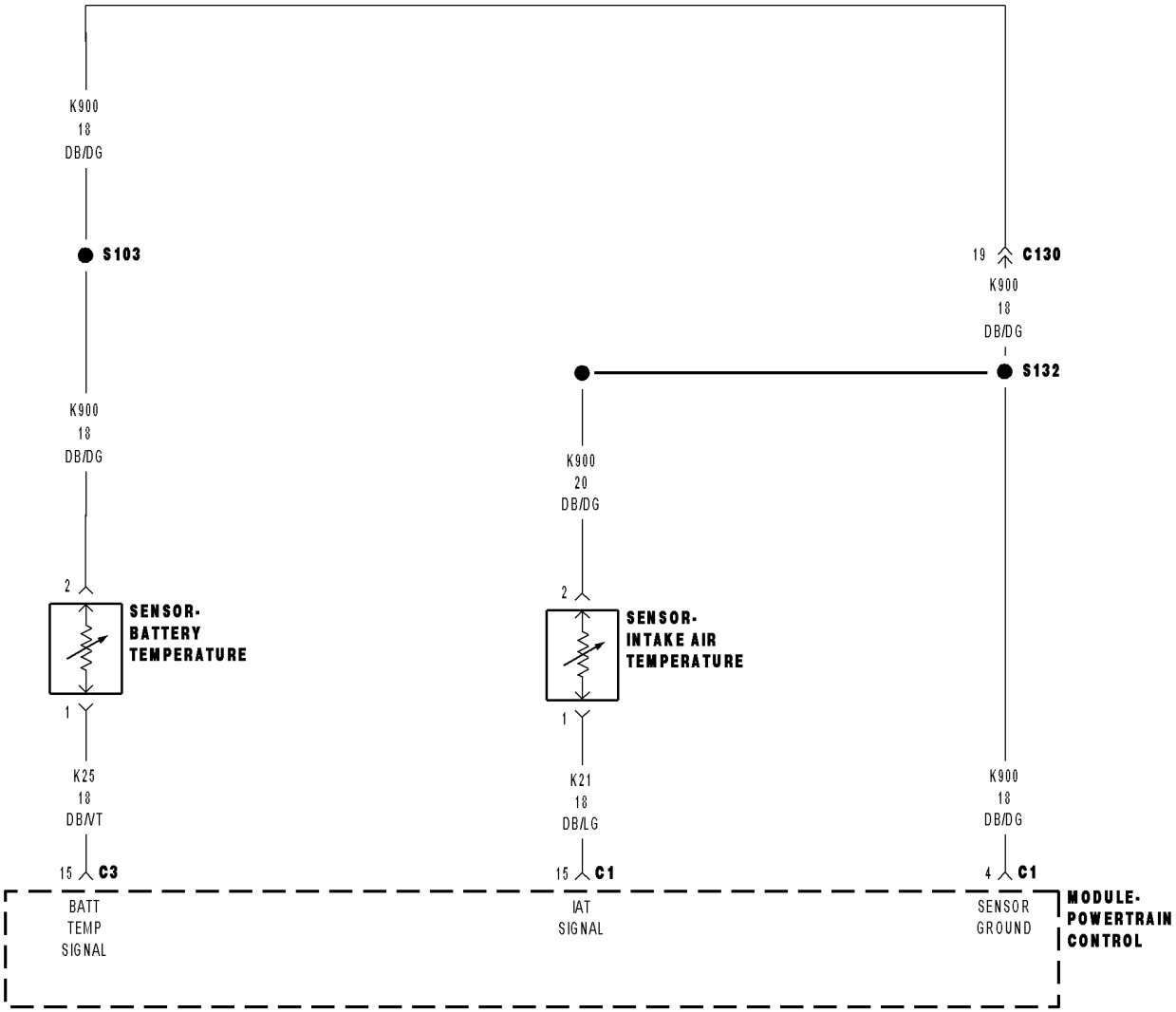
If there are no possible causes remaining, view repair.

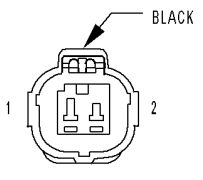
Repair

Replace and program the Powertrain Control Module per Service Information.

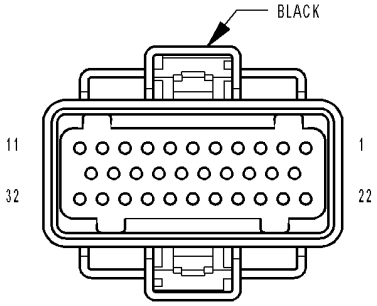
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE





SENSOR-
BATTERY
TEMPERATURE



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81512bee

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no Battery Temperature Sensor Open or Short Faults present.
- **Set Condition:**
  After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Battery Temperature has changed less than 4°C (7.2°F) change in temperature. One trip fault.

Possible Causes
GOOD TRIP EQUAL TO ZERO
(K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
BATTERY TEMPERATURE SENSOR
RESISTANCE IN THE (K25) BATTERY TEMP SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
(K25) BATTERY TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE (CONTINUED)

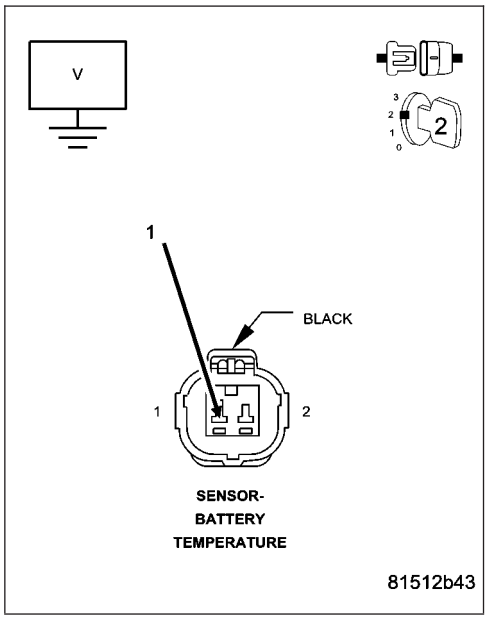
2. (K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the Battery Temp Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (K25) Battery Temp Signal circuit at the Sensor connector.



Is the voltage above 5.2 volts?

Yes >> Repair the short to voltage on the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

3. (K25) BATTERY TEMP SENSOR SIGNAL

With the scan tool, read the Battery Temp Sensor voltage with the Batt Temp Sensor still disconnected.

Is the voltage above 4.6 volts?

Yes >> Go To 4

No >> Go To 7

4. BATTERY TEMPERATURE SENSOR

Connect a jumper wire between the (K25) Battery Temp Signal circuit and the (K900) Sensor ground circuit at the Sensor harness connector.

With the scan tool, read the Battery Temp Sensor voltage.

Is the voltage below 1.0 volt?

Yes >> Replace the Battery Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

NOTE: Remove the jumper wire before continuing.

P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE (CONTINUED)

5. RESISTANCE IN THE (K25) BATTERY TEMP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Connect the Battery Temp Sensor harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Backprobe the (K25) Battery Temp Sensor Signal circuit at the Sensor harness connector and the PCM harness connector with both voltmeter leads.

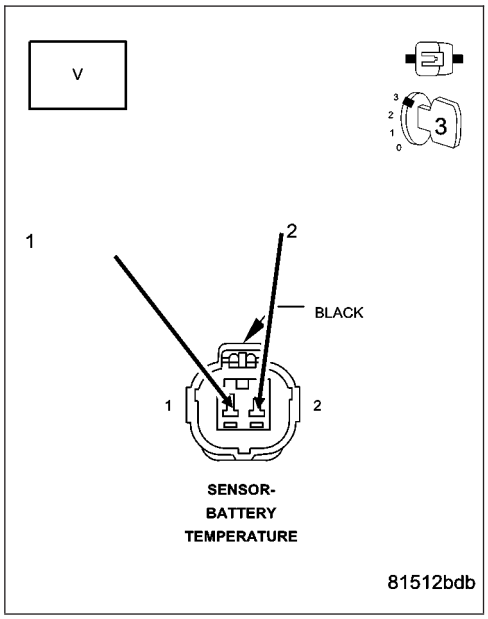
Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 6

No >> Repair the excessive resistance in the (K25) Battery Temp Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Backprobe the (K900) Sensor ground circuit at the Battery Temperature Sensor harness connector and the PCM harness connector using both volt meter leads.

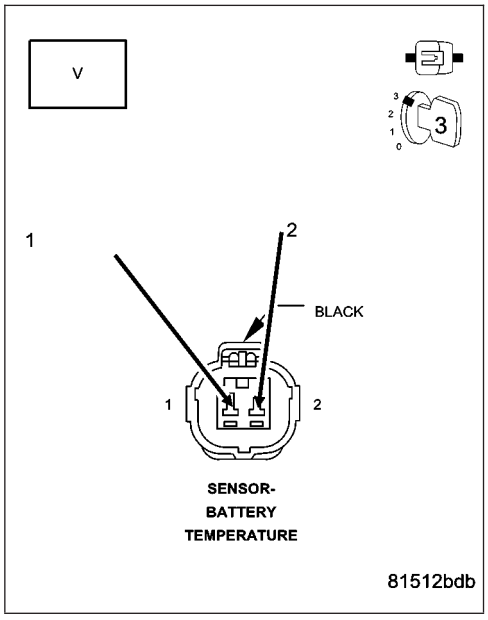
Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 8

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0071-AMBIENT/BATTERY TEMP SENSOR PERFORMANCE (CONTINUED)

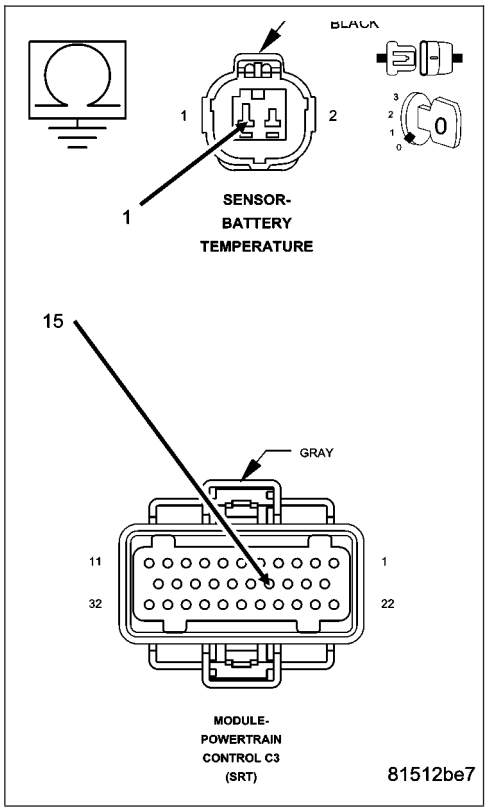
7. (K25) BATTERY TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the Battery Temp Sensor harness connector.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K25) Battery Temp Signal circuit.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K25) Battery Temp Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

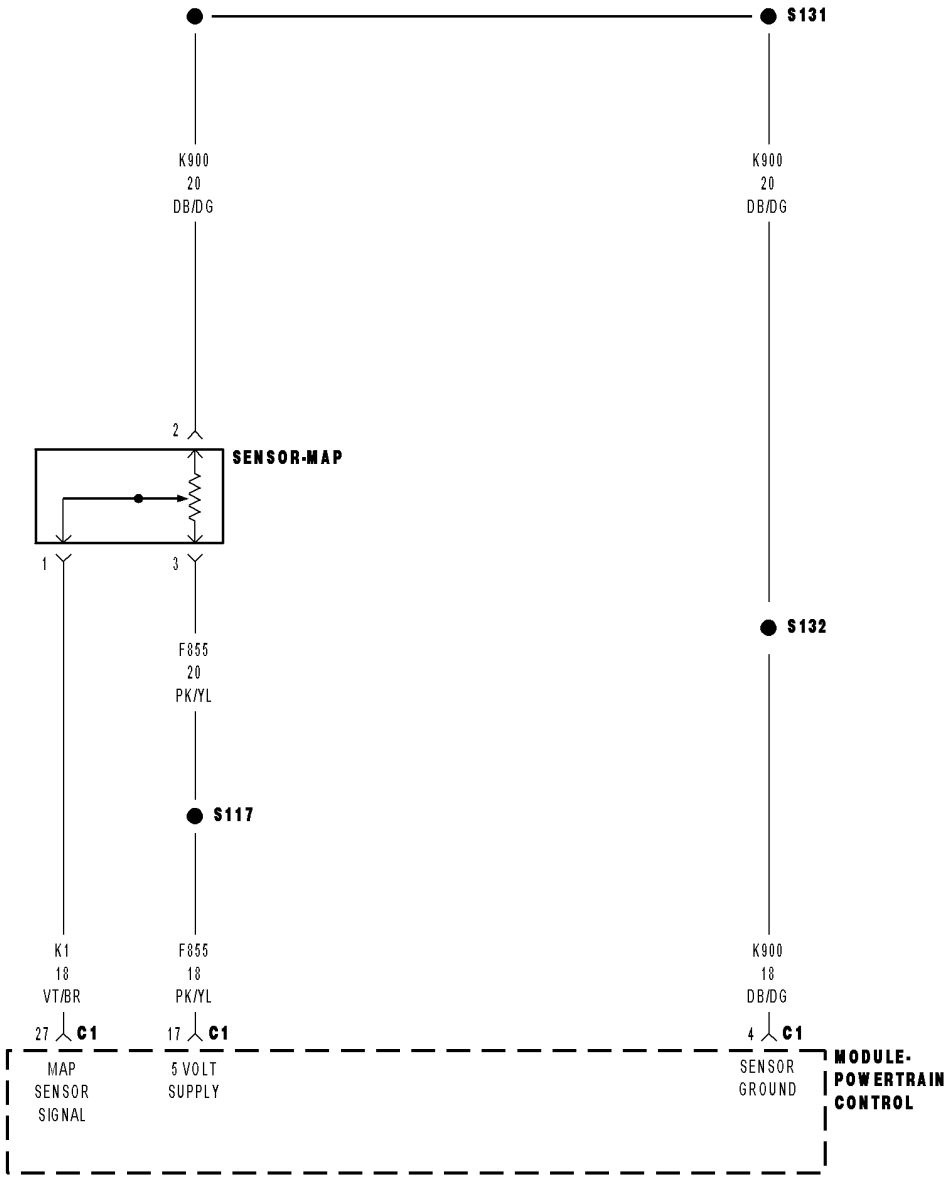
If there are no possible causes remaining, view repair.

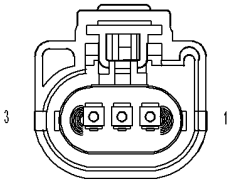
Repair

Replace and program the Powertrain Control Module per Service Information.

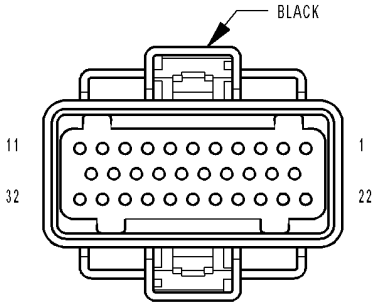
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0107-MAP SENSOR VOLTAGE TOO LOW





SENSOR-
MAP
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81512c2e

P0107-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine RPM above 416 but less than 1500, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The MAP Sensor signal voltage is below 0.1 of a volt for 2.0 seconds with the engine running.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE BELOW 0.08 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the MAP Sensor voltage.

Is the voltage below 0.08 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

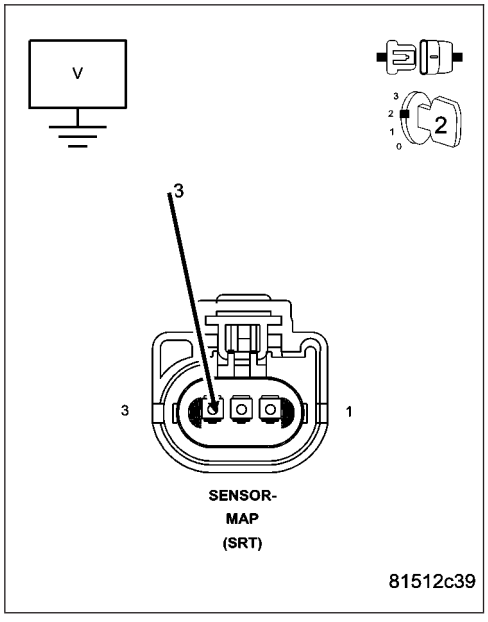
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6



P0107-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

3. MAP SENSOR

With a scan tool, monitor the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K1) MAP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

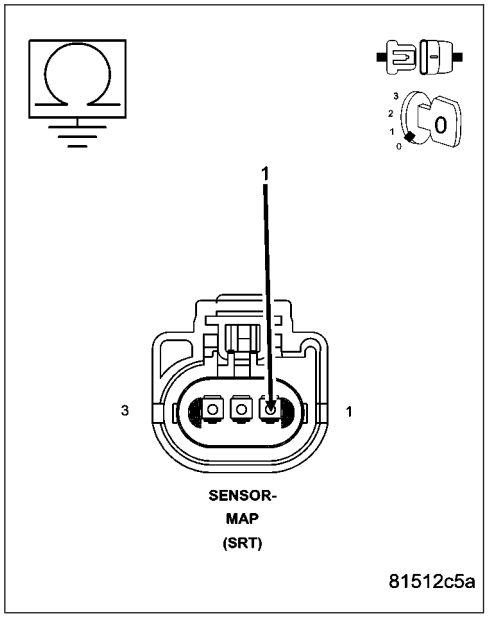
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



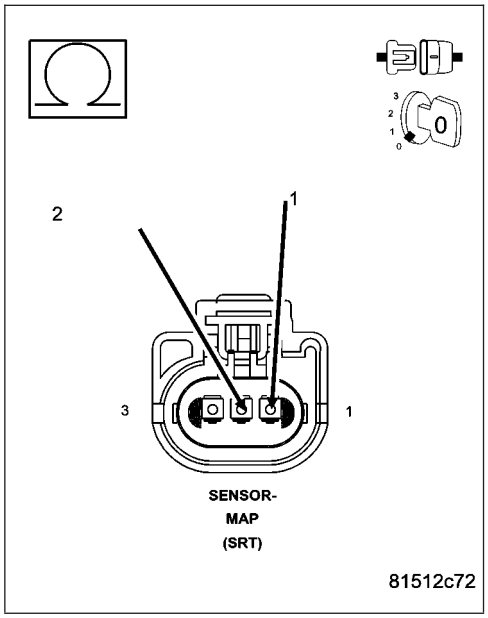
5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0107-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

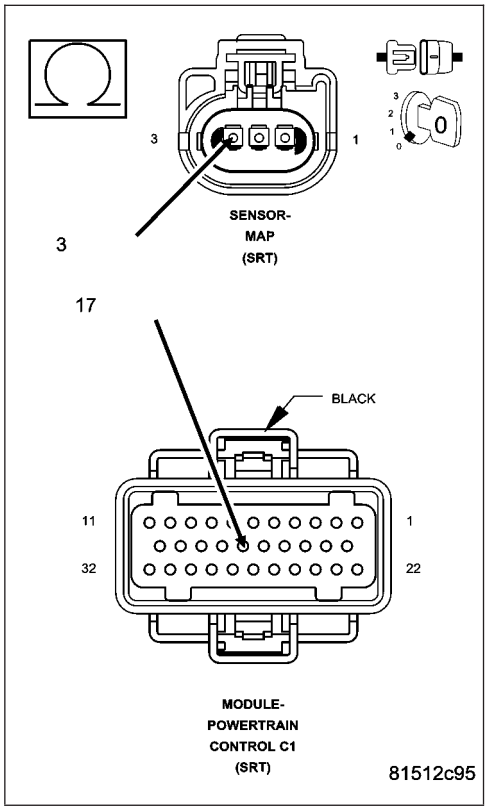
Disconnect the C1 PCM harness connector.

Measure the resistance of the (F855) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



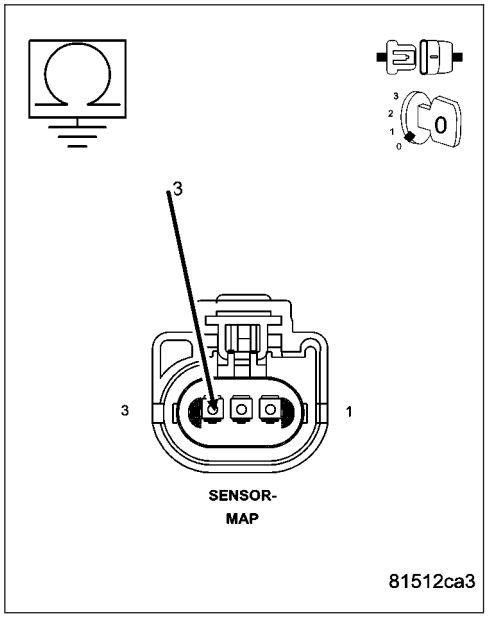
7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0107-MAP SENSOR VOLTAGE TOO LOW (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

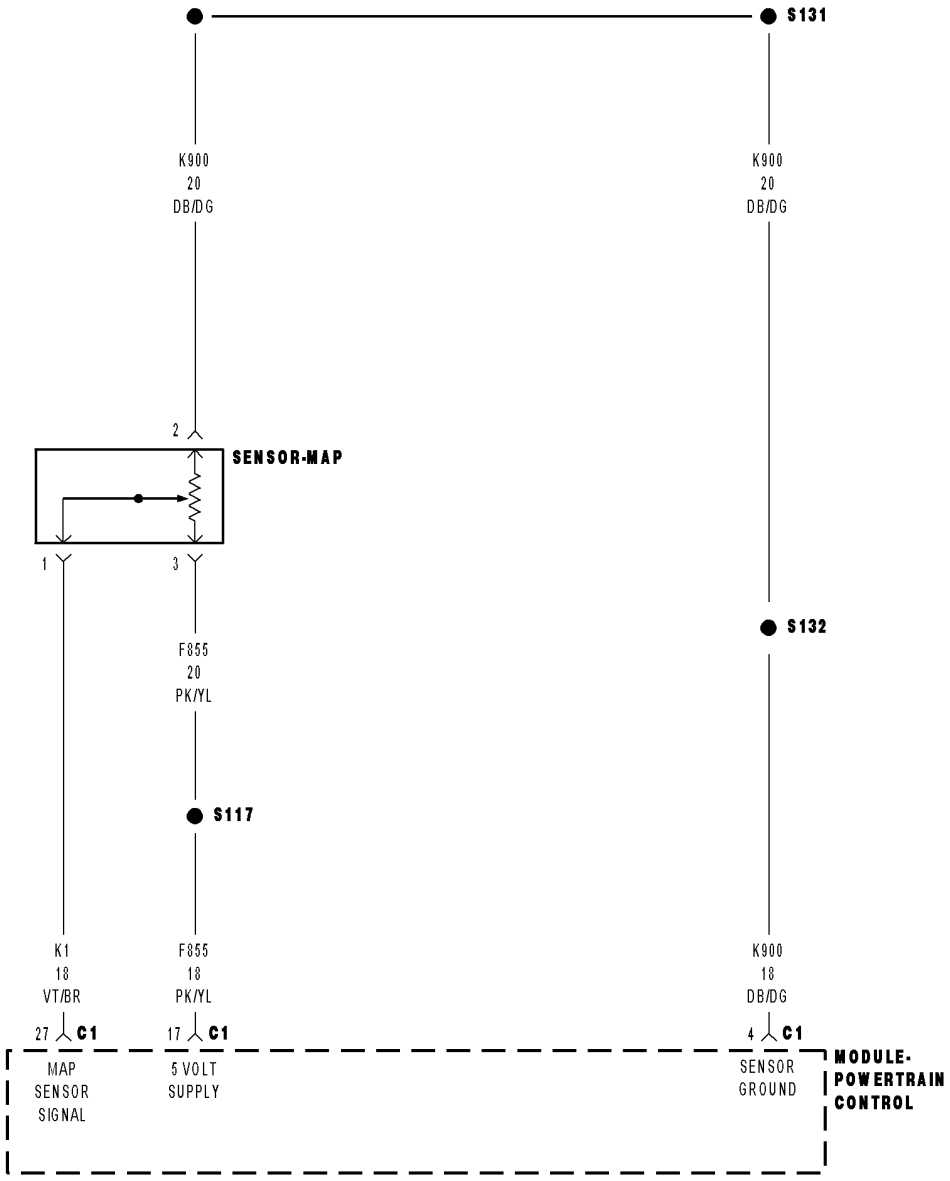
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

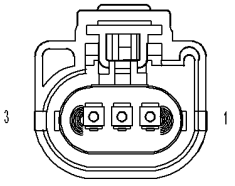
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

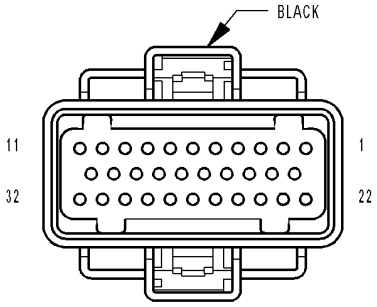
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0108–MAP SENSOR VOLTAGE TOO HIGH





SENSOR-
MAP
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81512c2e

P0108–MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine RPM above 400, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts
- **Set Condition:**
  With the engine RPM above 400, the TPS voltage less than 1.13 volts, and battery voltage greater than 10.4 volts

Possible Causes
(K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K1) MAP SIGNAL CIRCUIT OPEN
(K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
MAP SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. MAP SENSOR VOLTAGE ABOVE 4.92 VOLTS

Start the engine.

With a scan tool, read the MAP Sensor voltage.

Is the voltage above 4.92 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0108–MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

2. MAP SENSOR

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Connect a jumper wire between the (K1) MAP Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

Ignition on, engine not running.

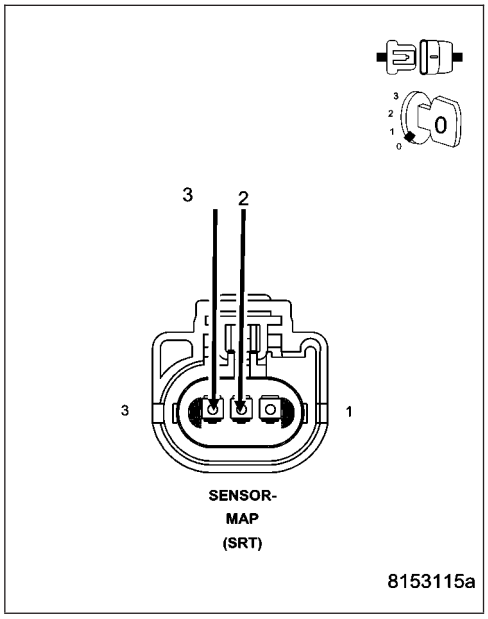
With a scan tool, monitor the MAP Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K1) MAP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 and C2 PCM harness connectors.

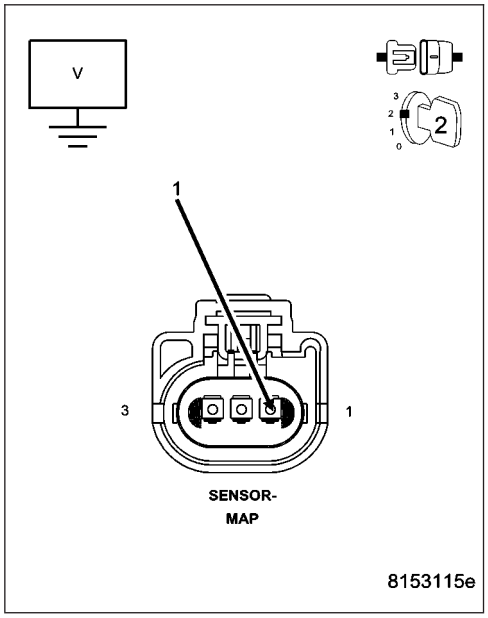
Ignition on, engine not running.

Measure the voltage on the (K1) MAP Signal circuit in the MAP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



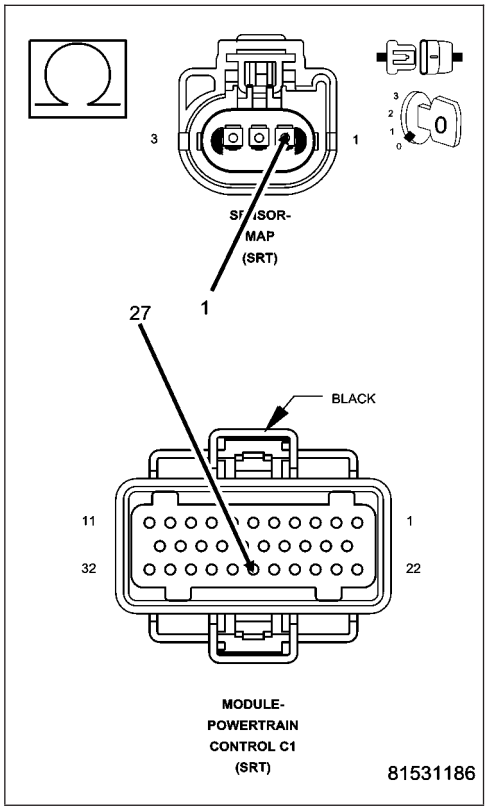
P0108–MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

4. (K1) MAP SIGNAL CIRCUIT OPEN

Turn the ignition off.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K1) MAP Signal circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



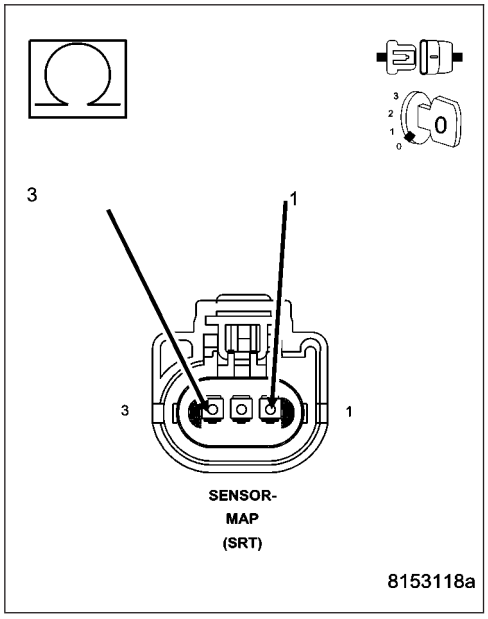
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K1) MAP SIGNAL CIRCUIT SHORTED TO THE (F856) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K1) MAP Signal circuit and the (F856) 5-volt Supply circuit in the MAP Sensor harness connector.



Is the resistance below 100 ohms?

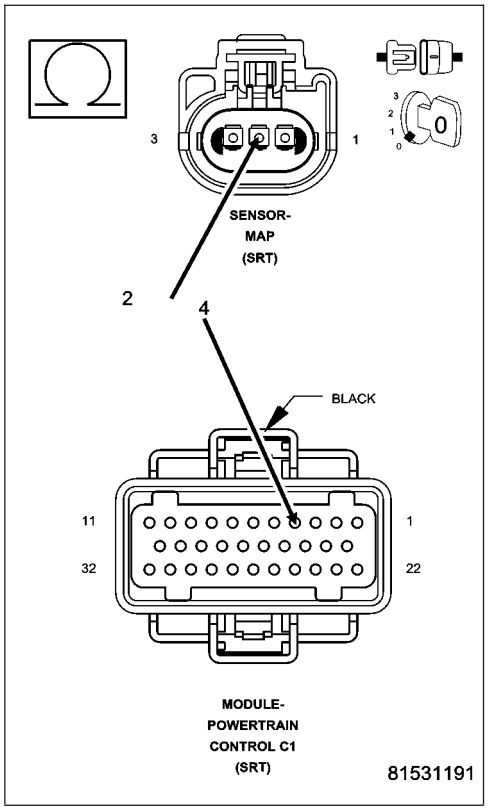
Yes >> Repair the short between the (F856) 5-volt Supply circuit and the (K1) MAP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0108–MAP SENSOR VOLTAGE TOO HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the appropriate terminal of special tool #8815.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

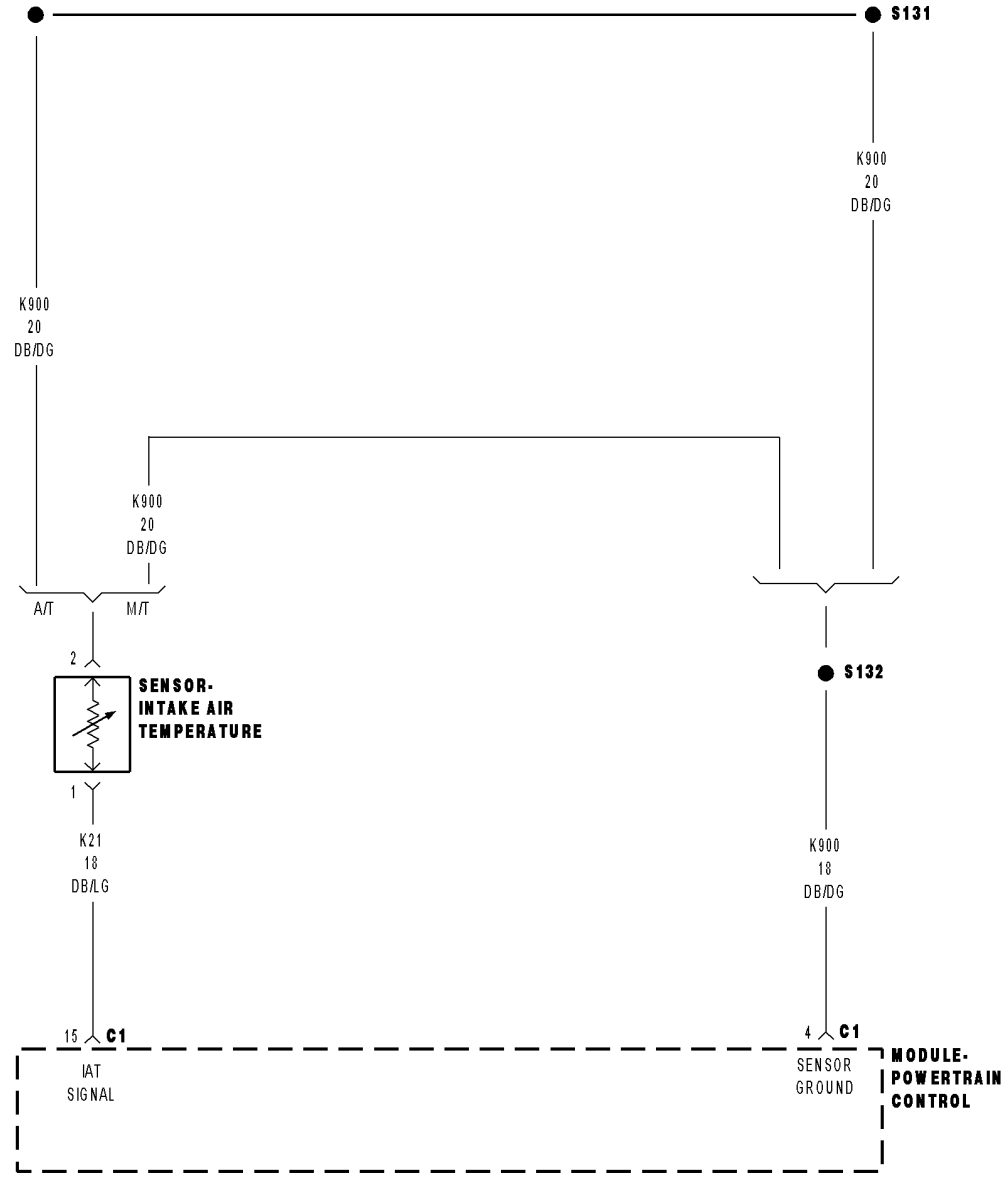
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

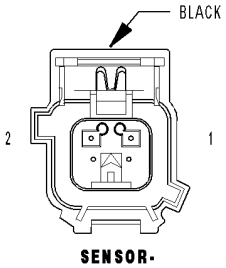
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

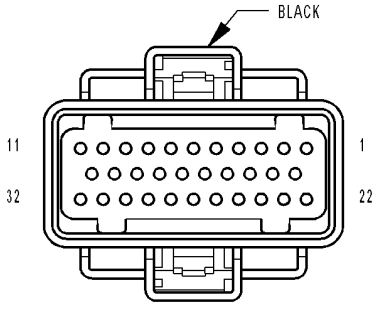
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0111-INTAKE AIR TEMP PERFORMANCE





SENSOR-
INTAKE AIR
TEMPERATURE
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81532317

P0111-INTAKE AIR TEMP PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and no Intake Air Temperature Sensor open/shorted faults present.
- **Set Condition:**
  After 5 warm cycles have occurred (coolant increases at least 22°C (40°F) to a minimum of 71°C (160°F) and the odometer mileage has increased 196.6 miles and the Intake Air Temperature has had less than 5°C (9°F) change in temperature.

Possible Causes
RESISTANCE IN THE (K21) IAT SENSOR SIGNAL CIRCUIT
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
IAT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. IAT SENSOR VOLTAGE ABOVE 4.6 VOLTS

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Ignition on, engine not running.

With the scan tool, read the IAT voltage.

Is the voltage above 4.6 volts?

Yes >> Go To 3

No >> Go To 5

P0111-INTAKE AIR TEMP PERFORMANCE (CONTINUED)

3. IAT SENSOR VOLTAGE BELOW 1.0 VOLT

Turn the ignition off.

Connect a jumper wire across the IAT Sensor harness connector.

Ignition on, engine not running.

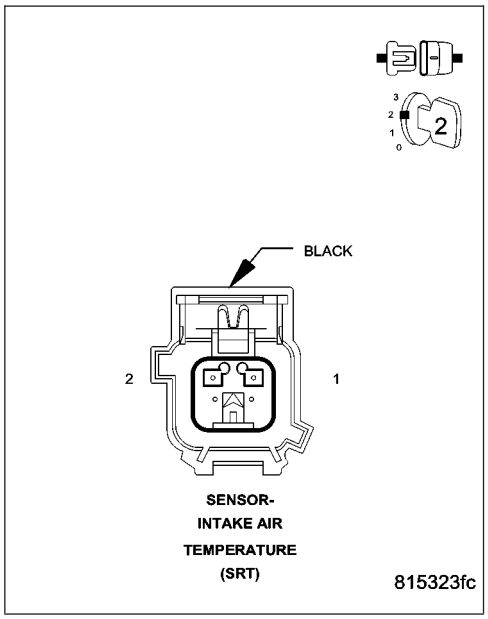
With the scan tool, read the IAT voltage.

Is the voltage below 1.0 volt?

Yes >> Replace the Intake Air Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

NOTE: Remove the jumper wire and connect the Sensor harness connector before continuing.



4. RESISTANCE IN THE (K21) IAT SENSOR SIGNAL CIRCUIT

Turn the ignition off.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Backprobe the (K21) IAT Sensor Signal circuit at the IAT Sensor harness connector and PCM harness connector with the voltmeter leads.

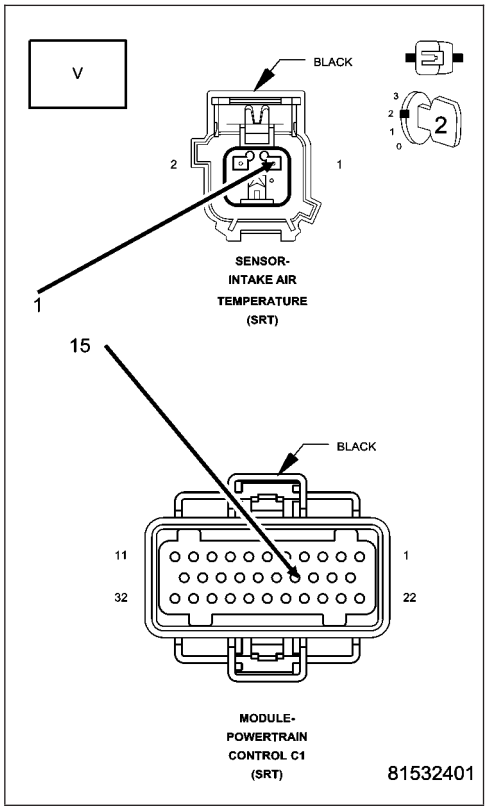
Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 6

No >> Repair the excessive resistance in the (K21) IAT Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0111-INTAKE AIR TEMP PERFORMANCE (CONTINUED)

5. RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

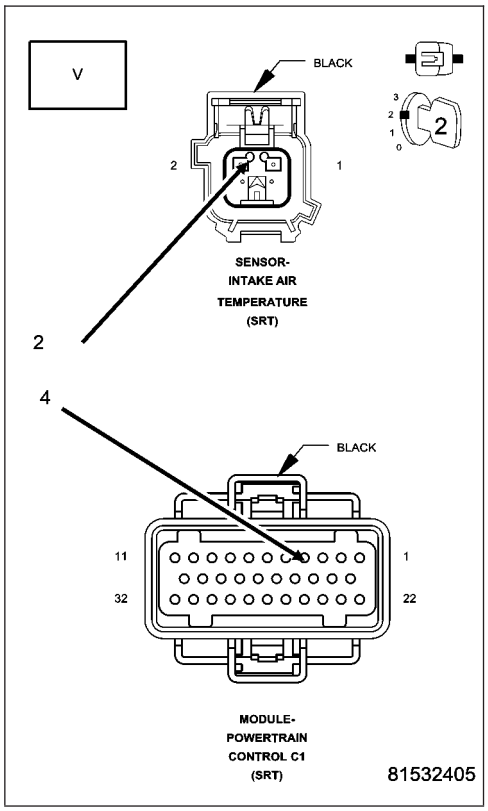
NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Backprobe the (K900) Sensor ground circuit at the IAT Sensor harness connector and PCM harness connector with both leads of a voltmeter.

Start the engine.

Allow the engine to idle.



Is the voltage below 0.10 of a volt?

Yes >> Go To 6

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

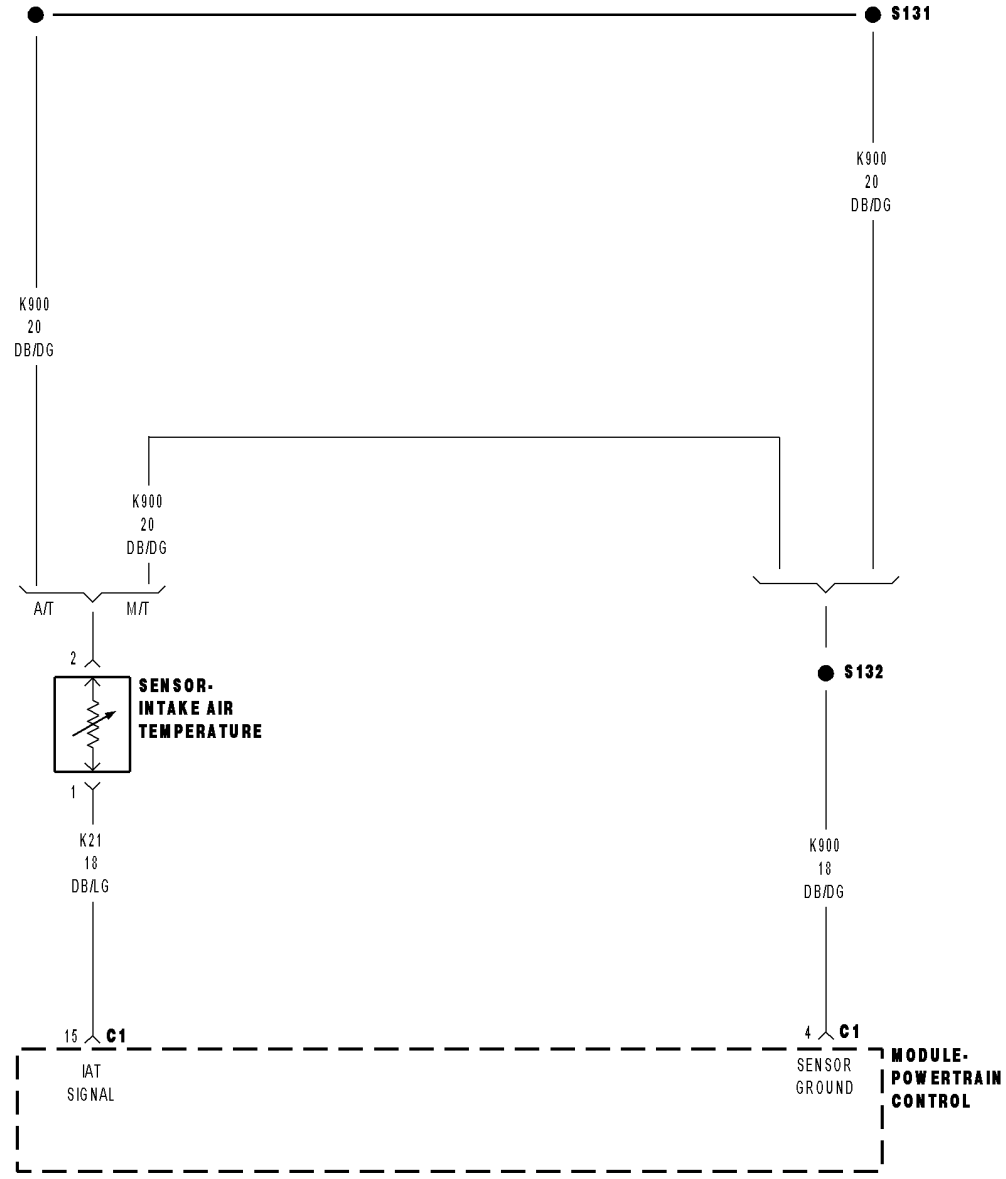
If there are no possible causes remaining, view repair.

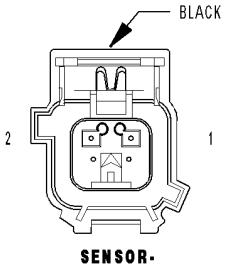
Repair

Replace and program the Powertrain Control Module per Service Information.

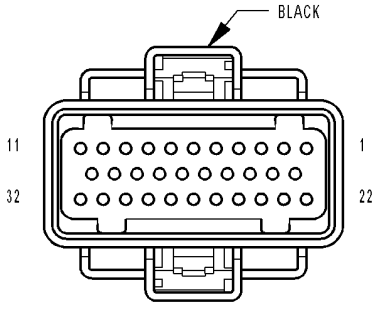
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW





SENSOR-
INTAKE AIR
TEMPERATURE
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

8153217

P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage greater than 10.4 volts.
- **Set Condition:**
  When the Inlet Air Temp Sensor Signal circuit voltage is less than 0.8 of a volt.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND
(K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
INTAKE AIR TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE BELOW 0.078 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the IAT voltage.

Is the voltage below 0.078 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. IAT SENSOR

Turn the ignition off.

Disconnect the IAT Sensor harness connector.

Ignition on, engine not running.

With a scan tool, read IAT voltage.

Is the voltage above 0.05 of a volt?

Yes >> Replace the Intake Air Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

3. (K21) IAT SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

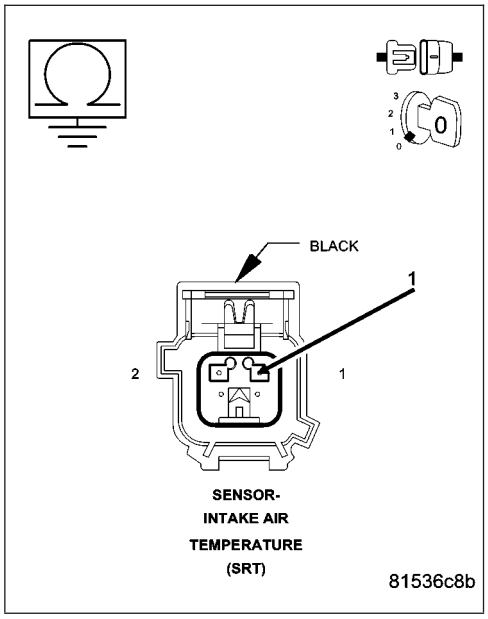
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K21) IAT Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



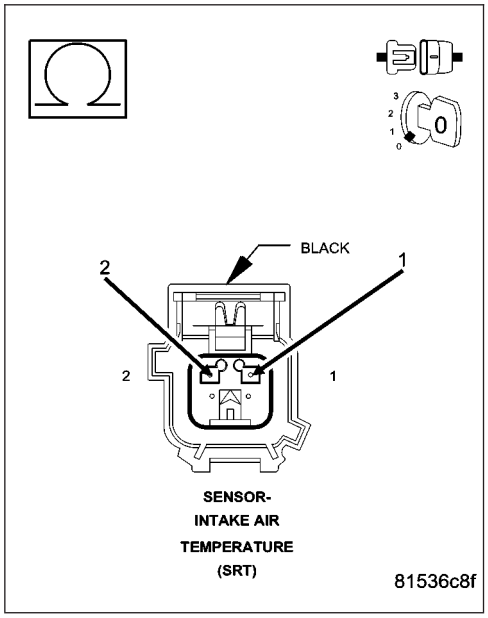
4. (K21) IAT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K21) IAT Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0112-INTAKE AIR TEMP SENSOR VOLTAGE TOO LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

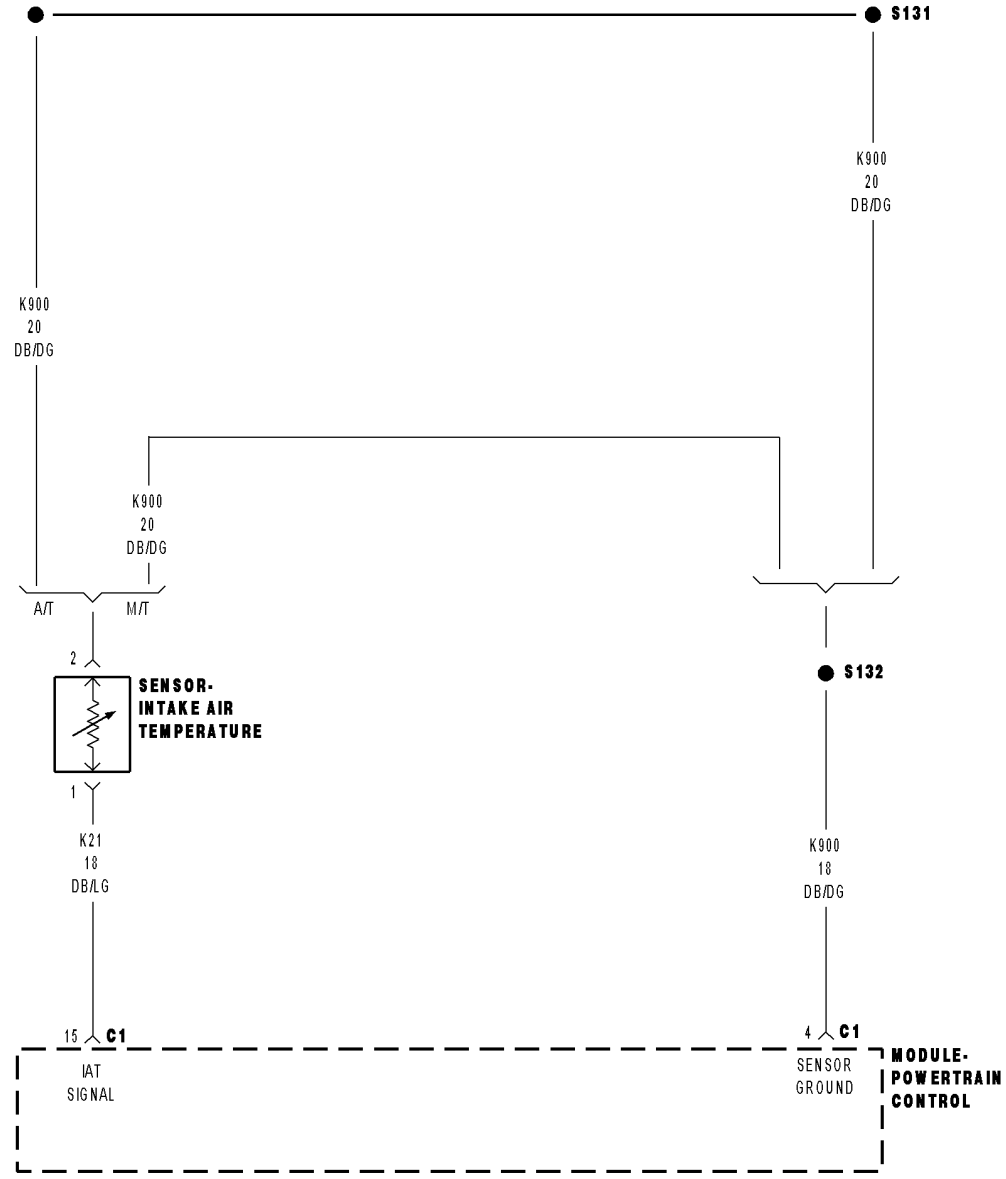
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

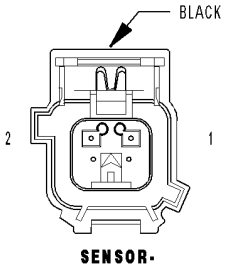
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

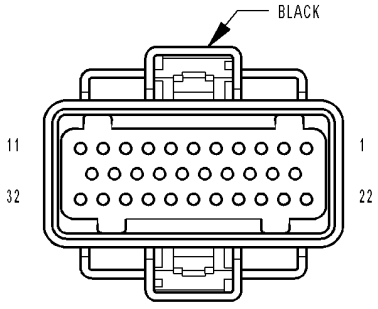
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH





SENSOR-
INTAKE AIR
TEMPERATURE
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81532317

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

For the Engine System Schematic circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Intake Air Temperature (IAT) sensor circuit voltage at the PCM goes above 4.98 volts for 2.8 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K21) IAT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
IAT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. IAT SENSOR VOLTAGE ABOVE 4.98 VOLTS

Ignition on, engine not running.

With a scan tool, read the Intake Air Temperature Sensor voltage.

Is the voltage above 4.98 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

2. IAT SENSOR

Turn the ignition off.

Disconnect the Intake Air Temperature Sensor harness connector.

Connect a jumper wire between the (K21) IAT Signal circuit and the (K900) Sensor ground circuit in the IAT Sensor harness connector.

Ignition on, engine not running.

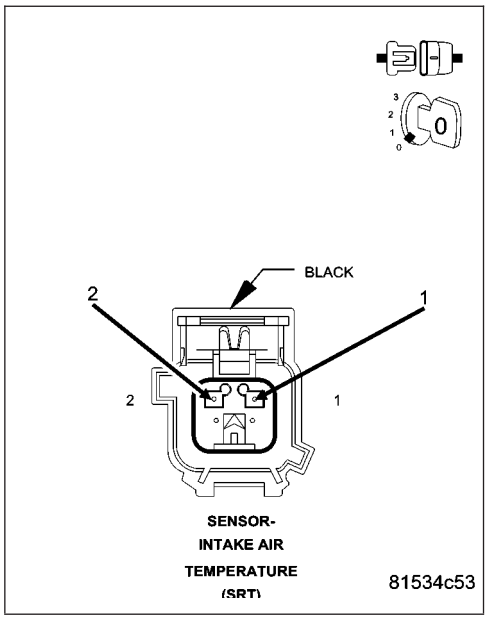
With a scan tool, read the IAT Sensor voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the IAT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K21) IAT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Disconnect the C2 PCM harness connector.

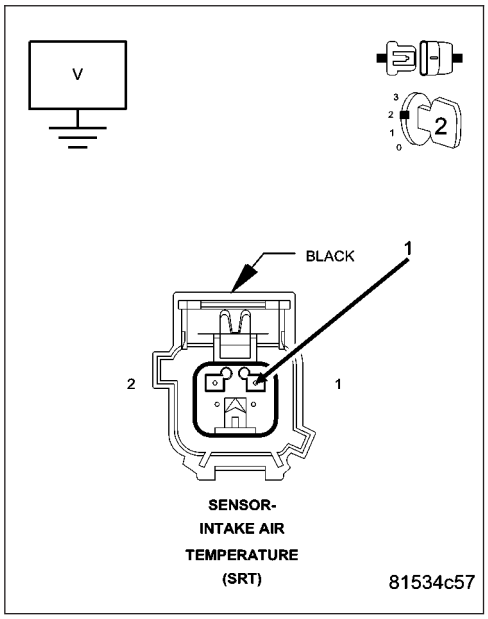
Ignition on, engine not running.

Measure the voltage on the (K21) IAT Signal circuit in the IAT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

4. (K21) IAT SIGNAL CIRCUIT OPEN

Turn the ignition off.

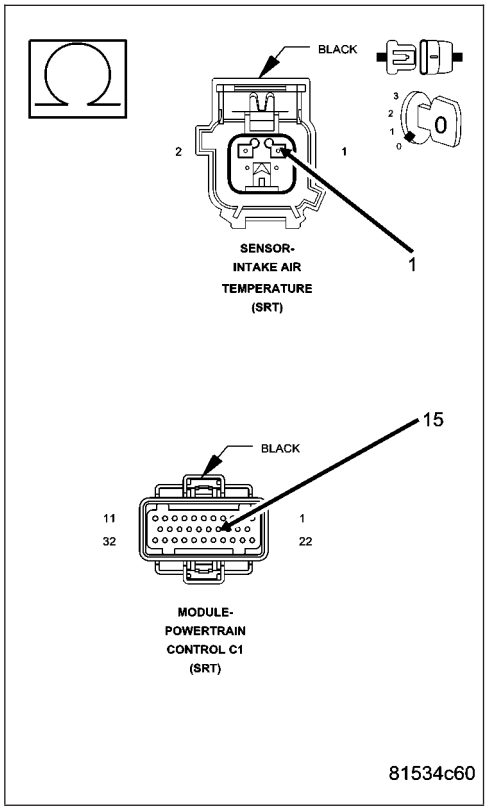
CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Measure the resistance of the (K21) IAT Signal circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K21) IAT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



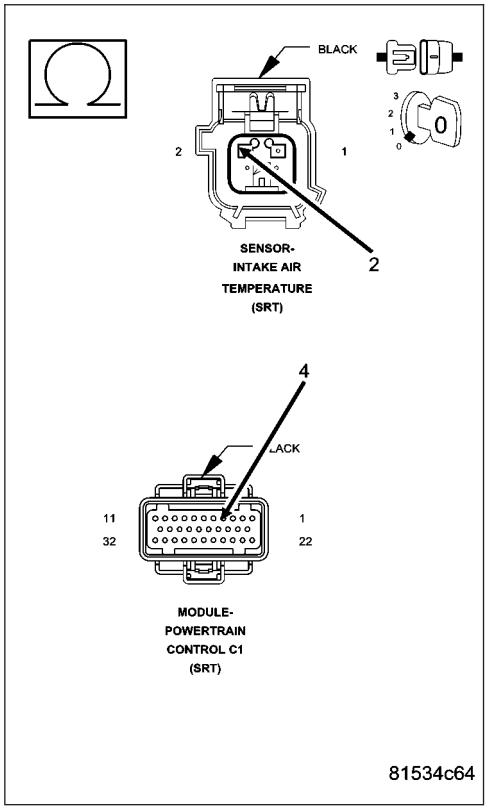
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the IAT Sensor harness connector to the appropriate terminal of special tool #8815.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0113-INTAKE AIR TEMPERATURE SENSOR CIRCUIT HIGH (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

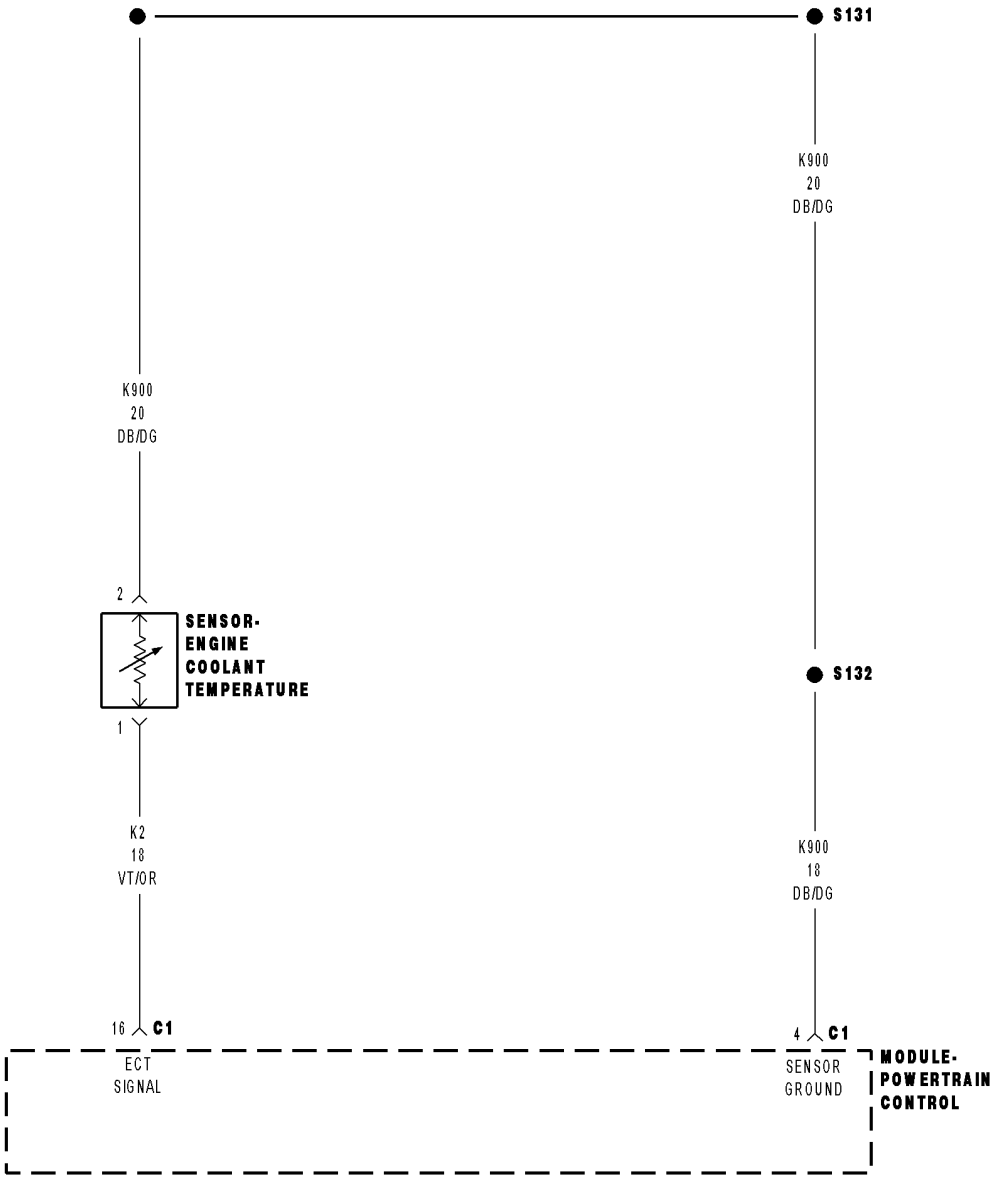
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

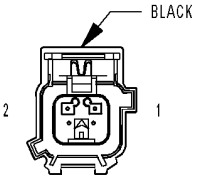
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

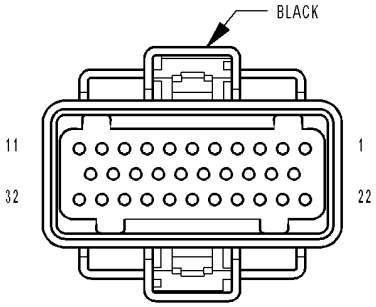
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW





SENSOR-
ENGINE
COOLANT
TEMPERATURE
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81536f8b

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) Signal circuit voltage at the PCM goes below 0.8 of a volt for more than 3 seconds.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO GROUND
(K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE BELOW 1.0 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage below 1.0 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Ignition on, engine not running.

With a scan tool, read ECT voltage.

Is the voltage above 1.0 volt?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

3. (K2) ECT SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Turn the ignition off.

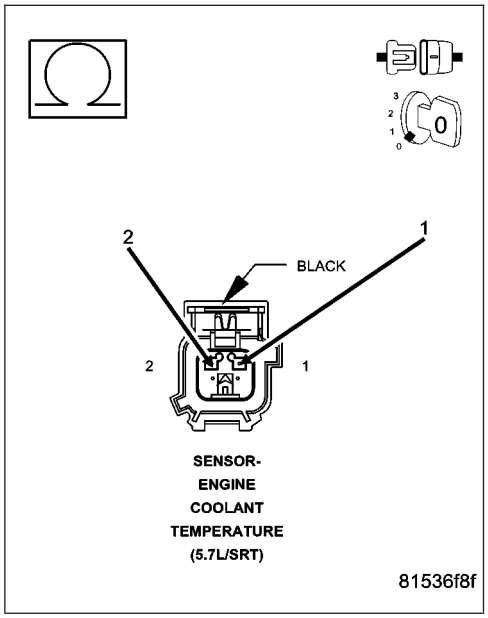
Disconnect the C1 PCM harness connector.

Measure the resistance between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to between the (K900) Sensor ground circuit and the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



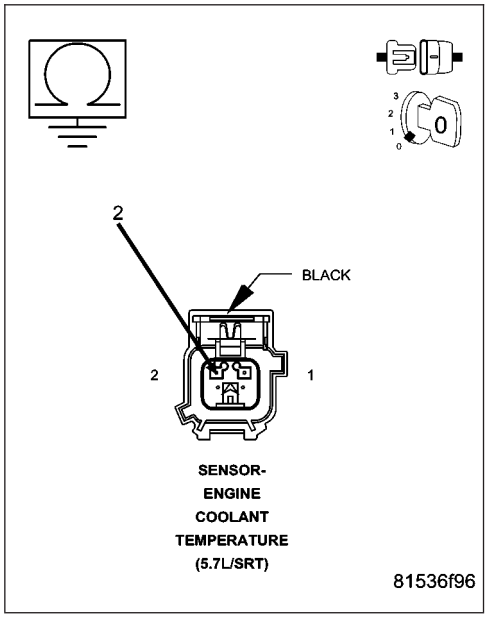
4. (K2) ECT SIGNAL CIRCUIT SHORTED GROUND

Measure the resistance between ground and the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P0117-ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT LOW (CONTINUED)

5. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

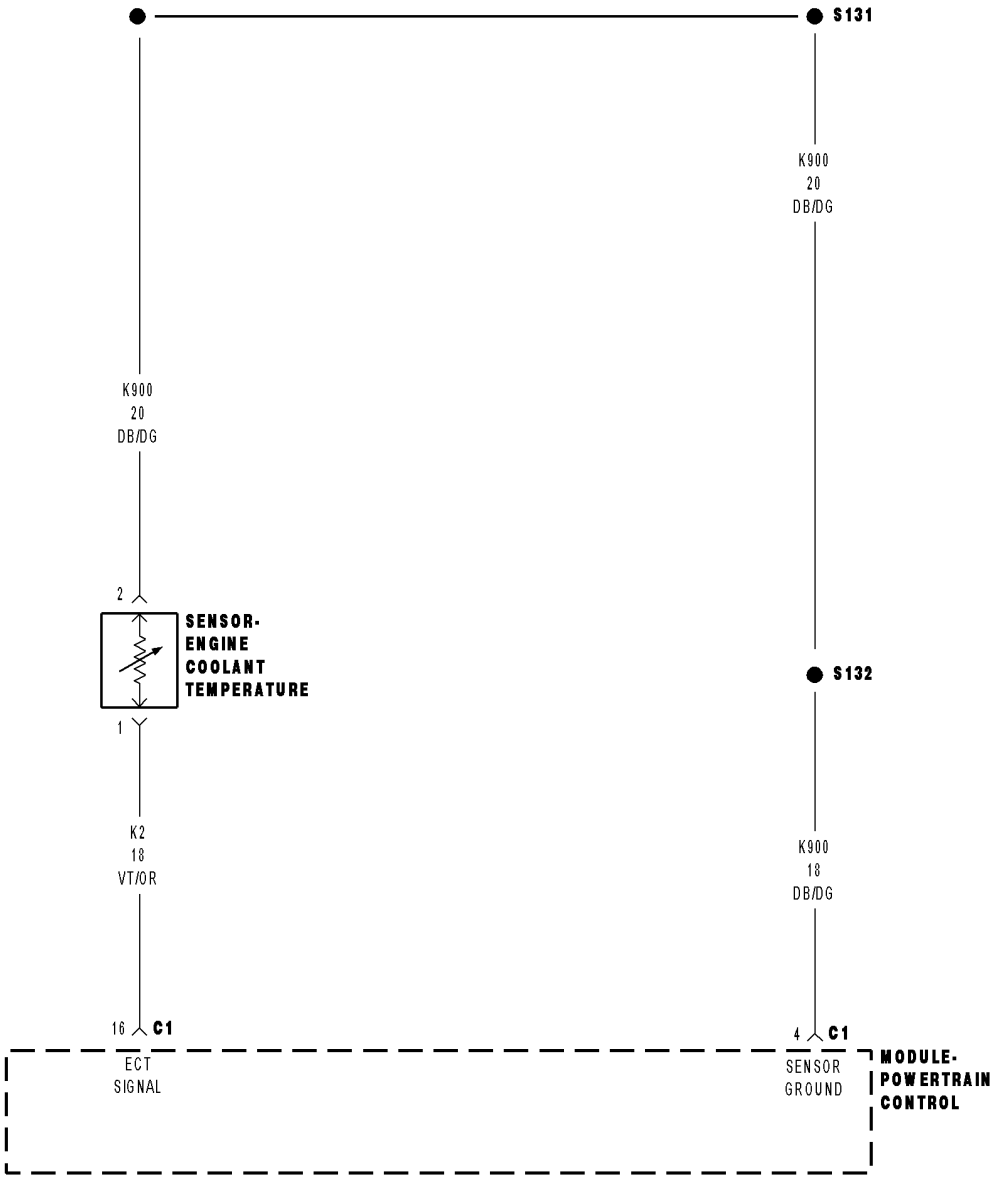
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

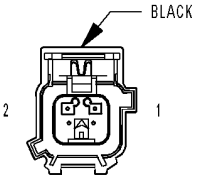
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

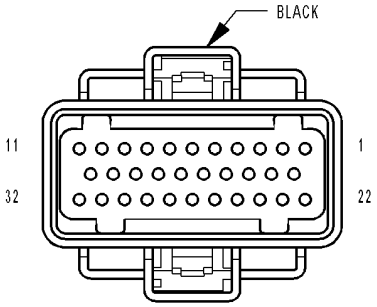
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH





SENSOR-
ENGINE
COOLANT
TEMPERATURE
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81536f8b

P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  The Engine Coolant Temperature (ECT) sensor circuit voltage at the PCM is greater than 4.94 volts for more than 3.0 seconds.

Possible Causes
(K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K2) ECT SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
ECT SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ECT SENSOR VOLTAGE ABOVE 4.94 VOLTS

Ignition on, engine not running.

With a scan tool, read the ECT voltage.

Is the voltage above 4.94 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

2. ECT SENSOR

Turn the ignition off.

Disconnect the ECT harness connector.

Connect a jumper wire between the (K2) ECT Signal circuit and the (K900) Sensor ground circuit in the ECT harness connector.

Ignition on, engine not running.

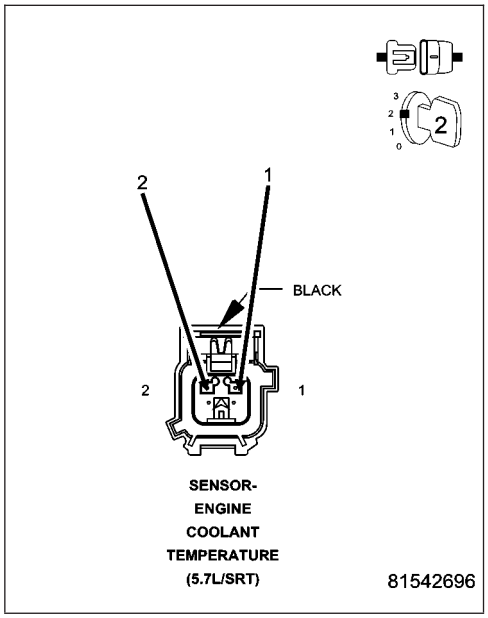
With a scan tool, read ECT voltage.

Is the voltage below 1.0 volt with the jumper wire installed?

Yes >> Replace the ECT Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K2) ECT SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

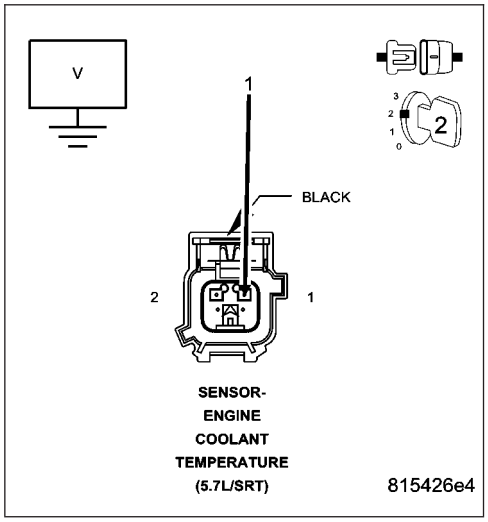
Ignition on, engine not running.

Measure the voltage on the (K2) ECT Signal circuit in the ECT Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

4. (K2) ECT SIGNAL CIRCUIT OPEN

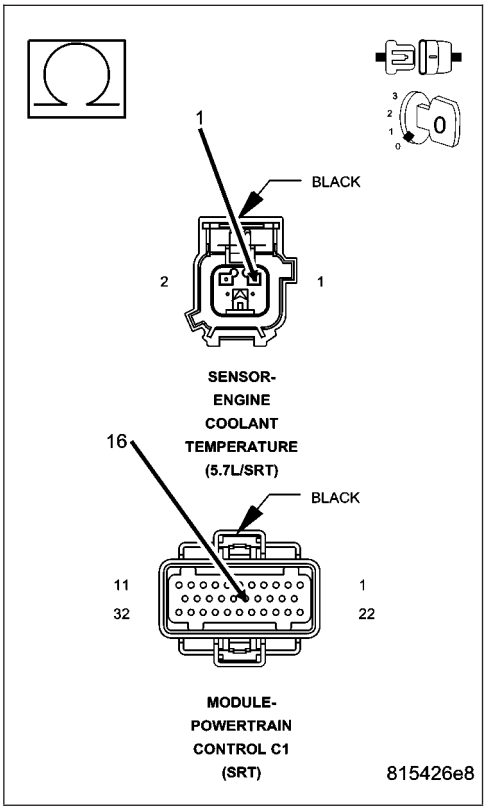
Turn the ignition off.

Measure the resistance of the (K2) ECT Signal circuit from the ECT Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K2) ECT Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



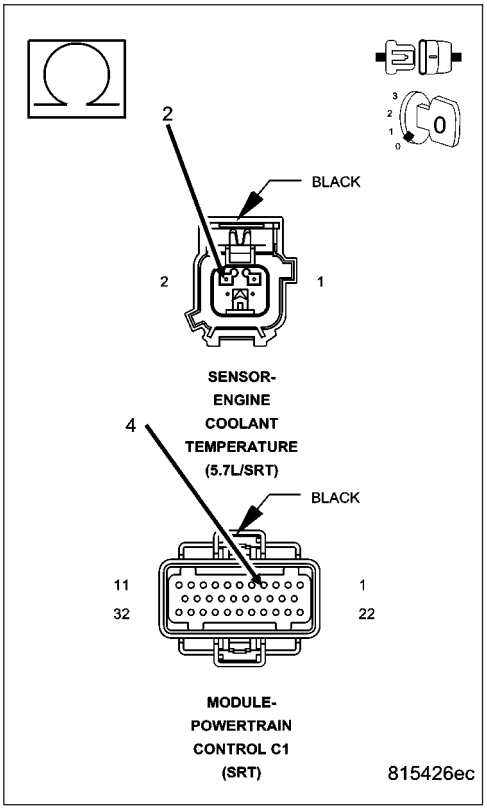
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the ECT Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0118-ENGINE COOLANT TEMP SENSOR VOLTAGE TOO HIGH (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

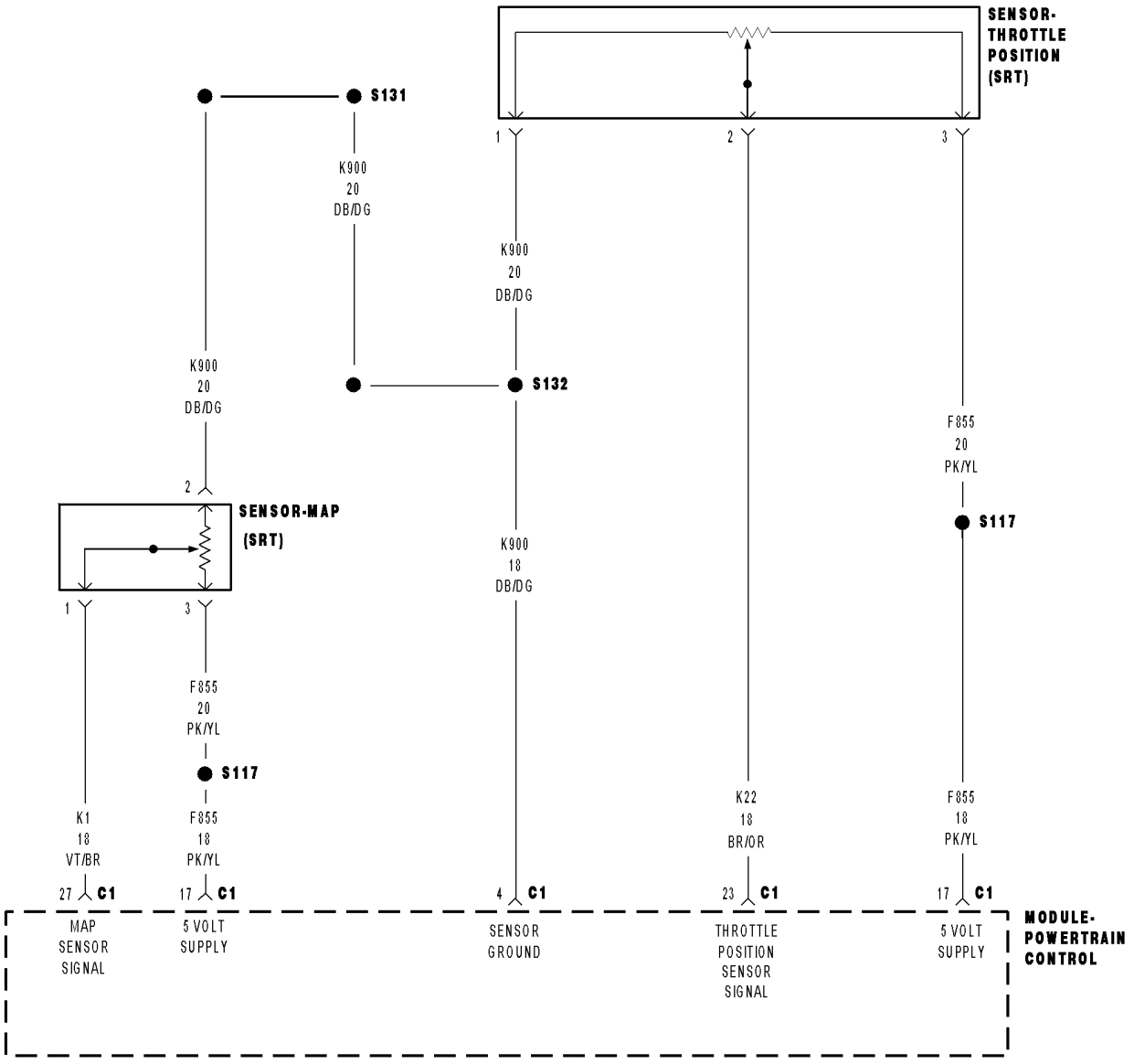
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

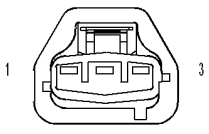
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

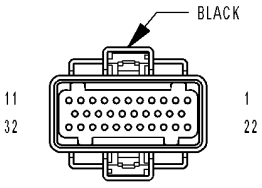
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP

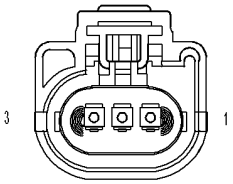




SENSOR-
THROTTLE
POSITION
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)



SENSOR-
MAP
(SRT)

8155c540

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

For the engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and no MAP Sensor or TP Sensor DTC's set. Engine speed must be greater than 1600 RPM.
- **Set Condition:**
  The PCM performs two separate tests. When the manifold vacuum is high, the TP Sensor should be low. When the manifold vacuum is low, the TP Sensor signal should be high. If the proper TP Sensor voltage is not detected when the two conditions are met, a DTC will be set after 4 seconds.

Possible Causes
RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
MAP SENSOR
RESISTANCE IN THE (K1) MAP SENSOR SIGNAL CIRCUIT
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
TP SENSOR OPERATION
RESISTANCE IN THE TP SENSOR (F855) 5-VOLT SUPPLY
TP SENSOR (F855) 5-VOLT SUPPLY SHORTED TO GROUND
THROTTLE POSITION SENSOR
RESISTANCE IN THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
RESISTANCE BETWEEN GROUND AND THE (K22) TP SENSOR NO.1 SIGNAL CIRCUIT
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

NOTE: Diagnose any TP Sensor or MAP component DTCs first before continuing.

NOTE: If the P0500 - No Vehicle Speed Signal is set along with this DTC, refer to the P0500 diagnostics before continuing.

NOTE: The throttle plate and linkage should be free of binding and carbon build up.

NOTE: Make sure the throttle plate is at the idle position.
Ignition on, engine not running.

NOTE: Repair any vacuum leaks that are present before continuing.
With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

2. MAP SENSOR OPERATION

Start the engine.

With the scan tool, monitor the MAP Sensor voltage.

Snap the throttle.

Does the scan tool display MAP voltage from below 2.0 volts at idle to above 3.5 volts at WOT?

Yes >> Go To 3

No >> Go To 10

---

3. TP SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, monitor the TP Sensor voltage while slowly depressing the throttle pedal from the idle position to the wide open throttle position.

Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Disconnect the PCM harness connectors.

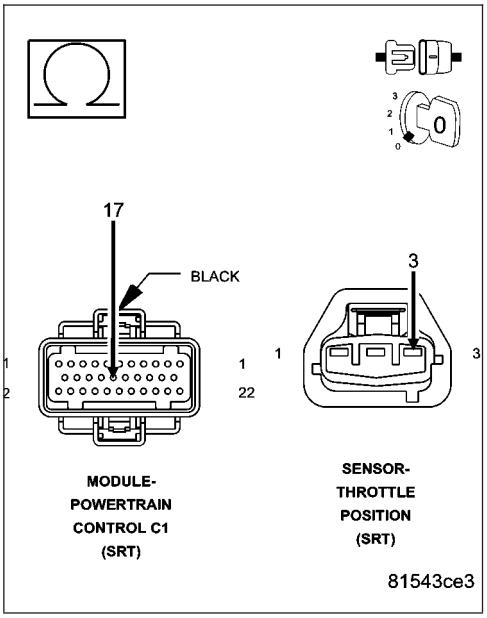
Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

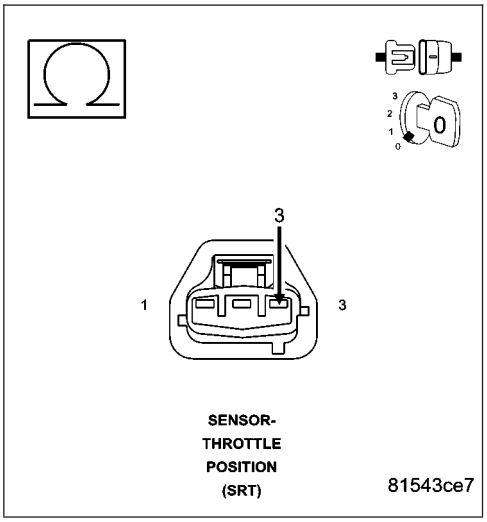
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

5. TP SENSOR (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the TP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

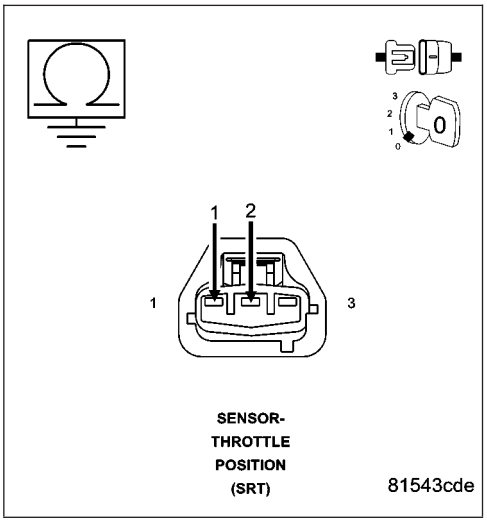
6. THROTTLE POSITION SENSOR

Connect the PCM harness connectors.

With the scan tool, monitor the TP Sensor voltage.

Ignition on, engine not running.

Connect a jumper wire between the (K22) TP Sensor No.1 Signal circuit and the (K900) Sensor ground circuit.



Did the TP Sensor voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

NOTE: Remove the jumper wire before continuing.

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

7. RESISTANCE IN THE (K22) TP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connectors.

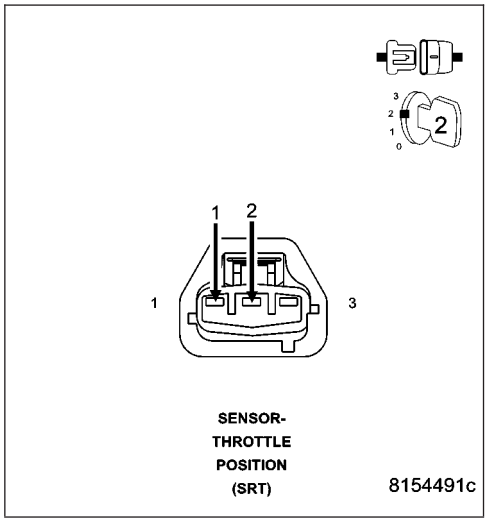
Measure the resistance of the (K22) TP Sensor No.1 Signal circuit from the TP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the excessive resistance in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



8. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

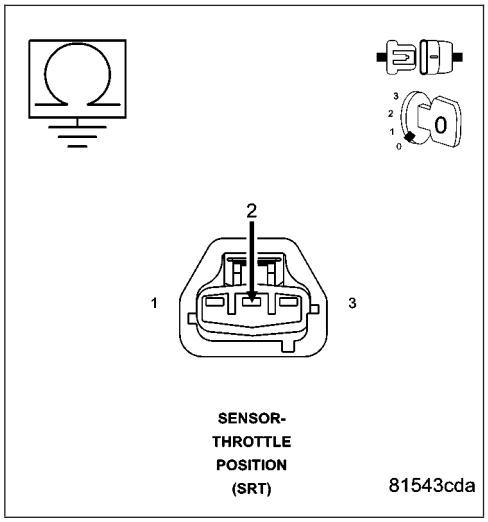
Measure the resistance between ground and the (K22) TP Sensor No.1 Signal circuit at the TP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor No.1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9



P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

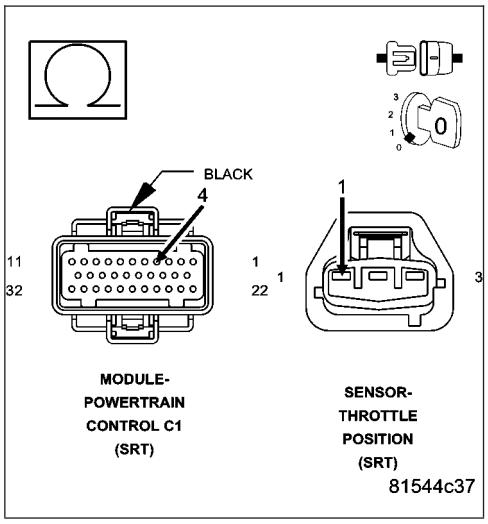
9. RESISTANCE IN (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 16

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



10. EXCESSIVE RESISTANCE IN THE (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

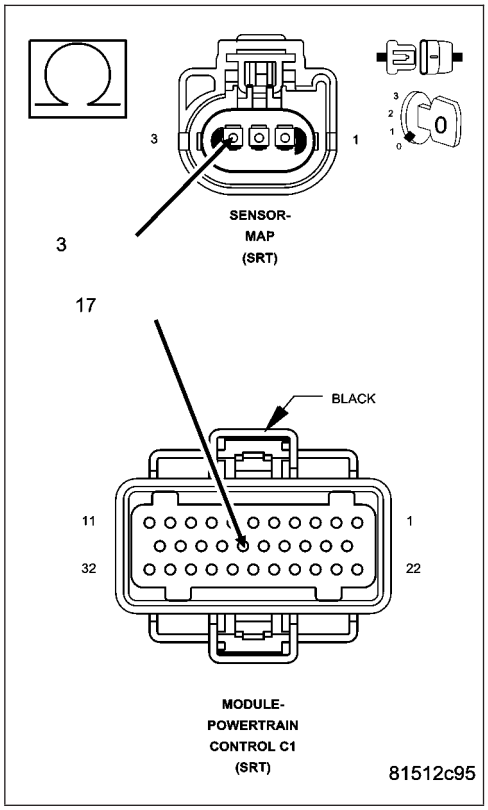
Disconnect the PCM harness connectors.

Measure the resistance of the (F855) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 11

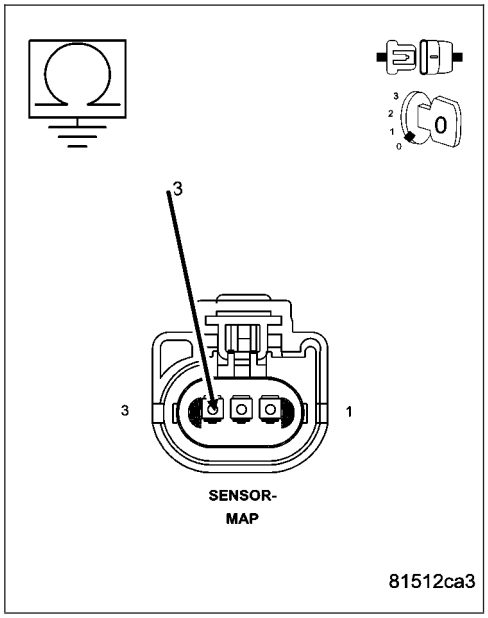
No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

11. MAP (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the MAP Sensor harness connector.



Is the resistance above 100k ohms?

Yes >> Go To 12

No >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. MAP SENSOR

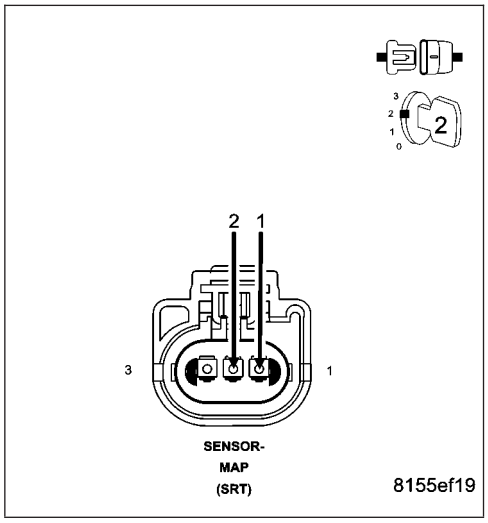
Connect the PCM harness connectors.

Ignition on, engine not running.

With the scan tool, monitor the MAP Sensor voltage.

Connect a jumper wire between the (K1) MAP Sensor Signal circuit and the (K900) Sensor ground circuit.

Cycle the ignition switch from off to on.



Did the voltage change from approximately 4.9 volts to below 0.5 of a volt with the jumper wire inst

Yes >> Replace the MAP Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

NOTE: Remove the jumper wire before continuing.

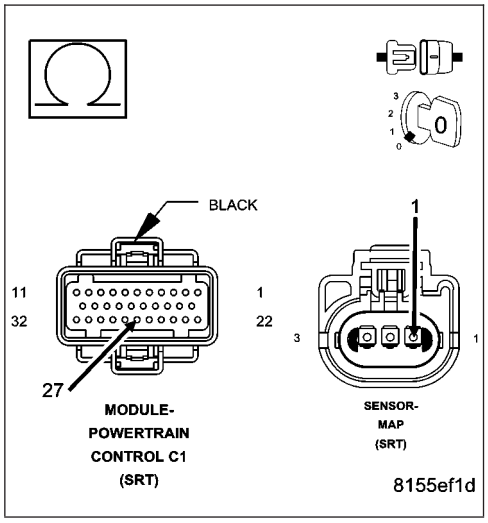
P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

13. EXCESSIVE RESISTANCE IN THE (K1) MAP SENSOR SIGNAL CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K1) MAP Sensor Signal circuit from the MAP Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

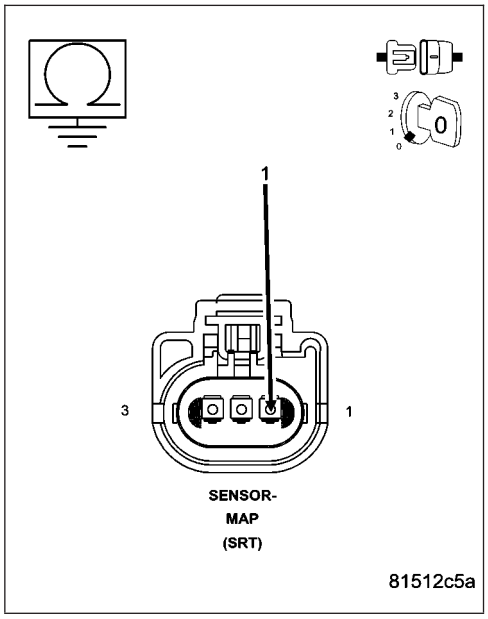
Yes >> Go To 14

No >> Repair the excessive resistance in the (K1) MAP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. SHORT TO GROUND IN THE (K1) MAP SENSOR SIGNAL CIRCUIT

Measure the resistance between ground and the (K1) MAP Sensor Signal circuit at the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Go To 15

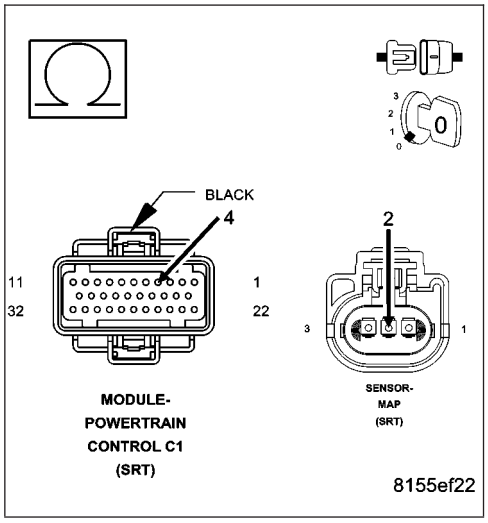
No >> Repair the short to ground in the (K1) MAP Sensor Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0121-TP SENSOR VOLTAGE DOES NOT AGREE WITH MAP (CONTINUED)

15. RESISTANCE IN MAP (K900) SENSOR GROUND CIRCUIT

Measure the resistance of the (K900) Sensor ground circuit from the MAP Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 16

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

16. PCM

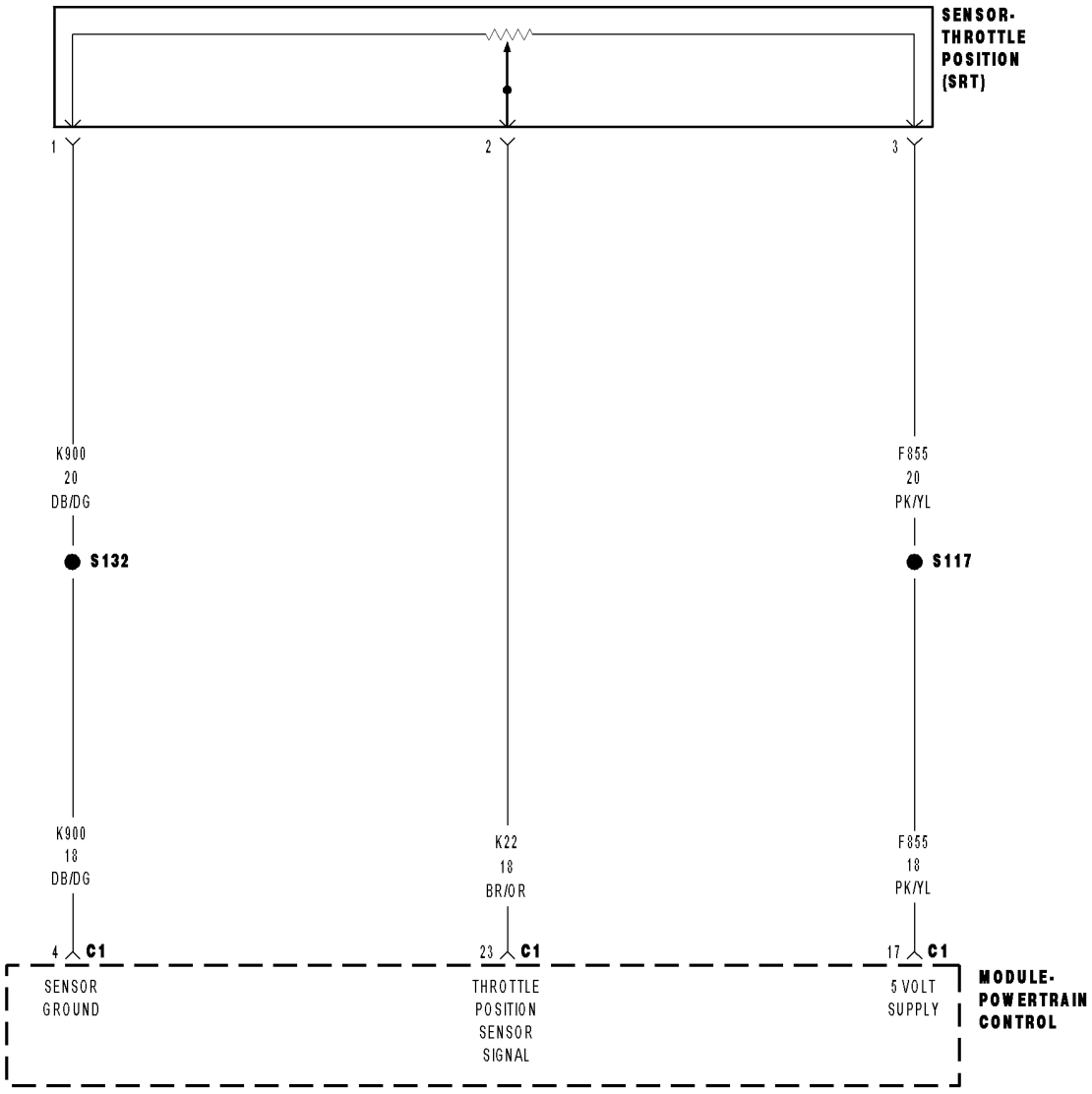
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

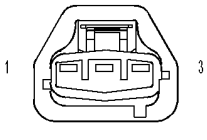
If there are no possible causes remaining, view repair.

Repair

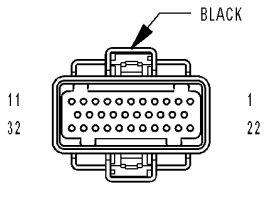
Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW





SENSOR-
THROTTLE
POSITION
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81543b32

P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is less than 0.1 of a volt for 1.3 seconds.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
(K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. THROTTLE POSITION SENSOR VOLTAGE BELOW 0.098 OF A VOLT

Ignition on, engine not running.

With a scan tool, read the TP Sensor voltage.

Is the voltage below 0.2 of a volt?

Yes >> Go To 2

No >> Go To 9

---

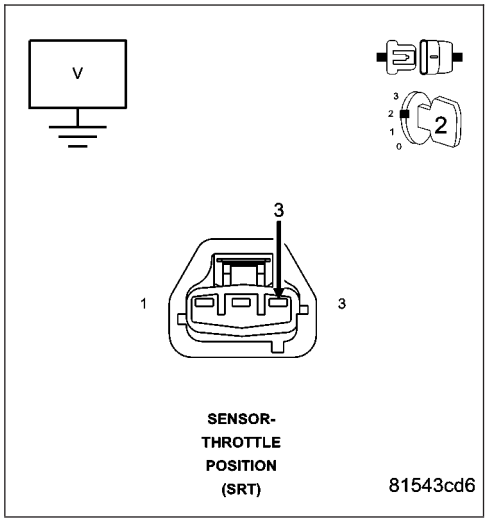
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the TP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW (CONTINUED)

3. THROTTLE POSITION SENSOR

With the a scan tool, monitor the TP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

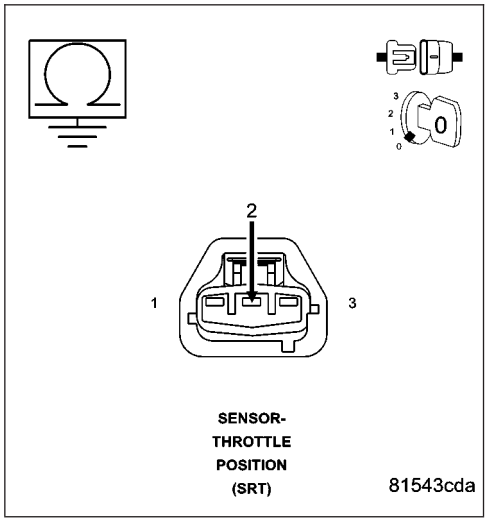
Disconnect the C2 PCM harness connector.

Measure the resistance between ground and the (K22) TP Sensor Signal circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K22) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



---

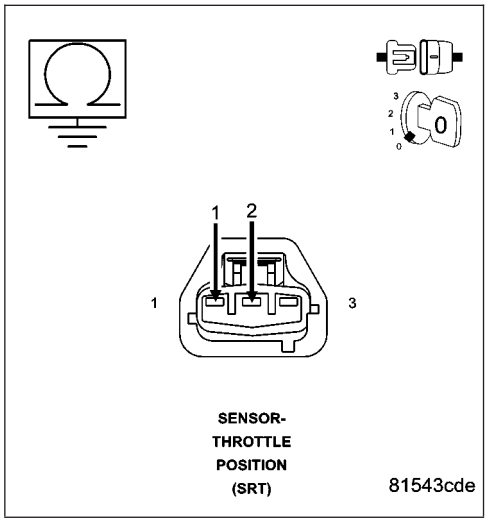
5. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K22) TP Sensor Signal circuit and the (K900) Sensor ground circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K22) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

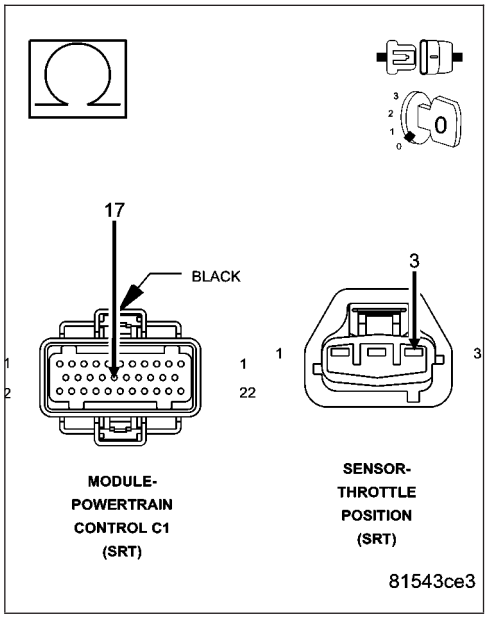
Disconnect the PCM harness connector.

Measure the resistance of the (F855) 5-volt Supply circuit from the TP Sensor harness connector to the appropriate terminal of the PCM.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



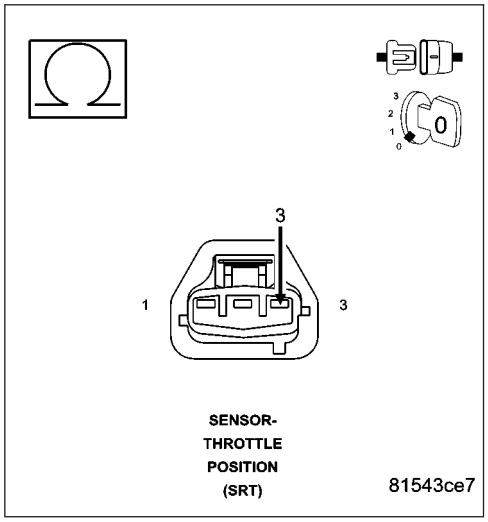
7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



P0122-THROTTLE POSITION SENSOR #1 VOLTAGE TOO LOW (CONTINUED)

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

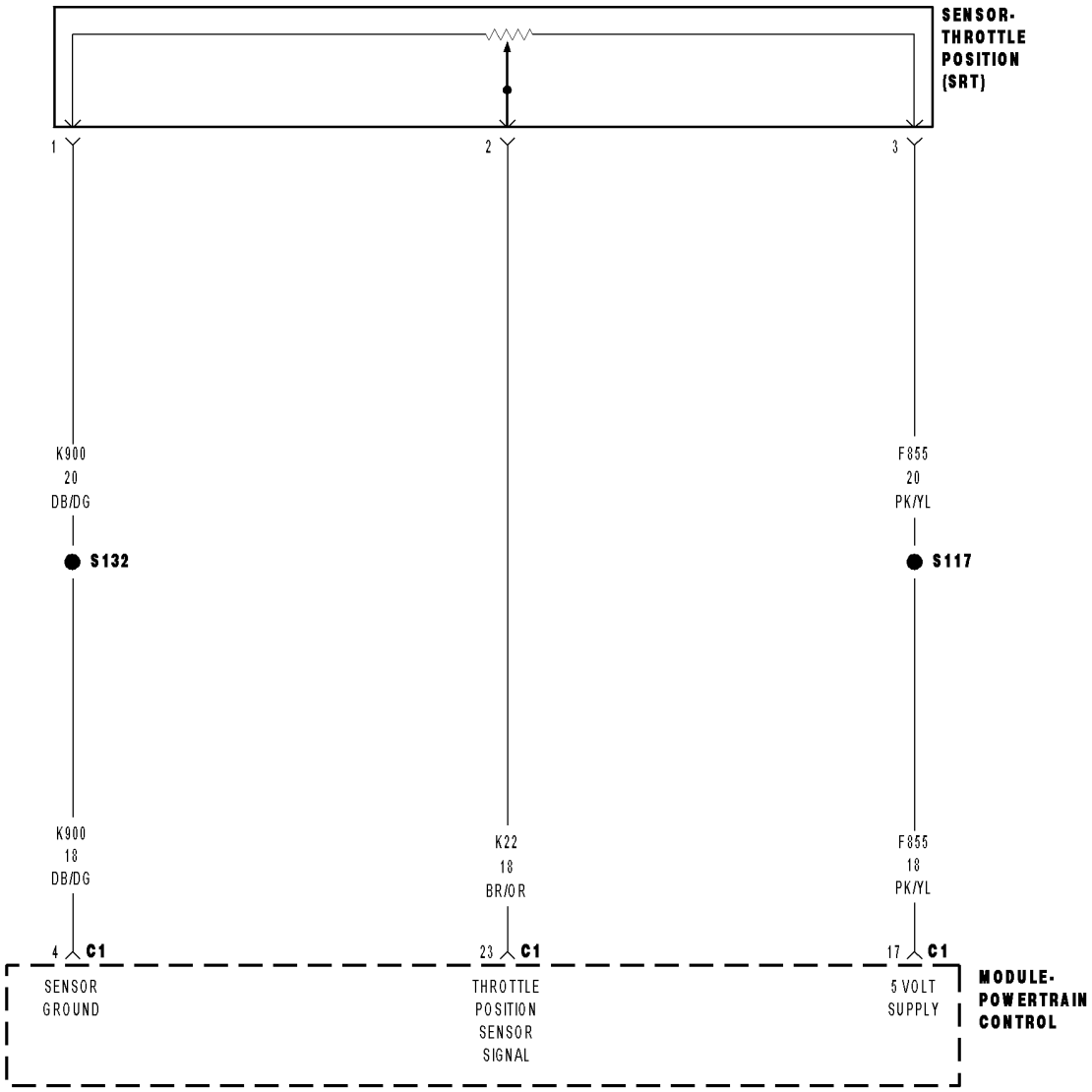
Slowly open the throttle from the idle position to the wide open throttle position.

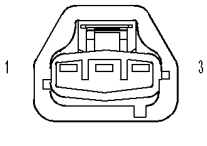
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

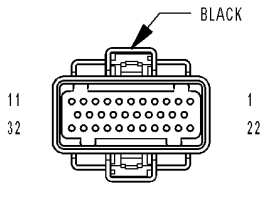
No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH





SENSOR-
THROTTLE
POSITION
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81543b32

P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH (CONTINUED)

For the Engine System Schematic circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  Throttle Position Sensor voltage at the PCM is greater than 4.50 volts for 3.2 seconds.

Possible Causes
(K22) TP SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K22) TP SENSOR SIGNAL CIRCUIT OPEN
(K22) TP SENSOR SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
THROTTLE POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. TP SENSOR VOLTAGE ABOVE 4.5 VOLTS

NOTE: Make sure the throttle is fully closed and free from binding or carbon build up.
Start the engine.
With a scan tool, read the TP Sensor voltage.

Is the voltage above 4.5 volts?

Yes >> Go To 2

No >> Go To 8

P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH (CONTINUED)

2. THROTTLE POSITION SENSOR

Turn the ignition off.

Disconnect the TP Sensor harness connector.

Connect a jumper wire between the (K22) TP Sensor Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

With a scan tool, monitor the TP Sensor voltage.

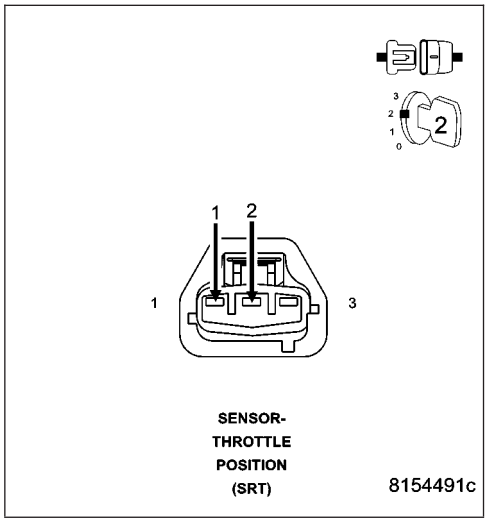
Ignition on, engine not running.

Is the voltage below 0.5 of a volt with the jumper wire installed?

Yes >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (K22) TP SENSOR SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connector.

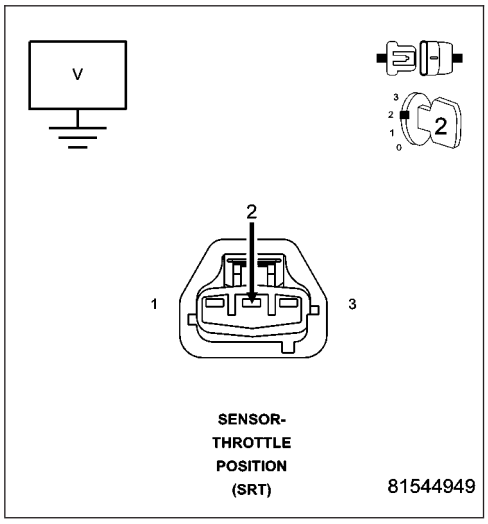
Ignition on, engine not running.

Measure the voltage on the (K22) TP Sensor Signal circuit in the TP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K22) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH (CONTINUED)

4. (K22) TP SENSOR NO.1 SIGNAL CIRCUIT OPEN

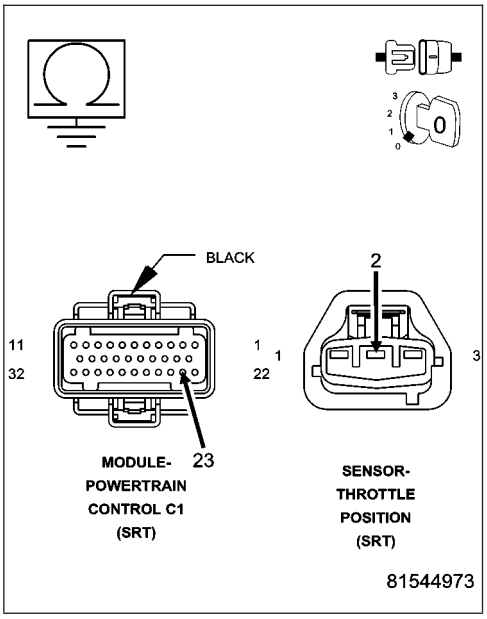
Turn the ignition off.

Measure the resistance of the (K22) TP Sensor Signal circuit from the TP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K22) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



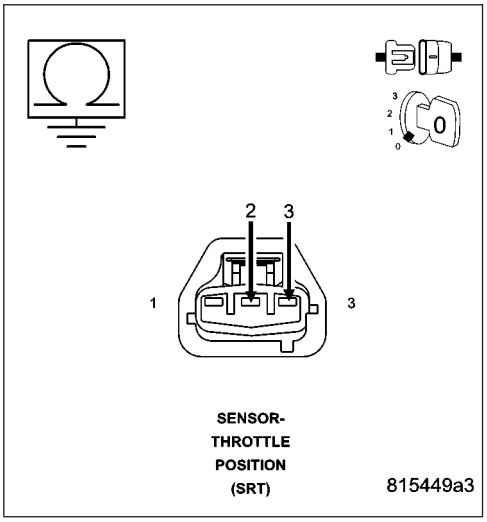
5. (K22) TP SENSOR SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K22) TP Sensor Signal circuit and the (F855) 5-volt Supply circuit in the TP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (K22) TP Sensor Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

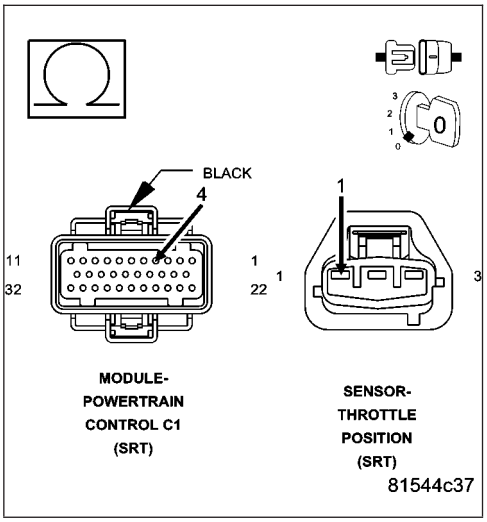
No >> Go To 6



P0123-THROTTLE POSITION SENSOR #1 VOLTAGE TOO HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the TP Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. THROTTLE POSITION SENSOR SWEEP

With a scan tool, monitor the Throttle Position Sensor voltage.

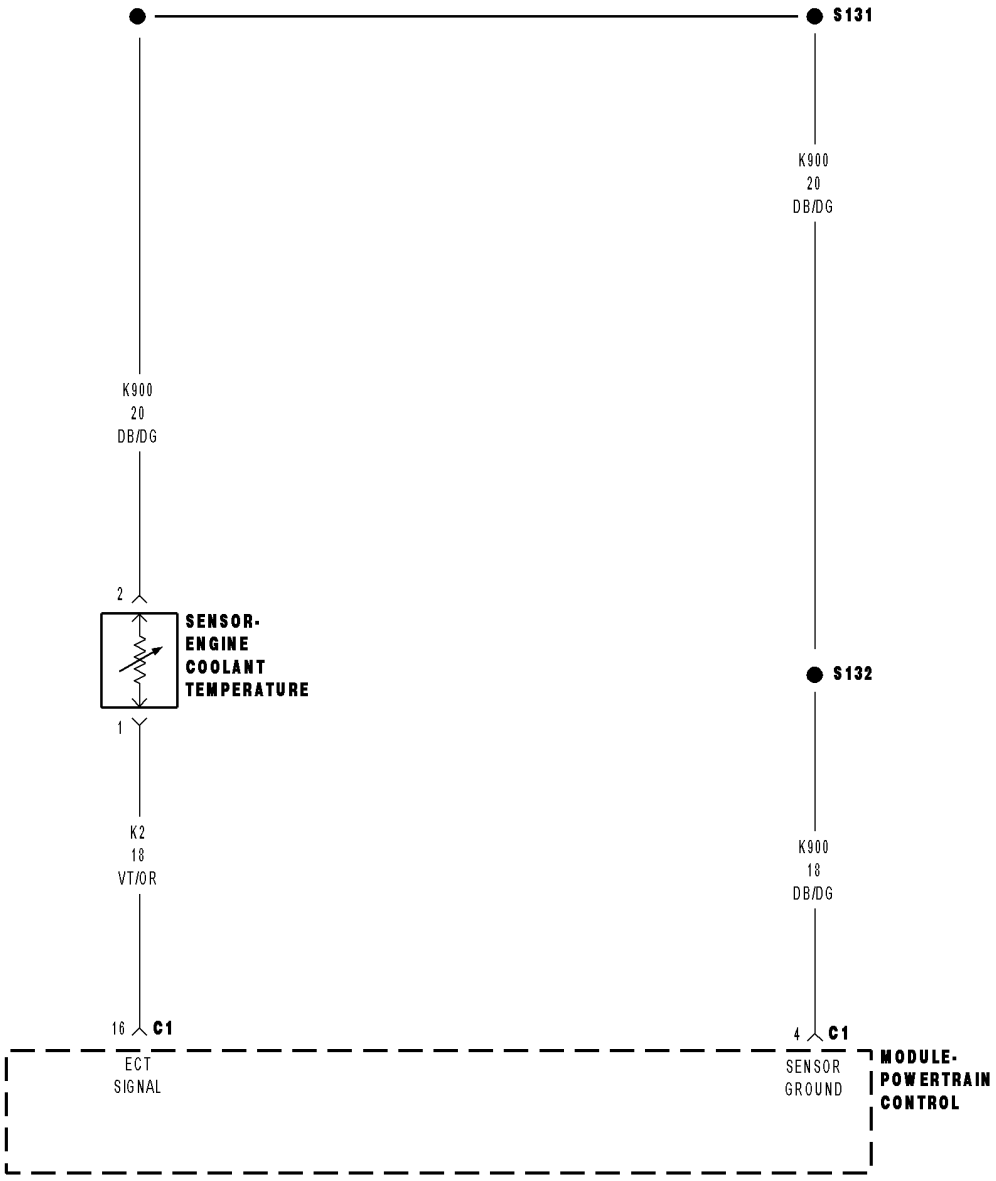
Slowly open the throttle from the idle position to the wide open throttle position.

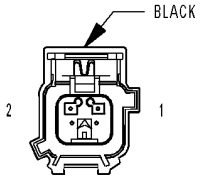
Does voltage start at approximately 0.8 of a volt and go above 3.5 volts with a smooth transition?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

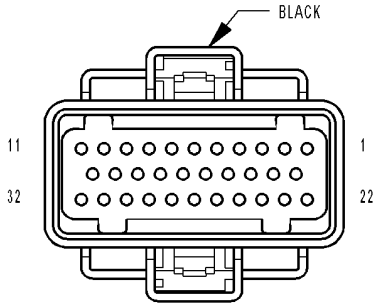
No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL





SENSOR-
ENGINE
COOLANT
TEMPERATURE
(5.7L/SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81536f8b

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

For the Engine System circuit diagrams Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The engine coolant temperature sensor is a negative temperature coefficient thermistor-type sensor whose resistance varies inversely with temperature. At cold temperatures the sensor resistance is high so the voltage is high. As the coolant temperature increases the resistance decreases and the voltage becomes low. The INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL determines if the engine coolant temperature will reach the closed loop fueling control temperature limit in a regulated time after start.

- **When Monitored:**
  With battery voltage greater than 10.4 volts and after engine is started.
- **Set Condition:**
  The engine temperature does not go above -10°C (15°F). Failure time depends on start-up coolant temperature and ambient temperature. (i.e. 2 minutes for a start temp of -10°C (15°F) or up to 10 minutes for a vehicle with a start-up temp of -28°C (5°F). Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
LOW COOLANT LEVEL
THERMOSTAT
ECT SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CHECKING COOLANT LEVEL AND CONDITION

Ignition on, engine not running.

With a scan tool, read DTCs.

NOTE: If an Engine Coolant Temperature (ECT) DTC is set along with this code, diagnose the ECT DTC first.

NOTE: Inspect the ECT terminals and related PCM terminals. Make sure the terminals are free from corrosion and damage.

NOTE: The best way to diagnose this DTC is to allow the vehicle to sit overnight outside in order to have a totally cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may have caused this DTC to set.

WARNING: Never open the cooling system when the engine is hot. The system is under pressure. Extreme burns or scalding may result. Failure to follow these instructions can result in personal injury or death. Allow the engine to cool before opening the cooling system.

Inspect the coolant system for proper level and condition.

Is the coolant level and condition OK?

Yes >> Go To 2

No >> Inspect the vehicle for a coolant leak, make the appropriate repairs, and add the correct amount of coolant.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0125-INSUFFICIENT COOLANT TEMP FOR CLOSED-LOOP FUEL CONTROL (CONTINUED)

2. THERMOSTAT OPERATION

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tool Eng Coolant Tmp Deg values should stay relatively close to each other.

Using the appropriate service information, determine the proper opening temperature of the thermostat.

Did the thermostat open at the proper temperature?

Yes >> Go To 3

No >> Replace the thermostat.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. ECT SENSOR OPERATION

Ignition on, engine not running.

With a scan tool, read the Eng Coolant Tmp Deg value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up monitor the Eng Coolant Tmp Deg value. The temp deg value change should be a smooth transition from start up to normal operating temp 82°C (180°F). Also monitor the actual coolant temperature with a thermometer.

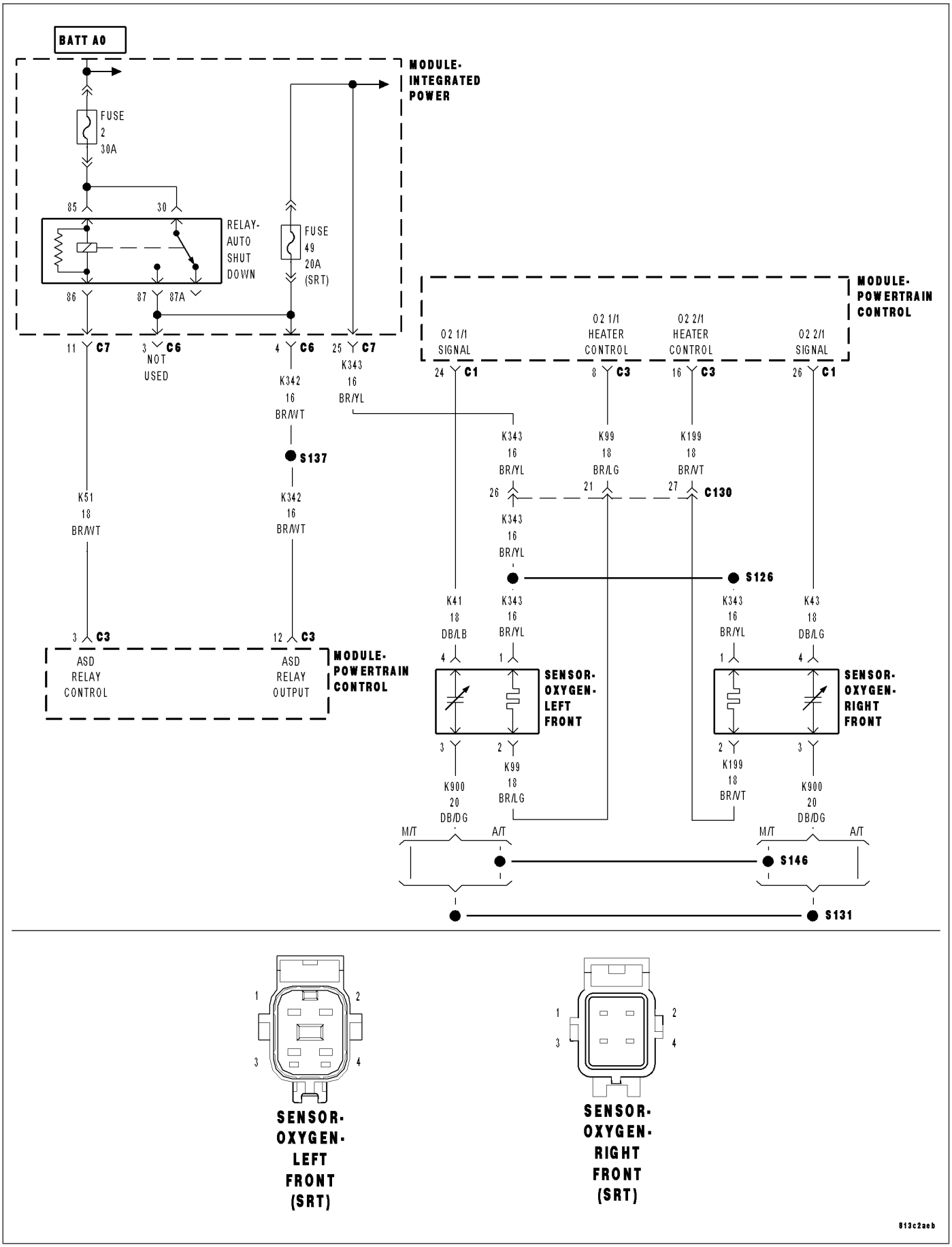
NOTE: As the engine warms up to operating temperature, the actual coolant temperature (thermometer reading) and the scan tools Eng Coolant Tmp Deg value should stay relatively close to each other.

Is the thermometer reading relatively close to the scan tool ECT reading?

Yes >> Test Complete.

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO LOW



P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.
- **Set Condition:**
  The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

Possible Causes
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 0.16 OF A VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage below 0.16 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do no wear loose clothing.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage above 0.16 of a volt?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0131-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO LOW (CONTINUED)

3. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

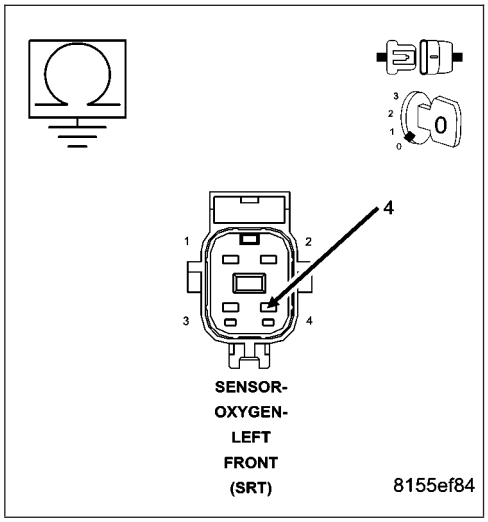
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit at the 1/1 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K41) O2 Sensor 1/1Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



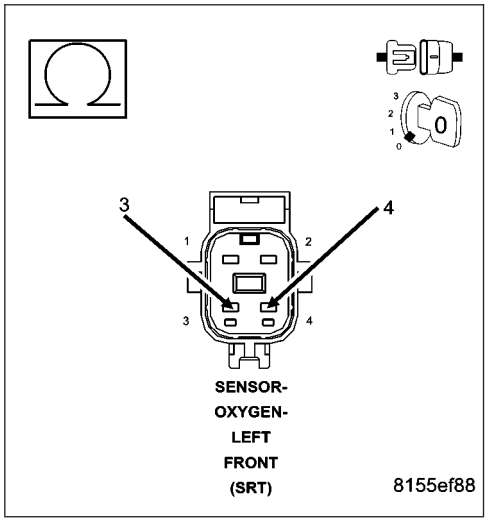
4. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (K900) Sensor ground circuit at the 1/1 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

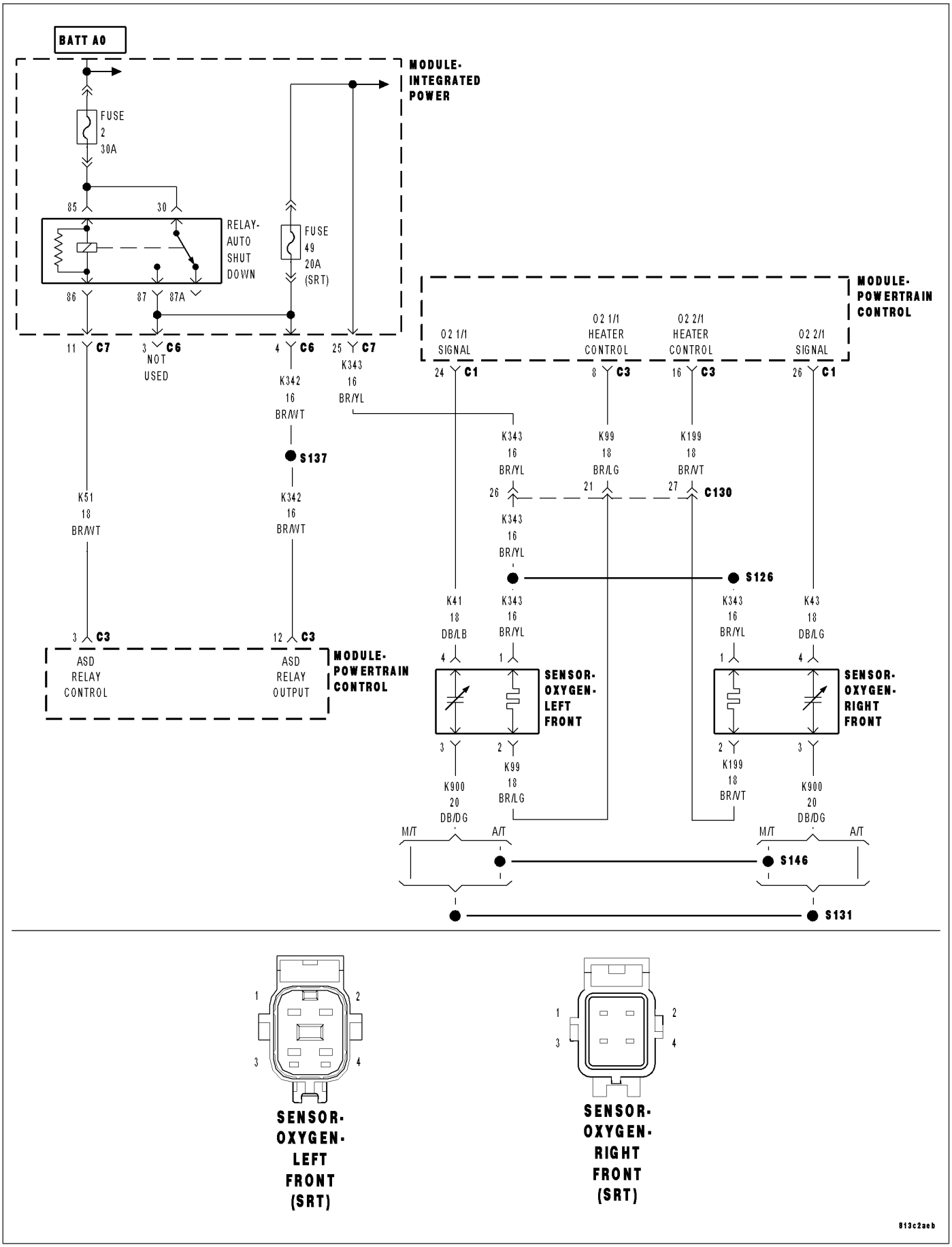
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH



P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagrams (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.
- **Set Condition:**
  The oxygen sensor voltage is above 1.5 volts.

Possible Causes
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT OPEN
(K41) O2 1/1 SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K343) ASD RELAY OUTPUT CIRCUIT OPEN
(K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO THE (K343) ASD RELAY OUTPUT CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 1.5 VOLTS

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage above 1.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

2. (K41) O2 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

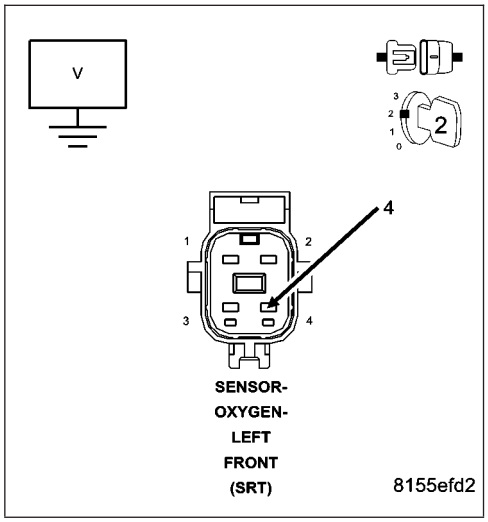
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K41) O2 Sensor 1/1 Signal circuit at the 1/1 O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to voltage in the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT OPEN

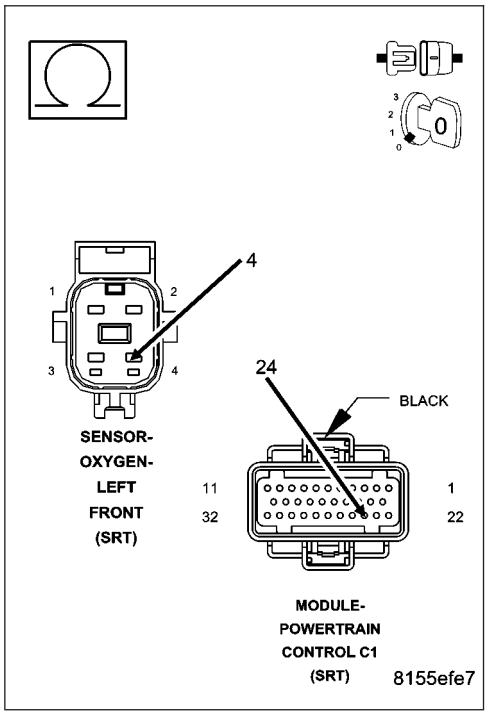
Turn the ignition off.

Measure the resistance of the (K41) O2 Sensor 1/1 Signal circuit from the O2 Sensor harness connector to the C1 PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

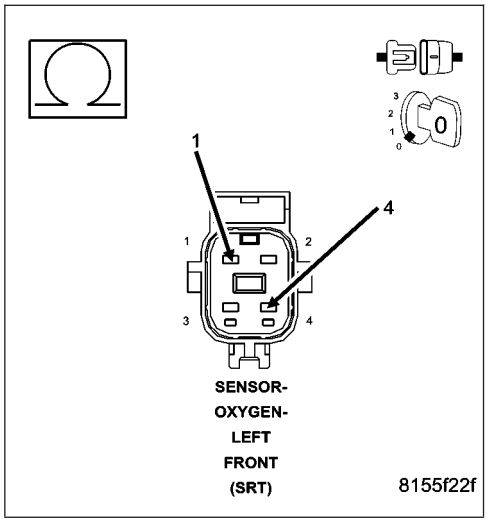
No >> Repair the open in the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

4. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO THE (K343) ASD RELAY OUTPUT CIRCUIT

Measure the resistance between the (K41) O2 Sensor 1/1 Signal circuit and the (K343) ASD Relay Output circuit at the O2 Sensor harness connector.



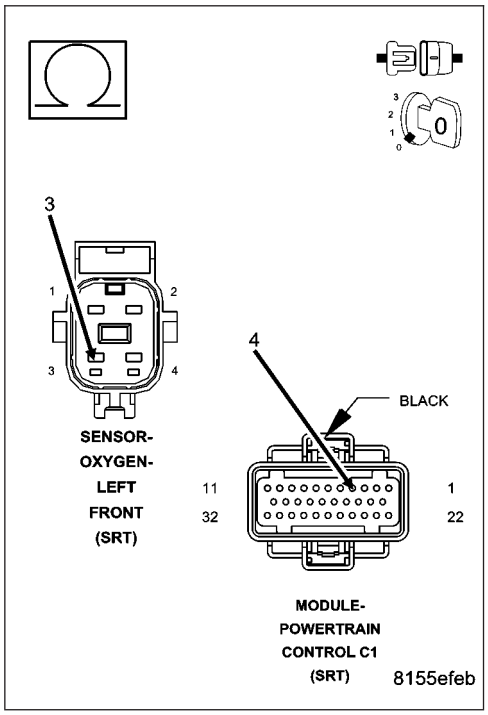
Is the resistance below 100 ohms?

Yes >> Repair the short between the O2 Sensor Signal circuit and the (K343) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the O2 Sensor harness connector to the C1 PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

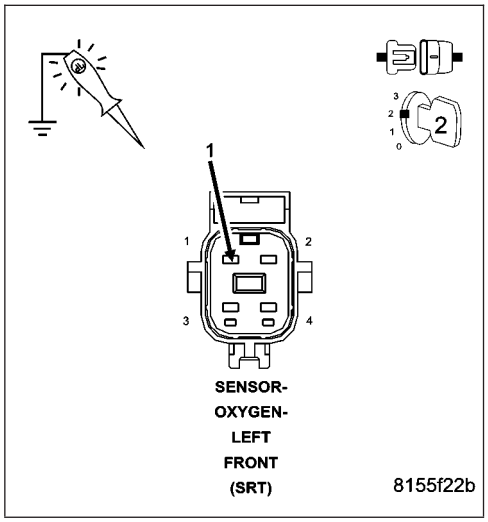
6. (K343) ASD RELAY OUTPUT CIRCUIT OPEN

Connect the PCM harness connectors.

Ignition on, engine not running.

With the scan tool actuate the O2 Heater Test.

Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit.



Does the test light illuminate brightly?

Yes >> Go To 7

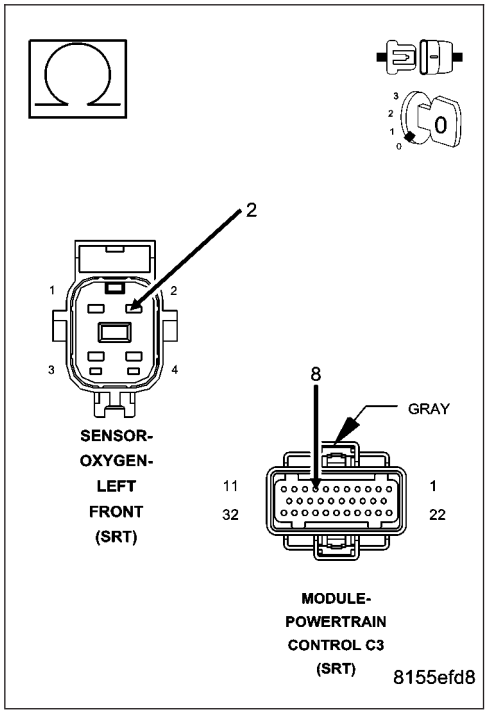
No >> Repair the open in the (K343) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (K99) O2 SENSOR 1/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance of the (K99) O2 Sensor 1/1 Heater Control circuit from the O2 Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K99) O2 Sensor 1/1 Heater Control Circuit (PWM) circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0132-O2 SENSOR 1/1 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

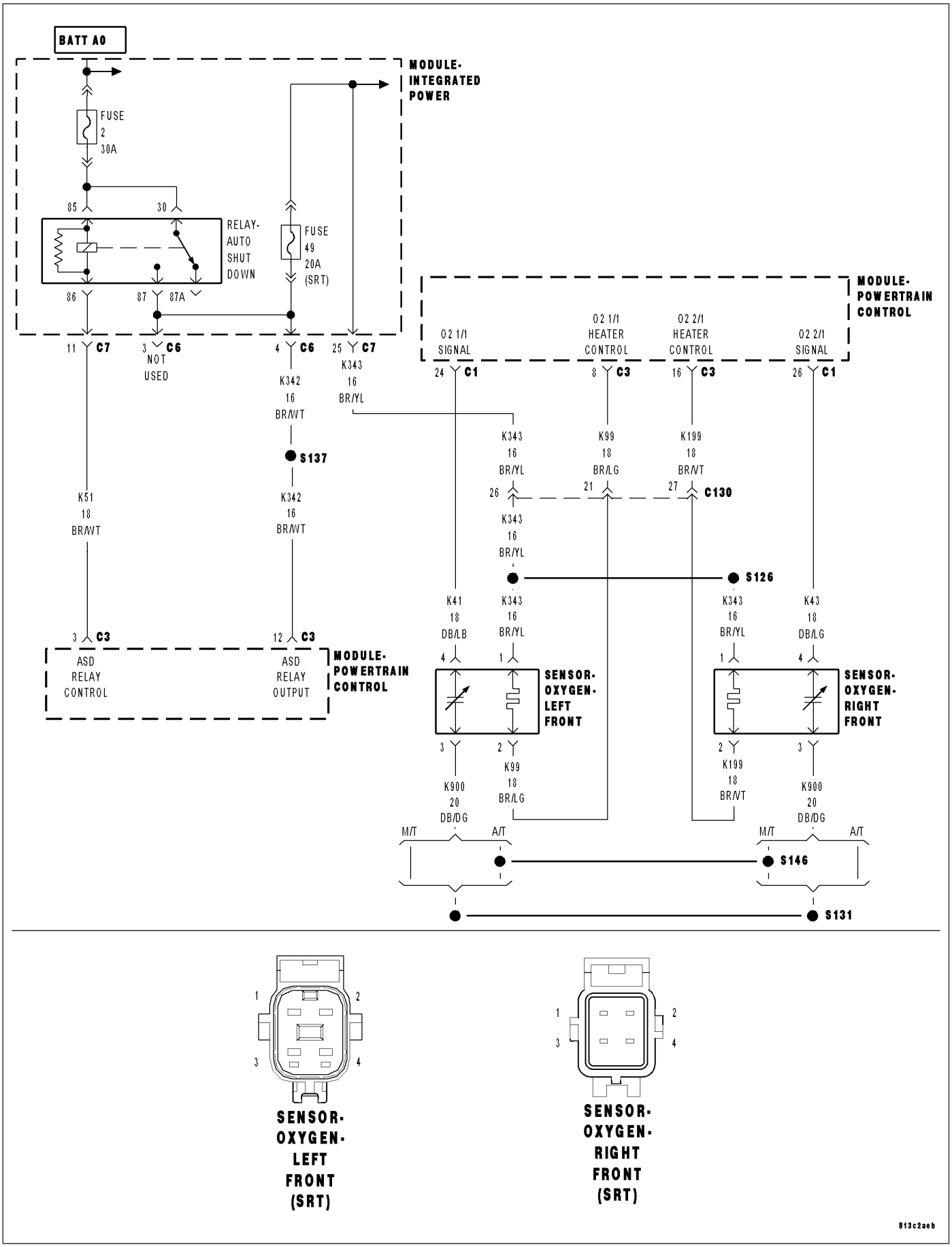
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0133-O2 SENSOR 1/1 SLOW RESPONSE



P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
(K41) O2 1/1 SIGNAL CIRCUIT
(K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0133-O2 SENSOR 1/1 SLOW RESPONSE (CONTINUED)

3. (K41) O2 1/1 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off.

While backprobing, measure the voltage of the (K41) O2 Sensor 1/1 Signal circuit between the 1/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection and are connected for positive polarity.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

While backprobing, measure the voltage of the (K900) Sensor ground circuit between the 1/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.

---

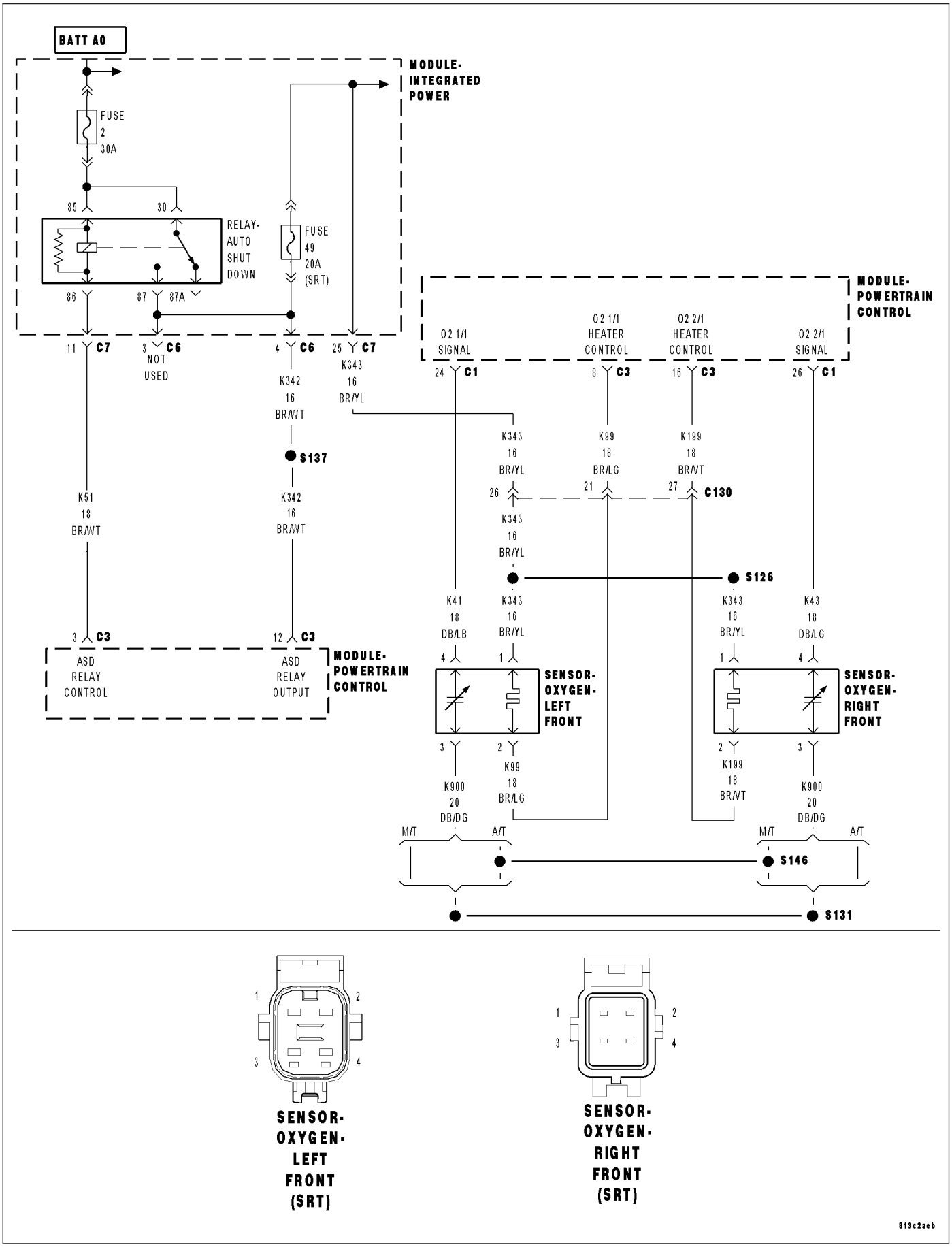
5. O2 SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE



P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.
- **Set Condition:**
  O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

Possible Causes
(K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN
(K99) O2 1/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K343) O2 FUSED ASD RELAY OUTPUT CIRCUIT OPEN
(K343) O2 FUSED ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 1/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 1/1 O2 Sensor connector between the (K99) O2 Heater Control terminal and the (K343) Fused ASD relay output terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 3.3 and 4.1 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

3. (K99) O2 1/1 HEATER CONTROL CIRCUIT OPEN

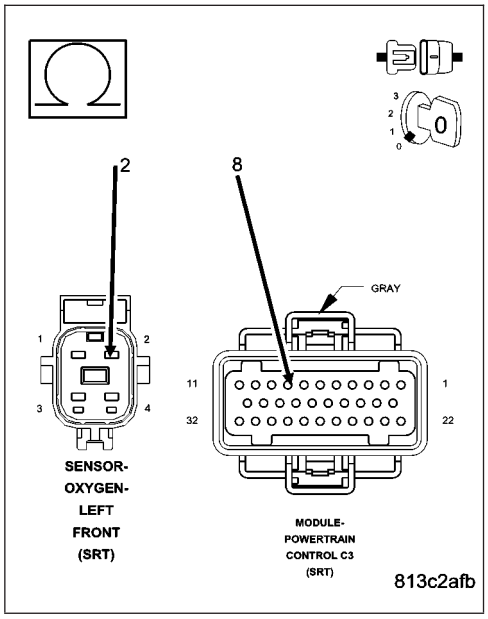
Disconnect the C3 PCM harness connector.

Measure the resistance of the (K99) O2 1/1 Heater Control circuit from the O2 harness connector to the PCM harness connector.

Is the resistance below 5 ohmS?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K99) O2 1/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K343) O2 1/1 FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Measure the resistance of the (K343) O2 1/1 Fused ASD Relay Output circuit, from the relay terminal to the O2 Sensor harness connector.

Is the resistance below 5 ohms?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K343) O2 1/1 Fused ASD relay output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K343) O2 1/1 FUSED ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K343) O2 1/1 Fused ASD Relay Output circuit in the O2 Sensor harness connector.

Is the resistance below 5 ohms?

Yes >> Repair the short to ground in the (K343) O2 1/1 Fused ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0135-O2 SENSOR 1/1 HEATER PERFORMANCE (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

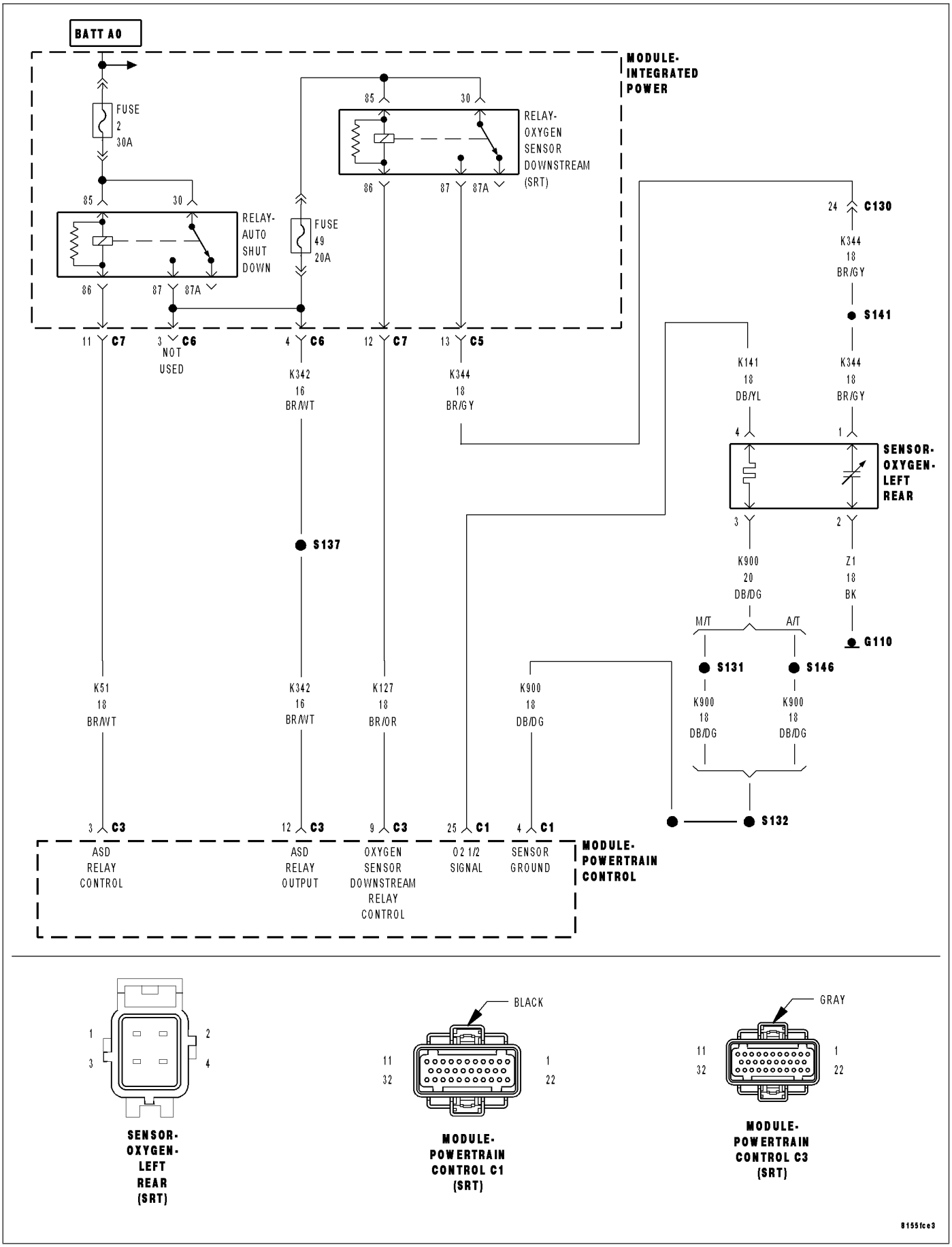
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION



P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition ON, with battery voltage greater than 10.4 volts.
- **Set Condition:**
  The state of the PCM relay control circuit, between the PCM and relay coil, does not match the desired state.

Possible Causes
O2 SENSOR HEATER RELAY
(K343) FUSED ASD RELAY OUTPUT CIRCUIT
(K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN
(K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the Scan Tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR HEATER RELAY

Turn the ignition off.

Remove the Heater Relay from the PDC.

Measurement is taken at the Heater Relay component.

Measure the resistance of the O2 Sensor Heater Relay Coil.

Is the resistance above 100 ohms?

Yes >> Replace the O2 Sensor Heater Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION (CONTINUED)

3. (K344) FUSED ASD RELAY OUTPUT CIRCUIT

Ignition on, engine not running.

With the Scan Tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K344) Fused ASD Relay Output circuit of the O2 Heater Relay in the PDC.

Does the test light illuminate brightly when the relay actuates?

Yes >> Go To 4

No >> Repair the open or short to ground in the ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K127) O2 Heater Relay Control circuit from the PDC (Heater Relay) connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K127) O2 Heater Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K127) O2 Heater Relay Control circuit at the PDC connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K127) O2 Sensor Heater Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. O2 HEATER ELEMENT

NOTE: Allow the O2 Sensor to cool to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element component side.

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance between 4.0 and 5.0 ohms at 70° F (21.1°C)?

Yes >> Go To 7

No >> Replace the O2 Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0136-O2 SENSOR 1/2 HEATER CIRCUIT MALFUNCTION (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

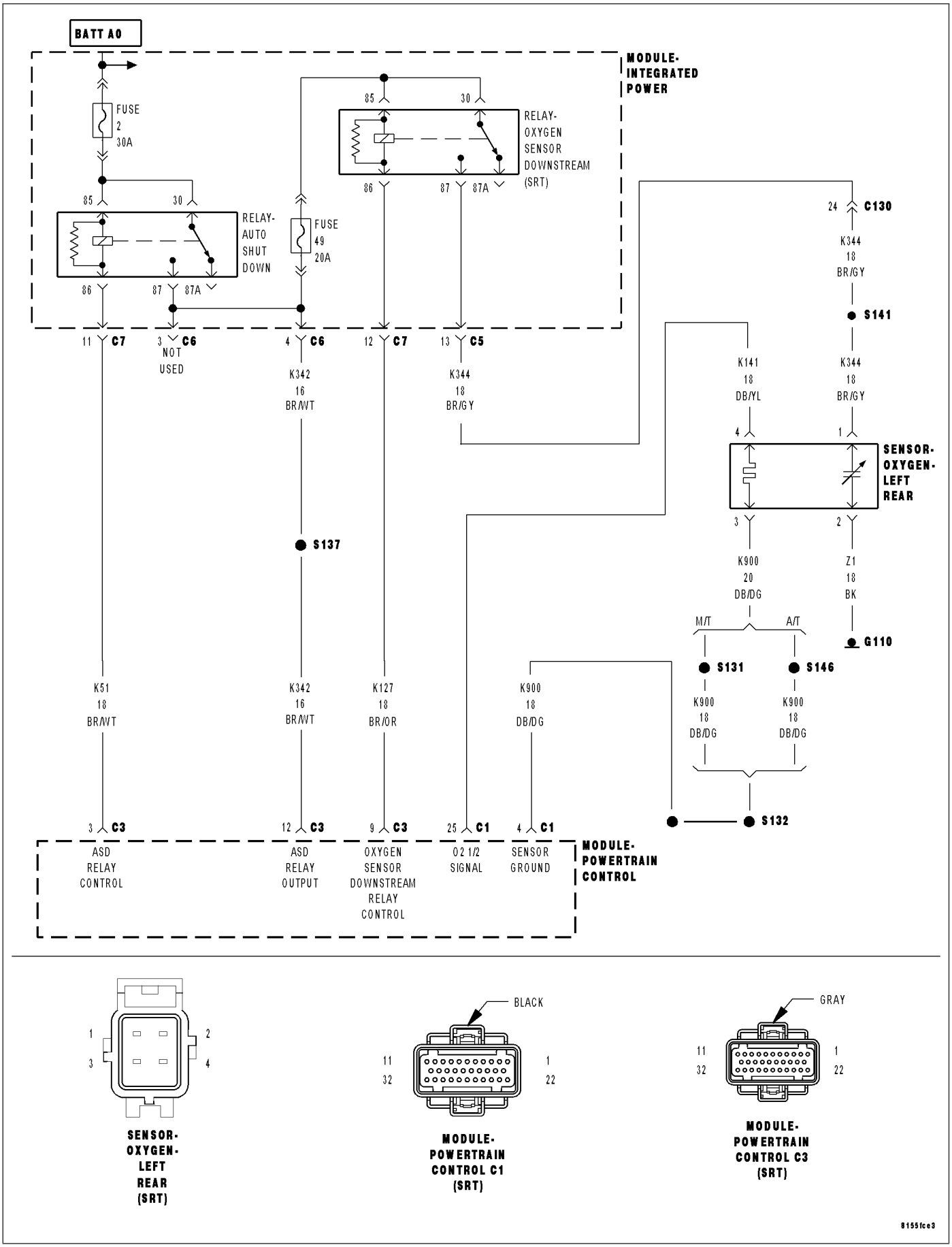
If there are not possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0137-O2 SENSOR 1/2 CIRCUIT LOW



P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.
- **Set Condition:**
  The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

Possible Causes
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K141) O2 SENSOR 2/1 SIGNAL SHORTED TO THE (Z1) HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 0.16 OF A VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage below 0.16 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage above 0.16 of a volt?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

3. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

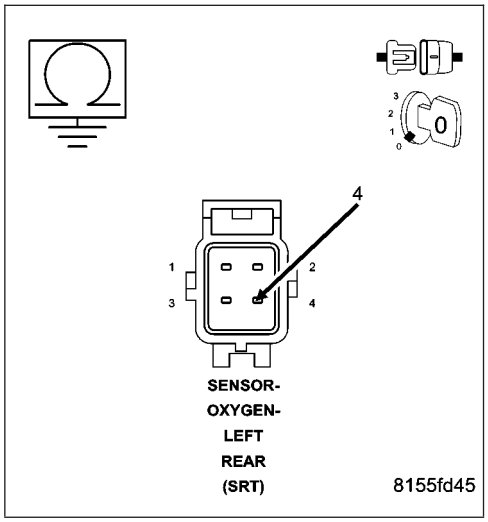
Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K141) O2 Sensor 1/2 Signal circuit at the 1/2 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K141) O2 Sensor 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



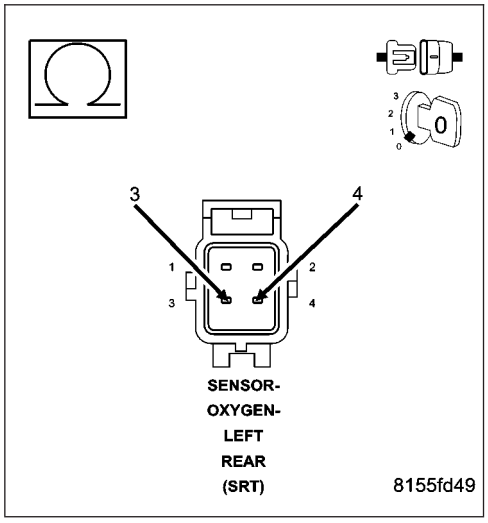
4. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K141) O2 Sensor 1/2 Signal circuit and the (K900) Sensor ground circuit at the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K141) O2 Sensor 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

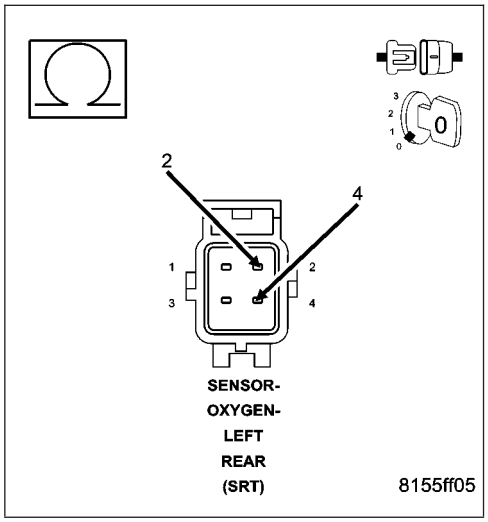
No >> Go To 5



P0137-O2 SENSOR 1/2 CIRCUIT LOW (CONTINUED)

5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO (Z1) HEATER GROUND CIRCUIT

Measure the resistance between the (K141) O2 Sensor 1/2 Signal circuit and the (Z1) O2 Sensor Heater ground circuit if it applies to the O2 Sensor being tested.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K141) O2 Sensor 1/2 Signal circuit and the (Z1) Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

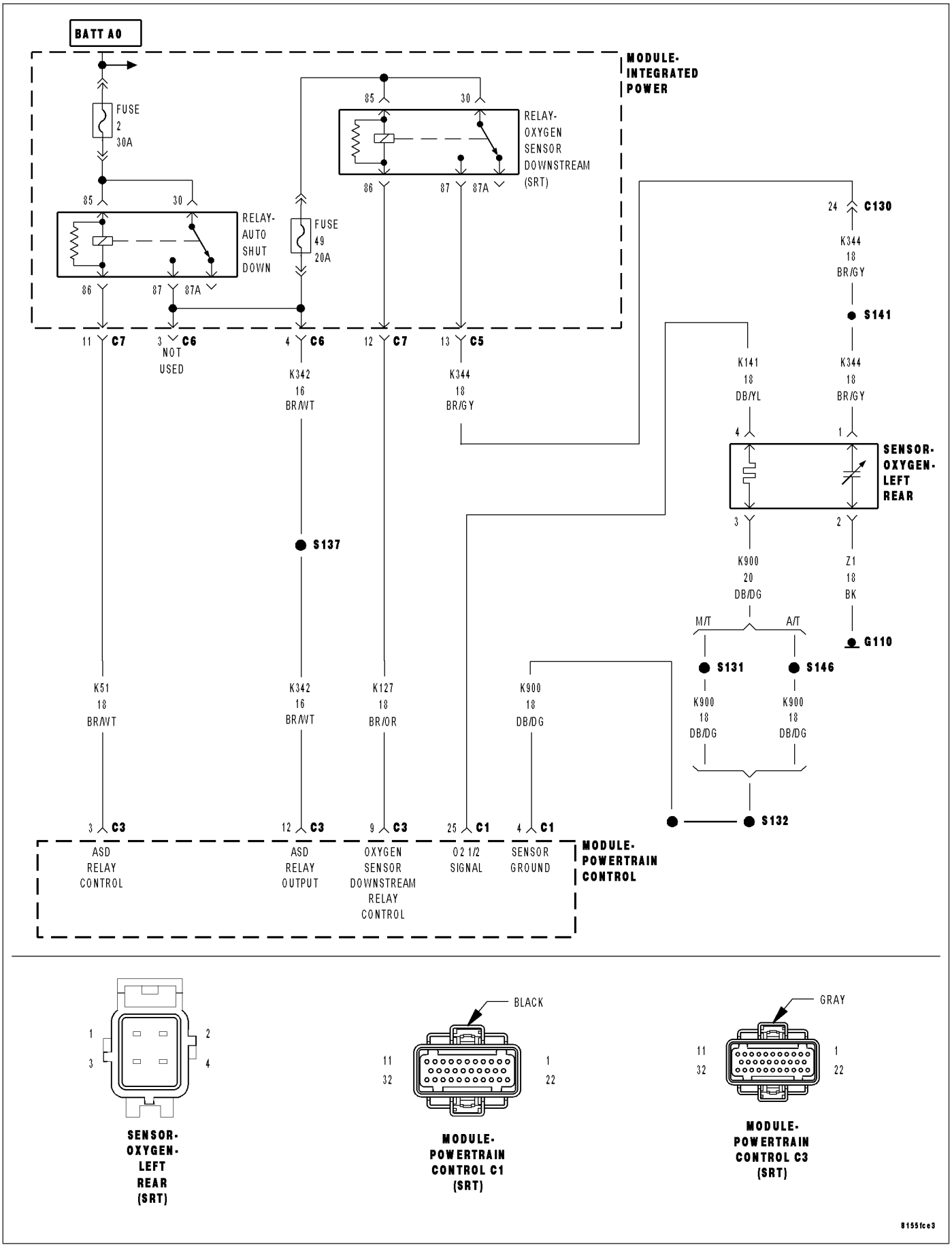
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0138-O2 SENSOR 1/2 CIRCUIT HIGH



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.
- **Set Condition:**
  The oxygen sensor voltage is above 1.5 volts.

Possible Causes
(K141) O2 SENSOR 1/2 SIGNAL SHORTED TO VOLTAGE
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT OPEN
(K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO THE (K344) O2 HEATER RELALY OUPUT CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
(Z1) O2 SENSOR HEATER GROUND CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 1.5 VOLTS

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage above 1.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operatind, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Turn the ignition off.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage below 1.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

3. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

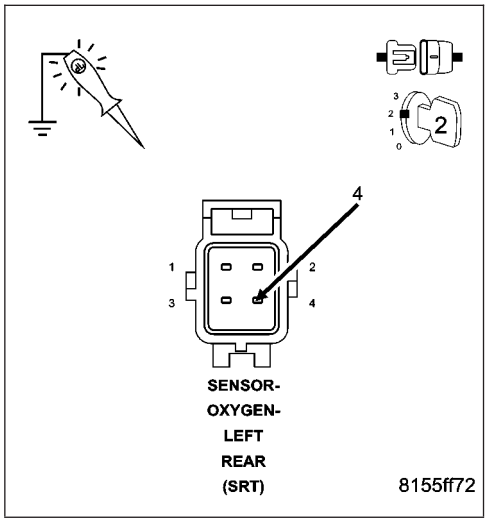
Using a 12-volt test light connected to ground, probe the (K141) O2 Sensor 1/2 Signal circuit at the 1/2 O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to voltage in the (K141) O2 Sensor 1/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

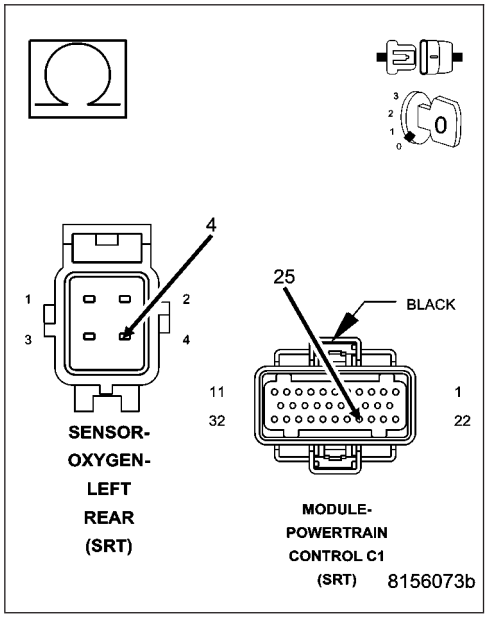
Measure the resistance of the (K141) O2 Sensor 1/2 Signal circuit from the 1/2 O2 Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K141) O2 Sensor 1/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

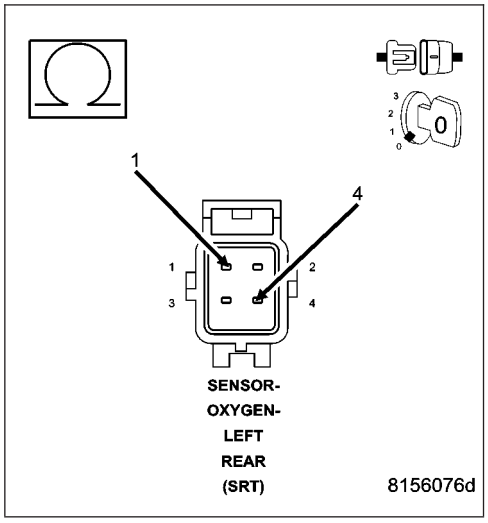
5. (K141) O2 SENSOR 1/2 SIGNAL CIRCUIT SHORTED TO THE (K344) O2 HEATER RELAY OUTPUT CIRCUIT

Measure the resistance between the (K141) O2 Sensor 1/2 Signal circuit and the (K344) O2 Heater Relay Output circuit at the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K141) O2 Sensor 1/2 Signal circuit and the (K344) O2 Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



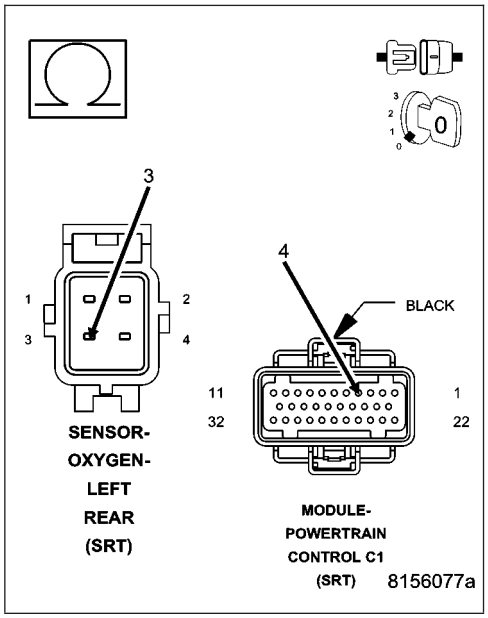
6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the 1/2 O2 Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0138-O2 SENSOR 1/2 CIRCUIT HIGH (CONTINUED)

7. (K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT OPEN

Connect the PCM harness connectors.

Ignition on, engine not running.

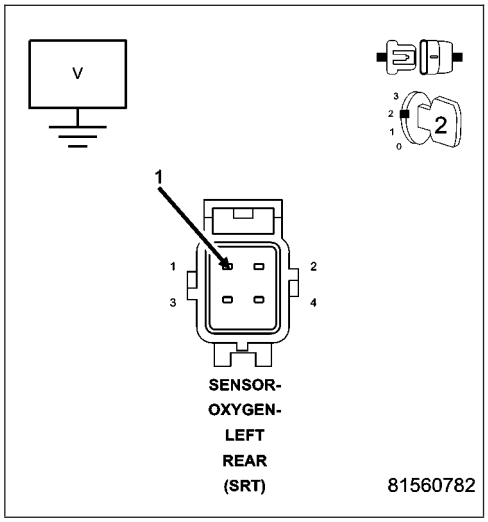
With the scan tool actuate the O2 Heater Test.

Measure the voltage on the (K344) O2 Sensor Heater Relay Output circuit.

Is the voltage above 11.0 volts?

No >> Repair the open in the (K344) O2 Sensor Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Yes >> Go To 8



8. (Z1) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Turn the ignition off.

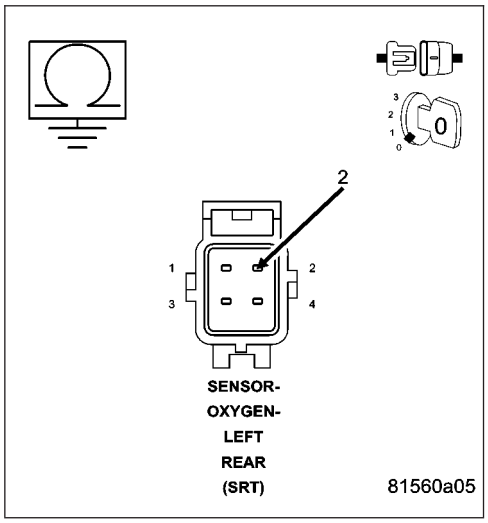
Disconnect the PCM harness connectors.

Measure the resistance between ground and the (Z1) O2 Sensor Heater ground circuit from the 1/2 O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (Z1) O2 Sensor Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

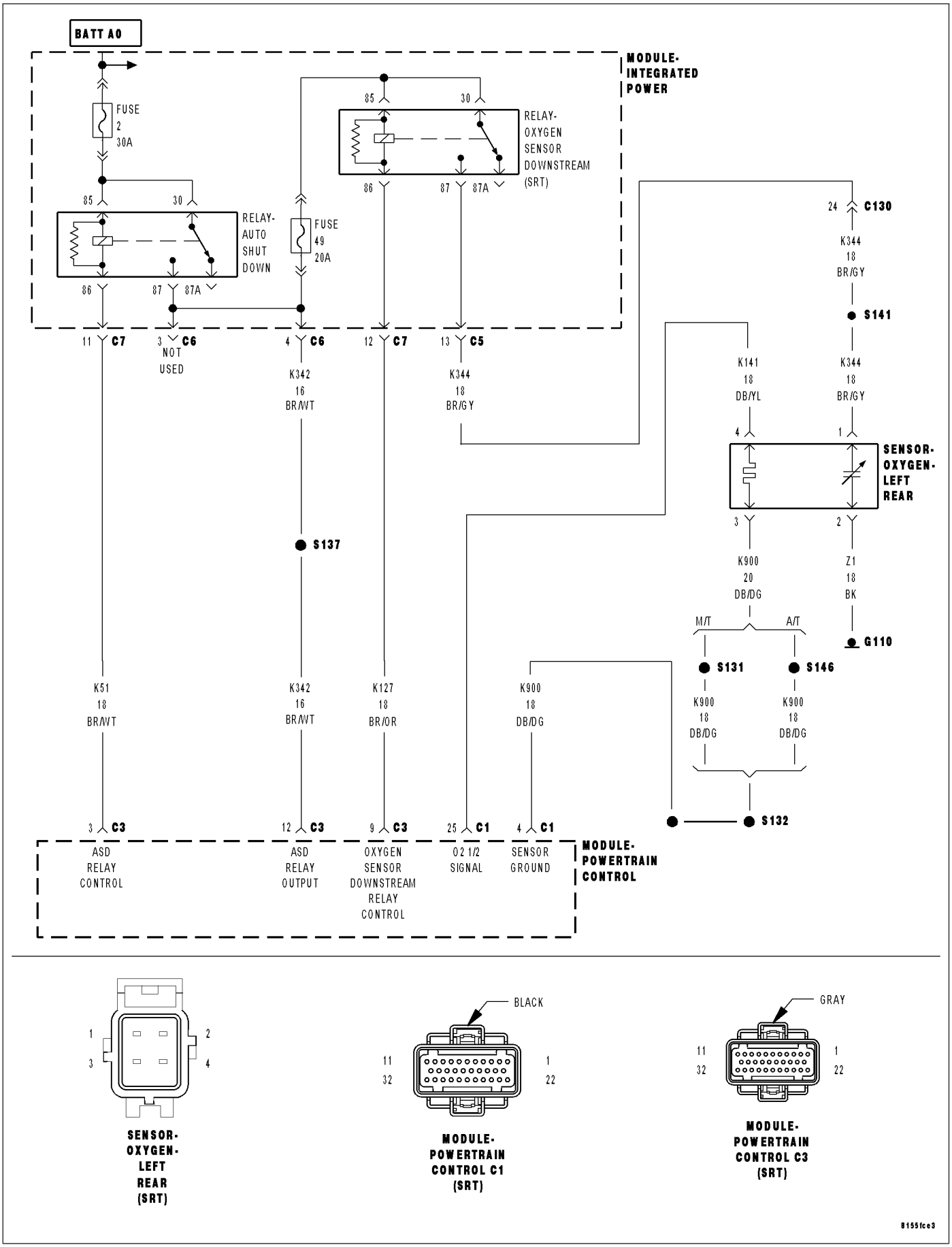
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0139-O2 SENSOR 1/2 SLOW RESPONSE



P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The downstream O2 Sensor is located in the exhaust path behind the catalytic converter, is monitored for proper response to assure optimum catalytic converter efficiency. The downstream O2 response monitor is intended to diagnose a downstream O2 sensor that is not moving or stuck in a voltage window and to insure accurate information for catalyst monitor diagnosis.

- **When Monitored:**
  Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
(K141) O2 1/2 SIGNAL CIRCUIT
(K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0139-O2 SENSOR 1/2 SLOW RESPONSE (CONTINUED)

3. (K141) O2 1/2 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off

Ignition on, engine not running.

With a voltmeter, back probe the (K141) O2 Sensor Signal circuit at the 1/2 O2 Sensor harness connector and the PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection and are connected for positive polarity.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K141) O2 Sensor 1/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

With a voltmeter, back probe the (K900) Sensor ground circuit at the 1/2 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

NOTE: Turn the ignition off before continuing.

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

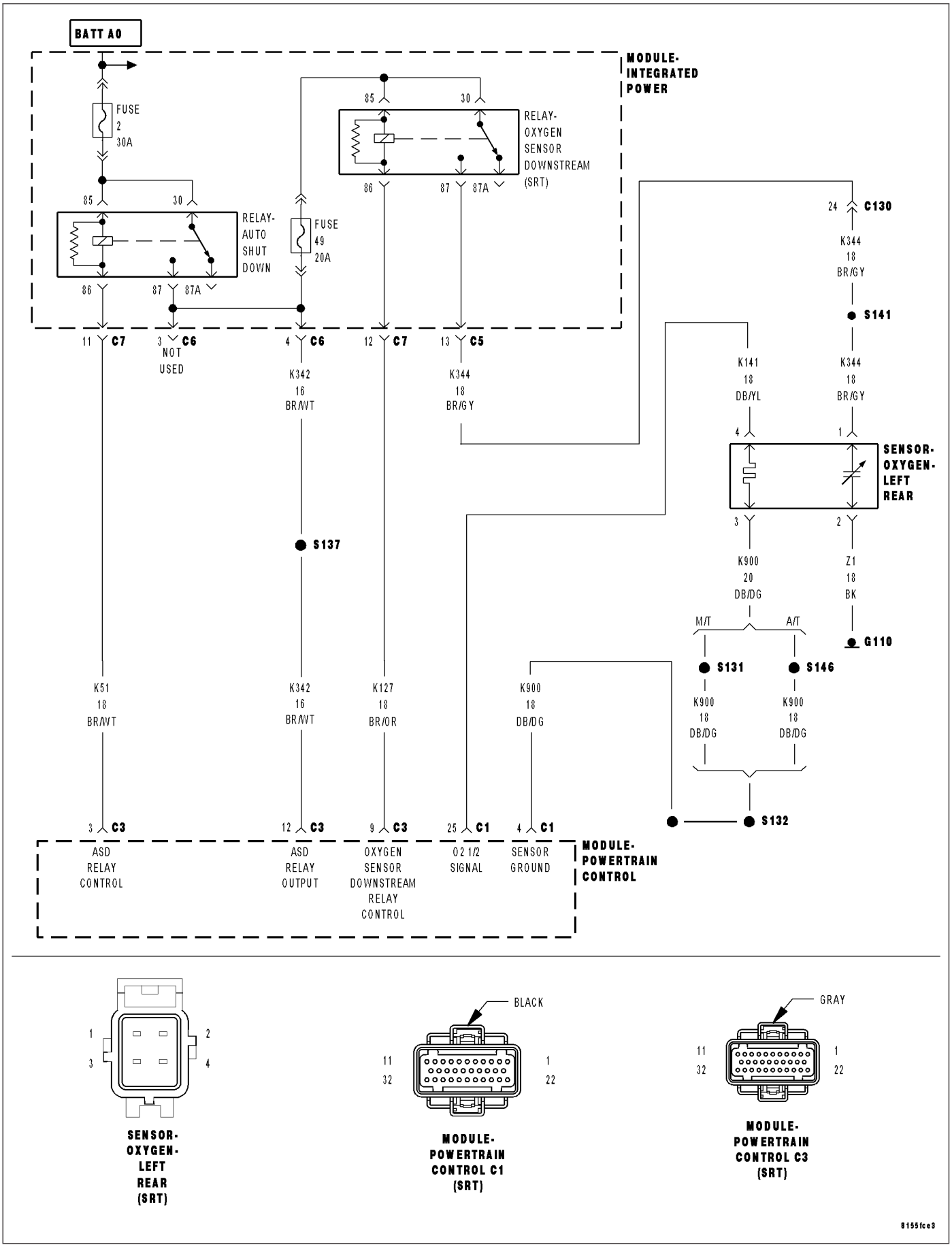
5. O2 SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE



P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

This diagnostic provides a continuous check of the O2 heater circuit during operation. The heater circuit is momentarily disabled to allow a resistance measurement to be taken to infer heater temperature. The current delivery to the heater is duty cycled to maintain a specific target temperature. The error from the target temperature is continuously monitored to assess heater performance.

- **When Monitored:**
  With battery voltage greater than 10.5 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.
- **Set Condition:**
  O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

Possible Causes
(K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT OPEN
(K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT SHORTED TO GROUND
(K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN
(K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(Z1) HEATER GROUND CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

With the scan tool, monitor O2 Sensor voltage for at least 2 minutes.

Does the voltage stabilize between 0.1 and 0.3 of a volt during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance across the O2 Sensor Heater element component side.

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance between 4.0 and 5.0 ohms at 70° F (21.1°C)?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

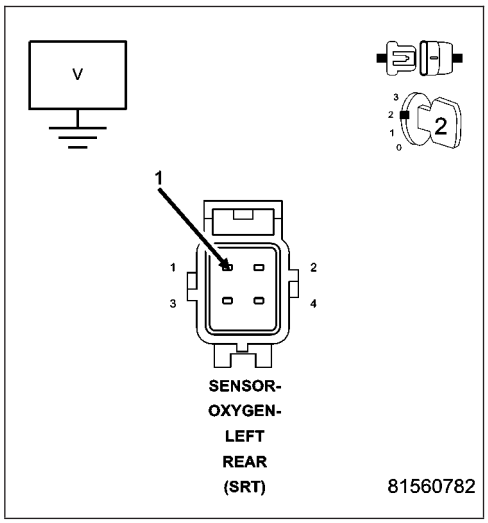
---

3. (K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT

Ignition on, engine not running and the O2 Sensor still disconnected.

With the scan tool, actuate the O2 Heater Test.

Using a 12-volt test light connected to ground, probe the (K344) O2 Heater Relay Output circuit at the O2 Sensor harness connector.



Does the light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (K344) O2 Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Remove the O2 Heater Relay.

Measure the resistance of the (K127) O2 Heater Relay Control circuit from the O2 Heater Relay to the PCM harness connector.

Is the resistance below 5.0 ohms?

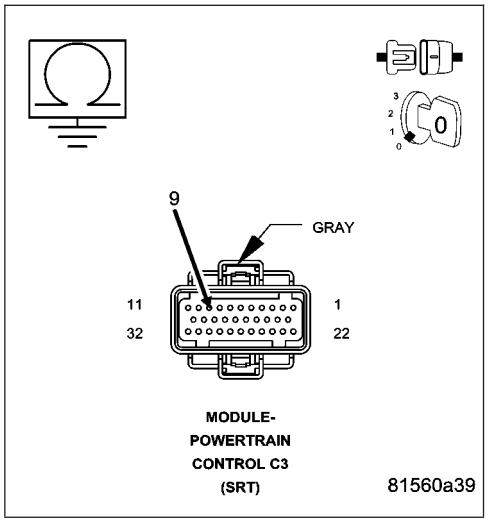
Yes >> Go To 5

No >> Repair the excessive resistance in the (K127) O2 Heater Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0141-O2 SENSOR 1/2 HEATER PERFORMANCE (CONTINUED)

5. (K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K127) O2 Heater Relay Control circuit at the PCM harness connector.



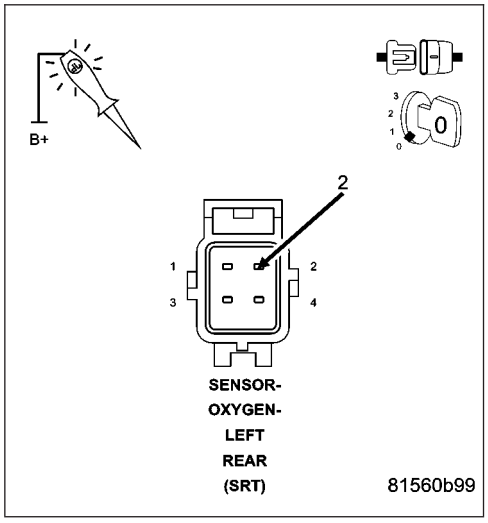
Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K127) O2 Heater Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (Z1) HEATER GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, probe the (Z1) O2 Heater Ground circuit at the O2 Sensor harness connector.



Does the test light illuminate brightly?

Yes >> Go To 7

No >> Repair the open in the (Z1) O2 Sensor Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

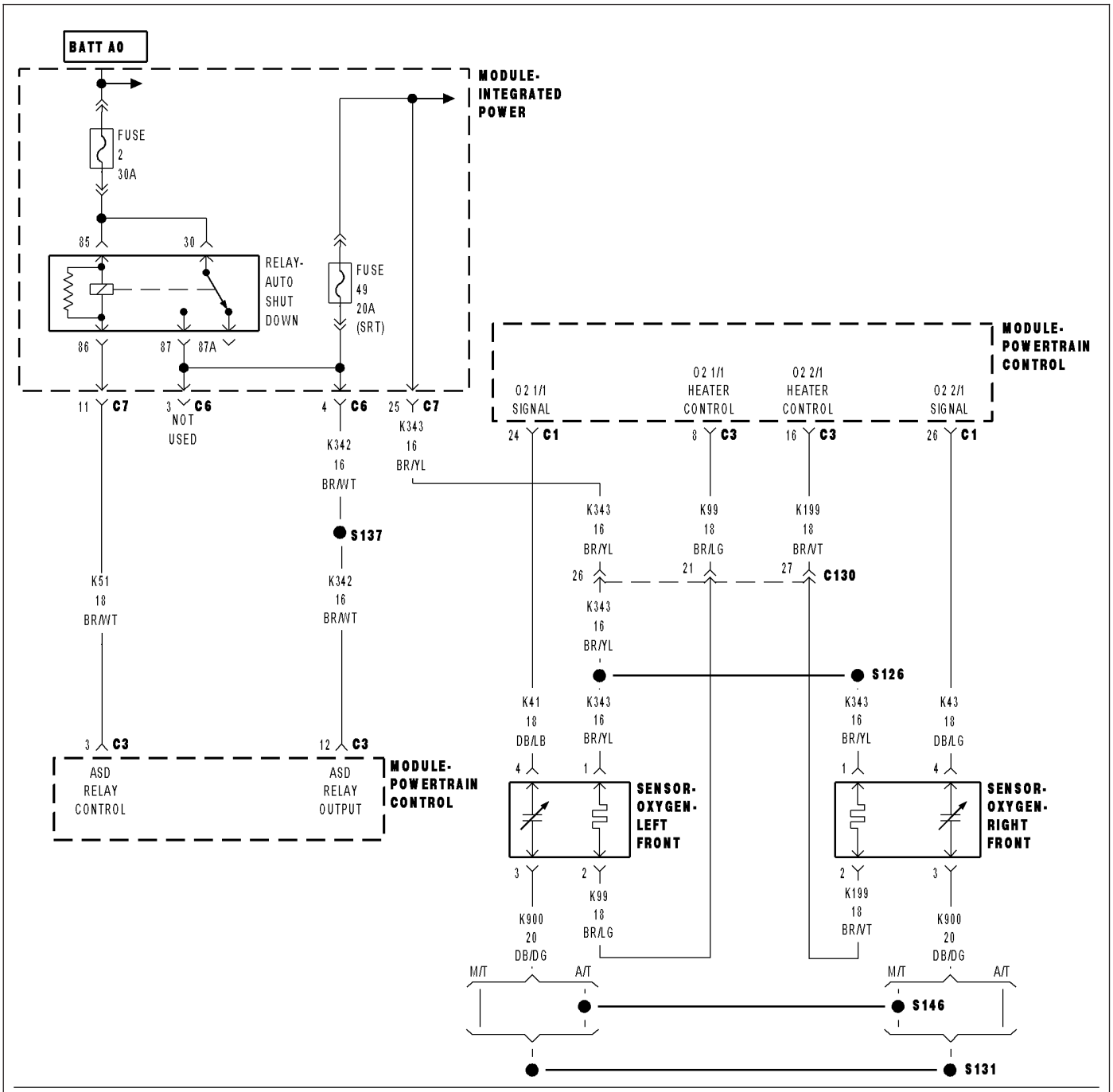
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

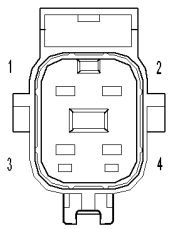
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

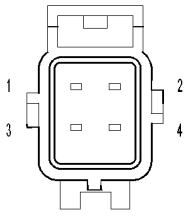
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0151-O2 SENSOR 2/1 CIRCUIT LOW





SENSOR-
OXYGEN-
LEFT
FRONT
(SRT)



SENSOR-
OXYGEN-
RIGHT
FRONT
(SRT)

813c2aeb

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.
- **Set Condition:**
  The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

Possible Causes
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO GROUND
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 0.16 OF A VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage below 0.16 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do no wear loose clothing.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage above 0.16 of a volt?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0151-O2 SENSOR 2/1 CIRCUIT LOW (CONTINUED)

3. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

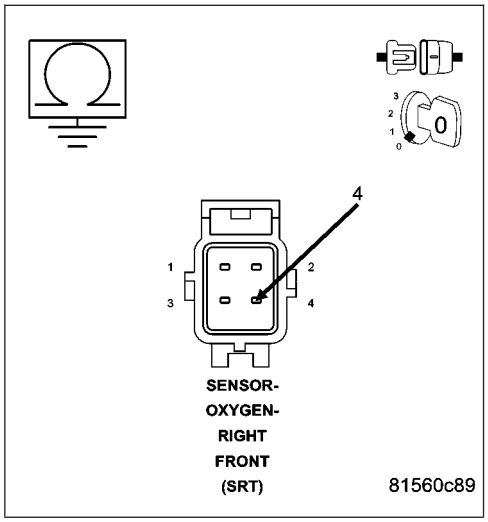
Disconnect the C1 PCM harness connector.

Measure the resistance between ground and the (K43) O2 Sensor 2/1 Signal circuit at the 2/1 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K43) O2 Sensor 2/1Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



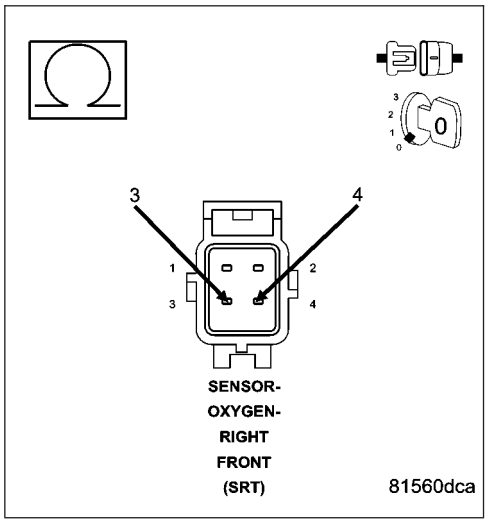
4. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K43) O2 Sensor 2/1 Signal circuit and the (K900) Sensor ground circuit at the 2/1 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

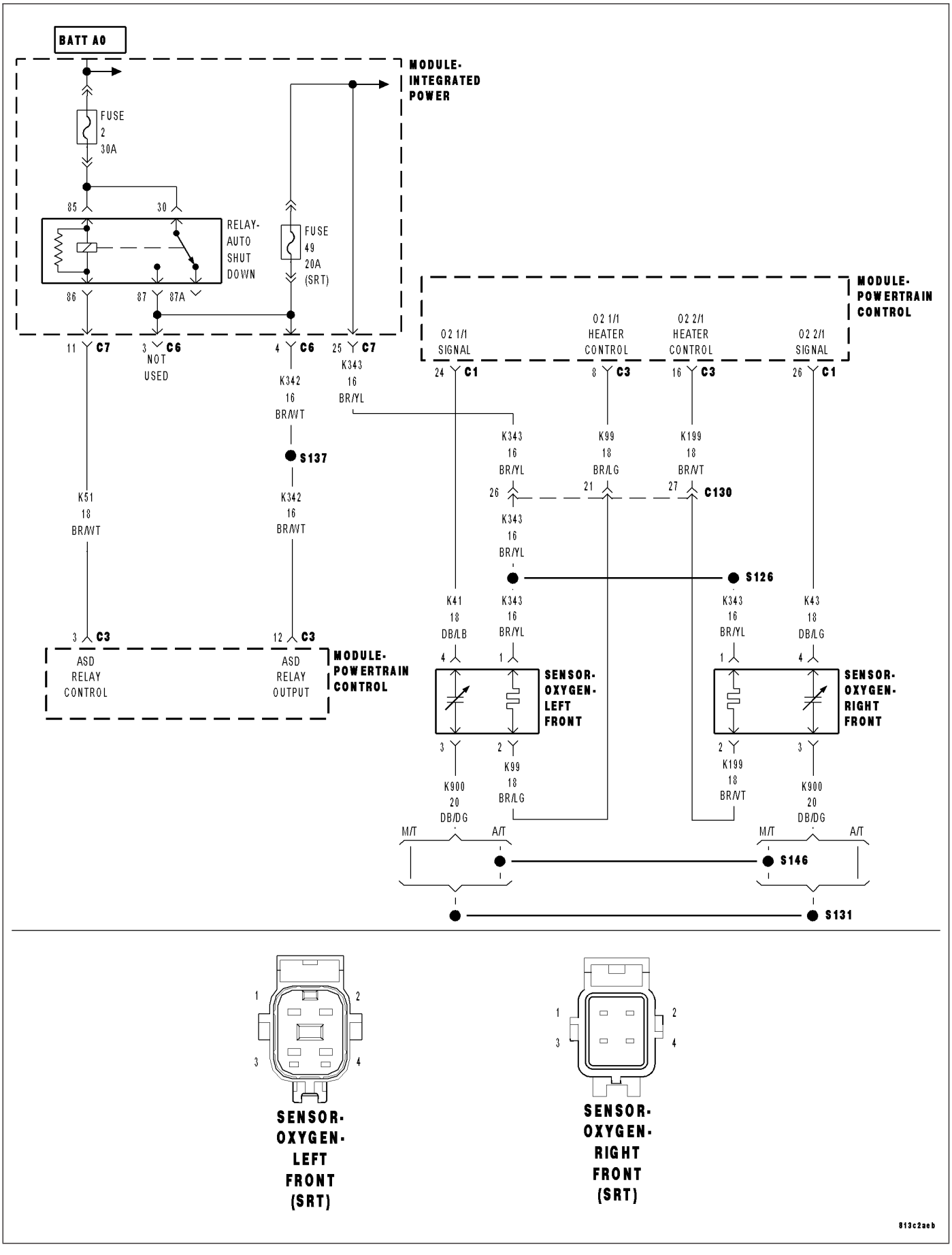
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS) (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.
- **Set Condition:**
  The oxygen sensor voltage is above 1.5 volts.

Possible Causes
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K199) O2 SENSOR 2/1 HEATER CONTROL CIRCUIT OPEN
(K43) O2 2/1 SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K343) ASD RELAY OUTPUT CIRCUIT OPEN
(K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO THE (K343) ASD RELAY OUTPUT CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 1.5 VOLTS

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage above 1.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

2. (K43) O2 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the C1 PCM harness connector.

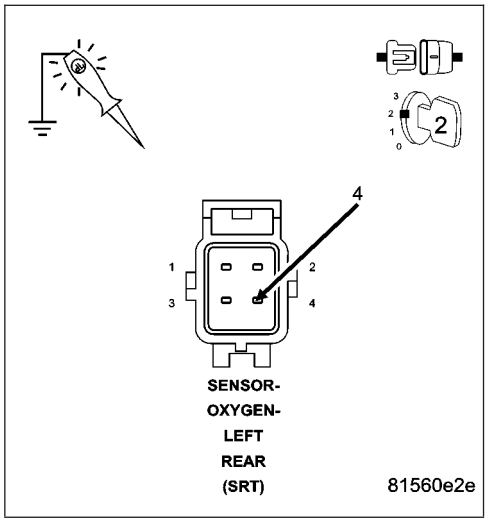
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K43) O2 Sensor 2/1 Signal circuit at the 2/1 O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to voltage in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT OPEN

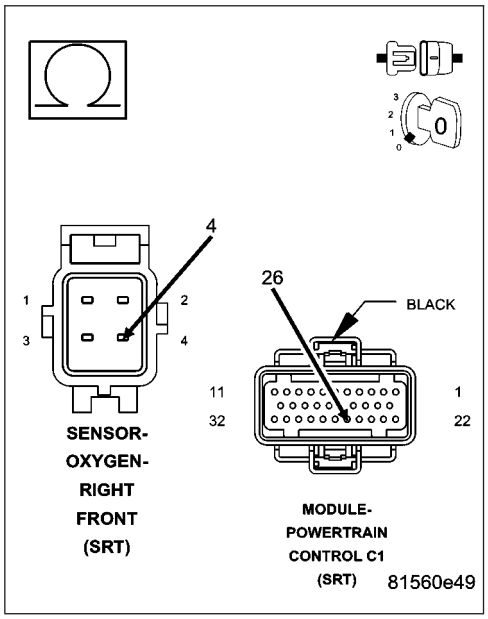
Turn the ignition off.

Measure the resistance of the (K43) O2 Sensor 2/1 Signal circuit from the O2 Sensor harness connector to the C1 PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

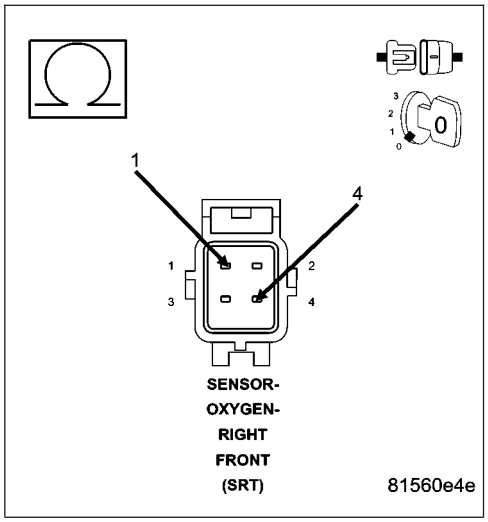
No >> Repair the open in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

4. (K43) O2 2/1 SENSOR SIGNAL CIRCUIT SHORTED TO THE (K343) ASD RELAY OUTPUT CIRCUIT

Measure the resistance between the (K43) O2 Sensor 2/1 Signal circuit and the (K343) ASD Relay Output circuit at the O2 Sensor harness connector.



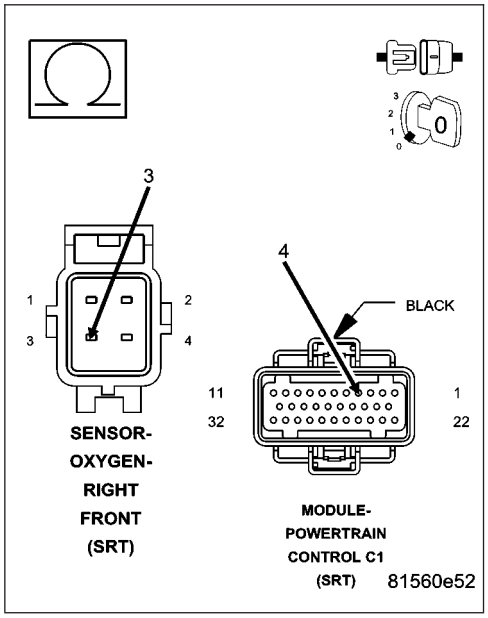
Is the resistance below 100 ohms?

Yes >> Repair the short between the (K43) O2 Sensor 2/1 Signal circuit and the (K343) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the O2 Sensor harness connector to the C1 PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

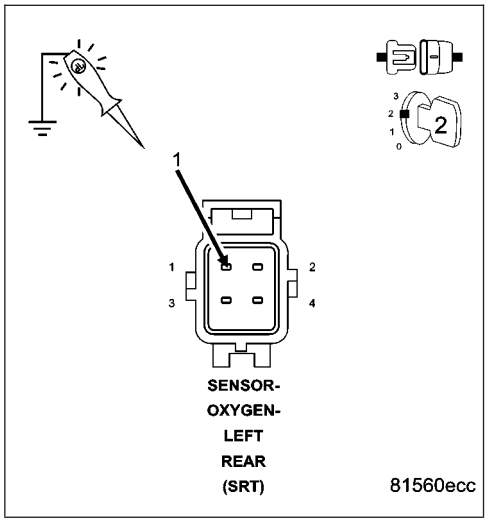
6. (K343) ASD RELAY OUTPUT CIRCUIT OPEN

Connect the PCM harness connectors.

Ignition on, engine not running.

With the scan tool actuate the O2 Heater Test.

Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit.



Does the test light illuminate brightly?

Yes >> Go To 7

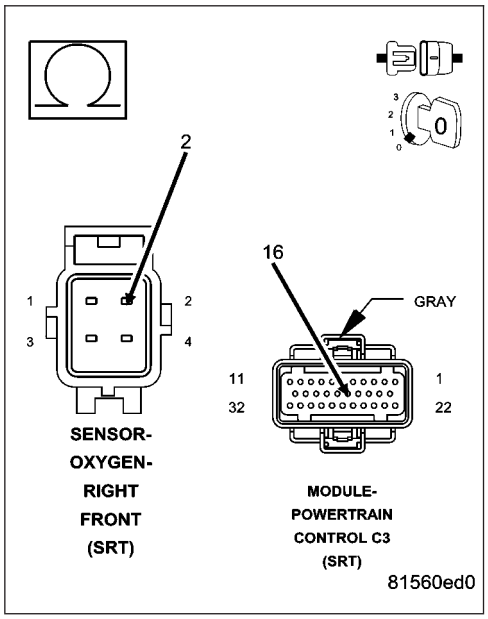
No >> Repair the open in the (K343) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (K199) O2 SENSOR 2/1 HEATER CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance of the (K199) O2 Sensor 2/1 Heater Control circuit from the O2 Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K199) O2 Sensor 2/1 Heater Control Circuit (PWM) circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0152-O2 SENSOR 2/1 CIRCUIT HIGH (CONTINUED)

8. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

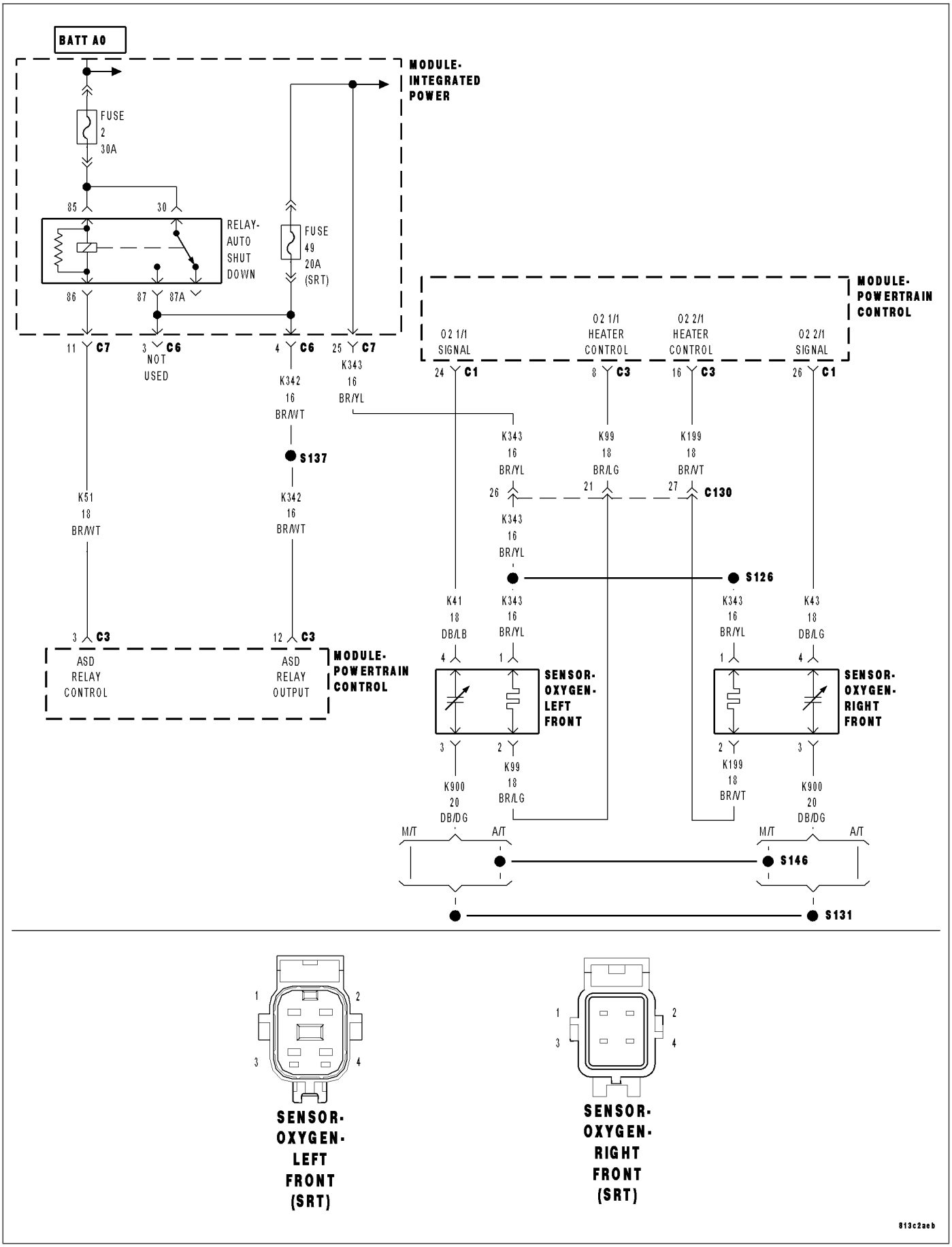
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0153-O2 SENSOR 2/1 SLOW RESPONSE



P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ECT greater than 147°F, after reaching a vehicle speed of 10 mph, and the throttle remaining open (off idle) for 2 minutes, bring the vehicle to a stop and allow the engine to idle with the transmission in DRIVE.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.27 of a volt to above 0.62 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
(K43) O2 2/1 SIGNAL CIRCUIT
(K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs and record the related Freeze Frame data.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0153-O2 SENSOR 2/1 SLOW RESPONSE (CONTINUED)

3. (K43) O2 2/1 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off.

While backprobing, measure the voltage of the (K43) O2 Sensor 2/1 Signal circuit between the 2/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection and are connected for positive polarity.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

While backprobing, measure the voltage of the (K900) Sensor ground circuit between the O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Turn the ignition off before continuing.

---

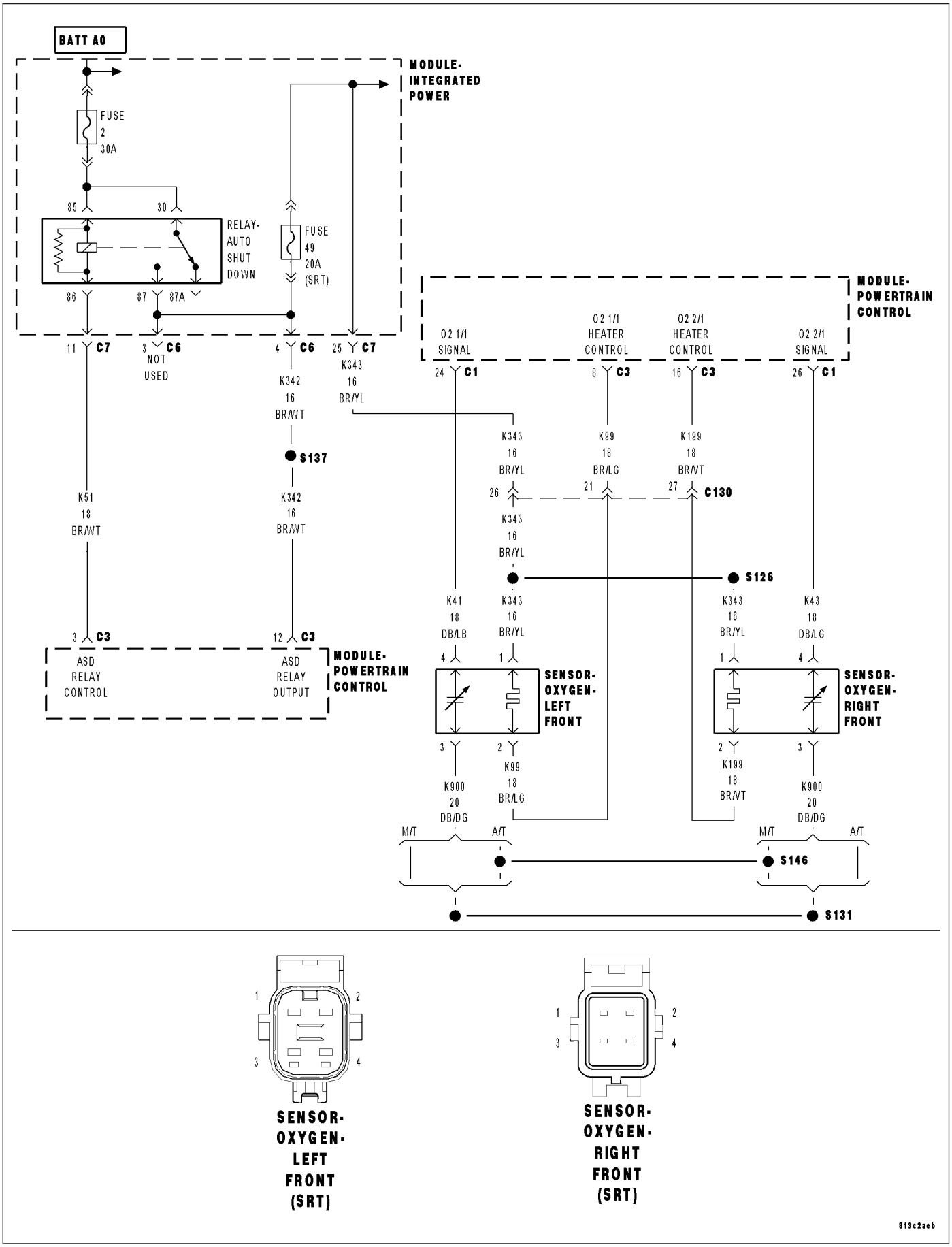
5. O2 SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE



P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.
- **Set Condition:**
  O2 sensor voltage greater than 3 volts for 30 to 90 seconds.

Possible Causes
(K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN
(K199) O2 2/1 HEATER CONTROL CIRCUIT SHORTED TO GROUND
(K343) O2 FUSED ASD RELAY OUTPUT CIRCUIT OPEN
(K343) O2 FUSED ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4.6 and 5.0 volts.

Ignition on, engine not running.

With a scan tool, actuate the O2 Heater Test.

With the scan tool, monitor 2/1 O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

---

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 sensor to cool down to room temperature.

Disconnect the O2 Sensor harness connector.

Measure the resistance of the O2 Heater Element across the 2/1 O2 Sensor connector between the (K199) O2 Heater Control terminal and the (K343) Fused ASD relay output terminal.

NOTE: O2 Heater Element resistance values should be measured at 70°F (21.1°C). The resistance value will vary with different temperature values.

Is the resistance of the O2 Sensor Heater Element between 3.3 and 4.1 ohms?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

3. (K199) O2 2/1 HEATER CONTROL CIRCUIT OPEN

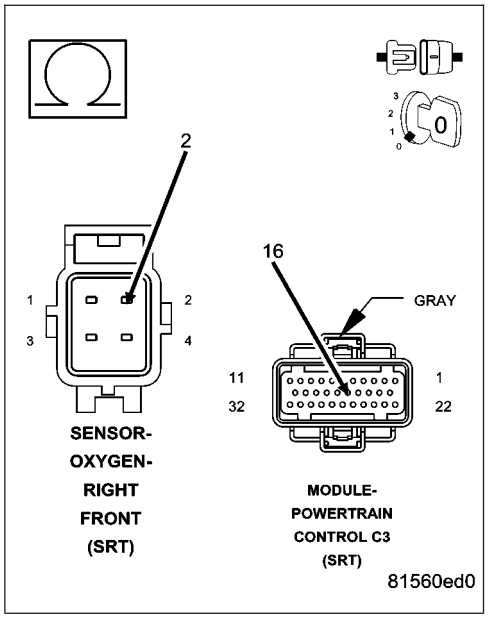
Disconnect the C3 PCM harness connector.

Measure the resistance of the (K199) O2 2/1 Heater Control circuit from the O2 harness connector to the PCM harness connector.

Is the resistance below 5 ohmS?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K199) O2 2/1 Heater Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K343) O2 2/1 FUSED ASD RELAY OUTPUT CIRCUIT OPEN

Measure the resistance of the (K343) O2 2/1 Fused ASD Relay Output circuit, from the relay terminal to the O2 Sensor harness connector.

Is the resistance below 5 ohms?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K343) O2 2/1 Fused ASD relay output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

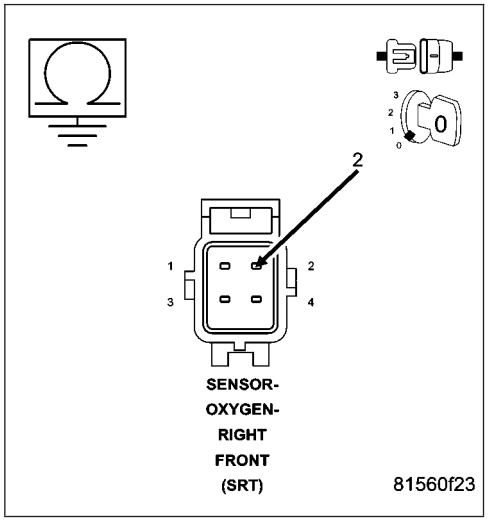
5. (K343) O2 2/1 FUSED ASD RELAY OUTPUT CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K343) O2 2/1 Fused ASD Relay Output circuit in the O2 Sensor harness connector.

Is the resistance below 5 ohms?

Yes >> Repair the short to ground in the (K343) O2 2/1 Fused ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0155-O2 SENSOR 2/1 HEATER PERFORMANCE (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

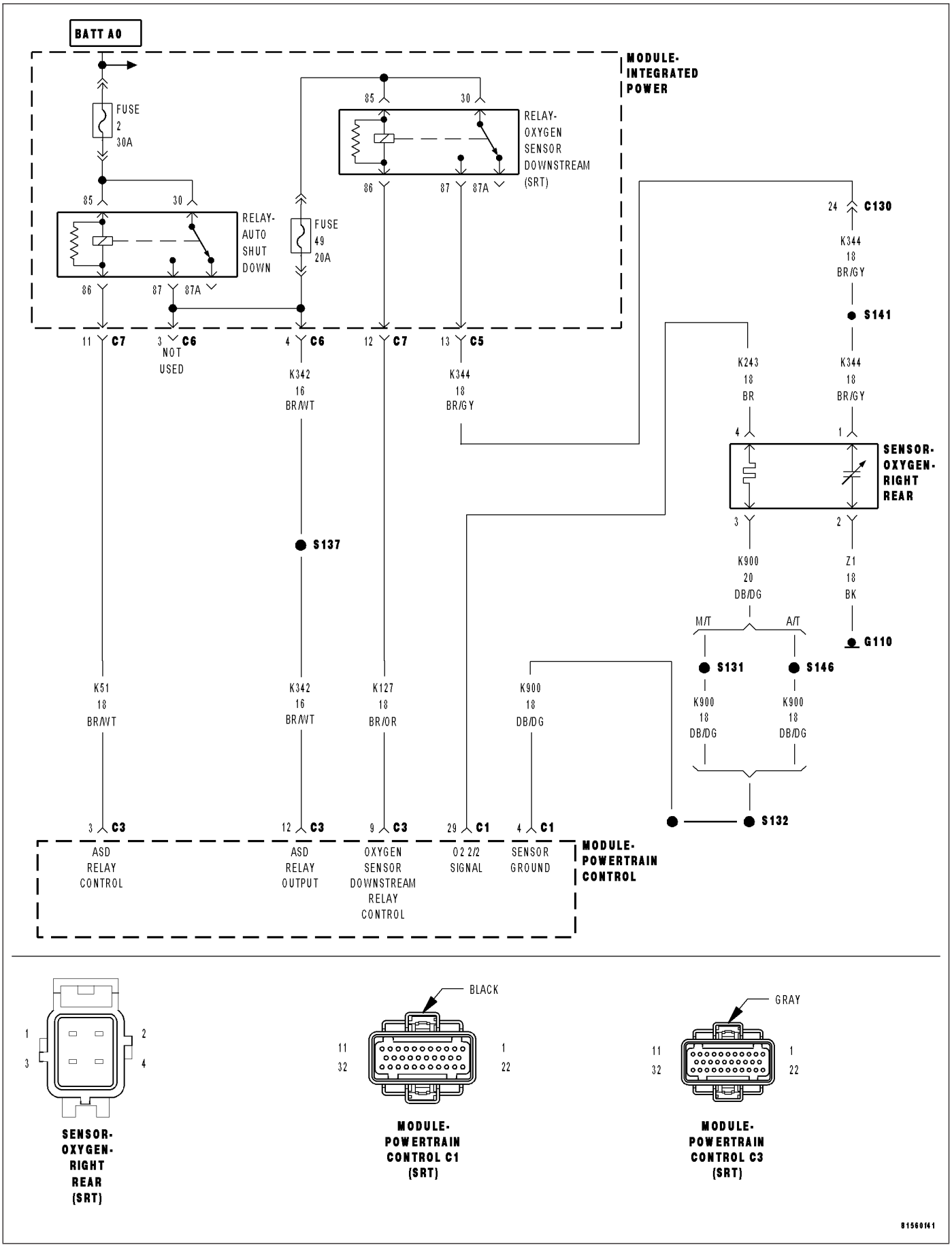
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO LOW



P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At a cold start, engine coolant below 98°F, Ambient/Battery Sensor reading within 27°F, and Engine Coolant Temperature above 170°F on the previous key off.
- **Set Condition:**
  The Oxygen Sensor signal voltage is below 0.156 of a volt for 28 seconds after starting engine.

Possible Causes
(K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO GROUND
(K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT
(K243) O2 SENSOR 2/2 SIGNAL SHORTED TO THE (Z1) HEATER GROUND CIRCUIT
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR BELOW 0.16 OF A VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage below 0.16 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage above 0.16 of a volt?

Yes >> Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO LOW (CONTINUED)

3. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

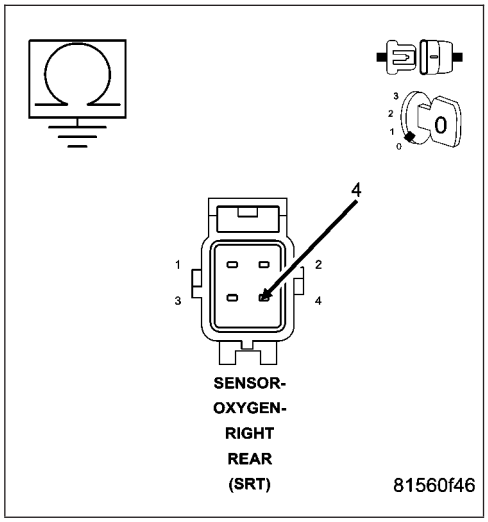
Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K243) O2 Sensor 2/2 Signal circuit at the 2/2 O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K243) O2 Sensor 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



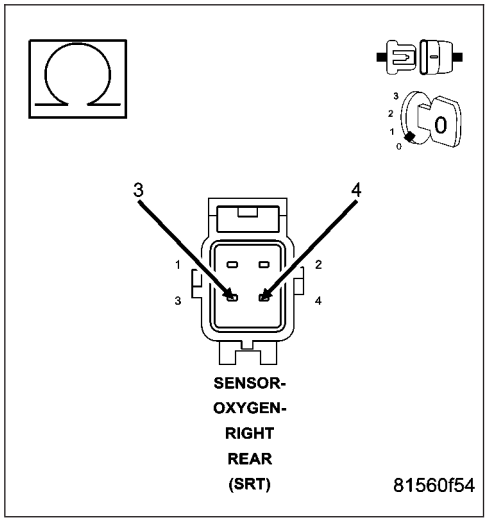
4. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K243) O2 Sensor 2/2 Signal circuit and the (K900) Sensor ground circuit at the O2 Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K243) O2 Sensor 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

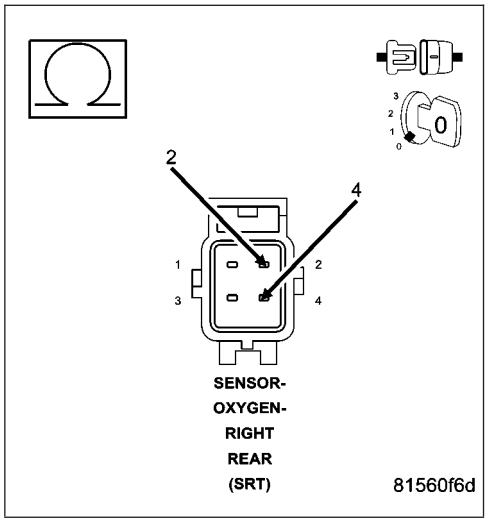
No >> Go To 5



P0157-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO LOW (CONTINUED)

5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO (Z1) HEATER GROUND CIRCUIT

Measure the resistance between the (K243) O2 Sensor 2/2 Signal circuit and the (Z1) O2 Sensor Heater ground circuit if it applies to the O2 Sensor being tested.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K243) O2 Sensor 2/2 Signal circuit and the (Z1) Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. PCM

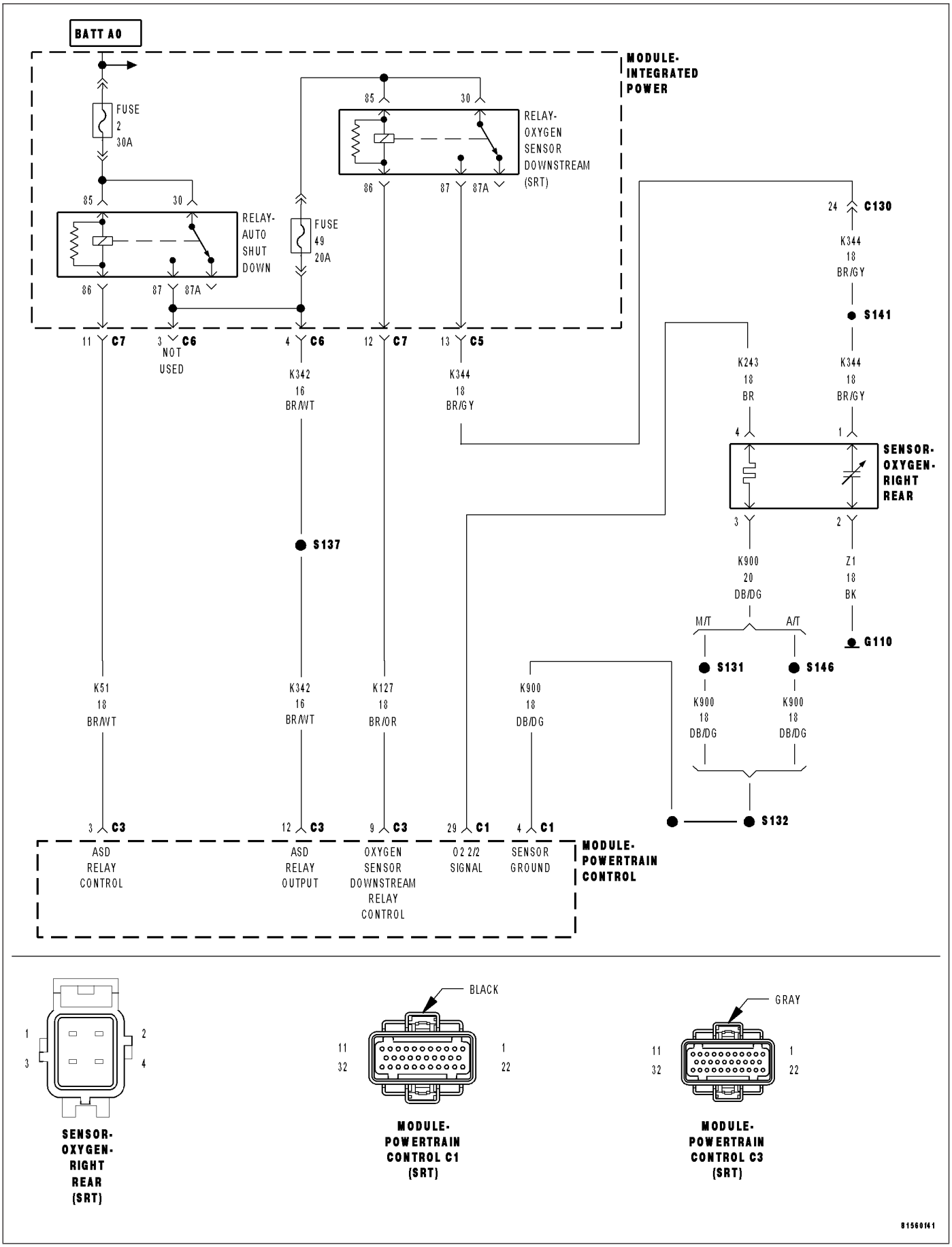
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH



P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, engine running for more than 4 minutes and coolant temperature above 180°F.
- **Set Condition:**
  The oxygen sensor voltage is above 1.5 volts.

Possible Causes
(K243) O2 SENSOR 2/2 SIGNAL SHORTED TO VOLTAGE
(K243) O2 SENSOR 2/2 SIGNAL CIRCUIT OPEN
(K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO THE (K344) O2 HEATER RELALY OUPUT CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
(Z1) O2 SENSOR HEATER GROUND CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR ABOVE 1.5 VOLTS

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
Start the engine.
Allow the engine to idle for 4 to 5 minutes.
With the scan tool, read the O2 Sensor voltage.

Is the voltage above 1.5 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. O2 SENSOR OPERATION

WARNING: When the engine is operatind, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Turn the ignition off.
Disconnect the O2 Sensor harness connector.
Start the engine.
With the scan tool, monitor the O2 Sensor voltage.

Is the O2 Sensor voltage below 1.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

3. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

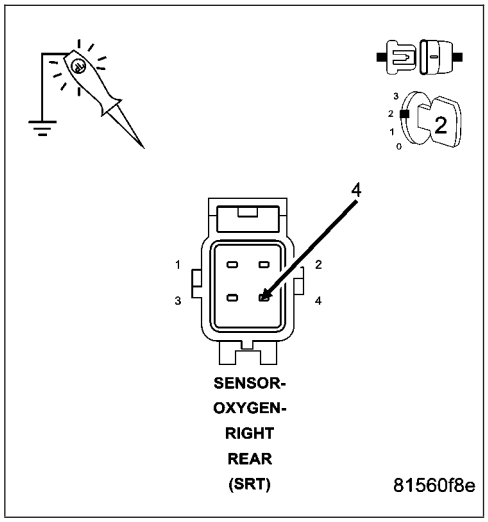
Using a 12-volt test light connected to ground, probe the (K243) O2 Sensor 2/2 Signal circuit at the 2/2 O2 Sensor harness connector.

Does the test light illuminate brightly?

Yes >> Repair the short to voltage in the (K243) O2 Sensor 2/2 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT OPEN

Turn the ignition off.

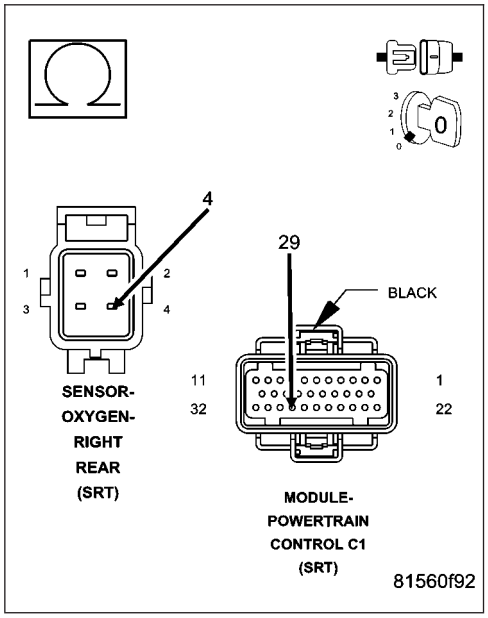
Measure the resistance of the (K243) O2 Sensor 2/2 Signal circuit from the 2/2 O2 Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K243) O2 Sensor 2/2 Signal circuit.

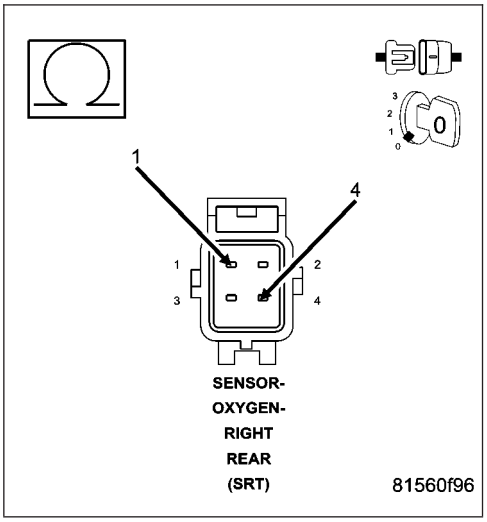
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

5. (K243) O2 SENSOR 2/2 SIGNAL CIRCUIT SHORTED TO THE (K344) O2 HEATER RELAY OUTPUT CIRCU IT

Measure the resistance between the (K243) O2 Sensor 2/2 Signal circuit and the (K344) O2 Heater Relay Output circuit at the O2 Sensor harness connector.



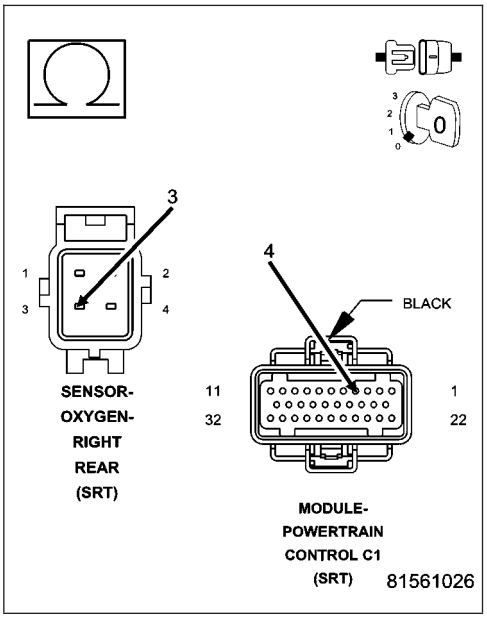
Is the resistance below 100 ohms?

Yes >> Repair the short between the (K243) O2 Sensor 2/2 Signal circuit and the (K344) O2 Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the 2/2 O2 Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0158-O2 SENSOR 2/2 CIRCUIT VOLTAGE TOO HIGH (CONTINUED)

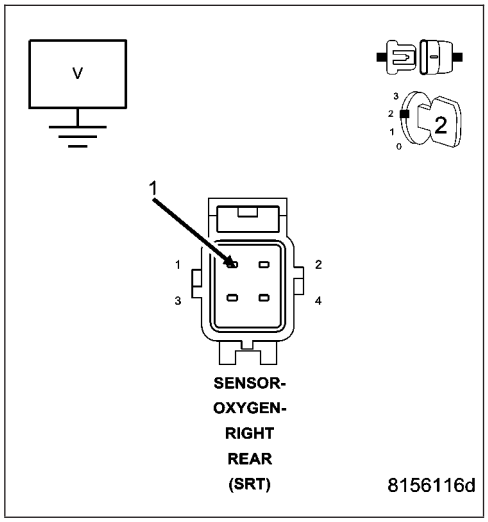
7. (K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT OPEN

Connect the PCM harness connectors.

Ignition on, engine not running.

With the scan tool actuate the O2 Heater Test.

Measure the voltage on the (K344) O2 Sensor Heater Relay Output circuit.



Is the voltage above 11.0 volts?

No >> Repair the open in the (K344) O2 Sensor Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

Yes >> Go To 8

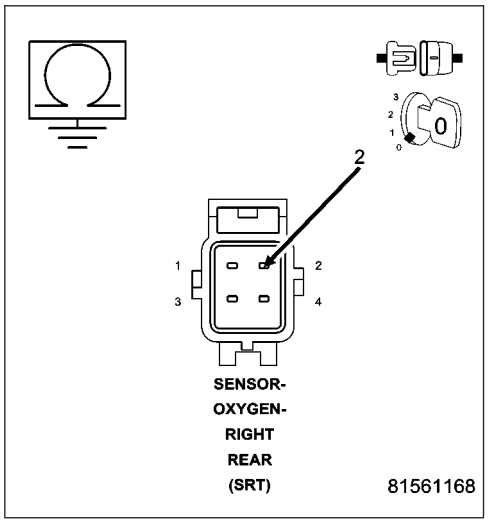
---

8. (Z1) O2 SENSOR HEATER GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (Z1) O2 Sensor Heater ground circuit from the 2/2 O2 Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (Z1) O2 Sensor Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

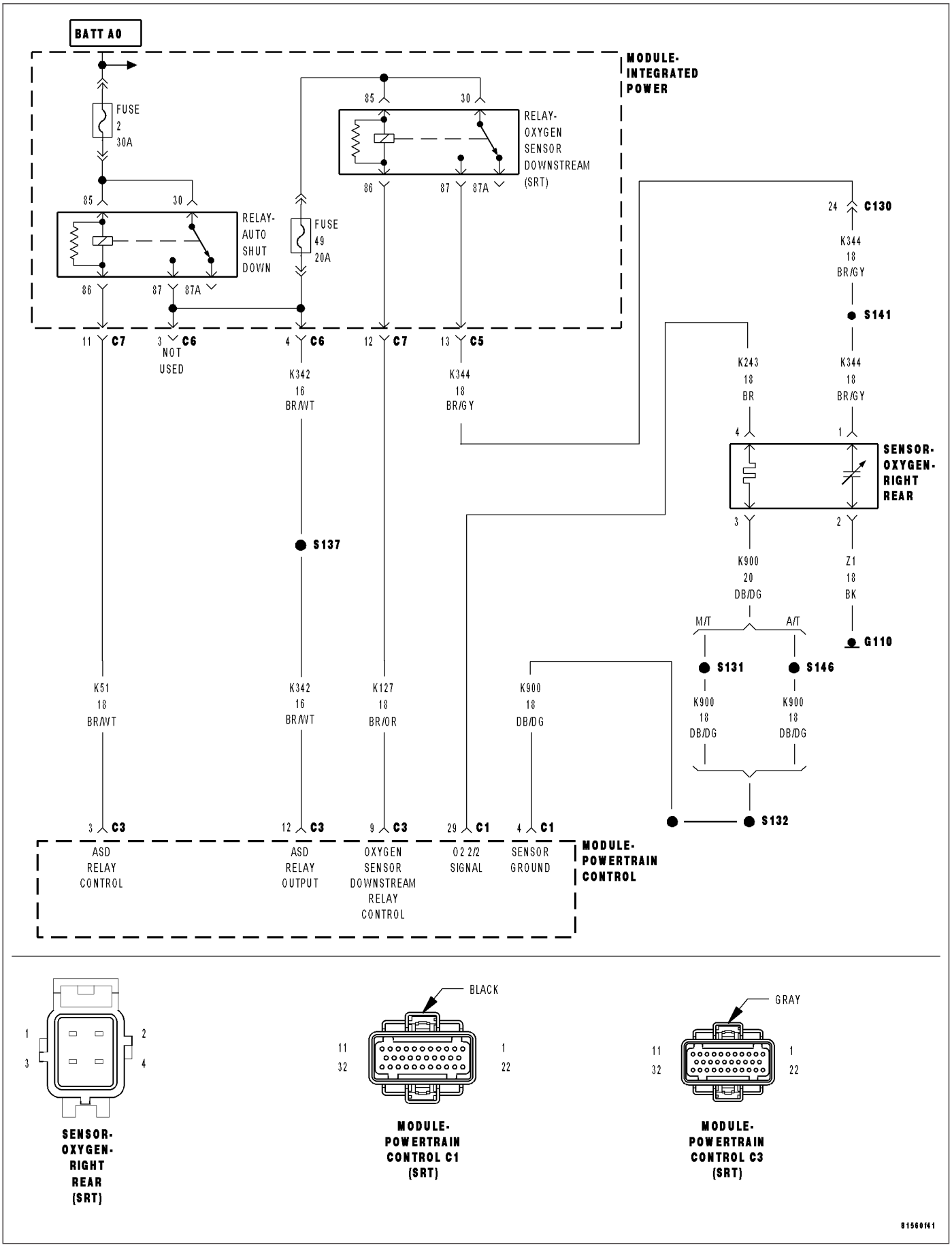
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0159-O2 SENSOR 2/2 SLOW RESPONSE



SENSOR-
OXYGEN-
RIGHT
REAR
(SRT)

MODULE-
POWERTRAIN
CONTROL C1
(SRT)

MODULE-
POWERTRAIN
CONTROL C3
(SRT)

81560141

P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Start engine. Allow engine to idle. For 1st part of test, if limits are exceeded, test passes. If not, 2nd part of test runs. amb/batt temp >44°F, Baro >22.13″ H2O, battery >10.5 volts, MAP >11.79 & <18.15″ H2O, RPM >1350 & <2200 and vss >50 and <65.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.58 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
(K243) O2 2/2 SIGNAL CIRCUIT
(K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Check for contaminants that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.
Ignition on, engine not running.

NOTE: After the repairs have been made, verify proper O2 Sensor operation. If all the O2 Sensor voltage readings have not returned to normal, follow the diagnostic procedure for the remaining O2 Sensors.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust system for leaks between the engine and the O2 Sensors.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0159-O2 SENSOR 2/2 SLOW RESPONSE (CONTINUED)

3. (K243) O2 2/2 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off

Ignition on, engine not running.

With a voltmeter, back probe the (K243) O2 Sensor Signal circuit at the 2/2 O2 Sensor harness connector and the PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection and are connected for positive polarity.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance in the (K243) O2 Sensor 2/2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

With a voltmeter, back probe the (K900) Sensor ground circuit at the 2/2 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads meet the terminals in the connector and that there is good terminal to wire connection.

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

NOTE: Turn the ignition off before continuing.

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

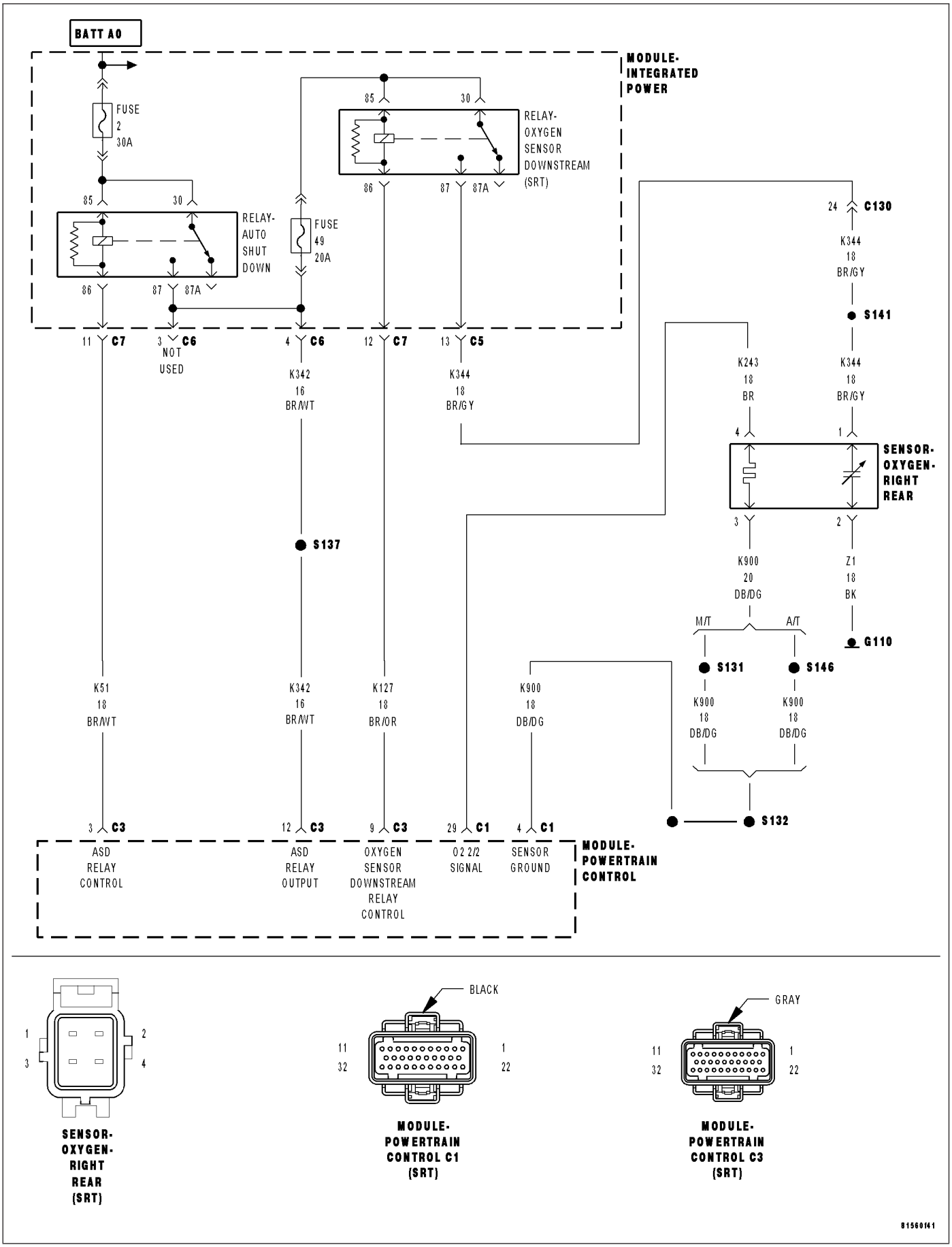
5. O2 SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE



P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 9 volts, at a cold start, ECT less than 147°F, battery temperature sensor equal to or less than 27°F, and engine at idle for at least 12 seconds.
- **Set Condition:**
  O2 sensor voltage greater than 3 volts for 60 to 240 seconds.

Possible Causes
(K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT OPEN
(K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT SHORTED TO GROUND
(K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN
(K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND
(Z1) HEATER GROUND CIRCUIT OPEN
O2 SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 8 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.
With the scan tool, actuate the O2 Heater Test.
With the scan tool, monitor O2 Sensor voltage for at least 2 minutes.

Does the voltage stabilize between 0.1 and 0.3 of a volt during the Heater test?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. O2 SENSOR HEATER ELEMENT

Turn the ignition off.

NOTE: Allow the O2 Sensor to cool to room temperature.
Disconnect the O2 Sensor harness connector.
Measure the resistance across the O2 Sensor Heater element component side.

NOTE: The resistance value will increase with warmer temperatures.

Is the resistance between 4.0 and 5.0 ohms at 70° F (21.1°C)?

Yes >> Go To 3

No >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

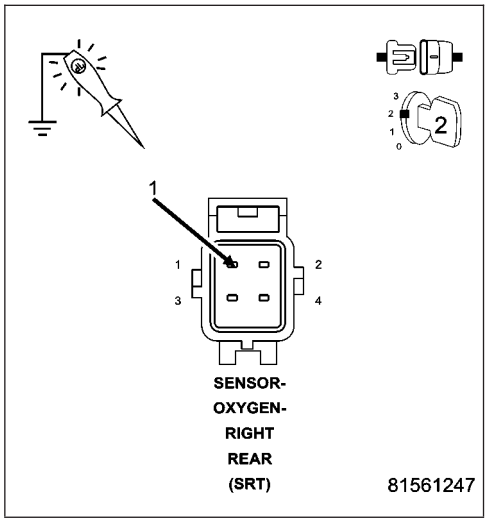
P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

3. (K344) O2 SENSOR HEATER RELAY OUTPUT CIRCUIT

Ignition on, engine not running and the O2 Sensor still disconnected.

With the scan tool, actuate the O2 Heater Test.

Using a 12-volt test light connected to ground, probe the (K344) O2 Heater Relay Output circuit at the O2 Sensor harness connector.



Does the light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (K344) O2 Heater Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K127) O2 HEATER RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Remove the O2 Heater Relay.

Measure the resistance of the (K127) O2 Heater Relay Control circuit from the O2 Heater Relay to the PCM harness connector.

Is the resistance below 5.0 ohms?

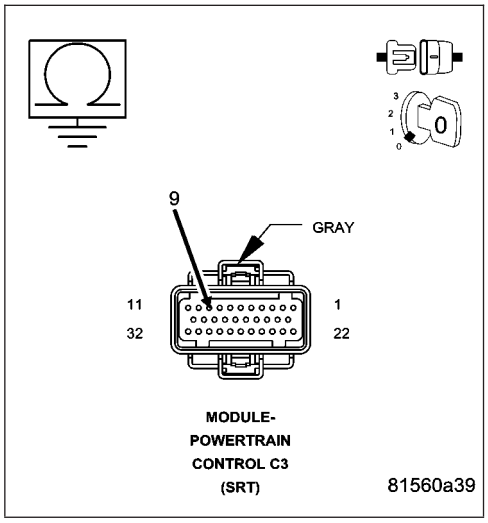
Yes >> Go To 5

No >> Repair the excessive resistance in the (K127) O2 Heater Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K127) O2 HEATER RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K127) O2 Heater Relay Control circuit at the PCM harness connector.



Is the resistance below 100 ohms?

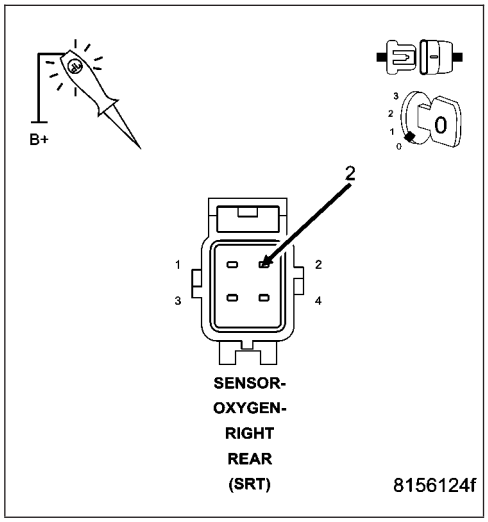
Yes >> Repair the short to ground in the (K127) O2 Heater Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0161-O2 SENSOR 2/2 HEATER PERFORMANCE (CONTINUED)

6. (Z1) HEATER GROUND CIRCUIT OPEN

Using a 12-volt test light connected to 12-volts, probe the (Z1) O2 Heater Ground circuit at the O2 Sensor harness connector.



Does the test light illuminate brightly?

Yes >> Go To 7

No >> Repair the open in the (Z1) O2 Sensor Heater ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

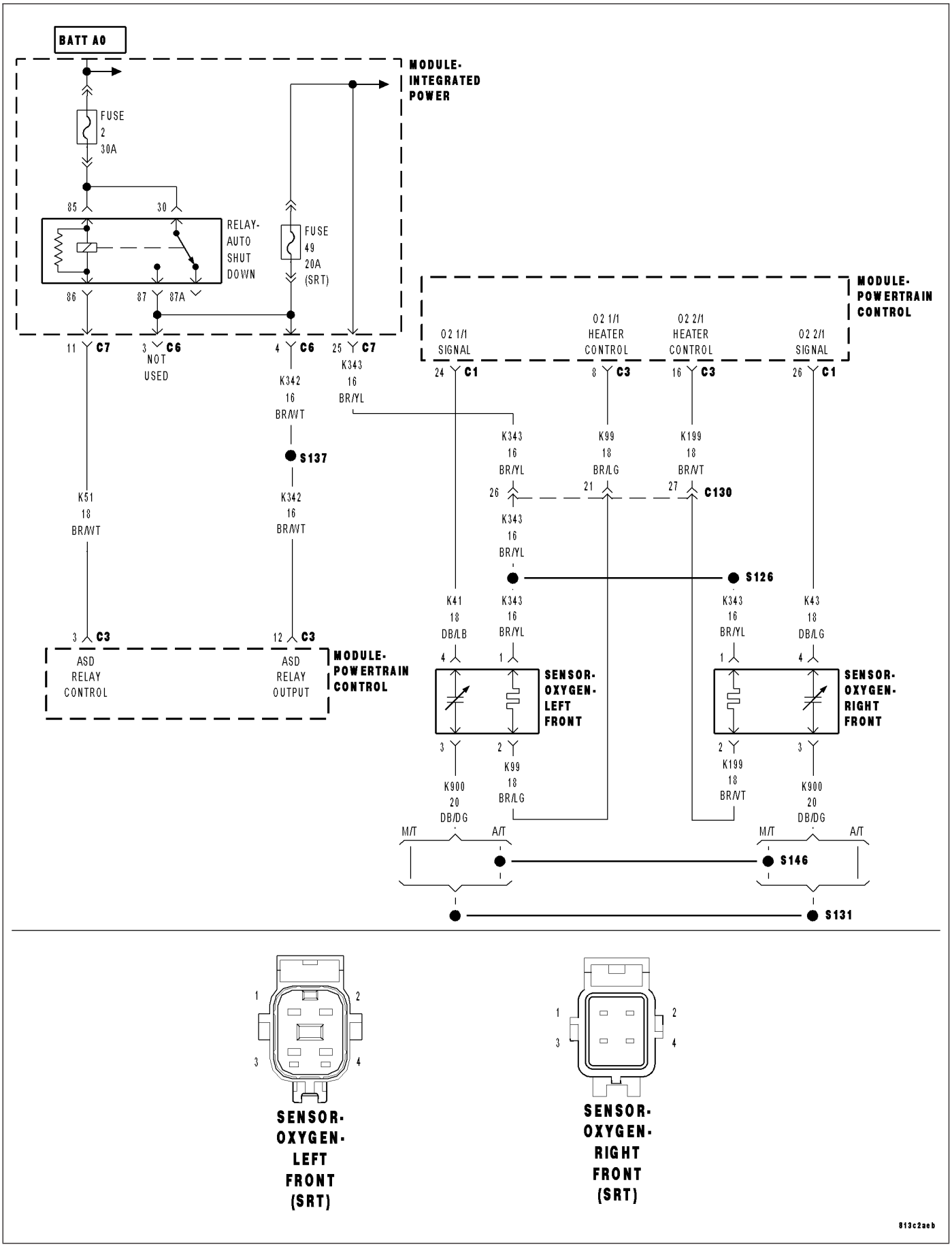
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN



P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL

Possible Causes
FUEL PRESSURE OUT OF SPECS
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SENSOR
(K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR 1/1 HEATER OPERATION
TP SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL CONDITION
FUEL FILTER/PRESSURE REGULATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Install a fuel pressure gauge.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Turn the ignition off.

Choose a conclusion that best matches your fuel pressure reading.

Below Specification
Go To 3

Within Specification
Go To 6

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CAUTION: Stop All Actuations.

---

3. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 or #6631 for 3/8 fuel line adapter, between the disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539 or #6631.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

5. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. O2 SENSOR OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor and Exhaust System to cool down before continuing the test.
Ignition on, engine not running.
With the scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage above 4.5 volts?

Yes >> Go To 7

No >> Go To 13

---

7. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.
With the scan tool, actuate the 1/1 O2 Heater Test.
With the scan tool, monitor all O2 Sensor voltage readings for at least 2 minutes.

Does the voltage stay above 4.5 volts for any of the O2 Sensors?

Yes >> Replace the O2 Sensor that had the voltage reading above 4.5 volts.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED

With the scan tool, read TP Sensor voltage.

NOTE: The throttle must be against the stop.

Is the voltage 0.92 of a volt or less with the Throttle closed?

Yes >> Go To 9

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

9. TP SENSOR SWEEP

With the scan tool, read the TP Sensor voltage.

While monitoring the scan tool, slowly open and close the throttle.

Does the voltage increase and decrease smoothly?

Yes >> Go To 10

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool in Sensors, read the MAP Sensor vacuum value.

NOTE: Remove the vacuum gauge before continuing.

Is the scan toolreading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 11

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the Engine Coolant Temperature increase smoothly and did it reach at least 82°C (180°F)?

Yes >> Go To 12

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

12. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

13. O2 SENSOR

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.
Disconnect the harness connector(s) of the O2 Sensor(s) that had a voltage reading below 4.5 volts in the previous step.
With the scan tool, monitor the O2 Sensor voltage reading(s).

Is the voltage above 4.5 volts for any of the O2 Sensors?

Yes >> Replace the O2 Sensor that had a voltage reading above 4.5 volts.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

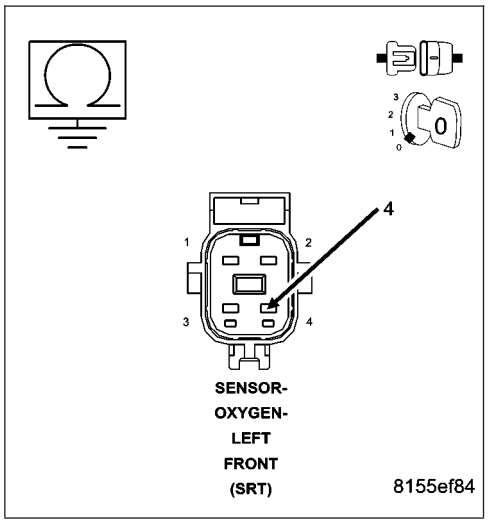
P0171-FUEL SYSTEM 1/1 LEAN (CONTINUED)

14. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K41) O2 Sensor 1/1 Signal circuit at the PCM harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K41) O2 Sensor 1/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

15. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

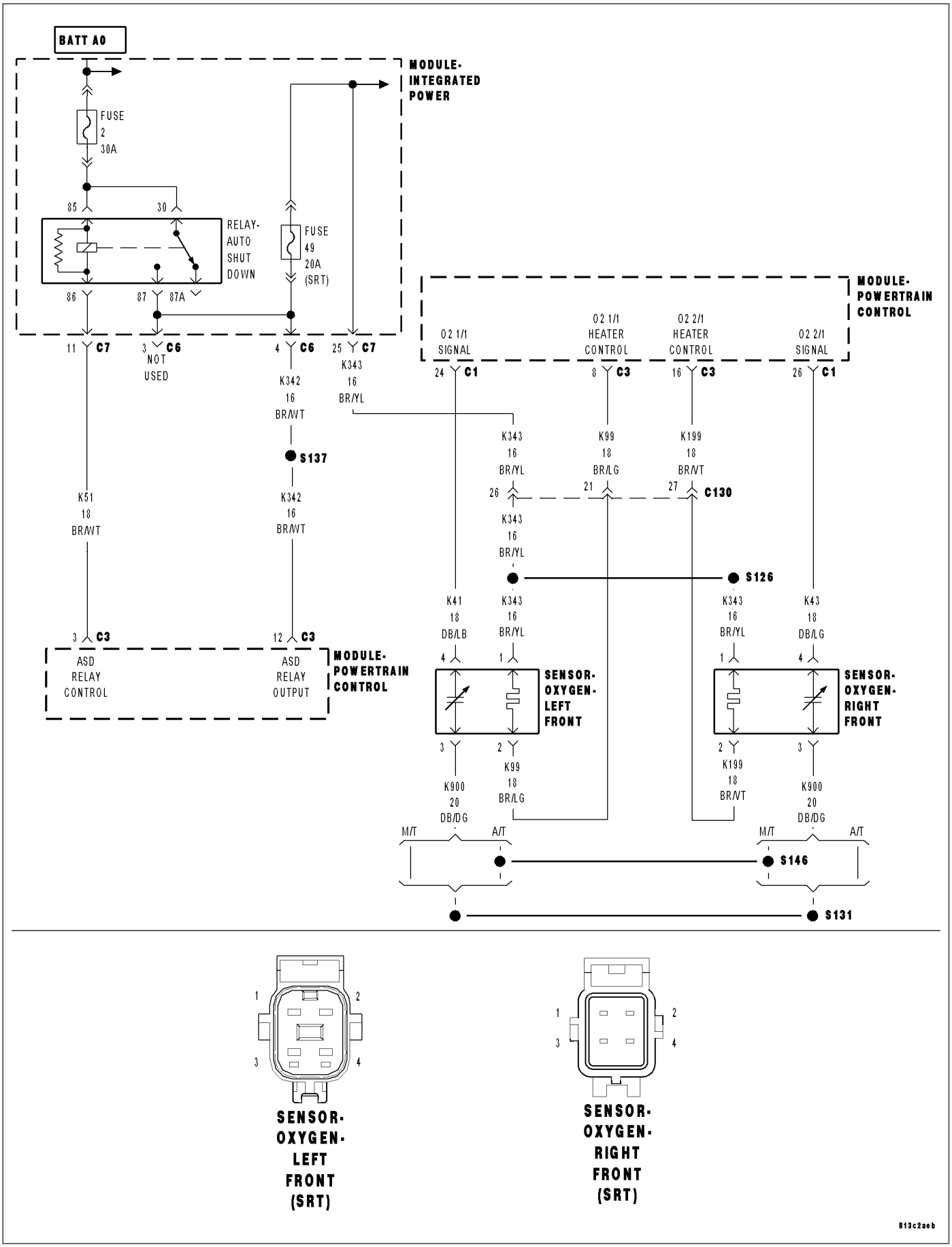
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR
(K41) O2 SENSOR 1/1 SIGNAL CIRCUIT OPEN
(K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
1/1 O2 SENSOR HEATER OPERATION
EVAP SYSTEM OPERATION
TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED
TP SENSOR
FUEL FILTER/PRESSURE REGULATOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL CONDITION
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

NOTE: Any O2 Sensor, TPS, ECT, MAP, or EVAP DTCs must be repaired before continuing.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Install a fuel pressure gauge.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CAUTION: Stop All Actuations.

---

3. O2 SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage above 4.5 volts for all of the O2 Sensors?

Yes >> Go To 4

No >> Go To 11

---

4. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4 and 5 volts.

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

With the scan tool, monitor O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the O2 Sensor that had the voltage reading above 4.5 volts.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

5. EVAP SYSTEM OPERATION

NOTE: The engine must be at operating temperature and in closed loop to perform this test.
Start the engine.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Allow the engine to reach normal operating temperature.

With the scan tool select System Tests, perform the Purge Vapors Test.

Observe the Short Term Adaptive value and press 3 to flow.

NOTE: Short Term Adaptive value change.

Did the Short Term Adaptive value change?

Yes >> Go To 6

No >> Refer to the Driveability category and perform the appropriate Diagnostic test.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED

Ignition on, engine not running.

With the scan tool, read TP Sensor voltage.

NOTE: The throttle must be against the stop.

Is the voltage 0.92 of a volt or less with the Throttle closed?

Yes >> Go To 7

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. TP SENSOR SWEEP

With the scan tool, read the TP Sensor voltage.

While monitoring the scan tool, slowly open and close the throttle.

Does the voltage increase and decrease smoothly?

Yes >> Go To 8

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

8. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool in Sensors, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 9

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

9. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the Engine Coolant Temperature value increase smoothly and reach at least 82°C?

Yes >> Go To 10

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

10. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. O2 SENSOR

Disconnect the sensor harness connector of the O2 Sensor(s) that had a voltage value greater than 4.5 volts in the previous step.
Ignition on, engine not running.
With the scan tool, monitor the O2 Sensor voltage reading(s).

Is the O2 Sensor voltage above 4.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

12. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

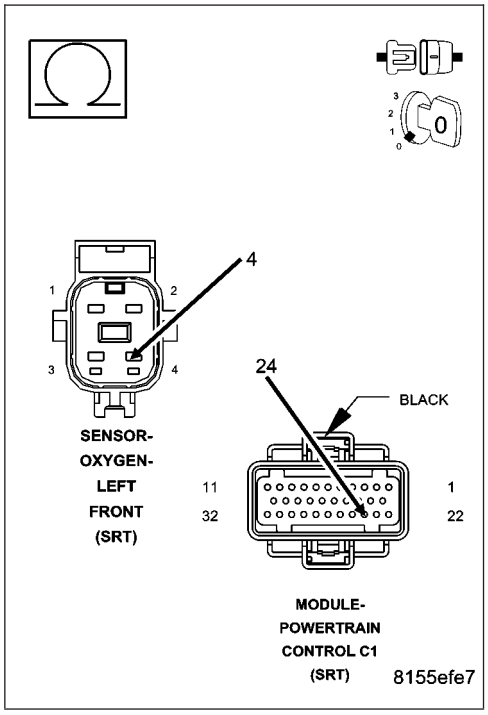
Disconnect the PCM harness connectors.

Measure the resistance of the (K41) O2 Sensor 1/1 Signal circuit from the PCM harness connector to the O2 Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 13

No >> Repair the open in the (K41) O2 Sensor 1/1 Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



13. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Ignition on, engine not running.

Leave the O2 Sensor and PCM harness connectors disconnected.

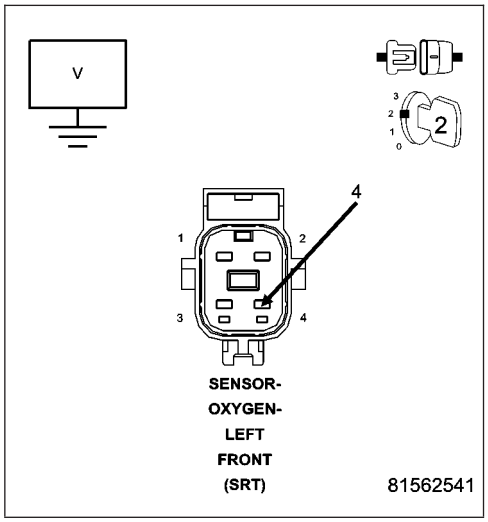
Measure the voltage on the (K41) O2 Sensor 1/1 Signal circuit at the 1/1 O2 Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to voltage in the O2 Sensor Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Turn the ignition off before continuing.



P0172-FUEL SYSTEM 1/1 RICH (CONTINUED)

14. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

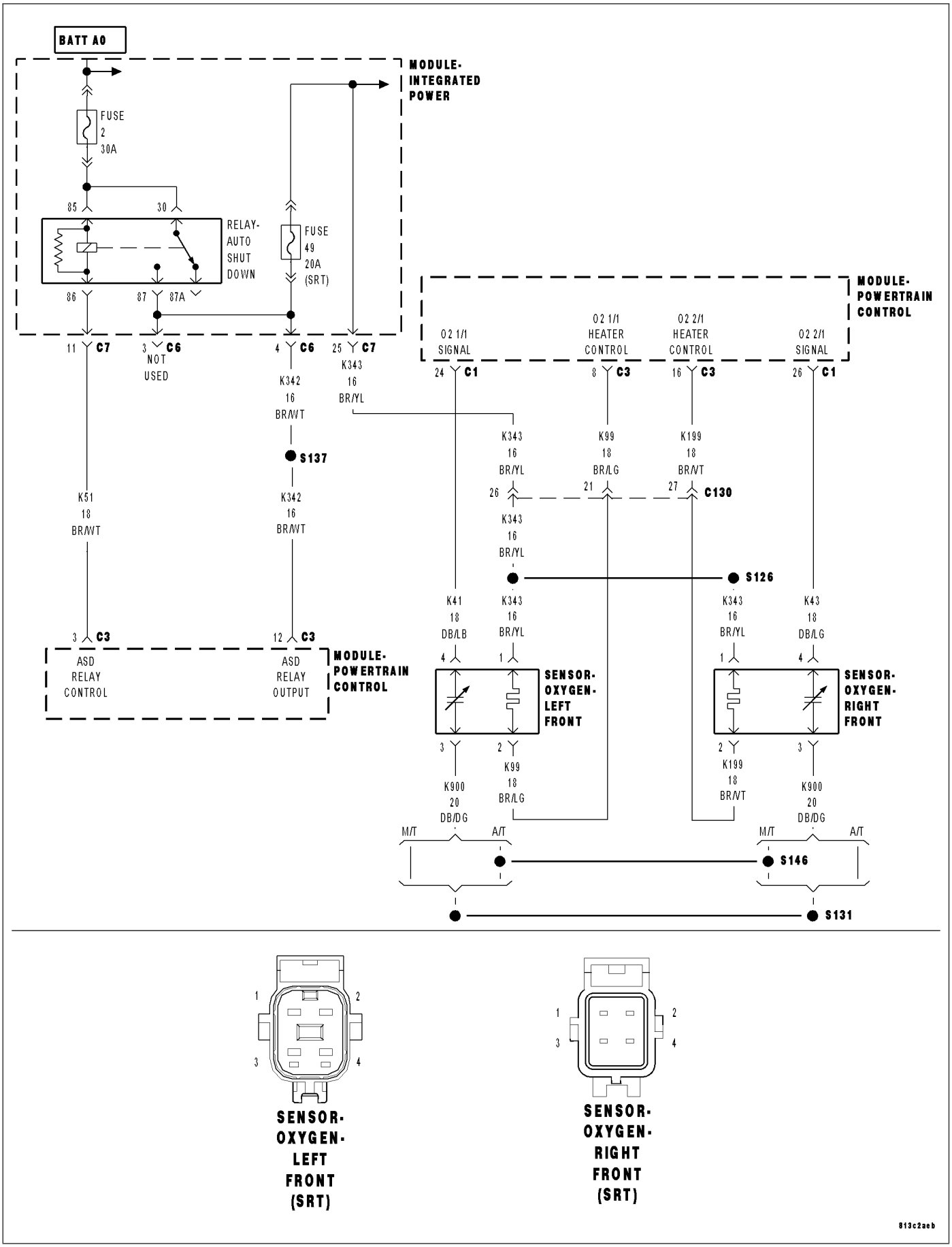
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN



P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a certain percentage is exceeded for two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
FUEL PRESSURE OUT OF SPECS
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP MODULE
O2 SENSOR
(K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO GROUND
O2 SENSOR 2/1 HEATER OPERATION
TP SENSOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL CONDITION
FUEL FILTER/PRESSURE REGULATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

2. CHECKING FUEL PRESSURE

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Install a fuel pressure gauge.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Turn the ignition off.

CAUTION: Stop All Actuations.

Choose a conclusion that best matches your fuel pressure reading.

Below Specification
Go To 3

Within Specification
Go To 6

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. RESTRICTED FUEL SUPPLY LINE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special 5/16 fuel line adapter tool #6539 or #6631 for 3/8 fuel line adapter, between the disconnected fuel line and the fuel pump module.

Attach a fuel pressure test gauge to the T fitting on tool #6539 or #6631.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

CAUTION: Stop All Actuations.

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

5. FUEL PUMP MODULE

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. O2 SENSOR OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor and Exhaust System to cool down before continuing the test.
Ignition on, engine not running.
With the scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage above 4.5 volts?

Yes >> Go To 7

No >> Go To 13

---

7. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.
With the scan tool, actuate the 1/1 O2 Heater Test.
With the scan tool, monitor all O2 Sensor voltage readings for at least 2 minutes.

Does the voltage stay above 4.5 volts for any of the O2 Sensors?

Yes >> Replace the O2 Sensor that had the voltage reading above 4.5 volts.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED

With the scan tool, read TP Sensor voltage.

NOTE: The throttle must be against the stop.

Is the voltage 0.92 of a volt or less with the Throttle closed?

Yes >> Go To 9

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

9. TP SENSOR SWEEP

With the scan tool, read the TP Sensor voltage.

While monitoring the scan tool, slowly open and close the throttle.

Does the voltage increase and decrease smoothly?

Yes >> Go To 10

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool in Sensors, read the MAP Sensor vacuum value.

Is the scan toolreading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 11

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

11. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the Engine Coolant Temperature increase smoothly and did it reach at least 82°C (180°F)?

Yes >> Go To 12

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

12. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from leaks.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

13. O2 SENSOR

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test.
Ignition on, engine not running.
Disconnect the harness connector(s) of the O2 Sensor(s) that had a voltage reading below 4.5 volts in the previous step.
With the scan tool, monitor the O2 Sensor voltage reading(s).

Is the voltage above 4.5 volts for any of the O2 Sensors?

Yes >> Replace the O2 Sensor that had a voltage reading above 4.5 volts.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

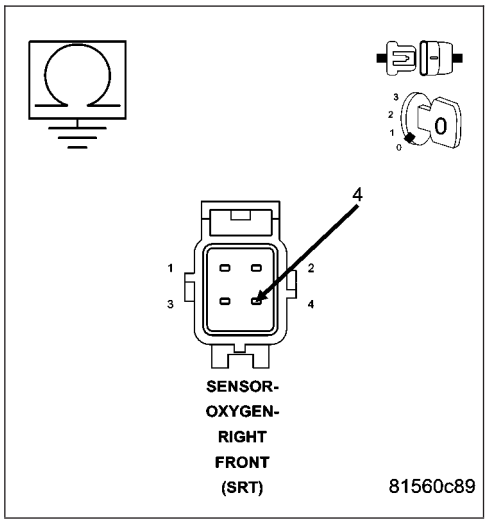
P0174-FUEL SYSTEM 2/1 LEAN (CONTINUED)

14. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K43) O2 Sensor 2/1 Signal circuit at the PCM harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K43) O2 Sensor 2/1 Signal circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

15. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

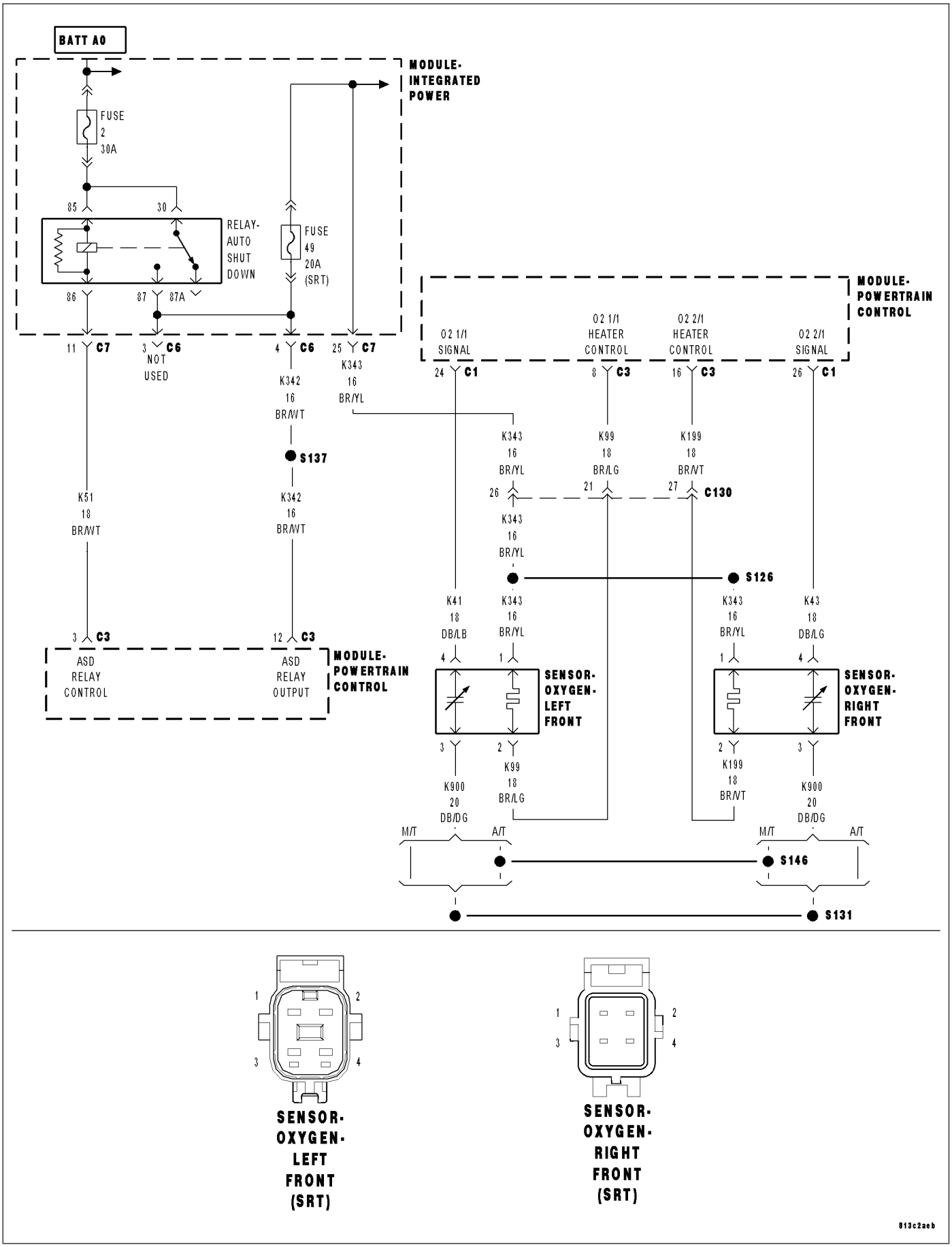
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH



P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The fuel feedback system will maintain a stoiciometric fuel/air mixture, 14.7:1, by modifying the injector pulsewidth according to the oxygen content of the exhaust gas. The PCM makes short term and long term fuel corrections to maintain stoiciometric fuel/air ratio for best catalytic converter efficiency. Short term fuel correction is based on upstream O2 sensor output and is designed for quick engine response. The long term fuel correction compensated for variations in the engine specifications, sensor tolerances and component aging and is designed to correct rich and lean conditions over a longer period of time.

- **When Monitored:**
  With the engine running in closed loop mode, the ambient/battery temperature above 20 deg. F and altitude below 8500 ft.
- **Set Condition:**
  If the PCM multiplies short term compensation by long term adaptive and a purge fuel multiplier and the result is below a certain value for 30 seconds over two trips, a freeze frame is stored, the MIL illuminates and a trouble code is stored. Two Trip Fault. Three good trips to turn off the MIL.

Possible Causes
O2 SENSOR
(K43) O2 SENSOR 2/1 SIGNAL CIRCUIT OPEN
(K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE
2/1 O2 SENSOR HEATER OPERATION
EVAP SYSTEM OPERATION
TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED
TP SENSOR
FUEL FILTER/PRESSURE REGULATOR
MAP SENSOR
ECT SENSOR
ENGINE MECHANICAL CONDITION
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

NOTE: Check for contaminates that may have damaged the O2 Sensor: contaminated fuel, unapproved silicone, oil and coolant.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

NOTE: Any O2 Sensor, TPS, ECT, MAP, or EVAP DTCs must be repaired before continuing.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

2. CHECKING FUEL PRESSURE

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Install a fuel pressure gauge.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification

Go To 3

Above Specification

Replace the fuel filter/pressure regulator.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CAUTION: Stop All Actuations.

---

3. O2 SENSOR OPERATION

Ignition on, engine not running.

With the scan tool, monitor all of the O2 Sensor voltage readings.

Is the voltage above 4.5 volts for all of the O2 Sensors?

Yes >> Go To 4

No >> Go To 11

---

4. O2 SENSOR HEATER OPERATION

Turn the ignition off.

NOTE: Wait a minimum of 10 minutes to allow the O2 Sensor to cool down before continuing the test. Allow the O2 Sensor voltage to stabilize between 4 and 5 volts.

Ignition on, engine not running.

With the scan tool, actuate the O2 Heater Test.

With the scan tool, monitor O2 Sensor voltage for at least 2 minutes.

Does the voltage stay above 4.5 volts?

Yes >> Replace the O2 Sensor that had the voltage reading above 4.5 volts.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

5. EVAP SYSTEM OPERATION

NOTE: The engine must be at operating temperature and in closed loop to perform this test.
Start the engine.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing.
Allow the engine to reach normal operating temperature.

With the scan tool select System Tests, perform the Purge Vapors Test.

Observe the Short Term Adaptive value and press 3 to flow.

NOTE: Short Term Adaptive value change.

Did the Short Term Adaptive value change?

Yes >> Go To 6

No >> Refer to the Driveability category and perform the appropriate Diagnostic test.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. TP SENSOR VOLTAGE GREATER THAN 0.92 OF A VOLT WITH THROTTLE CLOSED

Ignition on, engine not running.

With the scan tool, read TP Sensor voltage.

NOTE: The throttle must be against the stop.

Is the voltage 0.92 of a volt or less with the Throttle closed?

Yes >> Go To 7

No >> Check for a binding throttle condition. If OK, replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. TP SENSOR SWEEP

With the scan tool, read the TP Sensor voltage.

While monitoring the scan tool, slowly open and close the throttle.

Does the voltage increase and decrease smoothly?

Yes >> Go To 8

No >> Replace the Throttle Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

8. MAP SENSOR OPERATION

Turn the ignition off.

Connect a Vacuum Gauge to a Manifold Vacuum source.

Start the engine.

Allow the engine to idle.

NOTE: If engine will not idle, maintain a constant RPM above idle.

With the scan tool in Sensors, read the MAP Sensor vacuum value.

Is the scan tool reading within 1″ of the Vacuum Gauge reading?

Yes >> Go To 9

No >> Replace the MAP Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

NOTE: Remove the vacuum gauge before continuing.

---

9. ECT SENSOR OPERATION

NOTE: For this test to be valid, the thermostat must be operating correctly.

NOTE: This test works best if performed on a cold engine (cold soak)

Ignition on, engine not running.

With the scan tool, read the Engine Coolant Temperature Sensor value. If the engine was allowed to sit overnight (cold soak), the temperature value should be a sensible value that is somewhere close to the ambient temperature.

NOTE: If engine coolant temperature is above 82°C (180°F), allow the engine to cool until 65°C (150°F) is reached.

Start the Engine.

During engine warm-up, monitor the Engine Coolant Temperature value. The temp value change should be a smooth transition from start up to normal operating temp 82°C (180°F). The value should reach at least 82°C (180°F).

Did the Engine Coolant Temperature value increase smoothly and reach at least 82°C?

Yes >> Go To 10

No >> Replace the Engine Coolant Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

10. ENGINE MECHANICAL PROBLEM

Check for any of the following conditions/mechanical problems.
AIR INDUCTION SYSTEM - must be free from restrictions.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

11. O2 SENSOR

Disconnect the sensor harness connector of the O2 Sensor(s) that had a voltage value greater than 4.5 volts in the previous step.
Ignition on, engine not running.
With the scan tool, monitor the O2 Sensor voltage reading(s).

Is the O2 Sensor voltage above 4.5 volts?

Yes >> Replace the O2 Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 12

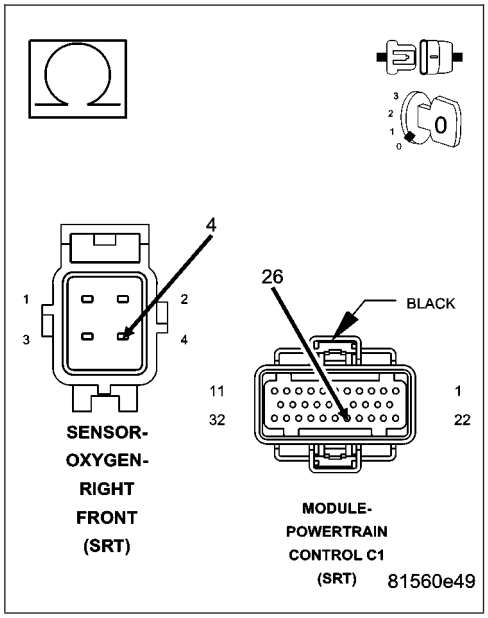
P0175-FUEL SYSTEM 2/1 RICH (CONTINUED)

12. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K43) O2 Sensor 2/1 Signal circuit from the PCM harness connector to the O2 Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 13

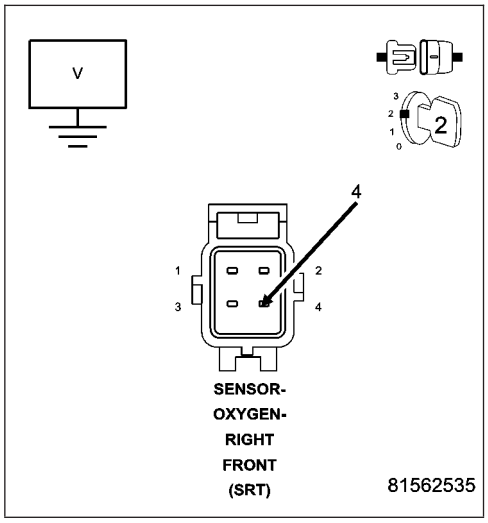
No >> Repair the open in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

13. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT SHORTED TO VOLTAGE

Ignition on, engine not running.

Leave the O2 Sensor and PCM harness connectors disconnected.

Measure the voltage on the (K43) O2 Sensor 2/1 Signal circuit at the 2/1 O2 Sensor harness connector.



Is the voltage above 5.2 volts?

Yes >> Repair the short to voltage in the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 14

NOTE: Turn the ignition off before continuing.

14. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

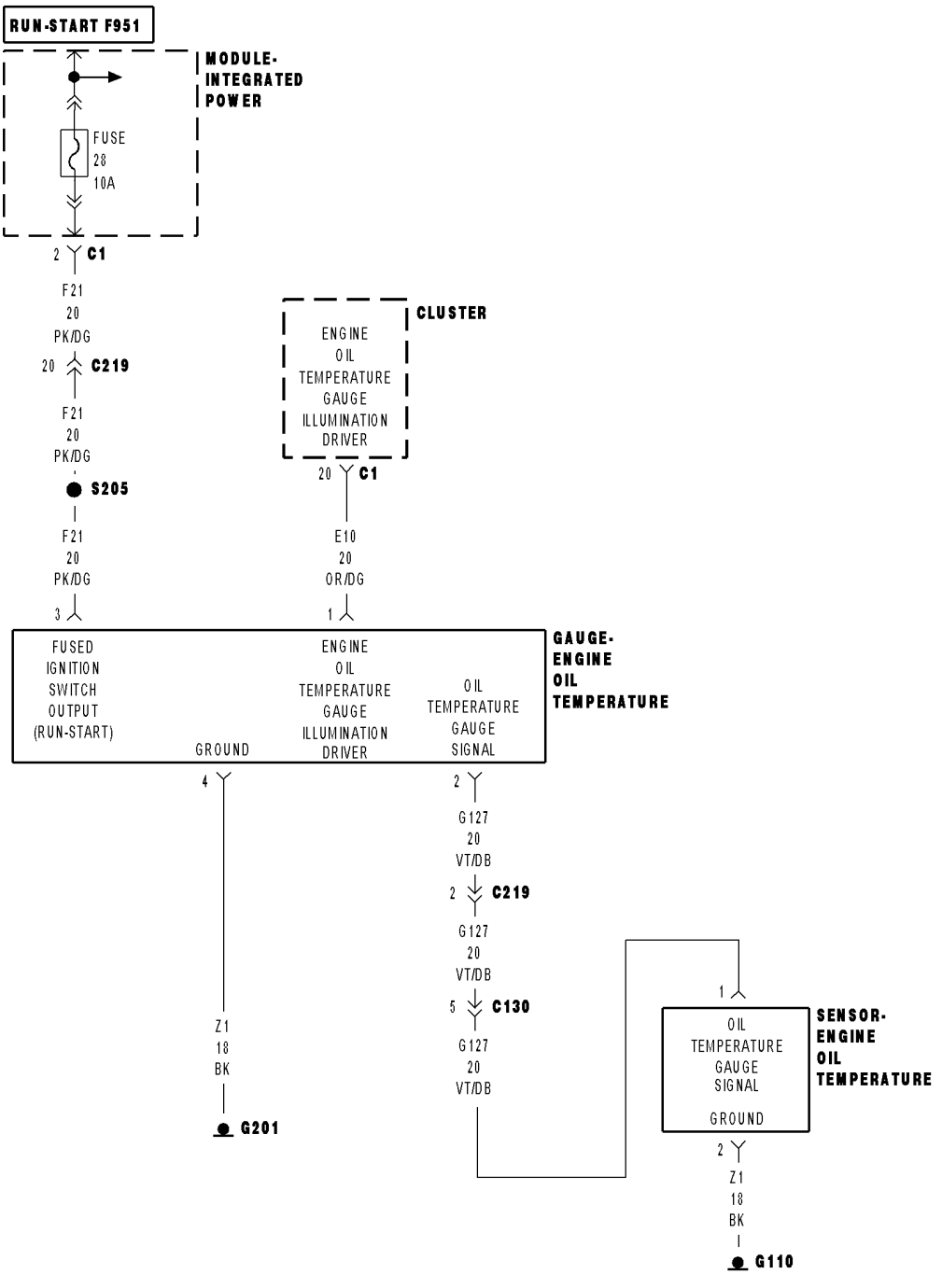
If there are no possible causes remaining, view repair.

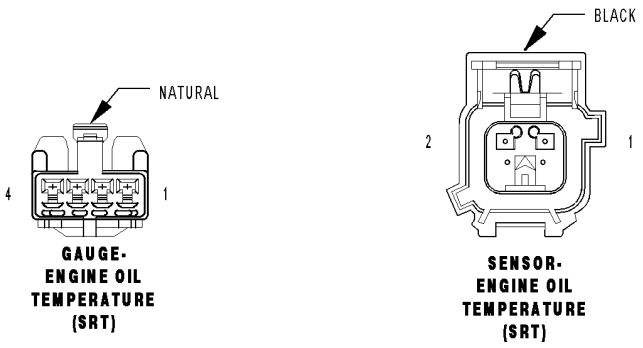
Repair

Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0197-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO LOW





81550a7c

P0197-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the engine oil temperature sensor signal goes below a specific value.

Possible Causes
ENGINE OIL TEMP SENSOR
(G127) ENGINE OIL TEMP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(G127) ENGINE OIL TEMP SENSOR CIRCUIT SHORTED TO THE (Z1) GROUND CIRCUIT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. EOT VOLTAGE BELOW 1.0 VOLT

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, read the Engine Oil Temp Sensor voltage.

Is the EOT Sensor voltage below 1.0 volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ENGINE OIL TEMP SENSOR

Turn the ignition off.
Disconnect the Engine Oil Temp harness connector.
Ignition on, engine not running.
With the scan tool, read Engine Oil Temp voltage.

Is the voltage above 1.0 volt?

Yes >> Replace the Engine Oil Temp Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0197-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO LOW (CONTINUED)

3. (G127) EOT SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

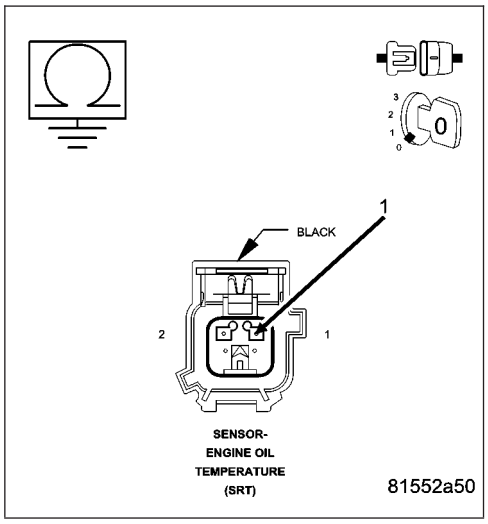
Disconnect the PCM harness connectors.

Measure the resistance between ground and the (G127) Engine Oil Temp Sensor Signal circuit at the EOT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (G127) Engine Oil Temp Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



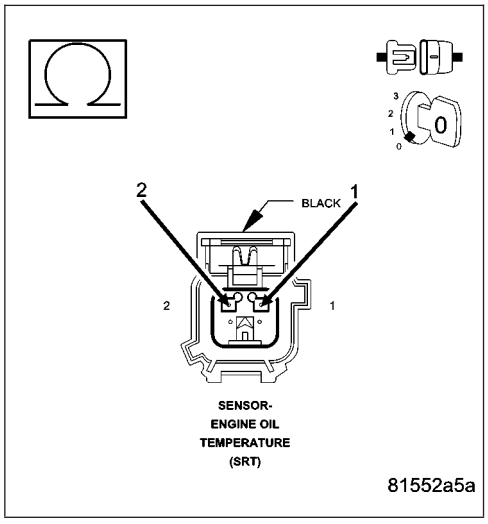
4. (G127) EOT SENSOR SIGNAL CIRCUIT SHORTED TO (Z1) GROUND CIRCUIT

Measure the resistance between the (G127) Engine Oil Temp Sensor Signal circuit and the (Z1) ground circuit at the EOT Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short between the (Z1) ground circuit and the (G127) Engine Oil Temp Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

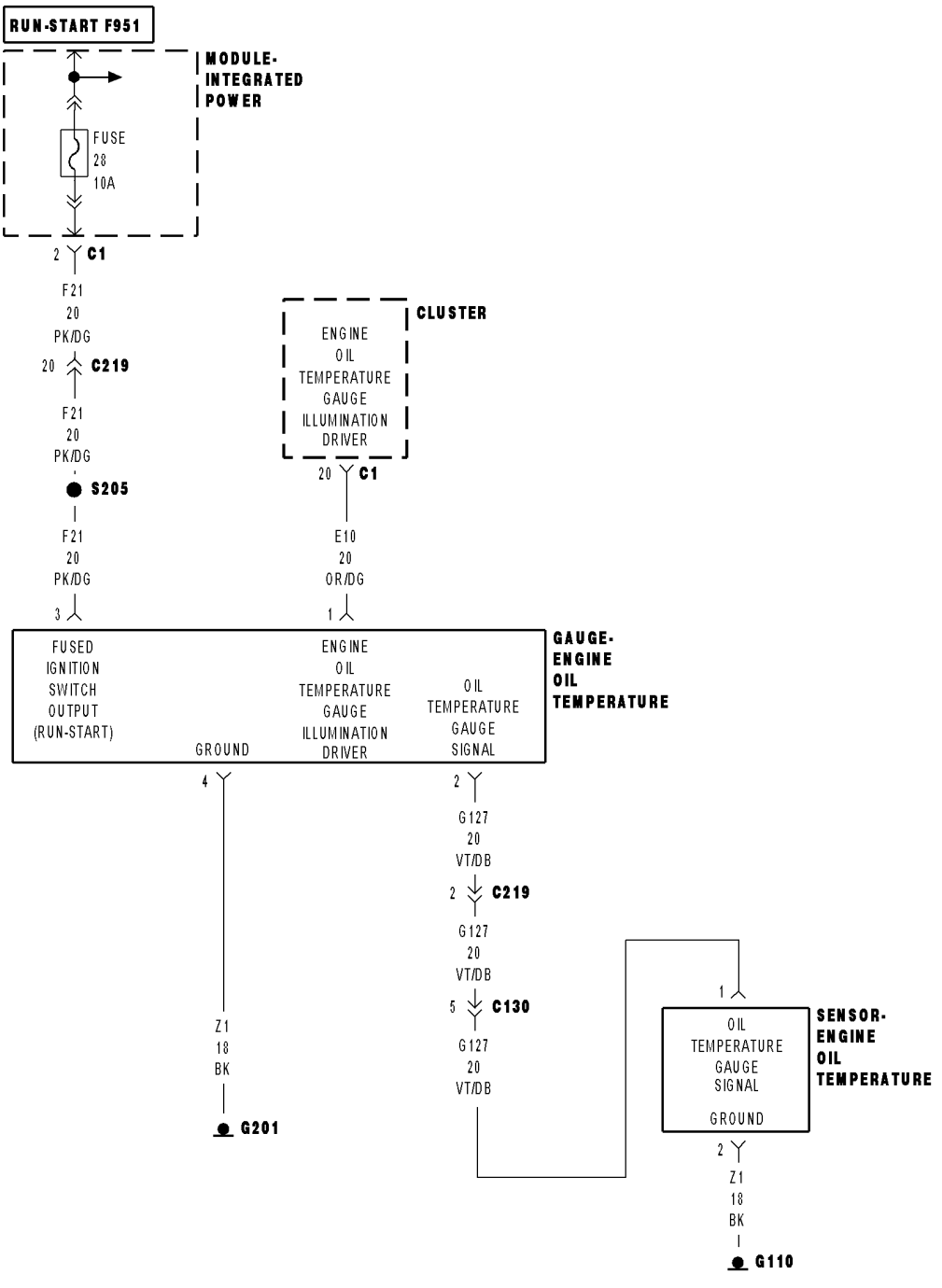
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

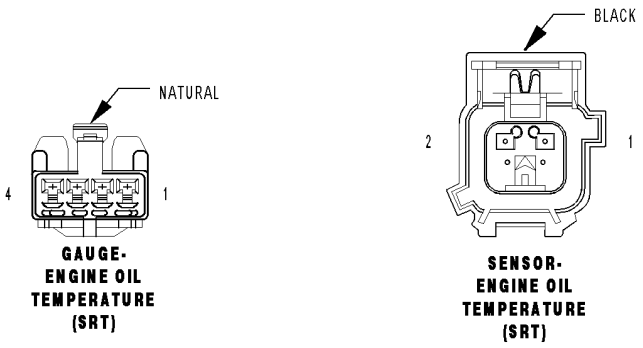
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0198-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO HIGH





81550a7c

P0198-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the engine oil temperature sensor signal above a specific voltage.

Possible Causes
ENGINE OIL TEMP SENSOR
(G127) ENGINE OIL TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE
(G127) ENGINE OIL TEMP SENSOR SIGNAL CIRCUIT OPEN
(Z1) GROUND CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. ENGINE OIL TEMP VOLTAGE ABOVE 4.9 VOLTS

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

With the scan tool, read Engine Oil Temp Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. ENGINE OIL TEMP SENSOR

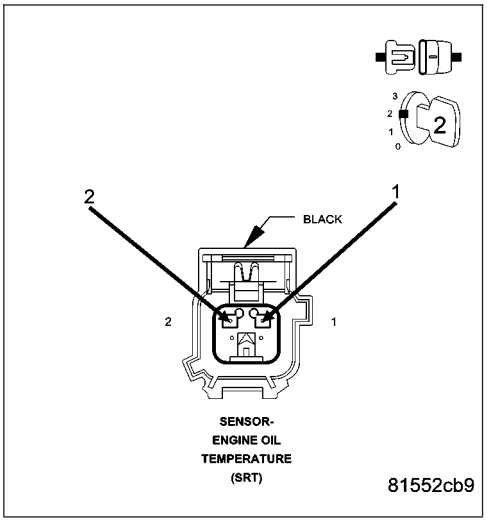
Turn the ignition off.

Disconnect the Engine Oil Temp Sensor harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (G127) Engine Oil Temp Sensor Signal circuit and the (Z1) ground circuit in the EOT harness connector.

With the scan tool, read the Engine Oil Temp Sensor voltage.



Is the voltage below 1.0 volt?

Yes >> Replace the Engine Oil Temp Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

P0198-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

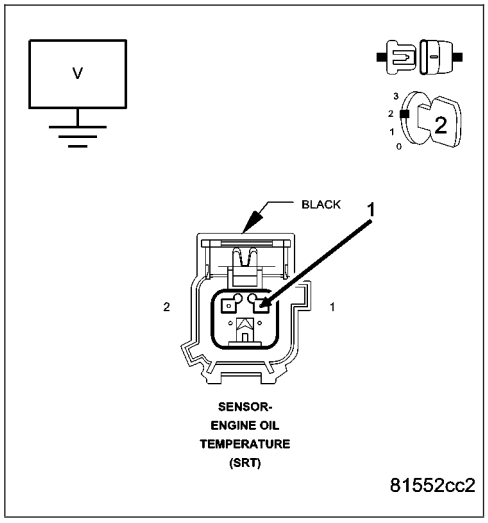
3. (G127) ENGINE OIL TEMP SENSOR SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

Measure the voltage on the (G127) Engine Oil Temp Sensor Signal circuit at the EOT Sensor harness connector.



Is the voltage above 5.3 volts?

Yes >> Repair the short to voltage in the (G127) Engine Oil Temp Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

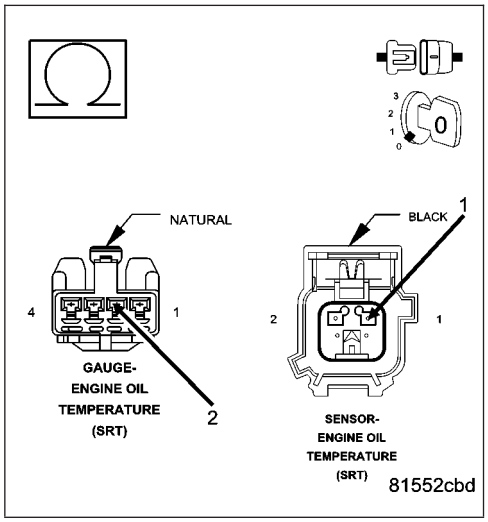
No >> Go To 4

---

4. (G127) ECT SENSOR SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (G127) Engine Oil Temp Sensor Signal circuit from the Sensor harness connector to the Engine Oil Temperature Guage.



Is the resistance below 5.0 ohms?

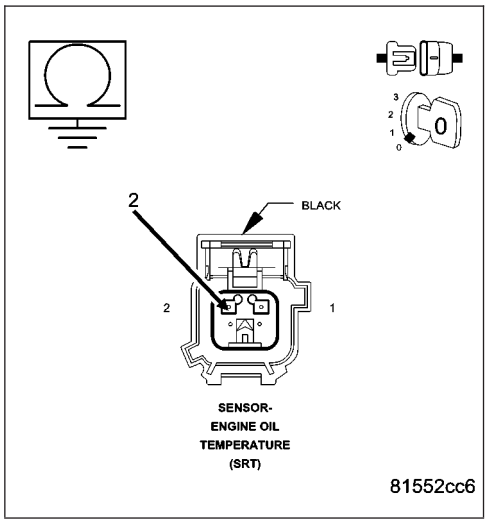
Yes >> Go To 5

No >> Repair the open in the (G127) Engine Oil Temp Sensor Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0198-ENGINE OIL TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

5. (Z1) GROUND CIRCUIT OPEN

Measure the resistance between a known good ground and the (Z1) ground circuit at the Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (Z1) ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

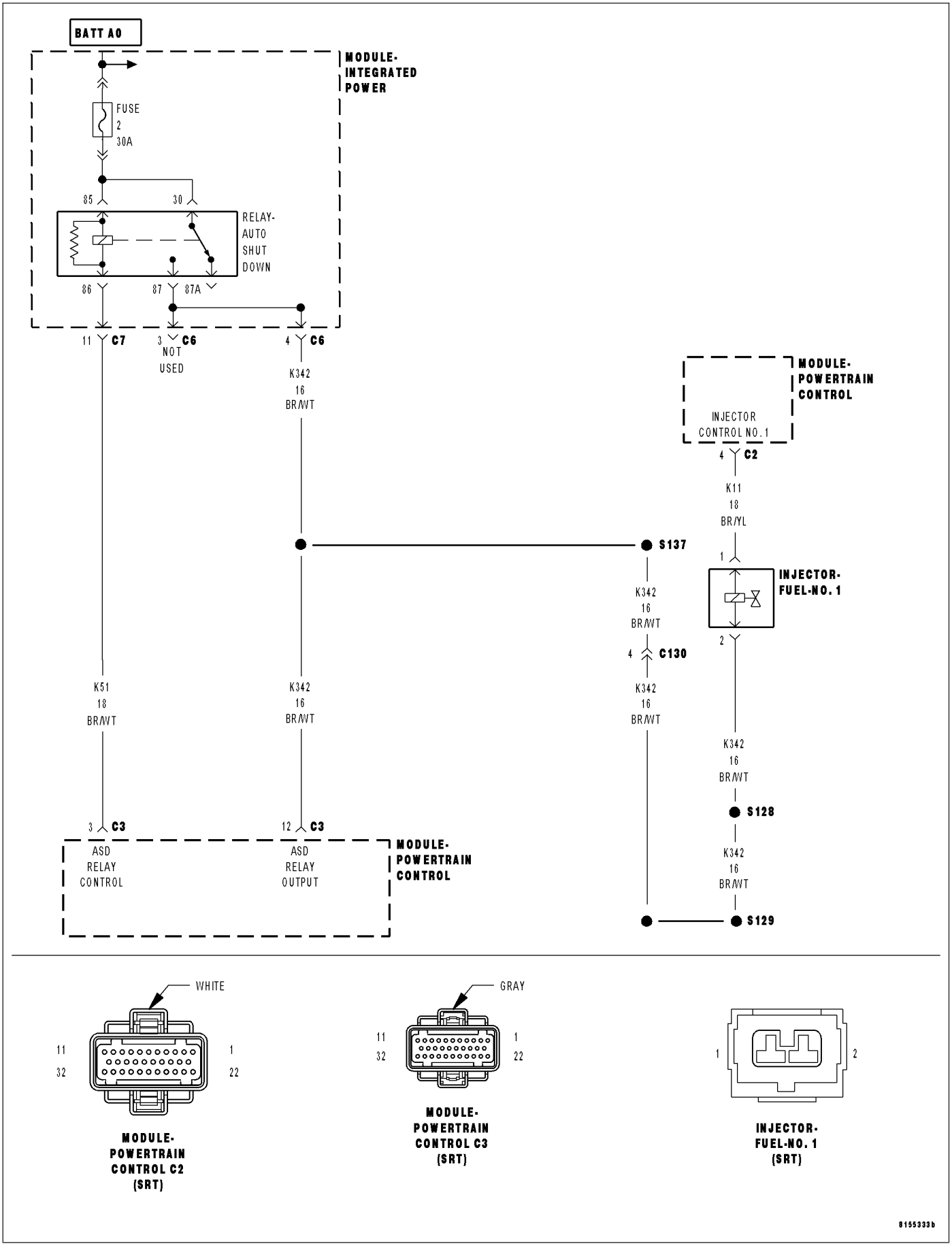
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0201-FUEL INJECTOR 1 CIRCUIT



P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN
(K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.1 Fuel Injector harness connector.

Ignition on, engine not running.

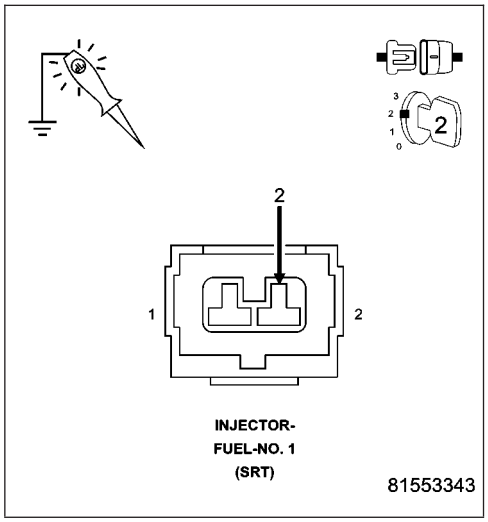
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.

With the scan tool, actuate the Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

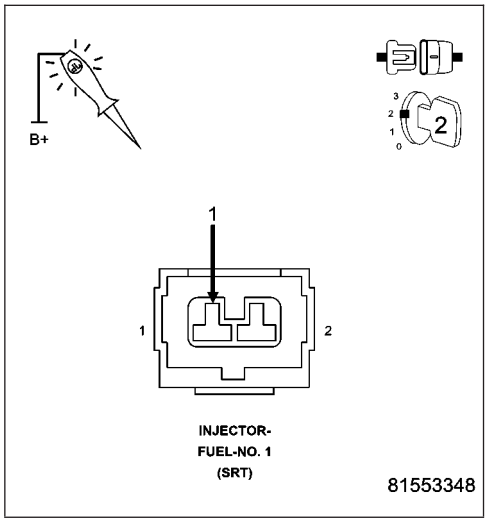
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K11) INJECTOR CONTROL NO.1 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

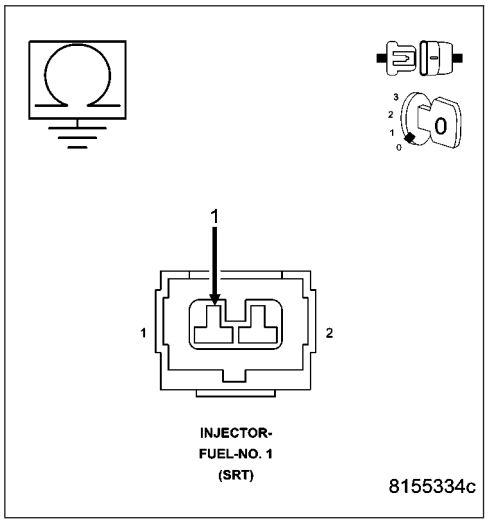
Measure the resistance between ground and the (K11) Injector Control No.1 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K11) Injector Control No.1 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



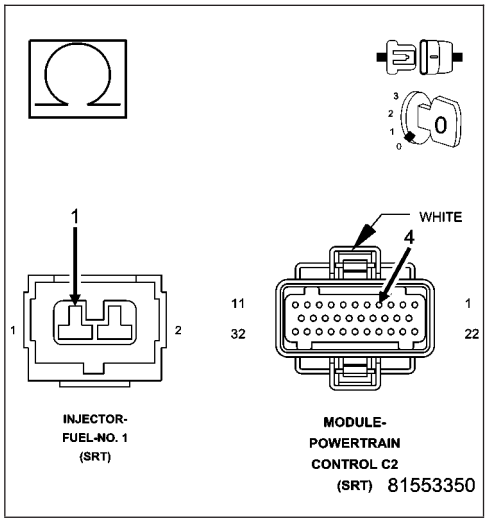
P0201-FUEL INJECTOR 1 CIRCUIT (CONTINUED)

5. (K11) INJECTOR CONTROL NO.1 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K11) Injector Control No.1 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K11) Injector Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

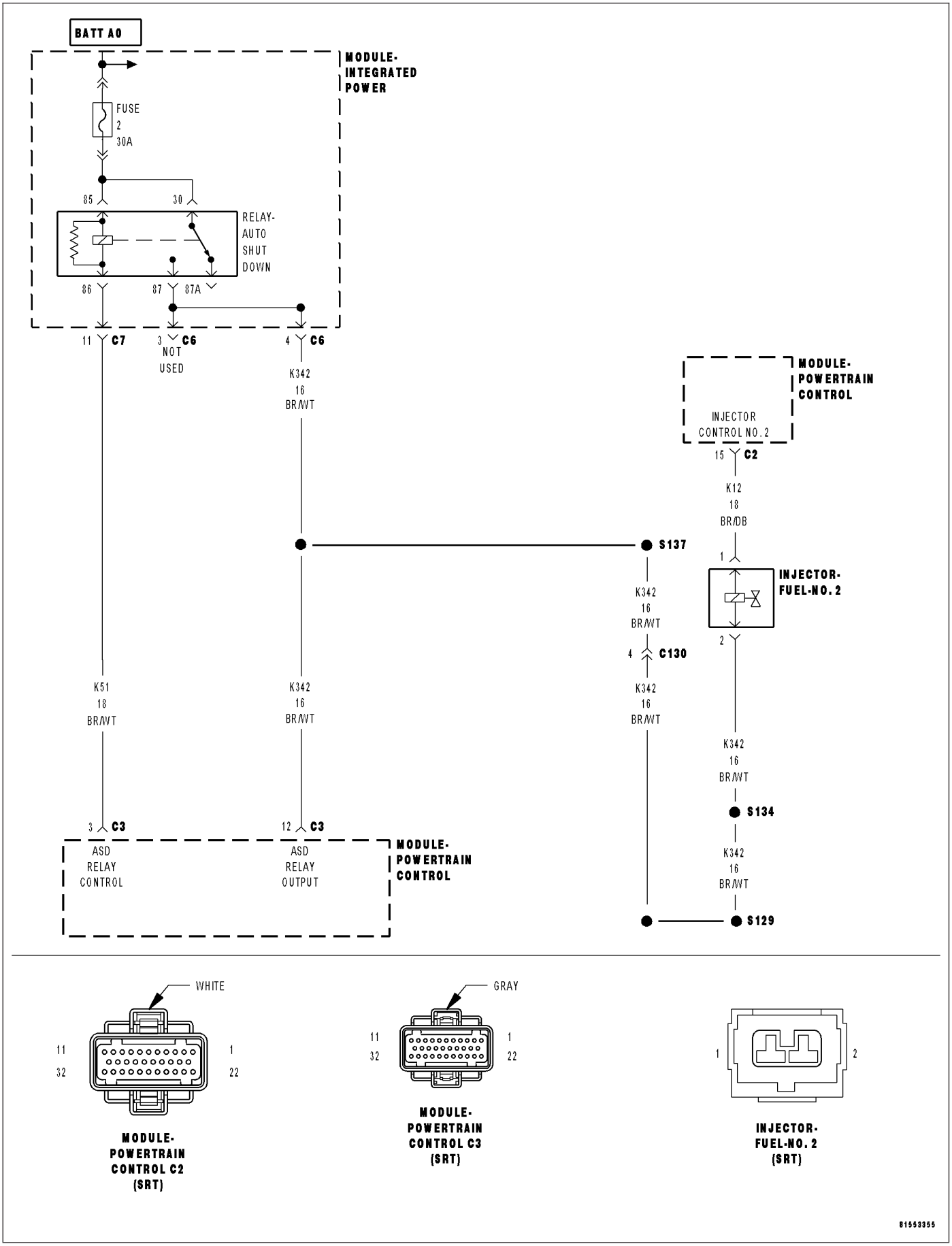
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0202-FUEL INJECTOR 2 CIRCUIT



P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN
(K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.2 Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.2 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control No.2 circuit.

With the scan tool, actuate the No.2 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

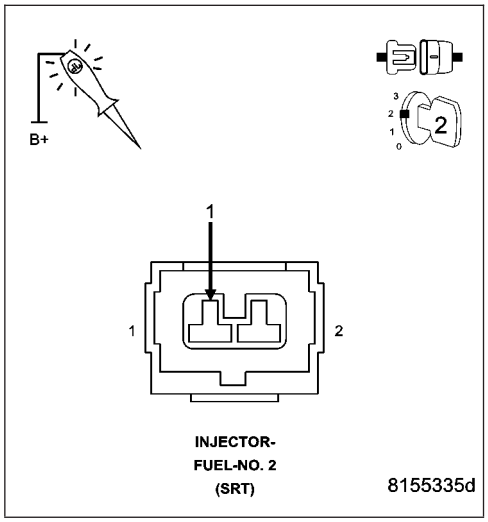
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K12) INJECTOR CONTROL NO.2 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

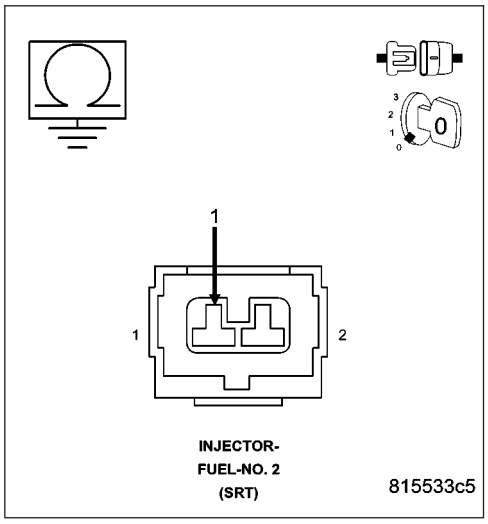
Measure the resistance between ground and the (K12) Injector Control No.2 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K12) Injector Control No.2 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



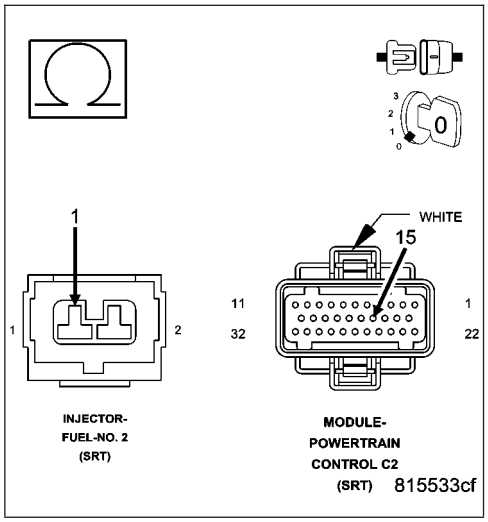
P0202-FUEL INJECTOR 2 CIRCUIT (CONTINUED)

5. (K12) INJECTOR CONTROL NO.2 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K12) Injector Control No.2 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K12) Injector Control No.2 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

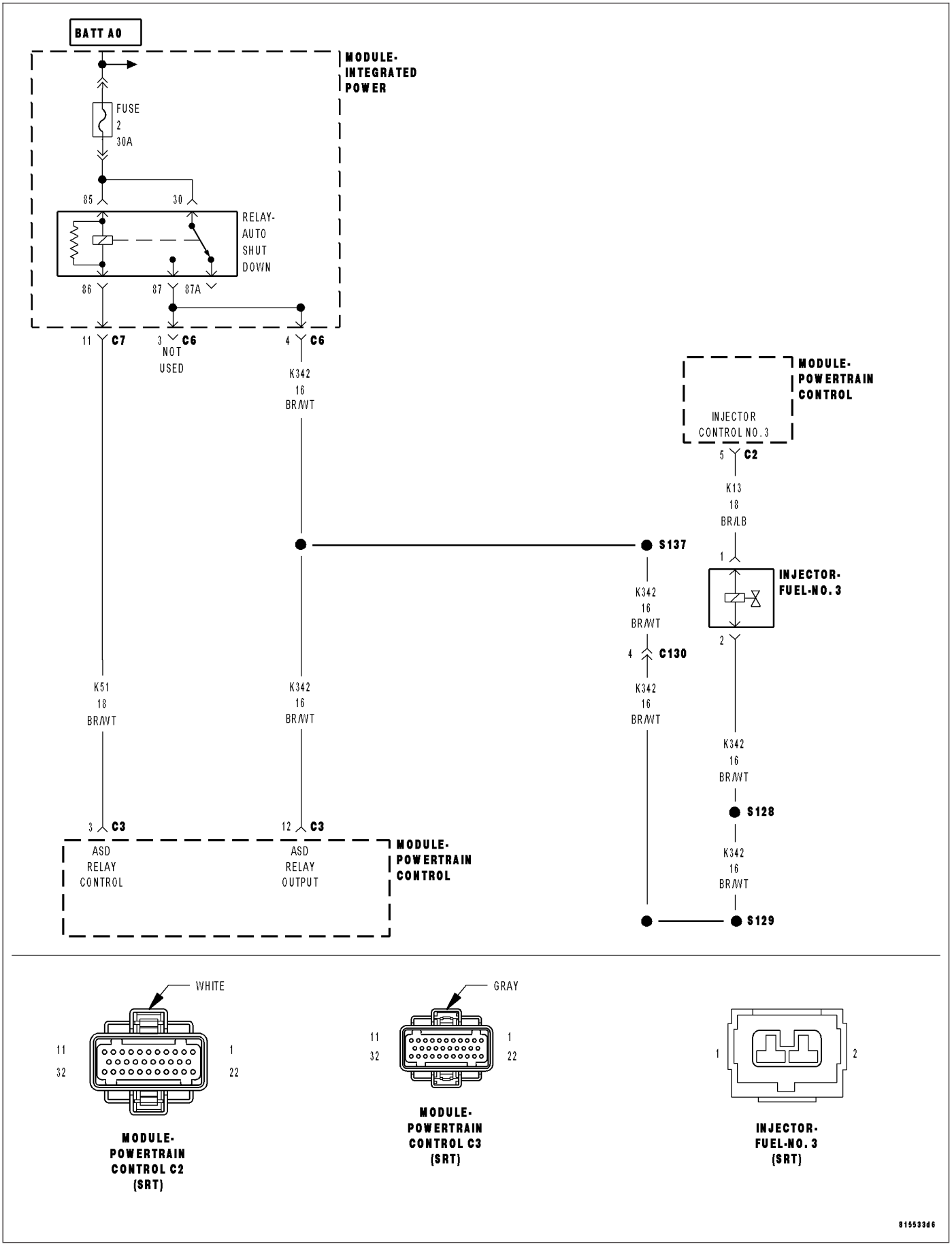
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0203-FUEL INJECTOR 3 CIRCUIT



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN
(K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.3 Fuel Injector harness connector.

Ignition on, engine not running.

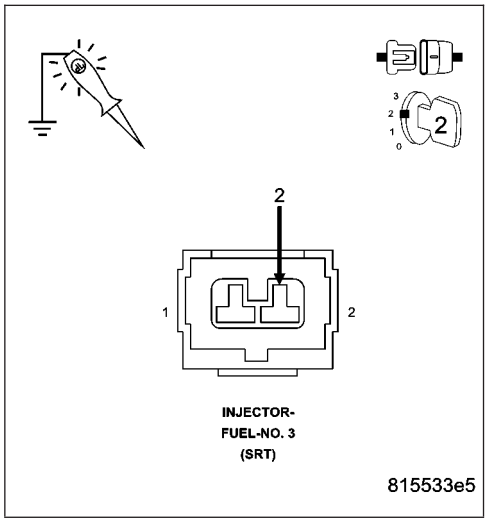
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.3 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control No.3 circuit.

With the scan tool, actuate the No.3 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

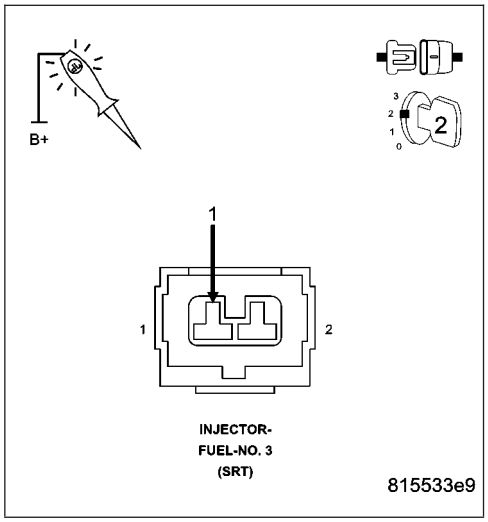
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K13) INJECTOR CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

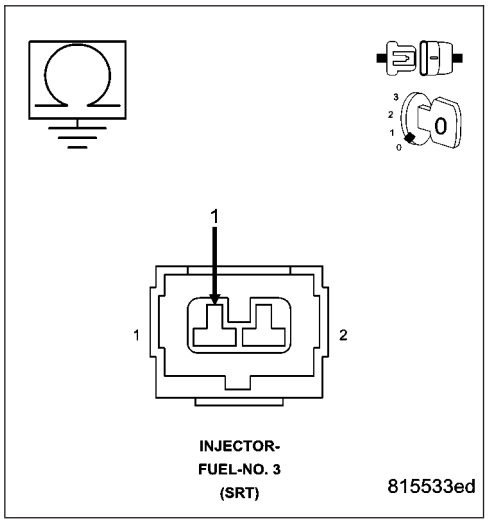
Measure the resistance between ground and the (K13) Injector Control No.3 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K13) Injector Control No.3 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



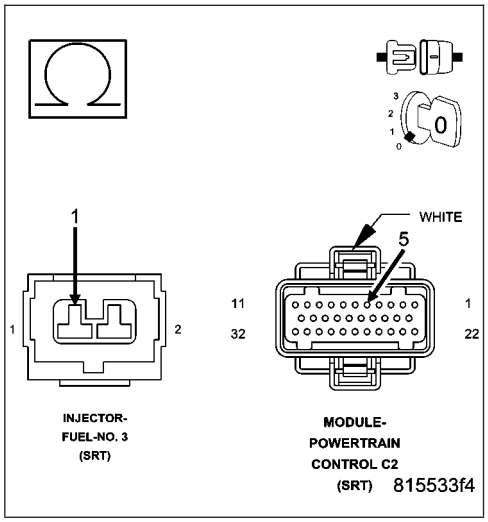
P0203-FUEL INJECTOR 3 CIRCUIT (CONTINUED)

5. (K13) INJECTOR CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K13) Injector Control No.3 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K13) Injector Control No.3 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

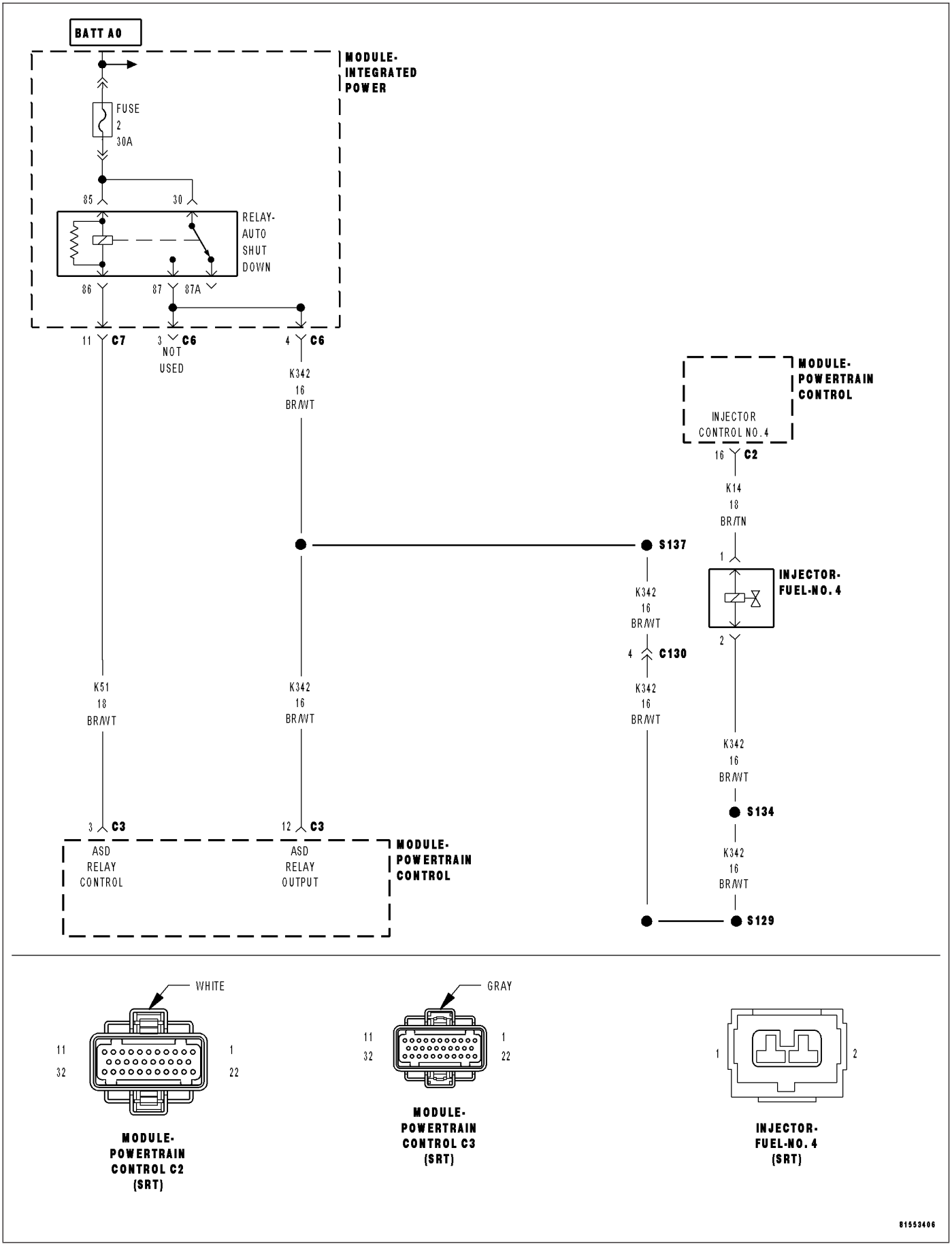
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0204-FUEL INJECTOR 4 CIRCUIT



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN
(K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.4 Fuel Injector harness connector.

Ignition on, engine not running.

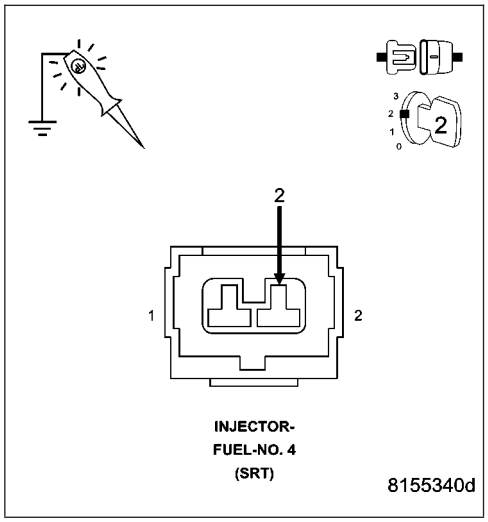
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.4 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control No.4 circuit.

With the scan tool, actuate the No.4 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

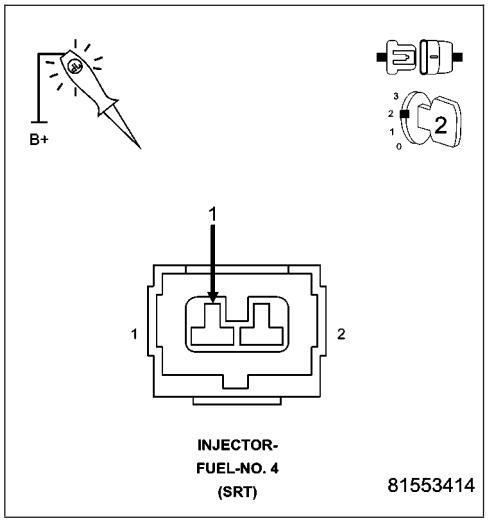
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K14) INJECTOR CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

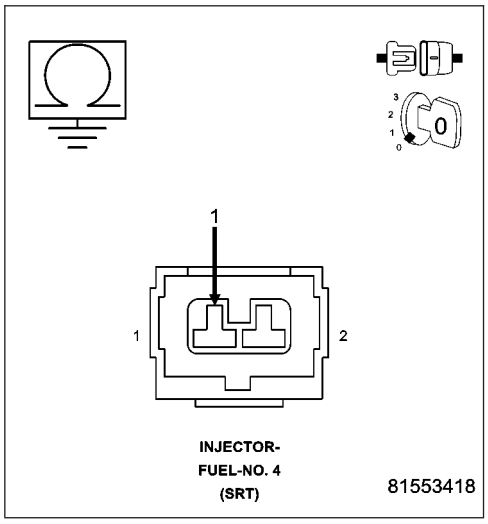
Measure the resistance between ground and the (K14) Injector Control No.4 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K14) Injector Control No.4 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



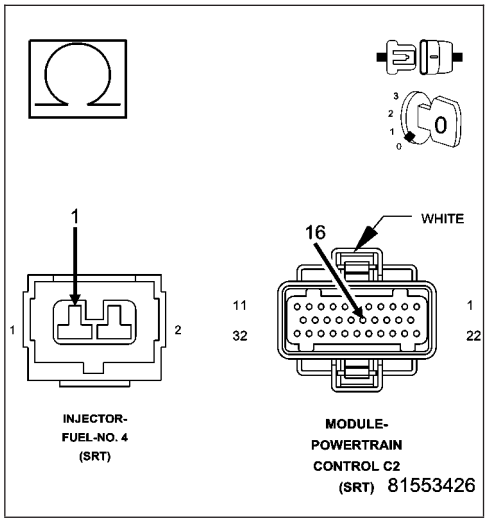
P0204-FUEL INJECTOR 4 CIRCUIT (CONTINUED)

5. (K14) INJECTOR CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K14) Injector Control No.4 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K14) Injector Control No.4 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

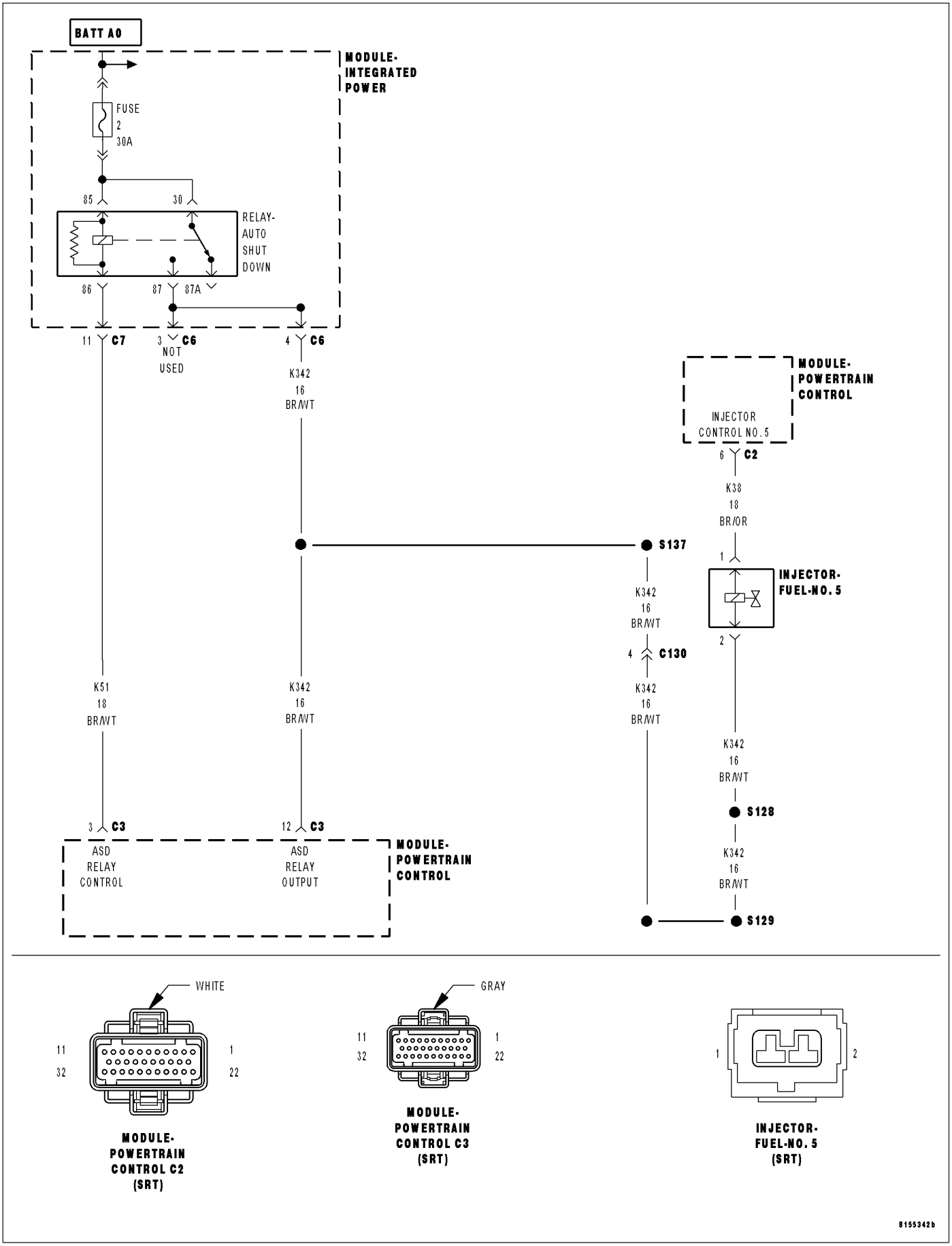
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0205-FUEL INJECTOR 5 CIRCUIT



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN
(K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.5 Fuel Injector harness connector.

Ignition on, engine not running.

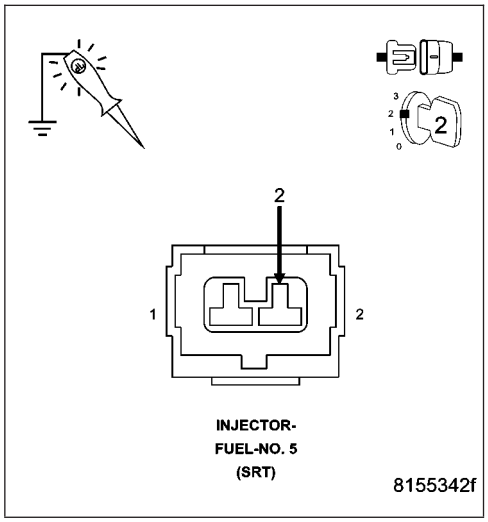
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.5 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control No.5 circuit.

With the scan tool, actuate the No.5 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

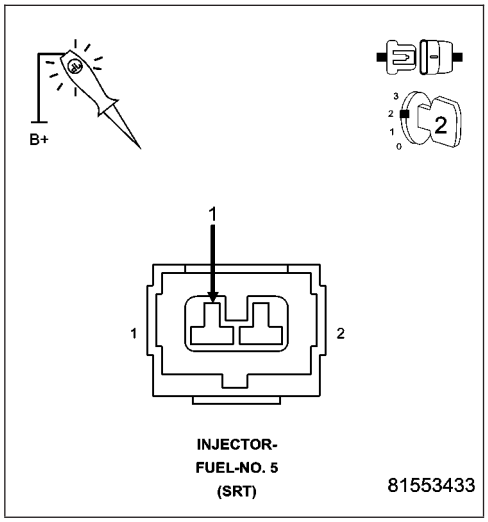
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K38) INJECTOR CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

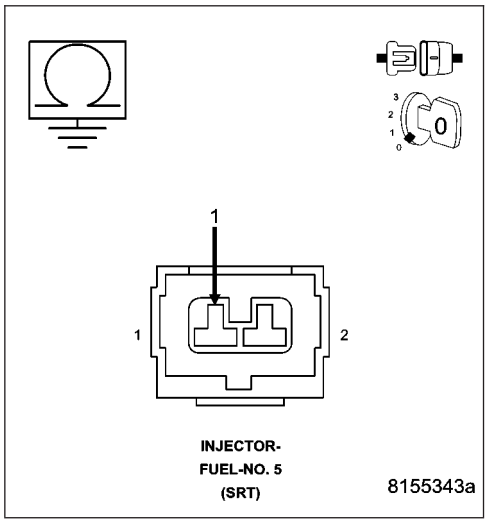
Measure the resistance between ground and the (K38) Injector Control No.5 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K38) Injector Control No.5 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0205-FUEL INJECTOR 5 CIRCUIT (CONTINUED)

5. (K38) INJECTOR CONTROL NO.5 CIRCUIT OPEN

Turn the ignition off.

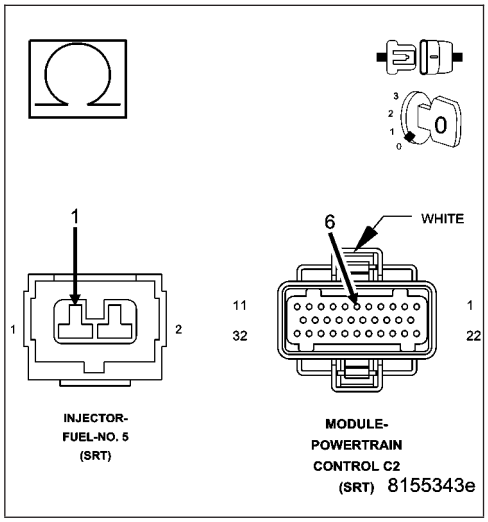
Disconnect the PCM harness connector.

Measure the resistance of the (K38) Injector Control No.5 circuit from the Fuel Injector harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K38) Injector Control No.5 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

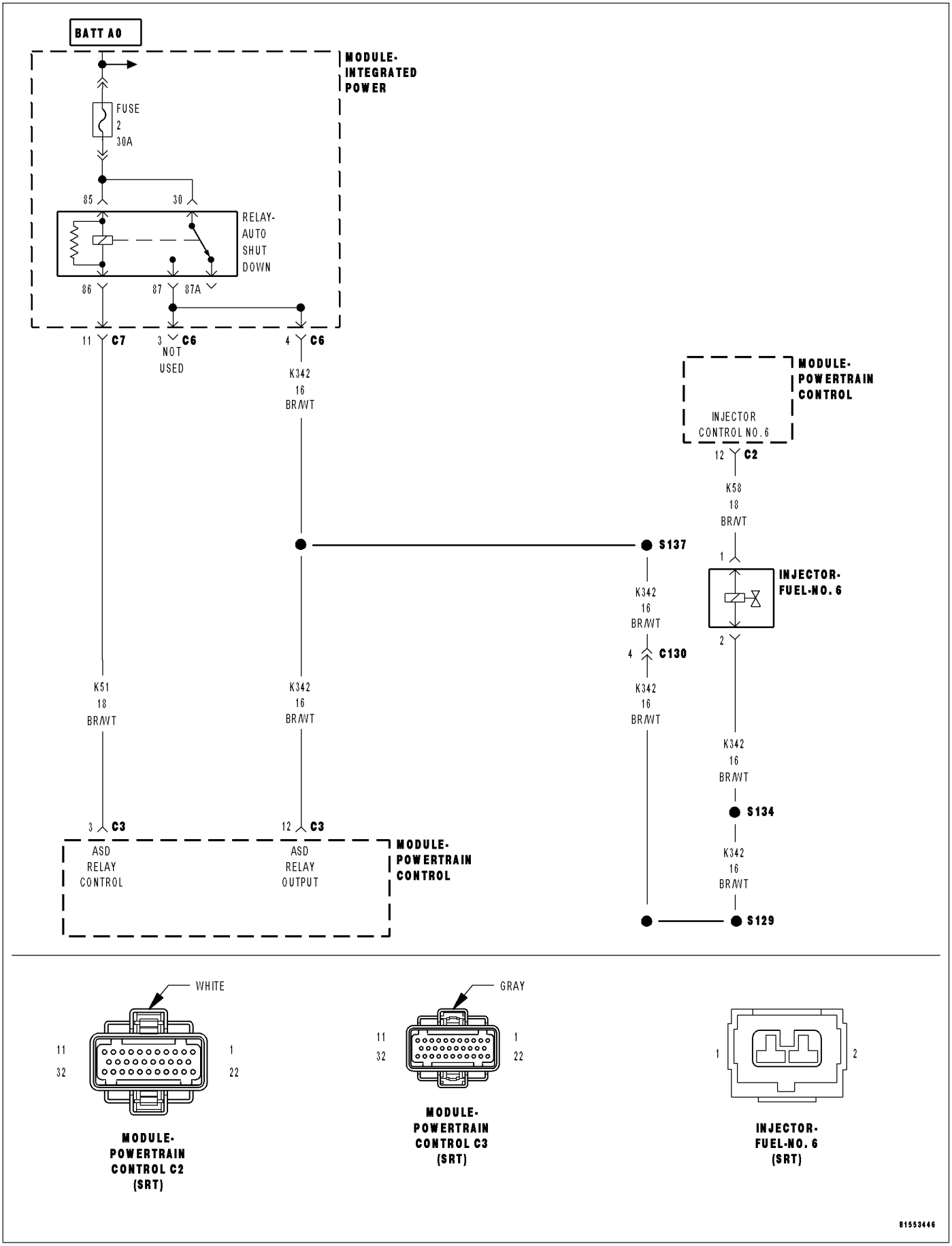
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0206-FUEL INJECTOR 6 CIRCUIT



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN
(K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.6 Fuel Injector harness connector.

Ignition on, engine not running.

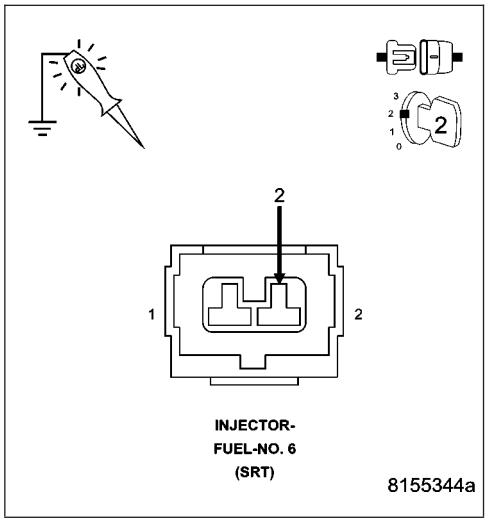
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.6 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control No.6 circuit.

With the scan tool, actuate the No.6 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

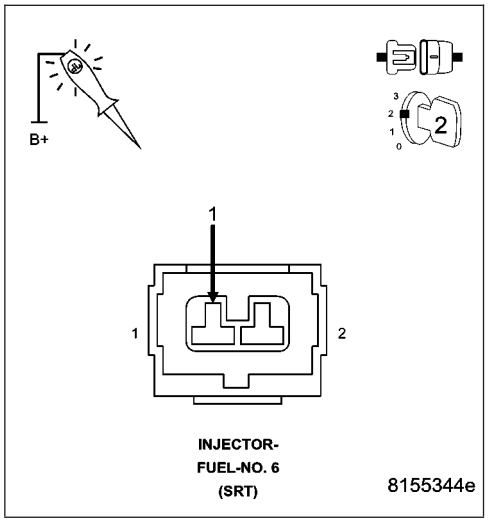
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K58) INJECTOR CONTROL NO.6 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

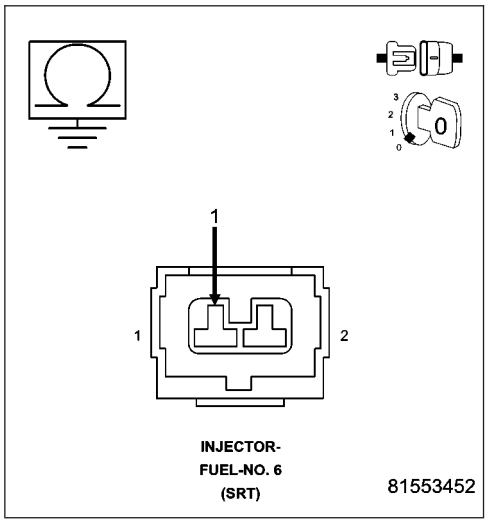
Measure the resistance between ground and the (K58) Injector Control No.6 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K58) Injector Control No.6 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



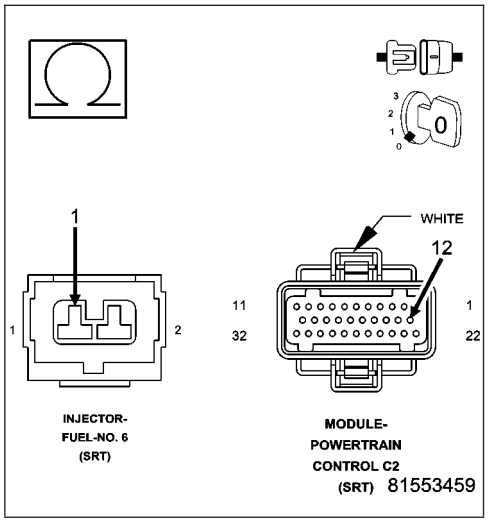
P0206-FUEL INJECTOR 6 CIRCUIT (CONTINUED)

5. (K58) INJECTOR CONTROL NO.6 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K58) Injector Control No.6 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K58) Injector Control No.6 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

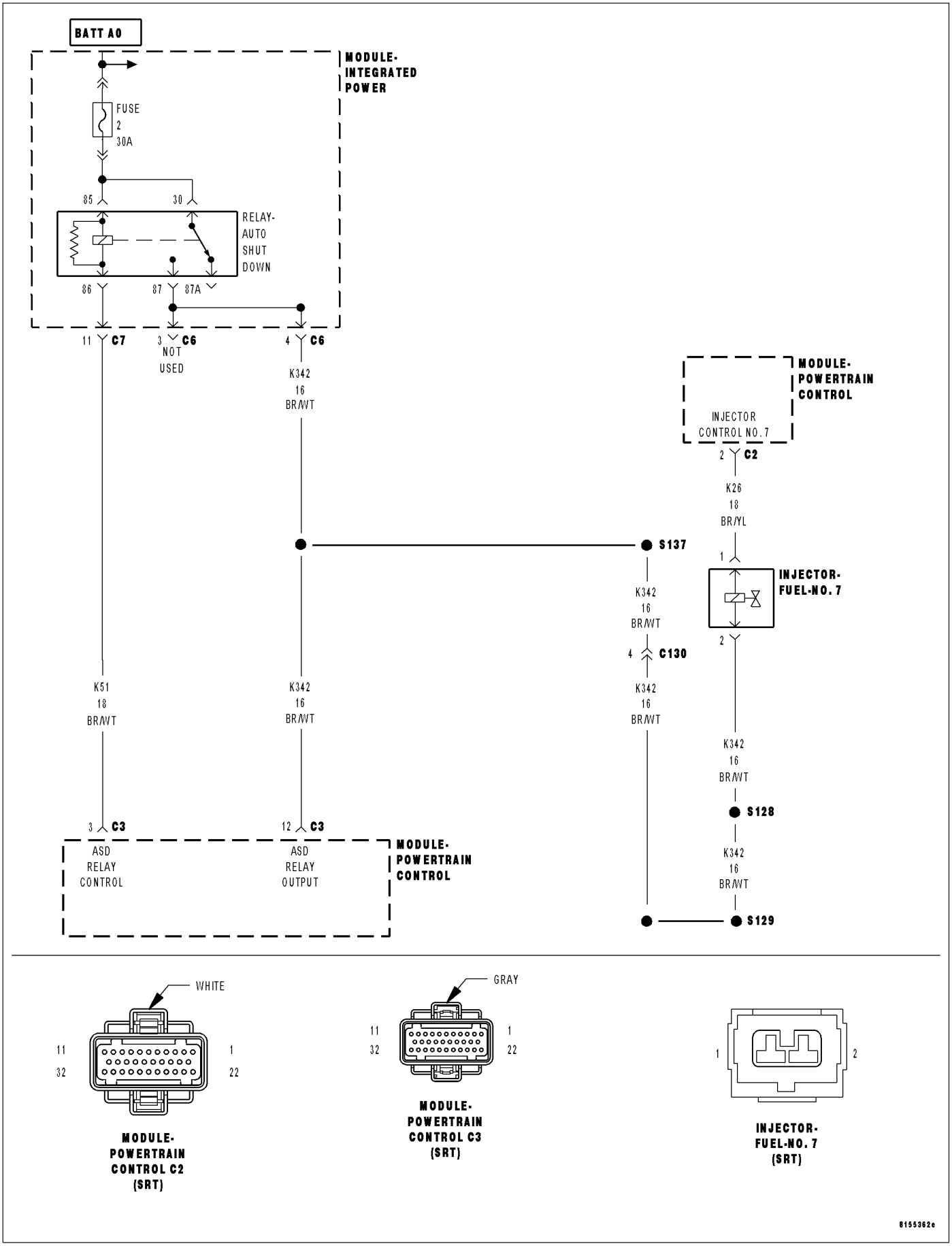
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0207-FUEL INJECTOR 7 CIRCUIT



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN
(K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.7 Fuel Injector harness connector.

Ignition on, engine not running.

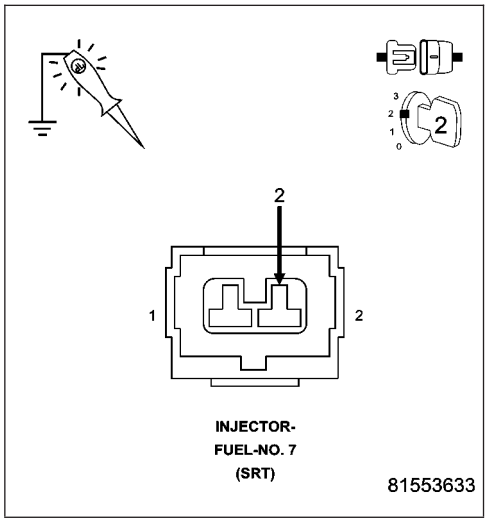
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.7 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K26) Injector Control No.7 circuit.

With the scan tool, actuate the No.7 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

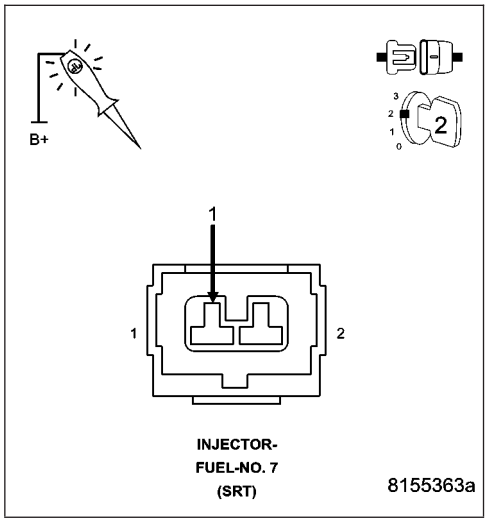
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K26) INJECTOR CONTROL NO.7 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

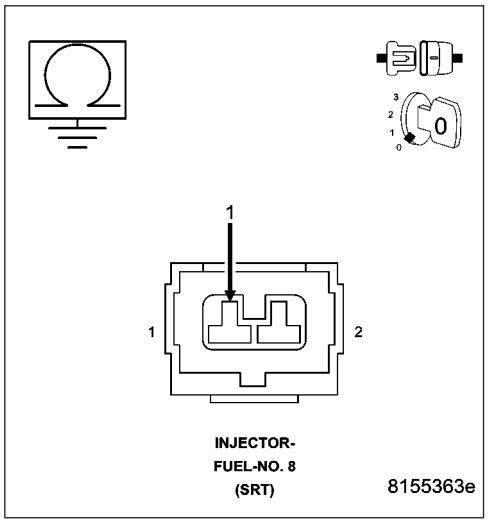
Measure the resistance between ground and the (K26) Injector Control No.7 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K26) Injector Control No.7 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



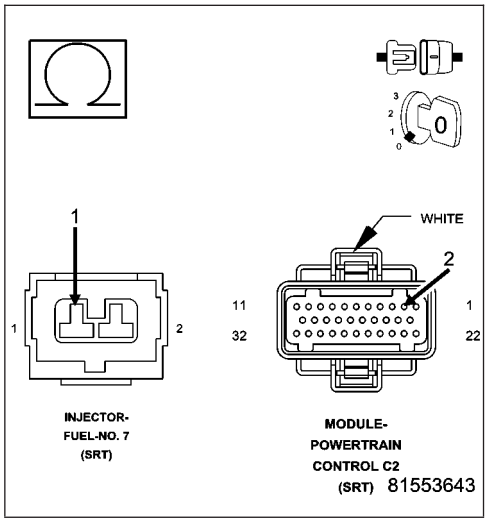
P0207-FUEL INJECTOR 7 CIRCUIT (CONTINUED)

5. (K26) INJECTOR CONTROL NO.7 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K26) Injector Control No.7 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K26) Injector Control No.7 circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

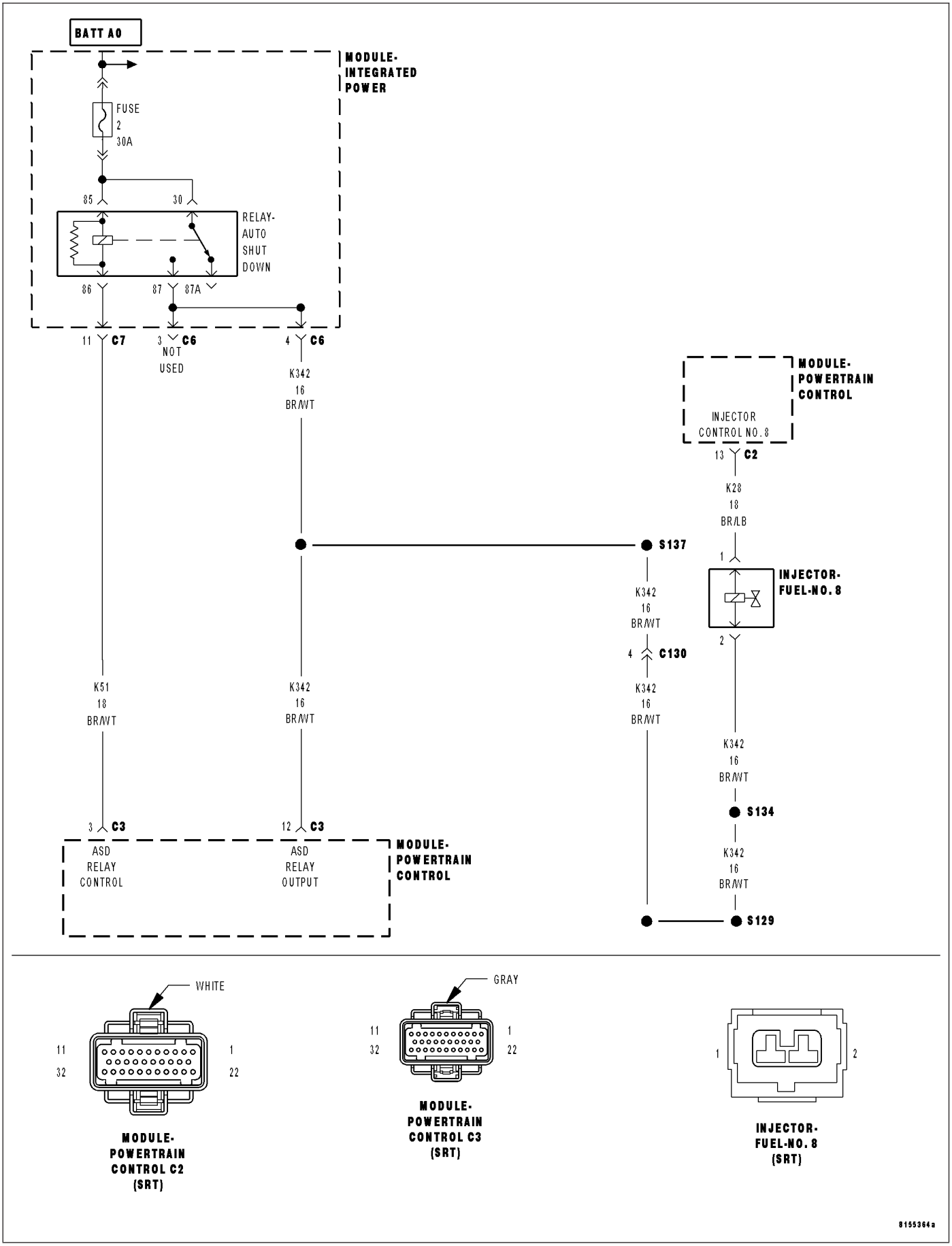
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0208-FUEL INJECTOR 8 CIRCUIT



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN
(K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.8 Fuel Injector harness connector.

Ignition on, engine not running.

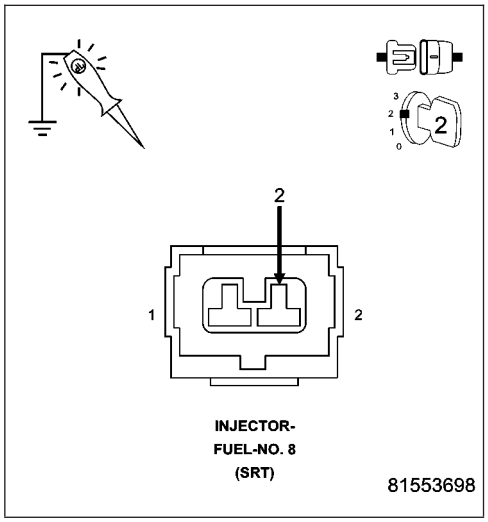
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.8 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control No.8 circuit.

With the scan tool, actuate the No.8 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

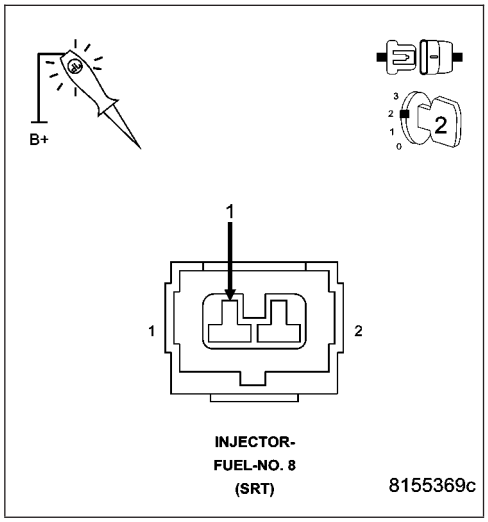
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K28) INJECTOR CONTROL NO.8 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

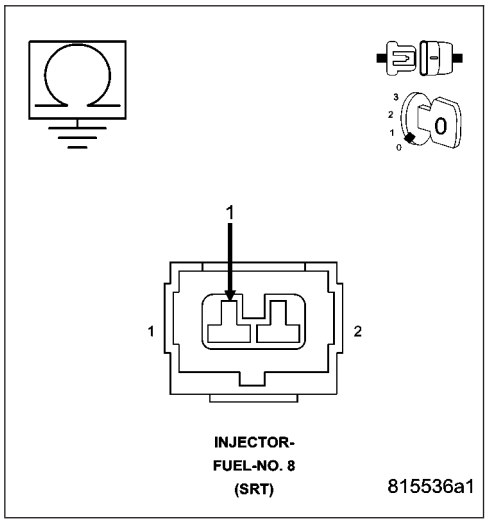
Measure the resistance between ground and the (K28) Injector Control No.8 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K28) Injector Control No.8 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



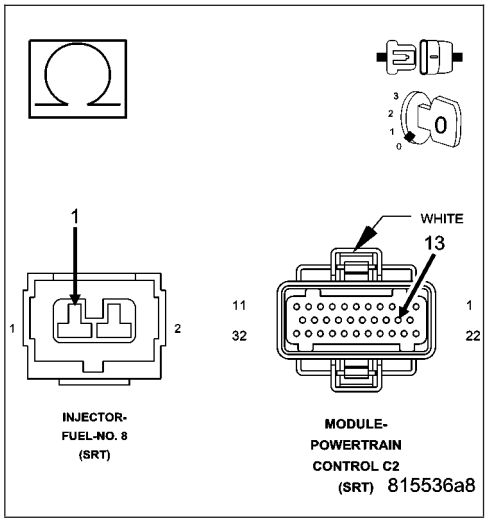
P0208-FUEL INJECTOR 8 CIRCUIT (CONTINUED)

5. (K28) INJECTOR CONTROL NO.8 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K28) Injector Control No.8 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K28) Injector Control No.8 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

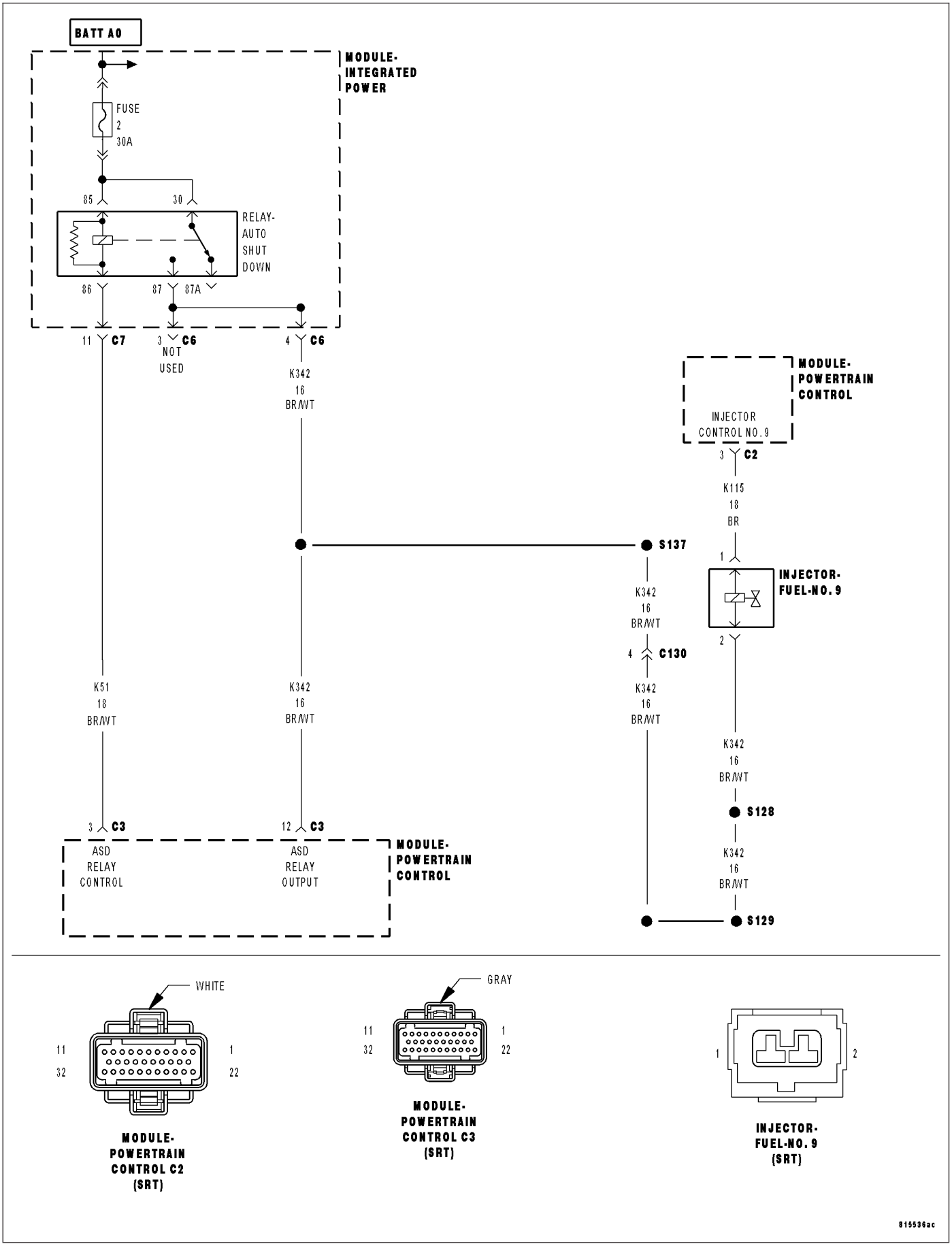
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0209-FUEL INJECTOR 9 CIRCUIT



P0209-FUEL INJECTOR 9 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K115) INJECTOR CONTROL NO.9 CIRCUIT OPEN
(K115) INJECTOR CONTROL NO.9 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the No.9 Fuel Injector harness connector.

Ignition on, engine not running.

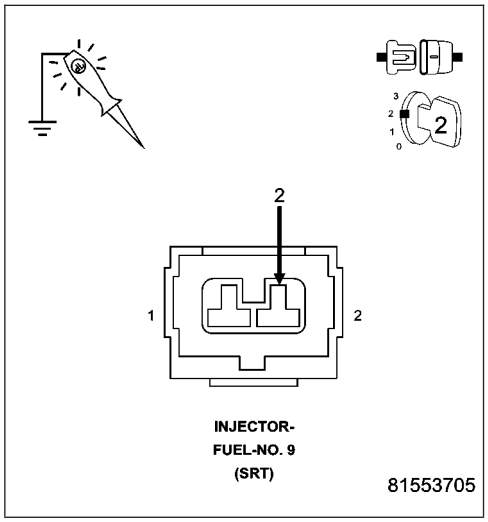
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the No.9 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0209-FUEL INJECTOR 9 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K115) Injector Control No.9 circuit.

With the scan tool, actuate the No.9 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

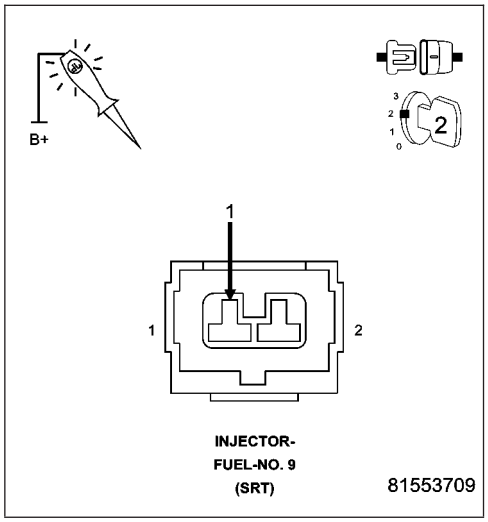
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K115) INJECTOR CONTROL NO.9 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

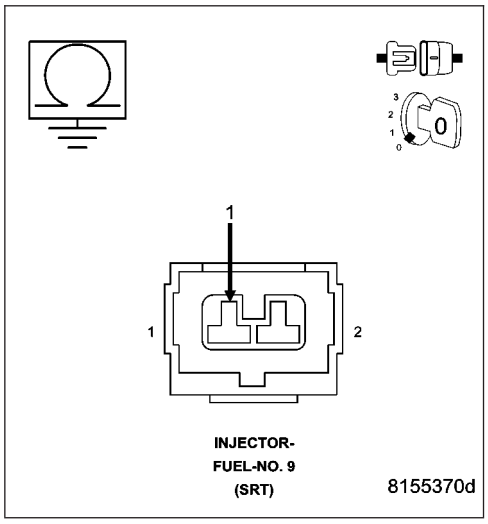
Measure the resistance between ground and the (K115) Injector Control No.9 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K115) Injector Control No.9 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



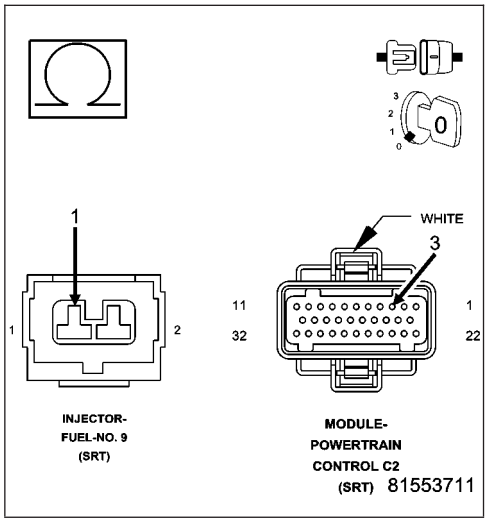
P0209-FUEL INJECTOR 9 CIRCUIT (CONTINUED)

5. (K115) INJECTOR CONTROL NO.9 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K115) Injector Control No.9 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K115) Injector Control No.9 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

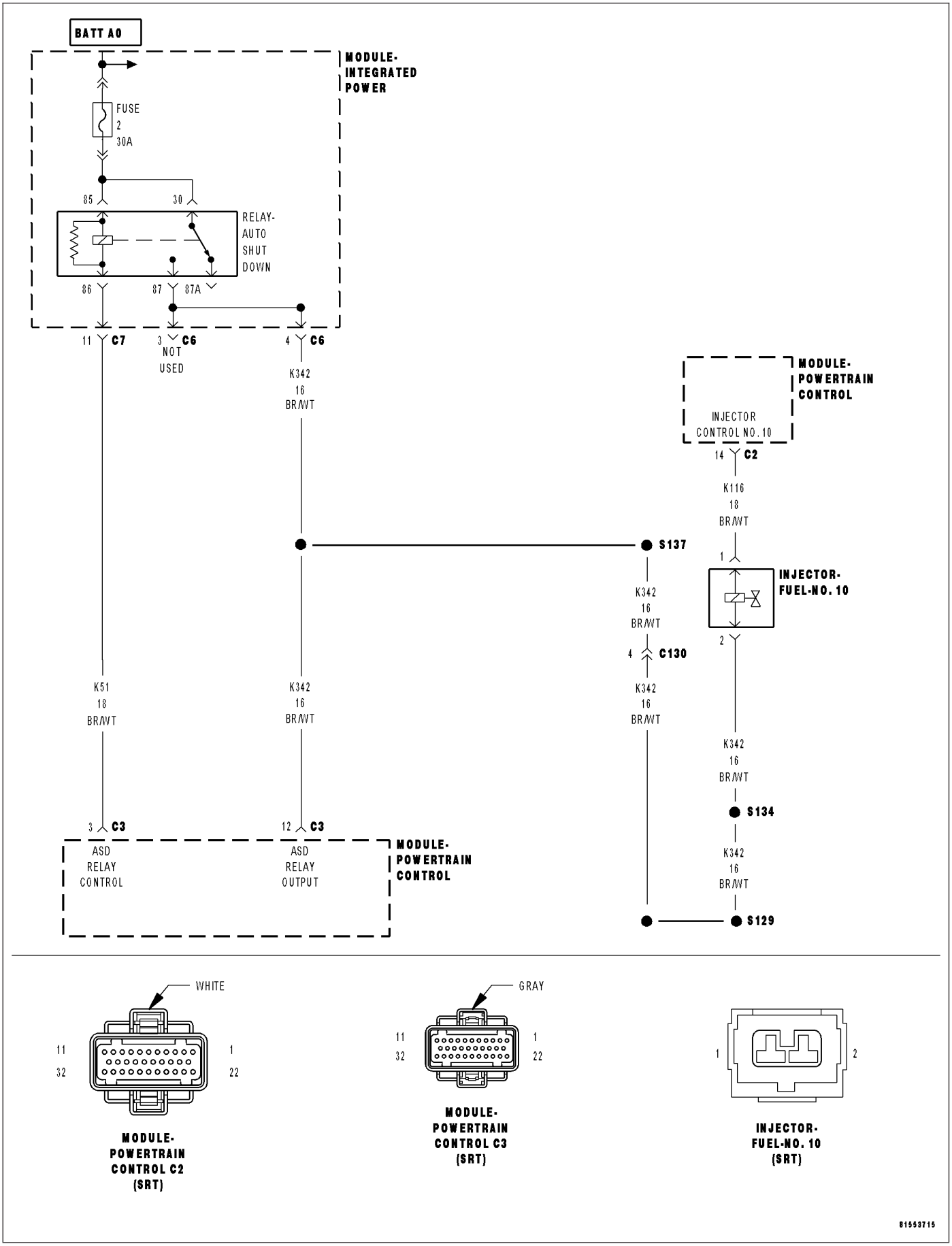
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0210-FUEL INJECTOR 10 CIRCUIT



P0210-FUEL INJECTOR 10 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 10.4 volts, the auto shutdown relay energized, injector pulse width less than 10ms, and engine speed less than 3000 rpm.
- **Set Condition:**
  This trouble code takes .64 to 10.0 seconds to set when no inductive kick is sensed .18ms after injector turn off, and with no other injectors on.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K116) INJECTOR CONTROL NO.10 CIRCUIT OPEN
(K116) INJECTOR CONTROL NO.10 CIRCUIT SHORTED TO GROUND
FUEL INJECTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTC.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the NO.10 Fuel Injector harness connector.

Ignition on, engine not running.

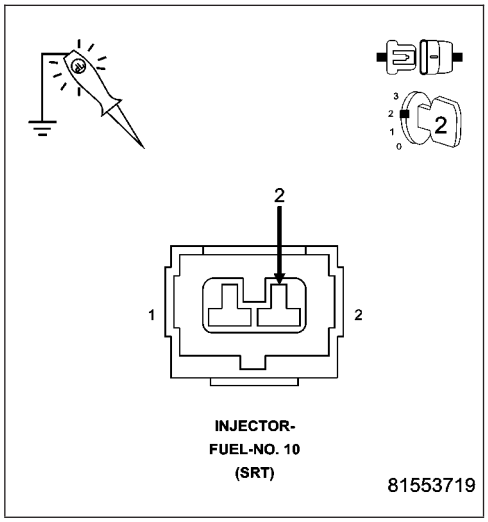
With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the NO.10 Fuel Injector harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0210-FUEL INJECTOR 10 CIRCUIT (CONTINUED)

3. FUEL INJECTOR

Using a 12-volt test light connected to 12-volts, probe the (K116) Injector Control NO.10 circuit.

With the scan tool, actuate the NO.10 Fuel Injector.

What is the state of the test light during the actuation?

Brightly Blinking.

Replace the Fuel Injector.

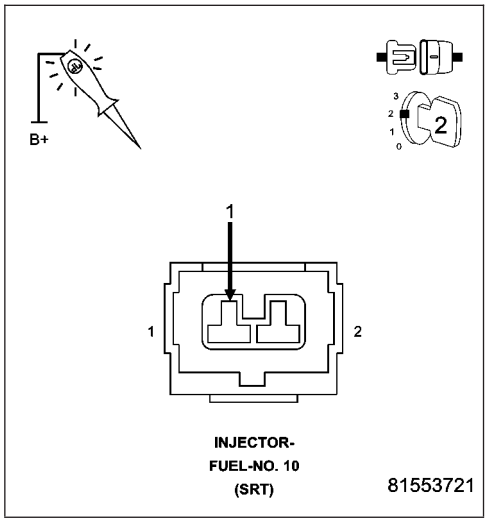
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON Constantly.

Go To 4

OFF Constantly.

Go To 5



4. (K116) INJECTOR CONTROL NO.10 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connector.

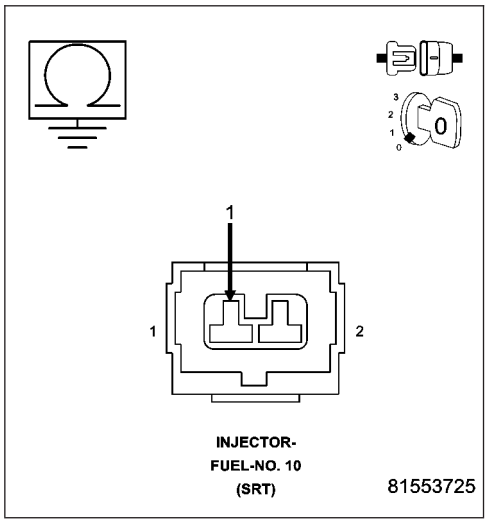
Measure the resistance between ground and the (K116) Injector Control NO.10 circuit in the Injector harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K116) Injector Control NO.10 circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



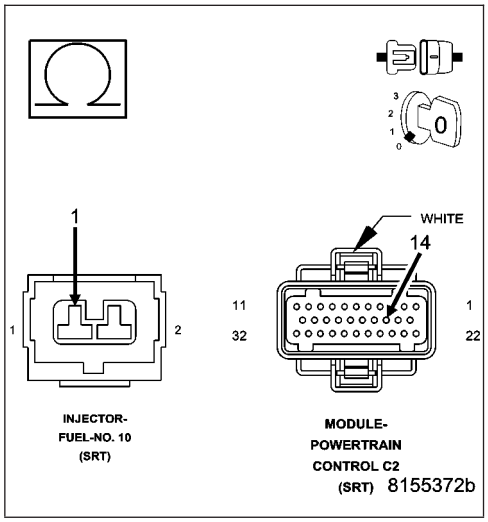
P0210-FUEL INJECTOR 10 CIRCUIT (CONTINUED)

5. (K116) INJECTOR CONTROL NO.10 CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K116) Injector Control NO.10 circuit from the Fuel Injector harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K116) Injector Control NO.10 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 2% (2.5% LEV) misfire rate is measured during two trips. Above 3000 RPM 1 trip less than 3000 RPM 2 trip. Three good trips to turn off the MIL.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
INJECTOR CONTROL CIRCUIT
COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

NOTE: Check for any TSB's that apply to a Misfire condition. Review the vehicle repair history for any misfire condition repairs that have been performed.

Star the engine.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector of the misfiring cylinders.

Disconnect the Fuel Injector harness connector of the misfiring cylinders.

Ignition on, engine not running.

With a scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connectors.
Remove the Ignition Coils.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Does the Spark Plug have any problems?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi)

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector for the cylinder that indicated the misfire.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector of the misfiring cylinder.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

---

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.
Check the Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

---

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0300-MULTIPLE CYLINDER MISFIRE (CONTINUED)

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay or ASD Relay.

Using a 12-volt test light connected to 12-volts, probe the Ignition Coil Control circuit.

Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 3.7L and 4.7L Ignition coil is 0.6 to 0.9 of an ohm and the resistance of a 5.7L Ignition coil is 0.558 to 0.682 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16

---

16. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the Ignition Coil harness connector.

Disconnect the PCM harness connectors.

CAUTION: Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install Miller Special Tool #8815 to perform diagnosis.

Check the Coil Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

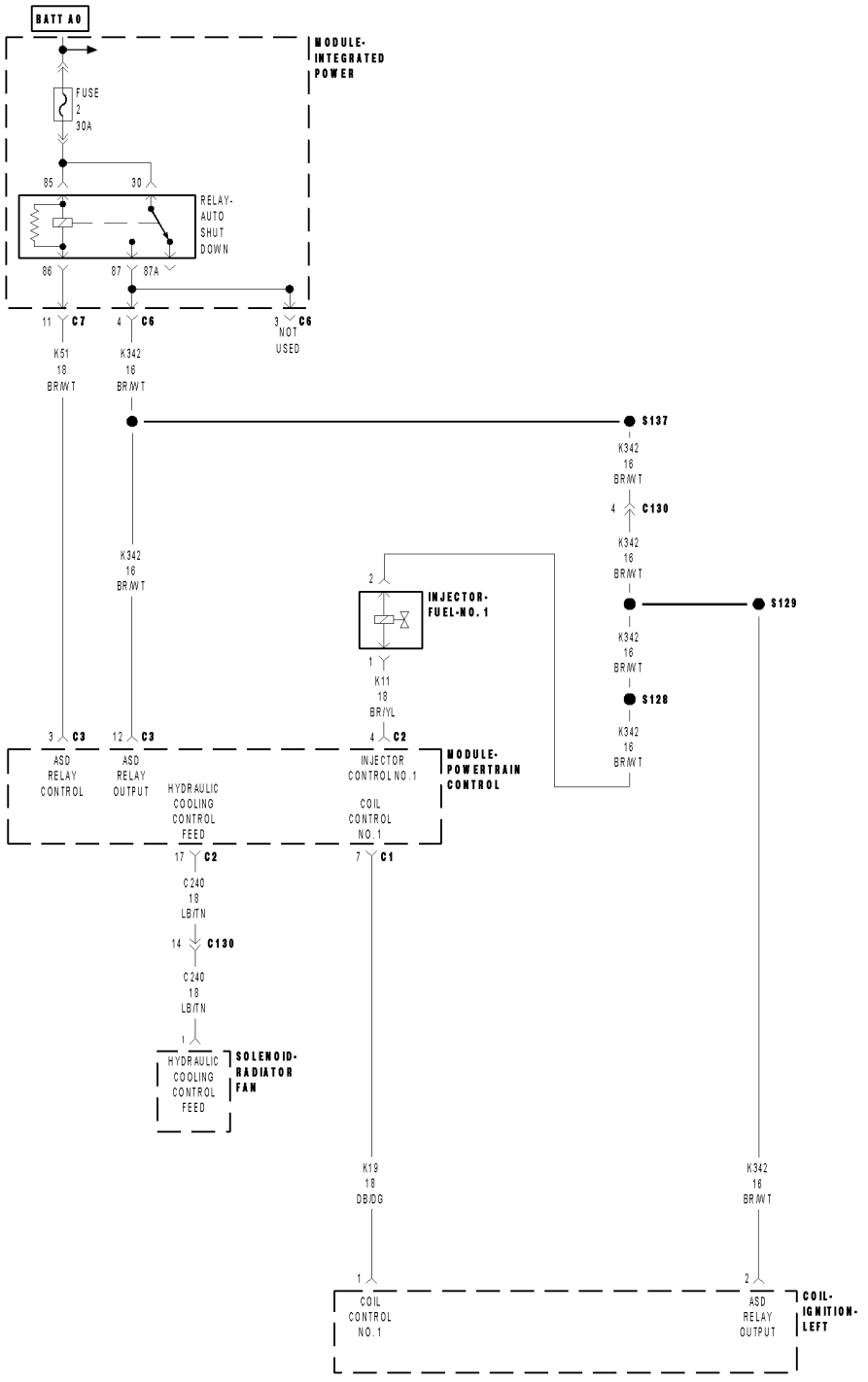
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

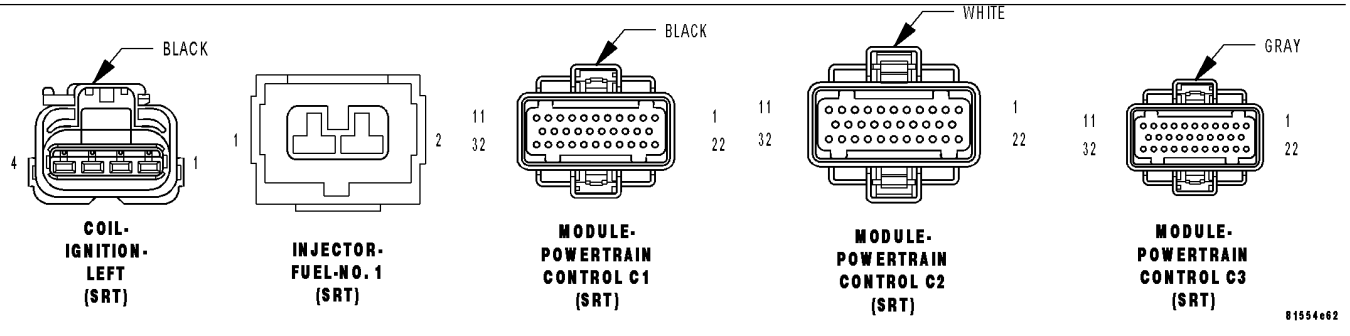
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER #1 MISFIRE





P0301-CYLINDER #1 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K11) INJECTOR CONTROL CIRCUIT
(K19) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER #1 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0301-CYLINDER #1 MISFIRE (CONTINUED)

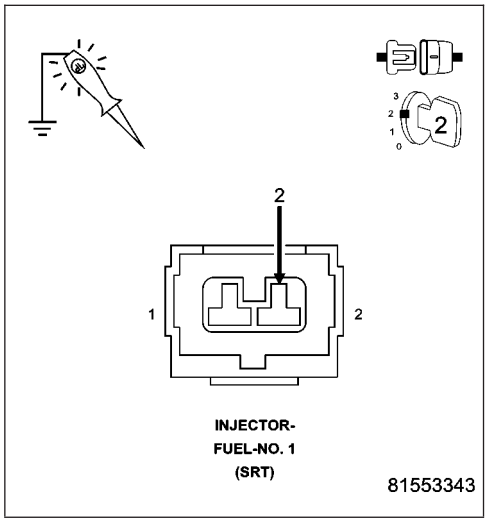
3. (K342) ASD RELAY OUTPUT CIRCUIT

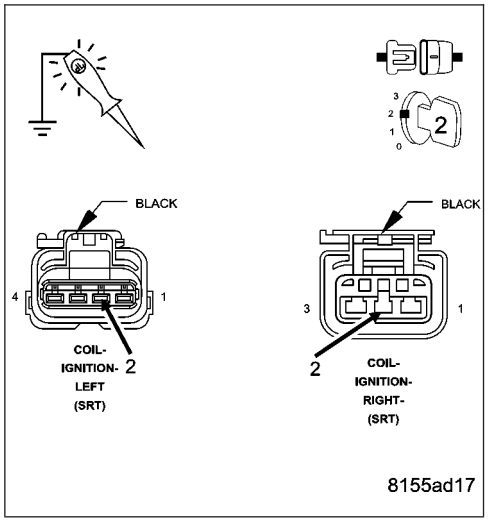
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0301-CYLINDER #1 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0301-CYLINDER #1 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0301-CYLINDER #1 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

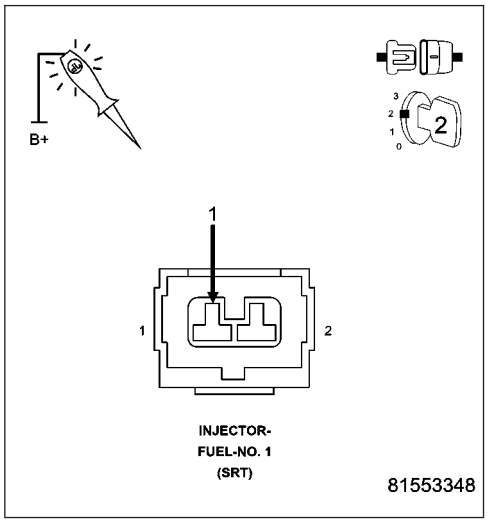
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K11) Injector Control No.1 circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0301-CYLINDER #1 MISFIRE (CONTINUED)

11. (K11) INJECTOR CONTROL CIRCUIT

Turn the ignition off.

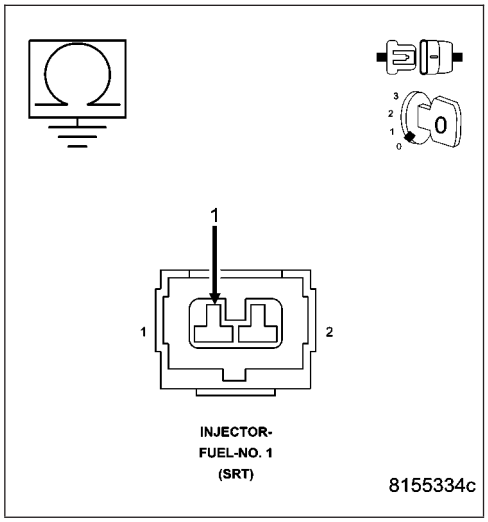
Disconnect the PCM harness connector.

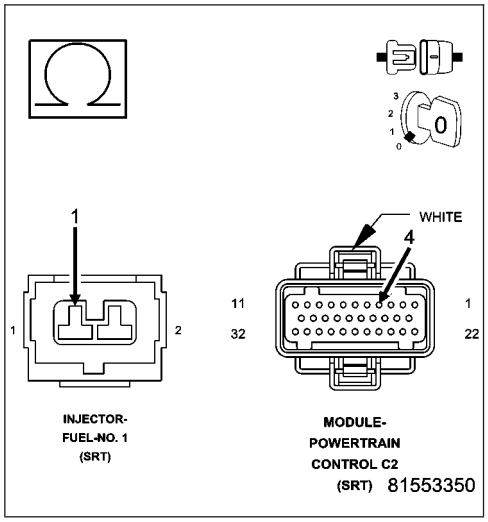
Check the (K11) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the (K11) Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0301-CYLINDER #1 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K19) Ignition Coil Control No.1 circuit.

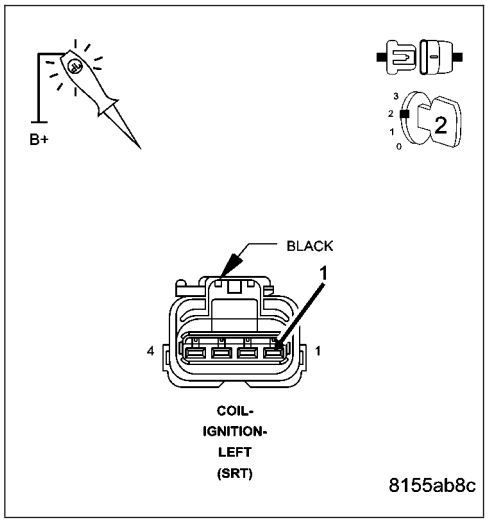
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0301-CYLINDER #1 MISFIRE (CONTINUED)

16. (K19) IGNITION COIL CONTROL NO.1 CIRCUIT

Turn the ignition off.

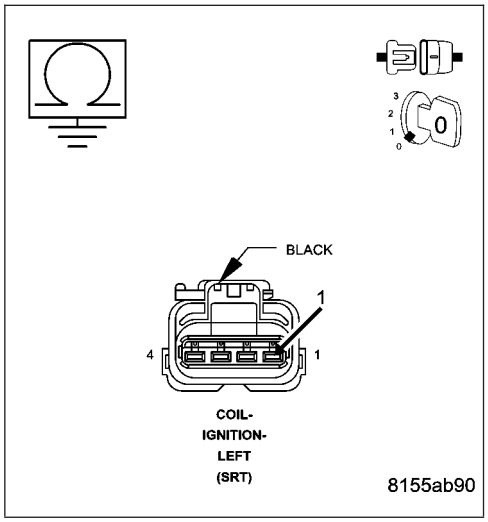
Disconnect the C1 PCM harness connector.

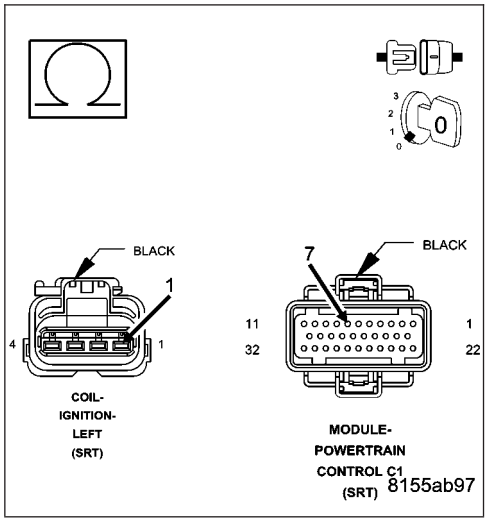
Check the (K19) Ignition Coil Control No.1 circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the (K19) Ignition Coil Control No.1 circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

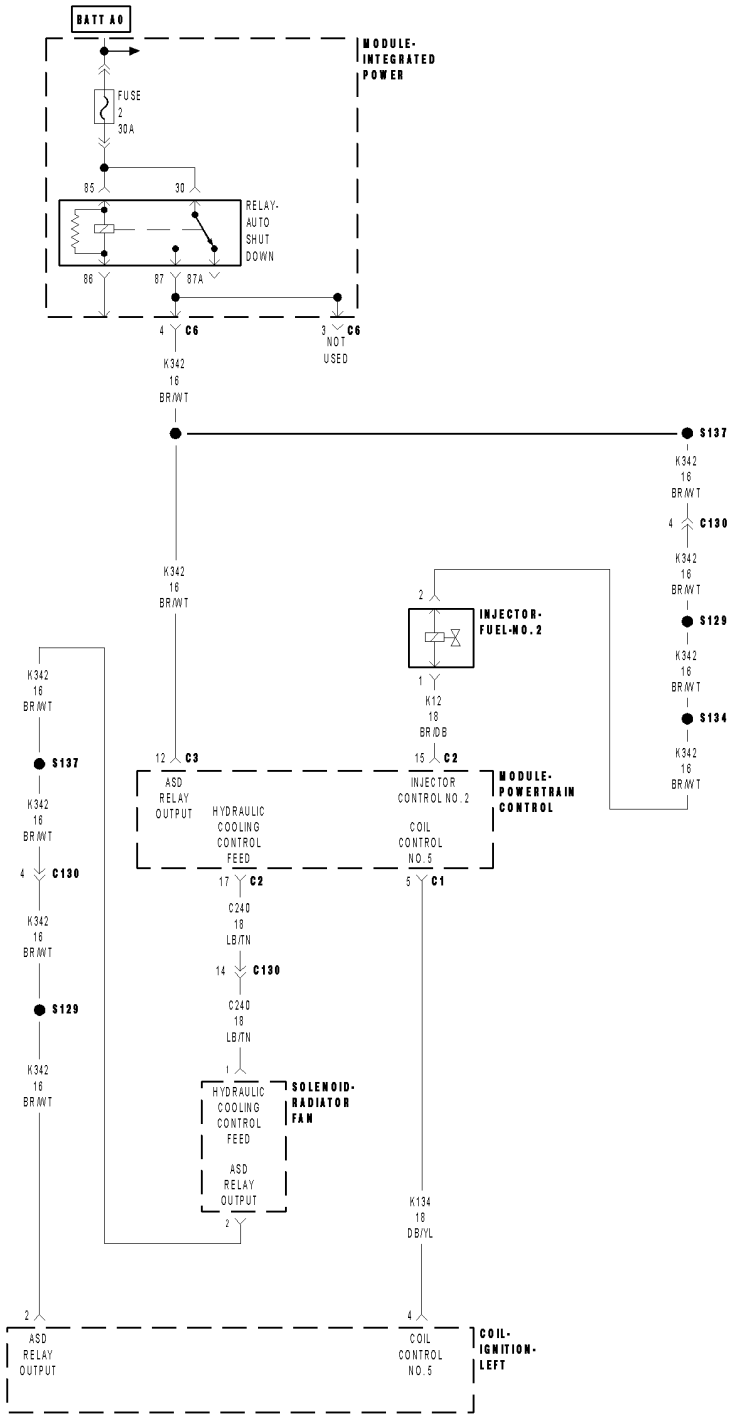
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

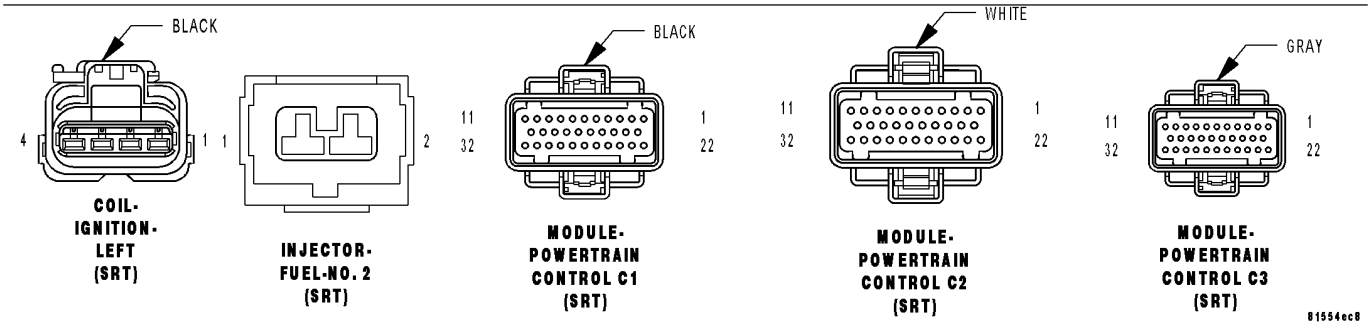
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER #2 MISFIRE





P0302-CYLINDER #2 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K12) INJECTOR CONTROL CIRCUIT
(K134) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER #2 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

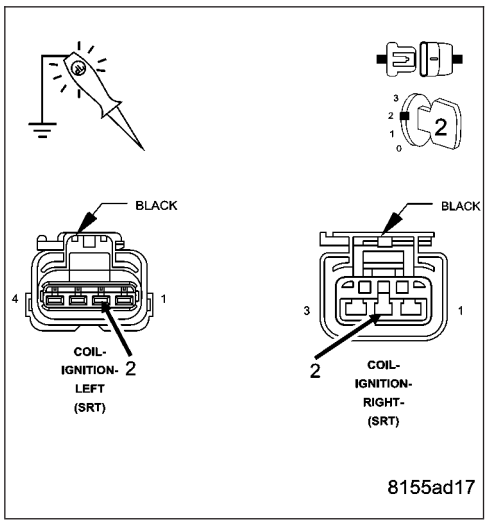
Disconnect the Ignition Coil harness connector.

Disconnect the Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER #2 MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0302-CYLINDER #2 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0302-CYLINDER #2 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

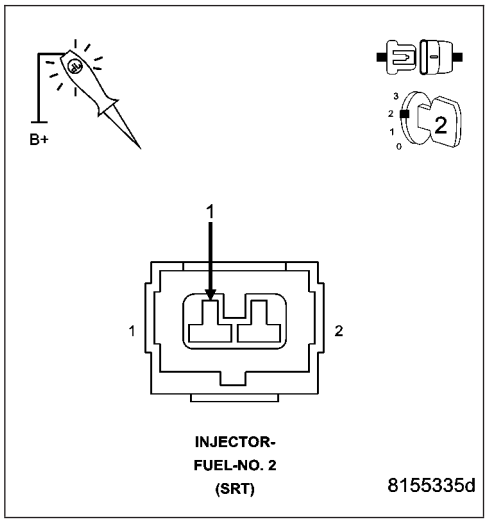
Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K12) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0302-CYLINDER #2 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

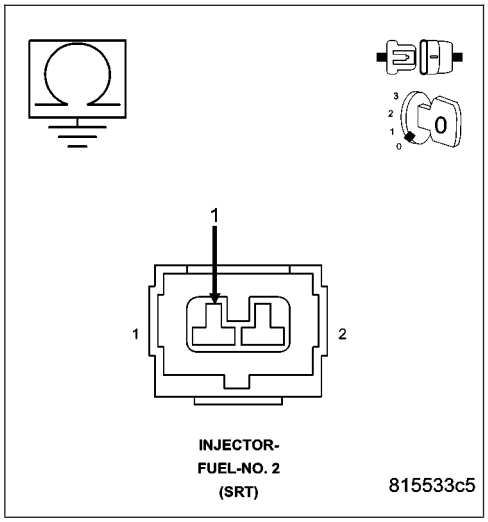
Disconnect the PCM harness connector.

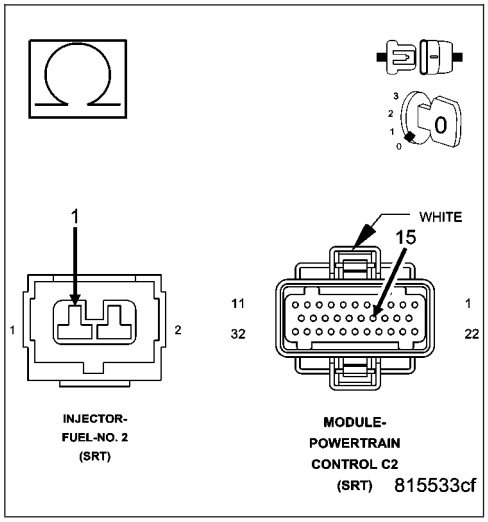
Check the (K14) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0302-CYLINDER #2 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K134) Coil Control circuit.

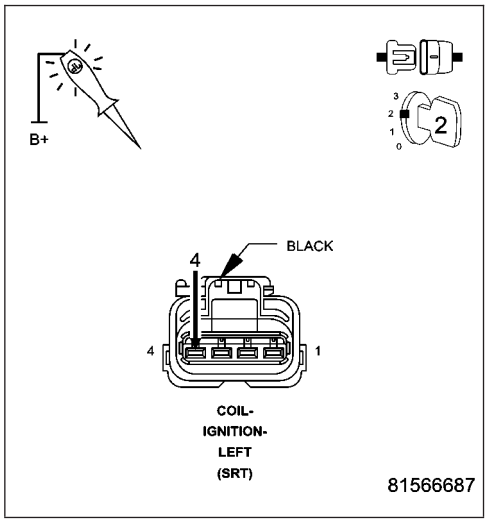
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0302-CYLINDER #2 MISFIRE (CONTINUED)

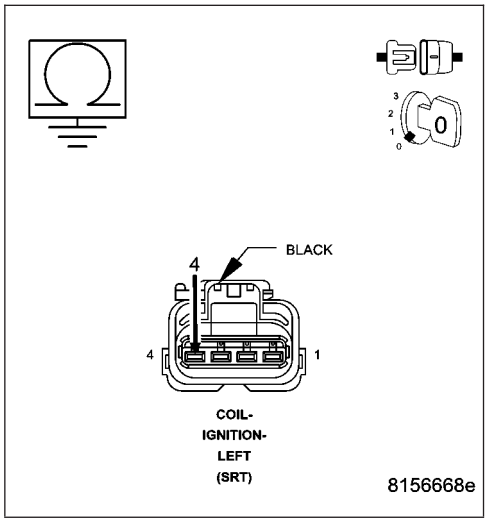
16. COIL CONTROL CIRCUIT

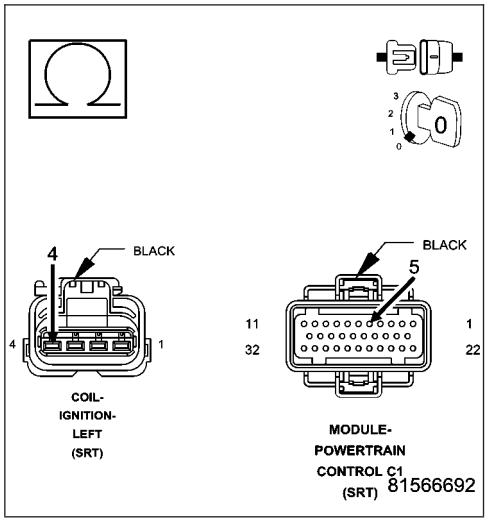
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K134) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

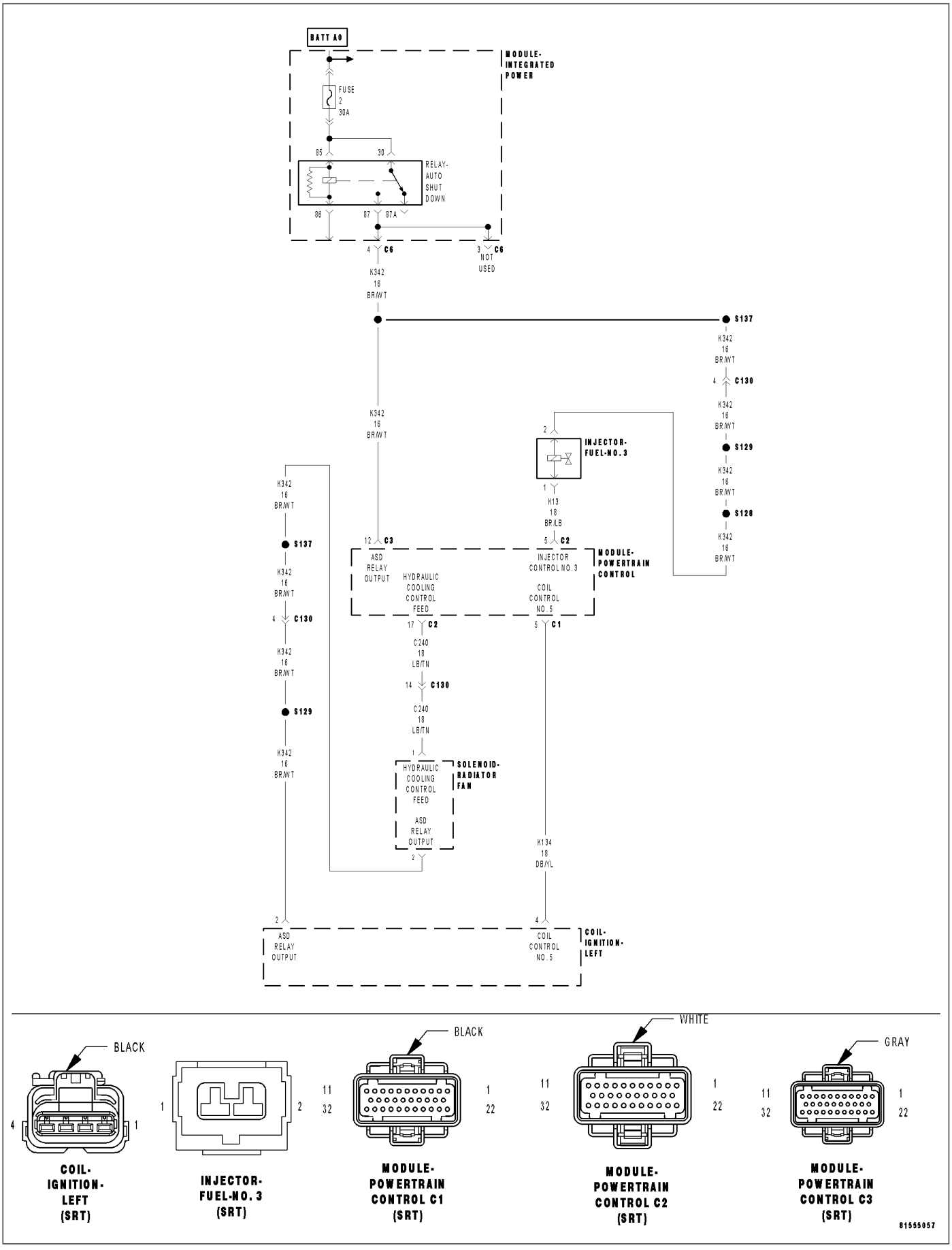
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER #3 MISFIRE



P0303-CYLINDER #3 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K13) INJECTOR CONTROL CIRCUIT
(K134) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER #3 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

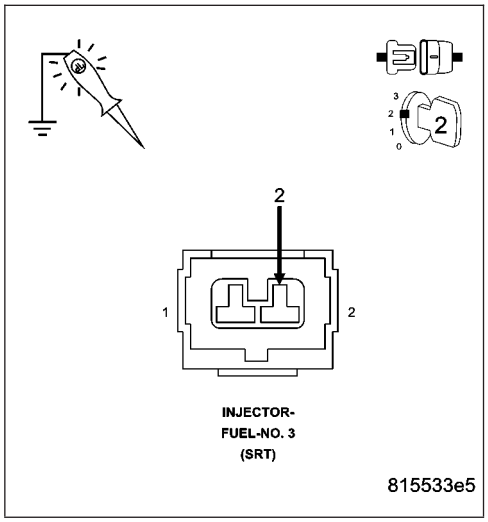
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0303-CYLINDER #3 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

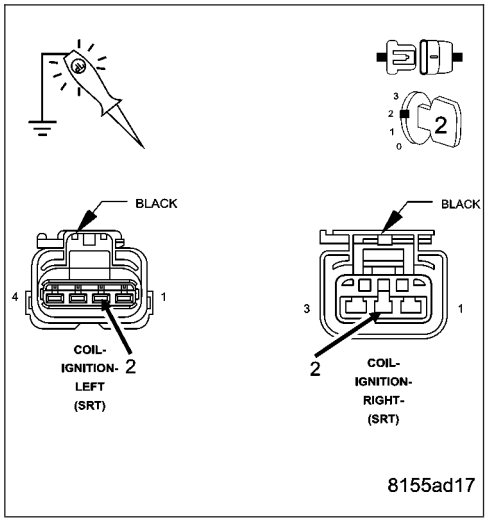
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0303-CYLINDER #3 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0303-CYLINDER #3 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0303-CYLINDER #3 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

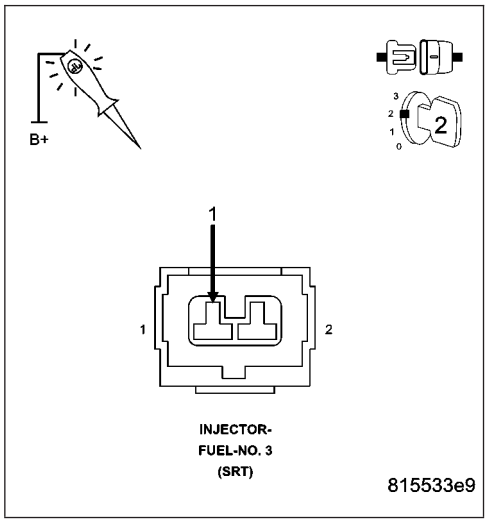
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K13) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0303-CYLINDER #3 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

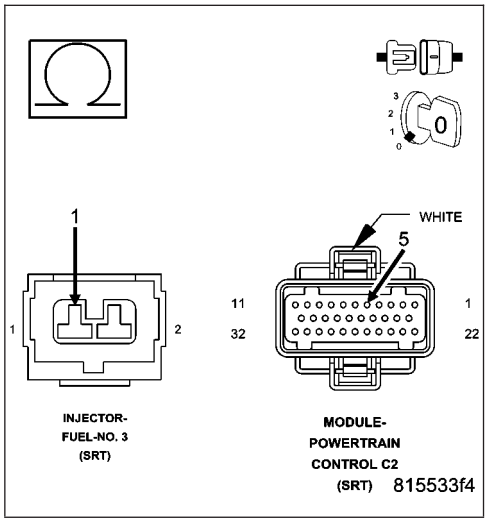
Disconnect the PCM harness connector.

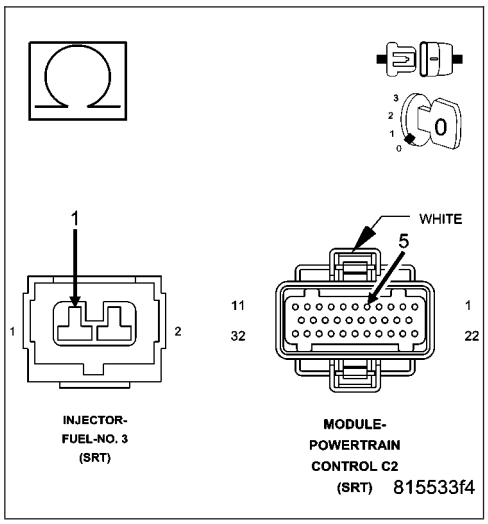
Check the (K13) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0303-CYLINDER #3 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K134) Coil Control circuit.

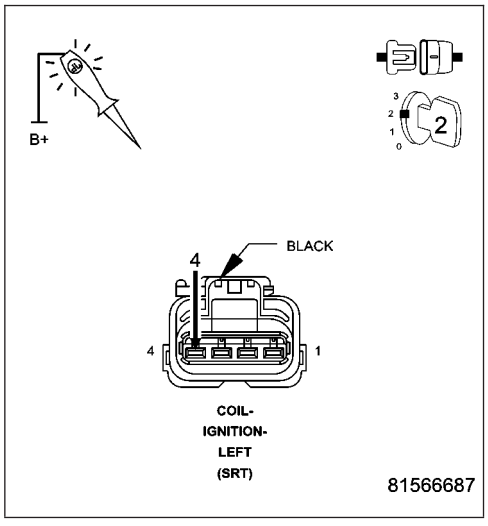
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0303-CYLINDER #3 MISFIRE (CONTINUED)

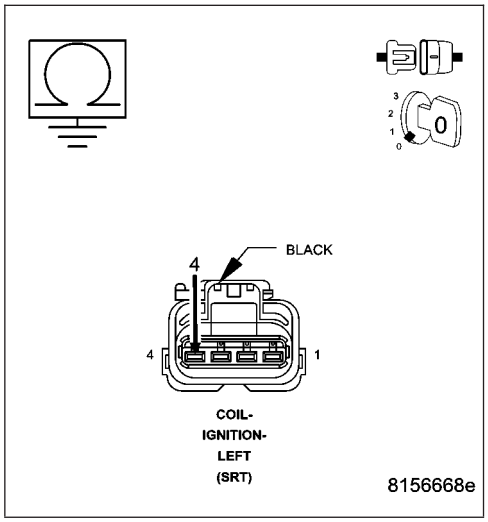
16. COIL CONTROL CIRCUIT

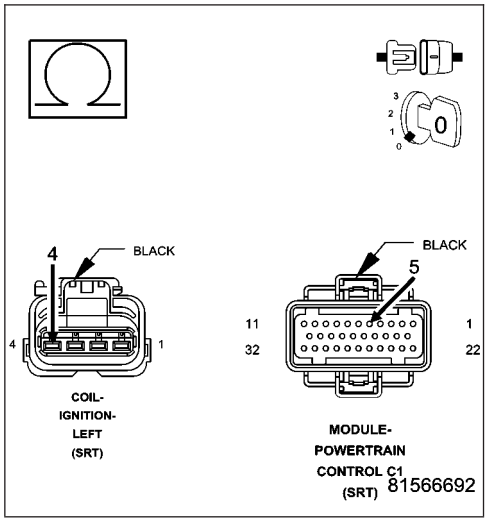
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K134) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

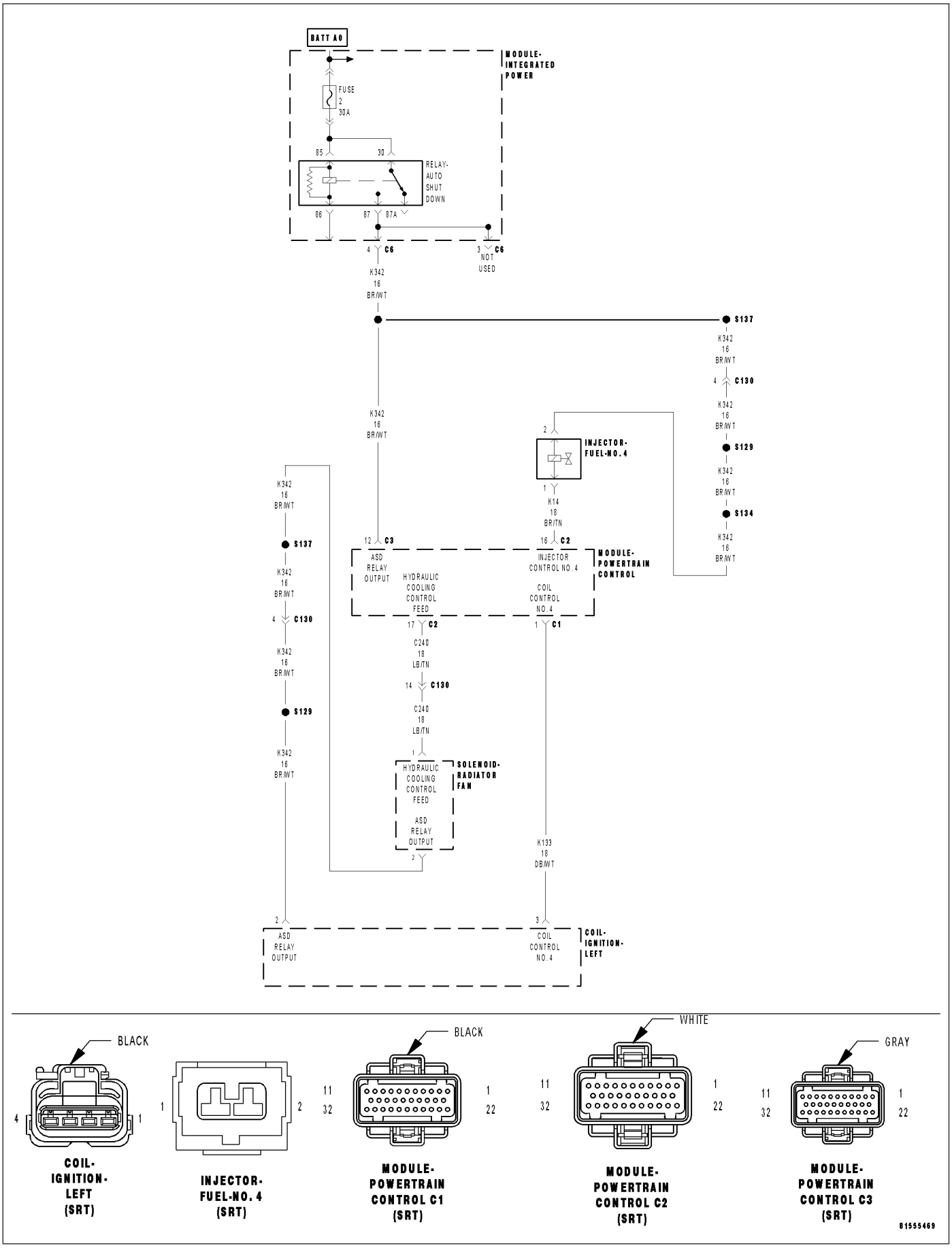
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER #4 MISFIRE



P0304-CYLINDER #4 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K14) INJECTOR CONTROL CIRCUIT
(K133) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER #4 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0304-CYLINDER #4 MISFIRE (CONTINUED)

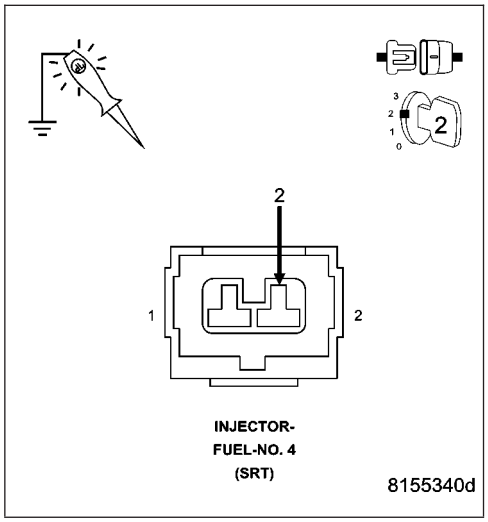
3. (K342) ASD RELAY OUTPUT CIRCUIT

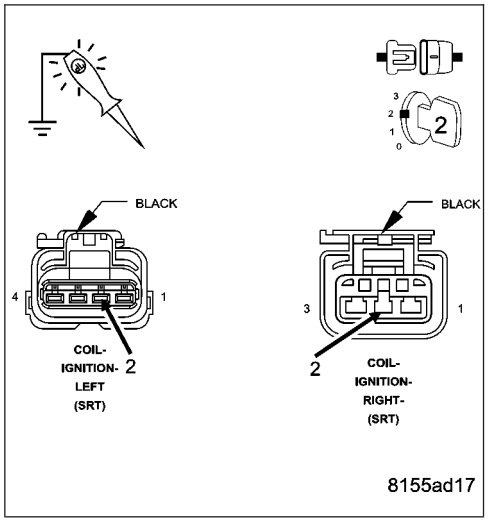
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)





4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0304-CYLINDER #4 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0304-CYLINDER #4 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0304-CYLINDER #4 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

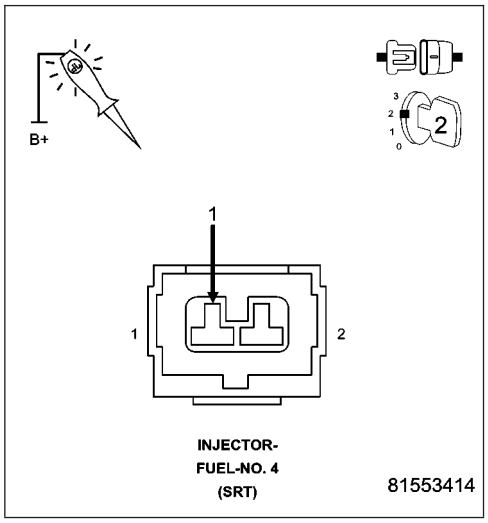
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K14) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0304-CYLINDER #4 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

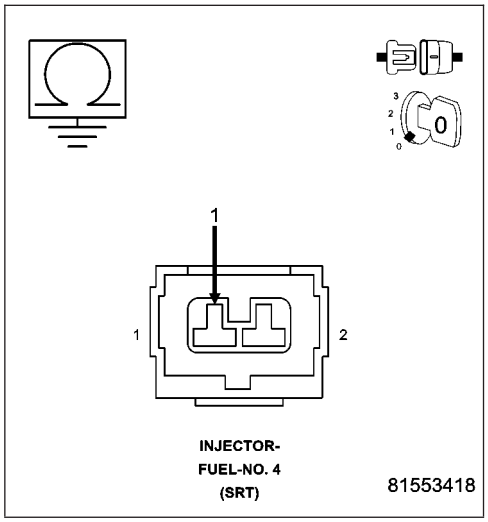
Disconnect the PCM harness connector.

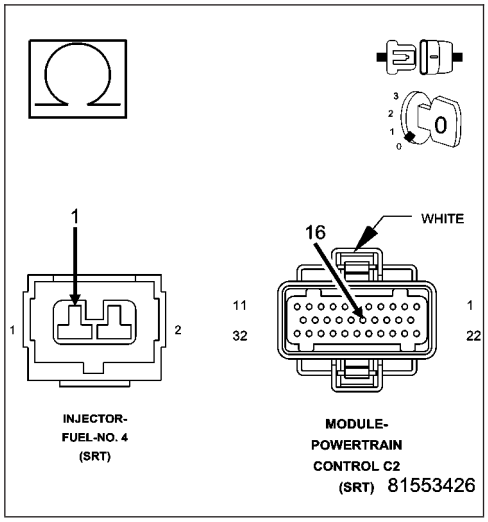
Check the Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0304-CYLINDER #4 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K133) Coil Control circuit.

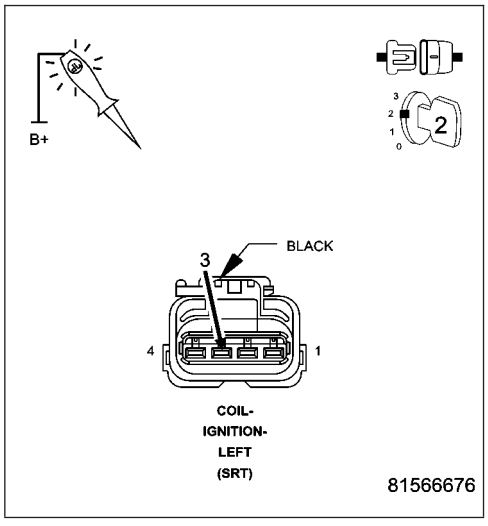
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0304-CYLINDER #4 MISFIRE (CONTINUED)

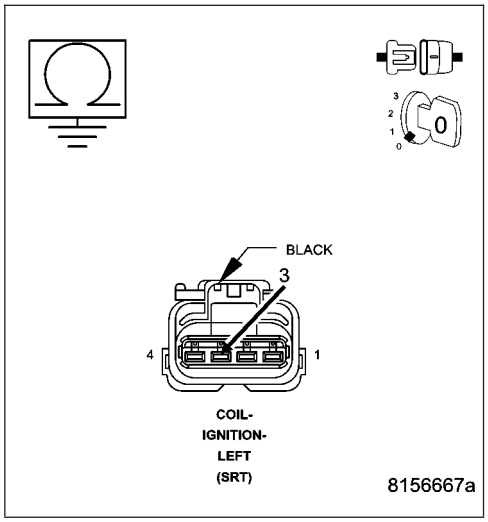
16. COIL CONTROL CIRCUIT

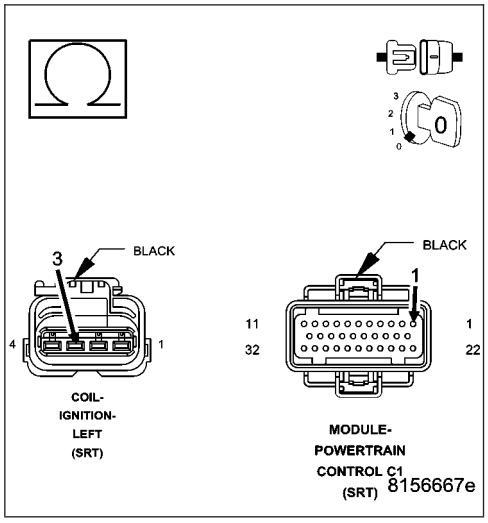
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K133) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

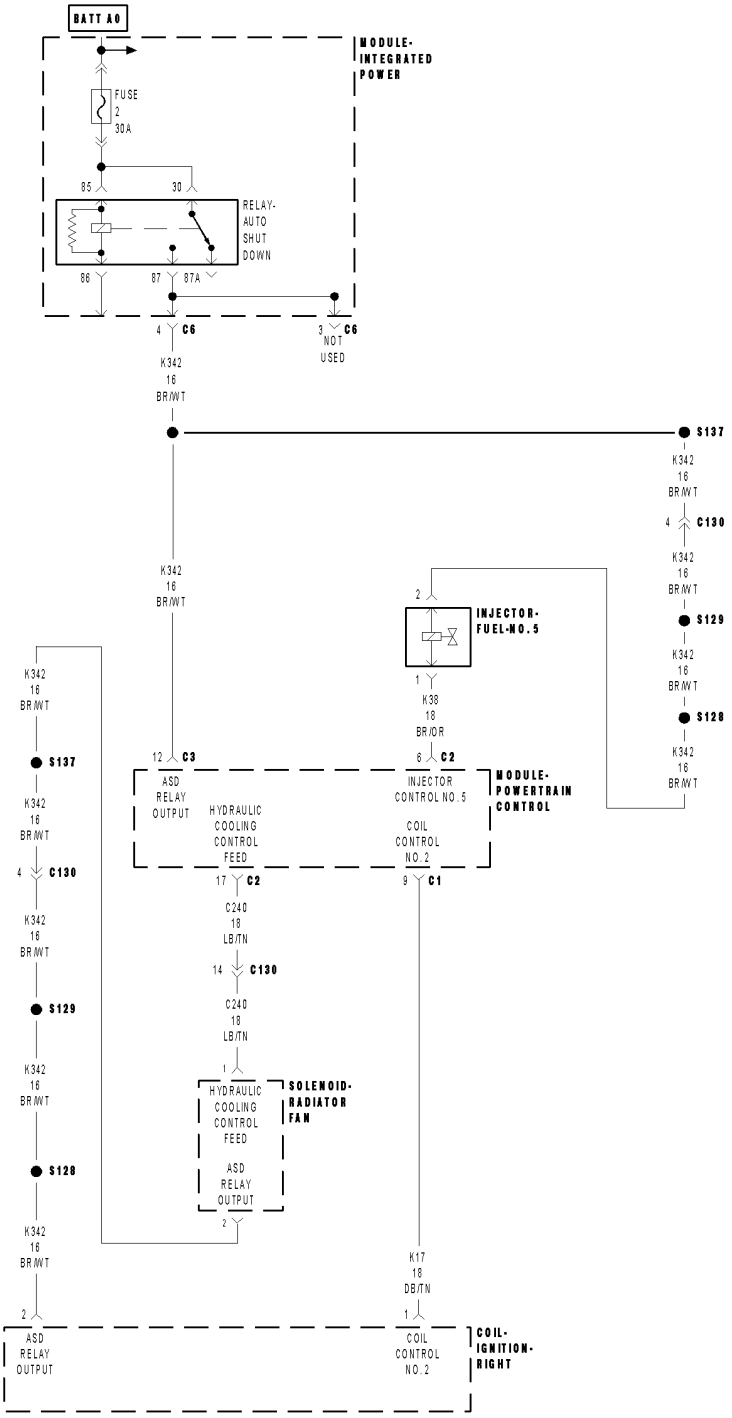
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

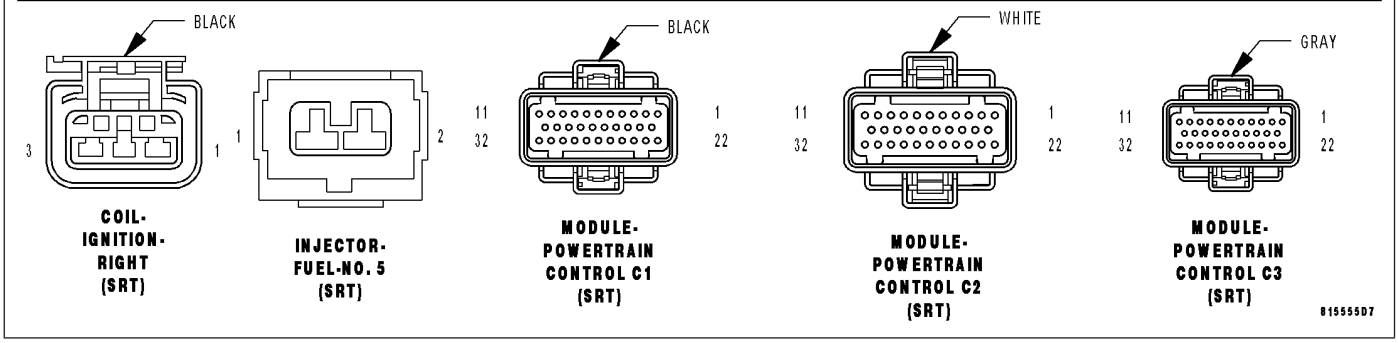
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER #5 MISFIRE





P0305-CYLINDER #5 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K38) INJECTOR CONTROL CIRCUIT
(K17) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER #5 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

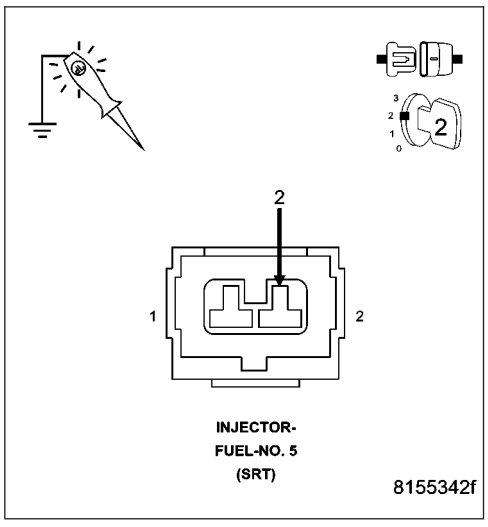
Disconnect the Ignition Coil harness connector.

Disconnect the Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER #5 MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0305-CYLINDER #5 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0305-CYLINDER #5 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

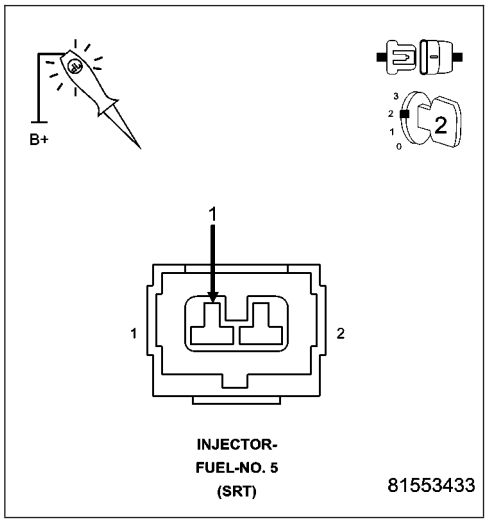
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K38) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0305-CYLINDER #5 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

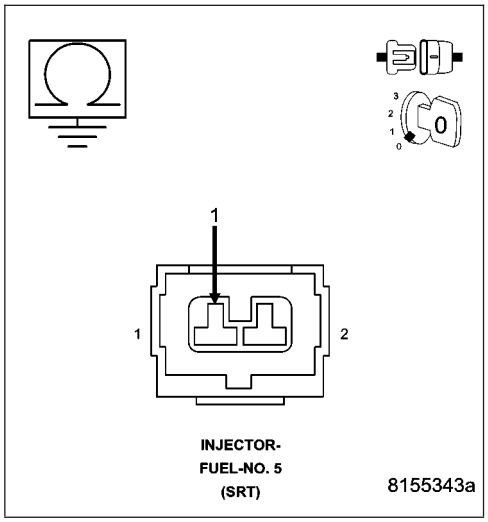
Disconnect the PCM harness connector.

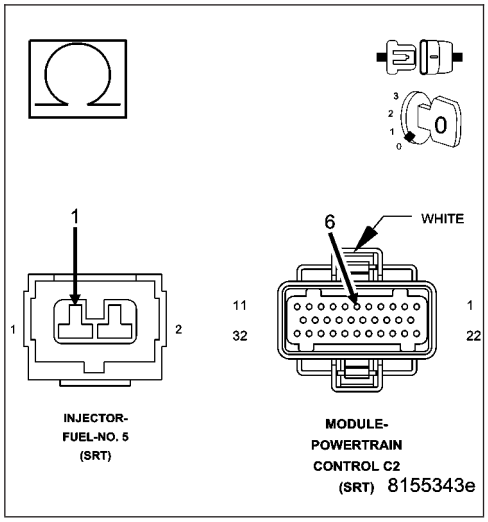
Check the (K38) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0305-CYLINDER #5 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control circuit.

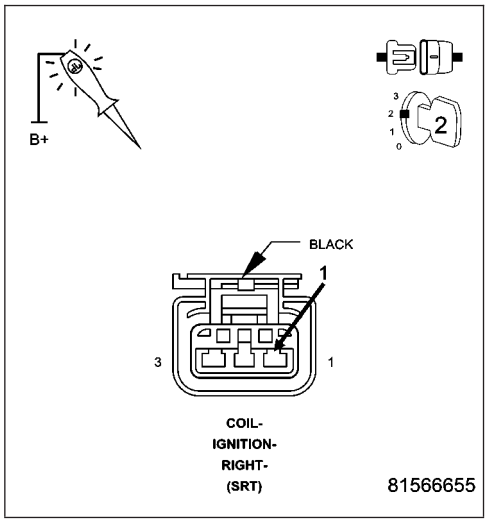
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



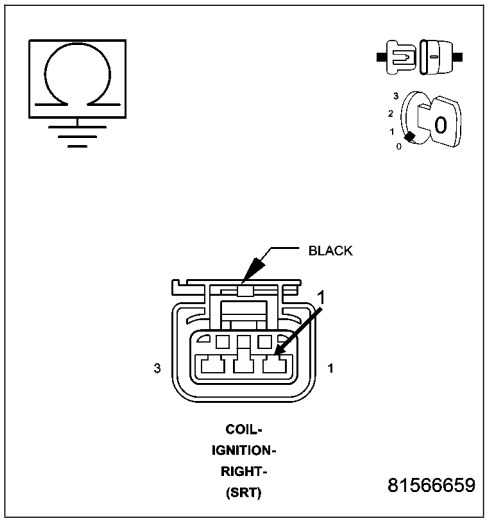
P0305-CYLINDER #5 MISFIRE (CONTINUED)

16. COIL CONTROL CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connector.

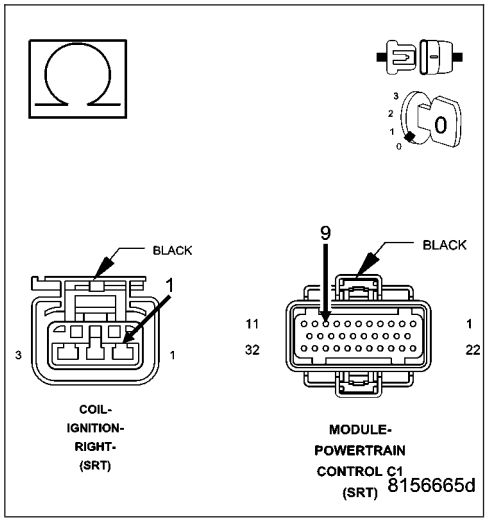
Check the (K17) Coil Control circuit for an open, short to ground, and short to voltage.



Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17



17. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

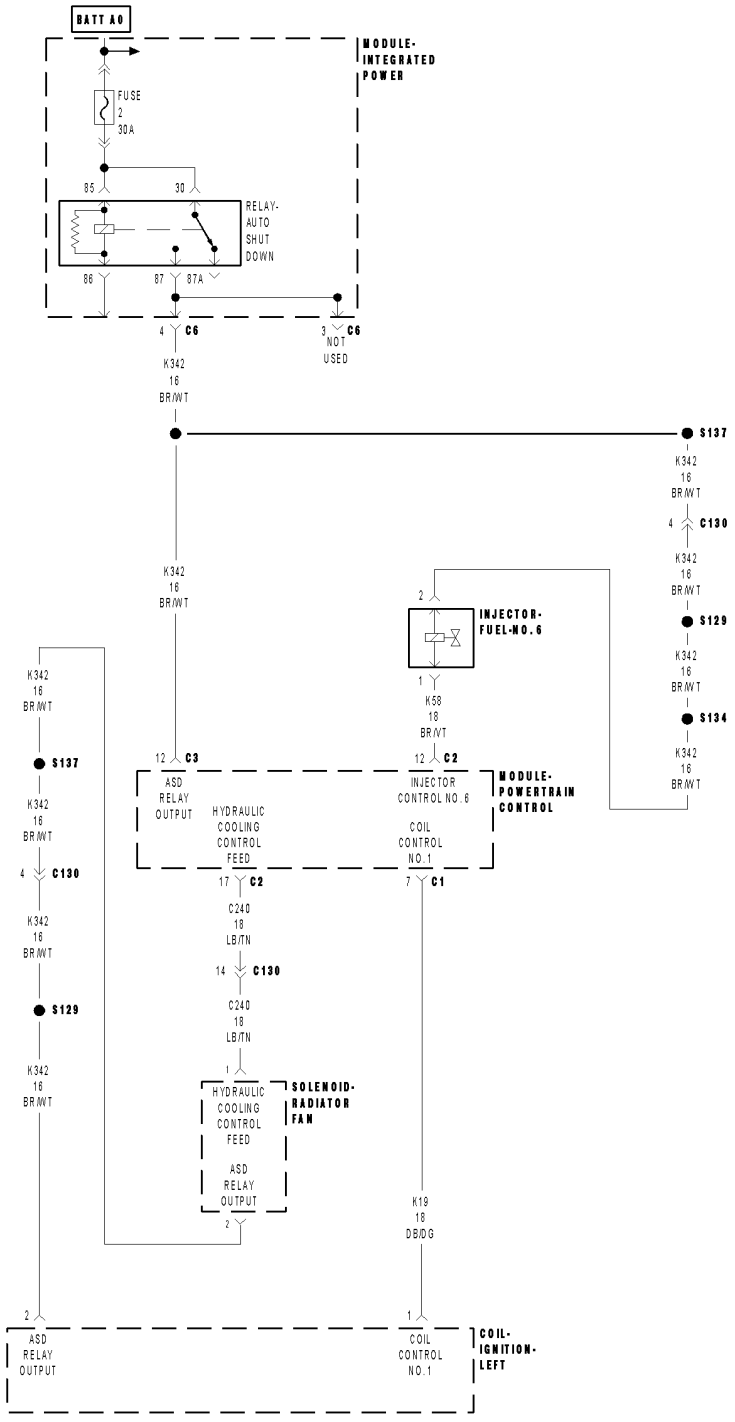
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

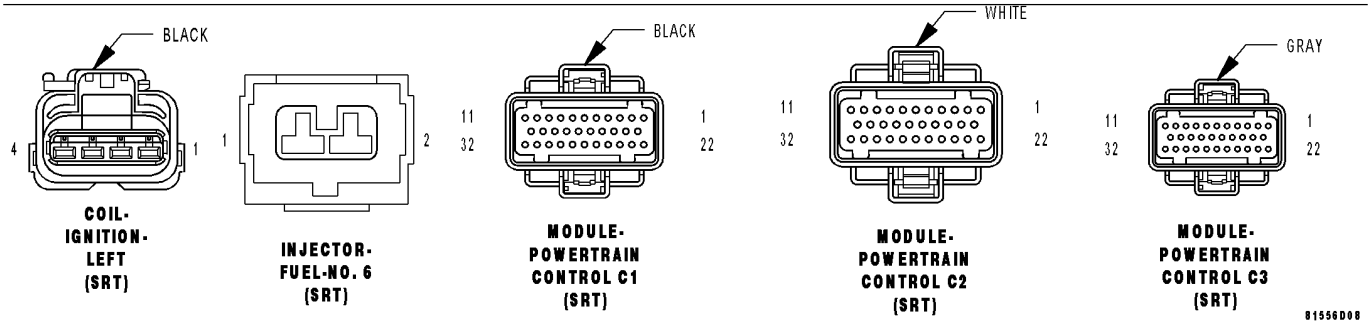
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER #6 MISFIRE





P0306-CYLINDER #6 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K58) INJECTOR CONTROL CIRCUIT
(K19) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER #6 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

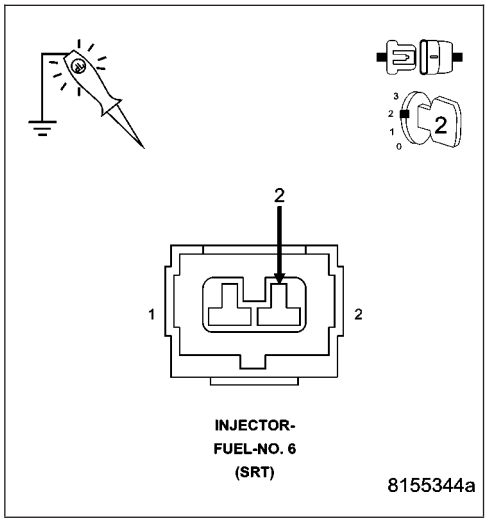
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0306-CYLINDER #6 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

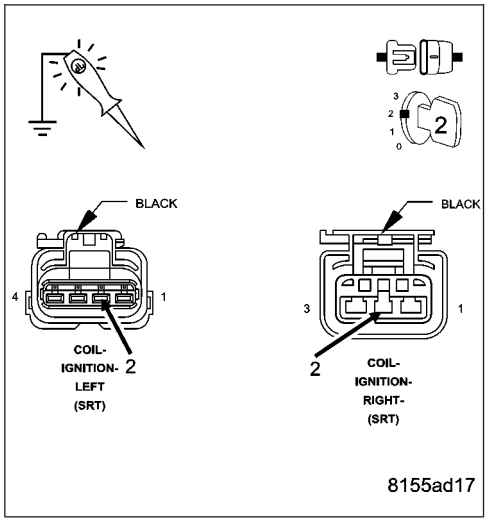
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0306-CYLINDER #6 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0306-CYLINDER #6 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0306-CYLINDER #6 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

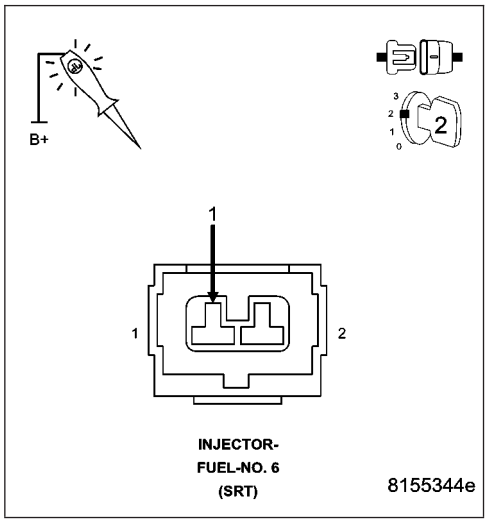
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K58) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0306-CYLINDER #6 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

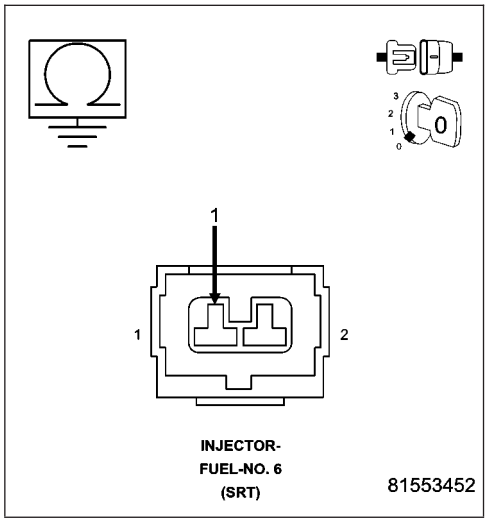
Disconnect the PCM harness connector.

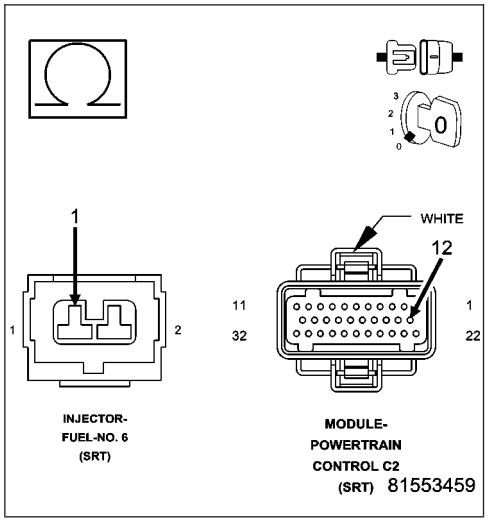
Check the (K58) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0306-CYLINDER #6 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K19) Ignition Coil Control circuit.

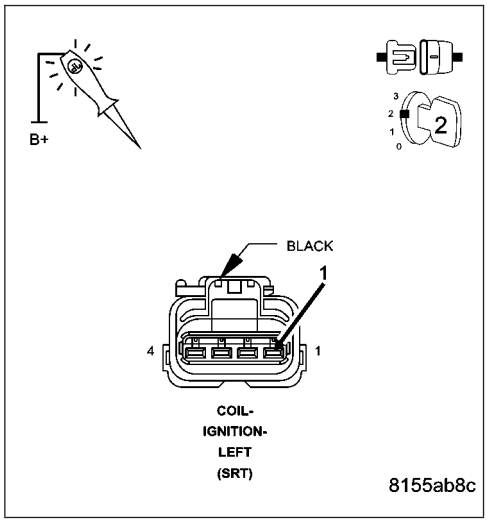
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0306-CYLINDER #6 MISFIRE (CONTINUED)

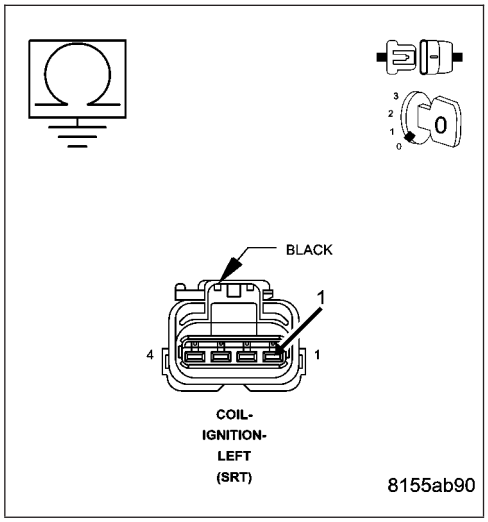
16. COIL CONTROL CIRCUIT

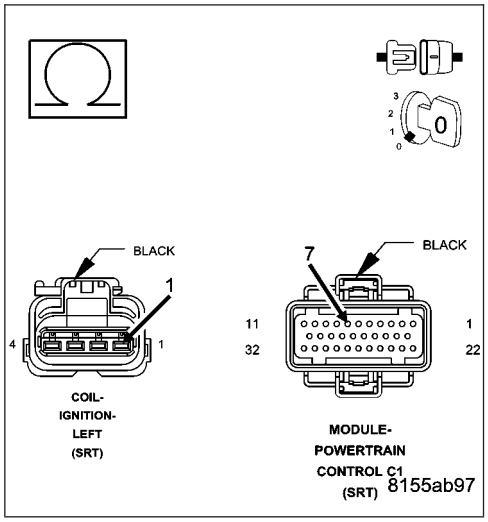
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K19) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

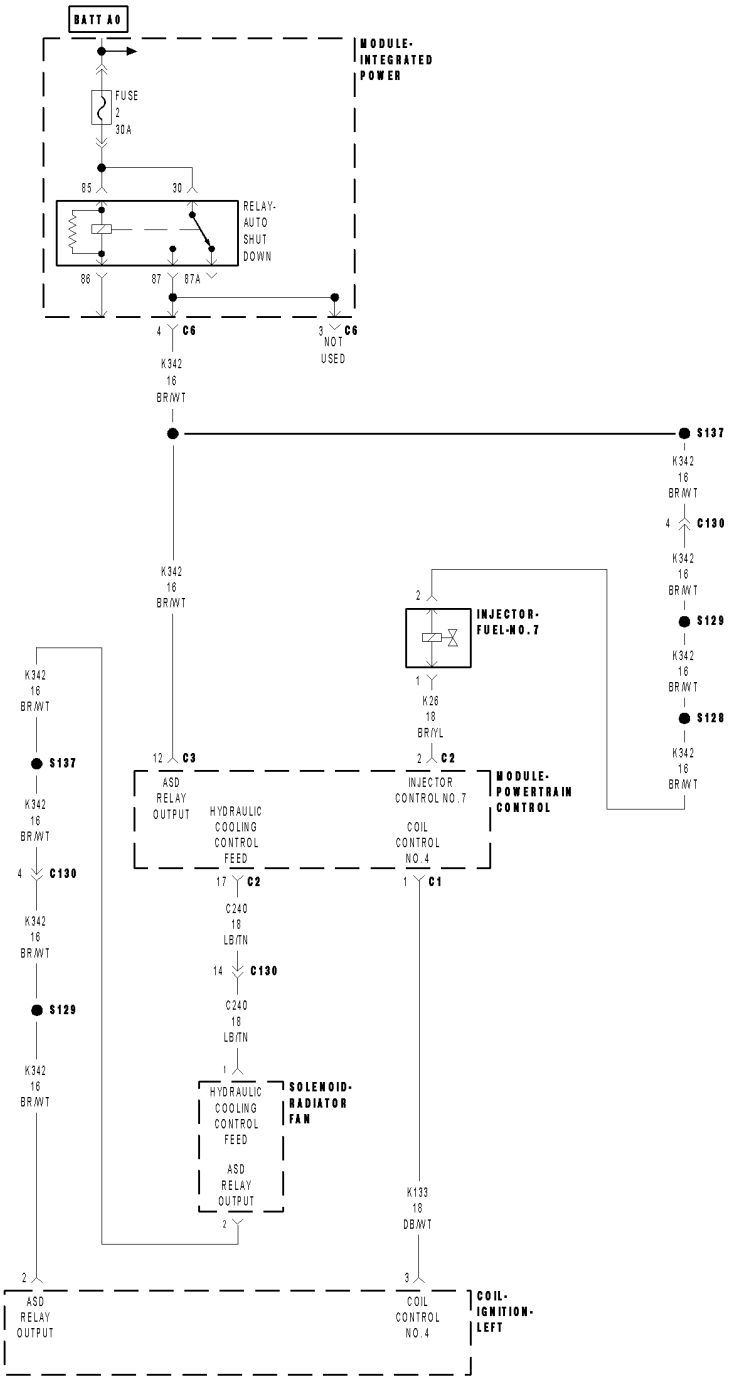
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

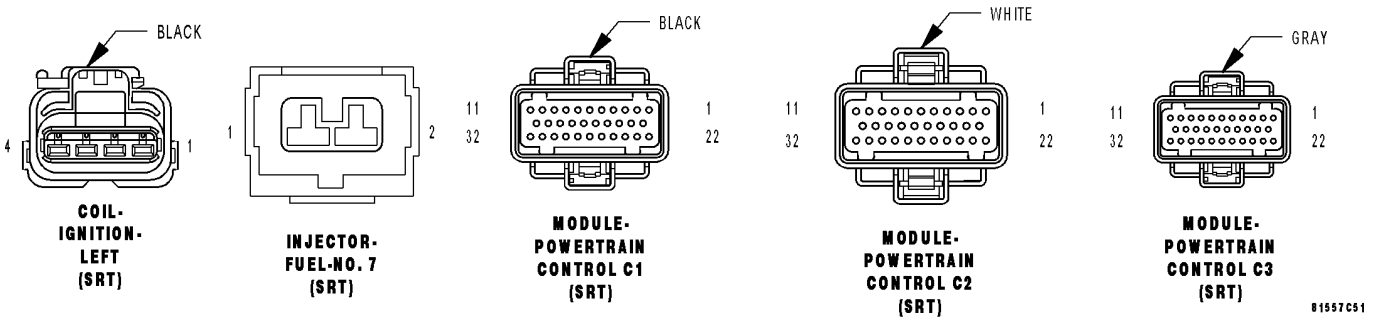
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER #7 MISFIRE





P0307-CYLINDER #7 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K26) INJECTOR CONTROL CIRCUIT
(K133) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER #7 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

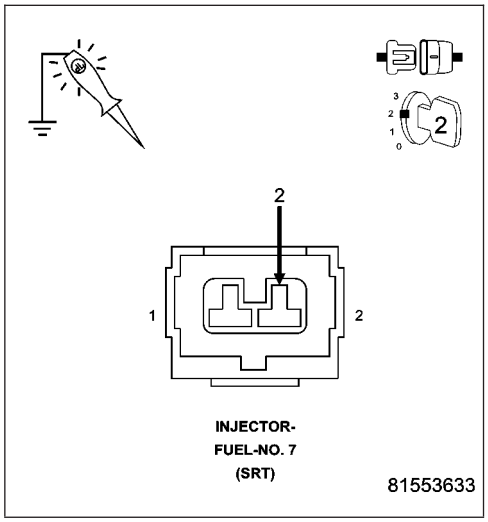
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0307-CYLINDER #7 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

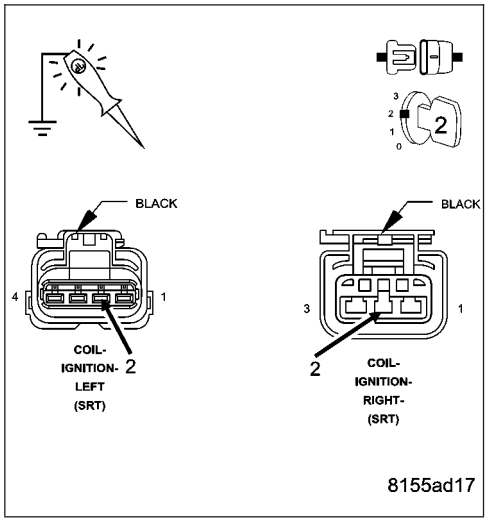
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0307-CYLINDER #7 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0307-CYLINDER #7 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0307-CYLINDER #7 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

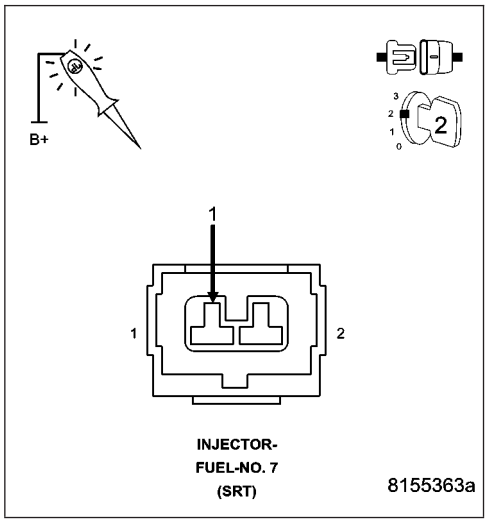
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0307-CYLINDER #7 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

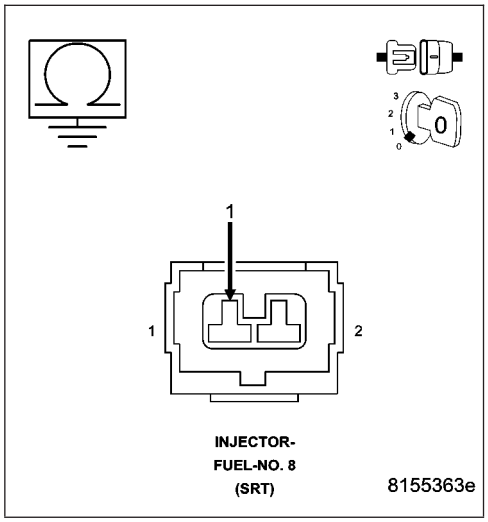
Disconnect the PCM harness connector.

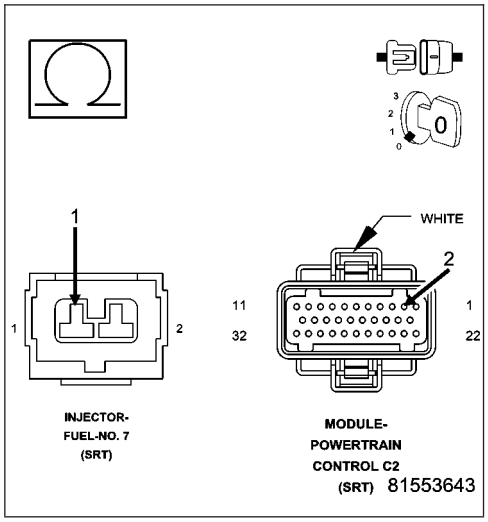
Check the (K26) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0307-CYLINDER #7 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K133) Coil Control circuit.

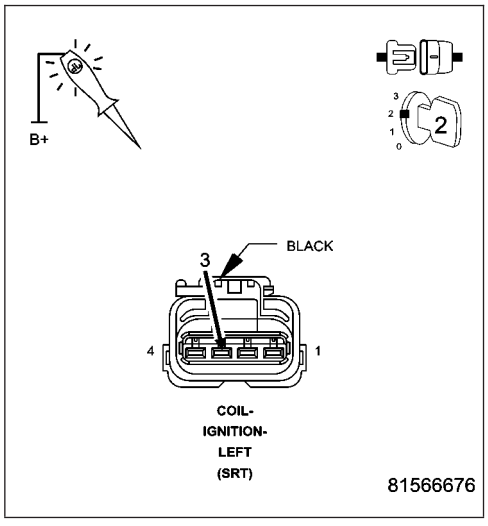
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0307-CYLINDER #7 MISFIRE (CONTINUED)

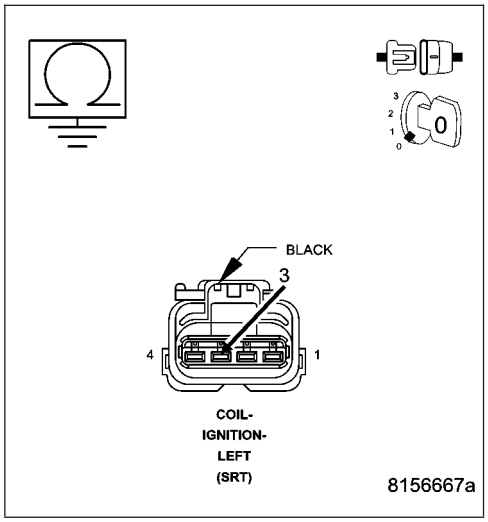
16. COIL CONTROL CIRCUIT

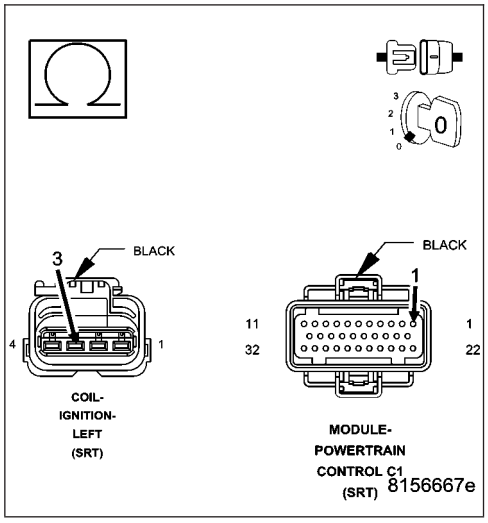
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K133) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

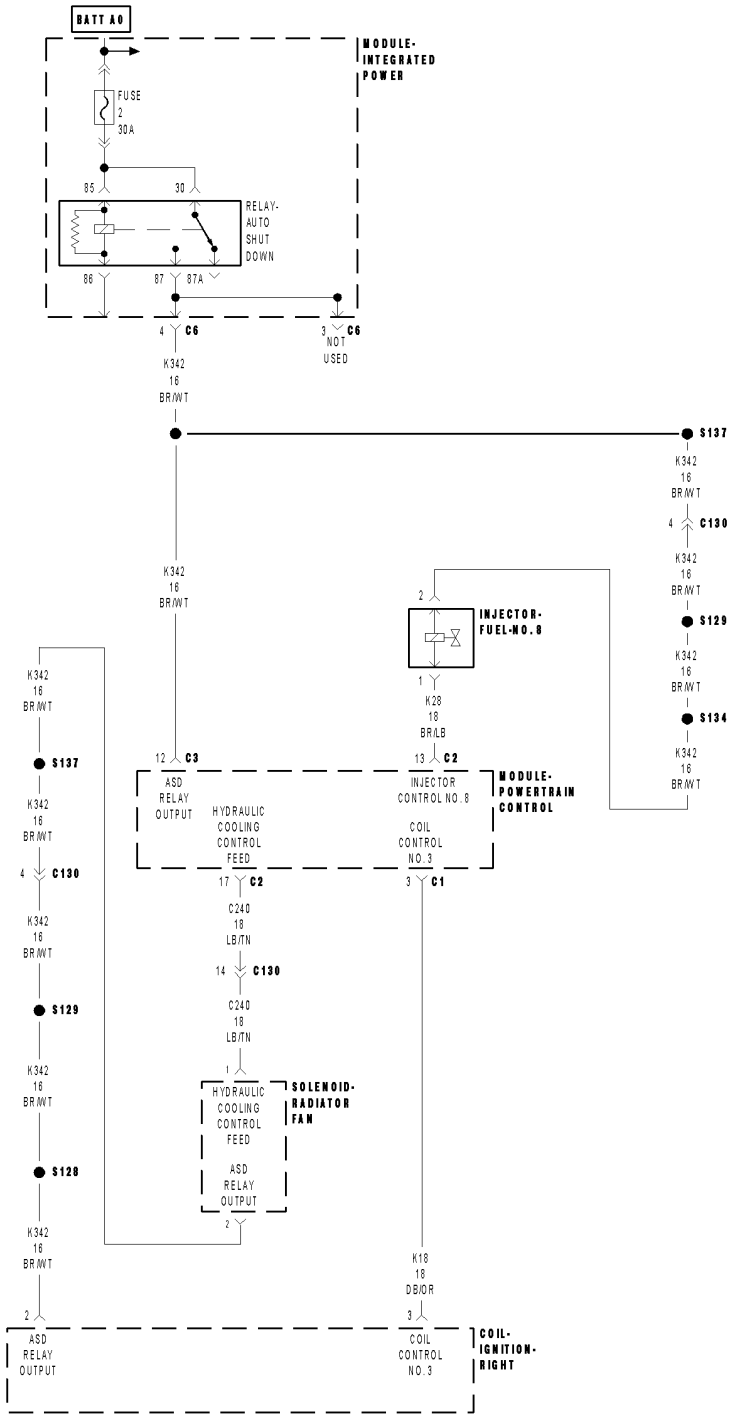
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

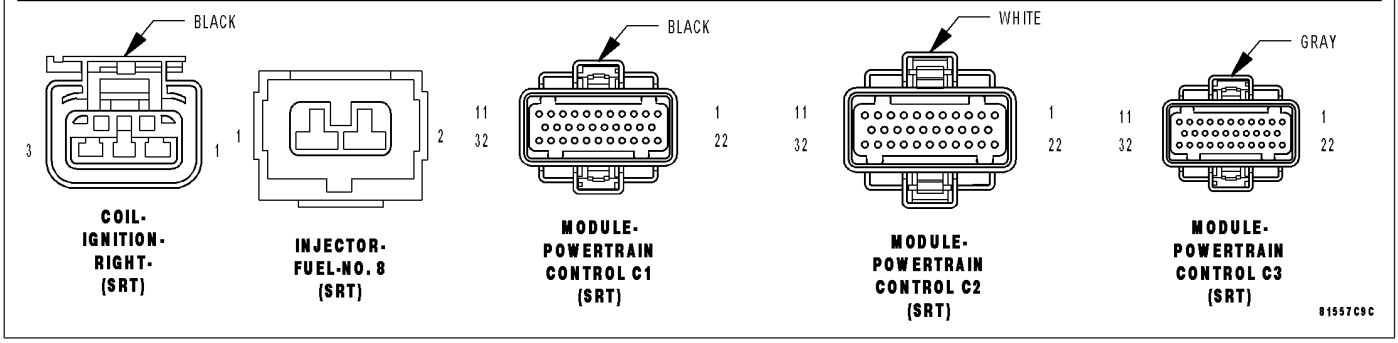
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER #8 MISFIRE





P0308-CYLINDER #8 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K28) INJECTOR CONTROL CIRCUIT
(K18) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER #8 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

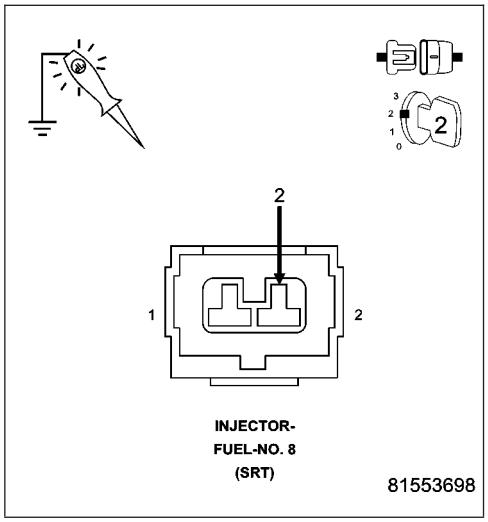
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0308-CYLINDER #8 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

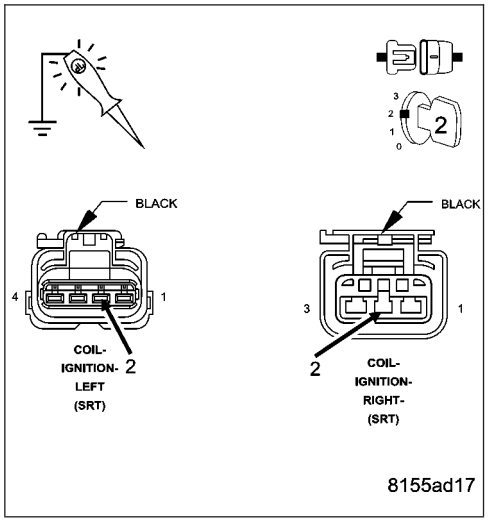
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0308-CYLINDER #8 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0308-CYLINDER #8 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0308-CYLINDER #8 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17

---

10. FUEL INJECTOR

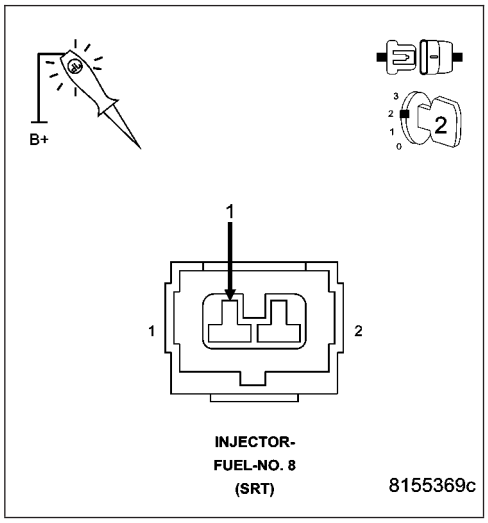
Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K28) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.

Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11



P0308-CYLINDER #8 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

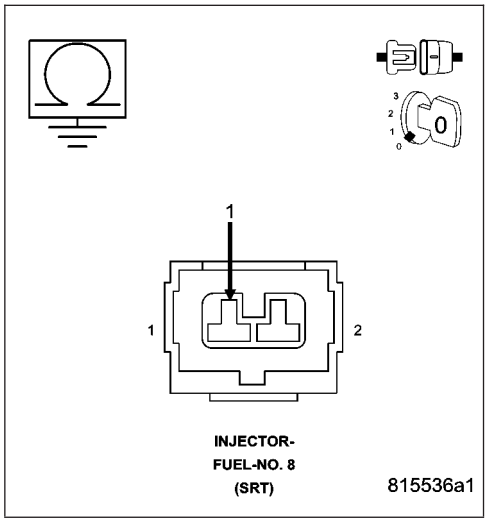
Disconnect the PCM harness connector.

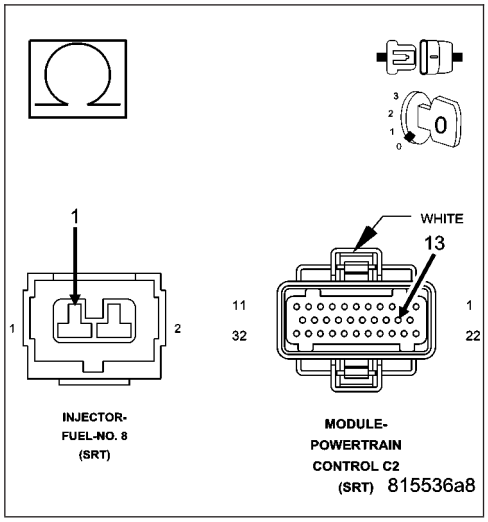
Check the (K28) Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0308-CYLINDER #8 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control circuit.

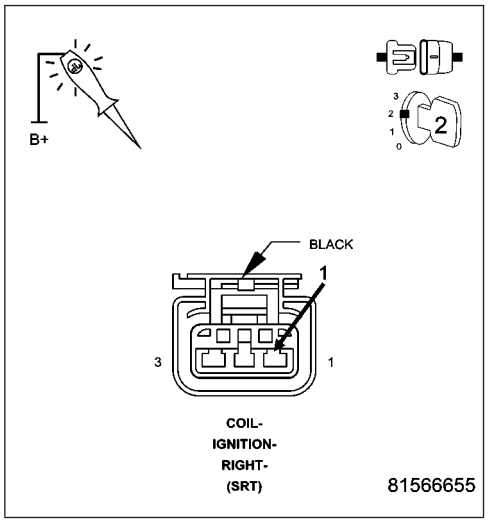
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0308-CYLINDER #8 MISFIRE (CONTINUED)

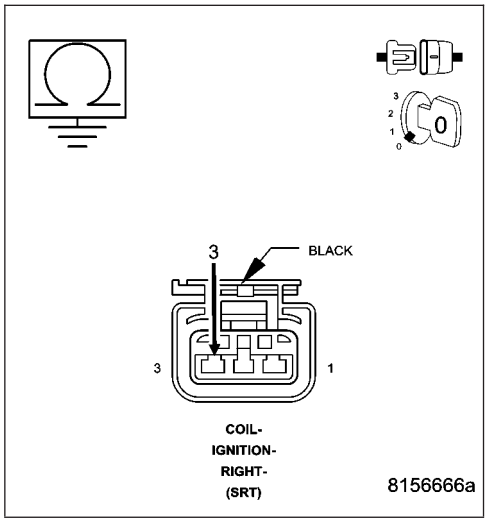
16. COIL CONTROL CIRCUIT

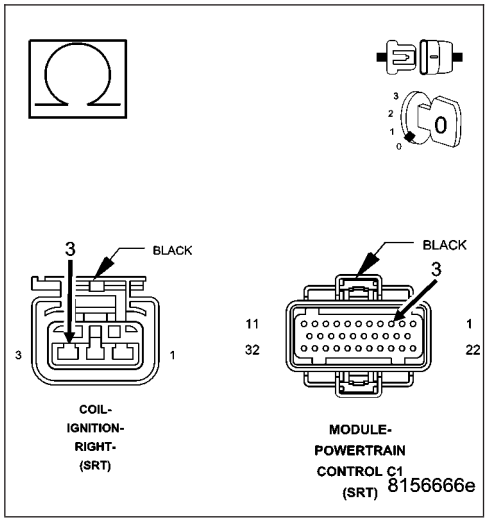
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K18) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

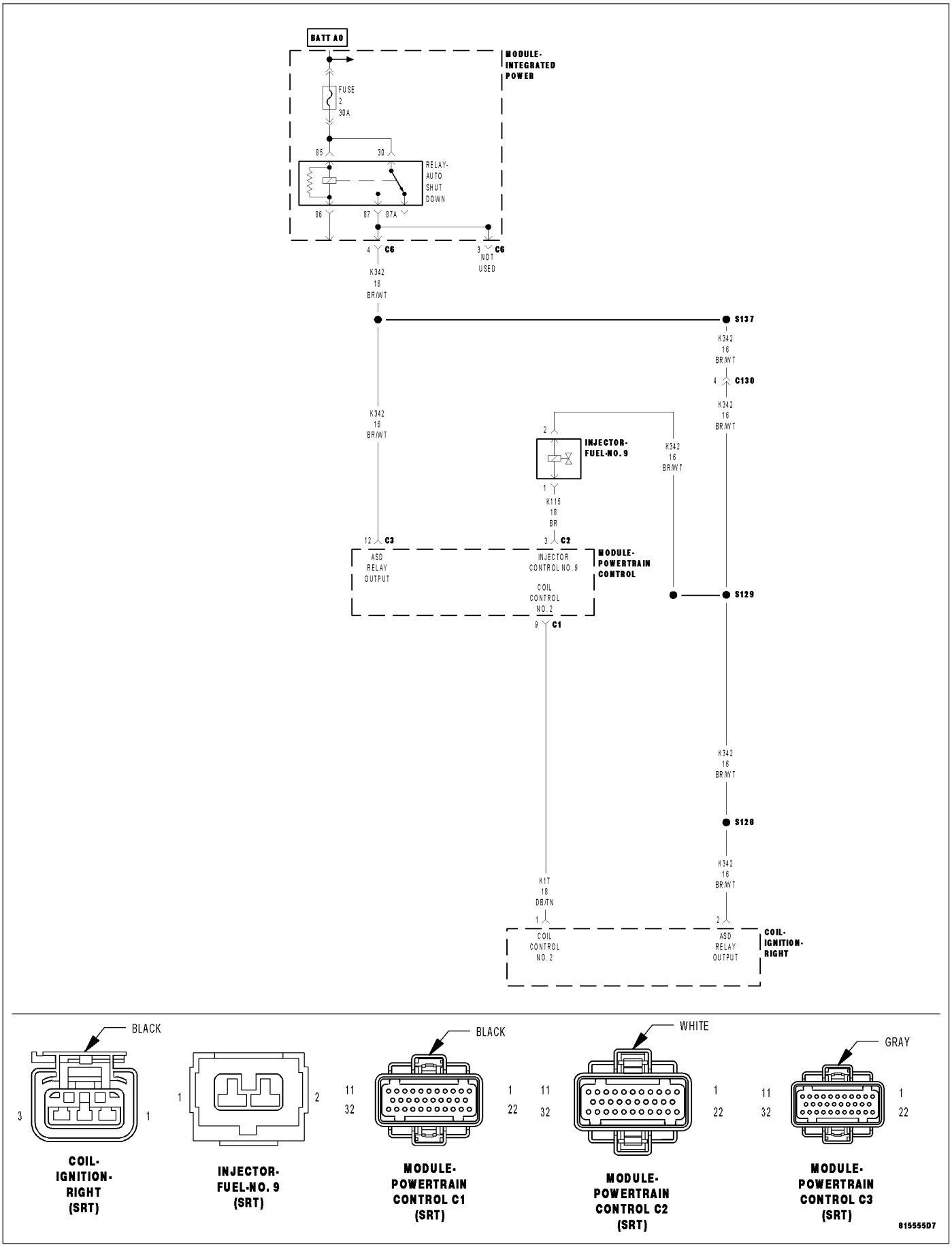
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0309-CYLINDER #9 MISFIRE



P0309-CYLINDER #9 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K115) INJECTOR CONTROL CIRCUIT
(K18) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0309-CYLINDER #9 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

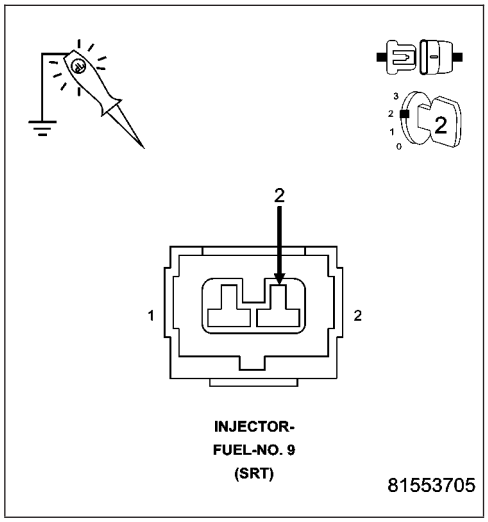
Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0309-CYLINDER #9 MISFIRE (CONTINUED)

3. (K342) ASD RELAY OUTPUT CIRCUIT

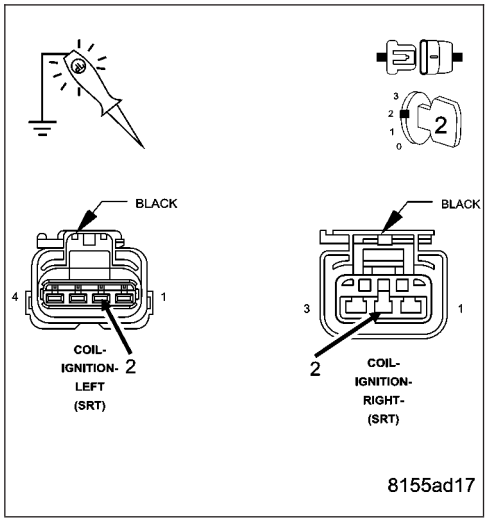
Turn the ignition off.
Disconnect the Ignition Coil harness connector.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.
With the scan tool, actuate the ASD Relay.
Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

P0309-CYLINDER #9 MISFIRE (CONTINUED)

5. SPARK PLUG

Turn the ignition off.

Remove the Spark Plug.

Inspect the Spark Plug for the following conditions.

- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Install a fuel pressure gauge to the fuel rail.

Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0309-CYLINDER #9 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0309-CYLINDER #9 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

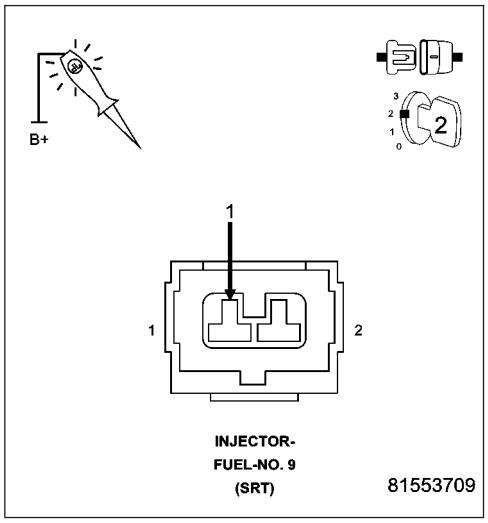
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K115) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0309-CYLINDER #9 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

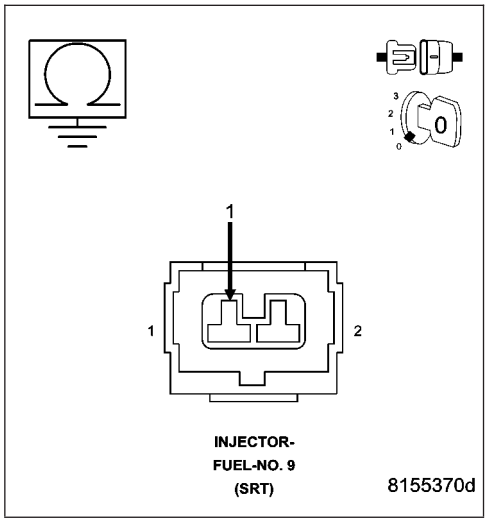
Disconnect the PCM harness connector.

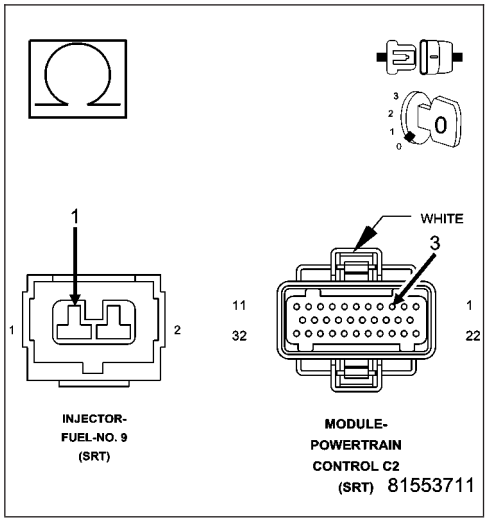
Check the (K115) Injector Control circuit for an open, short to ground, and short to voltage.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0309-CYLINDER #9 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K18) Coil Control circuit.

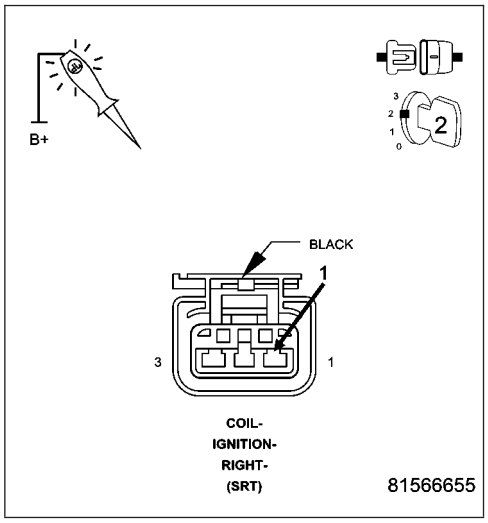
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0309-CYLINDER #9 MISFIRE (CONTINUED)

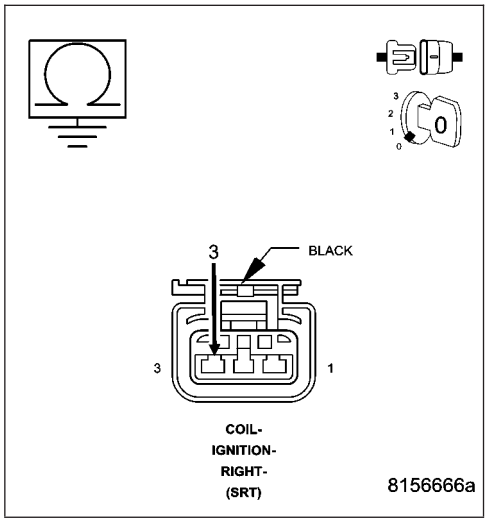
16. COIL CONTROL CIRCUIT

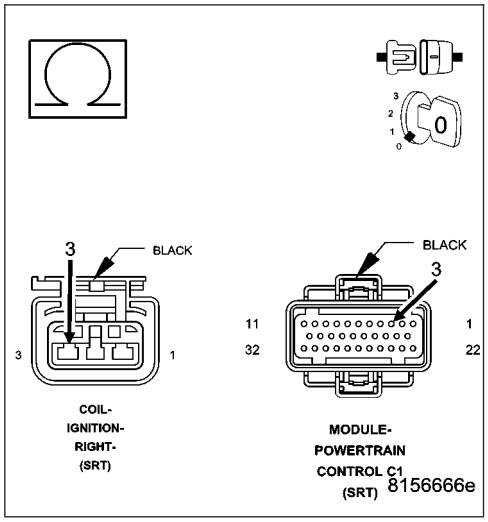
Turn the ignition off.
Disconnect the PCM harness connector.
Check the Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

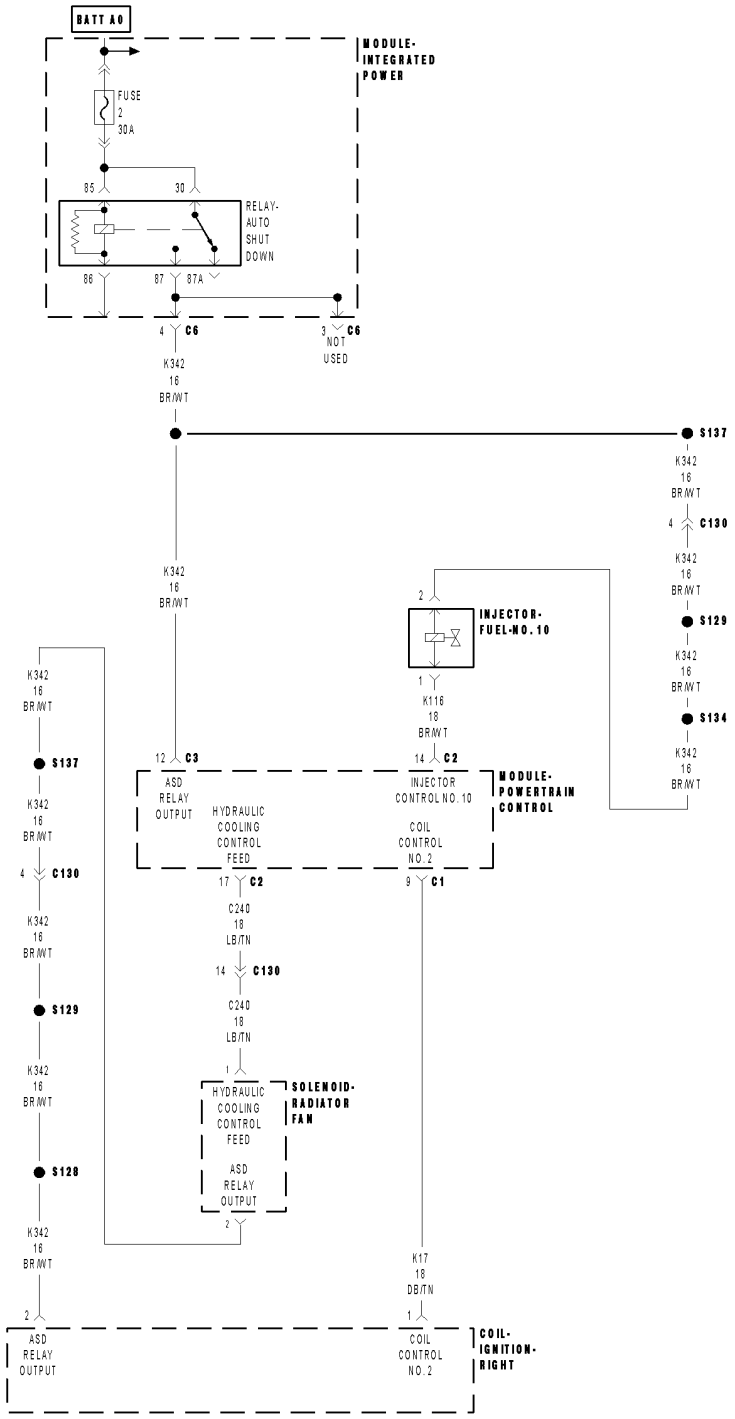
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

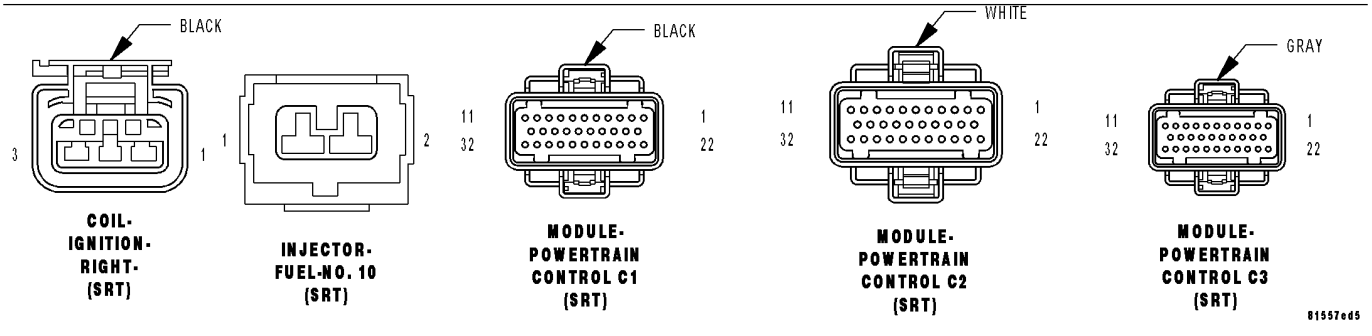
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0310-CYLINDER #10 MISFIRE





P0310-CYLINDER #10 MISFIRE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Any time the engine is running, and the adaptive numerator has been successfully updated.
- **Set Condition:**
  When more than a 1% misfire rate is measured during two trips, or with a 6% to 30% misfire rate during one trip.

Possible Causes
(K342) ASD RELAY OUTPUT CIRCUIT
(K116) INJECTOR CONTROL CIRCUIT
(K17) COIL CONTROL CIRCUIT
IGNITION WIRE
SPARK PLUG
IGNITION COIL
FUEL PUMP INLET STRAINER PLUGGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP MODULE
FUEL PRESSURE LEAK DOWN
FUEL INJECTOR
ENGINE MECHANICAL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. CYLINDER MIS-FIRE CONDITION ACTIVE

Engine running.

Observe the WHICH CYLINDER IS MISFIRING screen for at least one minute on the scan tool.

Is there a misfire present at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0310-CYLINDER #10 MISFIRE (CONTINUED)

2. VISUAL INSPECTION

NOTE: Anything that affects the speed of the crankshaft can cause a misfire DTC.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.

- Visually inspect the engine for any of the following conditions.
- Worn serpentine belt
- Binding Engine-Driven accessories: A/C Compressor, P/S Pump, Water pump.
- Misalignment of the Water pump, P/S Pump and A/C Compressor pulleys
- Corroded PCM power and ground circuits.
- Improper CKP, CMP, MAP, and TP Sensor mounting
- Poor connector/terminal to component connection. i.e., CKP sensor, Fuel Injector, Ign coil, etc.
- Vacuum leaks
- Restricted Air Induction system or Exhaust system.
- Internal engine component failures.

Were any of the above conditions present?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. (K342) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

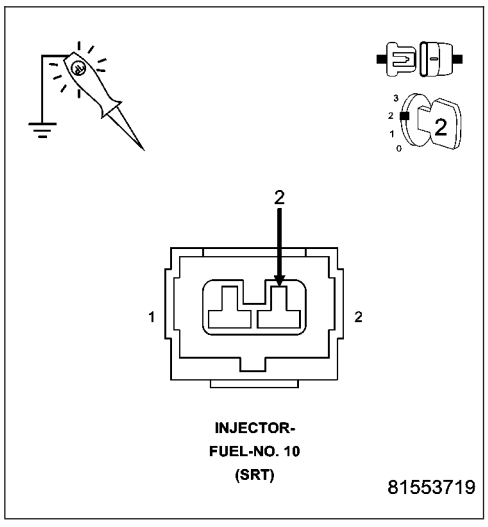
Disconnect the Ignition Coil harness connector.

Disconnect the Fuel Injector harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connected to ground, probe the (K342) ASD Relay Output circuit in the Ignition Coil harness connector and Fuel Injector harness connector while the relay is actuating.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (K342) ASD Relay Output circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0310-CYLINDER #10 MISFIRE (CONTINUED)

4. IGNITION SYSTEM OPERATION

Turn the ignition off.
Connect the Ignition Coil harness connector.
Remove the Ignition Coil.
Leave the Fuel Injector harness connector of the cylinder being tested disconnected.
Install a spark tester on the Ignition Coil.
While cranking the engine observe the spark coming from the spark tester.

NOTE: A crisp blue spark that is able to jump the gap of the spark tester should be generated.

Is good spark present?

Yes >> Go To 5

No >> Go To 14

NOTE: Connect the Fuel Injector harness connector before continuing.

---

5. SPARK PLUG

Turn the ignition off.
Remove the Spark Plug.
Inspect the Spark Plug for the following conditions.
- Cracks
- Carbon Tracking
- Foreign Material
- Gap size out of specifications
- Loose or broke electrode

NOTE: Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.

Were any of the above conditions present?

Yes >> Replace the Spark Plug.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. FUEL PRESSURE CHECK

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.
Install a fuel pressure gauge to the fuel rail.
Start the engine and observe the fuel pressure reading.

NOTE: Fuel pressure specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Choose a conclusion that best matches your fuel pressure reading.

Within Specification
Go To 7

Below Specification
Go To 12

Above Specification
Replace the fuel filter/pressure regulator.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0310-CYLINDER #10 MISFIRE (CONTINUED)

7. FUEL PRESSURE LEAK DOWN

NOTE: Before continuing visually and physically inspect the fuel delivery system for external leaks or damage. Repair / replace as necessary.

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death

Install special tool #6539 (5/16″) or #6631 (3/8″) fuel line adapter.

Install the fuel pressure gauge.

Start the engine and allow the fuel system to reach maximum pressure.

Turn the ignition off.

NOTE: Fuel specification is 407 KPa +/- 34 KPa (59 psi +/- 5 psi).

Using special tool #C4390, Hose Clamp Pliers, pinch the rubber fuel line between the fuel pressure gauge and the engine.

Monitor the fuel pressure gauge for a minimum of 5 minutes.

NOTE: The pressure should not fall below 241 KPa (35 psi).

Does the pressure fall below the listed specification?

Yes >> Replace the leaking Fuel Injector(s).
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. FUEL INJECTOR OPERATION

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

CAUTION: After each Fuel Injector actuation, start the engine to clean the cylinder of fuel. Failure to do so could cause engine damage.

Remove special tool #C4390.

Start the engine and allow the fuel pressure to reach maximum pressure.

Ignition on, engine not running.

Using the scan tool, actuate the Fuel Injector.

Monitor the fuel pressure gauge.

Does the fuel pressure gauge indicate a drop in fuel pressure?

Yes >> Go To 9

No >> Go To 10

NOTE: Turn the ignition off, remove the Fuel Pressure gauge, and connect the fuel lines before continuing.

P0310-CYLINDER #10 MISFIRE (CONTINUED)

9. ENGINE MECHANICAL

Check for any of the following conditions/mechanical problems.
ENGINE VACUUM - must be at least 13 inches in neutral
ENGINE VALVE TIMING - must be within specifications
ENGINE COMPRESSION - must be within specifications
ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
ENGINE PCV SYSTEM - must flow freely
TORQUE CONVERTER STALL SPEED - must be within specifications
POWER BRAKE BOOSTER - no internal vacuum leaks
FUEL - must be free of contamination
CAM LOBES - must not be worn excessively
CYLINDER LEAKAGE TEST - must be within specifications
VALVE SPRINGS - cannot be weak or broken

Are there any engine mechanical problems?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

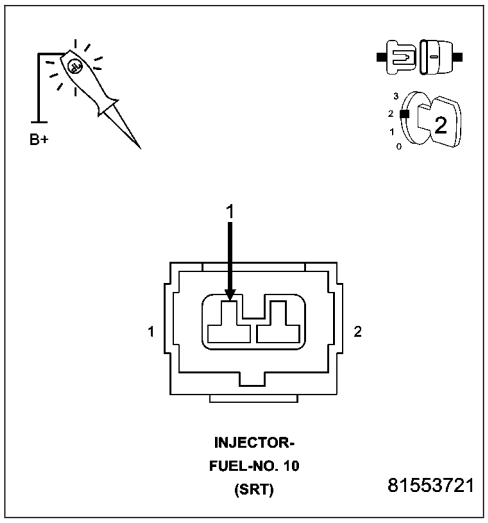
No >> Go To 17

---

10. FUEL INJECTOR

Turn the ignition off.
Disconnect the Fuel Injector harness connector.
Ignition on, engine not running.

NOTE: When a Misfire is detected for a particular cylinder, the PCM will shut down that cylinders Injector Control circuit.
With the scan tool, erase DTCs.
Using a 12-volt test light connected to 12-volts, probe the (K116) Injector Control circuit.
With the scan tool, actuate the Fuel Injector.



Does the test light blink/flicker?

Yes >> Replace the Fuel Injector.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0310-CYLINDER #10 MISFIRE (CONTINUED)

11. INJECTOR CONTROL CIRCUIT

Turn the ignition off.

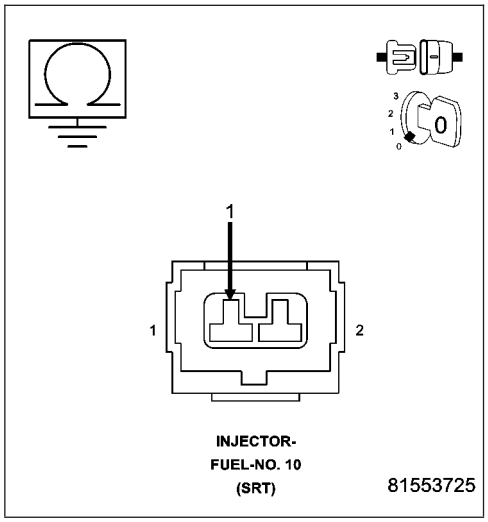
Disconnect the PCM harness connector.

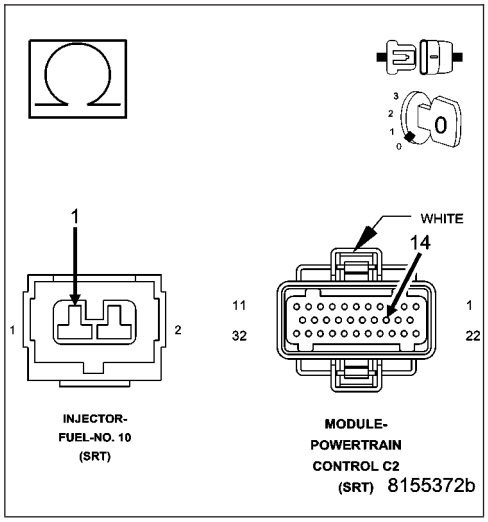
Check the Injector Control circuit for an open or short to ground.

Was a problem found with the Injector Control circuit?

Yes >> Repair the excessive resistance or short in the Injector Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





12. FUEL SUPPLY LINE RESTRICTED

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Raise vehicle on hoist, and disconnect the fuel pressure line at the fuel pump module.

Install special tool #6539 (5/16″) #6631(3/8″) fuel line adapter and the fuel pressure gauge between the fuel supply line and the fuel pump module.

Ignition on, engine not running.

With the scan tool, actuate the ASD Fuel System test and observe the fuel pressure gauge.

NOTE: Fuel pressure specification is 379 KPa +/- 14 KPa (55 psi +/- 2 psi).

Is the fuel pressure within specification?

Yes >> Repair or replace fuel supply line as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

P0310-CYLINDER #10 MISFIRE (CONTINUED)

13. FUEL PUMP INLET STRAINER

Turn the ignition off.

WARNING: The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in personal injury or death.

Remove the Fuel Pump Module and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes >> Replace the Fuel Pump Inlet Strainer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Before continuing, check the Fuel Pump Module harness connector terminals for corrosion, damage, or terminal push out. Make sure the ground circuit is functional. Repair as necessary. Replace the Fuel Pump Module.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. IGNITION WIRE

NOTE: If the vehicle being tested does not have an ignition wire answer YES to this test and continue.

Turn the ignition off.

Remove the ignition wire.

Measure the resistance of the ignition wire.

Is the resistance below 10K ohms?

Yes >> Go To 15

No >> Replace the Ignition Wire.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

15. IGNITION COIL

Disconnect the Ignition Coil harness connector.

Remove the Fuel Pump Relay.

Using a 12-volt test light connected to 12-volts, probe the (K17) Coil Control circuit.

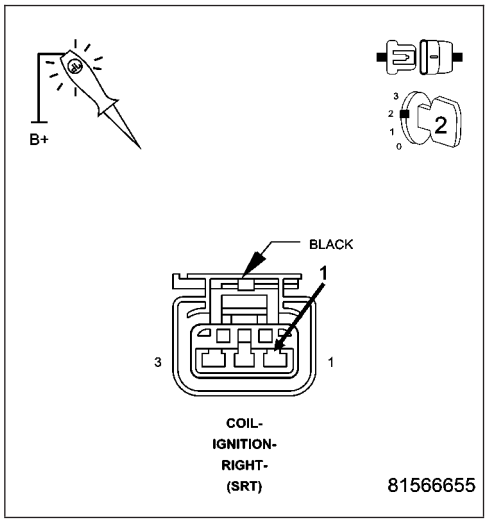
Crank the engine for 5 seconds while observing the test light.

NOTE: The primary resistance of the 8.3L Ignition coil is 0.53 to 0.65 of an ohm at 77°F (25°C).

Does the test light brightly blink/flicker?

Yes >> Replace the Ignition Coil.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 16



P0310-CYLINDER #10 MISFIRE (CONTINUED)

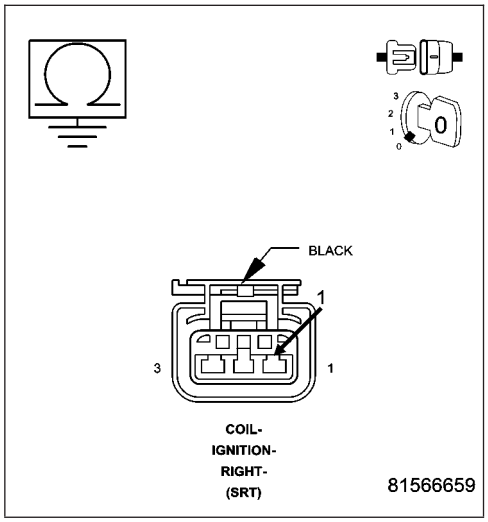
16. COIL CONTROL CIRCUIT

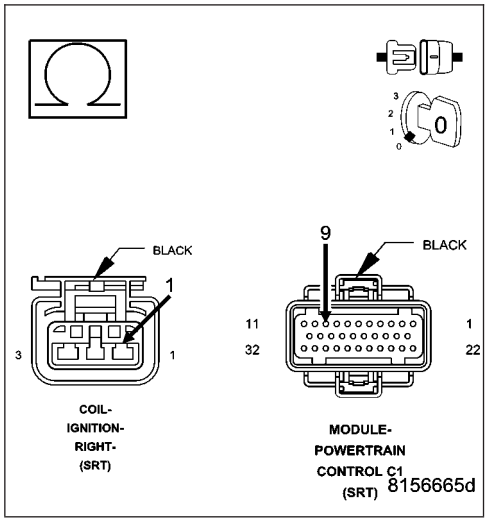
Turn the ignition off.
Disconnect the PCM harness connector.
Check the (K17) Coil Control circuit for an open or short to ground.

Was a problem found with the Coil Control circuit?

Yes >> Repair the Coil Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 17





17. PCM

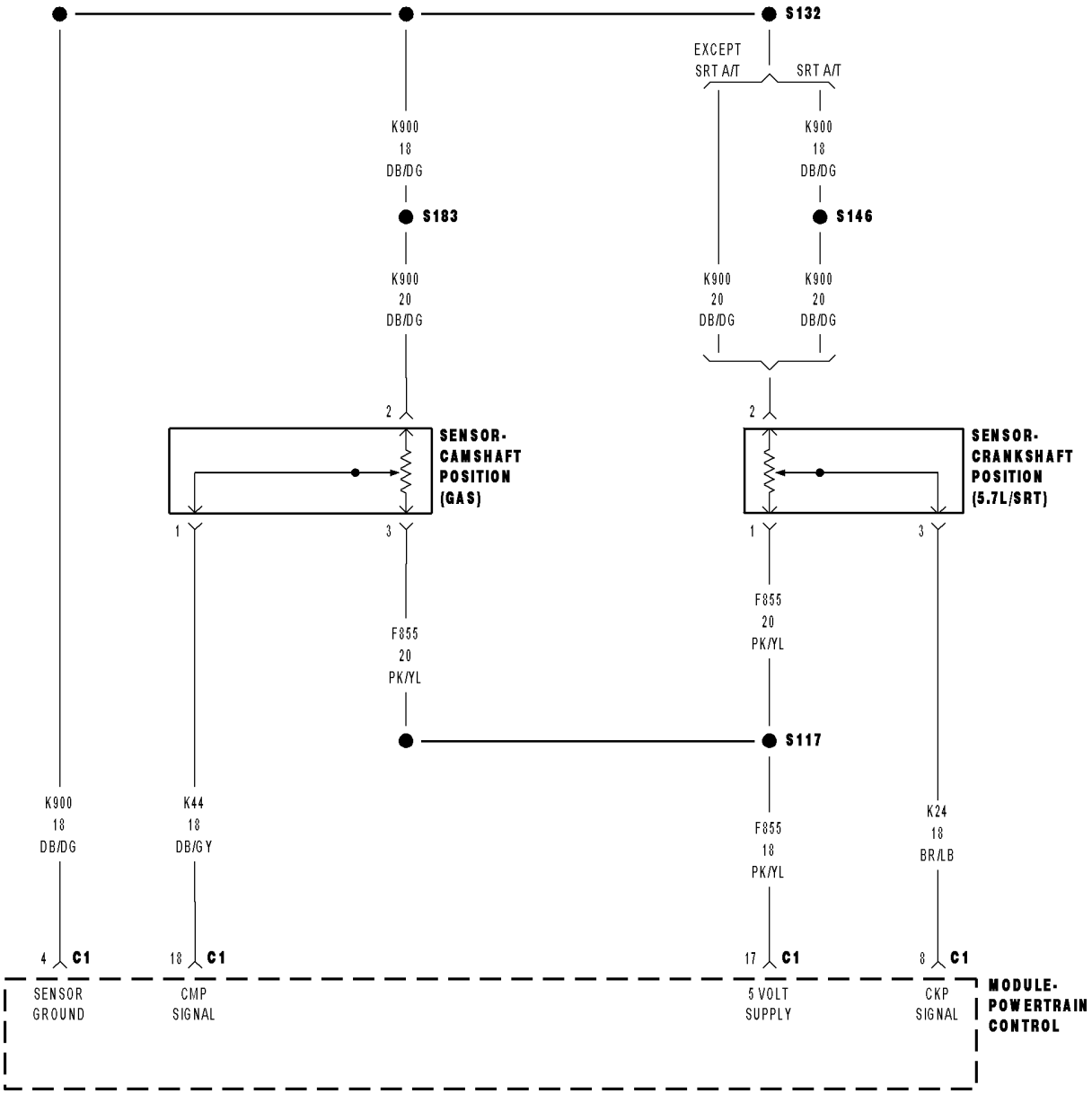
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

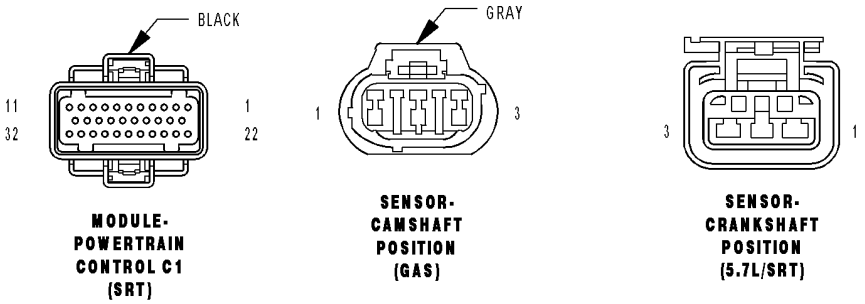
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0320–NO CANK REFERENCE SIGNAL AT PCM





81558518

P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine cranking.
- **Set Condition:**
  No CKP signal is present during engine cranking, and at least 8 camshaft position sensor signals have occurred. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K24) CKP SIGNAL CIRCUIT OPEN
(K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K24) CKP SIGNAL CIRCUIT SHORTED GROUND
(K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CRANKSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

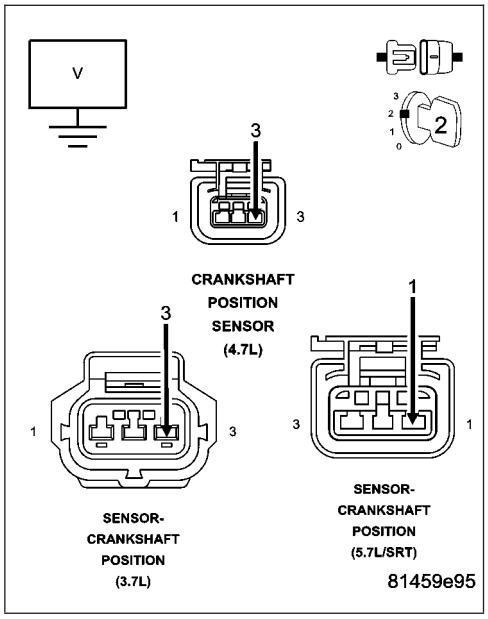
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CKP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



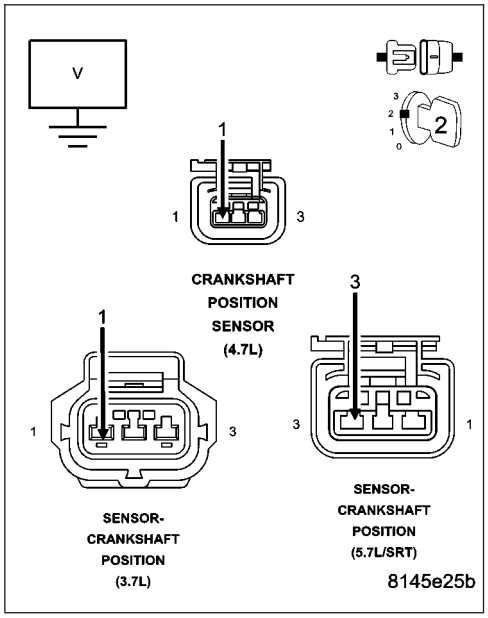
Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10

3. (K24) CKP SIGNAL CIRCUIT

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7

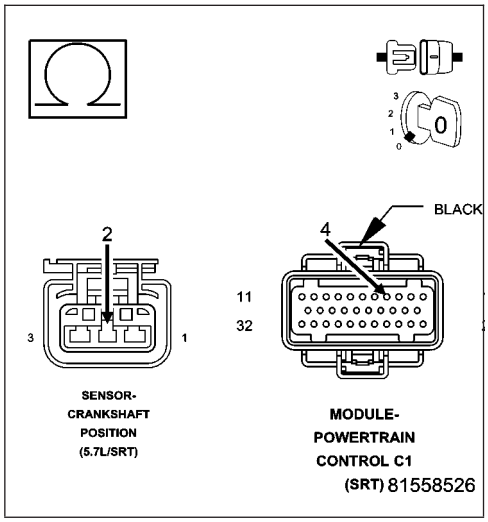
P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connector.

Measure the resistance of the (K900) Sensor ground circuit from the CKP Sensor harness connector to the PCM harness connector.



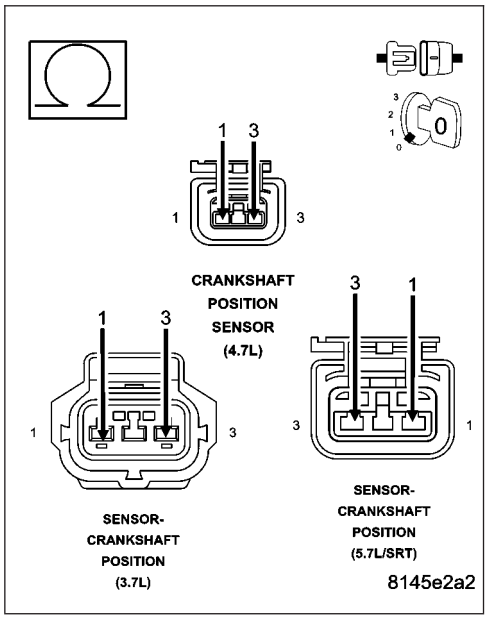
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K24) CKP SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K24) CKP Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

6. CRANKSHAFT POSITION SENSOR

NOTE: Inspect the slots on the flywheel for damage. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

7. (K24) CKP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connector.

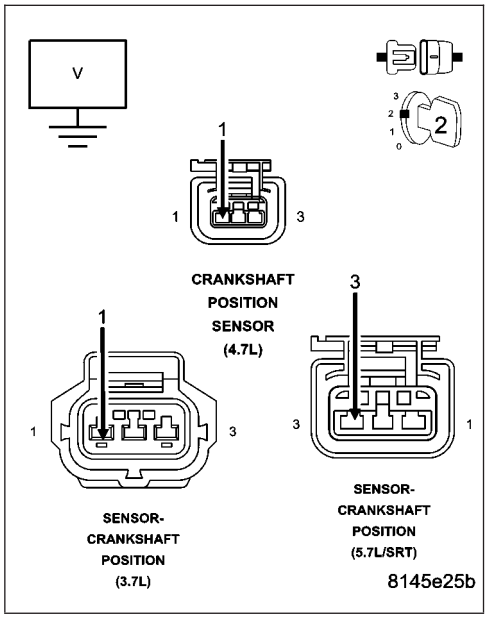
Ignition on, engine not running.

Measure the voltage on the (K24) CKP Signal circuit in the CKP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



8. (K24) CKP SIGNAL CIRCUIT OPEN

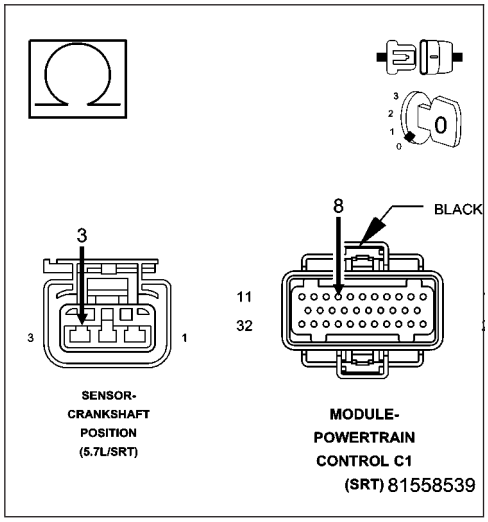
Turn the ignition off.

Measure the resistance of the (K24) CKP Signal circuit from the CKP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

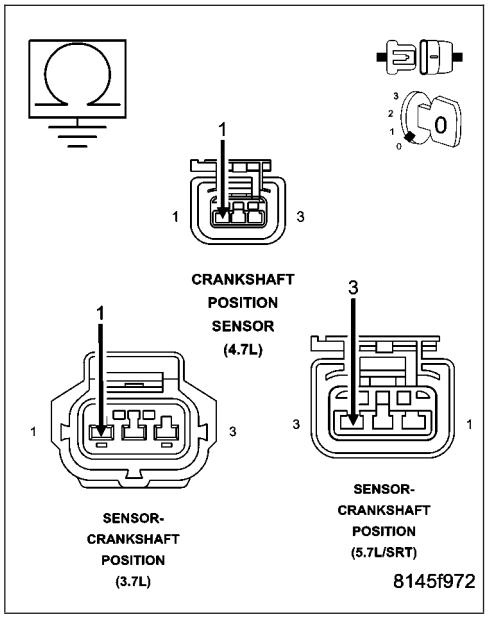
No >> Repair the open in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

9. (K24) CKP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K24) CKP Signal circuit in the CKP Sensor harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K24) CKP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

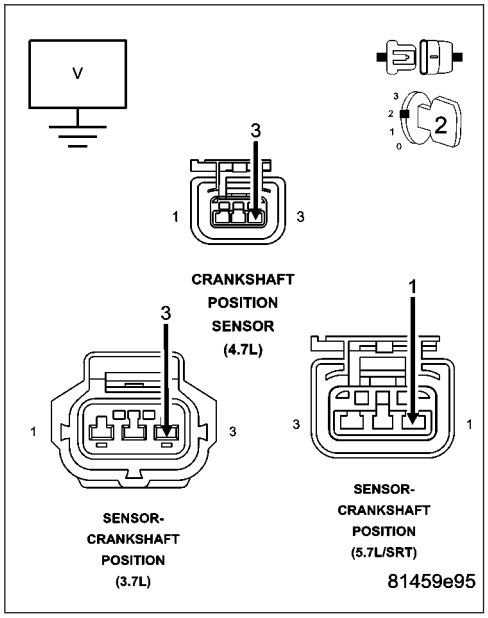
10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 11

P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

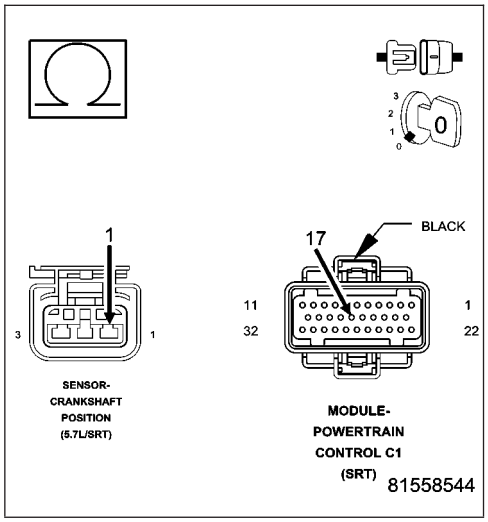
Turn the ignition off.

Measure the resistance of the (F855) 5-volt Supply circuit from the CKP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



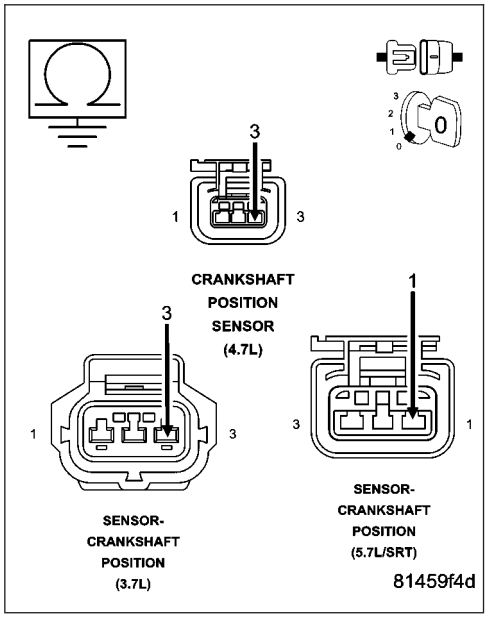
12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CKP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13



P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

14. ERRATIC CKP SENSOR SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crank Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CKP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

Did the CKP Sensor generate any erratic pulses?

Yes >> Inspect the related wire harness and replace the Crankshaft Position Sensor if no wiring problems were found.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

P0320–NO CANK REFERENCE SIGNAL AT PCM (CONTINUED)

15. ERRATIC CMP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Cam Position Sensor.

Observe the lab scope screen.

Look for any pulses generated by the CMP Sensor.

Allow the engine to idle.

Observe the lab scope screen.

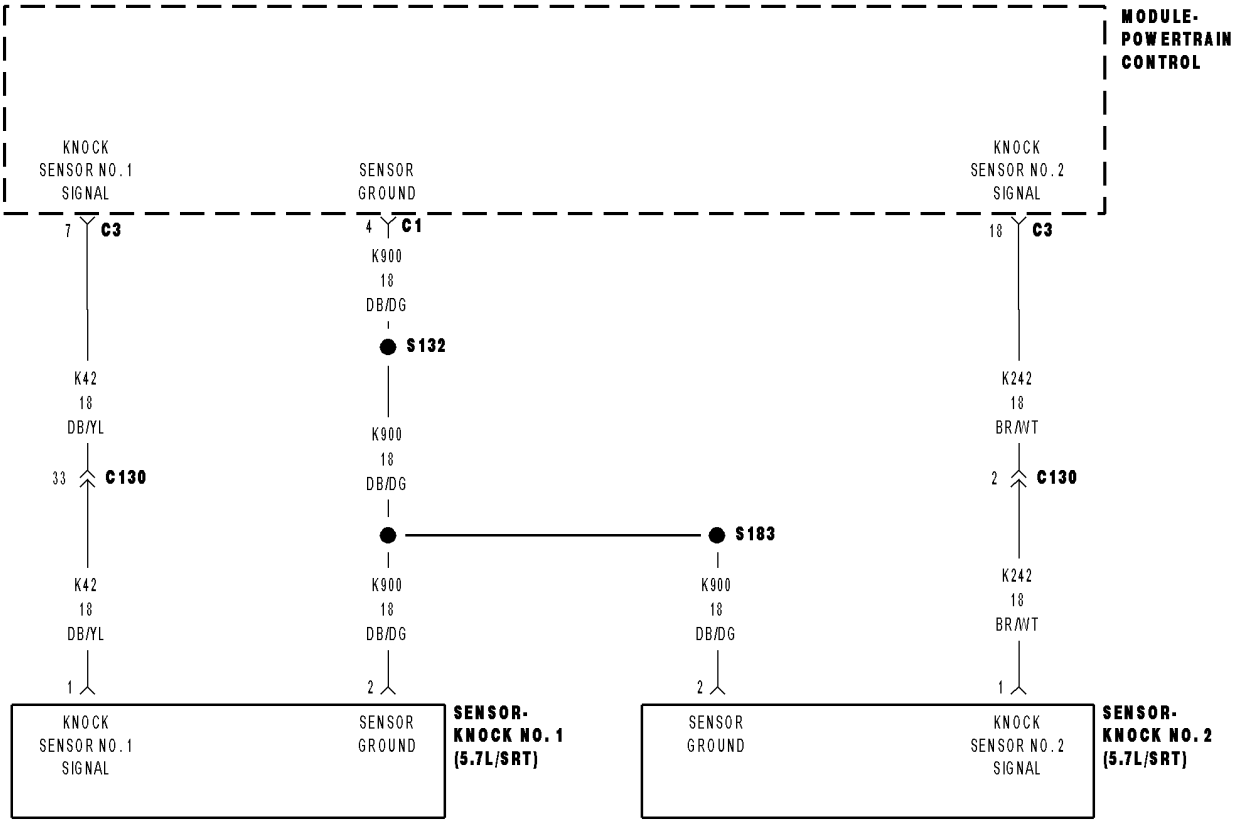
Did the CMP Sensor generate any pulses?

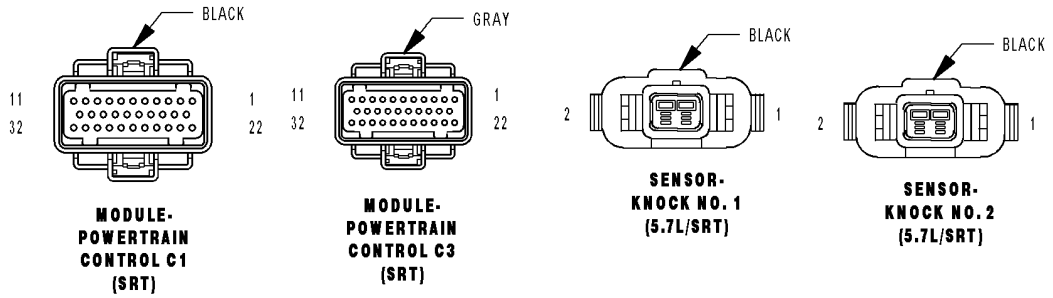
Yes >> Inspect the related wire harness and replace the Camshaft Position Sensor if no wiring problems were found.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test complete, the conditions that set this DTC are not present at this time.

P0325-KNOCK SENSOR 1 CIRCUIT





81558977

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running.
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC will also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.
With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

2. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the Knock Sensor harness connector.

Disconnect the PCM harness connector.

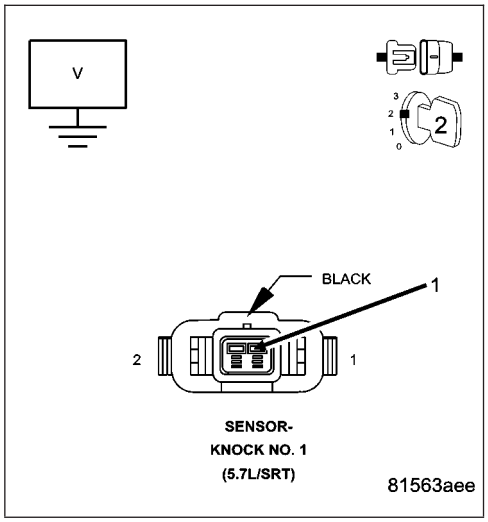
Ignition on, engine not running.

Measure the voltage on the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.

Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K42) KNOCK SENSOR NO.1 SIGNAL CIRCUIT OPEN

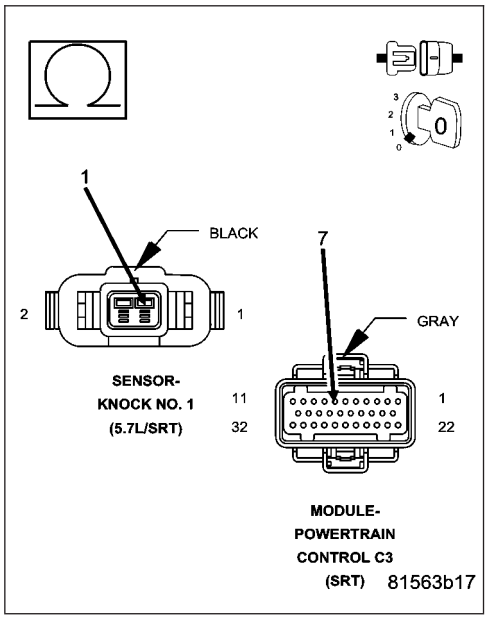
Turn the ignition off.

Measure the resistance of the (K42) Knock Sensor No.1 Signal circuit from the Knock Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

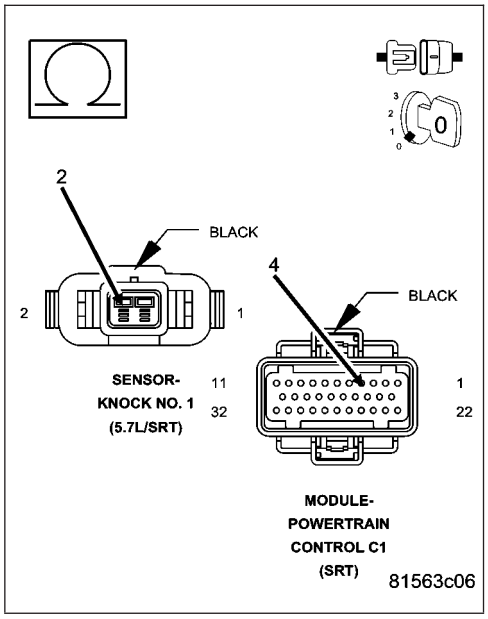
No >> Repair the open in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the Knock Sensor harness connector to the PCM harness connector.



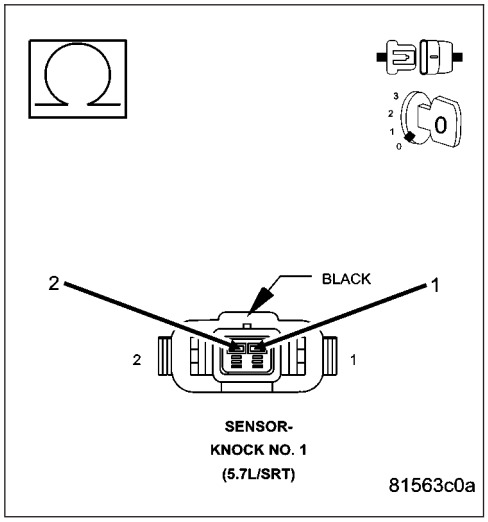
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K42) Knock Sensor No.1 Signal circuit and the (K900) Sensor ground circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

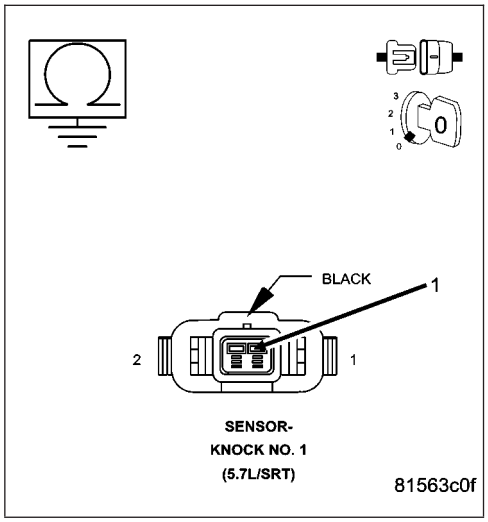
Yes >> Repair the short between the (K42) Knock Sensor No.1 Signal circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0325-KNOCK SENSOR 1 CIRCUIT (CONTINUED)

6. (K42) KNOCK SENSOR NO.1 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K42) Knock Sensor No.1 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K42) Knock Sensor No.1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. KNOCK SENSOR

Replace the Knock Sensor.
Ignition on, engine not running.
With the scan tool, erase DTC.
Attempt to operate the vehicle using the information noted in the Freeze Frame.
With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

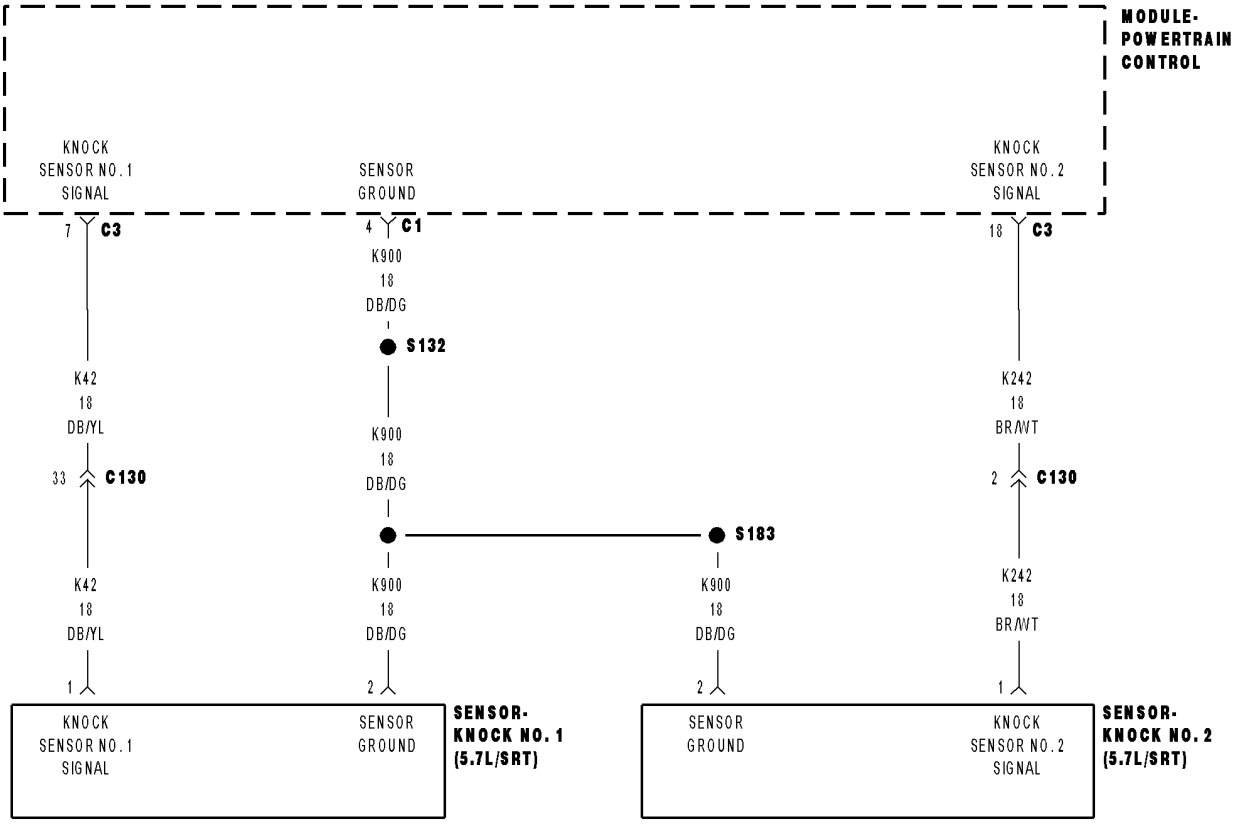
Yes >>

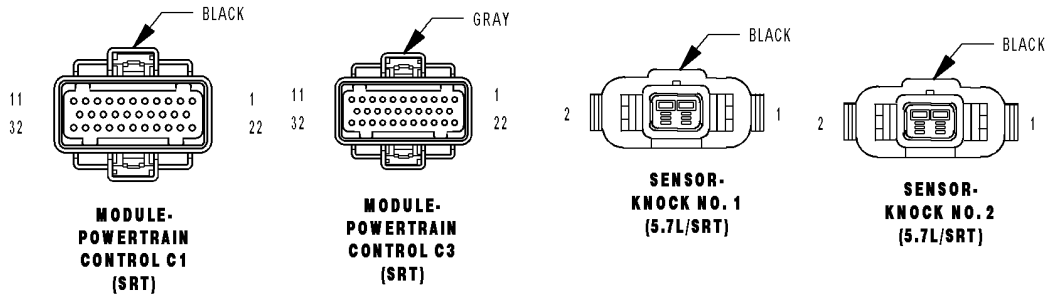
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0330-KNOCK SENSOR 2 CIRCUIT





81558977

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running
- **Set Condition:**
  The Knock Sensor circuit voltage falls below a minimum value at idle or deceleration. The minimum value is from a look-up table internal to the PCM and is based on engine RPM. DTC well also set if the sensor voltage goes above 5.0 volts. One Trip Fault. Three good trips to turn off the MIL. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
(K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT SHORTED TO GROUND
KNOCK SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

2. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the No.2 Knock Sensor harness connector.

Disconnect the C3 PCM harness connector.

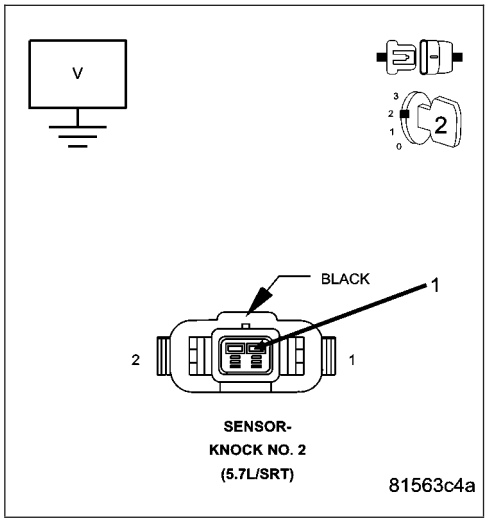
Ignition on, engine not running.

Measure the voltage on the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.

Is the voltage above 2.0 volts?

Yes >> Repair the short to battery voltage in the (K242) Knock Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K242) KNOCK SENSOR NO.2 SIGNAL CIRCUIT OPEN

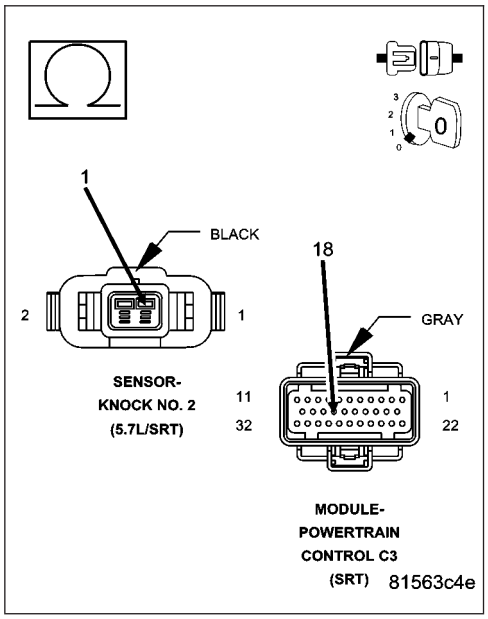
Turn the ignition off.

Measure the resistance of the (K242) Knock Sensor No.2 Signal circuit from the Knock Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

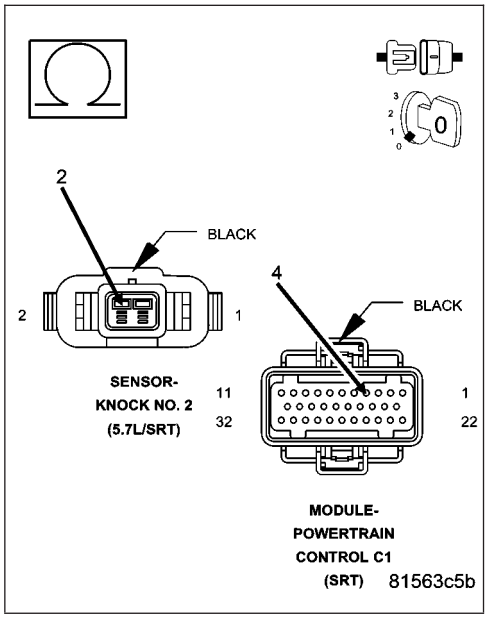
No >> Repair the open in the (K242) Knock Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the Knock Sensor harness connector to the PCM harness connector.



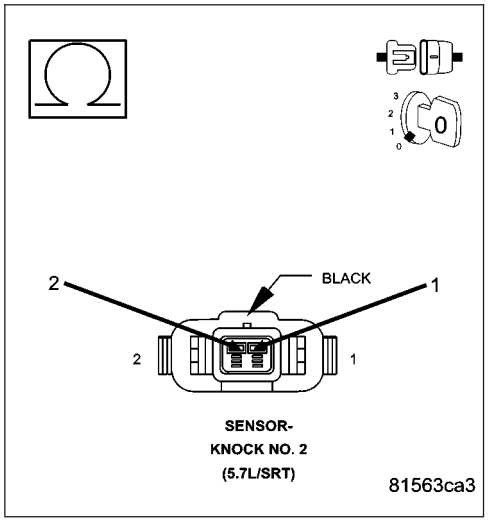
Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K242) Knock Sensor No.2 Signal circuit and the (K900) Sensor ground circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

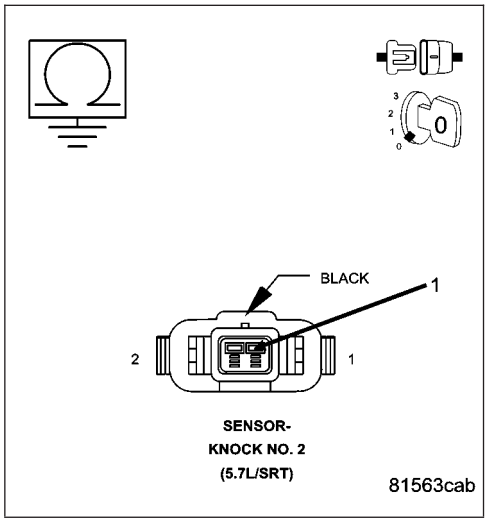
Yes >> Repair the short between the (K242) Knock Sensor No.2 Signal circuit and the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

P0330-KNOCK SENSOR 2 CIRCUIT (CONTINUED)

6. (K242) KNOCK SENSOR NO.2 SIGNAL SHORTED TO GROUND

Measure the resistance between ground and the (K242) Knock Sensor No.2 Signal circuit in the Knock Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K242) Knock Sensor No.2 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. KNOCK SENSOR

Replace the Knock Sensor.
Ignition on, engine not running.
With the scan tool, erase DTC.
Attempt to operate the vehicle using the information noted in the Freeze Frame.
With the scan tool, read DTCs.

Does the scan tool display the DTC that was previously erased?

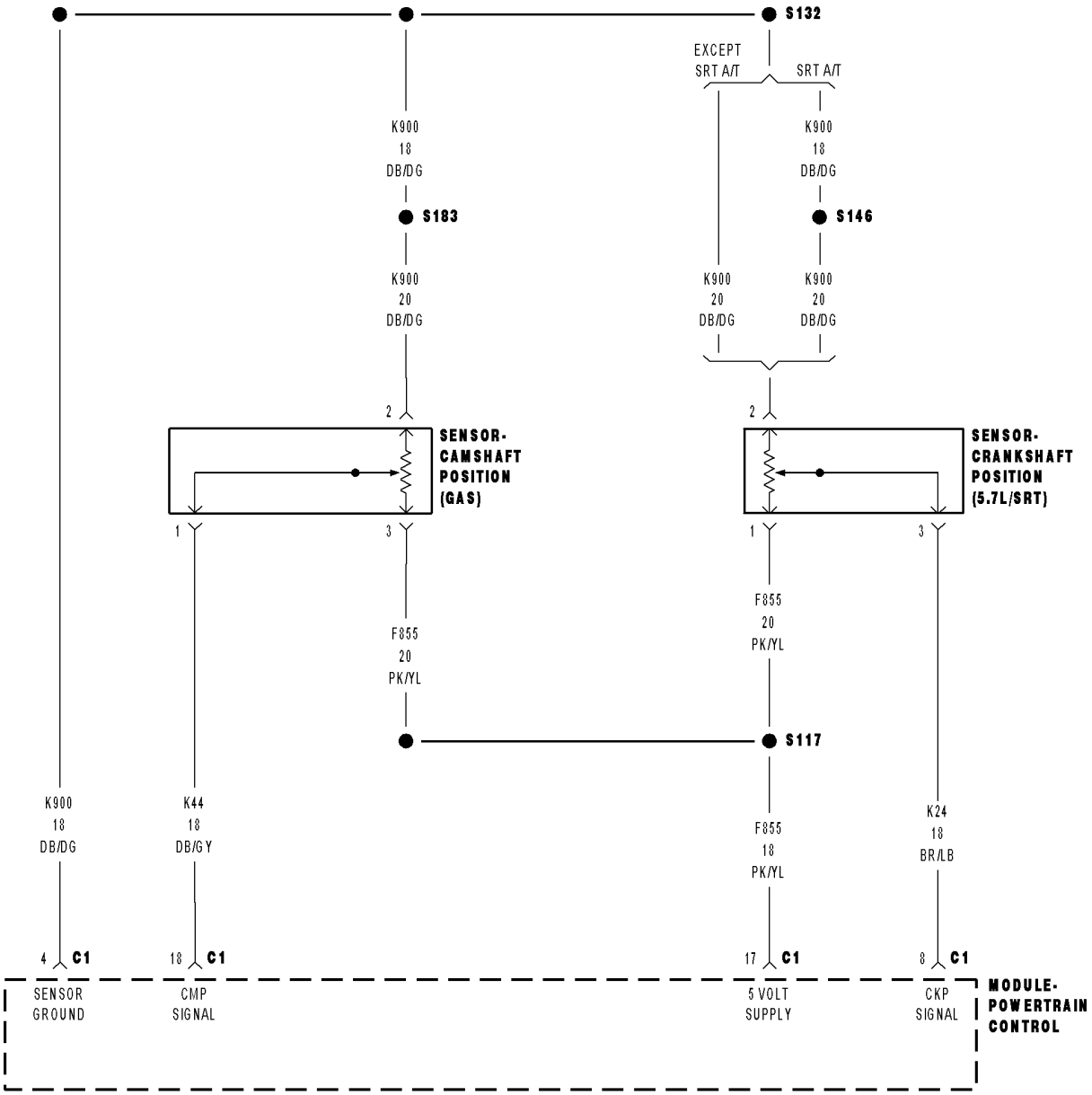
Yes >>

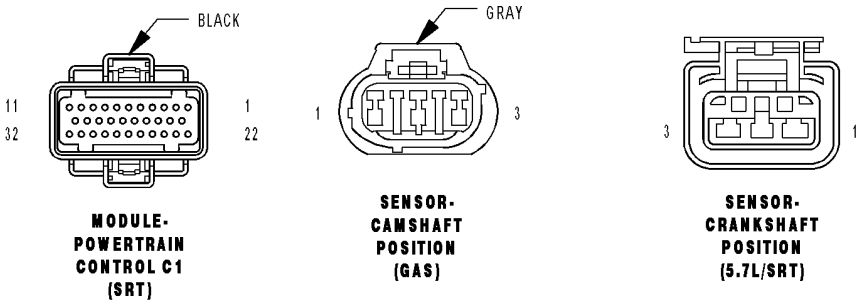
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary. Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P0340-CAMSHAFT POSITION SENSOR CIRCUIT





8155933b

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During engine cranking and with the engine running. Battery voltage greater than 10 volts.
- **Set Condition:**
  At least 5 seconds or 2.5 engine revolutions have elapsed with crankshaft position sensor signals present but no camshaft position sensor signal. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
(K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(K44) CMP SIGNAL CIRCUIT OPEN
(K44) CMP SIGNAL CIRCUIT SHORTED GROUND
(K44) CMP SIGNAL SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

Crank the engine.
Ignition on, engine not running.
With a scan tool read the DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Go To 14

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

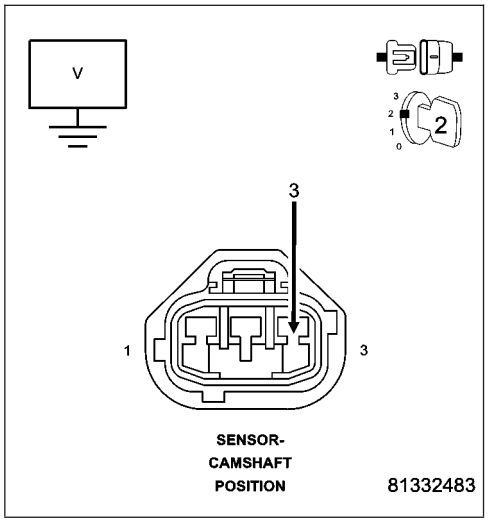
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the CMP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CMP Sensor harness connector.



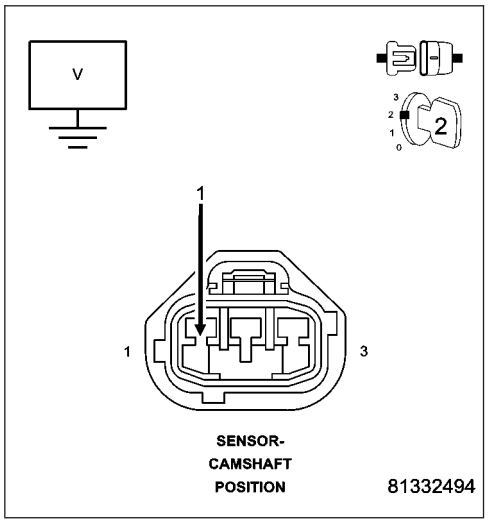
Is the voltage between 4.5 and 5.2 volts?

Yes >> Go To 3

No >> Go To 10

3. (K44) CMP SIGNAL CIRCUIT

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the voltage between 4.5 and 5.0 volts?

Yes >> Go To 4

No >> Go To 7

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

4. (K900) SENSOR GROUND CIRCUIT OPEN

Turn the ignition off.

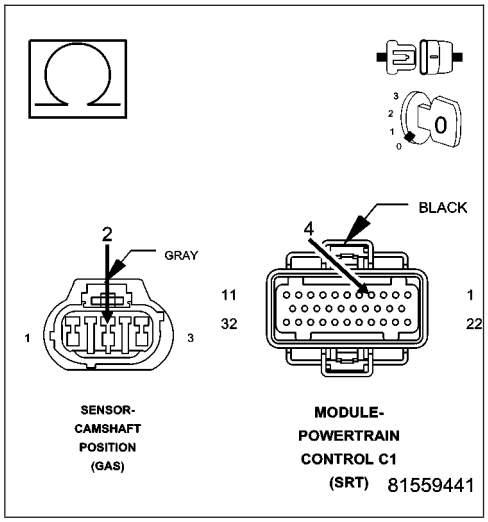
Disconnect the PCM harness connector.

Measure the resistance of the (K900) Sensor ground circuit from the CMP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



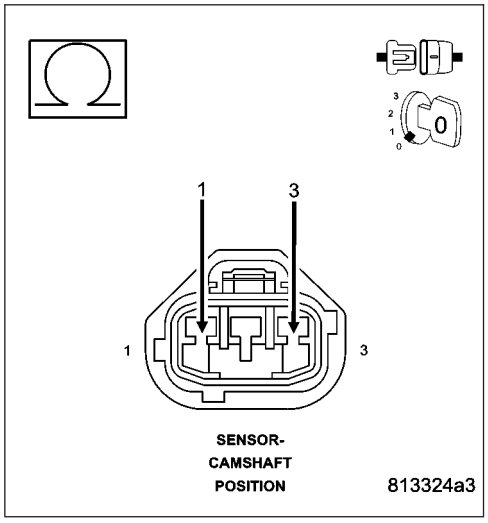
5. (K44) CMP SIGNAL SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (K44) CMP Signal circuit and the (F855) 5-volt Supply circuit in the CMP Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K44) CMP Signal circuit and the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



6. CAMSHAFT POSITION SENSOR

NOTE: Inspect the Camshaft sprocket for damage per the Service Information. If a problem is found repair as necessary.

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

7. (K44) CMP SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connector.

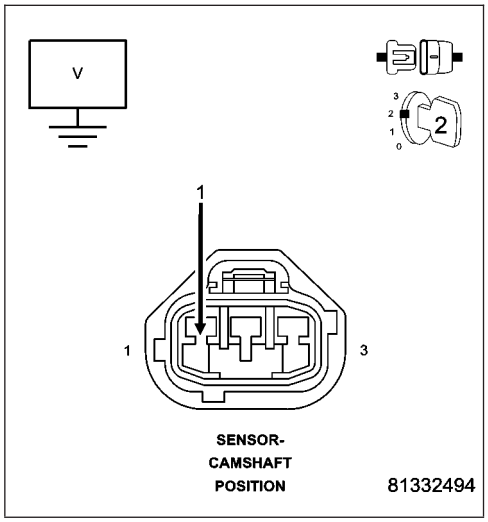
Ignition on, engine not running.

Measure the voltage on the (K44) CMP Signal circuit in the CMP Sensor harness connector.

Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8



8. (K44) CMP SIGNAL CIRCUIT OPEN

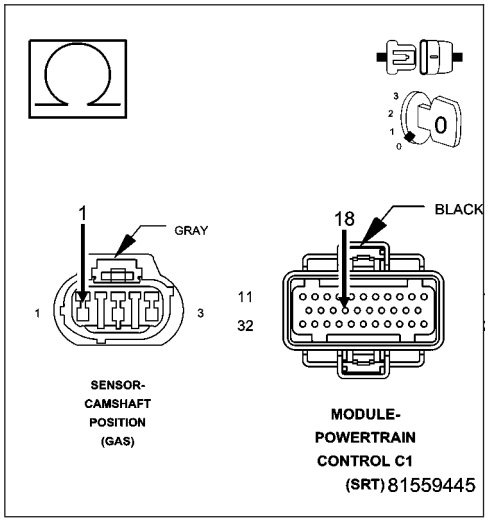
Turn the ignition off.

Measure the resistance of the (K44) CMP Signal circuit from the CMP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

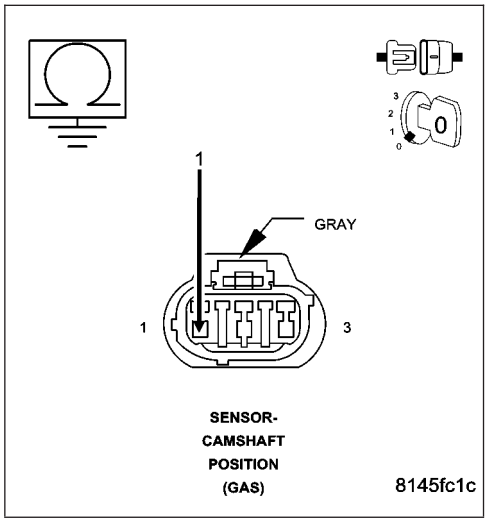
No >> Repair the open in the (K44) CMP Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

9. (K44) CMP SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K44) CMP Signal circuit in the CMP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K44) CMP Signal circuit
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

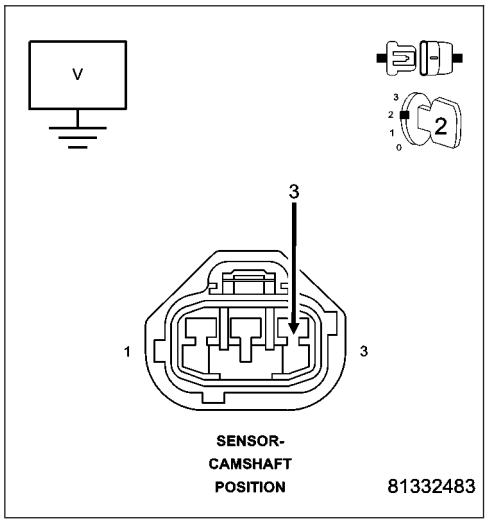
10. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

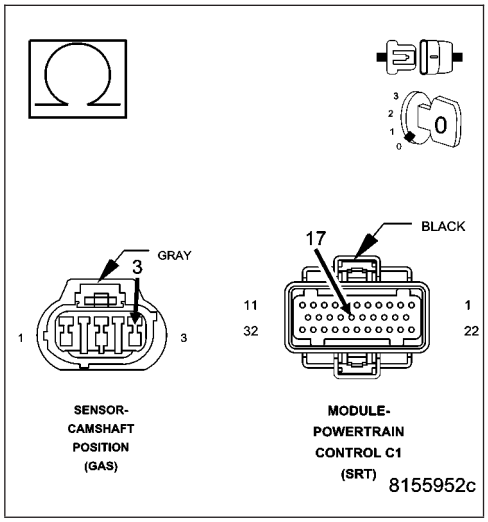
No >> Go To 11

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

11. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (F855) 5-volt Supply circuit between the CMP Sensor harness connector and the PCM harness connector.



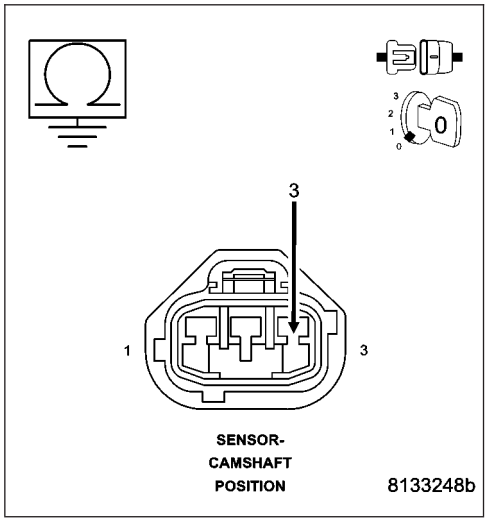
Is the resistance below 5.0 ohms?

Yes >> Go To 12

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

12. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the CMP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 13

13. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0340-CAMSHAFT POSITION SENSOR CIRCUIT (CONTINUED)

14. ERRATIC CMP SIGNAL

With a lab scope probe and the Miller special tool #6801, back probe the (K44) CMP Signal circuit in the CMP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap the Camshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

Did the CMP Sensor generate any erratic pulses?

Yes >> Replace the Camshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 15

---

15. ERRATIC CKP SIGNAL

Turn the ignition off.

With a lab scope probe and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector.

WARNING: When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in personal injury or death.

Ignition on, engine not running.

Wiggle the related wire harness and lightly tap on the Crankshaft Position Sensor.

Observe the lab scope screen.

Allow the engine to idle.

Observe the lab scope screen.

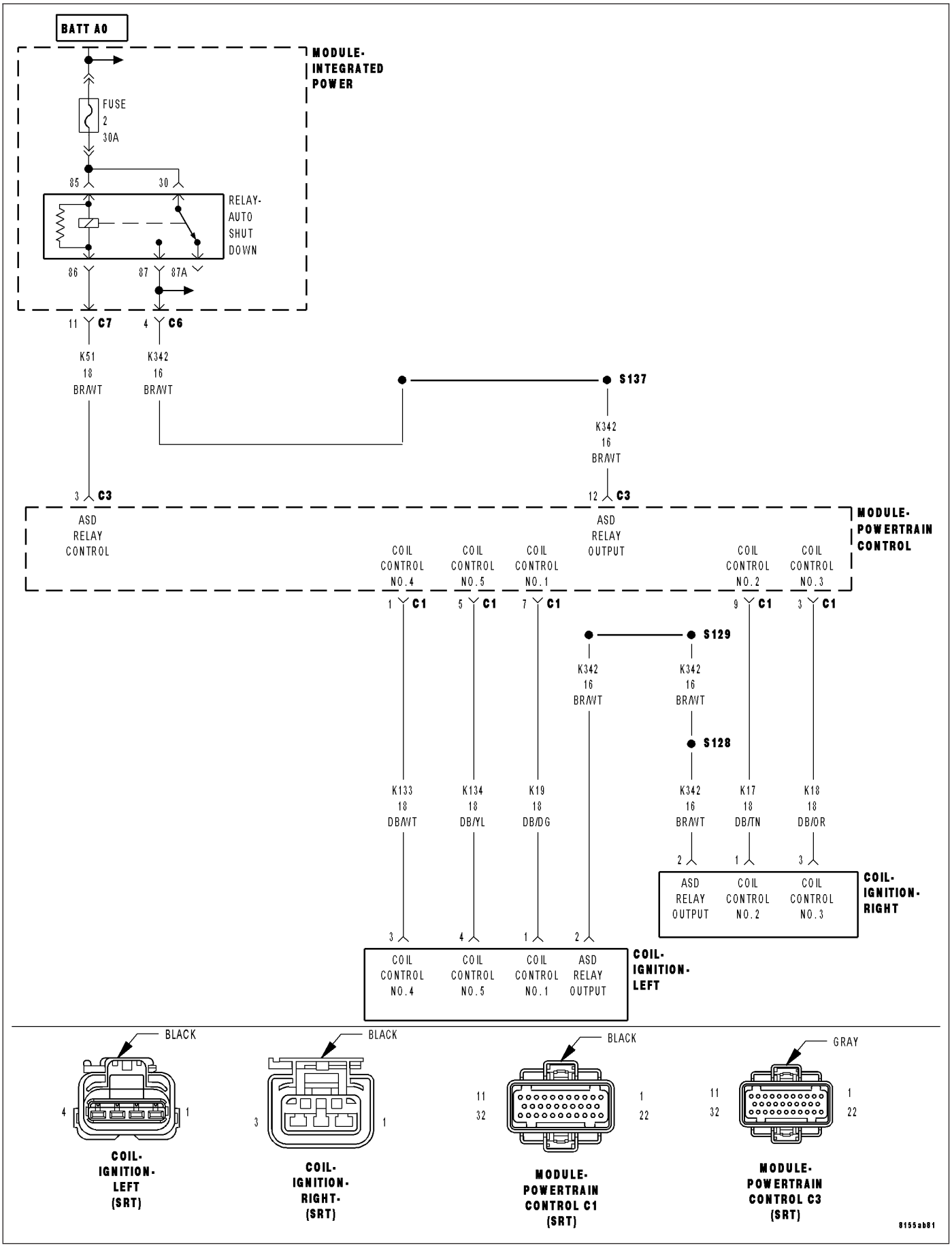
Did the CKP Sensor generate any erratic pulses?

Yes >> Replace the Crankshaft Position Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test complete, the conditions that set this DTC are not present at this time

---

P0351-IGNITION COIL #1 PRIMARY CIRCUIT



P0351-IGNITION COIL #1 PRIMARY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.
- **Set Condition:**
  Peak current is not achieved with battery based dwell plus 1.5 ms of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

Possible Causes
(K343) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL
(K19) IGNITION COIL CONTROL CIRCUIT OPEN
(K19) IIGNITION COIL CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K343) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition coil harness connector.

Ignition on, engine not running.

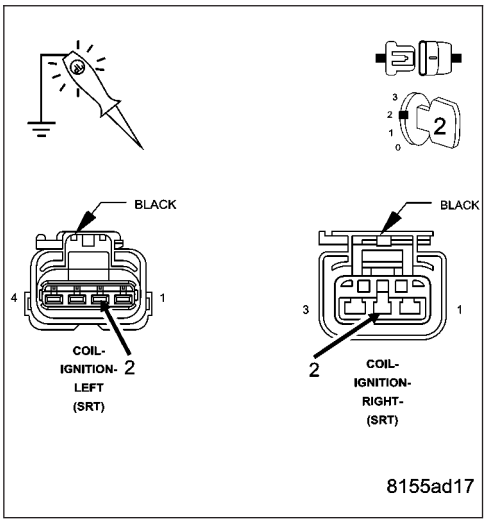
Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit at the coil harness connector.

With the scan tool, actuate the ASD Relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Inspect the related fuse. Repair the excessive resistance or short to ground in the (K343) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



CAUTION: Stop All Actuations

P0351-IGNITION COIL #1 PRIMARY CIRCUIT (CONTINUED)

3. IGNITION COIL RESISTANCE

Turn the ignition off.

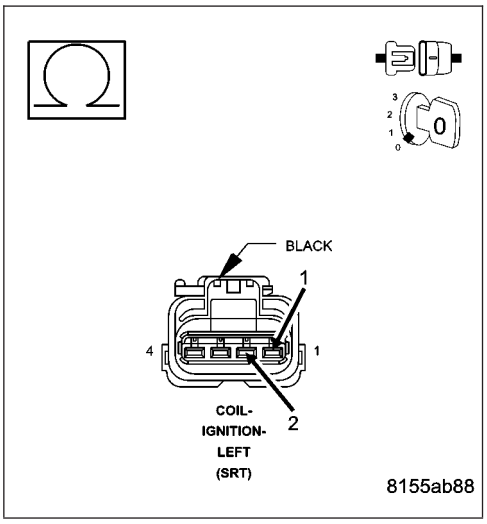
The resistance of a 8.3L Primary Ignition coil is 0.53 to 0.65 of an ohm.

Measure the resistance of the primary Ignition coil.

Is the resistance within the appropriate specification?

Yes >> Go To 4

No >> Replace the Ignition coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K19) IIgnition Coil Driver circuit.

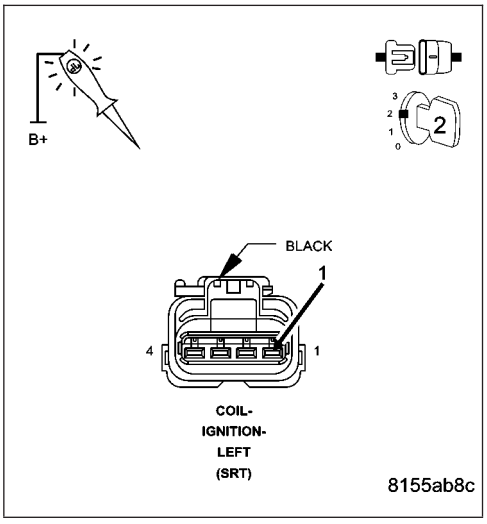
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



P0351-IGNITION COIL #1 PRIMARY CIRCUIT (CONTINUED)

5. (K19) IGNITION COIL DRIVER CIRCUIT SHORTED TO GROUND

Turn the ignition off.

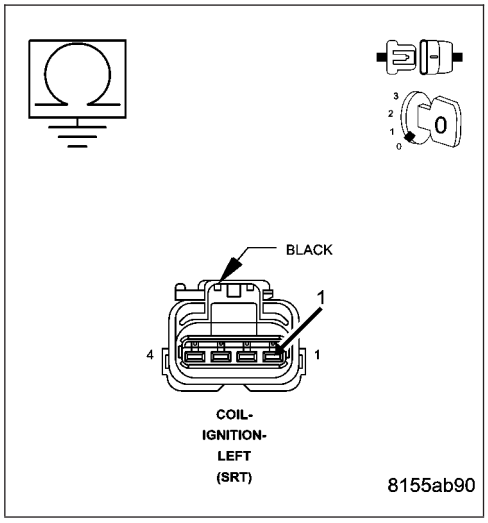
Disconnect the C1 PCM harness connector.

Measure the resistance between the (K19) Ignition Coil Control circuit and ground.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K19) Ignition Coil Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



6. (K19) COIL DRIVER CIRCUIT OPEN

Turn the ignition off.

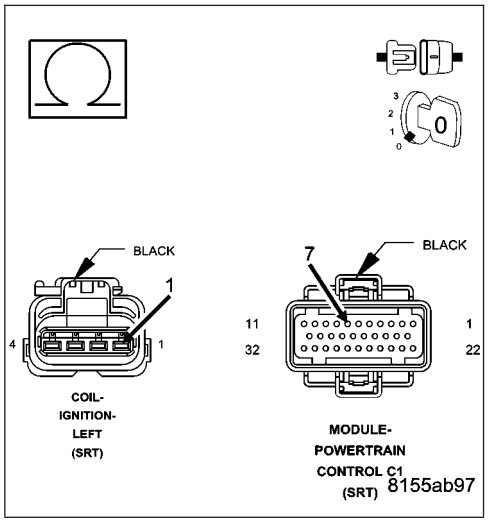
Disconnect the C1 PCM harness connector.

Measure the resistance of the (K19) Ignition Coil Control circuit from the Ignition Coil connector to the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K19) Ignition Coil Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

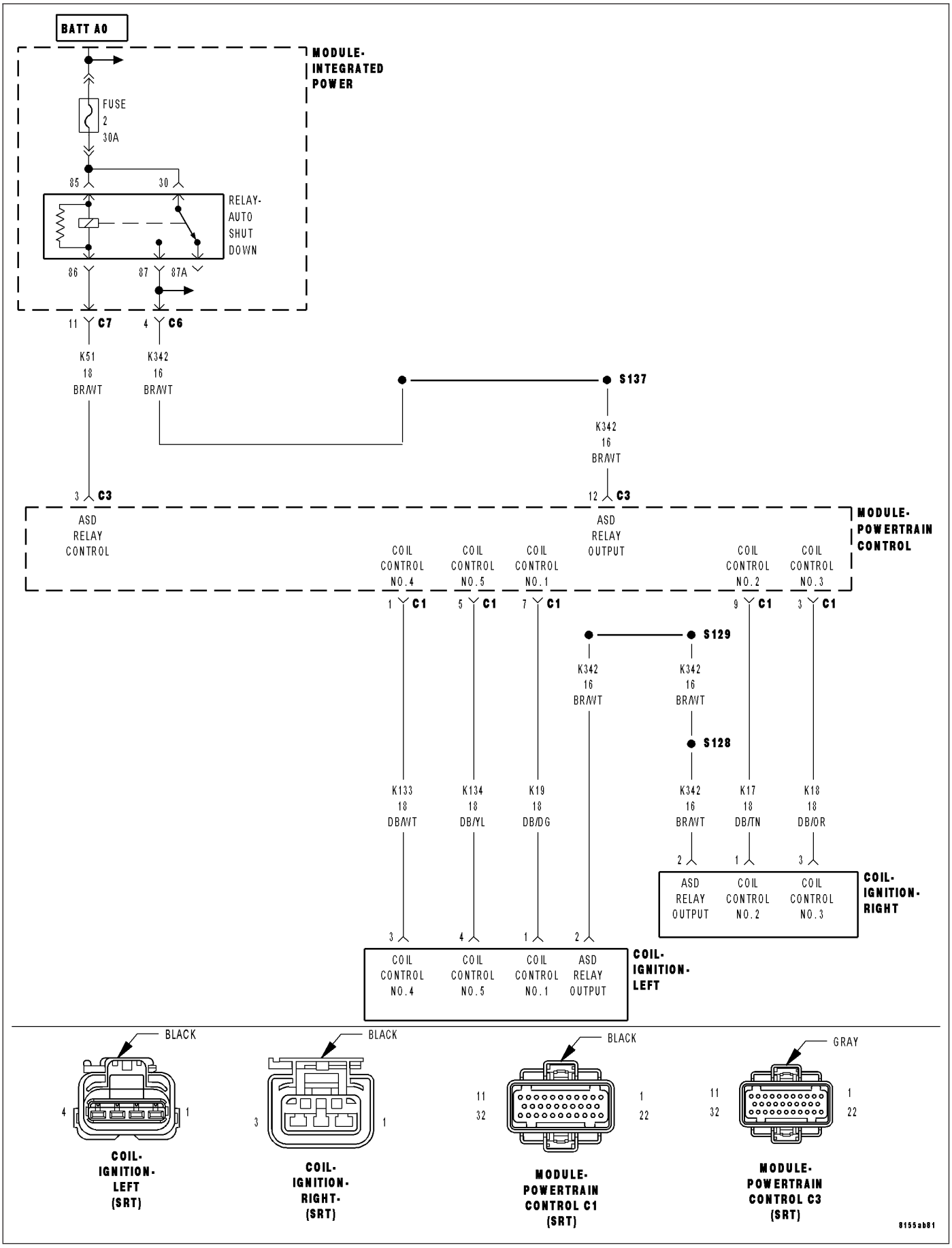
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0352-IGNITION COIL #2 PRIMARY CIRCUIT



P0352-IGNITION COIL #2 PRIMARY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.
- **Set Condition:**
  Peak current is not achieved with battery based dwell plus 1.5 ms of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

Possible Causes
(K343) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL
(K17) IGNITION COIL NO.2 CONTROL CIRCUIT OPEN
(K17) IGNITION COIL NO.2 CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K343) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition coil harness connector.

Ignition on, engine not running.

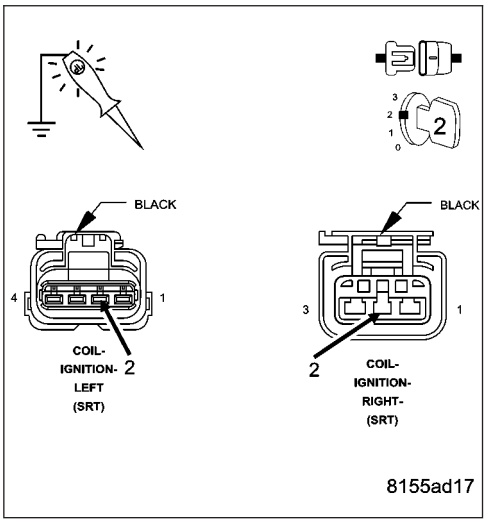
Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit at the coil harness connector.

With the scan tool, actuate the ASD Relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Inspect the related fuse. Repair the excessive resistance or short to ground in the (K343) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



CAUTION: Stop All Actuations.

P0352-IGNITION COIL #2 PRIMARY CIRCUIT (CONTINUED)

3. IGNITION COIL RESISTANCE

Turn the ignition off.

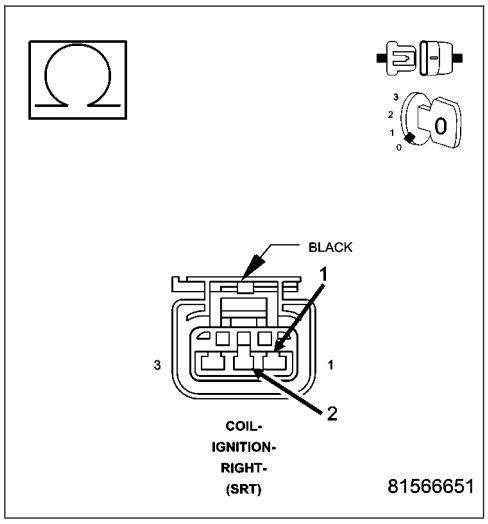
The resistance of a 8.3L Primary Ignition coil is 0.53 to 0.65 of an ohm.

Measure the resistance of the primary Ignition coil.

Is the resistance within the appropriate specification?

Yes >> Go To 4

No >> Replace the Ignition coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K17) Ignition Coil No.2 Control circuit.

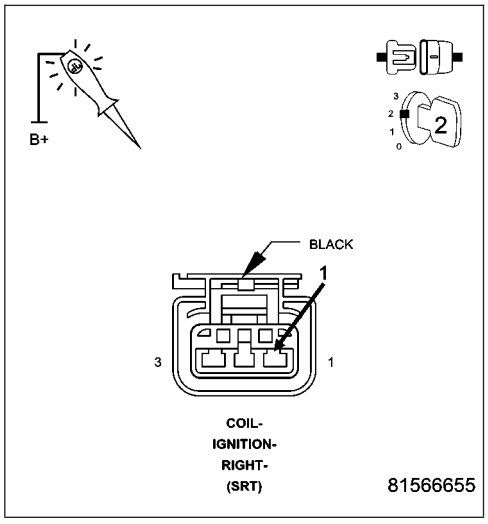
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



P0352-IGNITION COIL #2 PRIMARY CIRCUIT (CONTINUED)

5. (K17) IGNITION COIL NO.2 CONTROL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

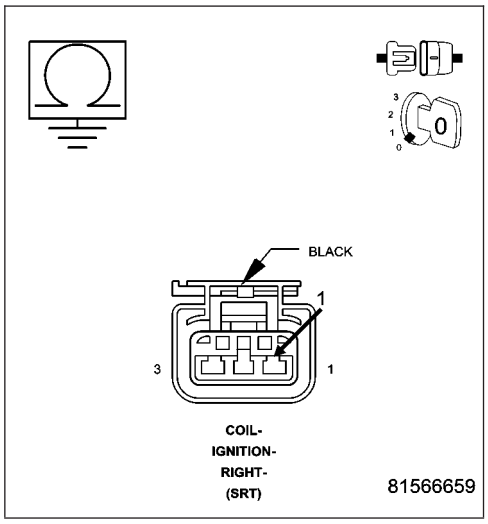
Disconnect the C1 PCM harness connector.

Measure the resistance between the (K17) Ignition Coil No.2 Control circuit and ground.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K17) Ignition Coil No.2 Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



6. (K17) IGNITION COIL NO.2 CONTROL CIRCUIT OPEN

Turn the ignition off.

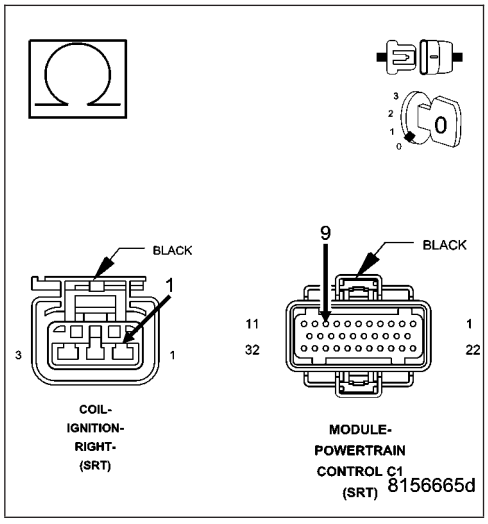
Disconnect the C1 PCM harness connector.

Measure the resistance of the (K17) Ignition Coil No.2 Control circuit from the Ignition Coil connector to the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K17) Ignition Coil No.2 Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

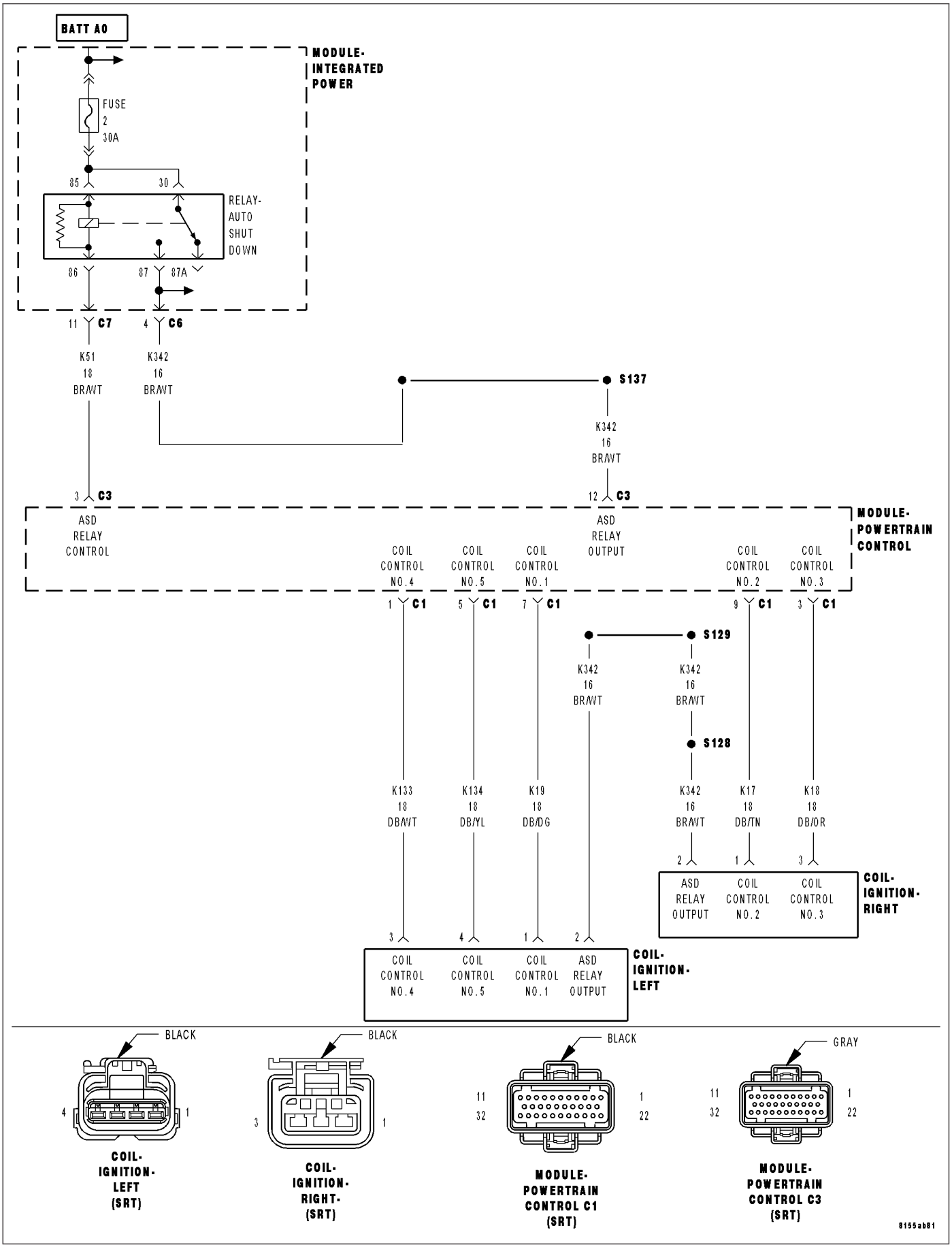
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0353-IGNITION COIL #3 PRIMARY CIRCUIT



P0353-IGNITION COIL #3 PRIMARY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.
- **Set Condition:**
  Peak current is not achieved with battery based dwell plus 1.5 ms of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

Possible Causes
(K343) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL
(K18) IGNITION COIL CONTROL NO.3 CIRCUIT OPEN
(K18) IGNITION COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K343) ASD RELAY OUTPUT CIRCUIT

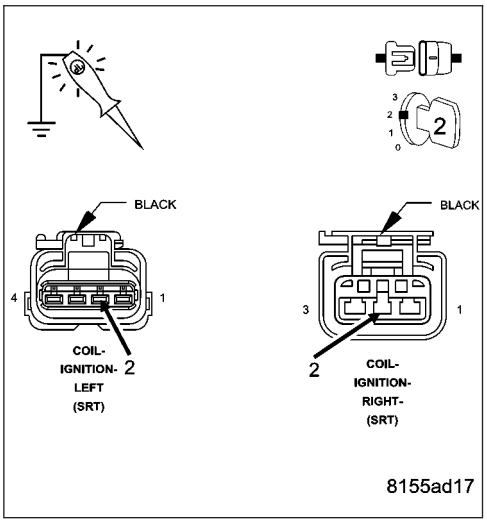
Turn the ignition off.

Disconnect the Ignition coil harness connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit at the coil harness connector.

With the scan tool, actuate the ASD Relay.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Inspect the related fuse. Repair the excessive resistance or short to ground in the (K343) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CAUTION: Stop All Actuations

P0353-IGNITION COIL #3 PRIMARY CIRCUIT (CONTINUED)

3. IGNITION COIL RESISTANCE

Turn the ignition off.

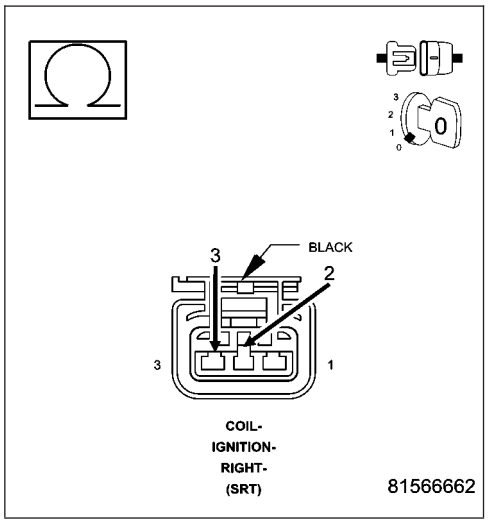
The resistance of a 8.3L Primary Ignition coil is 0.53 to 0.65 of an ohm.

Measure the resistance of the primary Ignition coil.

Is the resistance within the appropriate specification?

Yes >> Go To 4

No >> Replace the Ignition coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the Ignition (K18) Igniton Coil No.3 Control circuit.

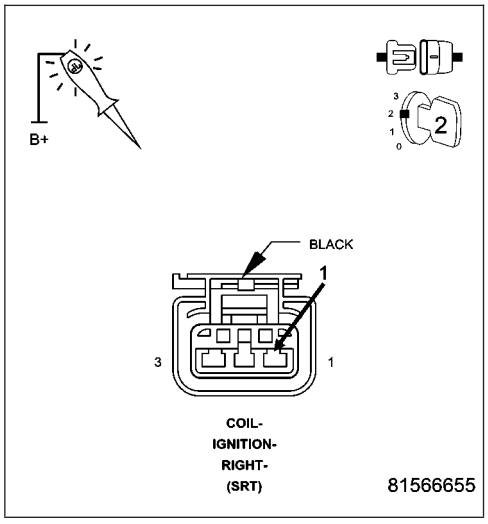
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



P0353-IGNITION COIL #3 PRIMARY CIRCUIT (CONTINUED)

5. (K18) COIL CONTROL NO.3 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

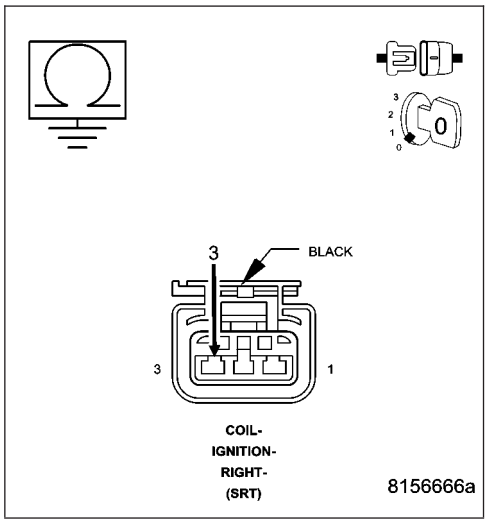
Measure the resistance between the (K18) Ignition Coil Control No.3 circuit and ground.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K18) Ignition Coil Control No.3 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



6. (K18) IGNITION COIL CONTROL NO.3 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

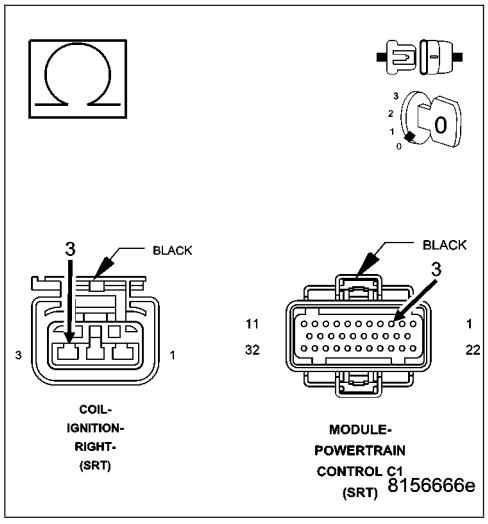
Measure the resistance of the (K18) Ignition Coil Control No.3 circuit from the Ignition Coil connector to the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K18) Ignition Coil Control No.3 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

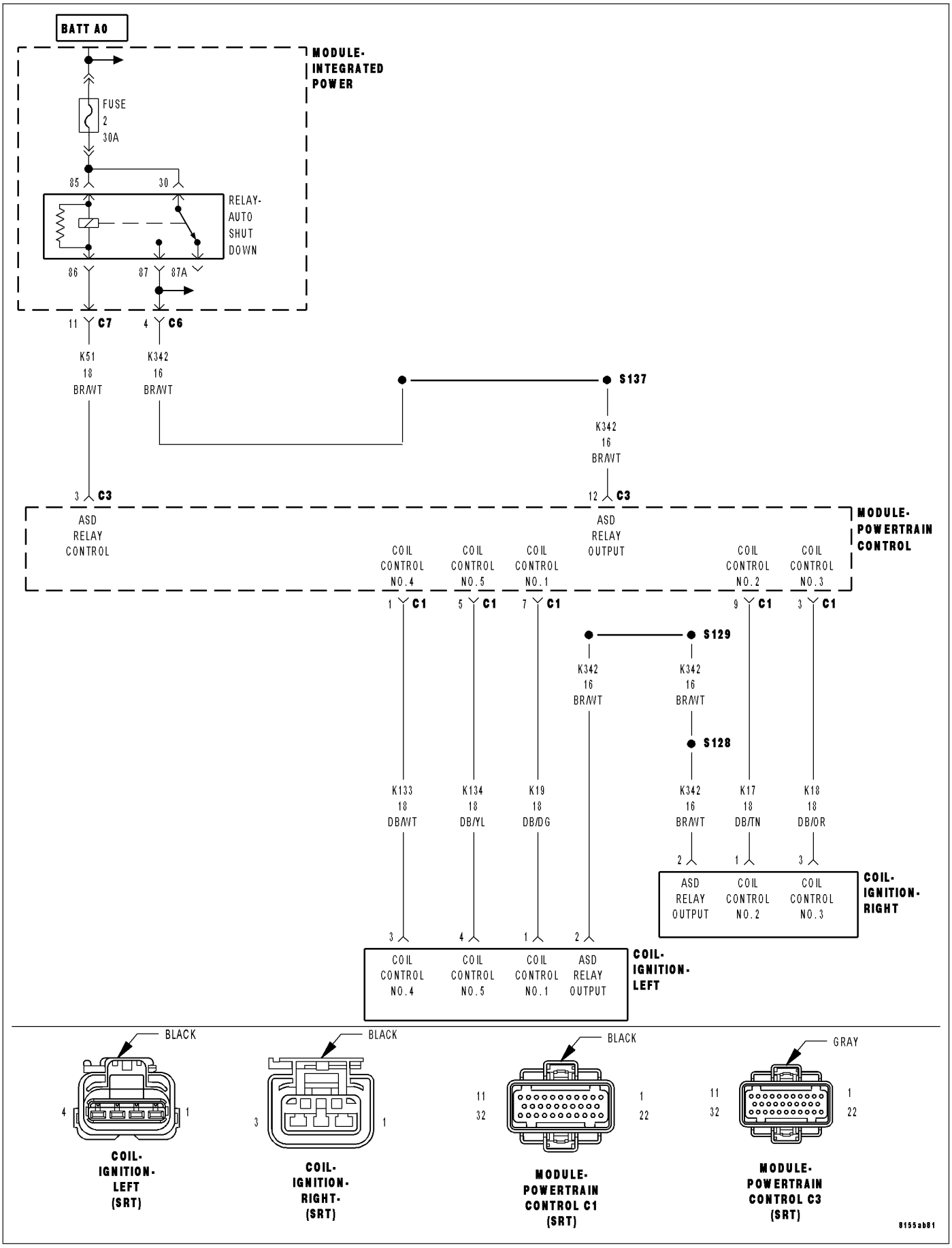
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0354-IGNITION COIL #4 PRIMARY CIRCUIT



P0354-IGNITION COIL #4 PRIMARY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.
- **Set Condition:**
  Peak current is not achieved with battery based dwell plus 1.5 ms of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

Possible Causes
(K343) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL
(K133) IGNITION COIL CONTROL NO.4 CIRCUIT OPEN
(K133) IGNITION COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K343) ASD RELAY OUTPUT CIRCUIT

Turn the ignition off.

Disconnect the Ignition coil harness connector.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit at the coil harness connector.

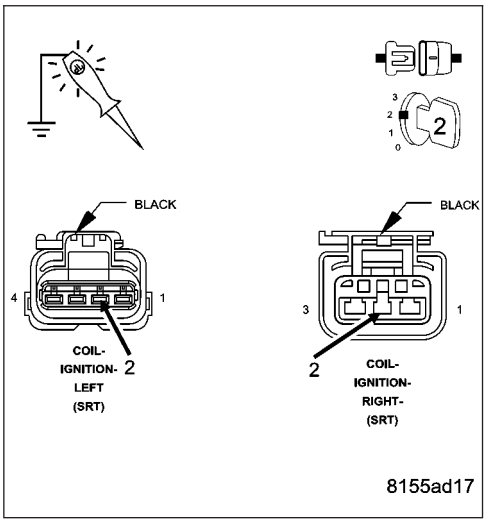
With the scan tool, actuate the ASD Relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Inspect the related fuse. Repair the excessive resistance or short to ground in the ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

CAUTION: Stop All Actuations



P0354-IGNITION COIL #4 PRIMARY CIRCUIT (CONTINUED)

3. IGNITION COIL RESISTANCE

Turn the ignition off.

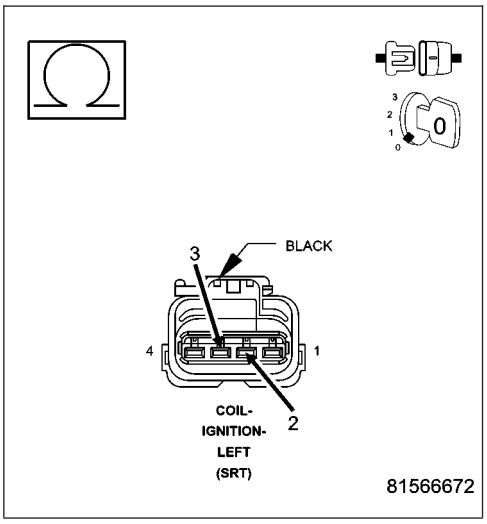
The resistance of a 8.3L Primary Ignition coil is 0.53 to 0.65 of an ohm.

Measure the resistance of the primary Ignition coil.

Is the resistance within the appropriate specification?

Yes >> Go To 4

No >> Replace the Ignition coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K133) Ignition Coil Control No.4 circuit.

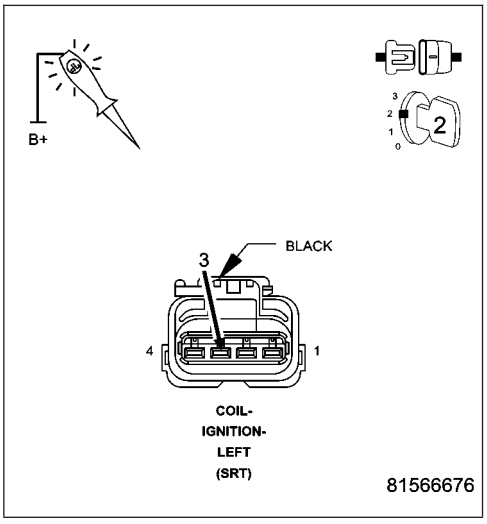
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



P0354-IGNITION COIL #4 PRIMARY CIRCUIT (CONTINUED)

5. (K133) IGNITION COIL CONTROL NO.4 CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C1 PCM harness connector.

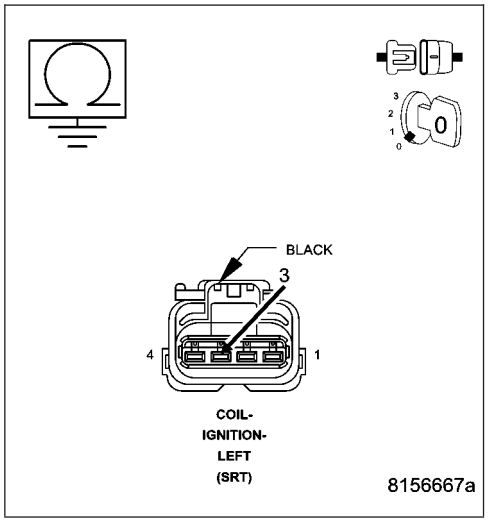
Measure the resistance between the (K133) Ignition Coil Control No.4 circuit and ground.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K133) Ignition Coil Control No.4 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



6. (K133) IGNITION COIL CONTROL NO.4 CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

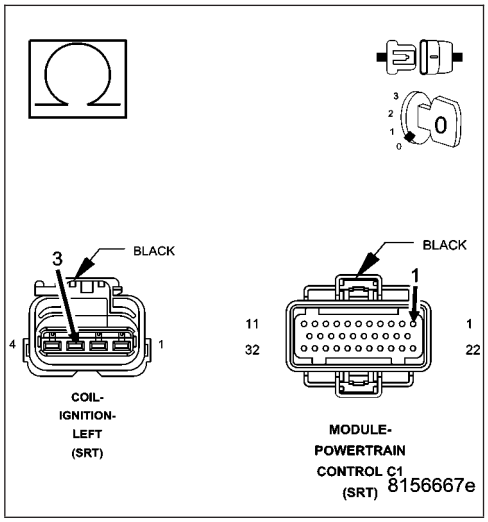
Measure the resistance of the (K133) Ignition Coil Control No.4 circuit from the Ignition Coil connector to the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K133) Ignition Coil Control No.4 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

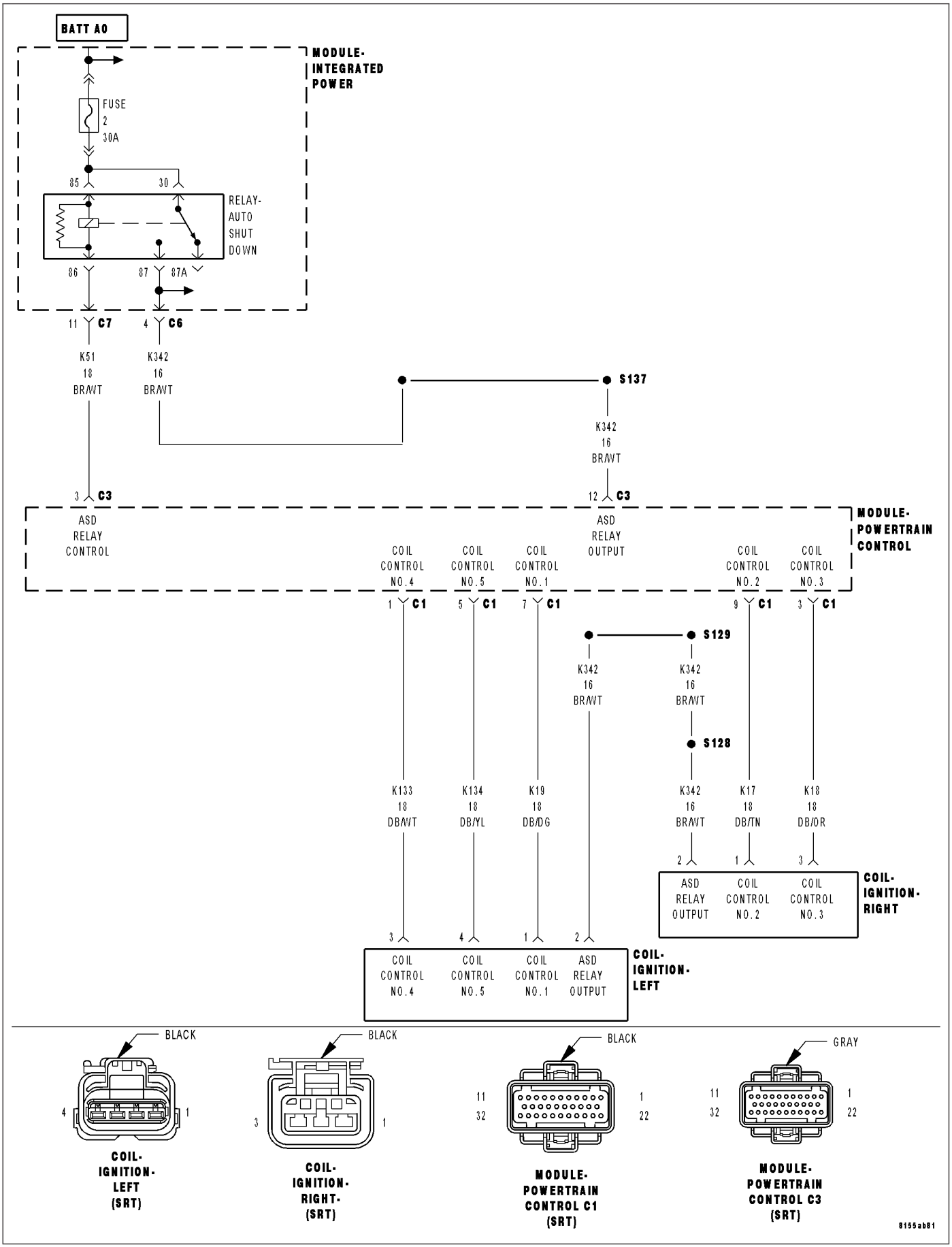
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0355-IGNITION COIL #5 PRIMARY CIRCUIT



P0355-IGNITION COIL #5 PRIMARY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With battery voltage greater than 8 volts during engine cranking or greater than 12 volts with engine running, engine rpm less than 2016, and none of the coils in dwell when checked.
- **Set Condition:**
  Peak current is not achieved with battery based dwell plus 1.5 ms of diagnostic offset. It takes less than 3 seconds during cranking or up to 6 seconds while running to set.

Possible Causes
(K343) ASD RELAY OUTPUT CIRCUIT
IGNITION COIL
(K134) IGNITION COIL CONTROL NO.5 CIRCUIT OPEN
(K134) IGNITION COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K343) ASD RELAY OUTPUT CIRCUIT

Turn the Ignition off.

Disconnect the Ignition coil harness connector.

Ignition on, engine not running.

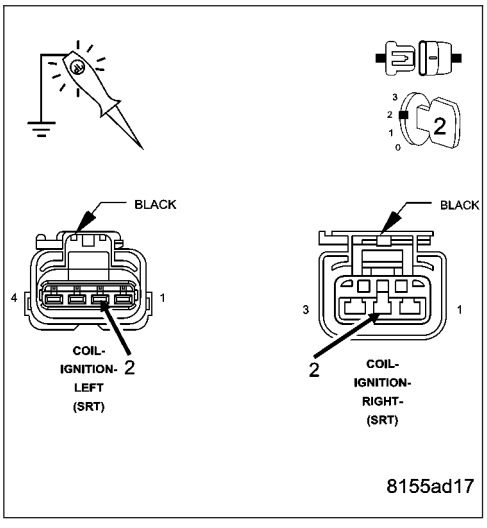
Using a 12-volt test light connected to ground, probe the (K343) ASD Relay Output circuit at the coil harness connector.

With the scan tool, actuate the ASD Relay.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Inspect the related fuse. Repair the excessive resistance or short to ground in the (K343) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



CAUTION: Stop All Actuations

P0355-IGNITION COIL #5 PRIMARY CIRCUIT (CONTINUED)

3. IGNITION COIL RESISTANCE

Turn the Ignition off.

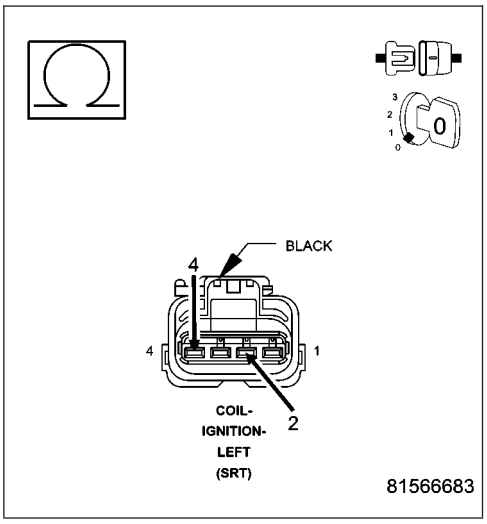
The resistance of a 8.3L Primary Ignition coil is 0.53 to 0.65 of an ohm.

Measure the resistance of the primary Ignition coil.

Is the resistance within the appropriate specification?

Yes >> Go To 4

No >> Replace the Ignition coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. IGNITION COIL

Using a 12-volt test light connected to a 12-volt source, probe the (K134) Ignition Coil Control No.5 circuit.

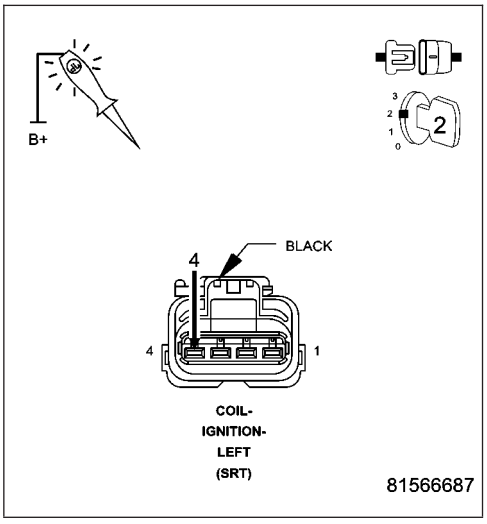
Crank the engine for 5 seconds while observing the test light.

What is the condition of the test light while cranking the engine?

Brightly blinking.
Replace the Ignition Coil.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

ON constantly.
Go To 5

OFF constantly.
Go To 6



P0355-IGNITION COIL #5 PRIMARY CIRCUIT (CONTINUED)

5. (K134) IGNITION COIL CONTROL NO.5 CIRCUIT SHORTED TO GROUND

Turn the Ignition off.

Disconnect the C1 PCM harness connectors.

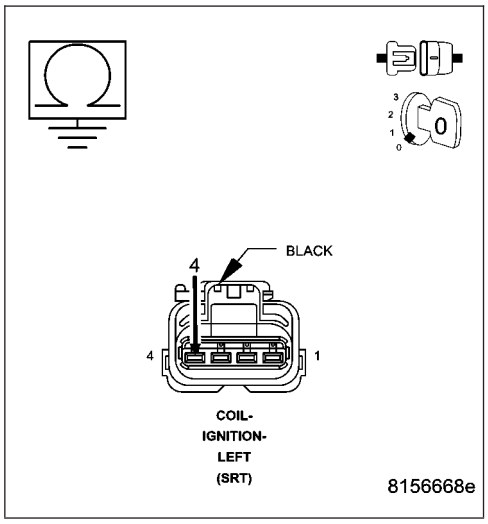
Measure the resistance between the (K134) Ignition Coil Control No.5 circuit and ground.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K134) Ignition Coil Control No.5 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



6. (K134) IGNITION COIL CONTROL NO.5 CIRCUIT OPEN

Turn the Ignition off.

Disconnect the PCM harness connectors.

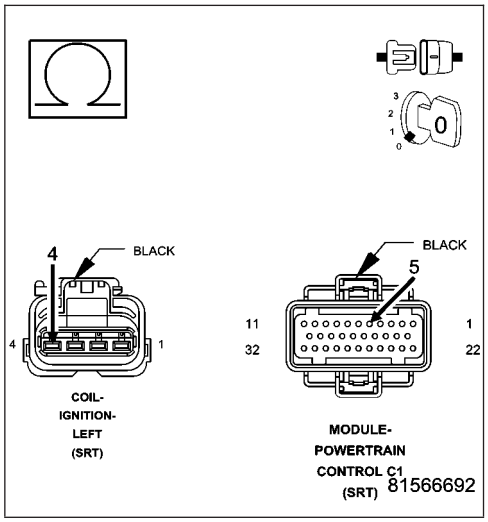
Measure the resistance of the (K134) Ignition Coil Control No.5 circuit from the Ignition Coil connector to the PCM connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K134) Ignition Coil Control No.5 circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

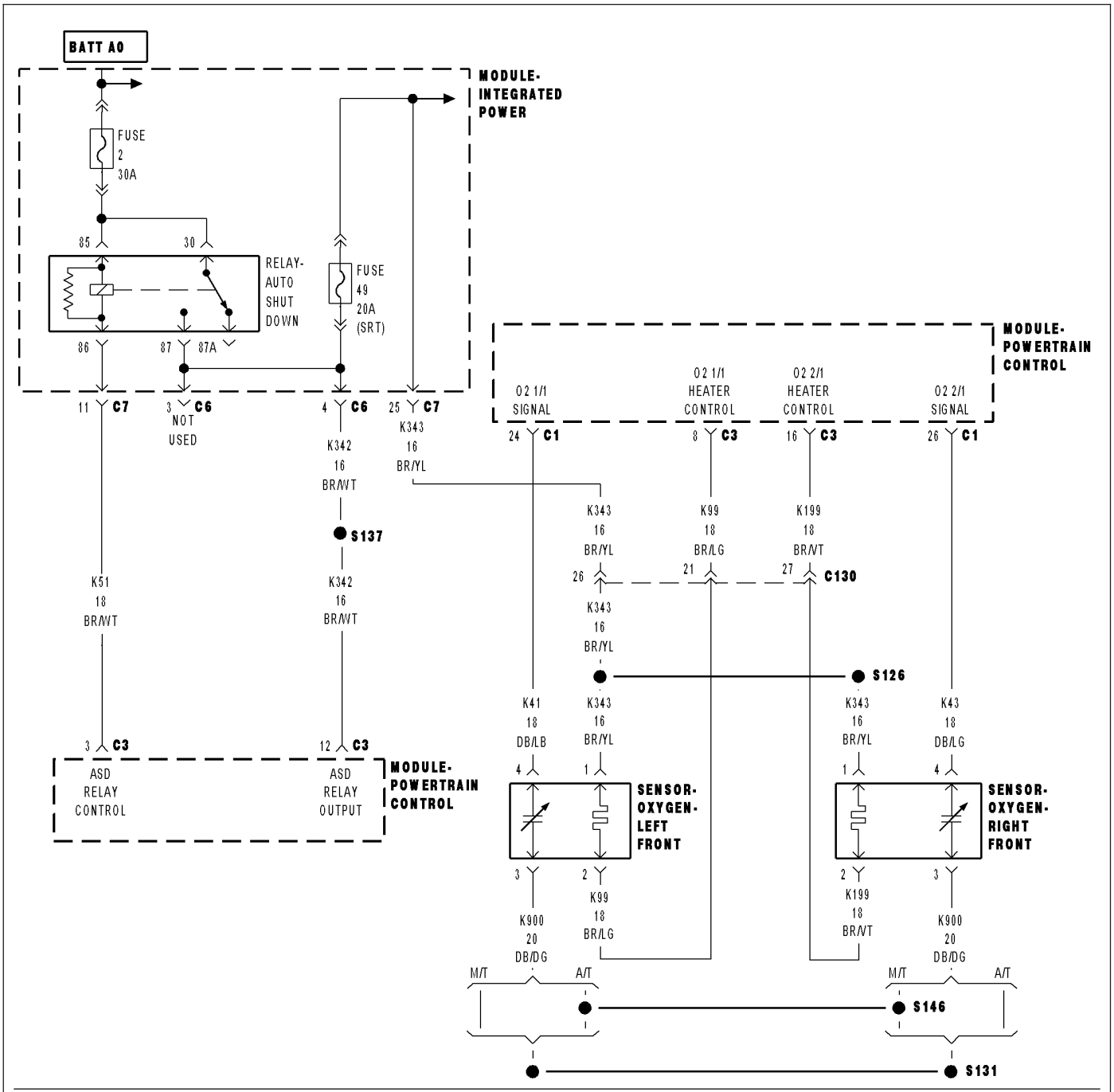
If there are no possible causes remaining, view repair.

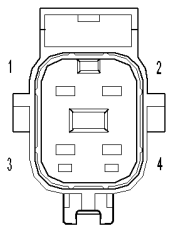
Repair

Replace and program the Powertrain Control Module per Service Information.

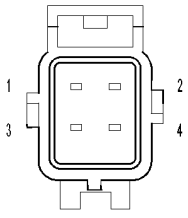
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY





SENSOR-
OXYGEN-
LEFT
FRONT
(SRT)



SENSOR-
OXYGEN-
RIGHT
FRONT
(SRT)

813c2aeb

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 70°C (158°F), 180 seconds of open throttle operation, at a speed greater than 18 mph and less than 55 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0420-1/1 CATALYTIC CONVERTER EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 1/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 1/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the Front O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

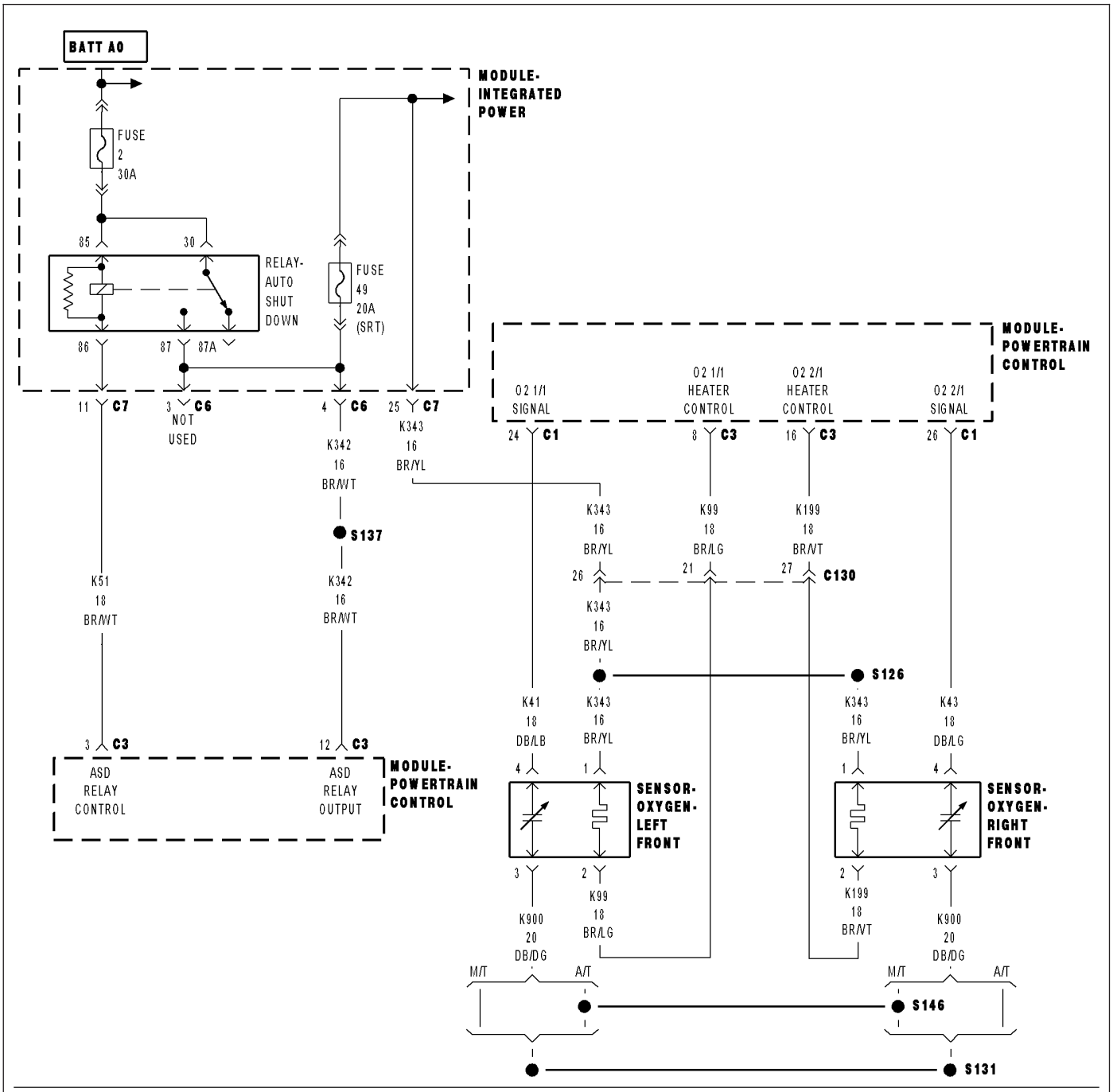
6. CATALYTIC CONVERTER

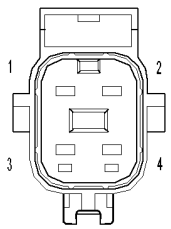
If there are no possible cause remaining, view repair.

Repair

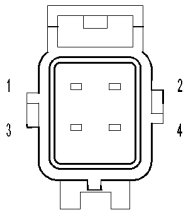
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0432-2/1 CATALYTIC CONVERTER EFFICIENCY





SENSOR-
OXYGEN-
LEFT
FRONT
(SRT)



SENSOR-
OXYGEN-
RIGHT
FRONT
(SRT)

813c2aeb

P0432-2/1 CATALYTIC CONVERTER EFFICIENCY (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Theory of Operation

The upstream O2 sensor is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. During the catalyst/O2 monitor test, the response rate (cycles/second) of the upstream O2 sensor determines the sensor's ability to achieve the tailpipe emissions limits. The response rate of the downstream O2 sensor relative to the upstream O2 sensor response rate measures the catalyst's ability to store oxygen and is used to infer the catalyst's ability to achieve the tailpipe emissions limits.

- **When Monitored:**
  After engine warm up to 147 deg. F, 180 seconds of open throttle operation, at a speed greater than 20 mph, with the engine at 1200-1700 rpm and MAP vacuum between 15.0 and 21.0 inches of mercury (Hg).
- **Set Condition:**
  As catalyst efficiency deteriorates, the switch rate of the downstream O2 sensor approaches that of the upstream O2 sensor. If at any point during the test the switch ratio reaches a predetermined value a counter is incremented by one. Three good trips to turn off the MIL.

Possible Causes
EXHAUST LEAK
ENGINE MECHANICAL
AGING O2 SENSOR
CATALYTIC CONVERTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set. Review the repair history of the vehicle before continuing.

NOTE: If an O2 Sensor DTC set along with the Catalytic Converter Efficiency DTC diagnose the O2 Sensor DTC(s) before continuing.

NOTE: Check for contaminants that may have damaged the O2 Sensor and Catalytic Converter: contaminated fuel, unapproved silicone, oil and coolant, repair necessary.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0432-2/1 CATALYTIC CONVERTER EFFICIENCY (CONTINUED)

2. VISUALLY INSPECT CATALYTIC CONVERTER

Inspect the Catalytic Converter for the following damage.
Damaged Catalytic Converter, dents or holes.
Severe discoloration caused by overheating the Catalytic Converter.
Catalytic Converter broken internally.
Leaking Catalytic Converter.

Were any problems found?

Yes >> Replace the Catalytic Converter. Repair the condition that may have caused the failure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. EXHAUST LEAK

Start the engine.
Inspect the exhaust for leaks between the engine and the 2/1 O2 Sensor.
Inspect the exhaust for leaks between the engine and the 2/2 O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. ENGINE MECHANICAL

Check the exhaust for excessive smoke caused by an internal problem in the engine.

Is an engine mechanical condition present?

Yes >> Repair the engine mechanical condition as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. AGING O2 SENSOR

A new rear O2 Sensor along with an aging front O2 Sensor may cause the DTC to set.
Review the vehicles repair history.

Has the rear O2 Sensor been replaced without replacing the front O2 Sensor?

Yes >> Replace the 2/1 O2 Sensor as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

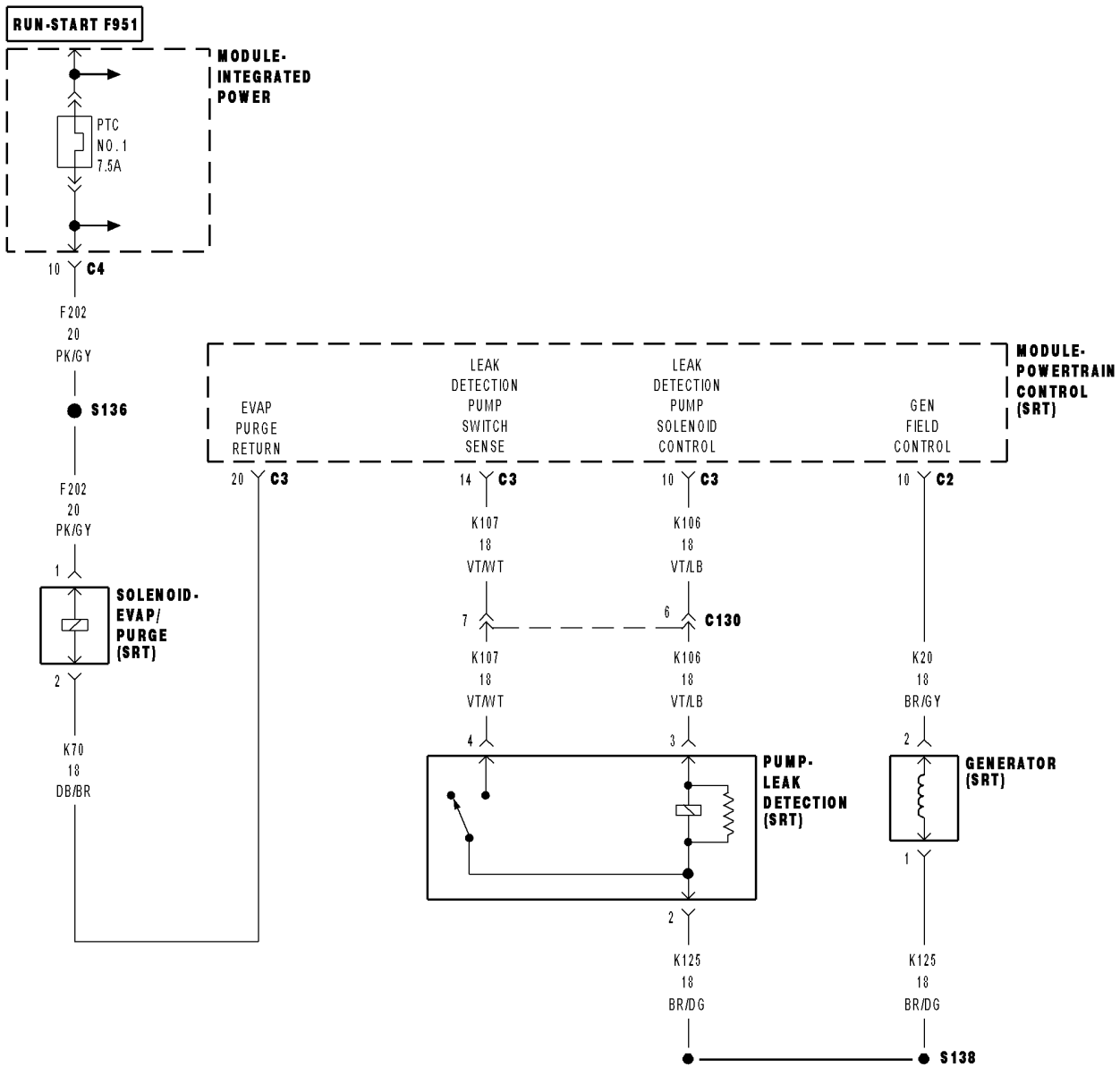
6. CATALYTIC CONVERTER

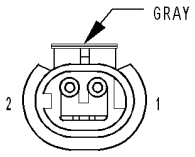
If there are no possible cause remaining, view repair.

Repair

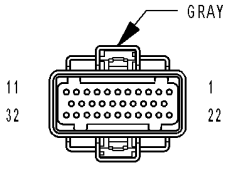
Replace the Catalytic Converter.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0441-EVAP PURGE FLOW MONITOR

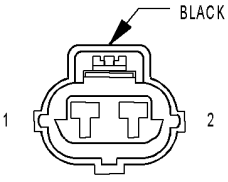




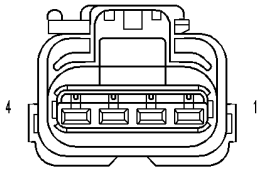
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P0441-EVAP PURGE FLOW MONITOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With engine temperature greater than 170° F, fuel control in closed loop, engine idling for 2 minutes, no low fuel, MAP less than 15.7 inches mercury and barometric altitude less than 8,000 feet.
- **Set Condition:**
  After having passed the Leak Detection Pump (LDP) test, no air flow through the evaporative system is detected by the EVAP monitor.

Possible Causes
EVAP PURGE HOSE (SOLENOID TO CANISTER)
EVAP PURGE HOSE (CANISTER TO FUEL TANK)
EVAP PURGE SOLENOID VACUUM SUPPLY
EVAP PURGE SOLENOID (LEAKS/STUCK OPEN)
EVAP PURGE SOLENOID

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

1. GOOD TRIP EQUAL TO ZERO

Check for any related TSBs.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL INSPECTION

Visually inspect the Evap canister. Look for any physical damage or any signs of fuel that has entered the canister. Any signs of fuel may indicate a bad rollover valve.

Were any problems found?

Yes >> Repair or Replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0441-EVAP PURGE FLOW MONITOR (CONTINUED)

3. VISUAL INSPECTION OF EVAP PURGE HOSE (SOLENOID TO CANISTER)

Visually inspect the Evap purge hose that goes from the Purge Solenoid to the Evap Canister. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose.

Were any problems found?

Yes >> Repair or replace hose as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. VISUAL INSPECTION OF EVAP PURGE HOSE (EVAP CANISTER TO FUEL TANK)

Visually inspect the Evap Purge hose that goes between the Evap canister and the fuel tank. Look for any physical damage such as a pinched, plugged, ripped or dry rotted hose.

Were any problems found?

Yes >> Repair or replace hose as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EVAP VACUUM SUPPLY HOSE INSPECTION

Carefully inspect the Evap Purge Solenoid vacuum supply hose for proper routing. Also check for a pinched or plugged hose from the throttle body to the Purge Solenoid.

Inspect the vacuum nipple at the throttle body for any damage or plugging.

Make sure vacuum fitting at the purge solenoid is not over installed.

Is the vacuum supply hose and throttle body vacuum nipple free from defects?

Yes >> Go To 6

No >> Repair the vacuum supply hose/tube as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. EVAP PURGE SOLENOID LEAKS

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty rollover valve. Replace purge solenoid if contamination is found

Disconnect the vacuum hoses at the EVAP Purge Solenoid.

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side)

Does the Evap Purge Solenoid hold vacuum?

Yes >> Go To 7

No >> Replace the Evap Purge Solenoid and the Evap Canister and clean out Evap lines as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0441-EVAP PURGE FLOW MONITOR (CONTINUED)

7. EVAP PURGE SOLENOID

Using a hand vacuum pump, apply 10 inches of vacuum to the Evap Purge Solenoid vacuum source port. (component side)

Ignition on, engine not running.

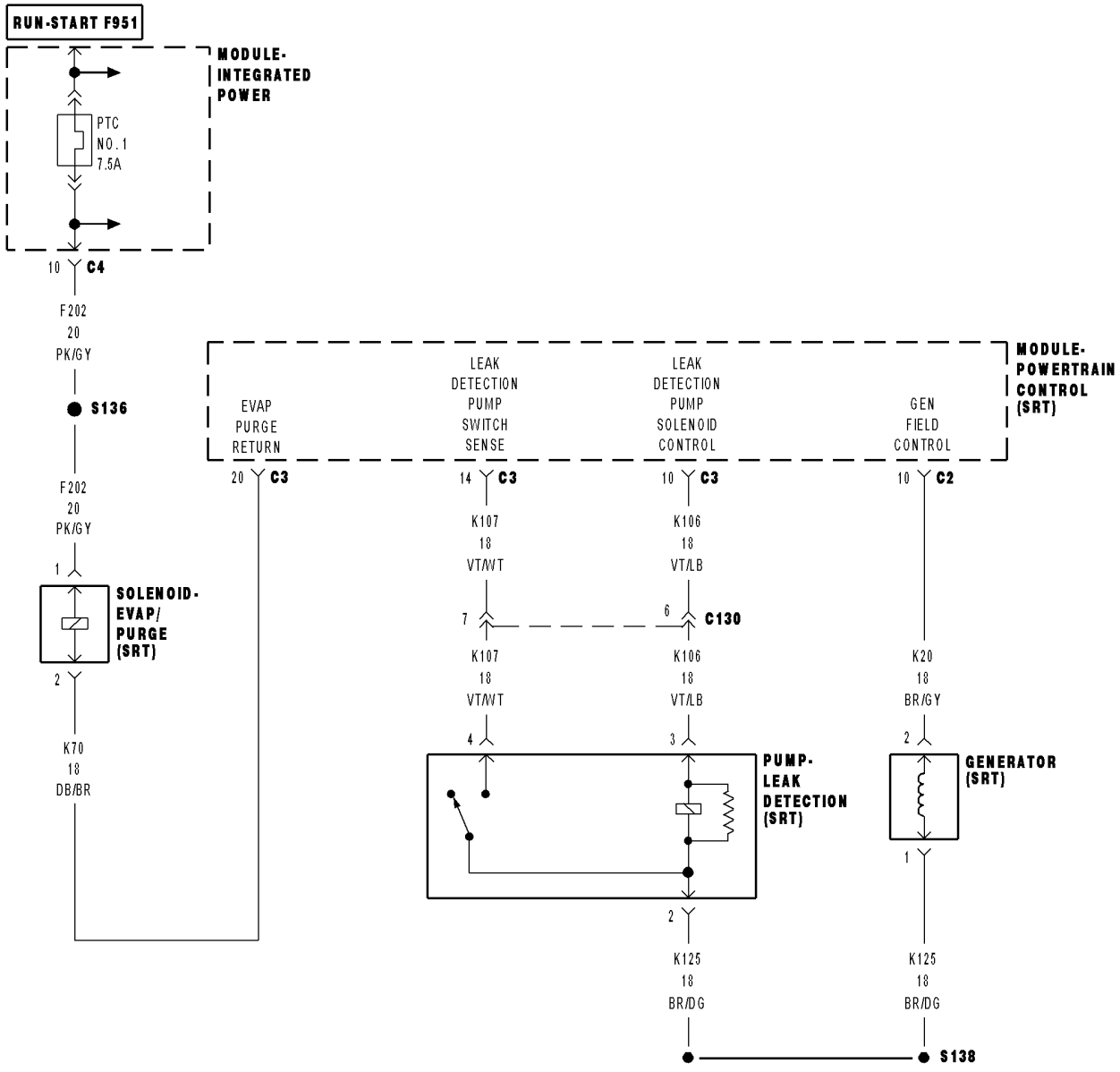
With the scan tool, actuate the EVAP Purge Solenoid and observe the vacuum gauge.

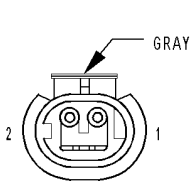
Does the vacuum drop when the solenoid is actuated?

Yes >> Refer to the INTERMITTENT CONDTION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

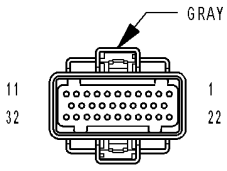
No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED

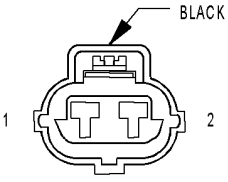




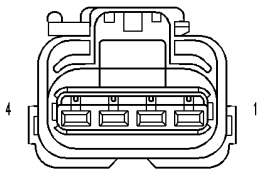
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.
- **Set Condition:**
  If there is a leak larger than 0.040″ and smaller than 0.080″ in the evaporative system.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
LDP SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED (CONTINUED)

3. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0442-EVAP LEAK MONITOR MEDIUM (0.040) LEAK DETECTED (CONTINUED)

4. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

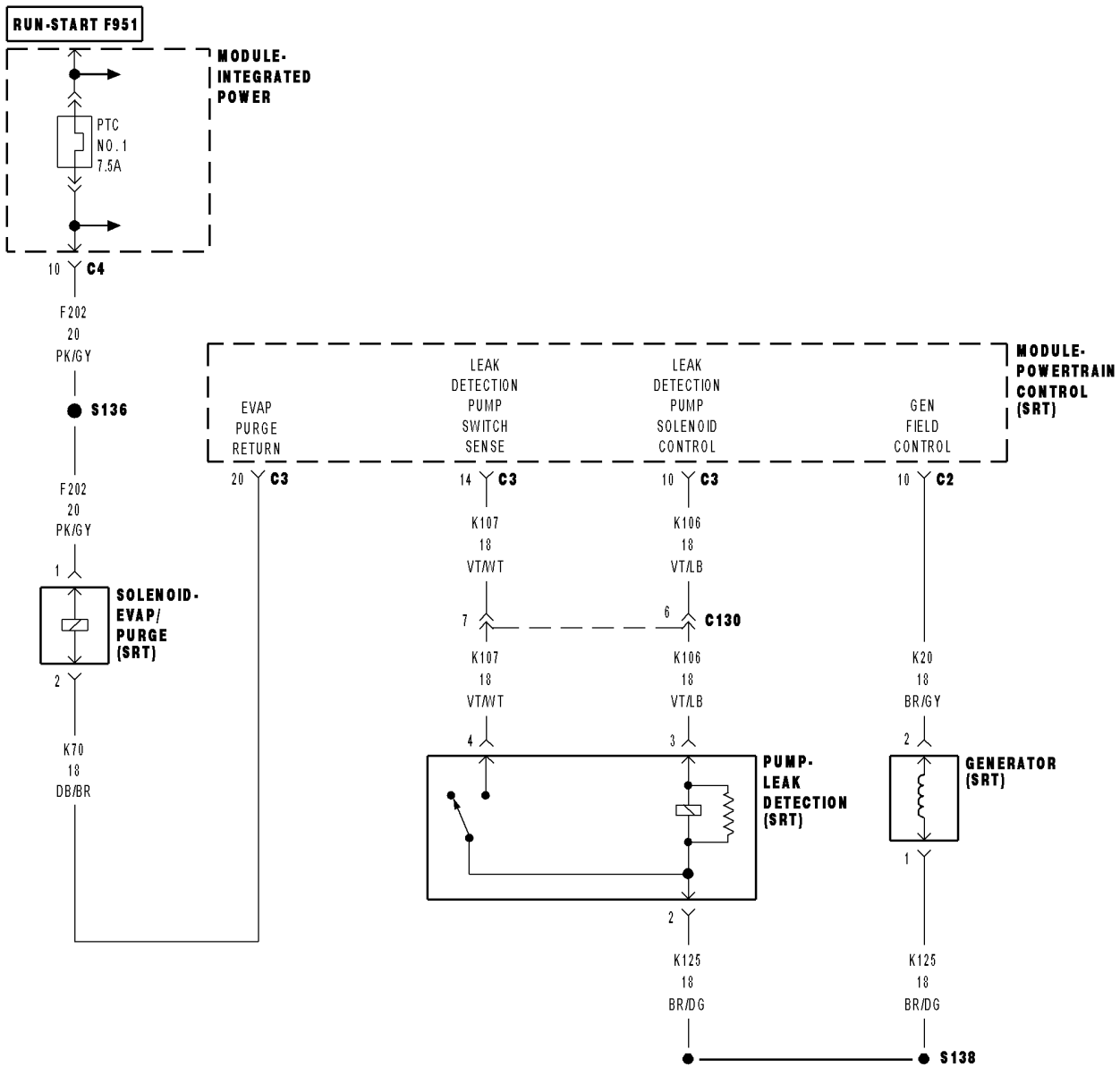
NOTE: Monitor the vacuum gauge for at least 15 seconds.

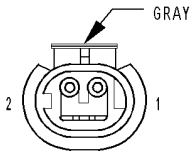
Does the EVAP Purge Solenoid hold vacuum?

Yes >> Test Complete.

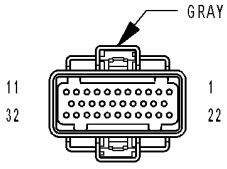
No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT

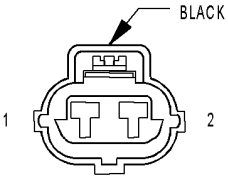




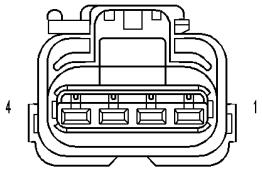
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously after the ignition is turned on and the battery voltage is above 10.4 volts.
- **Set Condition:**
  Not powering down, not in limp-in and time since last solenoid activation is greater than 72 micro seconds. The PCM will set a trouble code if the actual state of the solenoid does not match the intended state on two consecutive key cycles.

Possible Causes
(F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN
EVAP PURGE SOLENOID
(K70) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN
(K70) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Check for any related TSBs.
Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. EVAP PURGE SOLENOID

Turn the ignition off.
Disconnect the Evap Purge Solenoid connector.
Measure the resistance between the terminals of the Evap Purge Solenoid.

Is the resistance between 29.0 and 44.0 ohms?

Yes >> Go To 3

No >> Replace the Evap Purge Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

3. (F202) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN

Ignition on, engine not running.

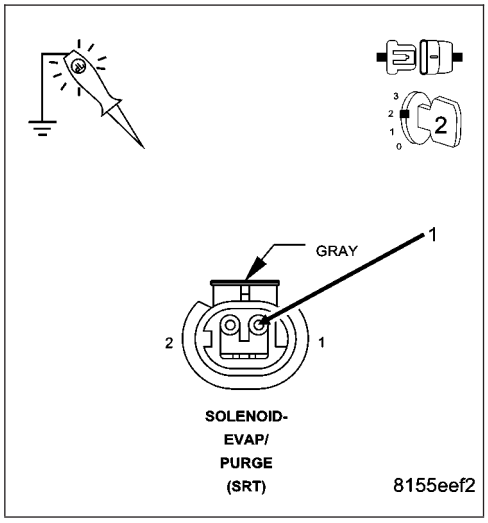
Using a 12-volt test light connected to ground, probe the (F202) Fused Ignition Switch Output circuit.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the excessive resistance or short to ground in the (F202) Fused Ignition Switch Output circuit. Inspect related fuse and repair as necessary.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (K70) EVAP PURGE SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

NOTE: Check connectors - Clean/repair as necessary.

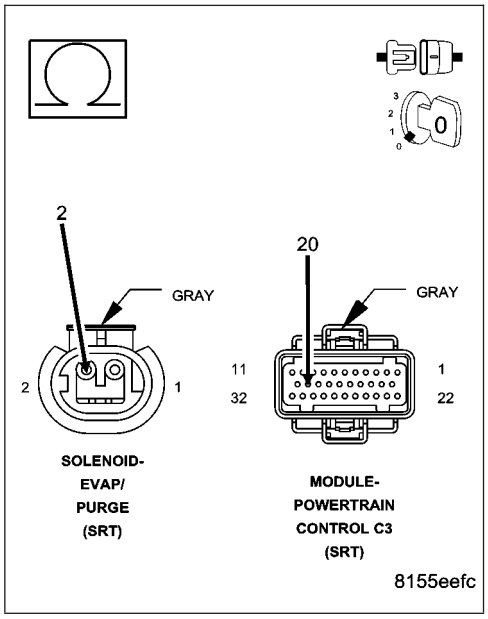
Measure the resistance of the (K70) Evap Purge Solenoid Control circuit from the PCM harness connector to the Evap Purge Solenoid harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K70) Evap Purge Solenoid Control circuit.

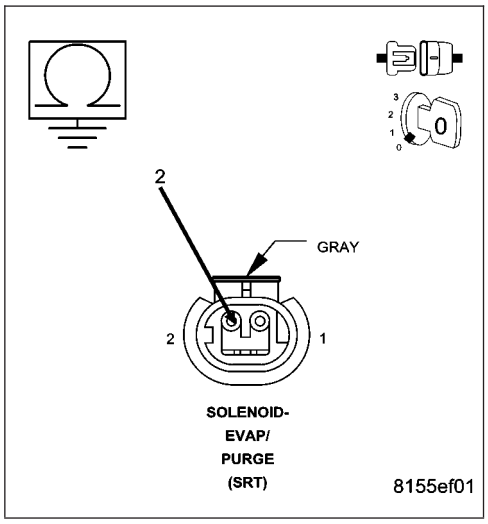
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0443-EVAP PURGE SOLENOID CIRCUIT (CONTINUED)

5. (K70) EVAP PURGE SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K70) Evap Purge Solenoid Control circuit.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K70) Evap Purge Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

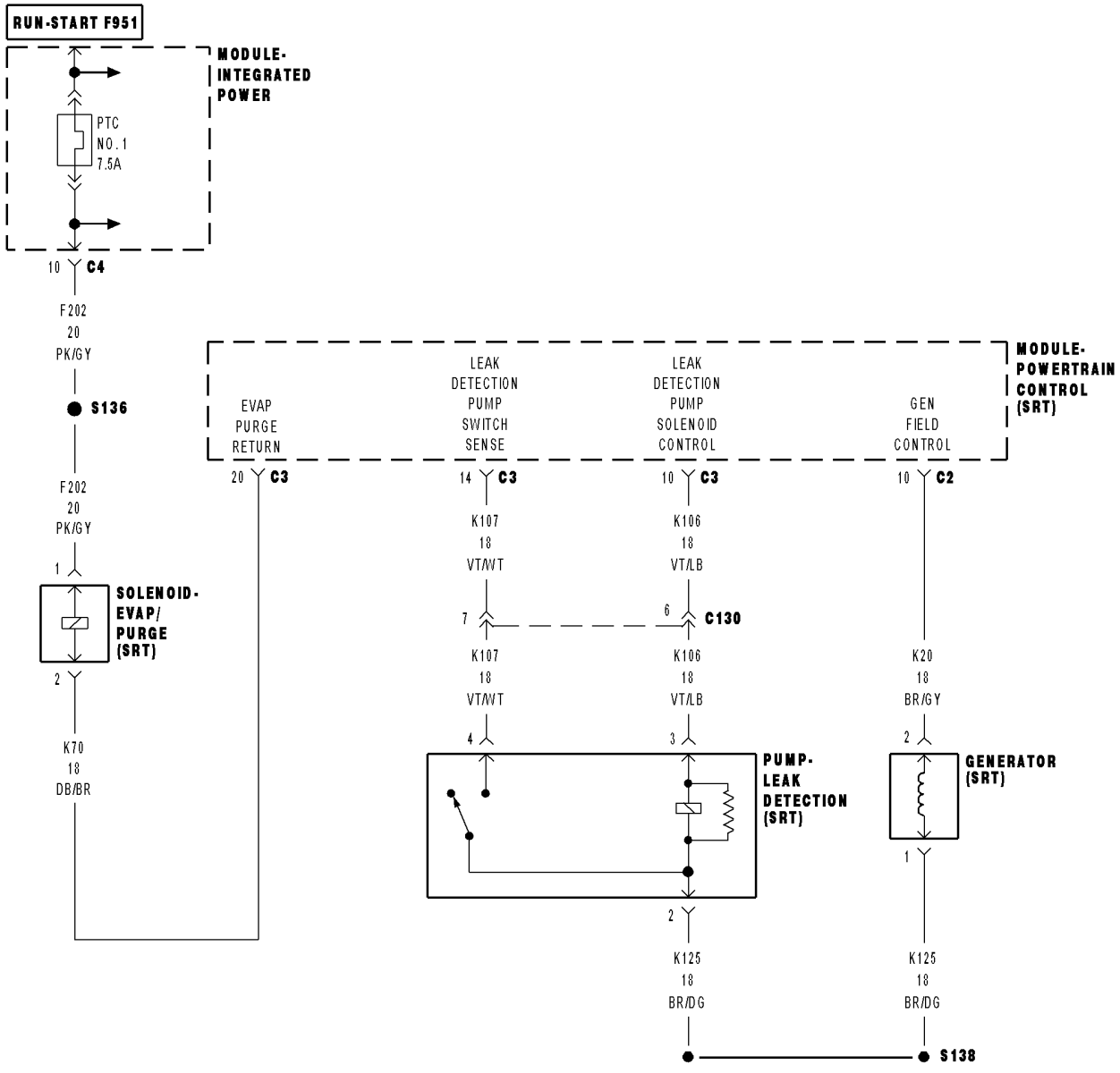
6. PCM

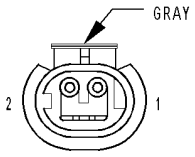
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

If there are no possible causes remaining, view repair.

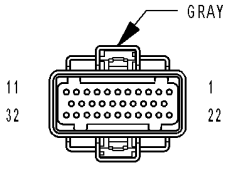
Repair
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED

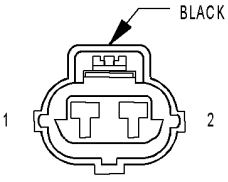




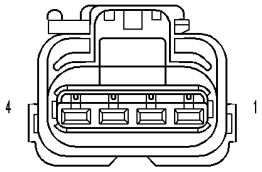
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after a cold start, with battery/ambient temperature between 40° F and 90° F and coolant temperature within 10° F of battery/ambient.
- **Set Condition:**
  If there is a leak larger than 0.080″ in the evaporative system.

Possible Causes
EVAP PURGE SYSTEM LEAK
EVAP PURGE SOLENOID
LDP SWITCH

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. ACTIVE DTC

NOTE: Since a hot vehicle can conceal a leak, it is best to perform this test at room temperature.

NOTE: A loose gas cap could have caused this DTC to set. Make sure gas cap is tight and in good condition. Make sure the gas cap meets OEM specifications.

Ignition on, engine not running.

With a scan tool, read DTCs.

Is the DTC active at this time?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VISUAL AND PHYSICAL INSPECTION

Perform a visual and physical inspection of the entire Evaporative Emission system.

Check for the follow conditions:

- Holes or cracks
- Loose seal points
- Evidence of damaged components
- Incorrect routing of hoses and tubes
- Fuel Cap gasket seal

Were any of the above conditions found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED (CONTINUED)

3. VERIFY EVAPORATIVE EMISSION LEAK

To continue testing you will need Miller Tool #8404A Evaporative Emission Leak Detector (EELD).

WARNING: Keep lit cigarettes, sparks, flames, and other ignition sources away from the test area to prevent the ignition of explosive gases. Keep the test area well ventilated.

NOTE: The fuel tank should have between 20% and 80% of fuel tank capacity to properly test the Evap system.

Connect the red power lead of the EELD to the battery positive terminal and the black ground lead to battery negative terminal.

Block the vent hose of the canister if using the service port.

Connect shop air to the EELD.

Set the smoke/air control switch to AIR.

Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).

Press the remote smoke/air start button.

Position the red flag on the air flow meter so it is aligned with the indicator ball.

When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size leak indicated by the DTC set in the PCM.

Install the service port adapter #8404-14 on the vehicle's service port and block the vent hose of the EVAP Canister (if equipped) or install the #8404-ADP service adaptor into the filter line.

Connect the Air supply hose from the EELD to the service port (if equipped) or to the #8404-ADP adapter.

Press the remote button to activate AIR flow.

NOTE: Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

Compare the flow meter indicator ball reading to the red flag.

ABOVE the red flag indicates a leak present.

BELOW the red flag indicates a sealed system.

Is the indicator ball above the red flag?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0455-EVAP LEAK MONITOR LARGE LEAK DETECTED (CONTINUED)

4. EVAPORATIVE EMISSION LEAK DETECTION

NOTE: A thorough visual inspection of the Evap system hoses, tubes, and connections may save time in your diagnosis. Look for any physical damage or signs of wetness at connections. The strong smell of fuel vapors may also aid diagnosis.

To continue testing, you will need Miller Tool #8404A Evaporative Emissions Leak Detector (EELD).

Remove the Air supply hose from the service port (if equipped) or from the #8404-ADP adapter.

Connect the SMOKE supply tip (black hose) to the service port (if equipped) or to the #8404-ADP adapter.

Set the smoke/air control switch to SMOKE.

NOTE: The flow meter indicator ball will not move in the smoke mode.

Press the remote smoke/air start button.

NOTE: Make sure that smoke has filled the EVAP system by continuing to press the remote smoke/air start button, remove the vehicle fuel cap, and wait for the smoke to exit. Once smoke is indicated reinstall the fuel cap.

NOTE: For optimal performance, introduce smoke into the system for an additional 60 seconds; continue introducing smoke at 15 second intervals, as necessary.

While still holding the remote smoke/air start button, use the white light (#8404-CLL) to follow the EVAP system path, and look for the source of the leak indicated by exiting smoke.

If a leak is concealed from view (i.e., top of fuel tank), release the remote smoke/air start button, and use the ultra-violet (UV) black light #8404-UVL and the yellow goggles 8404-20 to look for residual traces of dye that is left behind by the smoke.

The exiting smoke deposits a residual fluid that is either bright green or bright yellow in color when viewed with a UV light.

NOTE: Carefully inspect the vent side of the EVAP Canister. Due to the filtering system in the canister the smoke may not be as thick. Introducing smoke into the filtered side of the canister may assist in locating the leak.

Was a leak found?

Yes >> Repair or replace the leaking component as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. EVAP PURGE SOLENOID OPERATION

NOTE: After disconnecting the Evap Purge Solenoid vacuum connections, inspect the lines and solenoid for any signs of contamination from the EVAP Canister. This may indicate a faulty check valve. Replace/repair as necessary.

Turn the ignition off.

Disconnect the vacuum hoses at the Evap Purge Solenoid.

Using a hand vacuum pump, apply 10 in Hg to the ″CAN″ of the EVAP Purge Solenoid.

NOTE: Monitor the vacuum gauge for at least 15 seconds.

Does the EVAP Purge Solenoid hold vacuum?

Yes >> Test Complete.

No >> Replace the Evap Purge Solenoid.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0460-FUEL LEVEL SENDING UNIT NO CHANGE OVER MILES

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running and fuel level either below 15% or above 85% of capacity.
- **Set Condition:**
  The PCM sees low fuel, less than 15%, for more than 120 miles or fuel level does not change by at least 4% for more than 250 miles.

Possible Causes
PHYSICALLY DAMAGED/DEFORMED/OBSTRUCTED FUEL TANK
FUEL LEVEL SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. CHECKING FOR A DAMAGED/DEFORMED/OBSTRUCTED FUEL TANK

Turn the ignition off.

WARNING: WARNING: The fuel system is under a constant pressure, even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.

Inspect the outside of the fuel tank for defects.

Remove the fuel tank.

Remove the fuel pump module from the fuel tank.

Inspect the inside of the fuel tank for any obstructions or deformities.

Is the fuel tank free from defects?

Yes >> Go To 2

No >> Repair or replace the fuel tank as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

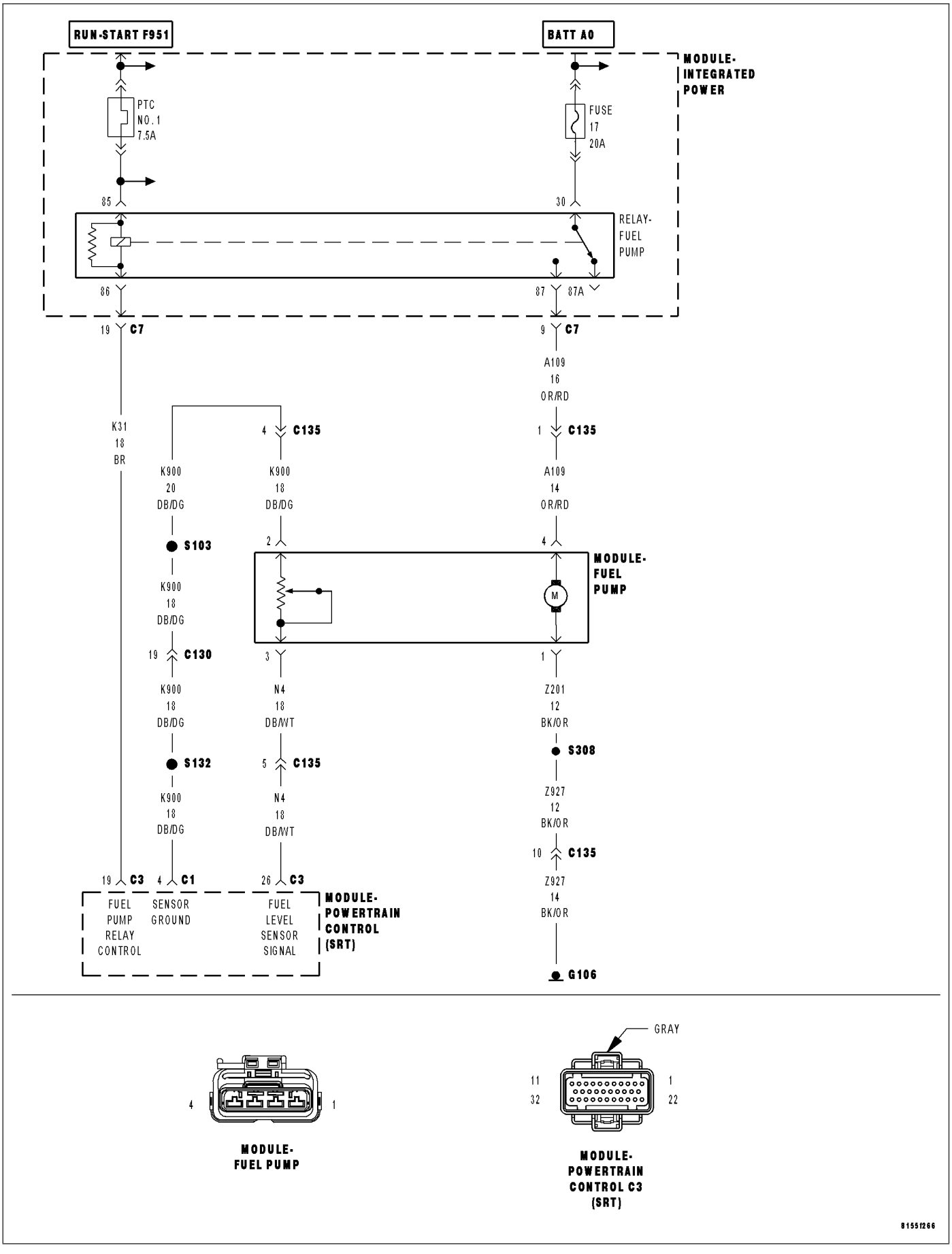
2. FUEL LEVEL SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Fuel Level Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW



P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage goes below 0.4 of a volt for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
FUEL LEVEL SENSOR
INSTRUMENT CLUSTER

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTAGE BELOW 0.4 OF A VOLT

NOTE: Diagnose any Bus Message failures before continuing.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage below 0.4 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. FUEL LEVEL SENSOR

Turn the ignition off.
Disconnect the Fuel Pump Module harness connector.
Ignition on, engine not running.
With the scan tool, read the Fuel Level Sensor voltage.

Did the Fuel Level Sensor voltage change from below 0.4 of a volt to above 4.0 volts?

Yes >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P0462-FUEL LEVEL SENDING UNIT VOLTS TOO LOW (CONTINUED)

3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

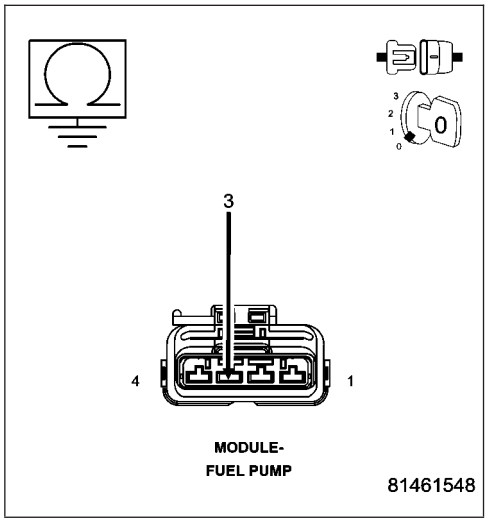
Disconnect the C3 PCM harness connector.

Measure the resistance between ground and the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



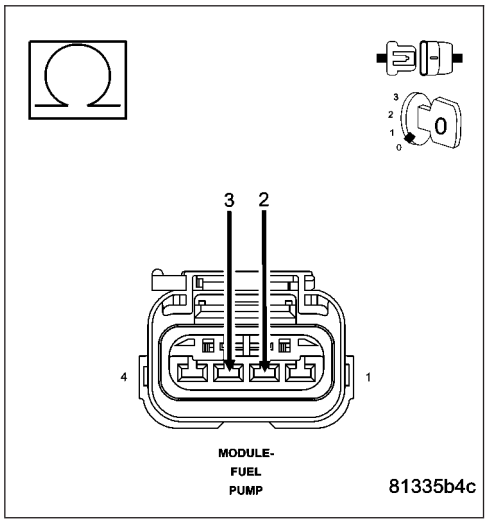
4. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit in the Fuel Pump Module harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor Ground circuit and the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

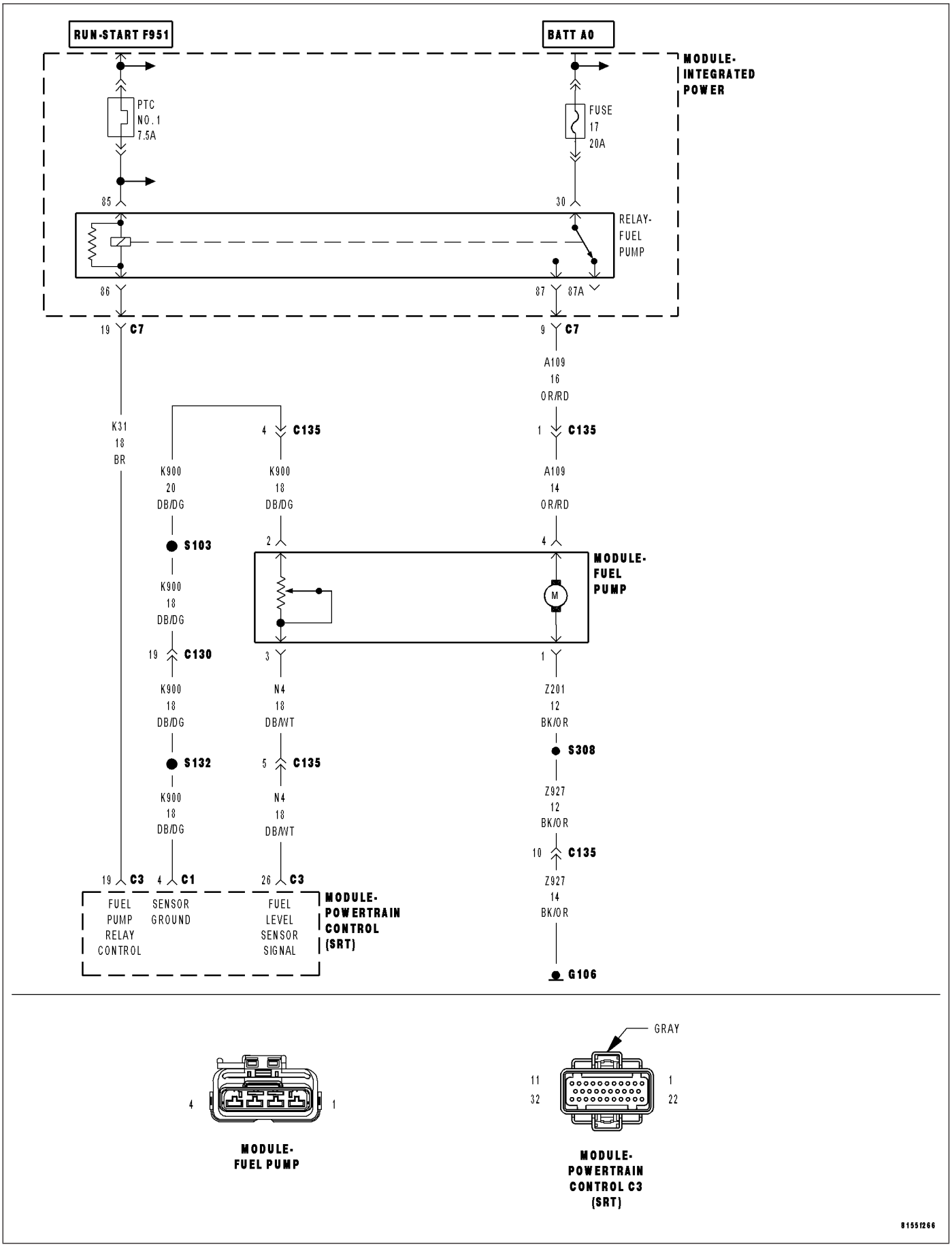
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH



P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The fuel level sensor signal voltage at the PCM goes above 4.9 volts for more than 90 seconds. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
(N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(N4) FUEL LEVEL SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
FUEL LEVEL SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. FUEL LEVEL SENSOR VOLTS ABOVE 4.9 VOLTS

NOTE: Diagnose any Bus Message failures before continuing.

Ignition on, engine not running.

With a scan tool, read the Fuel Level Sensor voltage.

Is the Fuel Level Sensor voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

2. FUEL LEVEL SENSOR

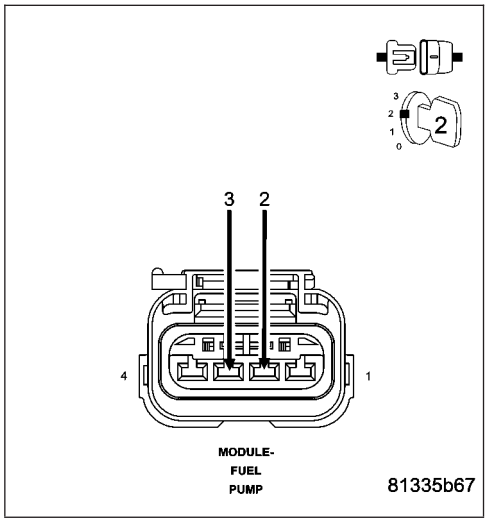
Turn the ignition off.

Disconnect the Fuel Pump Module electrical harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (N4) Fuel Level Signal circuit and the (K900) Sensor Ground circuit in the Fuel Pump Module harness connector.

With the scan tool, read the Fuel Level Sensor voltage.



Did the Fuel Level Sensor voltage change from above 4.8 volts to below 0.4 of a volt with the jumper wire installed?

Yes >> Replace the Fuel Level Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

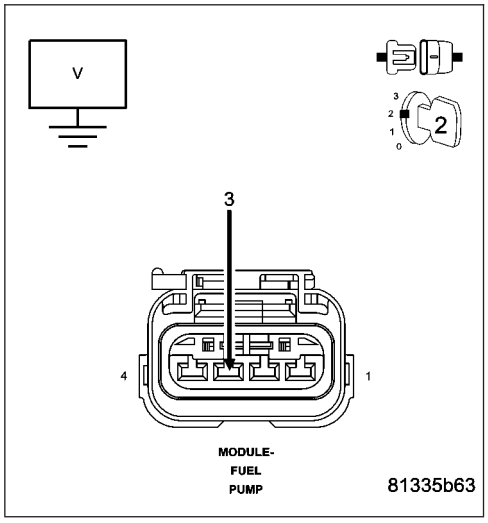
3. (N4) FUEL LEVEL SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Ignition on, engine not running.

Measure the voltage on the (N4) Fuel Level Signal circuit in the Fuel Pump Module harness connector.



Is the voltage above 0 volts?

Yes >> Repair the short to battery voltage in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

4. (N4) FUEL LEVEL SIGNAL CIRCUIT OPEN

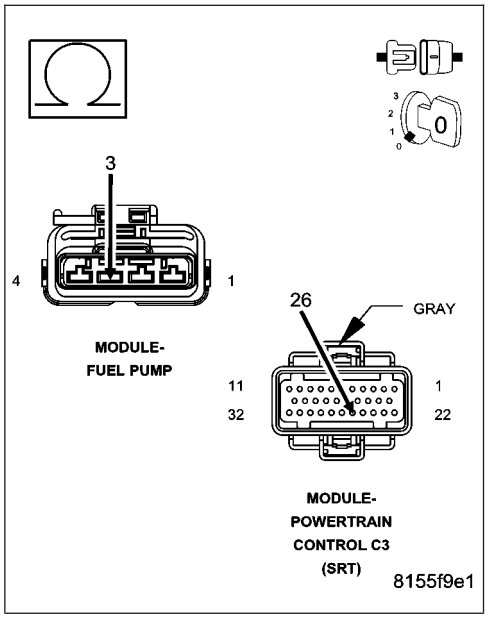
Turn the ignition off.

Measure the resistance of the (N4) Fuel Level Signal circuit from the Fuel Pump Module harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (N4) Fuel Level Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



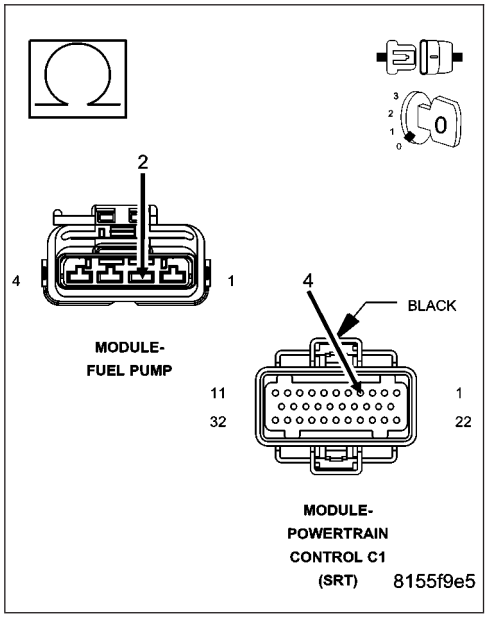
5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor Ground circuit from the Fuel Pump Module harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0463-FUEL LEVEL SENSOR 1 CIRCUIT HIGH (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

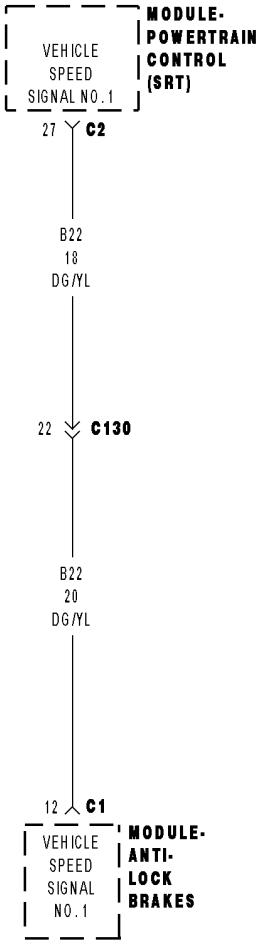
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

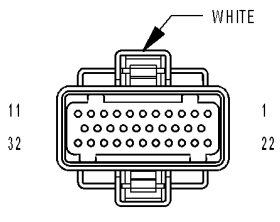
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

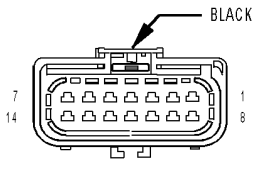
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0500-NO VEHICLE SPEED SIGNAL





MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
ANTI-
LOCK
BRAKES C1

81551913

P0500-NO VEHICLE SPEED SIGNAL (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine Temperature greater than 104 Deg F, MAP vacuum approximately 15″ to 16″ inches of mercury and Engine RPM between 1400 and 3000 rpm.
- **Set Condition:**
  No Vehicle Speed Signal for more than 15 seconds on two consecutive trips.

Possible Causes
(B22) VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO VOLTAGE
(B22) VEHICLE SPEED SIGNAL CIRCUIT OPEN BETWEEN CAB AND PCM
(B22) VEHICLE SPEED SIGNAL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

NOTE: With the scan tool check for any related DTCs that may be present in the ABS/RWAL Module or TCM, diagnose any ABS/RWAL Module DTC's before continuing.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDTION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (B22) VEHICLE SPEED SENSOR SIGNAL CIRCUIT SHORT TO VOLTAGE

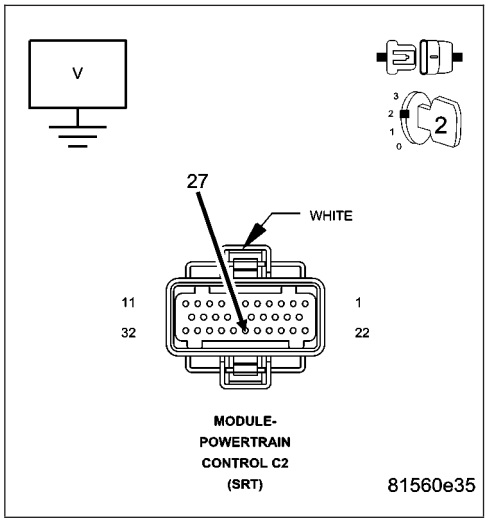
Turn the ignition off.

Disconnect the PCM harness connectors.

Disconnect the CAB Module harness connector.

Ignition on, engine not running.

Measure the voltage of the (B22) Vehicle Speed Signal circuit in the CAB Module or PCM harness connector.



Is the voltage above 4.9 volts?

Yes >> Repair the short to voltage in the (B22) Vehicle Speed Signal circuit between the CAB and PCM.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

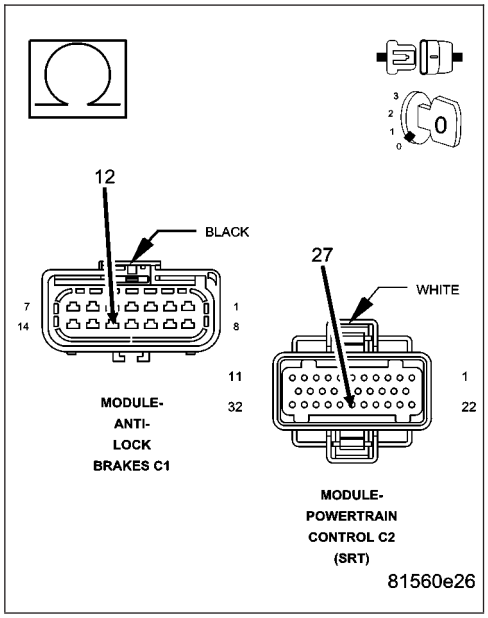
No >> Go To 3

P0500-NO VEHICLE SPEED SIGNAL (CONTINUED)

3. (B22) VEHICLE SPEED SENSOR SIGNAL CIRCUIT OPEN BETWEEN CAB AND PCM

Turn the ignition off.

Measure the resistance of the (B22) Vehicle Speed Signal circuit between the PCM harness connector and the CAB Module harness connector.



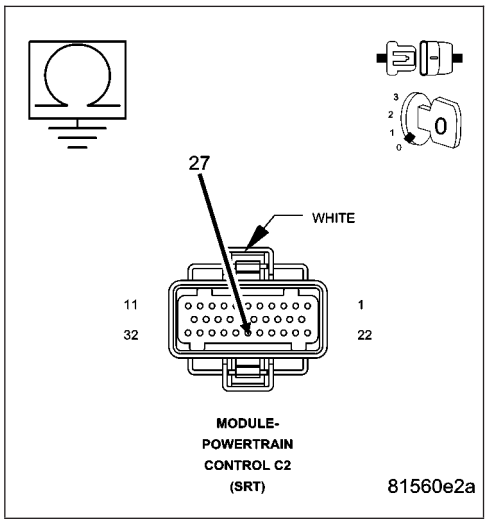
Is the resistance above 5.0 ohms?

Yes >> Repair the open in the (B22) Vehicle Speed Signal circuit between the CAB and PCM.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (B22) VEHICLE SPEED SENSOR SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (B22) Vehicle Speed Signal circuit at the PCM harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B22) Vehicle Speed Signal circuit between the CAB and PCM.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

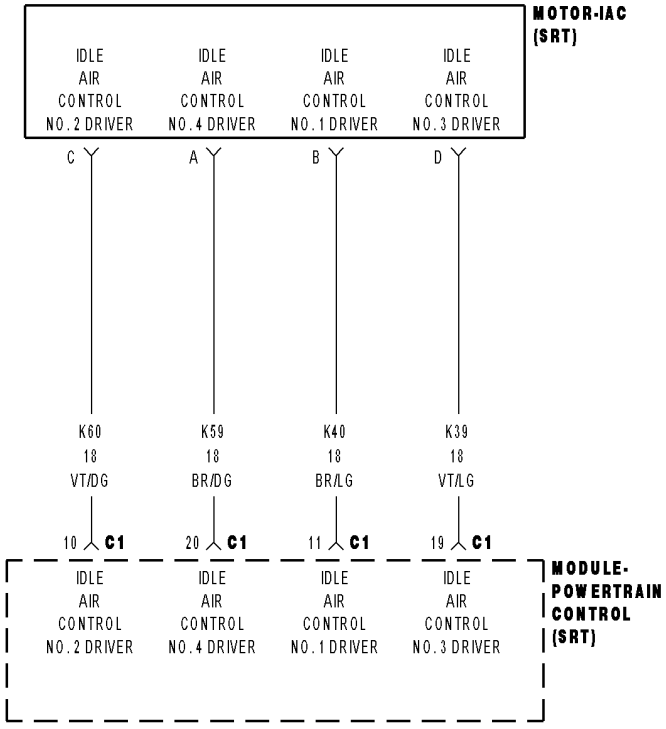
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

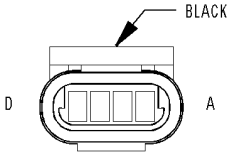
If there are no possible causes remaining, view repair.

Repair

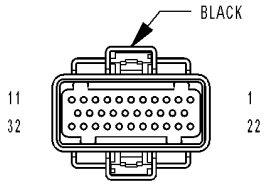
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0505-IDLE AIR CONTROL MOTOR CIRCUITS





MOTOR-IAC (SRT)



MODULE-POWERTRAIN CONTROL C1 (SRT)

81560150

P0505-IDLE AIR CONTROL MOTOR CIRCUITS (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  At power-up and battery voltage greater than 11.5 volts.
- **Set Condition:**
  The PCM senses a short to ground or battery voltage on any of the four Idle Air Control (IAC) driver circuits for 100 ms while the IAC motor is active.

Possible Causes
(K40) IAC #1 DRIVER CIRCUIT SHORTED TO (K60) #2, (K39) #3, OR (K59) #4 IAC DRIVER CIRCUITS
(K60) IAC #2 DRIVER CIRCUIT SHORTED TO (K39) IAC #3 OR (K59) IAC #4
(K39) IAC #3 DRIVER CIRCUIT SHORTED TO (K59) IAC #4 DRIVER CIRCUIT
IAC DRIVER CIRCUIT SHORTED TO VOLTAGE
IAC DRIVER CIRCUIT SHORTED TO GROUND
IAC MOTOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0505-IDLE AIR CONTROL MOTOR CIRCUITS (CONTINUED)

2. IAC #1 DRIVER CIRCUIT SHORTED TO #2, #3, OR #4

Turn the ignition off.

Disconnect the IAC Motor harness connector.

Disconnect the C1 PCM harness connector.

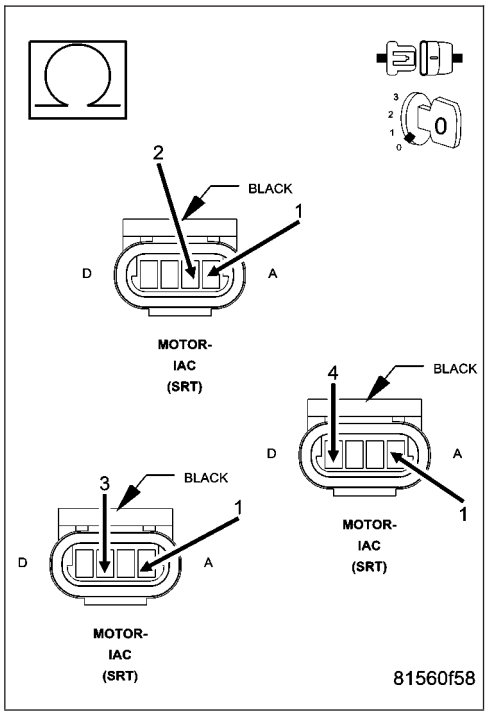
NOTE: The following steps are checking for a short between the IAC Driver circuits.

Measure the resistance between the (K40) IAC #1 Driver circuit and #2, #3, #4 Driver circuits.

Is the resistance below 100 ohms on any of the Drivers?

Yes >> Repair the short between the IAC Driver circuits.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3



3. (K60) IAC #2 DRIVER CIRCUIT SHORTED TO (K39) IAC #3 OR (K59) IAC #4 DRIVER CIRCUITS

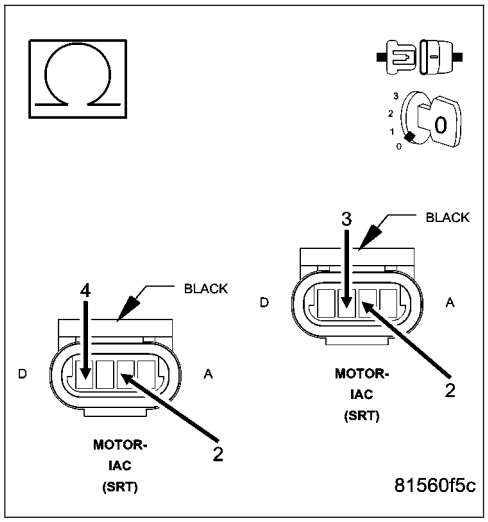
NOTE: The following steps are checking for a short between the IAC Driver circuits.

Measure the resistance between the (K60) IAC #2 Driver circuit and (K39) IAC #3, (K59) IAC #4 Driver circuits.

Is the resistance below 100 ohms on any of the Drivers?

Yes >> Repair the shorted between the IAC Driver circuits.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P0505-IDLE AIR CONTROL MOTOR CIRCUITS (CONTINUED)

4. (K39) IAC #3 DRIVER CIRCUIT SHORTED TO THE (K59) IAC #4 DRIVER CIRCUIT

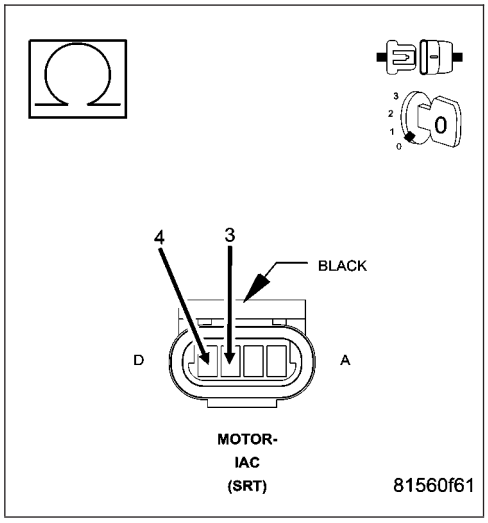
NOTE: The following steps are checking for a short between the Driver Circuits.

Measure the resistance between the (K39) IAC #3 Driver circuit and the (K59) IAC #4 Driver circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short between the IAC Driver circuits.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



5. IAC DRIVER CIRCUITS SHORTED TO VOLTAGE

Remove the ASD Relay.

Using a jumper wire, jumper between the (A14) Fused B+ circuit and (K342) ASD Relay Output circuit in the PDC.

Ignition on, engine not running with the PCM and IAC harness connectors disconnected.

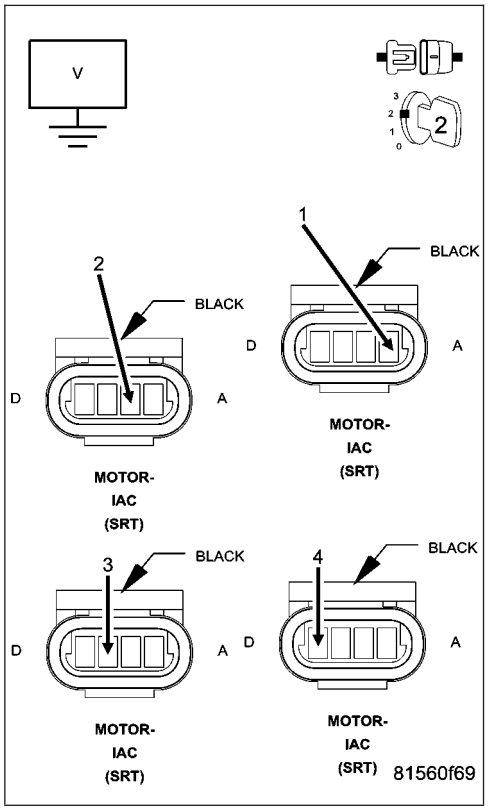
Measure the voltage on each of the IAC Driver circuits.

Is the voltage above 1.0 volt at any IAC Driver circuit?

Yes >> Repair the short to voltage on the appropriate IAC Driver circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

NOTE: Remove the jumper wire and install the ASD Relay before continuing.



P0505-IDLE AIR CONTROL MOTOR CIRCUITS (CONTINUED)

6. IAC DRIVER CIRCUITS SHORTED TO GROUND

Turn the ignition off.

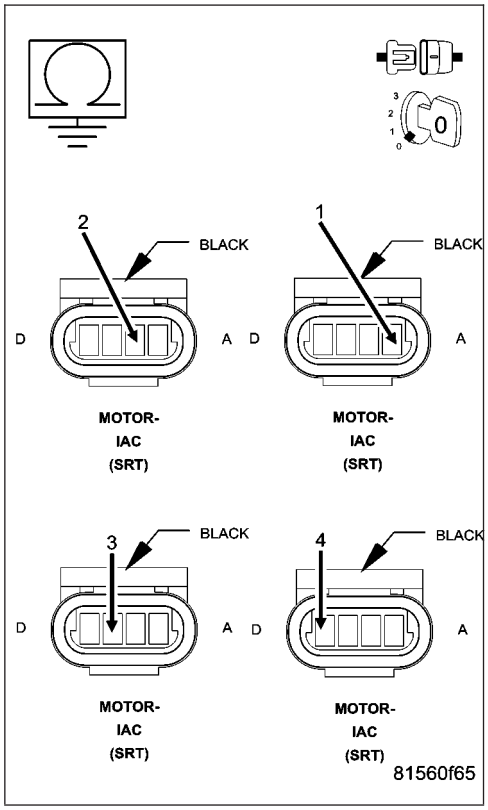
Repeat each measurement for each IAC Driver circuit.

Measure the resistance between ground and each IAC Driver circuit.

Is the resistance below 100 ohms at any IAC Driver circuit?

Yes >> Repair the short to ground in the appropriate IAC Driver circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



7. IAC MOTOR OPERATION

Turn the ignition off.

Connect the C1 PCM harness connectors.

Start and idle the engine.

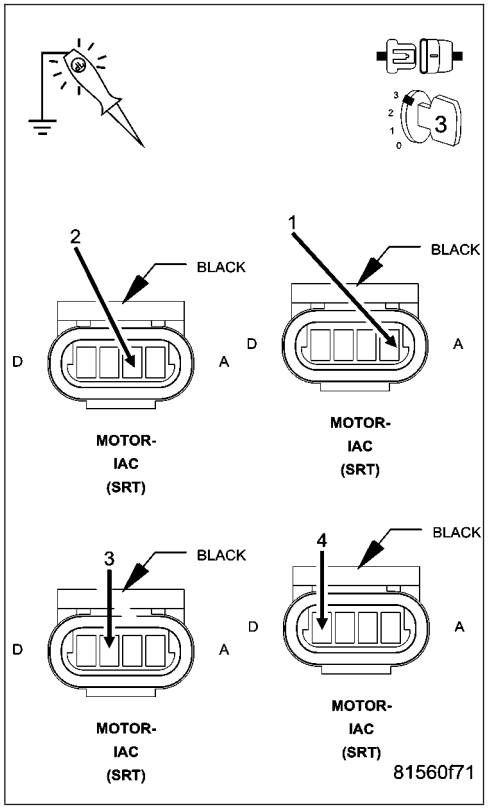
Using a test light connected to ground, probe the IAC Driver #1 circuit for 10 seconds.

Repeat the above test for the remaining IAC Motor Driver circuits.

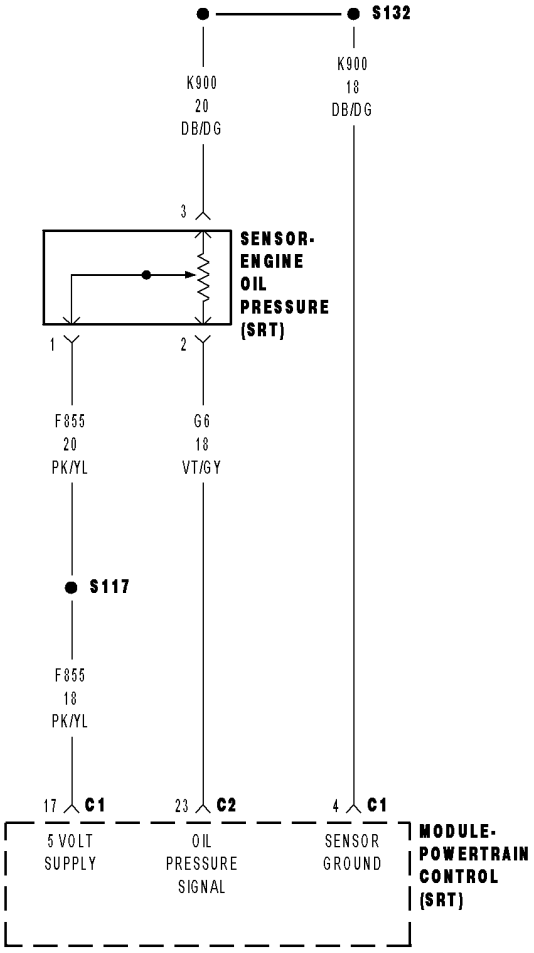
Does the test light turn on and off while probing each IAC Motor Driver circuits?

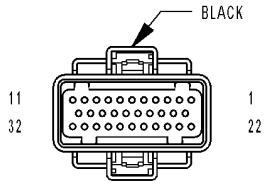
Yes >> Replace the Idle Air Control Motor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

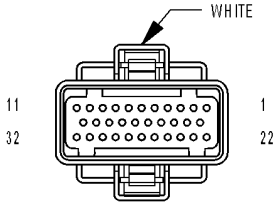


P0522-OIL PRESSURE CIRCUIT LOW

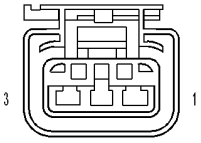




MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)



SENSOR-
ENGINE
OIL
PRESSURE
(SRT)

815612aa

P0522-OIL PRESSURE CIRCUIT LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on.
- **Set Condition:**
  When the PCM recognizes the Oil Pressure signal voltage lower than 0.3 of a volt.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
OIL PRESSURE SENSOR
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. OIL PRESSURE SENSOR VOLTAGE BELOW 0.1 VOLT

Start the engine.

With the scan tool in Sensors, read the Oil Pressure Sensor voltage.

Is the Oil Pressure Sensor voltage below 0.1 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

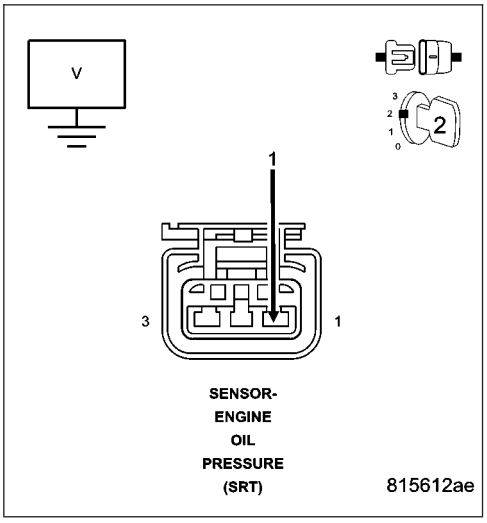
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the Oil Pressure Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

P0522-OIL PRESSURE CIRCUIT LOW (CONTINUED)

3. OIL PRESSURE SENSOR

With the scan tool in Sensors, read the Oil Pressure Sensor voltage with the Sensor harness connector still disconnected.

Is the voltage above 4.6 volts?

Yes >> Replace the Oil Pressure Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

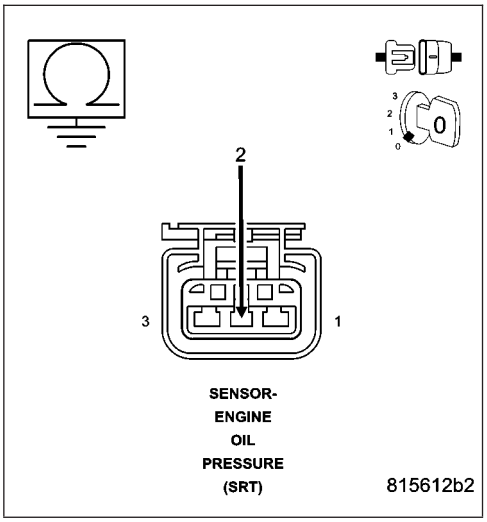
---

4. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance between (G6) Oil Pressure Signal circuit and ground at the Sensor connector.



Is the resistance below 100 ohms?

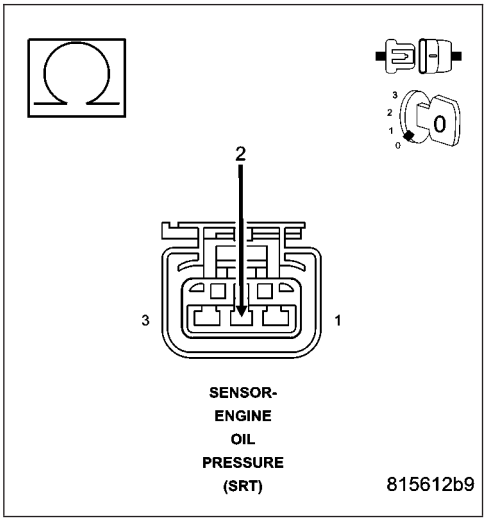
Yes >> Repair the short to ground in the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (G6) Oil Pressure Signal circuit and the (K900) Sensor ground circuit at the Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

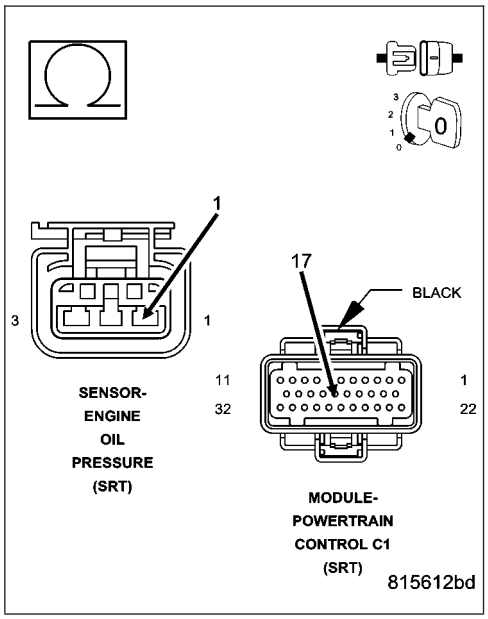
P0522-OIL PRESSURE CIRCUIT LOW (CONTINUED)

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the C1 PCM harness connector.

Measure the resistance of the (F855) 5-volt Supply circuit from the Sensor harness connector to the PCM harness connector.



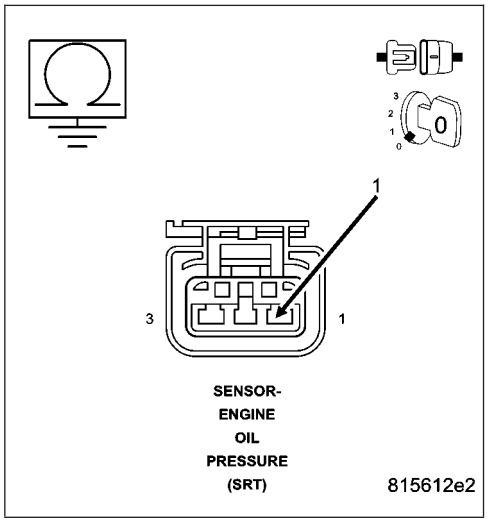
Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit in the Oil Pressure Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion,damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

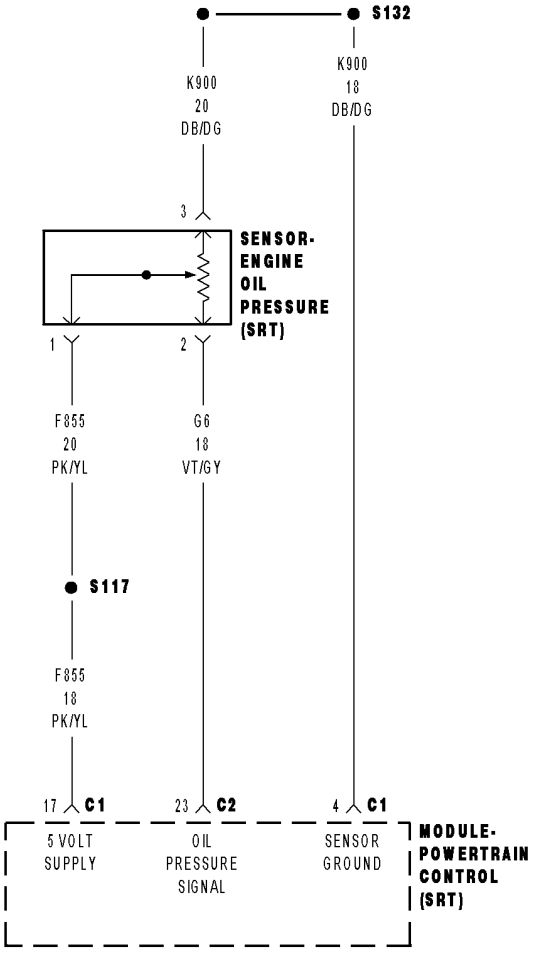
If there are no possible causes remaining, view repair.

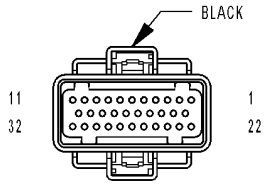
Repair

Replace and program the Powertrain Control Module per Service Information.

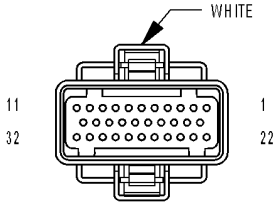
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0523-OIL PRESSURE CIRCUIT HIGH

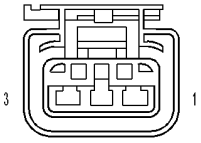




MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)



SENSOR-
ENGINE
OIL
PRESSURE
(SRT)

815612aa

P0523-OIL PRESSURE CIRCUIT HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  The oil pressure sensor signal at PCM goes above 4.9 volts. One Trip Fault.

Possible Causes
OIL PRESSURE SENSOR
(G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE
(G6) OIL PRESSURE SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. OIL PRESSURE SENSOR VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

With the scan tool in Sensors, read the Oil Pressure Sensor voltage.

Is the Oil Pressure Sensor voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. OIL PRESSURE SENSOR

Turn the ignition off.

Disconnect the Oil Pressure Sensor harness connector.

Ignition on, engine not running.

Connect a jumper wire between the (G60) Oil Pressure Signal circuit and (K900) Sensor ground circuit at the Sensor harness connector.

With the scan tool in Sensors, read the Oil Pressure Sensor voltage.

Is the voltage below 1.0 volt?

Yes >> Replace the Oil Pressure Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.

P0523-OIL PRESSURE CIRCUIT HIGH (CONTINUED)

3. (G6) OIL PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (G6) Oil Pressure Signal circuit.

Is the test light brightly illuminated?

Yes >> Repair the short to voltage in the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. (G6) OIL PRESSURE SIGNAL CIRCUIT OPEN

Turn the ignition off.

Measure the resistance of the (G6) Oil Pressure Signal circuit from the Oil Pressure Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (G6) Oil Pressure Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE) Perform POWERTRAIN VERIFICATION TEST.

---

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the Oil Pressure Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0601-PCM INTERNAL CONTROLLER FAILURE

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  Internal checksum for software failed, does not match calculated value. One Trip Fault, Three Good Trips to clear.

Possible Causes
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. PCM

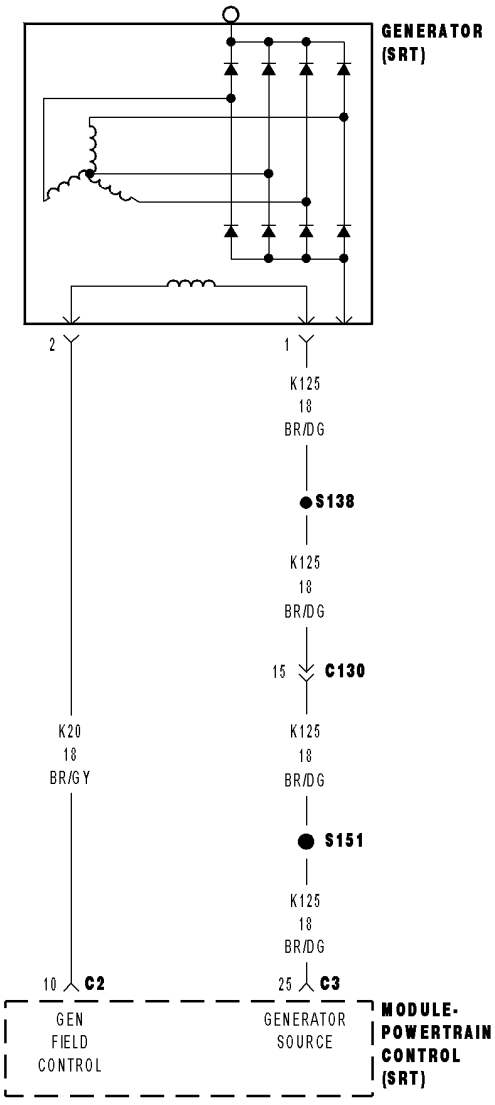
NOTE: Diagnose any CMP or CKP Sensor faults before continuing. Check for intermittent loose CMP or CKP connections.

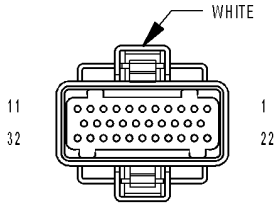
The Powertrain Control Module is reporting internal errors, view repair to continue.

Repair

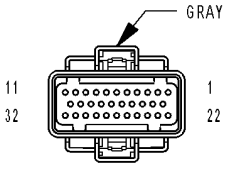
Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY

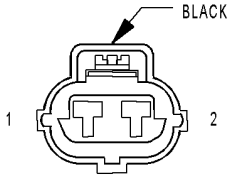




MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)

81562fb8

P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and the engine running.
- **Set Condition:**
  When the PCM tries to regulate the generator field with no result during monitoring.

Possible Causes
(K125) GEN FIELD SOURCE CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT OPEN
(K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GENERATOR FIELD PERFORMANCE

Ignition on, engine not running.

Record all DTCs and the related Freeze Frame data.

Turn the ignition off.

Disconnect the Generator harness connector.

Ignition on, engine not running.

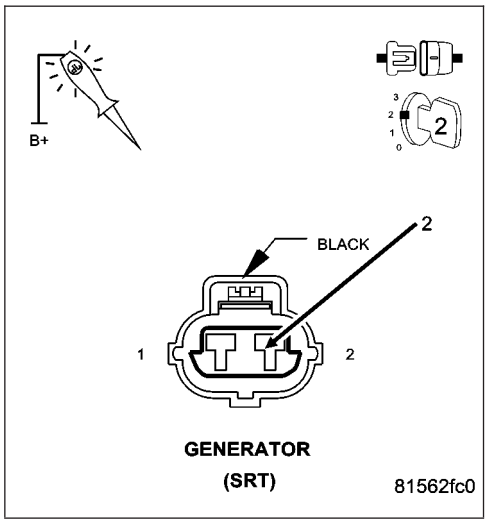
Using a 12-volt test light connected to 12-volts, probe the (K20) Gen Field Control circuit at the Generator harness connector.

With the scan tool, actuate the Generator Field Driver.

Does the test light blink?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2



P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

2. (K125) GEN FIELD SOURCE CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 and C3 PCM harness connectors.

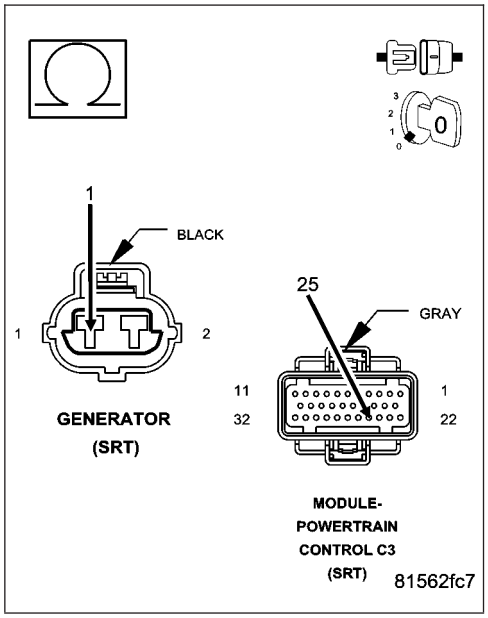
Carefully inspect all connectors for corrosion or spread terminals before continuing.

Measure the resistance of the (K125) Generator Field Source circuit from the Generator harness connector to the C3 PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 3

No >> Repair the open in the (K125) Gen Field Source circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



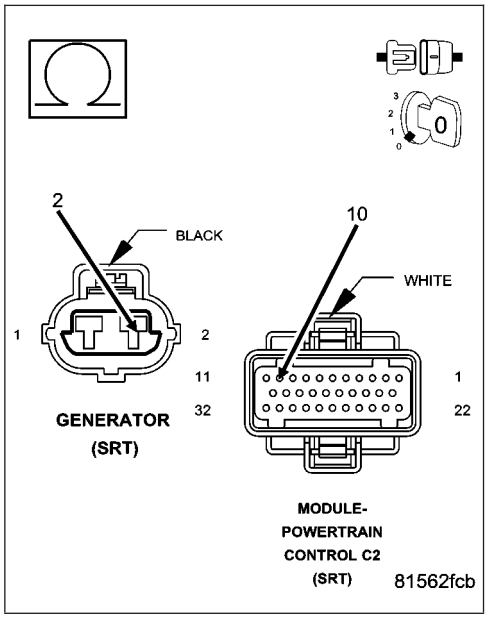
3. (K20) GEN FIELD CONTROL CIRCUIT OPEN

Measure the resistance of the (K20) Generator Field Control circuit from the Generator Field harness connector to the C2 PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

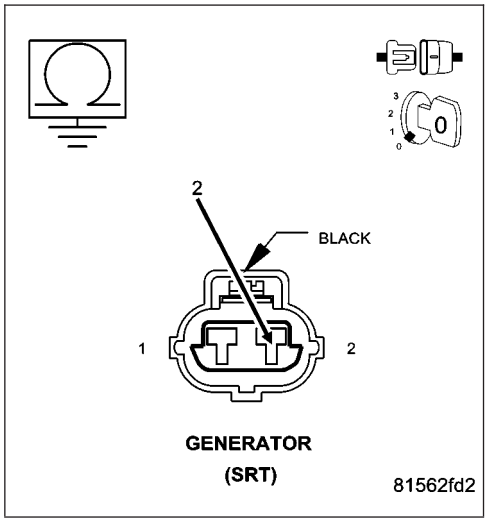
No >> Repair the open in the (K20) Gen Field Control circuit. Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P0622-GENERATOR FIELD NOT SWITCHING PROPERLY (CONTINUED)

4. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (K20) Generator Field Control circuit in the Generator harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K20) Gen Field Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. GENERATOR

Measure resistance across the Generator Field Terminals at the Generator.

Is the resistance between 0.5 of and ohm and 15 ohms?

Yes >> Go To 6

No >> Repair the Generator as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

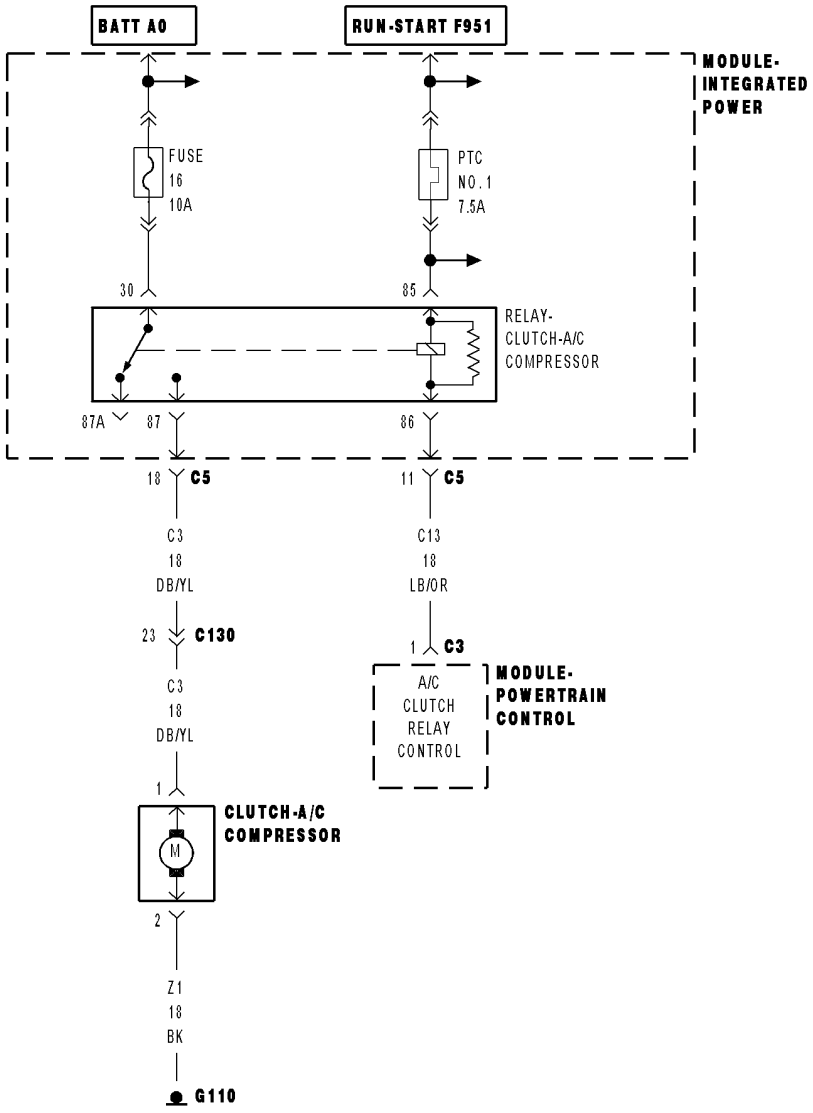
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

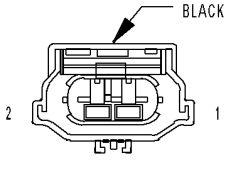
If there are no possible causes remaining, view repair.

Repair

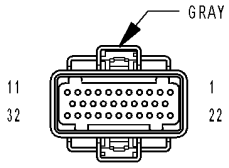
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT





CLUTCH-A/C
COMPRESSOR



MODULE-
POWERTRAIN
CONTROL C3
(SRT)

81562fe1

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10 volts. A/C Switch on.
- **Set Condition:**
  An open or shorted condition is detected in the A/C clutch relay control circuit. One Trip Fault. Three good trips to turn off the MIL.

Possible Causes
INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT
INTERNAL FUSED B+ CIRCUIT
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN
(C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND
A/C CLUTCH RELAY
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

Diagnostic Test

1. A/C CLUTCH RELAY OPERATION

Ignition on, engine not running.

With a scan tool, actuate the A/C Clutch Relay.

Is the A/C Clutch Relay operating?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. A/C CLUTCH RELAY RESISTANCE

Turn the ignition off.

Remove the A/C Clutch Relay from the IPM.

Measure the resistance of the A/C Clutch Relay Coil.

Is the resistance between 60 to 80 ohms?

Yes >> Go To 3

No >> Replace the A/C Clutch Relay.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

3. INTERNAL FUSED IGNITION SWITCH OUTPUT CIRCUIT AND FUSED B+ CIRCUIT

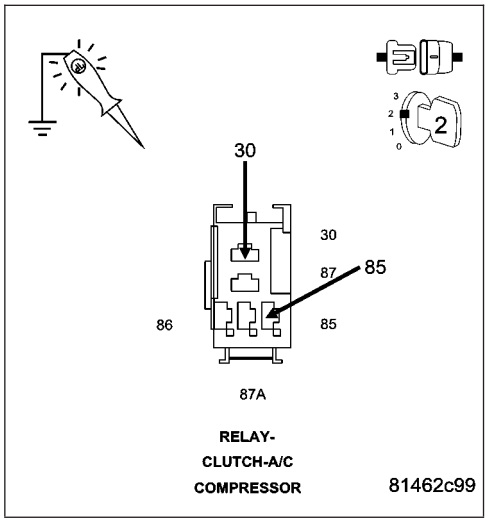
Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the Internal Fused Ignition Switch Output circuit and the Fused B+ circuit in the connection.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the Fused Ignition Switch Output circuit or the Fused B+ circuit. Check and replace any open fuses.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



4. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Measure the resistance of the (C13) A/C Clutch Relay Control circuit from the relay connection to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (C13) A/C Clutch Relay Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

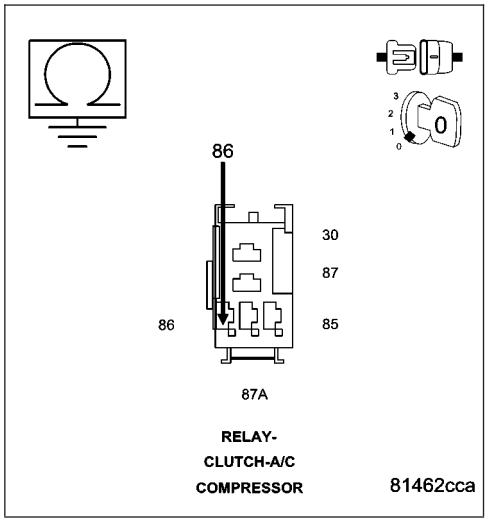
5. (C13) A/C CLUTCH RELAY CONTROL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (C13) A/C Clutch Relay Control circuit at the IPM.

Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (C13) A/C Relay Clutch Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6



P0645-A/C CLUTCH RELAY CIRCUIT (CONTINUED)

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

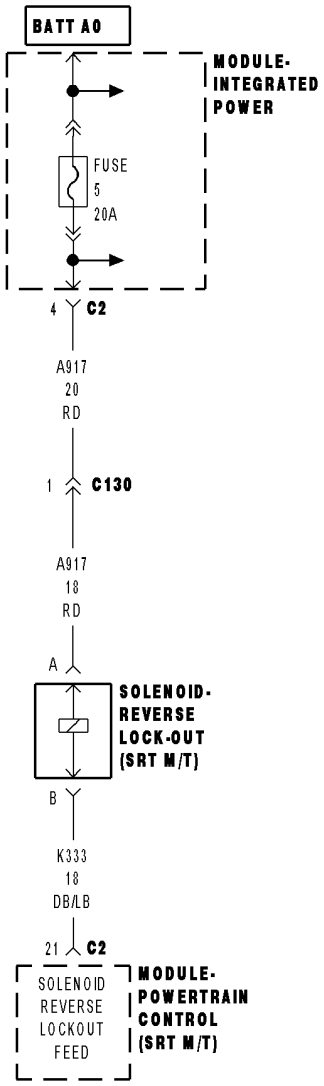
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

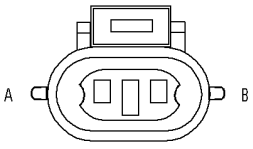
Were there any problems found?

Yes >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

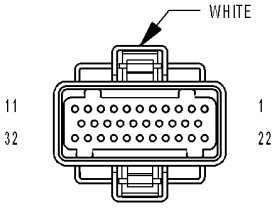
No >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P0801-REVERSE GEAR LOCKOUT CIRCUIT OPEN OR SHORTED





SOLENOID-
REVERSE
LOCK-OUT
(SRT M/T)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)

81562f15

P0801-REVERSE GEAR LOCKOUT CIRCUIT OPEN OR SHORTED (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine at operating temperature, Engine RPM above 608 rpm's, and Vehicle Speed above 5 MPH.
- **Set Condition:**
  Reverse Gear Lockout Solenoid Control circuit is not in the expected state when requested to operate by the PCM. Note: When Vehicle Speed is less then 5 MPH the PCM provides a ground for the solenoid which energizes the solenoid. (Allowing Reverse).

Possible Causes
(A917) FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K333) REVERSE LOCKOUT SOLENOID CONTROL CIRCUIT OPEN
(K333) REVERSE LOCKOUT SOLENOID CONTROL CIRCUIT SHORT TO GROUND
REVERSE LOCKOUT SOLENOID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (A917) FUSED IGNITION SWITCH OUTPUT CIRCUIT OPEN OR SHORT TO GROUND

Turn the ignition off.

Disconnect the Reverse Lockout Solenoid harness connector.

NOTE: Check connectors - Clean/repair as necessary.
Ignition on, engine not running.

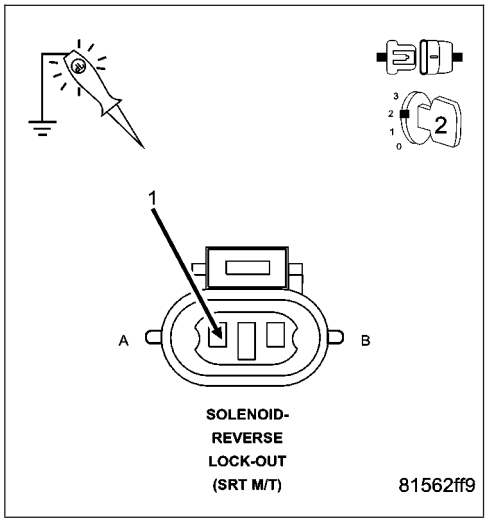
Using a 12-volt test light connected to ground, probe the (A917) Fused Ignition Switch Output circuit.

NOTE: The test light must be brightly lit. If the test light does not light or is Dim repair the circuit for a open or high resistance circuit.

Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open or short to ground in the (A917) Fused Ignition Switch Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



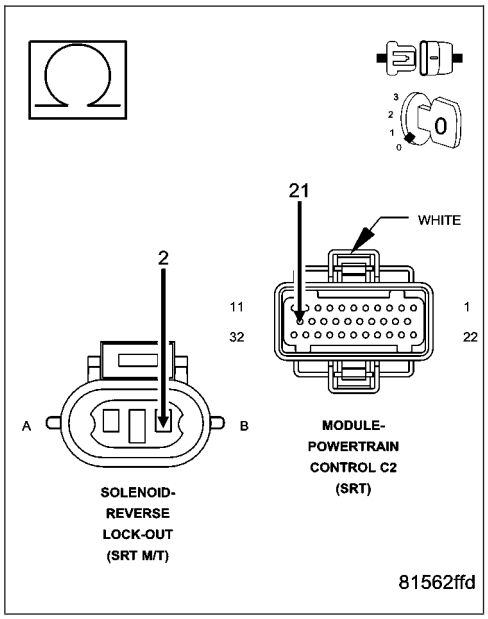
P0801-REVERSE GEAR LOCKOUT CIRCUIT OPEN OR SHORTED (CONTINUED)

3. (K333) REVERSE LOCKOUT SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the C2 PCM harness connector.

Measure the resistance of the (K333) Reverse Lockout Solenoid Control circuit from the PCM connector to the Reverse Lockout Solenoid connector.



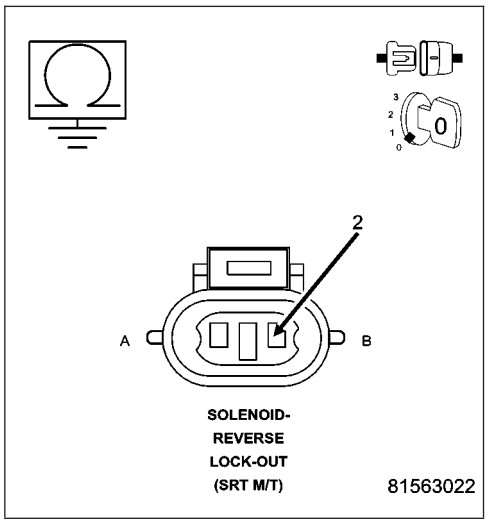
Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (K333) Reverse Lockout Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K333) REVERSE LOCKOUT SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K333) Reverse Lockout Solenoid Control circuit in the Solenoid harness connector.



Is the resistance below 5.0 ohms?

Yes >> Repair the short to ground in the (K333) Reverse Lockout Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P0801-REVERSE GEAR LOCKOUT CIRCUIT OPEN OR SHORTED (CONTINUED)

5. REVERSE LOCKOUT SOLENOID

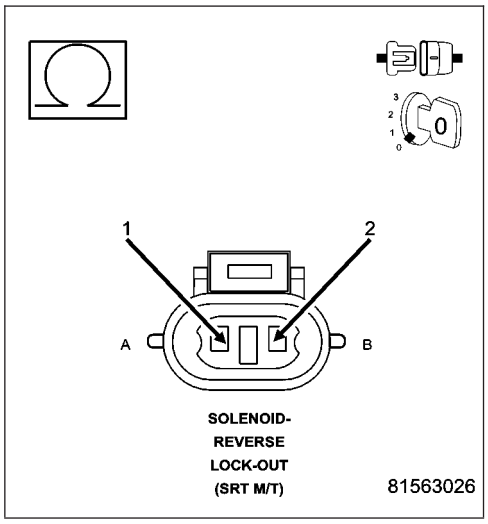
Measure the resistance across both terminals of the Reverse Lockout solenoid.

NOTE: The resistance should be about 13.5 ohms at 25°C. (77°F).

Is the resistance between 12.0 ohms and 14.0 ohms?

Yes >> Go To 6

No >> Replace the Reverse Lockout Solenoid.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. PCM

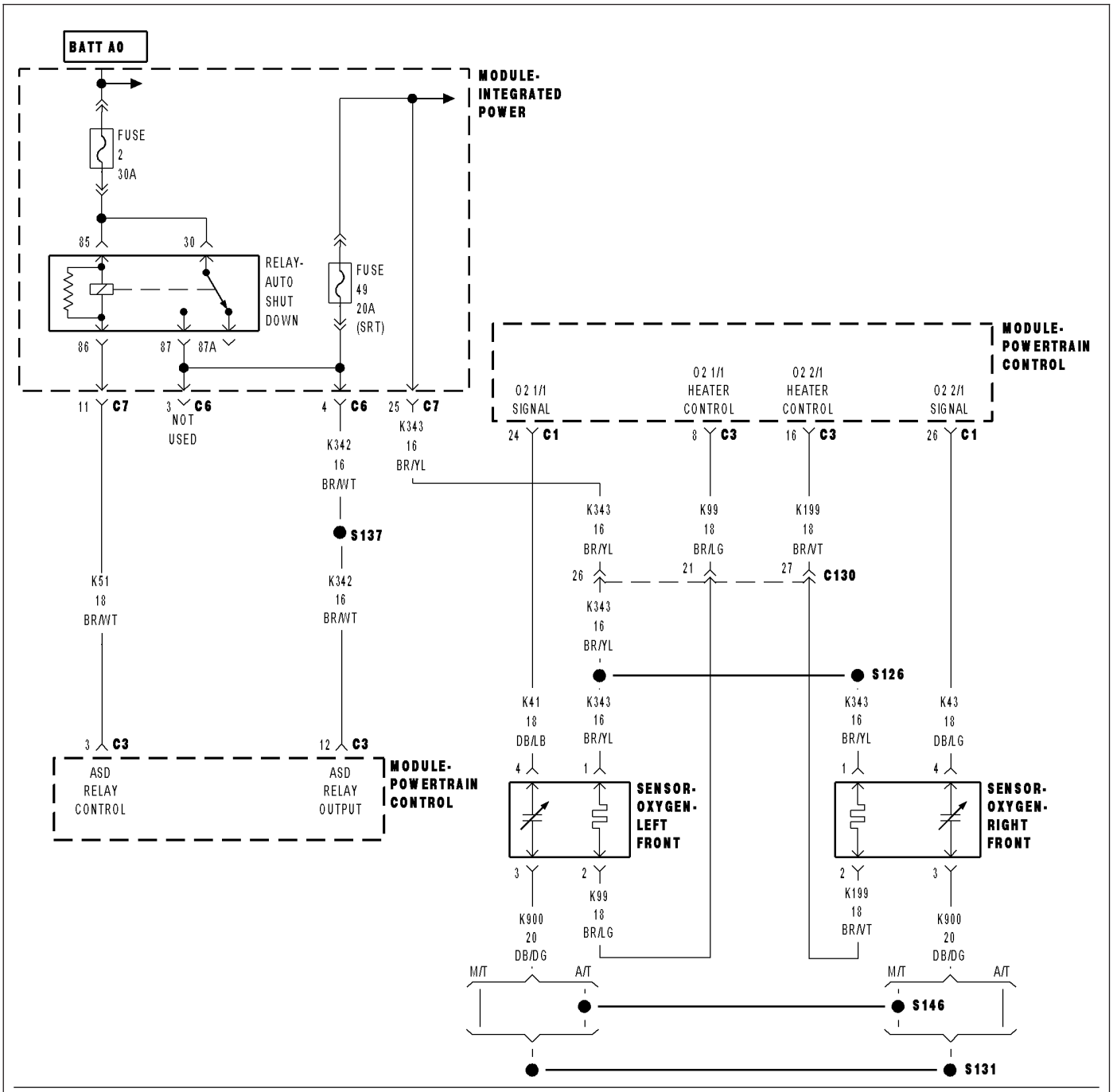
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

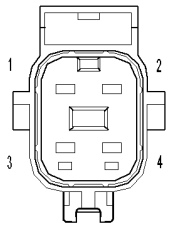
If there are no possible causes remaining, view repair..

Repair

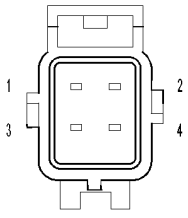
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1195-O2 SENSOR 1/1 SLOW DURING CATALYST MONITOR





SENSOR-
OXYGEN-
LEFT
FRONT
(SRT)



SENSOR-
OXYGEN-
RIGHT
FRONT
(SRT)

813c2aeb

P1195-O2 SENSOR 1/1 SLOW DURING CATALYST MONITOR (CONTINUED)

For the engine circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
RESISTANCE IN THE (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust for leaks between the engine and the appropriate O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1195-O2 SENSOR 1/1 SLOW DURING CATALYST MONITOR (CONTINUED)

3. (K41) O2 SENSOR 1/1 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off.

Backprobe the (K41) O2 Sensor 1/1 Signal circuit at the 1/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance on the (K41) O2 Sensor 1/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

Backprobe the (K900) Sensor ground circuit at the O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

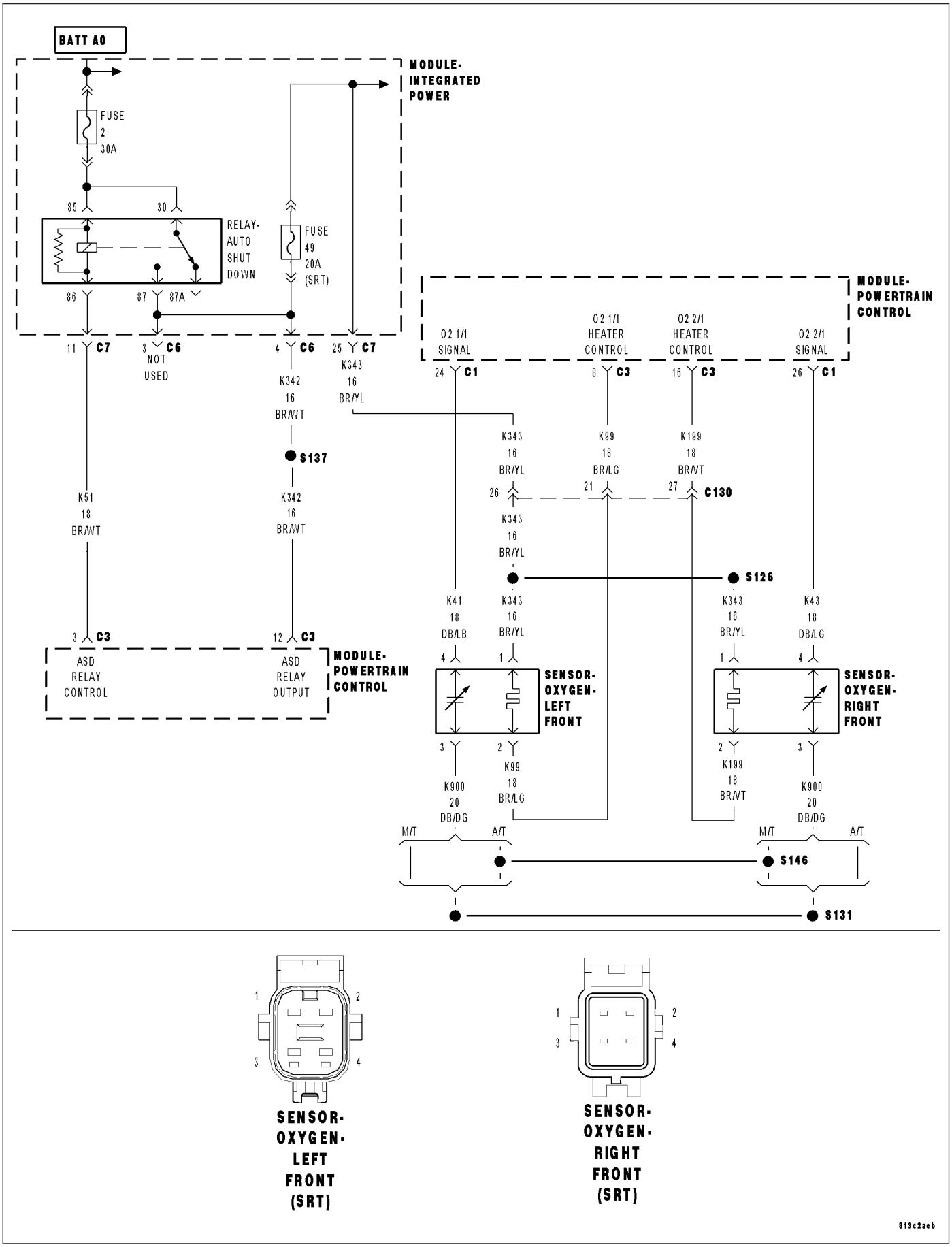
Turn the ignition off.

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1196-O2 SENSOR 2/1 SLOW DURING CATALYST MONITOR



P1196-O2 SENSOR 2/1 SLOW DURING CATALYST MONITOR (CONTINUED)

For the engine circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running, coolant greater than 170°F, open throttle, steady to slightly increasing vehicle speed greater than 18 mph but less than 55 mph, with a light load on the engine, for a period no less than 5 minutes.
- **Set Condition:**
  The oxygen sensor signal voltage is switching from below 0.39 of a volt to above 0.6 of a volt and back fewer times than required.

Possible Causes
EXHAUST LEAK
RESISTANCE IN THE (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT
RESISTANCE IN THE (K900) SENSOR GROUND CIRCUIT
O2 SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. EXHAUST LEAK

Start the engine.

Inspect the exhaust for leaks between the engine and the appropriate O2 Sensor.

Are there any exhaust leaks?

Yes >> Repair or replace the leaking exhaust parts as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1196-O2 SENSOR 2/1 SLOW DURING CATALYST MONITOR (CONTINUED)

3. (K43) O2 SENSOR 2/1 SIGNAL CIRCUIT VOLTAGE DROP

Turn the ignition off.

Backprobe the (K43) O2 Sensor 2/1 Signal circuit at the 2/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 4

No >> Repair the excessive resistance on the (K43) O2 Sensor 2/1 Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. (K900) SENSOR GROUND CIRCUIT VOLTAGE DROP

Turn the ignition off.

Backprobe the (K900) Sensor ground circuit at the 2/1 O2 Sensor harness connector and PCM harness connector.

NOTE: Make sure the voltmeter leads are connected for positive polarity, meet the terminals in the connector, and that there is good terminal to wire connection.

NOTE: Make sure the voltmeter leads are connected for positive polarity

Start the engine.

Allow the engine to idle.

Is the voltage below 0.10 of a volt?

Yes >> Go To 5

No >> Repair the excessive resistance in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. O2 SENSOR

Turn the ignition off.

If there are no possible causes remaining, view repair.

Repair

Replace the O2 Sensor
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1281-ENGINE IS COLD TOO LONG

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  The ignition key on, engine running.
- **Set Condition:**
  The engine does not warm to 176 Deg. F while driving for 20 minutes after start.

Possible Causes
ENGINE COLD TOO LONG
ECT SENSOR OPERATION

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. CHECK COOLING SYSTEM PERFORMANCE

NOTE: The best way to diagnose this DTC is to allow the vehicle to remain outside overnight in order to have a completely cold soaked engine.

NOTE: Extremely cold outside ambient temperatures may cause this DTC to set.

Verify that the coolant level is not low and correct as necessary.

Start the engine.

With the scan tool, set the engine RPM to 1500 and allow the engine to warm up for 10-15 minutes.

With the scan tool, monitor the ENG COOLANT TMP DEG value during the warm up cycle. Make sure the transition of temperature change is smooth.

Did the engine temperature reach a minimum of 80° C (176° F)?

Yes >> Go To 2

No >> Refer to the Service Information for cooling system performance diagnosis. The most probable cause is a Thermostat problem. Also, refer to any related TSBs.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ECT SENSOR OPERATION

WARNING: WARNING: MAKE SURE THE ENGINE COOLING SYSTEM IS COOL BEFORE REMOVING THE PRESSURE CAP OR ANY HOSE. SEVERE PERSONAL INJURY MAY RESULT FROM ESCAPING HOT COOLANT. THE COOLING SYSTEM IS PRESSURIZED WHEN HOT.

With the scan tool, read and record the ECT Sensor Temperature value.

Using the DRB Temperature Probe #CH7050, measure the engine coolant temperature.

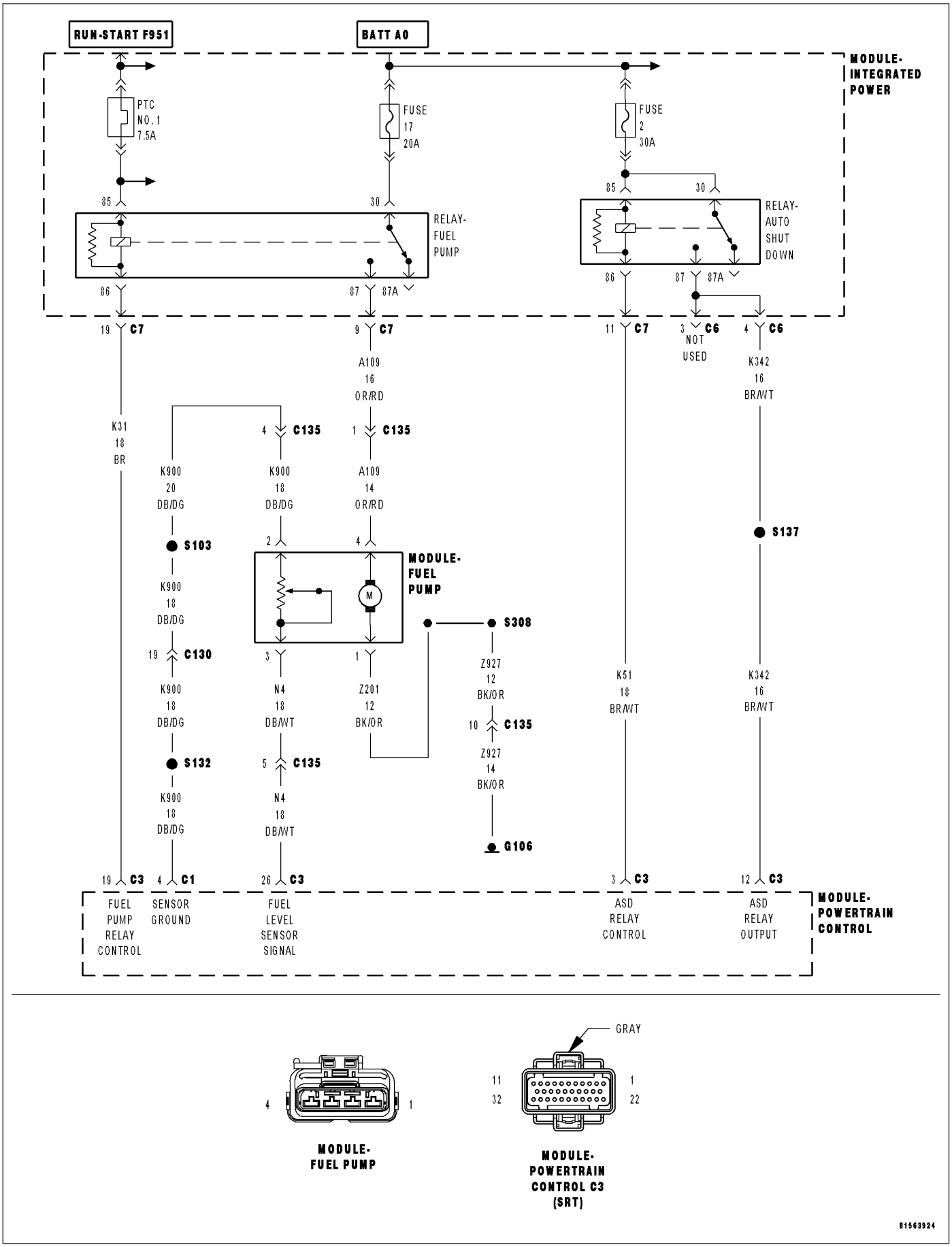
NOTE: The t-stat housing area should be around 192-195 at start to open.

Is the ECT Sensor value with -15°C (5°F) of the temperature probe reading?

Yes >> Test Complete.

No >> Replace the ECT Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT



MODULE-FUEL PUMP

MODULE-POWERTRAIN CONTROL C3 (SRT)

81563924

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on and battery voltage above 10.4 volts.
- **Set Condition:**
  An open or shorted condition is detected in the Fuel Pump Relay Control circuit.

Possible Causes
FUEL PUMP RELAY OPERATION
FUEL PUMP RELAY
FUSED IGNITION SWITCH OUTPUT CIRCUIT
(K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN
(K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. FUEL PUMP RELAY OPERATION

Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.
With the scan tool, actuate the Fuel Pump Relay.

Is the Fuel Pump Relay clicking?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. FUEL PUMP RELAY

Turn the ignition off.
Remove the Fuel Pump Relay.

NOTE: Check connectors - Clean/repair as necessary.
Measure the resistance between the coil terminals of the Fuel Pump Relay.

Is the resistance between 50 and 90 ohms?

Yes >> Go To 3

No >> Replace the Fuel Pump Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1282-FUEL PUMP/SYSTEM RELAY CONTROL CIRCUIT (CONTINUED)

3. FUSED IGNITION SWITCH CIRCUIT OPEN

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the Fused Ignition Switch Output circuit in the Fuel Pump Relay connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the Fused Ignition Switch Output circuit. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K31) FUEL PUMP RELAY CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K31) Fuel Pump Relay Control circuit from the Fuel Pump Relay connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K31) Fuel Pump Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K31) FUEL PUMP RELAY CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K31) Fuel Pump Relay Control circuit at the PDC.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K31) Fuel Pump Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

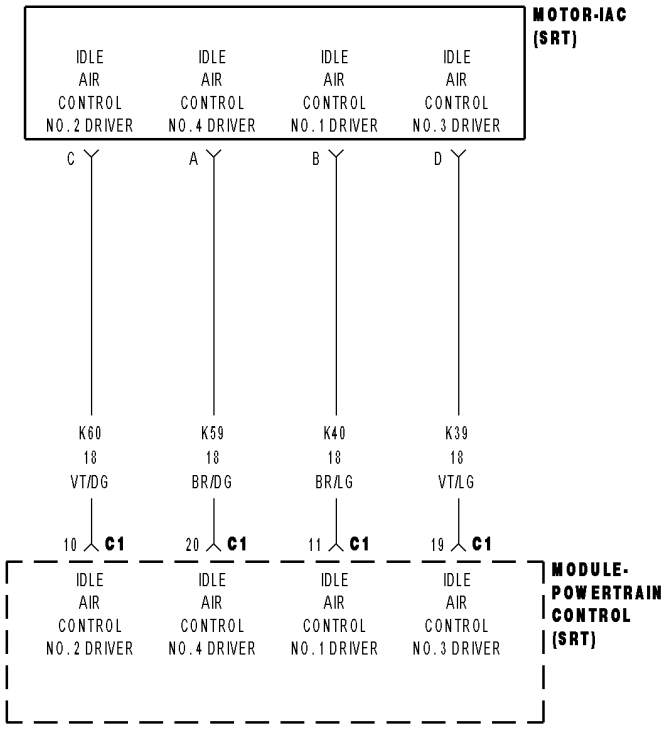
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

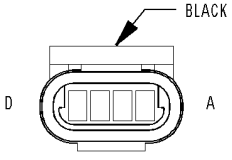
If there are no possible causes remaining, view repair.

Repair

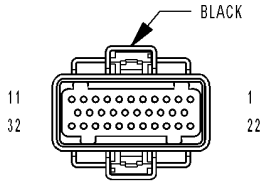
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1294-TARGET IDLE NOT REACHED





MOTOR-IAC (SRT)



MODULE-POWERTRAIN CONTROL C1 (SRT)

81563980

P1294-TARGET IDLE NOT REACHED (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine idling and in drive, if automatic. There must not be a MAP sensor trouble code or a throttle position sensor trouble code.
- **Set Condition:**
  Engine idle is not within 200 rpm above or 100 rpm below target idle for 14 seconds. Three separate failures are required to set a bad trip. Two bad trips are required to set the code.

Possible Causes
GOOD TRIP EQUAL TO ZERO
VACUUM LEAK
AIR INDUCTION SYSTEM
THROTTLE BODY AND THROTTLE LINKAGE
IAC DRIVER CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

NOTE: All MAP Sensor, IAC, and/or TPS codes present must be diagnosed first before proceeding.
With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. VACUUM LEAK

Inspect the Intake Manifold for vacuum leaks.
Inspect the Power Brake Booster for any vacuum leaks.
Inspect the PCV system for proper operation or any vacuum leaks.

Were any problems found?

Yes >> Repair vacuum leak as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1294-TARGET IDLE NOT REACHED (CONTINUED)

3. AIR INDUCTION SYSTEM

Inspect the Air Induction System for the following problems.
Restrictions: Dirty Air Cleaner, Foreign material in the air intake tube, etc.
Leaks: Air Intake tube connection, Air Cleaner housing, etc.

Were any problems found?

Yes >> Repair or replace as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. THROTTLE BODY AND THROTTLE LINKAGE

Inspect the throttle body plate for carbon build up or other restrictions.
Inspect the throttle linkage for binding and smooth operation.
Ensure the throttle plate is resting on the stop at idle.
Remove IAC, inspect the pintle and its seating surface inside the throttle body.

Were any problems found?

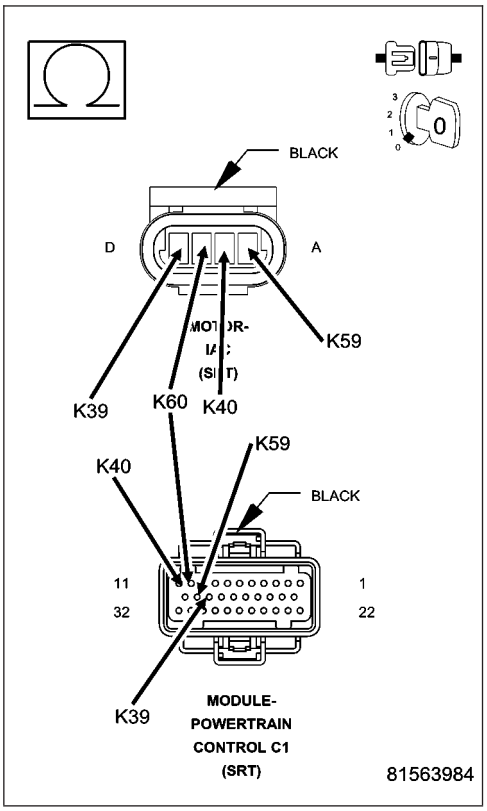
Yes >> Clean and/or replace the throttle body as needed.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. IAC DRIVER CIRCUITS OPEN

Turn the ignition off.
Disconnect IAC Motor harness connector.
Disconnect the PCM harness connectors.
Measure the resistance of each of the IAC Driver circuit from the IAC Motor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the appropriate IAC Driver circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1294-TARGET IDLE NOT REACHED (CONTINUED)

6. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

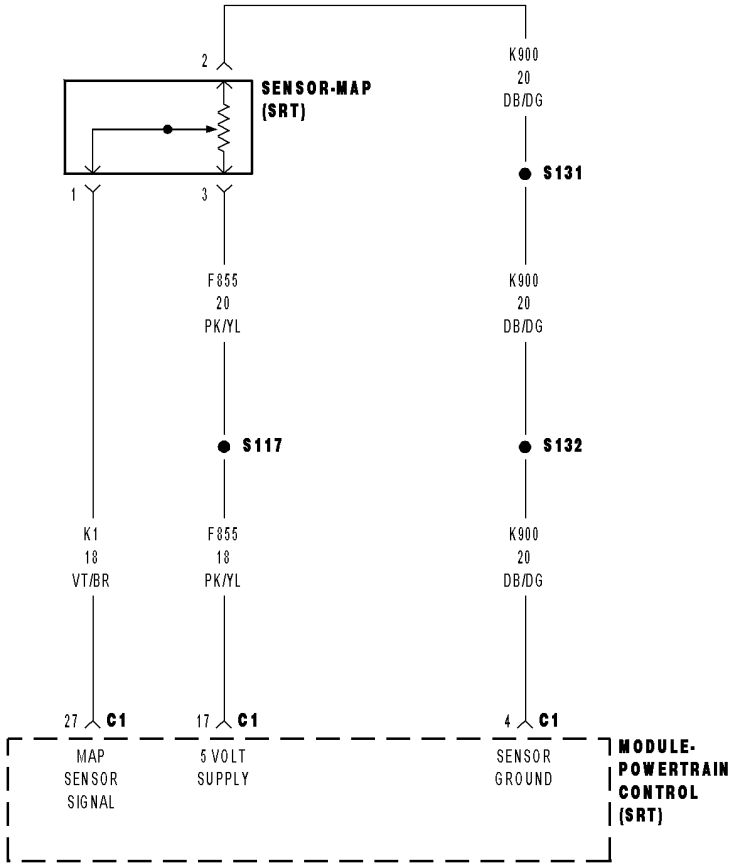
If there are no possible causes remaining, view repair.

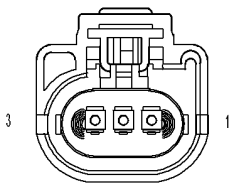
Repair

Replace and program the Powertrain Control Module per Service Information.

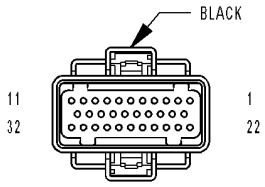
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1296-NO 5-VOLTS TO MAP SENSOR





SENSOR-
MAP
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81563c46

P1296-NO 5-VOLTS TO MAP SENSOR (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  During power-down and battery voltage greater than 10.4 volts.
- **Set Condition:**
  The MAP sensor signal voltage goes below 2.35 volts with the key off for 5 seconds.

Possible Causes
MAP SENSOR VOLTS BELOW 2.3 VOLTS
MAP SENSOR
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
SHORTED SENSOR
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. MAP SENSOR VOLTS BELOW 2.3 VOLTS

NOTE: If the P0107 - MAP Sensor Voltage Too Low is also set, diagnose it first before continuing with P1296 - No 5-volts To MAP Sensor.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

With the scan tool in Sensors, read the MAP Sensor voltage.

Is the voltage below 2.35 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

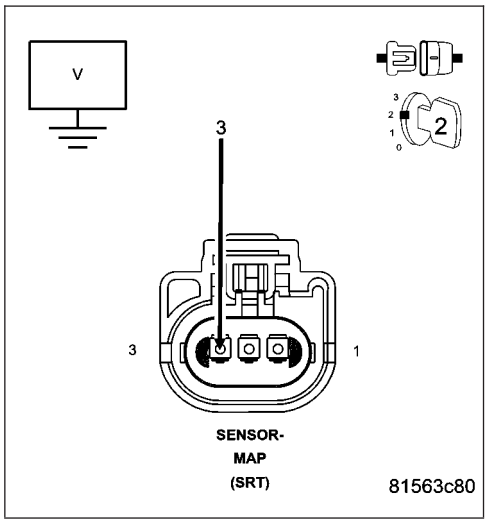
Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit at the MAP Sensor harness connector.

Is the voltage above 4.5 volts?

Yes >> Go To 3

No >> Go To 4



P1296-NO 5-VOLTS TO MAP SENSOR (CONTINUED)

3. MAP SENSOR

With the scan tool in Sensors, read the MAP Sensor voltage with the Sensor harness connector disconnected.

Is the voltage above 4.5 volts?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

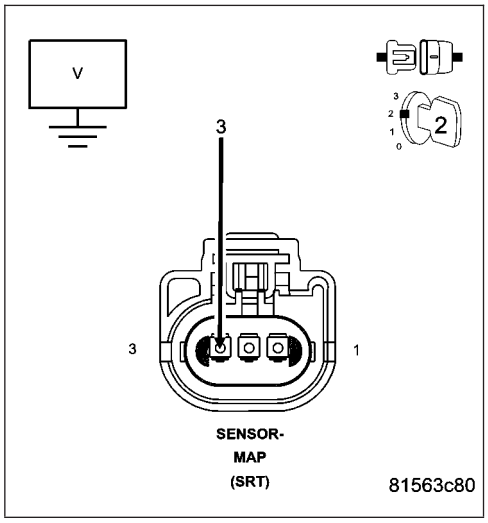
4. SHORTED SENSOR

Measure the voltage on the (K7) 5-volt Supply circuit in the MAP Sensor harness connector while disconnecting the remaining Sensors that share the (K7) 5-volt Supply circuit.

Does the voltage return to approximately 5.0 volts with any Sensor disconnected?

Yes >> Replace the Sensor that pulled the (K7) 5-volt Supply circuit low.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P1296-NO 5-VOLTS TO MAP SENSOR (CONTINUED)

5. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

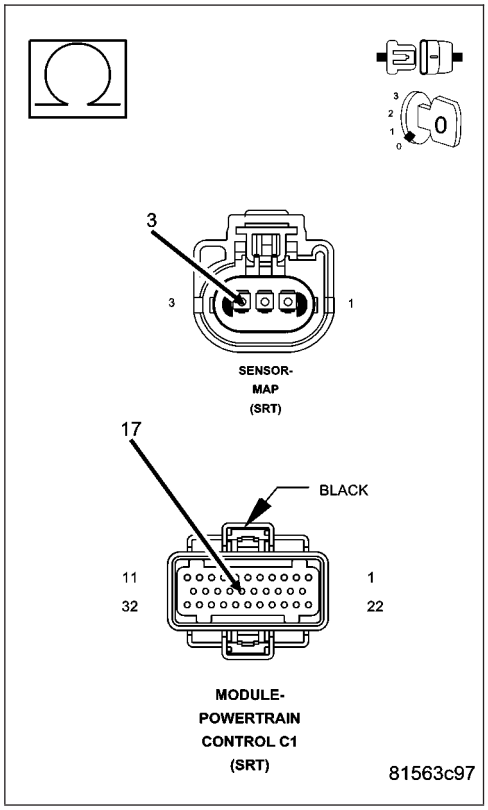
Measure the resistance of the (F855) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the excessive resistance in the (F855) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



6. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

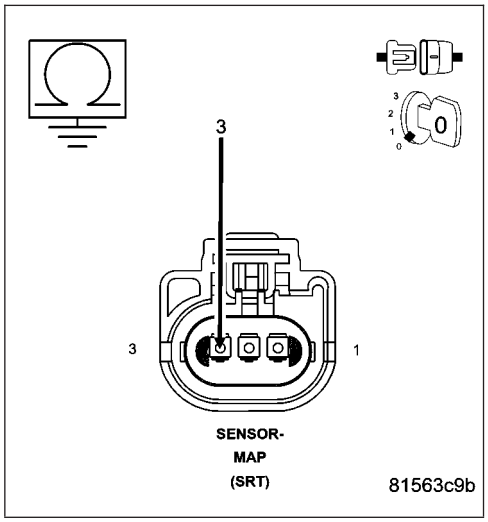
Measure the resistance between ground and the (F855) 5-volt Supply circuit in the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7



P1296-NO 5-VOLTS TO MAP SENSOR (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

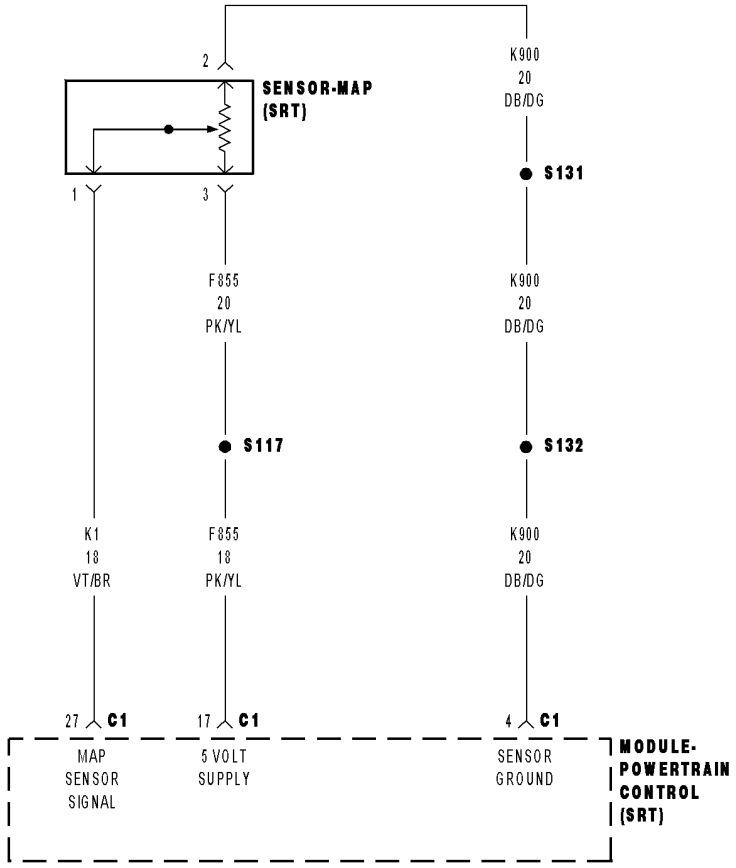
If there are no possible causes remaining, view repair.

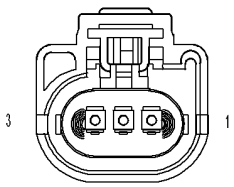
Repair

Replace and program the Powertrain Control Module per Service Information.

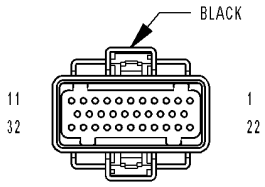
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1297-NO CHANGE IN MAP FROM START TO RUN





SENSOR-
MAP
(SRT)



MODULE-
POWERTRAIN
CONTROL C1
(SRT)

81563c46

P1297-NO CHANGE IN MAP FROM START TO RUN (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With engine RPM +/- 64 of target idle and the throttle blade at closed throttle.
- **Set Condition:**
  Too small of a difference is seen between barometric pressure with ignition on (engine running) and manifold vacuum for 8.80 seconds.

Possible Causes
GOOD TRIP EQUAL TO ZERO
MAP SENSOR VACUUM PORT
MAP SENSOR VOLTAGE BELOW 3.19 VOLTS
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
MAP SENSOR
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND
(K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

NOTE: If a MAP high or Low DTC set along with P1297, diagnose the High or Low DTC first before continuing.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. MAP SENSOR VACUUM PORT

Turn the ignition off.

Remove the MAP Sensor.

Inspect the vacuum port, check for restrictions or any foreign materials.

Were any restriction found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1297-NO CHANGE IN MAP FROM START TO RUN (CONTINUED)

3. MAP SENSOR VOLTAGE BELOW 3.19 VOLTS

Install the MAP Sensor.

Ignition on, engine not running.

With the scan tool, read the MAP Sensor voltage.

Is the voltage below 3.19 volts?

Yes >> Go To 4

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

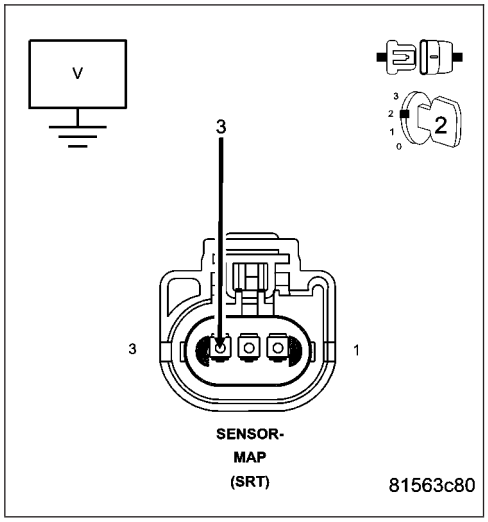
4. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the MAP Sensor harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit at the MAP Sensor harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 5

No >> Go To 8

---

5. MAP SENSOR

With the scan tool, monitor the MAP Sensor voltage with Sensor harness connector disconnected.

Is the voltage above 1.2 volts?

Yes >> Replace the MAP Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

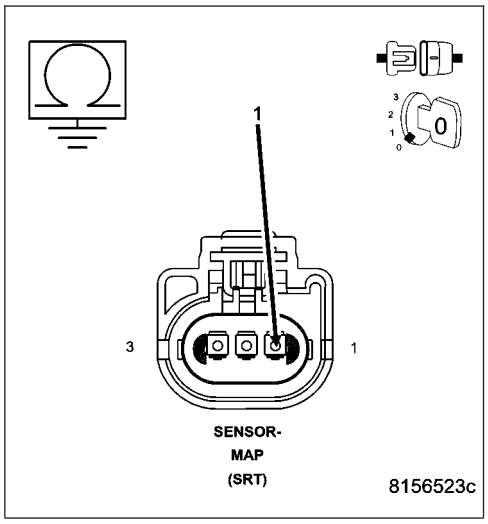
P1297-NO CHANGE IN MAP FROM START TO RUN (CONTINUED)

6. (K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K1) MAP Sensor Signal circuit at the MAP Sensor harness connector.



Is the resistance below 100 ohms?

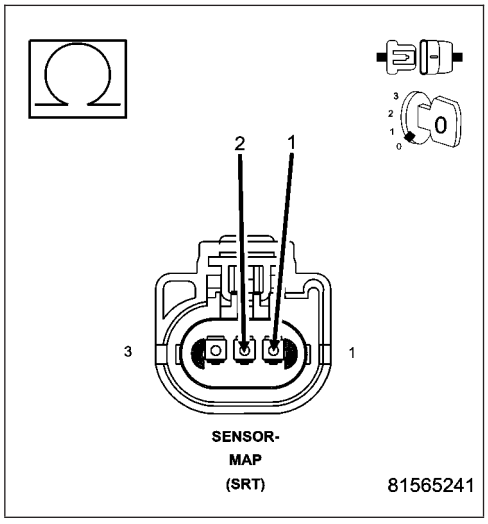
Yes >> Repair the short to ground in the (K1) MAP Sensor Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

7. (K1) MAP SENSOR SIGNAL CIRCUIT SHORTED TO (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (K1) MAP Sensor Signal circuit and the (K900) Sensor ground circuit at the MAP Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (K1) MAP Sensor Signal circuit.

Perform POWERTRAIN VERIFICATION TEST VER - 5.

No >> Go To 10

P1297-NO CHANGE IN MAP FROM START TO RUN (CONTINUED)

8. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

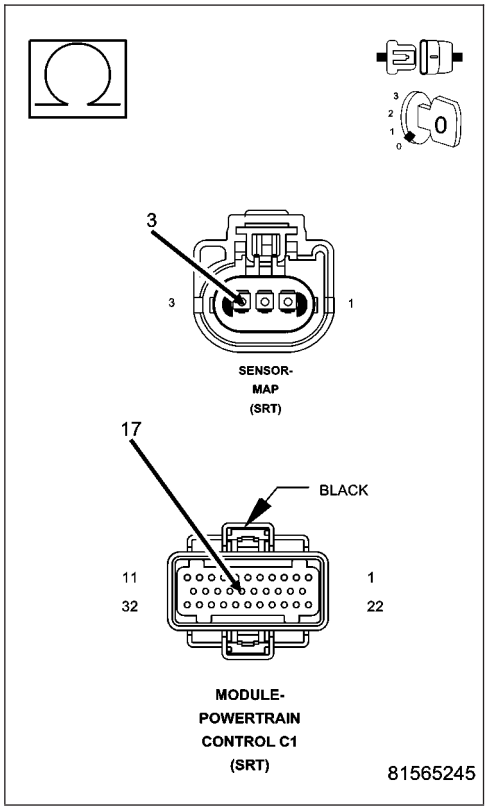
Disconnect the PCM harness connectors.

Measure the resistance of the (F855) 5-volt Supply circuit from the MAP Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



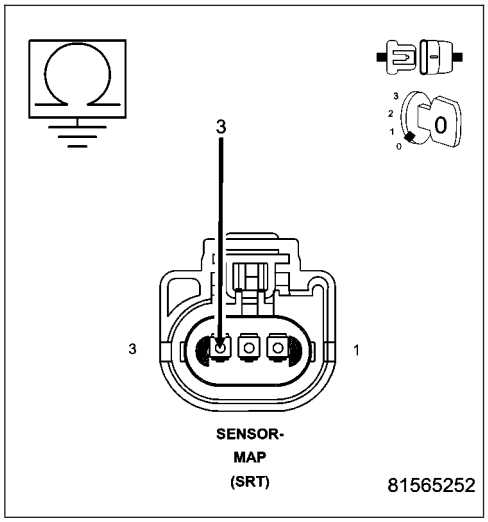
9. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (F855) 5-volt Supply circuit at the MAP Sensor harness connector.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10



P1297-NO CHANGE IN MAP FROM START TO RUN (CONTINUED)

10. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

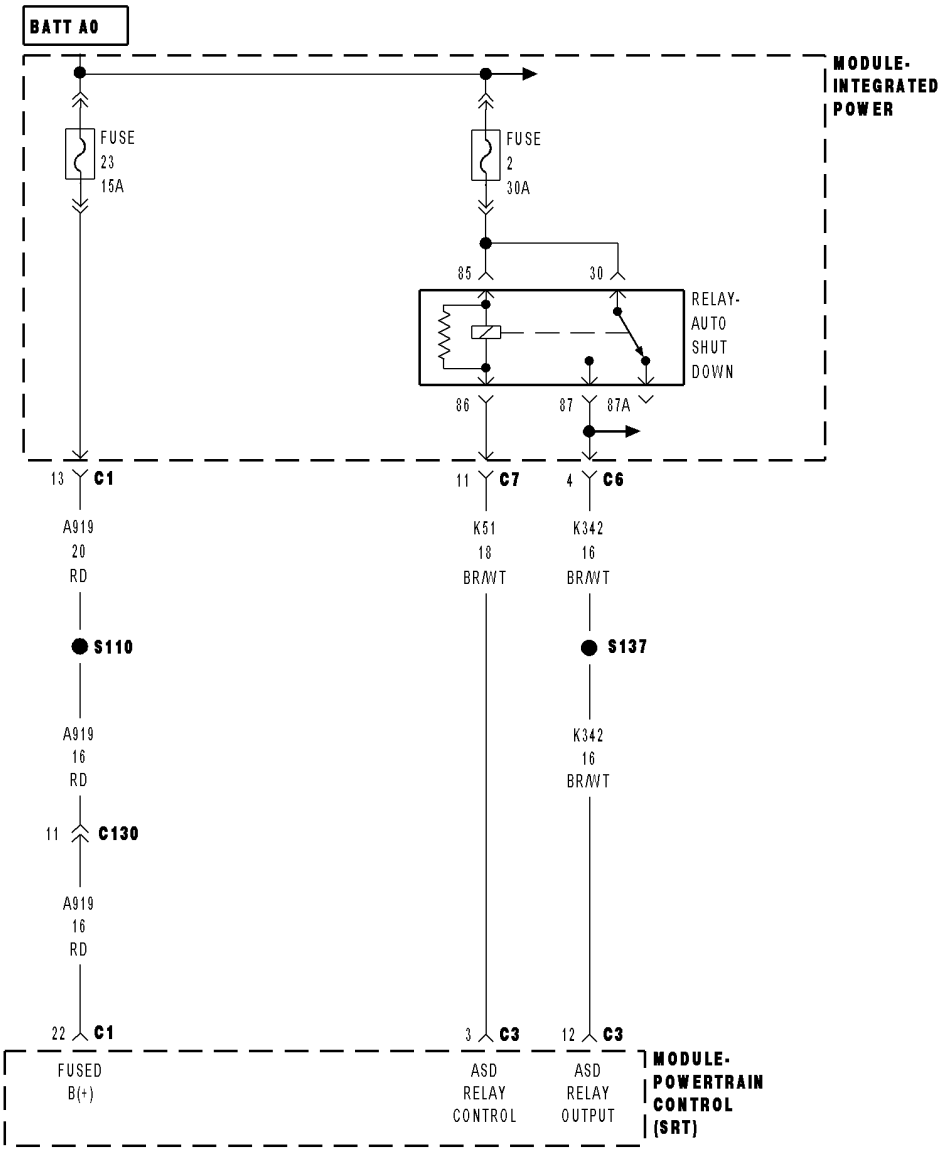
If there are no possible causes remaining, view repair.

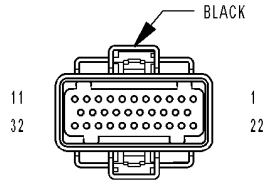
Repair

Replace and program the Powertrain Control Module per Service Information.

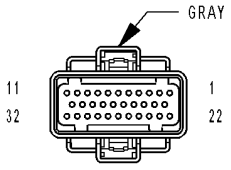
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT





MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)

8156584c

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition key on and battery voltage above 10.4 volts.
- **Set Condition:**
  An open or shorted condition is detected in the ASD Relay control circuit.

Possible Causes
GOOD TRIP EQUAL TO ZERO
ASD RELAY
(A14) FUSED B+ OUTPUT CIRCUITS
(K51) ASD RELAY CONTROL CIRCUIT OPEN
(K51) ASD RELAY CONTROL CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ASD RELAY

Turn the ignition off.

Remove the ASD Relay from the PDC.

Measure the resistance between the coil terminals of the ASD Relay.

Is the resistance between 50 and 80 ohms?

Yes >> Go To 3

No >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1388-AUTO SHUTDOWN RELAY CONTROL CIRCUIT (CONTINUED)

3. (A14) FUSED B+ OUTPUT CIRCUIT

Using a 12-volt test light connected to ground, probe the (A14) Fused B+ Output circuits in the ASD Relay connector.

Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open or short to ground in the (A14) Fused B+ Output circuits. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. (K51) ASD RELAY CONTROL CIRCUIT OPEN

Disconnect the PCM harness connectors.

Measure the resistance of the (K51) ASD Relay Control circuit from the ASD Relay cavity in the PDC to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (K51) ASD Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. (K51) ASD RELAY CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K51) ASD Relay Control circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K51) ASD Relay Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

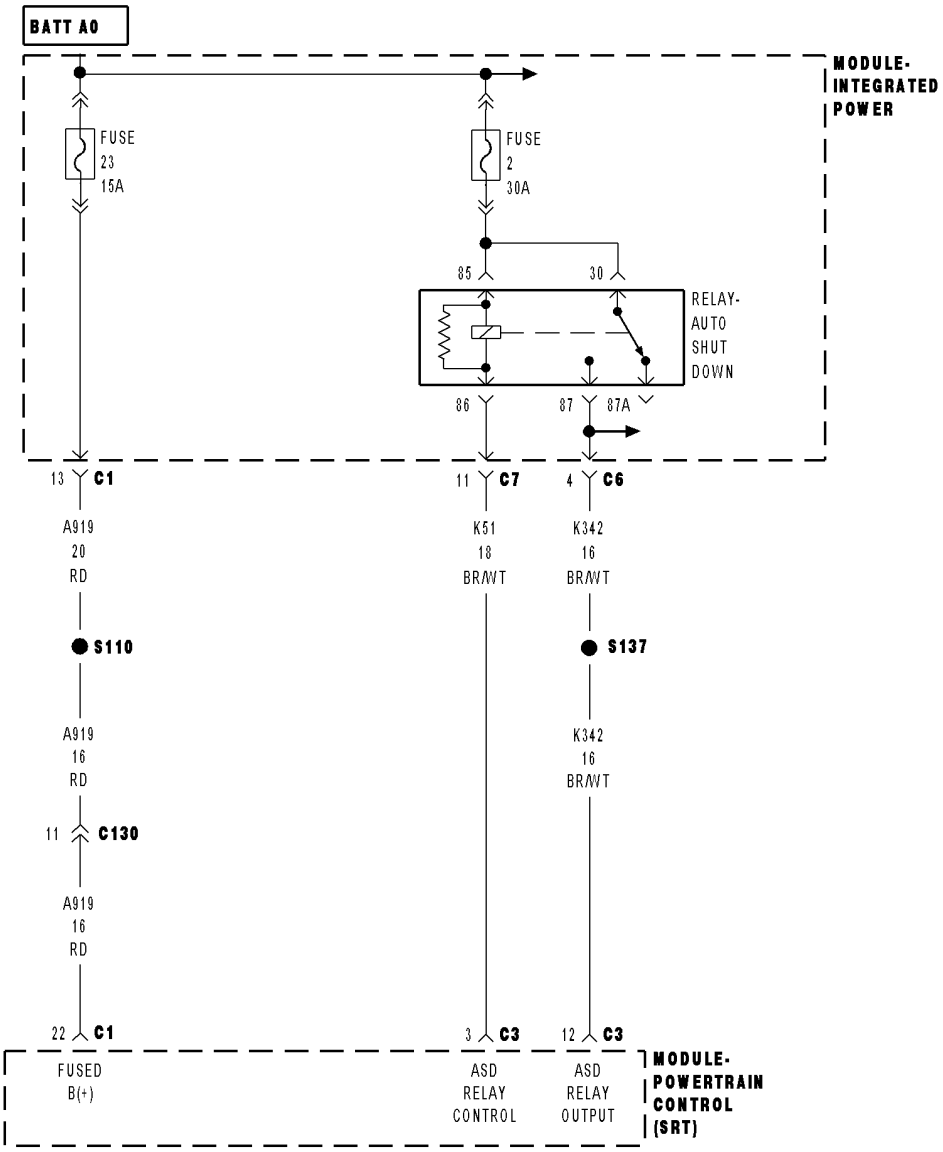
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

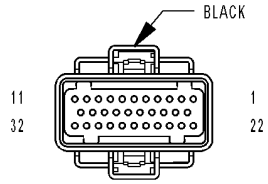
If there are no more possible causes remaining, view repair.

Repair

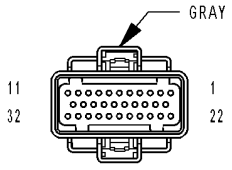
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM





MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)

8156584c

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With ignition key on, battery voltage above 10.4 volts, and engine RPM greater than 400.
- **Set Condition:**
  No voltage sensed at the PCM when the ASD Relay is energized.

Possible Causes
GOOD TRIP EQUAL TO ZERO
ASD RELAY
(A14) FUSED B+ CIRCUITS
(K342) ASD RELAY OUTPUT CIRCUIT OPEN
(K342) ASD OUTPUT CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. ENGINE STARTING STATUS

Attempt to start the engine.

Did the engine start?

Yes >> Go To 3

No >> Go To 4

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM (CONTINUED)

3. (K342) ASD OUTPUT CIRCUIT OPEN

Turn the ignition off.

Remove the ASD Relay from the PDC.

Disconnect the PCM harness connectors.

Measure the resistance of the (K342) ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K342) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. ASD RELAY

Install a substitute relay for the ASD Relay.

Attempt to start the vehicle.

Did the engine start?

Yes >> Replace the ASD Relay.
Perform POWERTRAIN VERIFICATION TEST VER - 2.

No >> Go To 5

---

5. (A14) FUSED B+ CIRCUITS

Turn the ignition off.

Remove the ASD Relay from the PDC.

Using a 12-volt test light, probe the (A14) Fused B+ circuits at the ASD Relay connector in the PDC.

Does the test light illuminate brightly?

Yes >> Go To 6

No >> Repair the open or short to ground in the (A14) Fused B+ circuits. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. (K342) ASD RELAY OUTPUT CIRCUIT OPEN

Disconnect the PCM harness connectors.

Measure the resistance of the (K342) ASD Relay Output circuit from the ASD Relay cavity in the PDC to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K342) ASD Relay Output circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1389-NO ASD RELAY OUTPUT VOLTAGE AT PCM (CONTINUED)

7. **PCM**

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

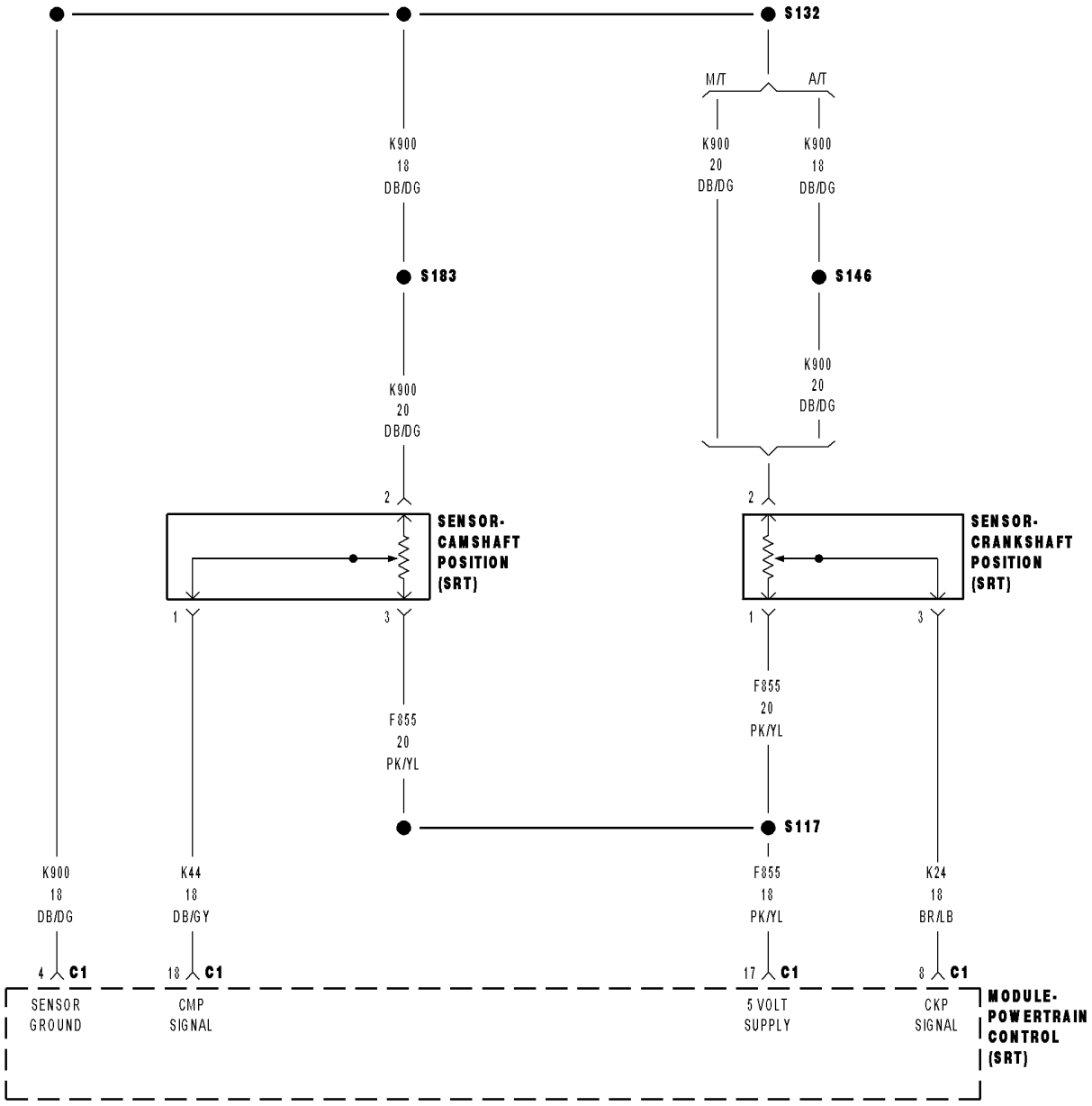
If there are no possible causes remaining, view repair.

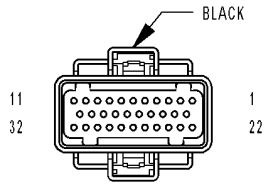
Repair

Replace and program the Powertrain Control Module per Service Information.

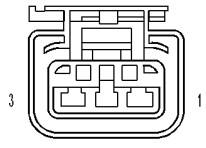
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1391-INTERMITTENT LOSS OF CMP OR CKP

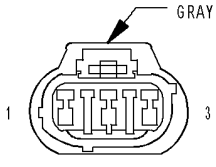




MODULE-
POWERTRAIN
CONTROL C1
(SRT)



SENSOR-
CRANKSHAFT
POSITION
(5.7L/SRT)



SENSOR-
CAMSHAFT
POSITION
(GAS)

81566736

P1391-INTERMITTENT LOSS OF CMP OR CKP (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Engine running or cranking.
- **Set Condition:**
  When the failure counter reaches 20 for 2 consecutive trips.

Possible Causes
GOOD TRIP EQUAL TO ZERO
CMP WIRE HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
CKP WIRE HARNESS INSPECTION
TONE WHEEL/PULSE RING INSPECTION
CHECKING INTERMITTENT CKP SIGNAL WITH LAB SCOPE
CAMSHAFT POSITION SENSOR
CRANKSHAFT POSITION SENSOR

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hand near the pulleys, belts, or fan. Do not wear loose clothing.

With the scan tool, read DTCs and record the related Freeze Frame data.

Start the engine and run until operating temp is reached. (Closed Loop)

If the DTC does not return right away it may be necessary to test drive the vehicle to duplicate the DTC.

Does the P1391 return?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. INTERMITTENT CAM POSITION SENSOR SIGNAL

Turn the ignition off.

With the scan tool as a Dual Channel Lab Scope and Miller special tool #6801, backprobe the (K44) CMP Signal circuit in the CMP harness connector and PCM harness connector.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hand near the pulleys, belts, or fan. Do not wear loose clothing.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 3

No >> Go To 6

P1391-INTERMITTENT LOSS OF CMP OR CKP (CONTINUED)

3. CMP WIRE HARNESS INSPECTION

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Make sure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to specification.

Refer to any TSB that may apply.

Were any of the above conditions present?

Yes >> Repair as necessary
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. TONE WHEEL/PULSE RING INSPECTION

Turn the ignition off.

Remove the Camshaft Position Sensor.

Inspect the Tone Wheel/Pulse Ring for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Pulse Ring as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. CAMSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Camshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. CHECKING CKP SIGNAL WITH THE SCAN TOOL LAB

Turn the ignition off.

With the scan tool as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the CKP harness connector and PCM harness connector.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hand near the pulleys, belts, or fan. Do not wear loose clothing.

Start the engine.

Observe the lab scope screen.

Are there any irregular or missing signals?

Yes >> Go To 7

No >> Go To 10

P1391-INTERMITTENT LOSS OF CMP OR CKP (CONTINUED)

7. CKP WIRE HARNESS INSPECTION

Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

Ensure the Crankshaft Position Sensor and the Camshaft Position Sensor are properly installed and the mounting bolt(s) are torqued to specification.

Refer to any TSB that may apply.

Were any of the above conditions present?

Yes >> Repair as necessary
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. TONE WHEEL/FLEX PLATE INSPECTION

Remove the Crankshaft Position Sensor.

Inspect the Tone Wheel/Flex Plate slots for damage, foreign material, or excessive movement.

Were any problems found?

Yes >> Repair or replace the Tone Wheel/Flex Plate as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. CRANKSHAFT POSITION SENSOR

If there are no possible causes remaining, view repair.

Repair

Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

10. CHECKING CKP SIGNAL WITH LAB SCOPE

NOTE: The conditions that set this DTC are not present at this time. The following test may help in identifying the intermittent condition.

Turn the ignition off.

With the scan tool as a Dual Channel Lab Scope and the Miller special tool #6801, backprobe the (K24) CKP Signal circuit in the PCM harness connector and CKP harness connector.

WARNING: When the engine is operating, do not stand in a direct line with the fan. Do not put your hand near the pulleys, belts, or fan. Do not wear loose clothing.

Start the engine.

Carefully wiggle the related wire harness and gently tap on the CKP sensor.

Compare the Channel 1 reading to the Channel 2 reading on the lab scope screen.

Both of the readings should be the same.

Were any of the above conditions present?

Yes >> Repair the wiring or connector concern.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Under closed throttle decel and Fuel Pulse Width equal to zero for 30 seconds.
- **Set Condition:**
  One of the CKP sensor target windows has more than 2.86% variance from the reference window.

Possible Causes
ADAPTIVE NUMERATOR RELEARN
CMP SENSOR CONNECTOR/WIRING
CKP SENSOR CONNECTOR/WIRING
DAMAGED TONE WHEEL/FLEX PLATE (CRANKSHAFT)
CRANKSHAFT POSITION SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. ADAPTIVE NUMERATOR RELEARN

NOTE: Check for any TSB's that may apply to this symptom.
Read and record the Freeze Frame Data. Use this information to help you duplicate the conditions that set the DTC. Pay particular attention to the DTC set conditions, such as, VSS, MAP, ECT, and Load.

Ignition on, engine not running.

With the scan tool in the miscellaneous menu, choose Clear PCM (battery disconnect) to reset the PCM.

With the scan tool, choose the Misfire Pretest screen.

Road test the vehicle and re-learn the adaptive numerator.

The adaptive numerator is learned when the Adaptive Numerator Done Learning line on the Misfire screen changes to Yes.

Did the adaptive numerator re-learn?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT (CONTINUED)

2. CMP CONNECTOR/HARNESS INSPECTION

Turn ignition off.

NOTE: Visually inspect the related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

NOTE: Make sure the Camshaft Position Sensor is tight.

NOTE: Refer to any technical service bulletins that may apply.

Were any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. CKP CONNECTOR/HARNESS INSPECTION

NOTE: Visually inspect the Crankshaft Position Sensor and related wire harness connectors. Look for broken, bent, pushed out, or corroded terminals.

NOTE: Visually inspect the related wire harness. Look for any chafed, pierced, pinched, or partially broken wires.

NOTE: Verify the Crank Position Sensor is properly installed.

Were any problems found?

Yes >> Repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. TONE WHEEL/FLEX PLATE INSPECTION

Disconnect and remove the Crankshaft Position Sensor.

Inspect the tone wheel/flexplate slots for damage, foreign material, or excessive movement.

Is the tone wheel/flexplate free from defects?

Yes >> Go To 5

No >> Repair/replace tone wheel/flex plate as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1398-MIS-FIRE ADAPTIVE NUMERATOR AT LIMIT (CONTINUED)

5. CRANKSHAFT POSITION SENSOR I

With the scan tool lab scope probe and the Miller special tool #6801, back probe the (K24) CKP Signal circuit in the PCM harness connector.

WARNING: WARNING: WHEN THE ENGINE IS OPERATING, DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING..
Start the engine and observe the lab scope screen for any erratic CKP Sensor pulses.

NOTE: Turn the ignition off before continuing.

Were any erratic Crank Position signals detected.

Yes. >> Replace the Crankshaft Position Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No. >> Go To 6

---

6. PCM

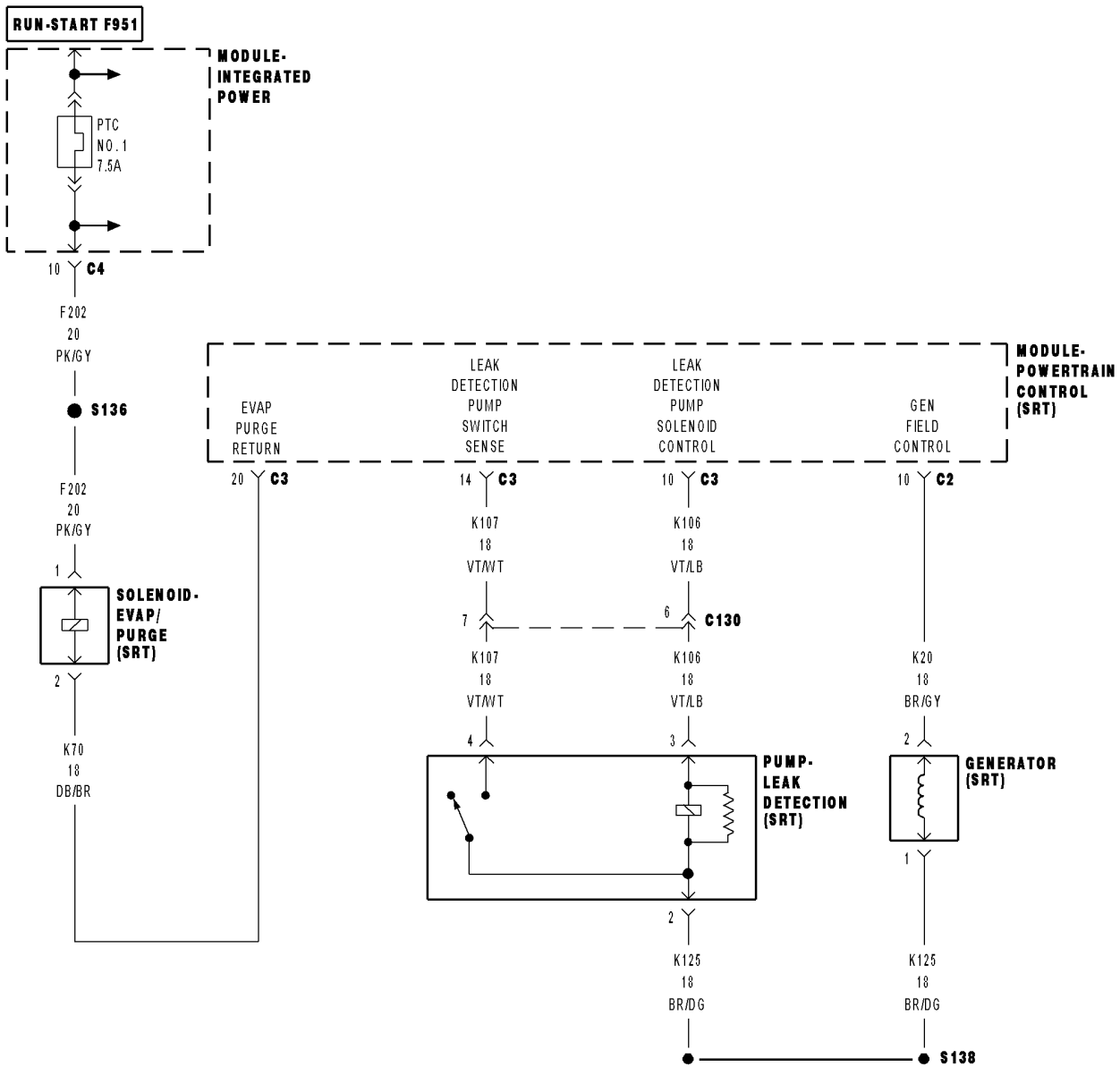
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

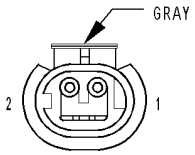
If there are no possible causes remaining, view repair.

Repair

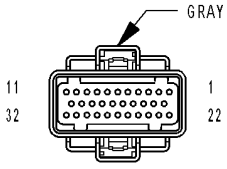
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND

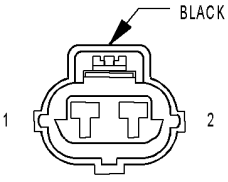




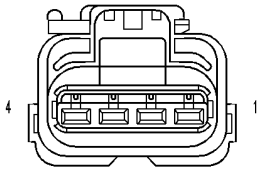
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after a cold start, with battery/ambient temperature between 40 deg. F and 90 Deg. F and coolant temperature within 10 Deg. F of battery/ambient.
- **Set Condition:**
  LDP test must pass first. If the PCM suspects a pinched hose it will not set a fault until it runs the EVAP purge flow monitor. If the purge monitor does not pass then the pinched hose fault will be set.

Possible Causes
GOOD TRIP EQUAL TO ZERO
EVAP CANISTER OBSTRUCTED
OBSTRUCTION IN HOSE/TUBE BETWEEN EVAP CANISTER AND PURGE SOLENOID
LDP PRESSURE HOSE OBSTRUCTED
LEAK DETECTION PUMP

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Check for any related TSB's.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. CHECKING FOR OBSTRUCTED EVAP CANISTER

Pressurize the EVAP System. On Miller Tool #8404, hold down the remote smoke/air start button and monitor the gauge.

When the flow meter gauge on the EELD reads 0 LPM, the EVAP system is completely pressurized.

Disconnect the LDP Pressure hose at the EVAP Canister. The LDP Pressure hose is the hose that connects the Evap Canister to the Leak Detection Pump.

Did the pressure drop when the hose was disconnected?

Yes >> Go To 3

No >> Replace the EVAP Canister.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1486-EVAP LEAK MONITOR PINCHED HOSE FOUND (CONTINUED)

3. CHECKING FOR OBSTRUCTION - EVAP CANISTER TO PURGE SOLENOID

NOTE: Connect all previously disconnected hose(s).

Re-pressurize the EVAP System. On Miller Tool #8404, hold down the smoke/air start button and monitor the gauge. When the flow meter gauge on the EELD reads 0 LPM, the EVAP system is completely pressurized.

Disconnect the EVAP hoses at the Purge Solenoid.

Did the pressure drop when the hose was disconnected?

Yes >> Go To 4

No >> Repair or replace hose/tube as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. LDP PRESSURE HOSE INSPECTION

Disconnect and remove the LDP pressure hose. The LDP pressure hose is the hose that connects the EVAP Canister to the Leak Detection Pump.

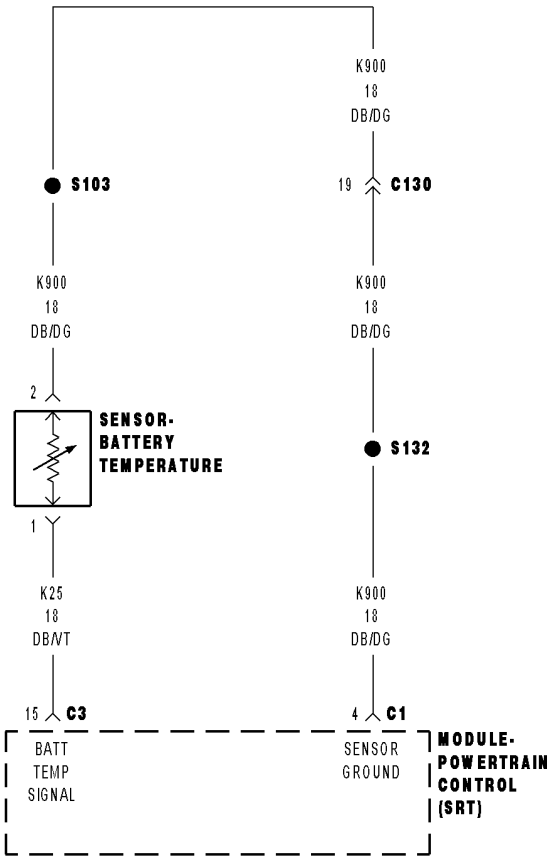
Inspect the LDP pressure hose for any obstructions or physical damage.

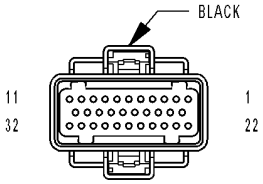
Is the LDP pressure hose free from defects?

Yes >> Replace the Leak Detection Pump.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

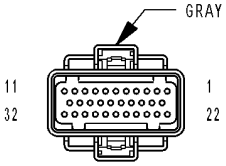
No >> Repair/replace hose as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1492-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH

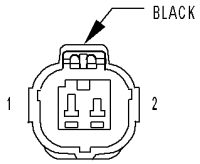




MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



SENSOR-
BATTERY
TEMPERATURE

81566721

P1492-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on.
- **Set Condition:**
  The PCM senses the voltage from the Battery Temperature Sensor above 4.9 volts for 3 seconds.

Possible Causes
BATTERY TEMP SENSOR VOLTAGE ABOVE 4.8 VOLTS
BATTERY TEMPERATURE SENSOR
(K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE
(K25) BATTERY TEMP SIGNAL CIRCUIT OPEN
(K900) SENSOR GROUND CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. BATTERY TEMP SENSOR VOLTAGE ABOVE 4.8 VOLTS

Ignition on, engine not running.

Record all DTCs and the related Freeze Frame data.

With the scan tool, monitor the Battery Temperature Sensor voltage.

Is the voltage above 4.8 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. BATTERY TEMPERATURE SENSOR

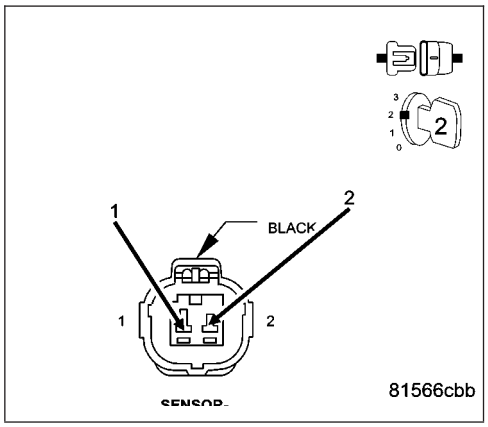
Turn the ignition off.

Disconnect the Battery Temp Sensor harness connector.

Ignition on, engine not running.

With the scan tool in sensors, read the Batt Temp Sensor voltage value.

Connect a jumper wire between the (K25) Batt Temp Signal circuit and the (K900) Sensor ground circuit at the Battery Temp Sensor connector.



NOTE: Remove the jumper wire before continuing.

Did the Battery Temp Sensor voltage change from greater than 4.5 volts to less than 1.0 volt?

Yes >> Replace the Battery Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

P1492-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

3. (K25) BATT TEMP SIGNAL CIRCUIT SHORTED TO VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

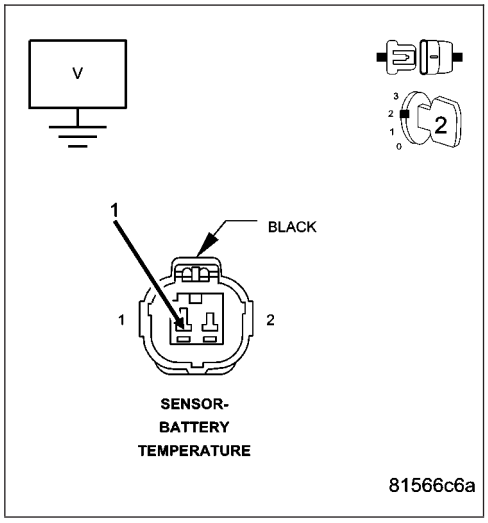
Ignition on, engine not running.

Measure the voltage on the (K25) Battery Temp Signal circuit at the Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to voltage in the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



4. (K25) BATT TEMP SIGNAL CIRCUIT OPEN

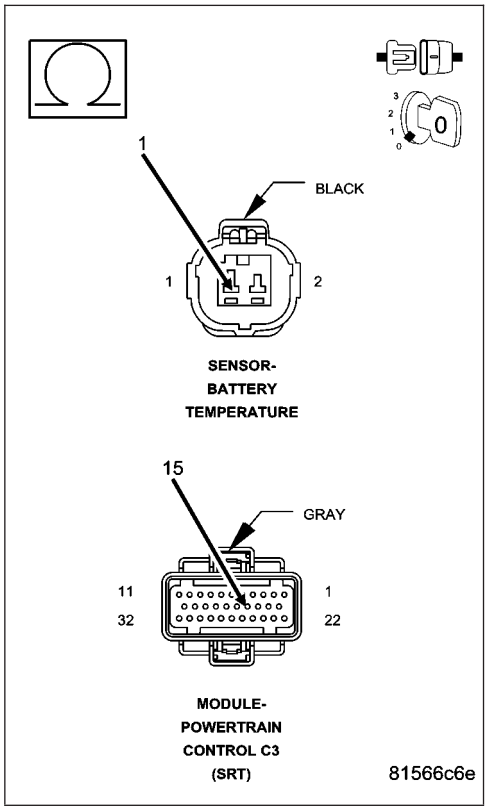
Turn the ignition off.

Measure the resistance of the (K25) Battery Temp Signal circuit from the Battery Temp Sensor harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

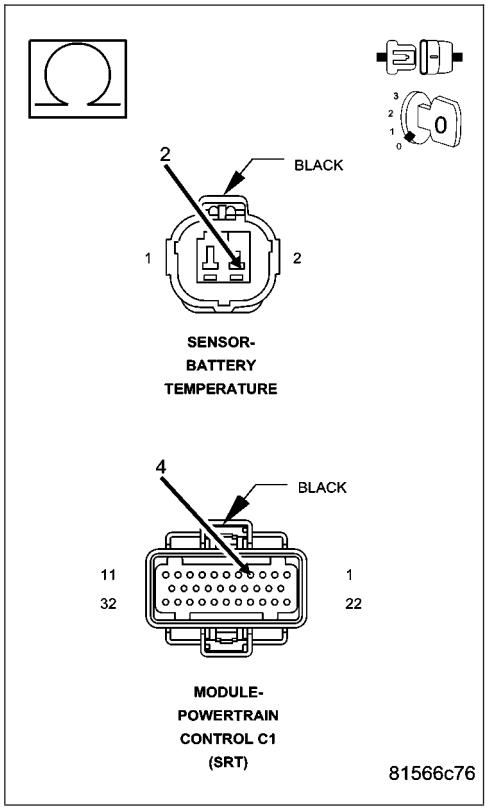
No >> Repair the open in the (K25) Batt Temp Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1492-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

5. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance in the (K900) Sensor ground circuit from the PCM harness connector to the Sensor connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 6

No >> Repair the open in the (K900) Sensor ground circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

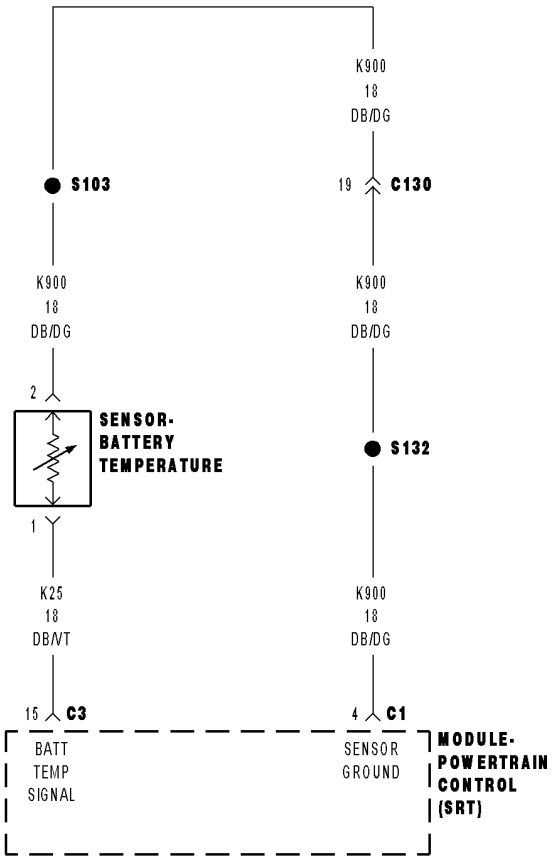
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

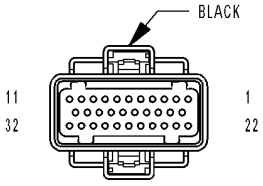
If there are no possible causes remaining, view repair.

Repair

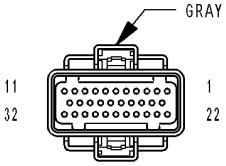
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1493-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW

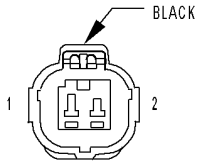




MODULE-
POWERTRAIN
CONTROL C1
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



SENSOR-
BATTERY
TEMPERATURE

81566721

P1493-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The PCM senses the voltage from the Battery Temperature Sensor below 0.5 of a volt for 3 seconds.

Possible Causes
BATTERY TEMP SENSOR VOLTAGE BELOW 0.5 OF A VOLT
BATTERY TEMPERATURE SENSOR
(K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO GROUND
(K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. BATTERY TEMP SENSOR VOLTAGE BELOW 0.5 OF A VOLT

Ignition on, engine not running.
Record all DTCs and the related Freeze Frame data.
With scan tool, monitor the Ambient/Battery Temperature Sensor voltage.

Is the voltage below 0.5 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. BATTERY TEMPERATURE SENSOR

Ignition on, engine not running.
With the scan tool in sensors, read the Battery Temp Sensor voltage.
Disconnect the Battery Temp Sensor harness connector.

Did the Battery Temperature Sensor voltage change from below 1.0 volt to above 4.5 volts?

Yes >> Replace the Battery Temperature Sensor.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

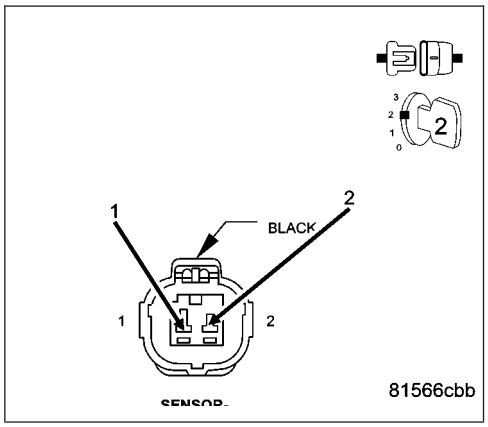
P1493-AMBIENT/BATTERY TEMPERATURE SENSOR VOLTAGE TOO LOW (CONTINUED)

3. (K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (K25) Battery Temp Signal circuit at the Battery Temp Sensor harness connector.



Is the resistance below 100 ohms?

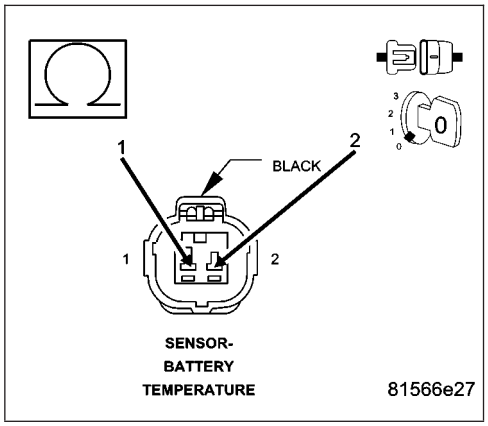
Yes >> Repair the short to ground in the (K25) Batt Temp Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

4. (K25) BATTERY TEMP SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND

Measure the resistance between the (K25) Battery Temp Signal circuit and the (K900) Sensor ground circuit at the Battery Temp Sensor harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground circuit and the (K25) Batt Temp Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

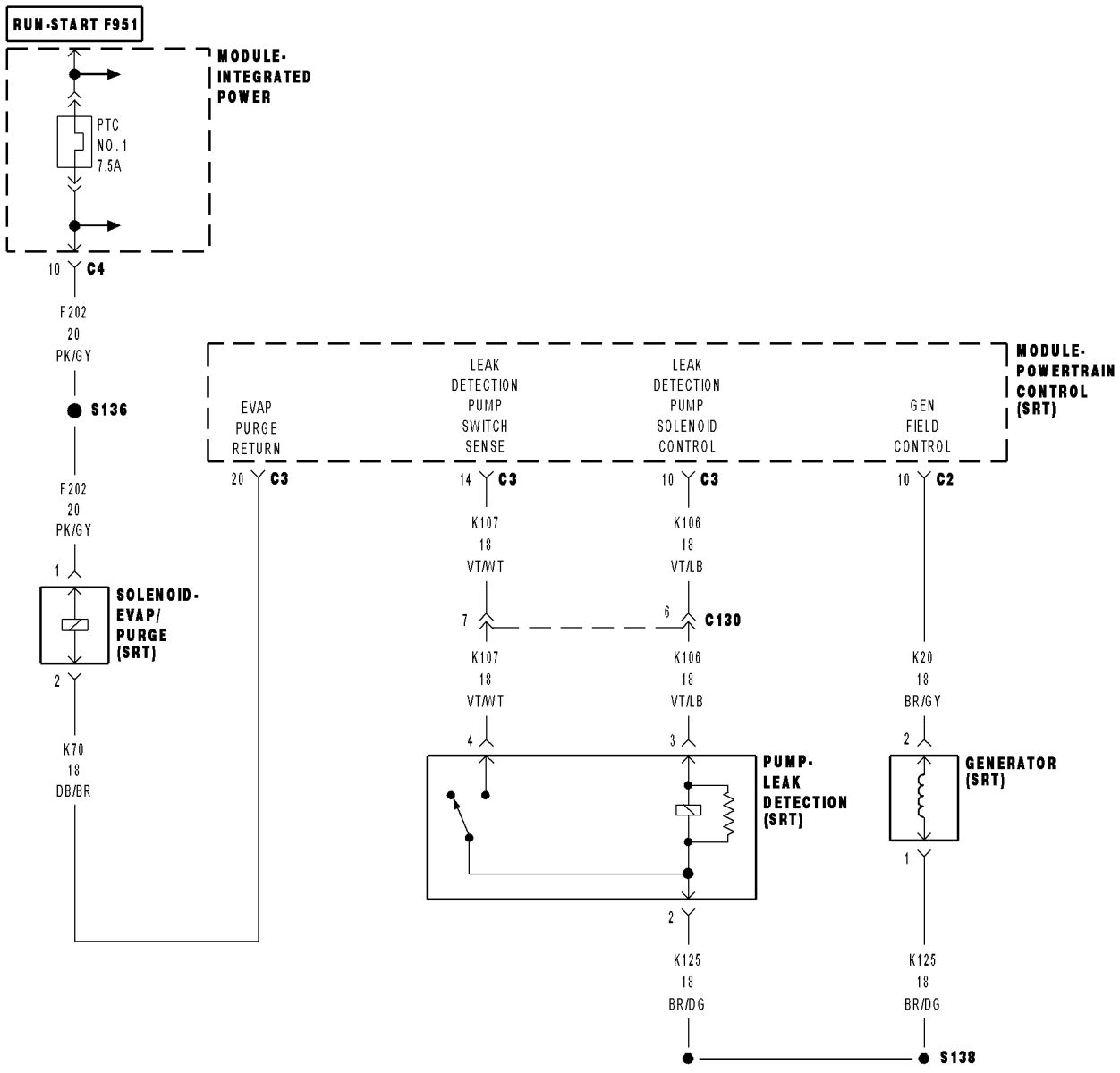
If there are no possible causes remaining, view repair.

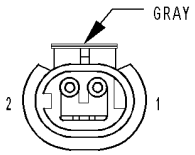
Repair

Replace and program the Powertrain Control Module per Service Information.

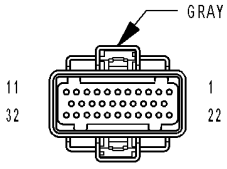
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1494-LEAK DETECTION PUMP SWITCH OR MECHANICAL FAULT

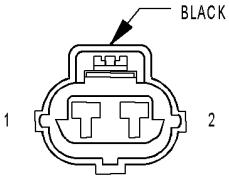




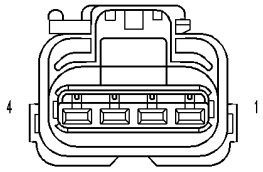
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P1494-LEAK DETECTION PUMP SWITCH OR MECHANICAL FAULT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Immediately after a cold start, with battery/ambient temperature between 40 Deg. F and 90 Deg. F and coolant temperature within 10 Deg. F of battery/ambient.
- **Set Condition:**
  The state of the switch does not change when the solenoid is energized.

Possible Causes
GOOD TRIP EQUAL TO ZERO
LDP VACUUM SUPPLY
LEAK DETECTION PUMP
(K107) LDP SWITCH SENSE CIRCUIT OPEN
(K107) LDP SWITCH SENSE CIRCUIT SHORTED TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Check for any related TSBs.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. LDP VACUUM SUPPLY

Turn the ignition off.

Disconnect the vacuum supply hose at the Leak Detection Pump.

Connect a vacuum gauge to the disconnected vacuum supply hose at the Leak Detection Pump.

Start the engine and read the vacuum gauge.

Does the vacuum gauge read at least 13″ Hg?

Yes >> Go To 3

No >> Repair leak or obstruction in vacuum hose as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1494-LEAK DETECTION PUMP SWITCH OR MECHANICAL FAULT (CONTINUED)

3. LEAK DETECTION PUMP

Turn the ignition off.

Connect the vacuum supply hose at the LDP.

Disconnect the Leak Detection Pump electrical harness connector.

Start the engine.

With the scan tool in Inputs/Outputs, read the Leak Detect Pump Switch state.

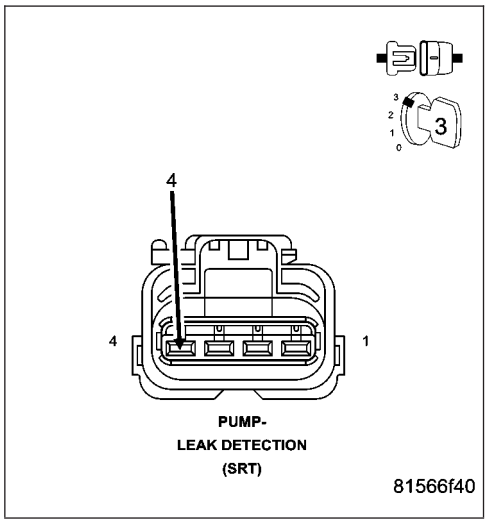
Connect a jumper wire between 12-volts and the (K107) LDP Switch Signal circuit.

NOTE: Remove the jumper wire before continuing.

Did the Leak Detect Pump Sw state change when the jumper was connected?

Yes >> Replace the Leak Detection Pump.
Perform POWERTRAIN VERIFICATION TEST VER - 6.

No >> Go To 4



4. (K107) LDP SWITCH SENSE CIRCUIT OPEN

Turn the ignition off.

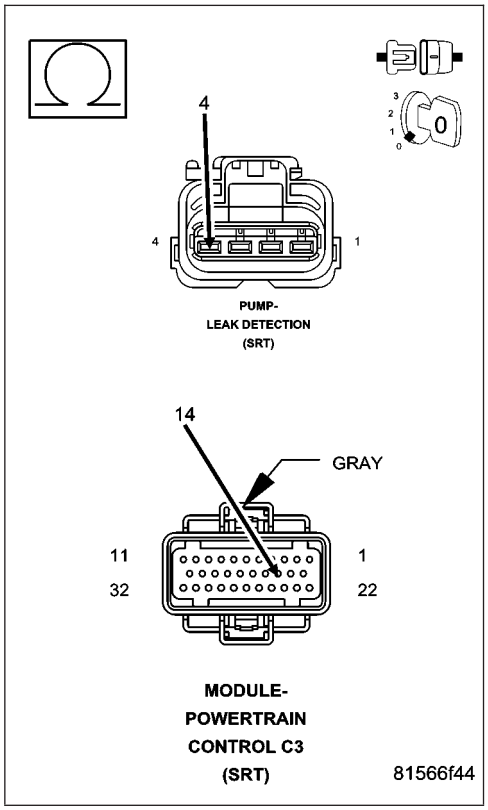
Disconnect the PCM harness connectors.

Measure the resistance of the (K107) LDP Switch Sense circuit from the PCM harness connector to LDP harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

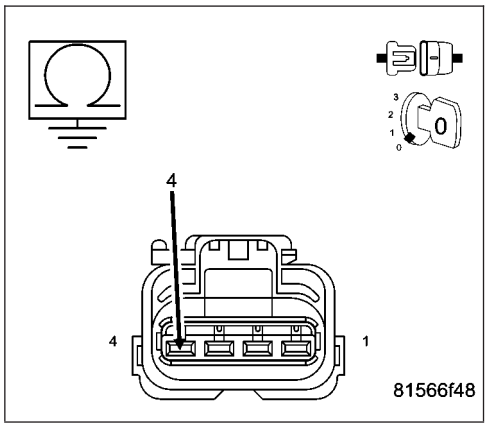
No >> Repair the open in the (K107) Leak Detection Pump Switch Sense circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1494-LEAK DETECTION PUMP SWITCH OR MECHANICAL FAULT (CONTINUED)

5. (K107) LDP SWITCH SENSE CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K107) LDP Switch Sense circuit.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K107) LDP Switch Sense circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

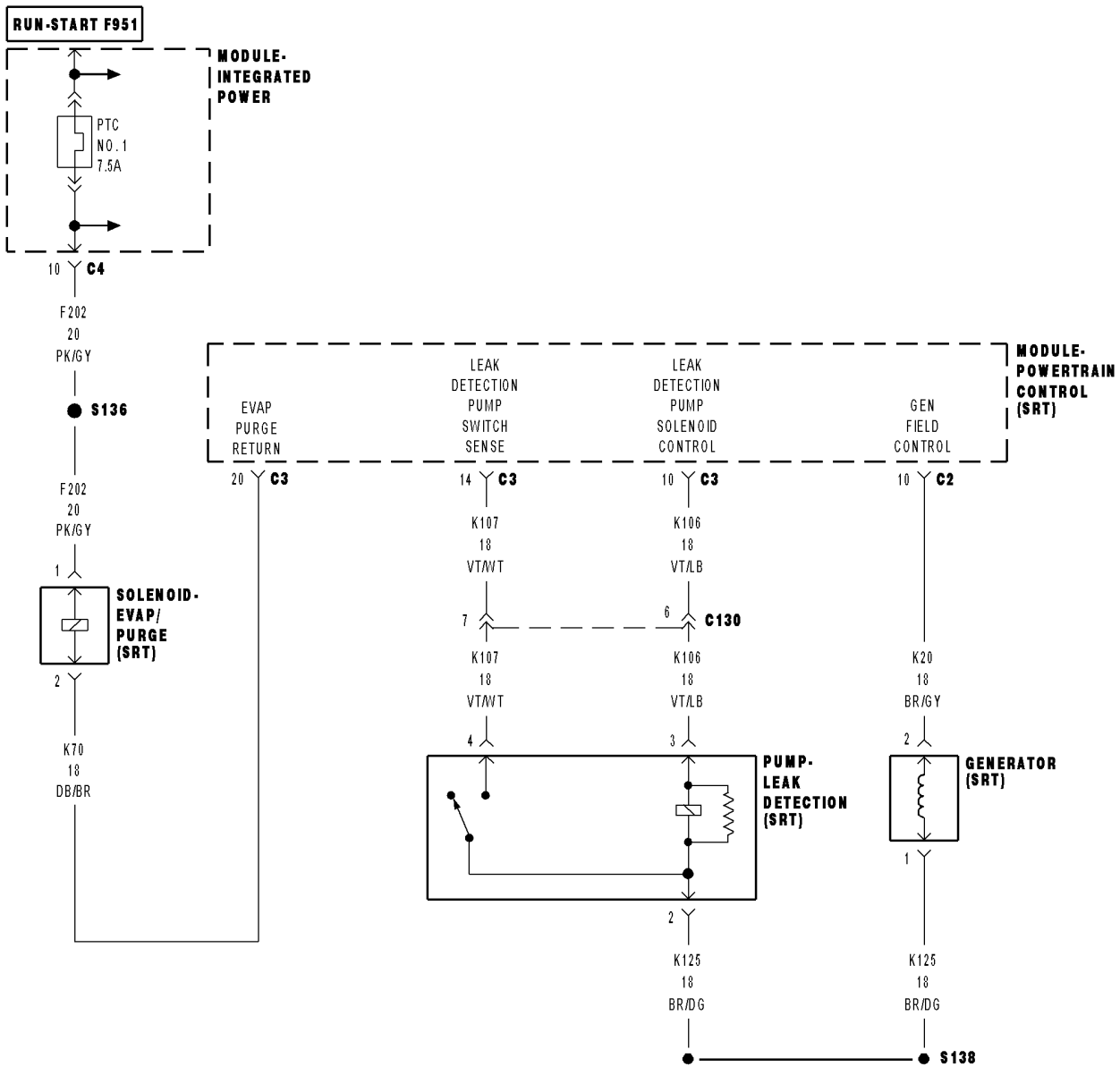
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

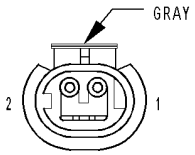
If there are no possible causes remaining, view repair.

Repair

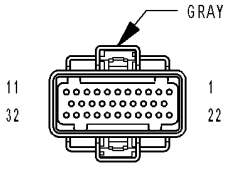
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT

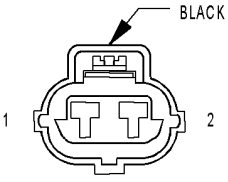




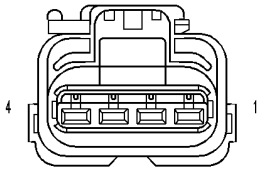
SOLENOID-
EVAP/
PURGE
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)



PUMP-
LEAK DETECTION
(SRT)

8155e655

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Continuously when the ignition is on and battery voltage is greater than 10.4 volts.
- **Set Condition:**
  The state of the solenoid circuit does not match the PCM's desired state.

Possible Causes
GOOD TRIP EQUAL TO ZERO
(K125) GENERATOR SOURCE CIRCUIT OPEN
(K107) LDP SWITCH SIGNAL CIRCUIT OPEN
(K107) LDP SWITCH SIGNAL CIRCUIT SHORTED TO GROUND
(K106) LEAK DETECTION PUMP SOLENOID CONTROL CIRCUIT OPEN
(K106) LDP SOLENOID CONTROL CIRCUIT SHORTED TO GROUND
LEAK DETECTION PUMP
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. GOOD TRIP EQUAL TO ZERO

Check for any related TSBs.
Ignition on, engine not running.
With the scan tool, read DTCs and record the related Freeze Frame data.

Is the Good Trip Counter displayed and equal to zero?

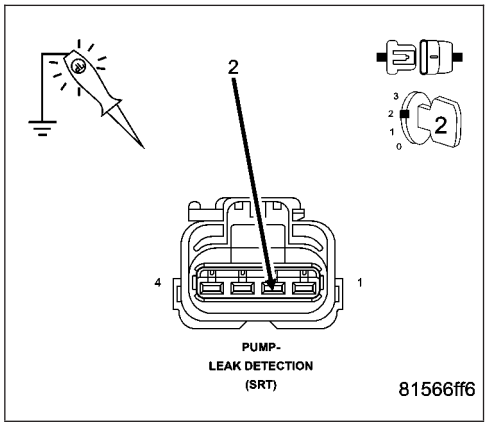
Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. (K125) GENERATOR SOURCE CIRCUIT OPEN

Turn the ignition off.
Disconnect the Leak Detection Pump electrical harness connector.
Ignition on, engine not running.
With the scan tool, actuate the Leak Detection Pump.
Using a 12-volt test light connected to ground, check the (K125) Generator Source circuit at the LDP connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open in the (K125) Generator Source circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT (CONTINUED)

3. LDP SOLENOID CONTROL OPERATION

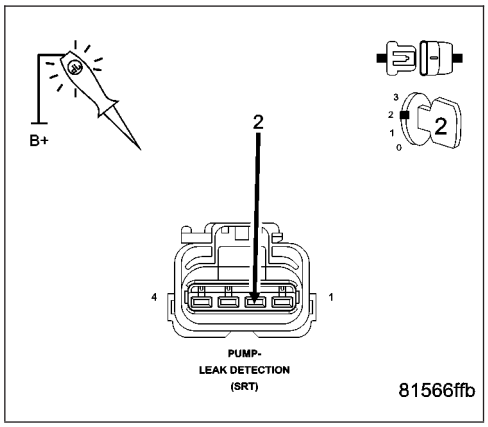
Turn the ignition off.

Connect a 12-volt test light to a good 12-volt source.

Ignition on, engine not running.

With the scan tool, actuate the Leak Detection Pump.

Probe the (K106) LDP Solenoid Control circuit with the test light while the Pump is actuating.



Does the test light blink?

Yes >> Go To 4

No >> Go To 7

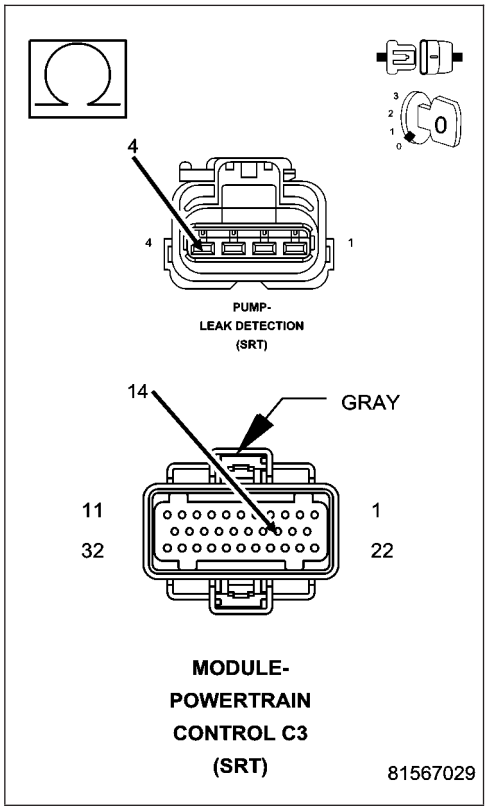
---

4. (K107) LDP SWITCH SIGNAL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K107) LDP Switch Signal circuit from the PCM harness connector to LDP harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 5

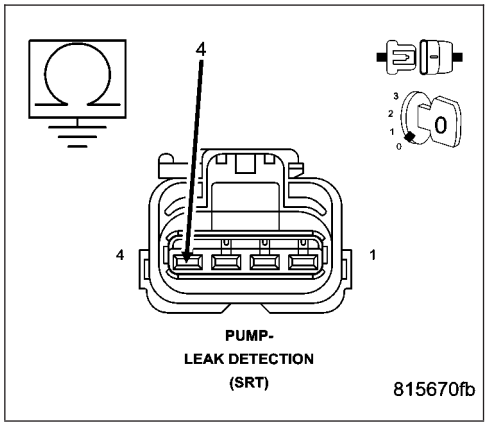
No >> Repair the open in the (K107) Leak Detection Pump Switch Signal circuit.

Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT (CONTINUED)

5. (K107) LDP SWITCH SIGNAL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K107) LDP Switch Signal circuit at the LDP harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K107) LDP Switch Signal circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 6

---

6. LEAK DETECTION PUMP

If there are no possible causes remaining, view repair.

Repair

Replace the Leak Detection Pump.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

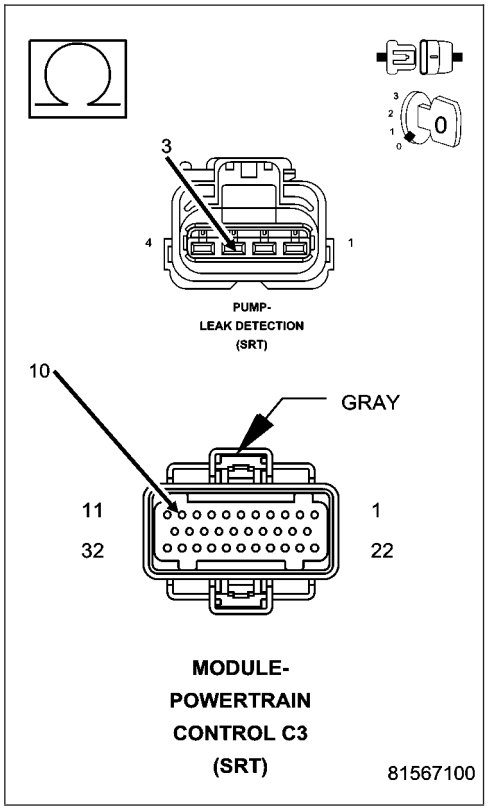
---

7. (K106) LEAK DETECTION PUMP SOLENOID CONTROL CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (K106) LDP Solenoid Control circuit from the PCM harness connector to the LDP harness connector.



Is the resistance below 5.0 ohms?

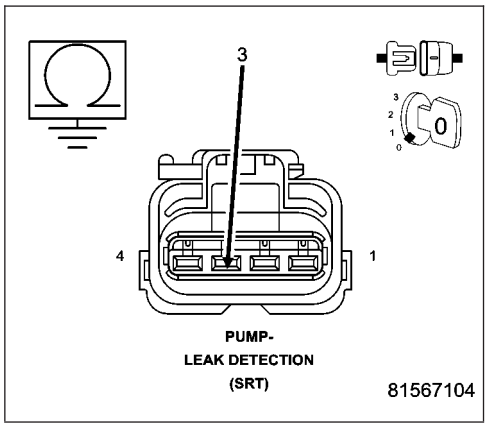
Yes >> Go To 8

No >> Repair the open in the (K106) Leak Detection Pump Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1495-LEAK DETECTION PUMP SOLENOID CIRCUIT (CONTINUED)

8. (K106) LDP SOLENOID CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (K106) LDP Solenoid Control circuit.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K106) LDP Solenoid Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

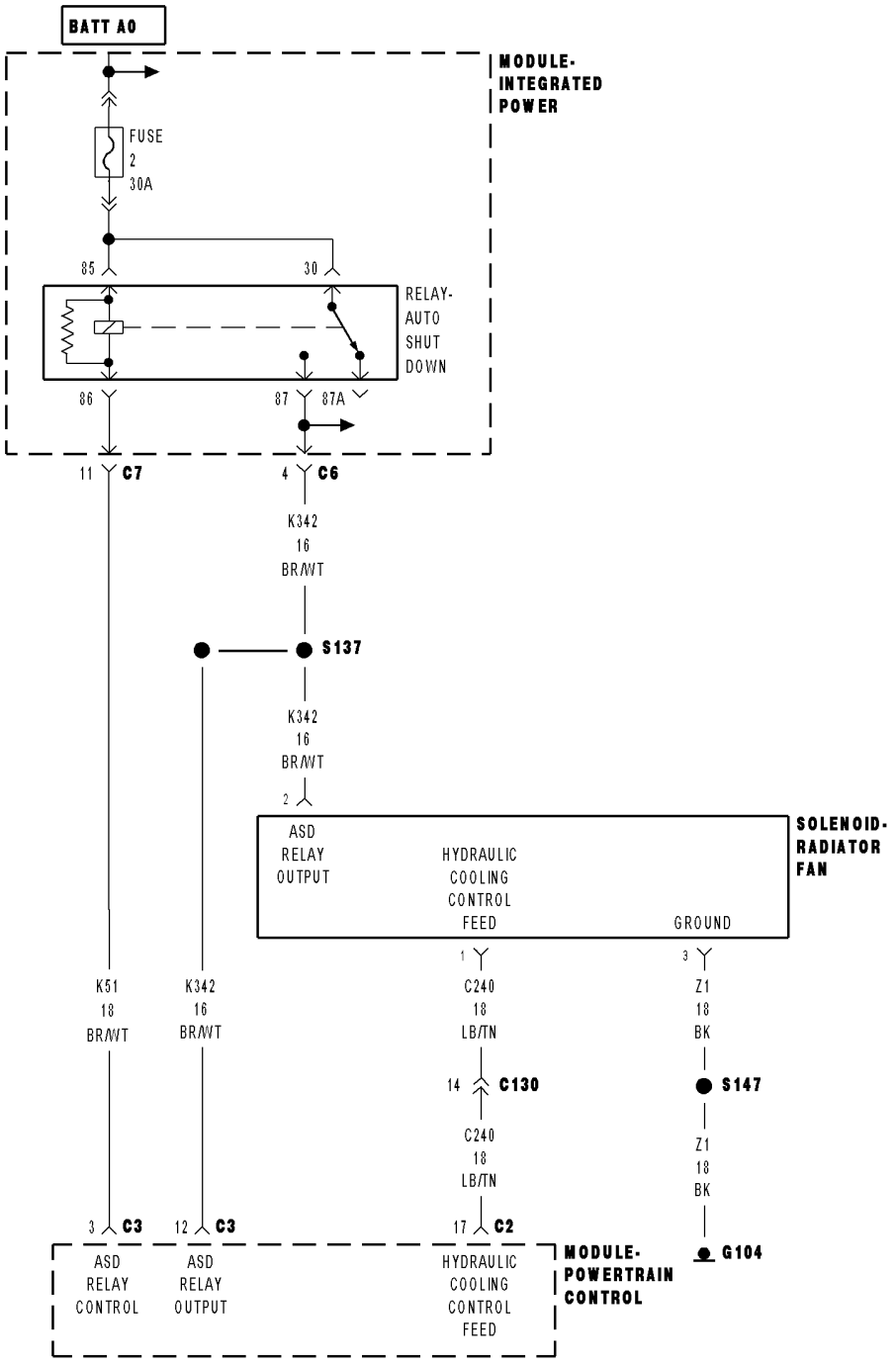
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

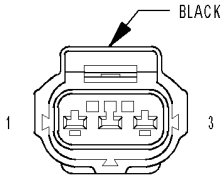
If there are no possible causes remaining, view repair.

Repair

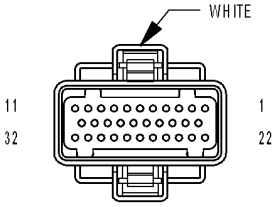
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1499-HYDRAULIC FAN SOLENOID CIRCUIT

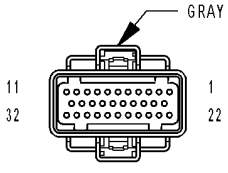




SOLENOID-
RADIATOR FAN
(SRT)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)

8156673d

P1499-HYDRAULIC FAN SOLENOID CIRCUIT (CONTINUED)

For the Engine circuit diagram (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/ENGINE CONTROL MODULE - SCHEMATIC - ELECTRICAL)

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and engine running.
- **Set Condition:**
  An open or shorted condition in the Hydraulic Fan Solenoid control circuit is detected by the Powertrain Control Module.

Possible Causes
RADIATOR FAN INOP
(K342) FUSED ASD RELAY OUTPUT CIRCUIT
(C240) COOLING FAN CONTROL CIRCUIT OPEN
(C240) COOLING FAN CONTROL CIRCUIT SHORTED TO GROUND
HYDRAULIC FAN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

1. RADIATOR FAN INOP

Ignition on, engine not running.

With the scan tool, perform the Hydraulic Fan Solenoid Test found under Engine Test and Systems Test.

Does the Radiator Fan operate properly?

Yes >> Refer to the INTERMITTENT CONDITION Symptom (Diagnostic Procedure).
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

2. (K342) FUSED ASD RELAY OUTPUT CIRCUIT

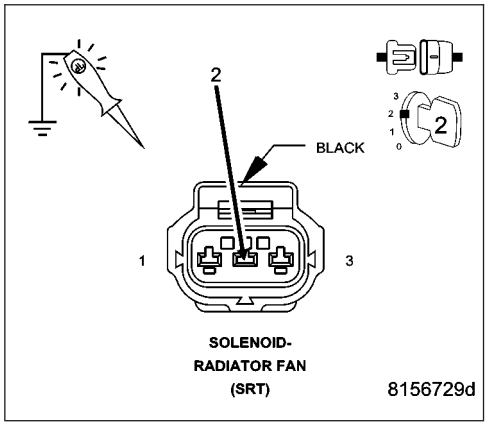
Turn the ignition off.

Disconnect the Fan Solenoid harness connector.

Ignition on, engine not running.

With the scan tool, actuate the ASD Relay.

Using a 12-volt test light connect to ground, probe the (K342) Fused ASD Relay Output circuit at the fan solenoid.



Does the test light illuminate brightly when the ASD Relay is actuated?

Yes >> Go To 3

No >> Repair the open or short to ground in the (K342) Fused ASD Relay Output circuit. Inspect the related fuse and repair as necessary.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1499-HYDRAULIC FAN SOLENOID CIRCUIT (CONTINUED)

3. (C240) COOLING FAN SOLENOID CIRCUIT OPEN

Turn the ignition off.

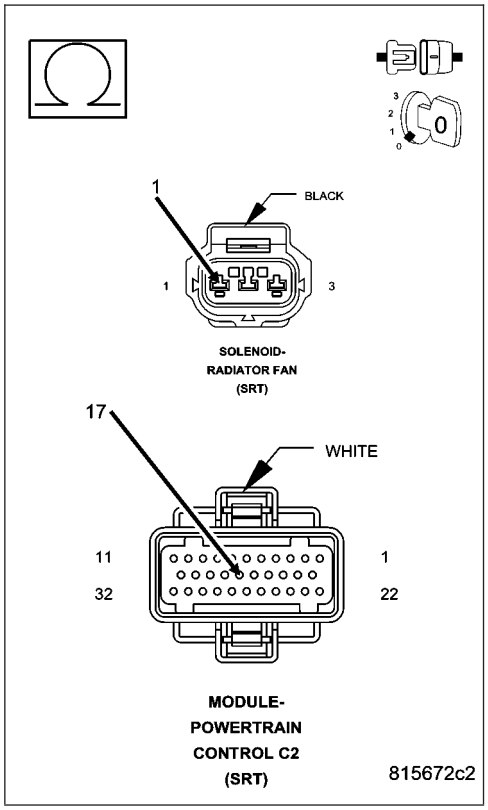
Disconnect the PCM harness connectors.

Measure the resistance of the (C240) Cooling Fan Solenoid Control circuit from the fan harness connector to the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 4

No >> Repair the open in the (C240) Cooling Fan Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



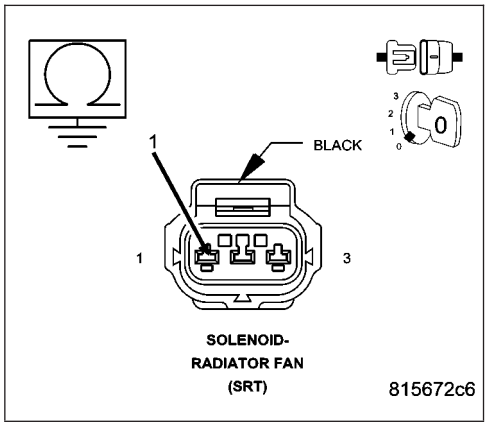
4. (C240) COOLING FAN CONTROL CIRCUIT SHORT TO GROUND

Measure the resistance between ground and the (C240) Cooling Fan Control circuit.

Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (C240) Cooling Fan Control circuit.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5



P1499-HYDRAULIC FAN SOLENOID CIRCUIT (CONTINUED)

5. HYDRAULIC FAN SOLENOID

Remove the ASD Relay and connect a jumper wire between the (K342) ASD Relay Output terminal and the (A14) Fused B+ circuit to keep the ASD Output circuit powered up for this step.

Connect another jumper wire to the (C240) Hydraulic Fan Solenoid Control circuit in the PCM harness connector. Momentarily connect the other end of the jumper wire to ground.

NOTE: Remove the jumper wires before continuing.

Did the solenoid actuate?

Yes >> Go To 6

No >> Replace the Hydraulid Radiator Fan.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

6. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

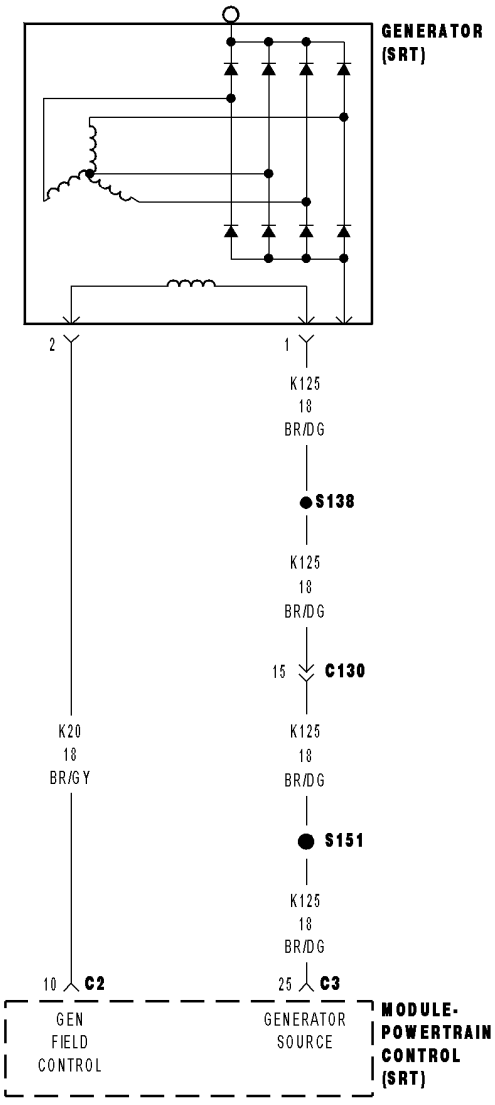
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

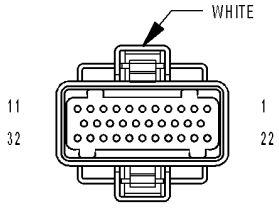
If there are no possible causes remaining, view repair.

Repair

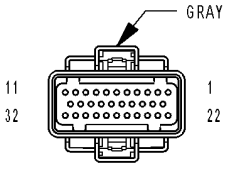
Replace and program the Powertrain Control Module per Service Information.
Perform POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH

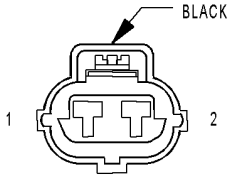




MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)

81562fb8

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and the engine speed greater than 0 RPM.
- **Set Condition:**
  When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not decrease.

Possible Causes
(K20) GENERATOR FIELD CONTROL CIRCUIT SHORTED TO GROUND
GENERATOR FIELD COIL SHORTED TO GROUND
BATTERY TEMPERATURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHARGING SYSTEM OPERATION

NOTE: Battery must be fully charged and be capable of passing a load test.

NOTE: Generator Belt tension and condition must be checked before continuing.

Ignition on, engine not running.

With the scan tool, read DTCs and the related Freeze Frame data then clear the DTCs.

With scan tool, actuate the Generator Field Driver.

With a 12-volt test light connected to ground, backprobe the (K20) Gen Field Control circuit in the back of Generator Field harness connector.

Does the test light illuminate brightly and flash?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1594-CHARGING SYSTEM VOLTAGE TOO HIGH (CONTINUED)

2. (K20) GEN FIELD CONTROL CIRCUIT SHORTED TO GROUND

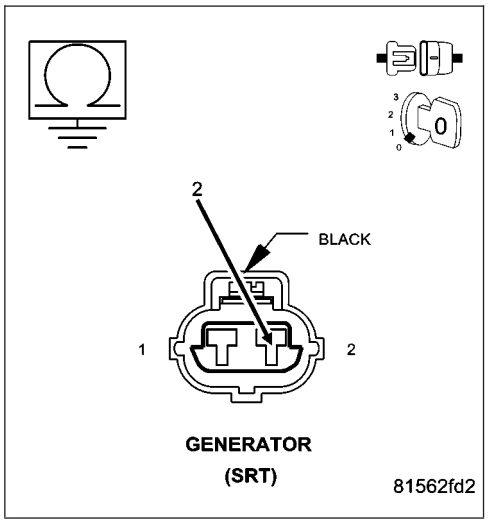
Turn the ignition off.

Disconnect the C2 PCM harness connector.

Disconnect the Generator Field Harness connector.

Carefully inspect the related connectors for corrosion or spread terminals before continuing.

Measure the resistance between ground and the (K20) Generator Field Driver circuit at the Generator Field harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (K20) Generator Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. GENERATOR FIELD COIL SHORTED TO GROUND

Measure the resistance between ground and the Generator Field terminals on the Generator.

Is the resistance below 100 ohms?

Yes >> Replace or repair the Generator Field Coil for a short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. BATTERY TEMPERATURE SENSOR

Connect the PCM harness connectors and the Generator harness connector.

Ignition on, engine not running.

With the scan tool in Inputs/Outputs, read the Batt Temp Sensor value.

Using a thermometer measure under hood temperature near Battery tray.

Is the temperature within 10 deg of Battery temperature?

Yes >> Go To 5

No >> Replace the Battery Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

5. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

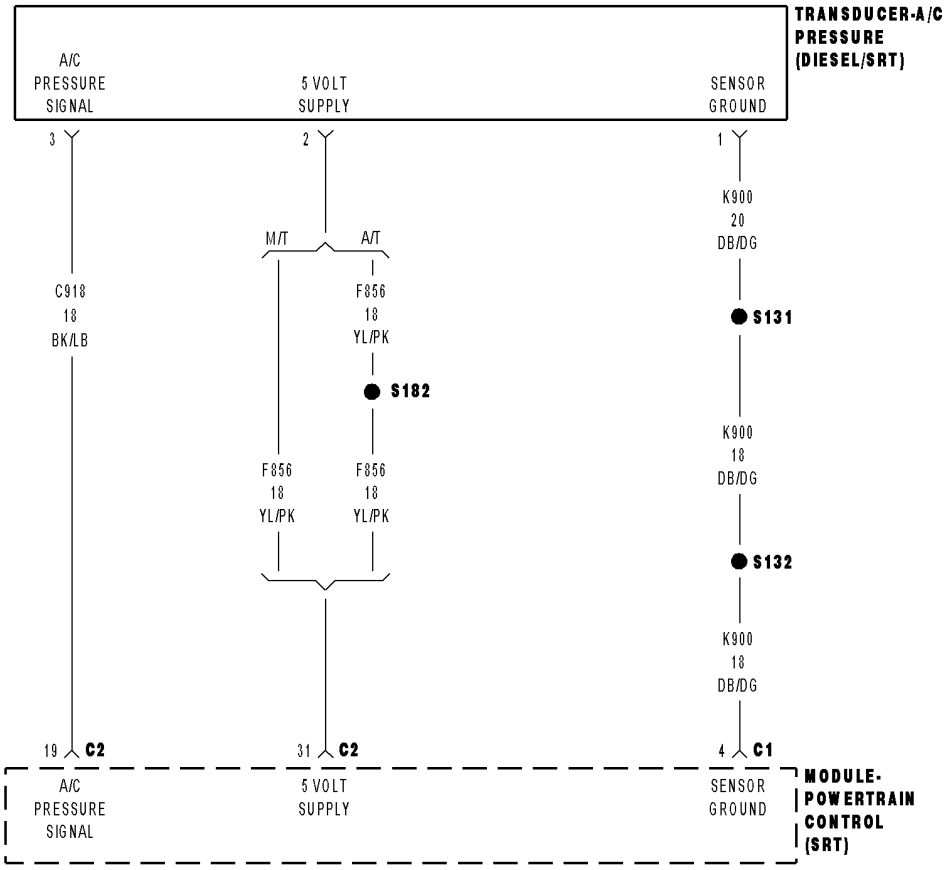
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

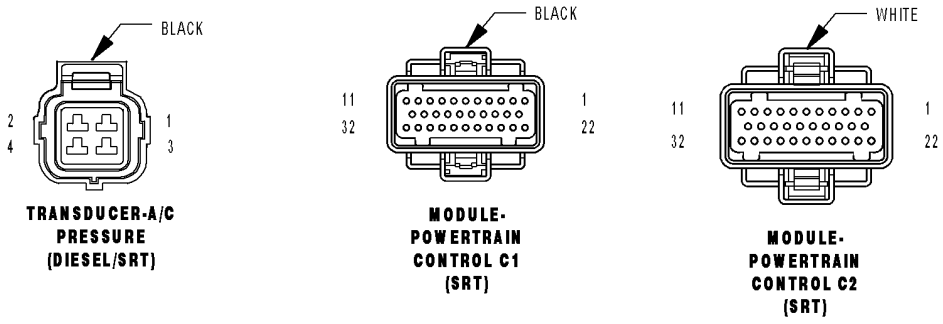
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH





81566742

P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the A/C Relay energized.
- **Set Condition:**
  The A/C Pressure Sensor Signal at the PCM goes above 4.92 volts.

Possible Causes
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO VOLTAGE
(C18) A/C PRESSURE SIGNAL CIRCUIT OPEN
(C18) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT
(K900) SENSOR GROUND CIRCUIT OPEN
A/C PRESSURE SENSOR
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. A/C PRESSURE SENSOR VOLTAGE ABOVE 4.9 VOLTS

NOTE: Make sure the A/C refrigerant System is properly charged per the Service Information.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Start the engine.

With the scan tool, read the A/C Pressure Sensor voltage.

Is the voltage above 4.9 volts?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

2. A/C PRESSURE SENSOR

Turn the ignition off.

Disconnect the A/C Pressure Sensor harness connector.

Connect a jumper wire between the (C918) A/C Pressure Signal circuit and the (K900) Sensor ground circuit in the Sensor harness connector.

With the scan tool, monitor the A/C Pressure Sensor voltage.

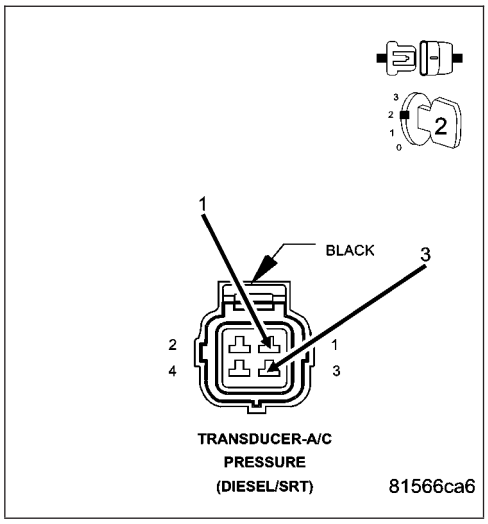
Ignition on, engine not running.

Is the voltage below 1.0 volt?

Yes >> Replace the A/C Pressure Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

NOTE: Remove the jumper wire before continuing.



3. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO BATTERY VOLTAGE

Turn the ignition off.

Disconnect the PCM harness connectors.

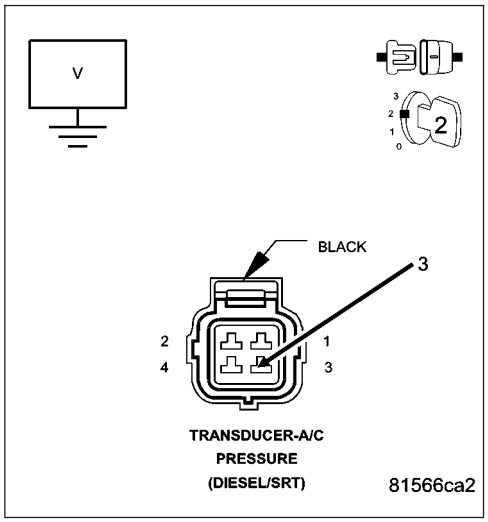
Ignition on, engine not running.

Measure the voltage on the (C918) A/C Pressure Signal circuit in the A/C Pressure Sensor harness connector.

Is the voltage above 5.2 volts?

Yes >> Repair the short to voltage in the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4



P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

4. (C918) A/C PRESSURE SIGNAL CIRCUIT OPEN

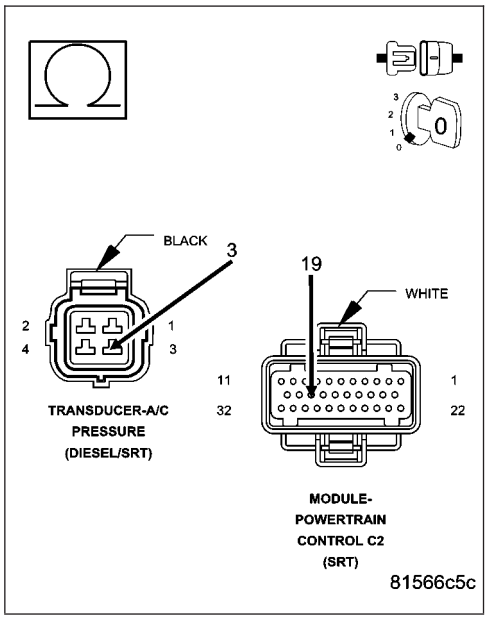
Turn the ignition off.

Measure the resistance of the (C918) A/C Pressure Signal circuit between the A/C Pressure Sensor harness connector and the PCM harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 5

No >> Repair the open in the (C918) A/C Pressure Signal circuit. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



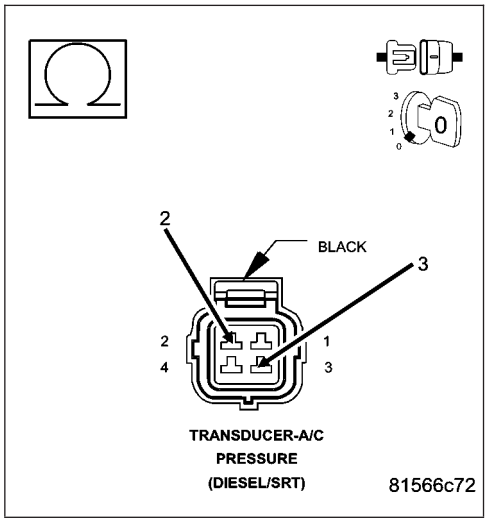
5. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (F855) 5-VOLT SUPPLY CIRCUIT

Measure the resistance between the (C918) A/C Pressure Signal circuit and the (F855) 5-volt Supply circuit in the A/C Pressure Sensor harness connector.

Is the resistance below 5.0 ohms?

Yes >> Repair the short between the (F855) 5-volt Supply circuit and the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

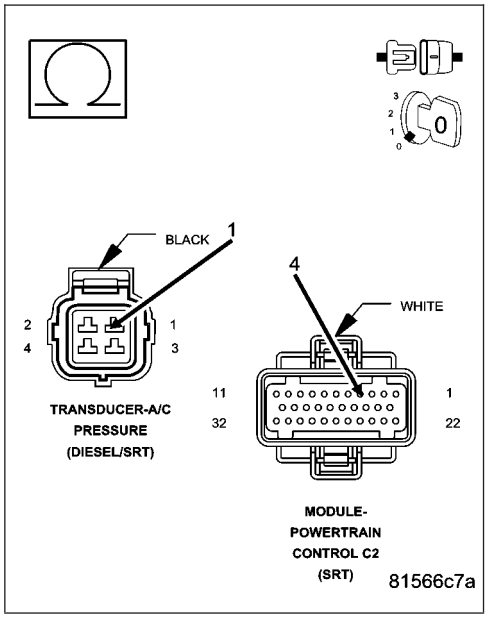
No >> Go To 6



P1598-A/C PRESSURE SENSOR VOLTAGE TOO HIGH (CONTINUED)

6. (K900) SENSOR GROUND CIRCUIT OPEN

Measure the resistance of the (K900) Sensor ground circuit from the A/C Pressure Sensor harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K900) Sensor ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

7. PCM

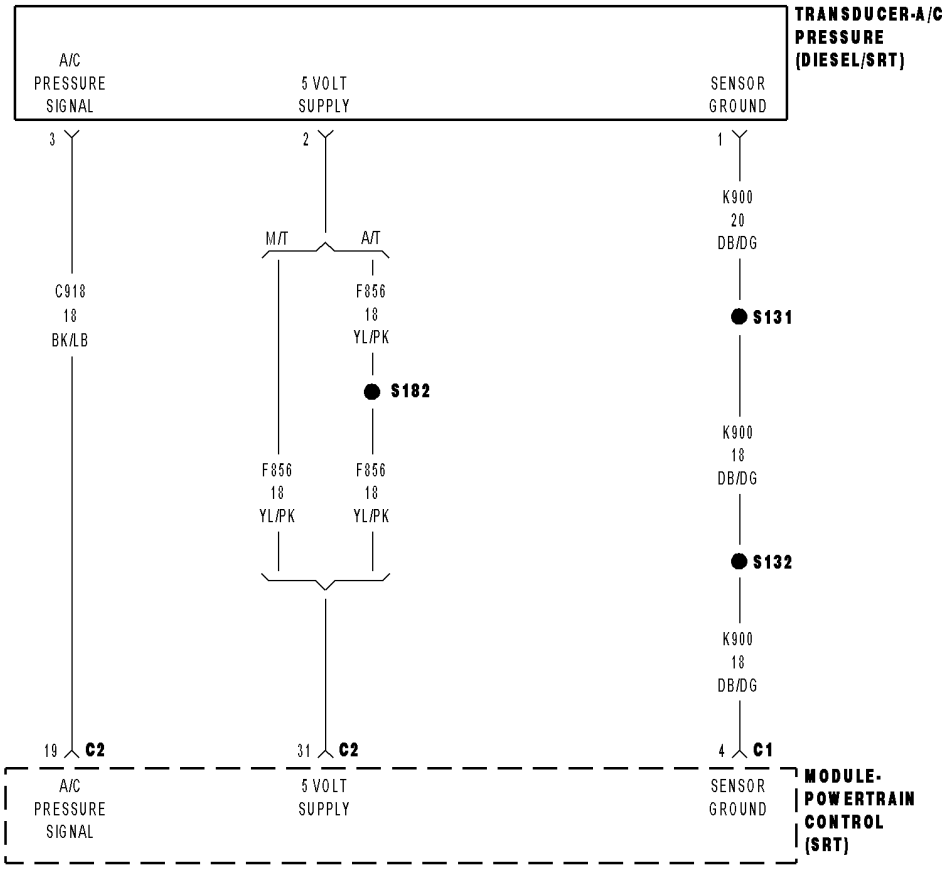
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

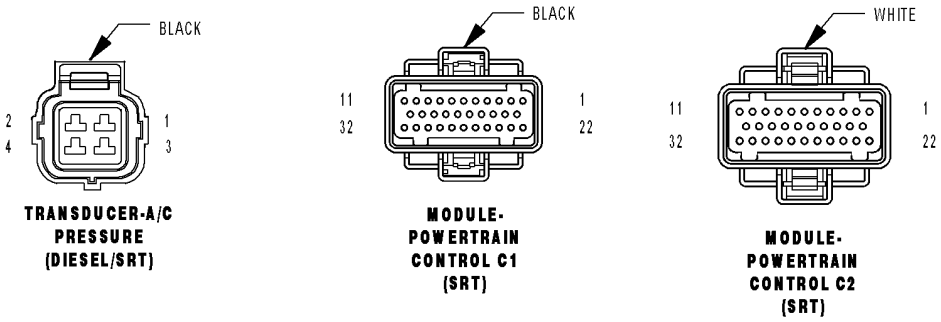
If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW





81566742

P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the engine running and the A/C Relay energized.
- **Set Condition:**
  The A/C Pressure Transducer Signal voltage at the PCM goes below 0.58 volts for 2.6 seconds.

Possible Causes
(F855) 5-VOLT SUPPLY CIRCUIT OPEN
(F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND
A/C PRESSURE SENSOR
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND
(C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. A/C PRESSURE SENSORr VOLTAGE BELOW 0.6 VOLTS

NOTE: Make sure the A/C refrigerant System is properly charged per the Service Information.

Ignition on, engine not running.

With the scan tool, read DTCs and record the related Freeze Frame data.

Start the engine.

With the scan tool, read the A/C Pressure Transducer voltage.

Is the voltage below 0.60 of a volt?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

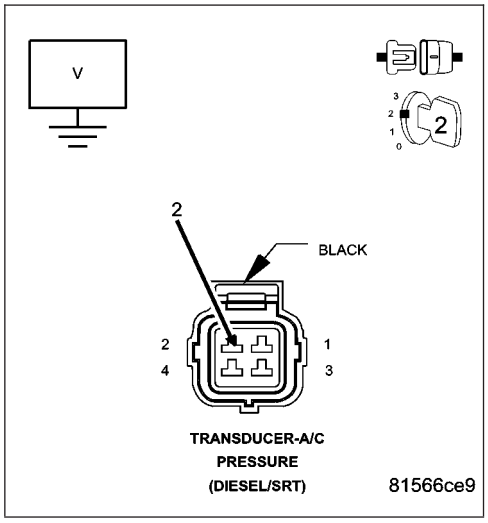
2. (F855) 5-VOLT SUPPLY CIRCUIT

Turn the ignition off.

Disconnect the A/C Pressure Transducer harness connector.

Ignition on, engine not running.

Measure the voltage on the (F855) 5-volt Supply circuit in the A/C Pressure Transducer harness connector.



Is the voltage between 4.5 to 5.2 volts?

Yes >> Go To 3

No >> Go To 6

3. A/C PRESSURE TRANSDUCER

With the scan tool, monitor the A/C Pressure Transducer voltage with the Transducer disconnected.

Is the voltage above 0.6 of a volt?

Yes >> Replace the A/C Pressure Transducer.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

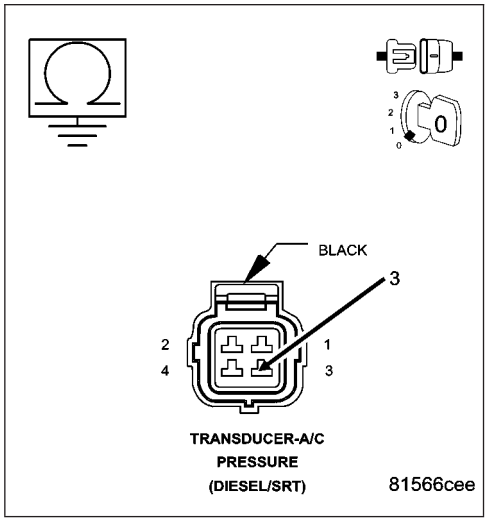
No >> Go To 4

4. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance between ground and the (C918) A/C Pressure Signal circuit in the A/C Pressure Transducer harness connector.



Is the resistance below 100 ohms?

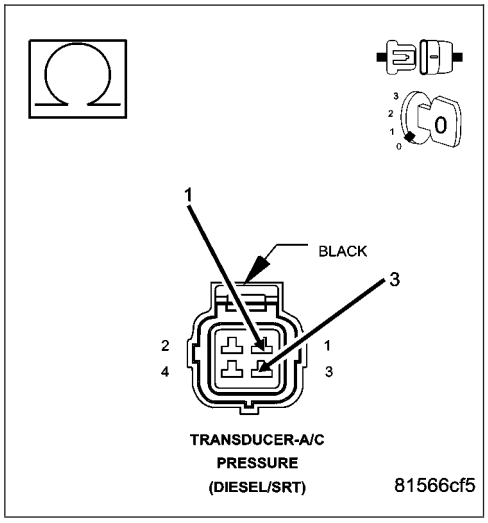
Yes >> Repair the short to ground in the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

5. (C918) A/C PRESSURE SIGNAL CIRCUIT SHORTED TO THE (K900) SENSOR GROUND CIRCUIT

Measure the resistance between the (C918) A/C Pressure Signal circuit and the (K900) Sensor ground circuit in the A/C Pressure Transducer harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short between the (K900) Sensor ground and the (C918) A/C Pressure Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

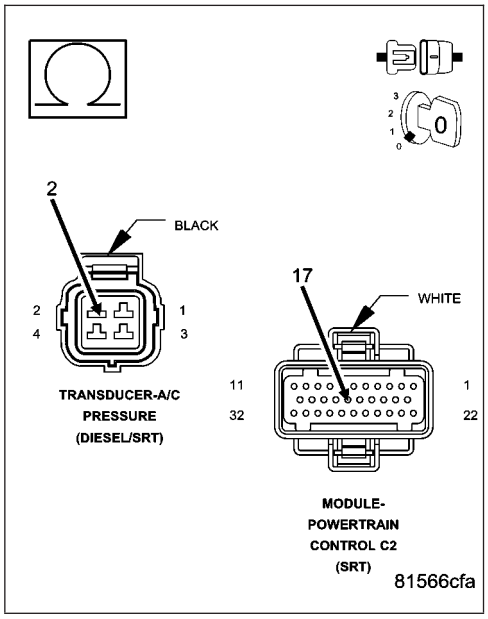
No >> Go To 8

6. (F855) 5-VOLT SUPPLY CIRCUIT OPEN

Turn the ignition off.

Disconnect the PCM harness connectors.

Measure the resistance of the (F855) 5-volt Supply circuit between the A/C Pressure Transducer harness connector and the PCM harness connector.



Is the resistance below 5.0 ohms?

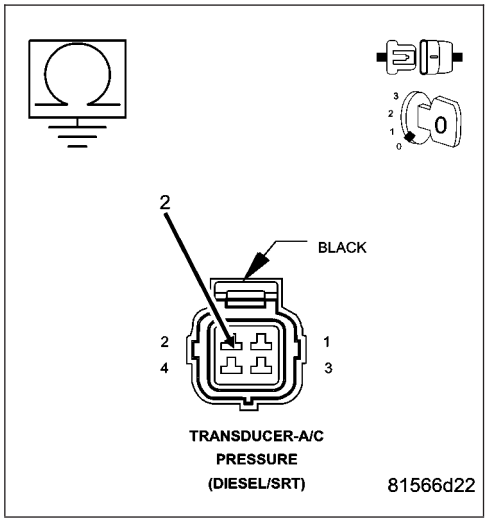
Yes >> Go To 7

No >> Repair the open in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1599-A/C PRESSURE SENSOR VOLTAGE TOO LOW (CONTINUED)

7. (F855) 5-VOLT SUPPLY CIRCUIT SHORTED TO GROUND

Measure the resistance between the (F855) 5-volt Supply circuit and ground in the A/C Pressure Transducer harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (F855) 5-volt Supply circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 8

---

8. PCM

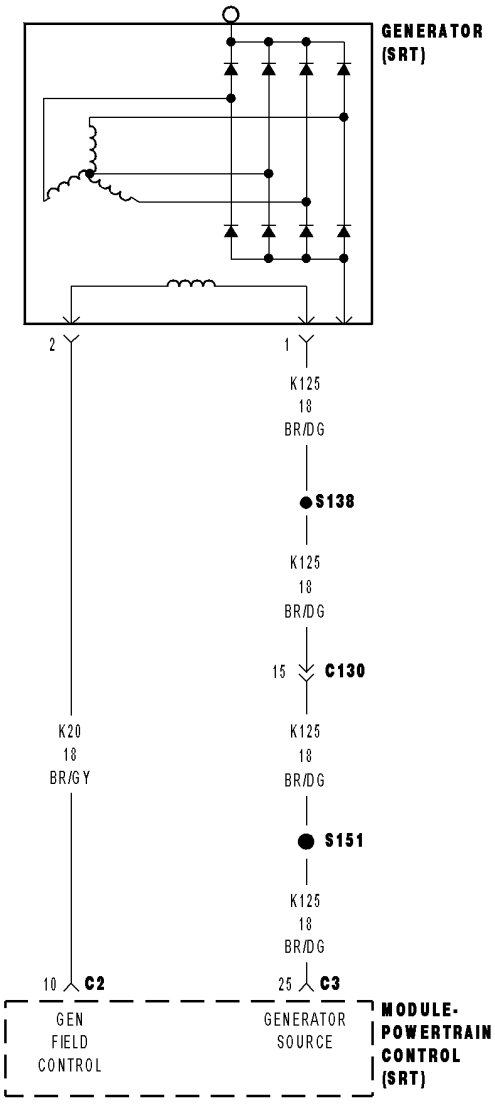
NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

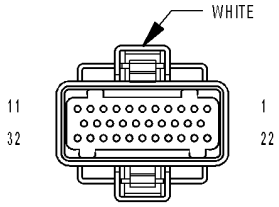
If there are no possible causes remaining, view repair.

Repair

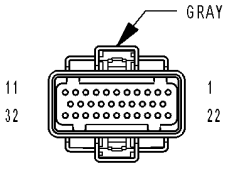
Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1682-CHARGING SYSTEM VOLTAGE TOO LOW

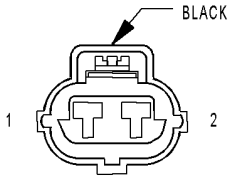




MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)

81562fb8

P1682-CHARGING SYSTEM VOLTAGE TOO LOW (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition key on and the engine running over 1500 RPM after 25 seconds.
- **Set Condition:**
  When the PCM regulates the generator field and there are no detected field problems, but the voltage output does not increase.

Possible Causes
BATTERY TEMPERATURE SENSOR
RESISTANCE IN THE BATTERY POSITIVE CIRCUIT
(K125) GENERATOR FIELD SOURCE CIRCUIT OPEN
RESISTANCE IN THE GENERATOR GROUND
(K125) GENERATOR FIELD SOURCE CIRCUIT SHORTED TO GROUND
(K20) GENERATOR FIELD CONTROL CIRCUIT OPEN
RESISTANCE IN THE GENERATOR FIELD COIL
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. CHARGING VOLTAGE BELOW 15.1 VOLTS

Turn the ignition off.

NOTE: Battery must be fully charged and capable of passing a battery load test.

NOTE: Generator Belt tension and condition must be checked before continuing.

NOTE: Inspect the vehicle for any aftermarket accessories that may exceed the maximum Generator output.

WARNING: When the engine is operating, do not stand in direct line of the fan. Do not put your hands near the pulley, belts, or fan. Do no wear loose clothing.

Start the engine.

Record all DTCs and the related Freeze Frame data.

With the scan tool, read the target charging voltage.

Is the target charging voltage above 15.1 volts?

Yes >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

P1682-CHARGING SYSTEM VOLTAGE TOO LOW (CONTINUED)

2. BATTERY TEMPERATURE SENSOR

Turn the ignition off.

NOTE: Generator Belt tension and condition must be checked before continuing.
Start the engine.
Allow the engine to reach normal operating temperature.
With the scan tool in sensors, read the Battery Temp Sensor value.
Using a Thermometer, measure under hood temperature.

Is the temperature within 10° F of Battery temperature?

Yes >> Go To 3

No >> Replace the Battery Temperature Sensor.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

3. HIGH RESISTANCE IN THE BATTERY POSITIVE CIRCUIT

Ignition on, engine not running.
Measure the voltage between the Generator B+ Terminal and the Battery Positive Post.

WARNING: When the engine is operating, do not stand in direct line of the fan. Do not put your hands near the pulley, belts, or fan. Do no wear loose clothing.

CAUTION: Make sure all wires are clear of the engine's moving parts.
Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the Battery Positive circuit between the Generator and Battery.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 4

---

4. RESISTANCE IN THE GENERATOR GROUND

Start the engine.

WARNING: When the engine is operating, do not stand in direct line of the fan. Do not put your hands near the pulley, belts, or fan. Do no wear loose clothing.
Warm the engine to operating temperature.

CAUTION: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator case and Battery Negative Post.

Is the voltage above 0.1 of a volt?

Yes >> Repair the excessive resistance in the Generator Ground circuit between the Generator Case and Battery Negative side.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

P1682-CHARGING SYSTEM VOLTAGE TOO LOW (CONTINUED)

5. (K125) GEN FIELD SOURCE CIRCUIT OPEN

Ignition on, engine not running.

Carefully inspect all connectors for corrosion or spread terminals before continuing.

With the scan tool actuate the Generator Field Driver.

While backprobing, measure the voltage on the (K125) Generator Field Source circuit at back of Generator.

Is the voltage above 10.0 volts?

Yes >> Go To 6

No >> Repair the open in the (K125) Generator Field Source circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

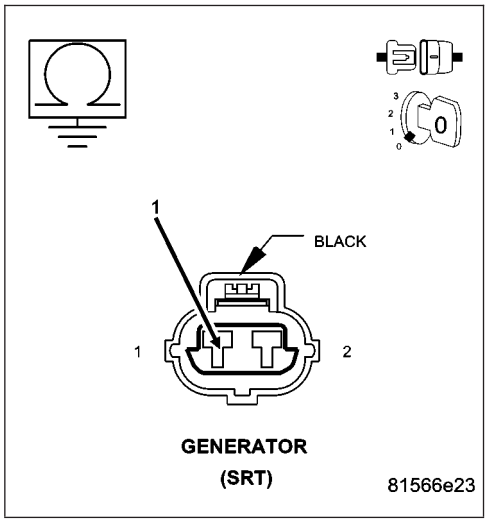
6. (K125) GEN FIELD SOURCE CIRCUIT SHORTED TO GROUND

Turn the ignition off.

Disconnect the PCM harness connectors.

Disconnect the Generator Field harness connector.

Measure the resistance between ground and the (K125) Generator Field Source circuit in the PCM harness connector.



Is the resistance below 100 ohms?

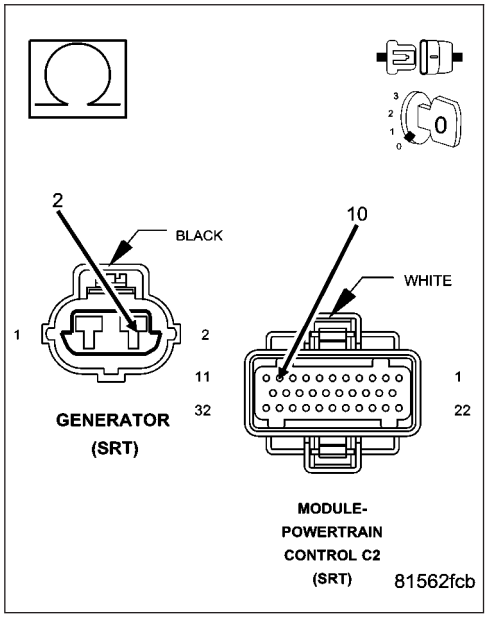
Yes >> Repair the short to ground in the (K125) Generator Field Source circuit and replace the PCM.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. (K20) GEN FIELD CONTROL CIRCUIT OPEN

Measure the resistance of the (K20) Generator Field Driver circuit from the Generator harness connector to the PCM harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 8

No >> Repair the open in the (K20) Generator Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1682-CHARGING SYSTEM VOLTAGE TOO LOW (CONTINUED)

8. GENERATOR FIELD COIL HIGH RESISTANCE

Measure resistance across the Generator Field Terminals at the Generator.

Is the resistance above 15 ohms?

Yes >> Replace or repair the Generator as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 9

---

9. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

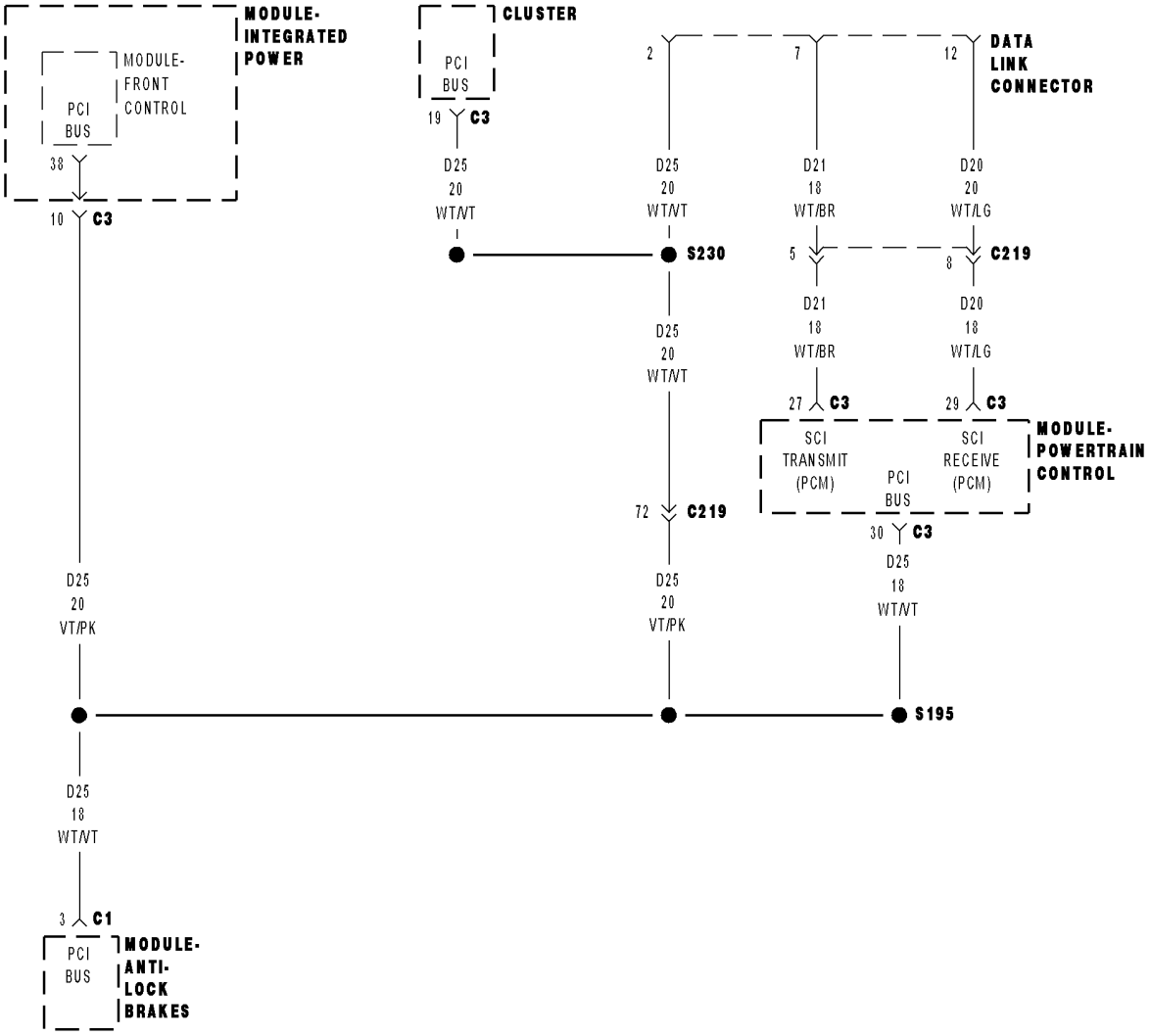
Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

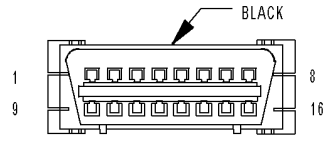
If there are no possible causes remaining, view repair.

Repair

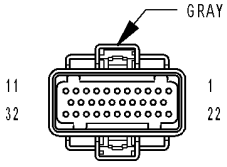
Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1687-NO CLUSTER BUS MESSAGE

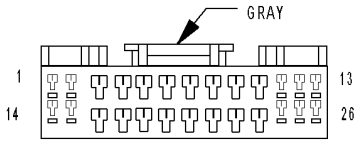




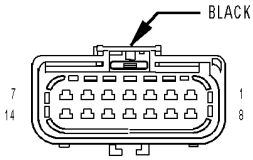
DATA LINK CONNECTOR



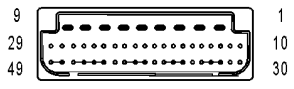
MODULE-
POWERTRAIN
CONTROL C3
(SRT)



CLUSTER C3



MODULE-
ANTI-
LOCK
BRAKES C1



MODULE-
FRONT
CONTROL IPM

8156691B

P1687-NO CLUSTER BUS MESSAGE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on.
- **Set Condition:**
  The PCM has not received an expected Cluster Status Bus message from the instrument cluster within the last 20 seconds.

Possible Causes
(D25) OPEN BETWEEN PCM AND CLUSTER
(D25) SHORTED BETWEEN PCM AND CLUSTER
CLUSTER
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. NO CLUSTER BUS MESSAGE

Ignition on, engine not running.
With the scan tool, erase DTCs.
Cycle the ignition key on and off several times.
With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. COMMUNICATE WITH CLUSTER

Ignition on, engine not running.
With the scan tool, attempt to communicate with the Instrument cluster.

Can communication be established with the Instrument Cluster?

Yes >> Go To 3

No >> Refer to the Communication Category of the Body Diagnostic Manual and perform the appropriate symptom related to no communication with cluster.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1687-NO CLUSTER BUS MESSAGE (CONTINUED)

3. INSTRUMENT CLUSTER OPERATION

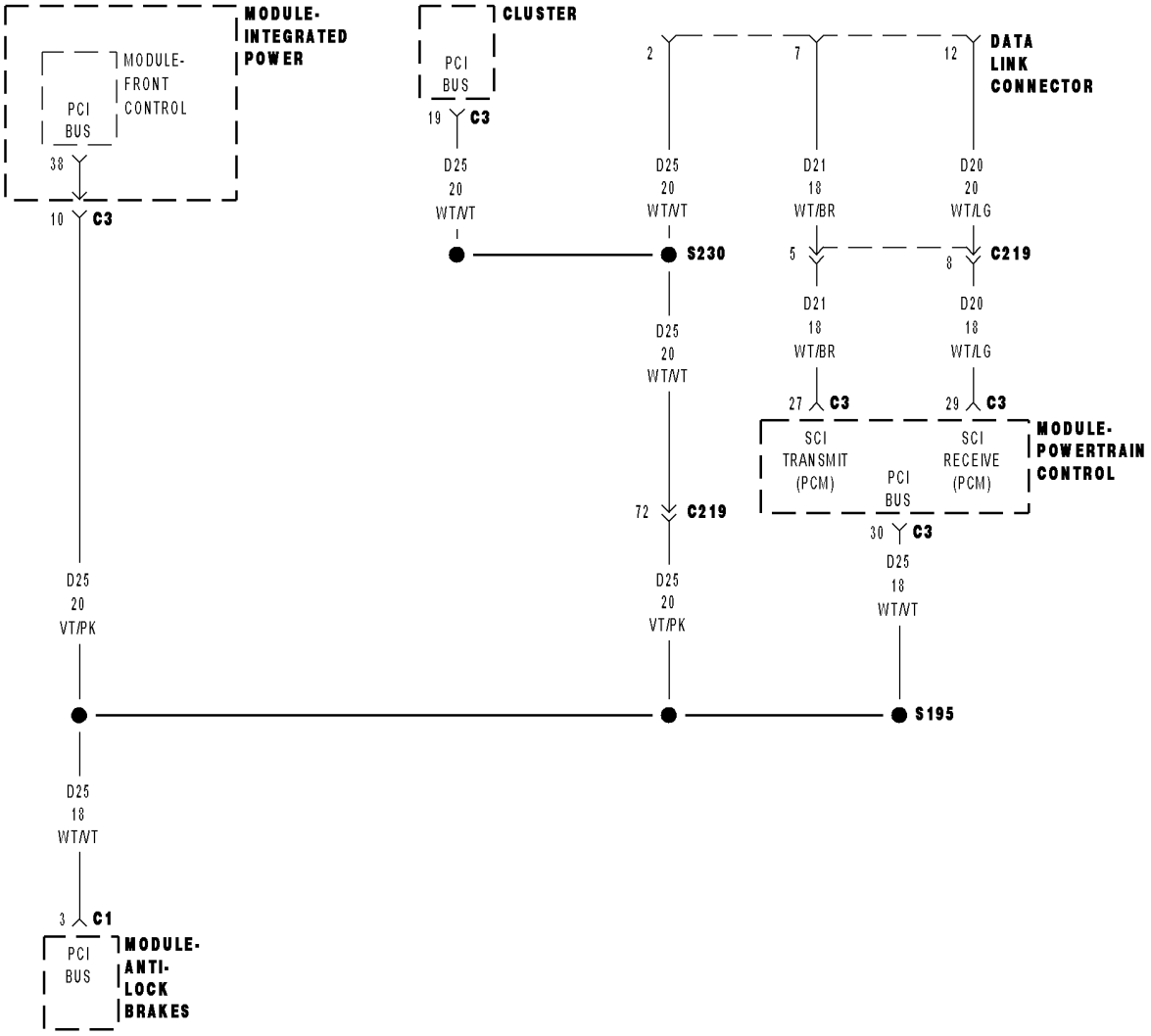
Start the engine
Allow the engine to idle.

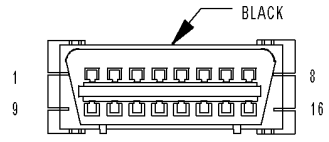
Is the correct engine speed display in the instrument cluster (Tach)?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

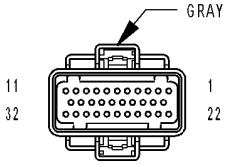
No >> Refer to the Instrument Category in the Body Diagnostic Manual and perform the appropriate symptom.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1695-BUS MESSAGE FROM BODY CONTROL MODULE

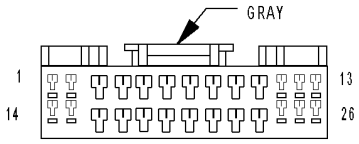




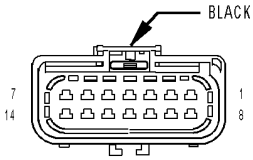
DATA LINK CONNECTOR



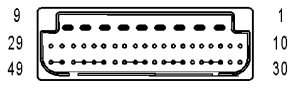
MODULE-
POWERTRAIN
CONTROL C3
(SRT)



CLUSTER C3



MODULE-
ANTI-
LOCK
BRAKES C1



MODULE-
FRONT
CONTROL IPM

815669fb

P1695-BUS MESSAGE FROM BODY CONTROL MODULE (CONTINUED)

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  With the ignition on. Battery voltage greater than 10.4 volts.
- **Set Condition:**
  No BUS messages recieved from the BCM for 20 seconds.

Possible Causes
(D25) PCI BUS CIRCUIT OPEN
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC RESET

Ignition on, engine not running.

With the scan tool, erase DTCs.

Cycle the ignition key on and off several times. Leaving the ignition on for at least 20 seconds.

With the scan tool, read DTCs.

Does the DTC reset?

Yes >> Go To 2

No >> Refer to the INTERMITTENT CONDITION Diagnostic Procedure.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

2. COMMUNICATE WITH FCM

With the scan tool, attempt to communicate with the FCM.

Can communication be established with the BCM?

Yes >> Go To 3

No >> Refer to the Communication Category and perform the appropriate symptom related to no communication with FCM.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

P1695-BUS MESSAGE FROM BODY CONTROL MODULE (CONTINUED)

3. (D25) PCI BUS CIRCUIT OPEN

Turn the ignition off.

Disconnect the C3 PCM harness connector.

Disconnect the FCM harness connector.

NOTE: Inspect the PCI Bus terminal at both the PCM connectors and the FCM connectors. Check for corrosion, damage or terminal push out.

Measure the resistance of the (D25) PCI BUS circuit between the C3 PCM harness connector and the FCM harness connector.

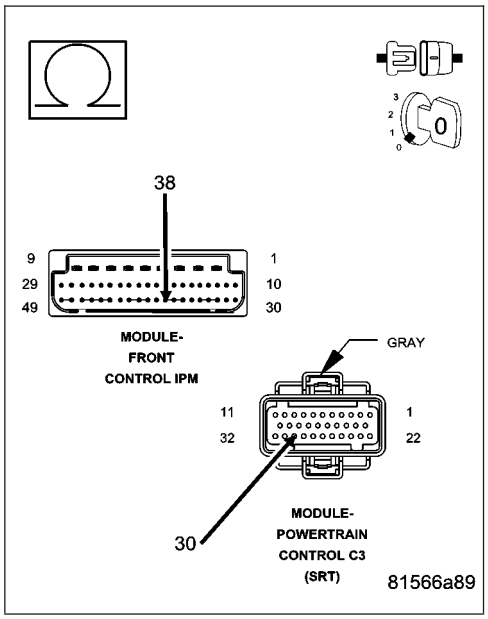
Is the resistance below 5.0 ohms?

Yes >> Replace and program the Powertrain Control Module per Service Information.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Repair the open in the (D25) PCI BUS circuit.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



P1696-PCM FAILURE EEPROM WRITE DENIED

For the Engine circuit diagram. (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

- **When Monitored:**
  Ignition on and battery voltage greater than 10 volts.
- **Set Condition:**
  An attempt to program/write to the internal EEPROM failed, also checks at powerdown.

Possible Causes
SRI MILEAGE INVALID
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. SCAN TOOL DISPLAYS WRITE FAILURE

Ignition on, engine not running.
With the scan tool, perform the SRI Memory Test.

Does the scan tool display Write Failure?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. SCAN TOOL DISPLAYS WRITE REFUSED

With the scan tool, perform the SRI Memory Test.

Does the scan tool display Write Refused?

Yes >> Go To 3

No >> Go To 4

---

3. PCM REFUSED 2ND TEST

With the scan tool, perform the SRI Memory Test a second time.

NOTE: Retest the SRI Memory two more times.

Does the scan tool display Write Refused again?

Yes >> Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

P1696-PCM FAILURE EEPROM WRITE DENIED (CONTINUED)

4. SCAN TOOL DISPLAYS SRI MILEAGE INVALID

With the scan tool, perform the SRI Memory Test.

Does the scan tool display SRI Mileage Invalid?

Yes >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. COMPARE SRI MILEAGE WITH ODOMETER

Compare the SRI Mileage stored with the Instrument Panel Odometer.

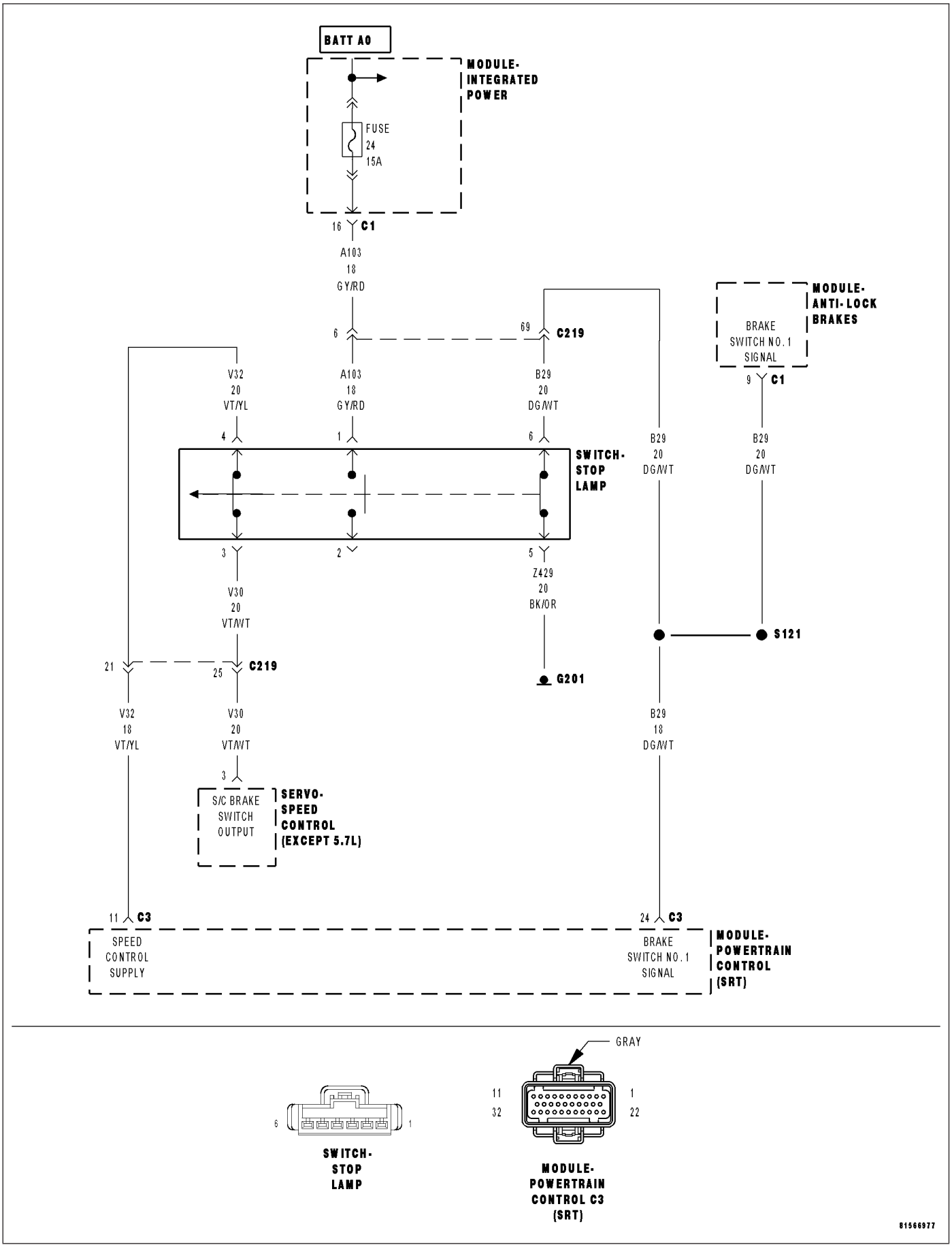
Is the mileage within the specified range displayed on the scan tool?

Yes >> Test Complete.

No >> Update the mileage and retest the SRI Memory.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

*BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON THE SCAN TOOL



***BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON THE SCAN TOOL (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A103) FUSED B+ CIRCUIT
(Z429) BRAKE LAMP SWITCH GROUND CIRCUIT OPEN
BRAKE LAMP SWITCH
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT OPEN
(B29) BRAKE SWITCH NO.1 SIGNAL CIRCUIT SHORT TO GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. SCAN TOOL DOES NOT SHOW BRAKE SW PRESSED OR RELEASED

Ignition on, engine not running.

With the scan tool in Inputs/Outputs, read the Brake Switch state.

While observing the scan tool display, press and release the brake pedal several times.

Does the scan tool display Brake Switch PRESSED and RELEASED?

Yes >> The Brake Lamp Switch is operating properly at this time.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 2

---

2. (A103) FUSED B+ CIRCUIT OPEN

Turn the ignition off.

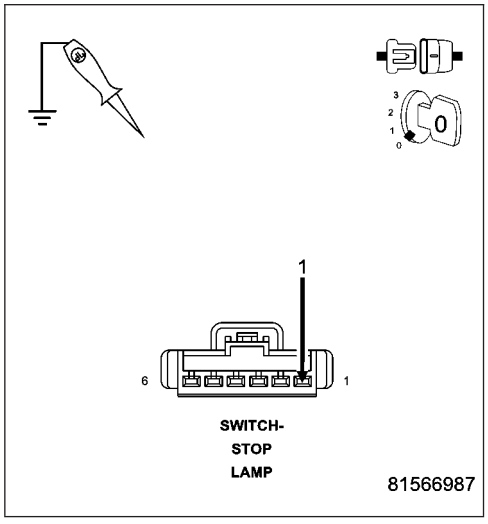
Disconnect the Brake Lamp Switch harness connector.

Using a 12-volt test light connected to ground, probe the (A103) Fused B+ circuit at the Brake Lamp Switch harness connector.

Does the test light illuminate brightly?

Yes >> Go To 3

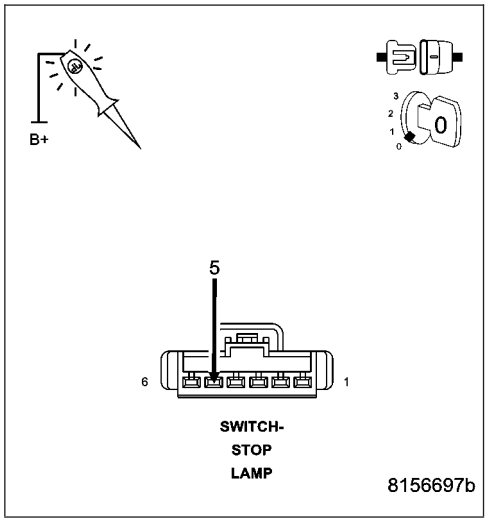
No >> Repair the open or short to ground in the (A103) Fused B+ circuit. Check and replace fuses as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)



***BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON THE SCAN TOOL (CONTINUED)**

3. (Z429) BRAKE LAMP SWITCH GROUND CIRCUIT OPEN

Using a 12-volt test light connect to 12-volts, probe the (Z429) Brake Lamp Switch ground circuit.



Does the test light illuminate brightly?

Yes >> Go To 4

No >> Repair the open in the (Z429) Brake Lamp Switch Ground circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

4. BRAKE LAMP SWITCH

Measure the resistance across the (B29) Brake Lamp Switch Signal terminal and the (Z429) Ground terminal (measurement taken across the switch).

Apply and release the Brake Pedal while monitoring the ohmmeter.

Does the resistance change from below 5.0 ohms to open circuit?

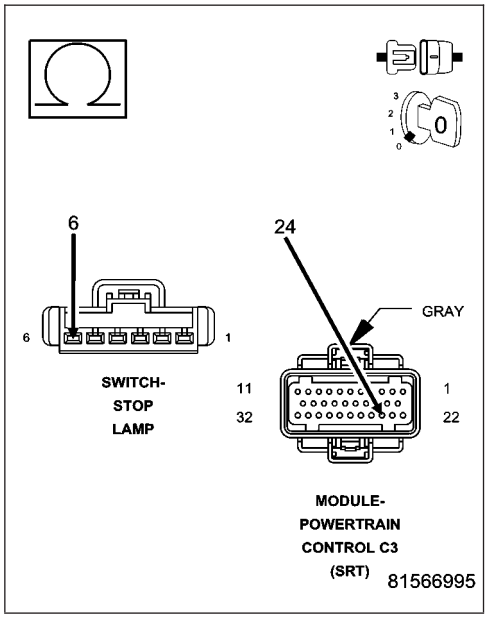
Yes >> Go To 5

No >> Replace the Brake Lamp Switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

5. (B29) BRAKE LAMP SWITCH SIGNAL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

Measure the resistance of the (B29) Brake Lamp Switch Signal circuit from the Stop Lamp Switch harness connector to the C3 PCM harness connector.



Is the resistance below 5.0 ohms?

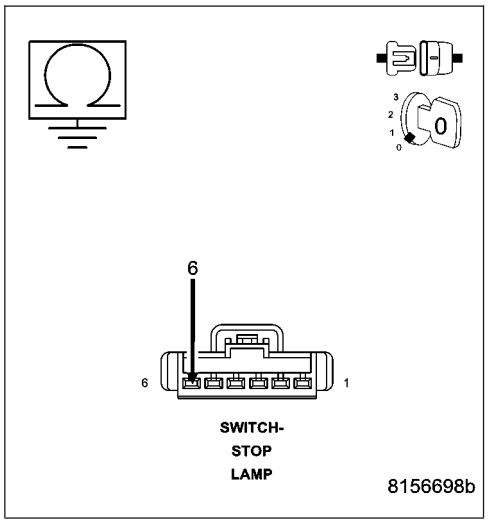
Yes >> Go To 6

No >> Repair the open in the (B29) Brake Lamp Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***BRAKE SWITCH SENSE STATUS DOES NOT CHANGE ON THE SCAN TOOL (CONTINUED)**

6. (B29) BRAKE LAMP SWITCH SIGNAL CIRCUIT SHORTED TO GROUND

Measure the resistance between ground and the (B29) Brake Lamp Switch Signal circuit at the Stop Lamp Switch harness connector.



Is the resistance below 100 ohms?

Yes >> Repair the short to ground in the (B29) Brake Lamp Switch Signal circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 7

---

7. (B29) BRAKE LAMP SWITCH SIGNAL LESS THAN 10.0 VOLTS

Connect the PCM harness connectors.

Connect the Brake Lamp Switch harness connector.

Brake pedal must be depressed in the next step.

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (B29) Brake Lamp Switch Signal circuit at the Brake Lamp Switch harness connector.

Is the test light illuminated and bright?

Yes >> Go To 8

No >> Replace or adjust the brake switch.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

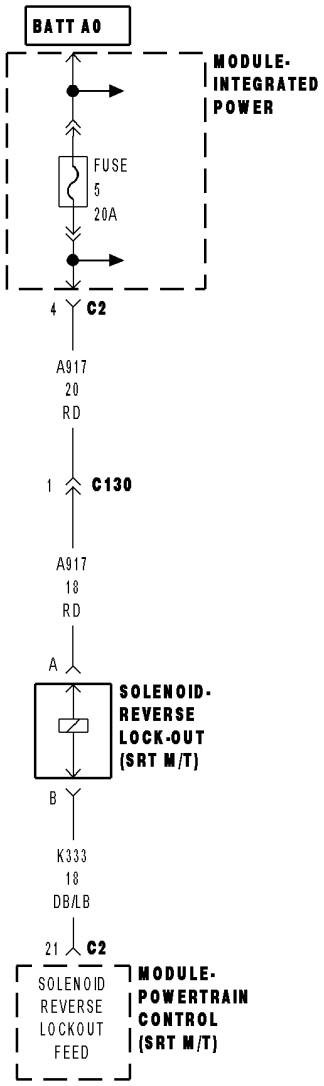
If there are no possible causes remaining, view repair.

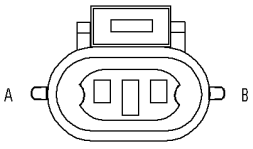
Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

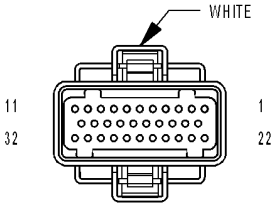
---

*CANNOT SHIFT INTO REVERSE





SOLENOID-
REVERSE
LOCK-OUT
(SRT M/T)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)

81562f15

***CANNOT SHIFT INTO REVERSE (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
REVERSE LOCKOUT SOLENOID STUCK

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. REVERSE LOCKOUT SOLENOID STUCK

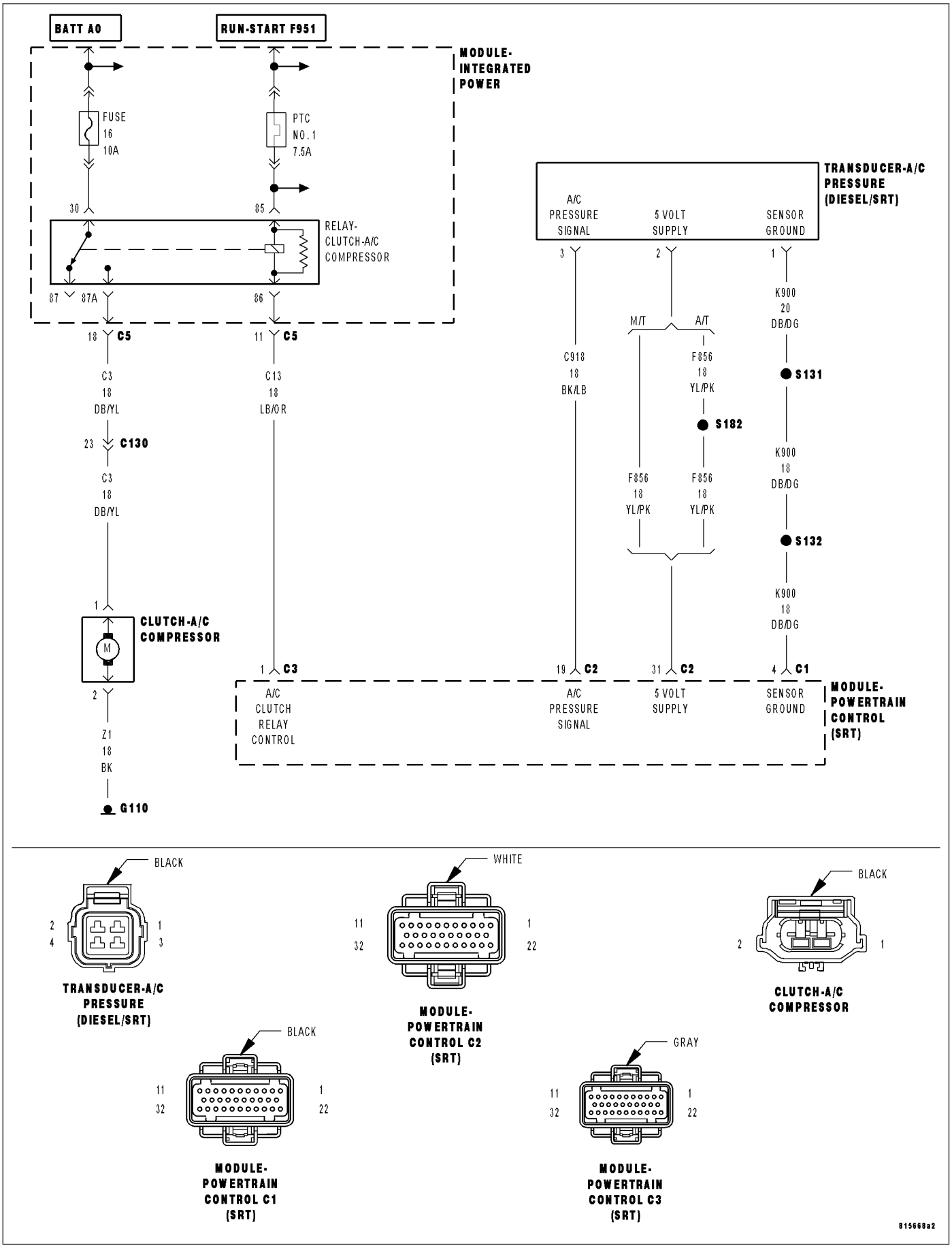
Check for a mechanically stuck Reverse Lockout Solenoid. This will not set a DTC in the PCM, but will prevent reverse gear engagement.

Is the solenoid stuck?

Yes >> Replace the Reverse Lockout Solenoid.

No >> Test Complete

*CHECKING A/C SYSTEM OPERATION WITH NO DTCS



***CHECKING A/C SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

For the XXXX circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
A/C SELECT CIRCUIT OPEN
A/C SELECT IN HVAC
PCM
A/C REQUEST CIRCUIT OPEN
REFRIGERATION SYSTEM NOT PROPERLY CHARGED
HIGH PRESS CUT-OFF SWITCH
LOW PRESSURE SWITCH
A/C CLUTCH COIL
A/C COMPRESSOR CLUTCH GROUND CIRCUIT OPEN
(C3) A/C CLUTCH RELAY OUTPUT CIRCUIT OPEN
FUSED B+ CIRCUIT OPEN
A/C CLUTCH RELAY

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. DTC AND COMMUNICATION PRESENT

Ignition on, engine not running.

Verify that communication with the HVAC and PCM is available over the BUS.

With the scan tool, check for DTCs in the PCM and HVAC module.

Are any A/C DTC's or communication failures present?

Yes >> Diagnose the related DTC(s) or BUS failure before continuing. Perform BODY VERIFICATION TEST - VER 1.

No >> Go To 2

---

2. A/C SELECT CIRCUIT OPEN

Engine running.

With the scan tool, read the A/C Select status in the PCM.

Turn the A/C Switch on and off a few times.

Does the A/C Select state change?

Yes >> Go To 3

No >> Go To 12

***CHECKING A/C SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

3. A/C REQUEST CIRCUIT OPEN

Engine Running.
Turn the A/C system on and the fan on high.
With the scan tool in Inputs/Outputs, read the A/C request state.

Does the A/C request state change?

Yes >> Go To 4

No >> Repair the open in the A/C Request circuit.
Perform BODY VERIFICATION TEST - VER 1.

---

4. REFRIGERATION SYSTEM NOT PROPERLY CHARGED

Turn the ignition off.
Verify that the Refrigerant System is properly charged per Service Procedure.

Is the Refrigerant System properly charged?

Yes >> Go To 5

No >> Properly charge the Refrigerant System per Service Information.
Perform BODY VERIFICATION TEST - VER 1.

---

5. HIGH PRESSURE CUT-OFF SWITCH

Turn the ignition off.
Verify the High Pressure Cut-Off Switch operation per Service Information.

Is the High Pressure Cut-Off Switch OK?

Yes >> Go To 6

No >> Replace the High Pressure Cut-Off Switch.
Perform BODY VERIFICATION TEST - VER 1.

---

6. LOW PRESSURE SWITCH

Turn the ignition off.
Verify the Low Pressure Switch operation per Service Information.

Is the Low Pressure Switch OK?

Yes >> Go To 7

No >> Replace the Low Pressure Switch.
Perform BODY VERIFICATION TEST - VER 1.

---

7. A/C CLUTCH COIL

Ignition on, engine not running.
Disconnect the A/C Compressor Clutch harness connector.
Connect a test light between the ground circuit and the A/C Clutch Relay Output circuit.
With the scan tool, actuate the A/C Clutch Relay.

Does the test light illuminate brightly on and off with the relay actuation?

Yes >> Replace the A/C Clutch Coil.
Perform BODY VERIFICATION TEST - VER 1.

No >> Go To 8

***CHECKING A/C SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

8. A/C COMPRESSOR CLUTCH GROUND CIRCUIT OPEN

Turn the ignition off.

Disconnect the A/C Clutch harness connector.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance between ground and the A/C Compressor Clutch ground circuit in the A/C Clutch harness connector.

Is the resistance below 5.0 ohms?

Yes >> Go To 9

No >> Repair the open in the A/C Compressor Clutch ground circuit.
Perform BODY VERIFICATION TEST - VER 1.

---

9. (C3) A/C CLUTCH RELAY OUTPUT CIRCUIT OPEN

Turn the ignition off.

Disconnect the A/C Clutch harness connector.

Remove the A/C Clutch Relay.

NOTE: Check connectors - Clean/repair as necessary.

Measure the resistance of the (C3) A/C Clutch Relay Output circuit between the IPM and the A/C Clutch Coil.

Is the resistance below 5.0 ohms?

Yes >> Go To 10

No >> Repair the open in the (C3) A/C Clutch Relay Output circuit.
Perform BODY VERIFICATION TEST - VER 1.

---

10. (A17) FUSED B+ CIRCUIT OPEN

Turn the ignition off.

Remove the A/C Clutch Relay.

NOTE: Check connectors - Clean/repair as necessary.

Measure the voltage of the Fused B+ circuit at the A/C Clutch Relay connector.

Is the voltage above 11.0 volts?

Yes >> Go To 11

No >> Repair the open in the Fused B+ circuit. The open may be in the IMP.
Perform BODY VERIFICATION TEST - VER 1.

---

11. A/C CLUTCH RELAY

If there are no possible causes remaining, view repair.

Repair

Replace the A/C Clutch Relay.
Perform BODY VERIFICATION TEST - VER 1.

***CHECKING A/C SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

12. A/C SELECT SWITCH STATUS IN HVAC

Ignition on, engine not running.

With the scan tool in the HVAC, under the Monitors screen, read the A/C Select Switch state.

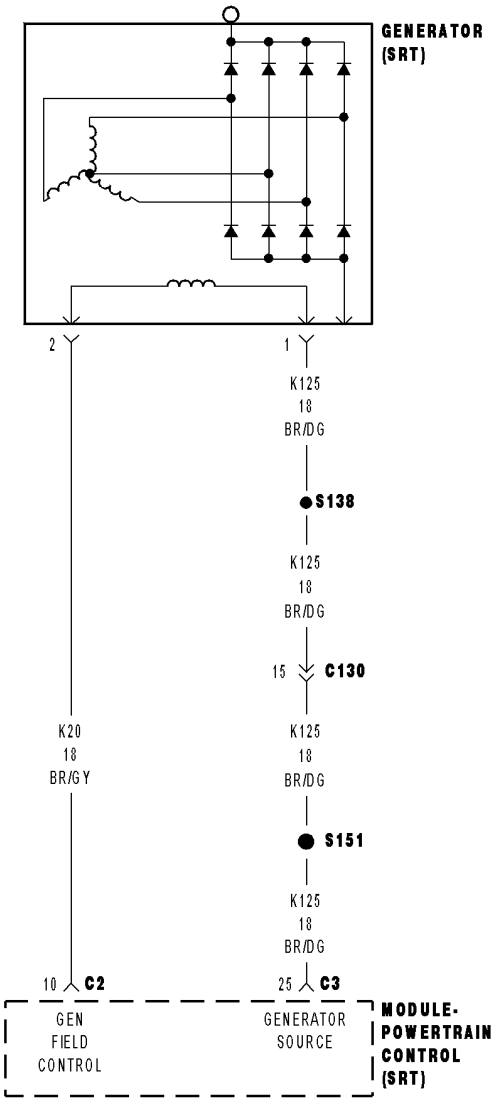
While monitoring the scan tool screen, turn the A/C switch on and off a few times.

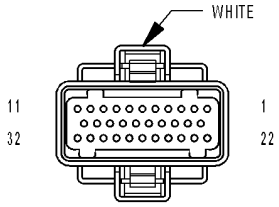
Does the A/C Select State change on the HVAC Monitors screen.

Yes >> Check for any related TSBs. Replace and program the PCM in accordance with the Service Information as long as no BUS problems exist.
Perform BODY VERIFICATION TEST - VER 1.

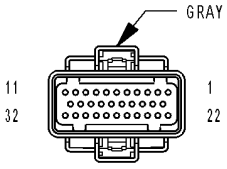
No >> Replace the A/C-Heater Control module.
Perform BODY VERIFICATION TEST - VER 1.

*CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS

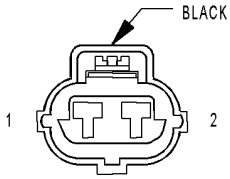




MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)



GENERATOR
(SRT)

81562fb8

***CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
GENERATOR BELT CONDITION
RESISTANCE IN THE BATTERY POSITIVE CIRCUIT
(K125) GENERATOR FIELD SOURCE CIRCUIT OPEN
GENERATOR FIELD COIL HIGH RESISTANCE
(K20) GEN FIELD CONTROL CIRCUIT OPEN
RESISTANCE IN THE GENERATOR GROUND
PCM

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. TARGET CHARGING DIFFERS FROM ACTUAL CHARGING BY 1 VOLT

NOTE: Verify that the Battery is able to pass a load test before continuing.

Ignition on, engine not running.

With the scan tool, read the Battery voltage and record the results.

Measure Battery voltage between the Battery Positive and Negative Terminals and record the results.

Compare the two voltage readings.

Is the voltage difference less than one volt?

Yes >> Go To 2

No >> Go To 8

---

2. RESISTANCE IN THE BATTERY POSITIVE CIRCUIT

Ignition on, engine not running.

Measure the voltage between the Generator B+ Terminal and the Battery+ Post.

CAUTION: Make sure all wires are clear of the engine's moving parts.

Start the engine.

Is the voltage above 0.4 of a volt?

Yes >> Repair the excessive resistance in the Battery Positive circuit between the Generator and Battery. Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

***CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

3. (K125) GEN FIELD SOURCE CIRCUIT OPEN

Ignition on, engine not running.

Record all DTCs and freeze frame data, now erase Codes.

Carefully inspect all connectors for corrosion or spread terminals before continuing.

With the scan tool, actuate the Generator Field Driver.

Measure the voltage of the (K125) Generator Field Source circuit by backprobing the back of Generator Field harness connector.

Is the voltage above 10.0 volts?

Yes >> Go To 4

No >> Repair the (K125) Generator Field Source circuit for an open or short to ground.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

4. RESISTANCE IN THE GENERATOR GROUND

Start the engine.

Warm the engine to operating temperature.

CAUTION: Make sure all wires are clear of the engine's moving parts.
Measure the voltage between the Generator case and Battery Negative Post.

Is the voltage above 0.1 of a volt?

Yes >> Repair the excessive resistance in the Generator Ground circuit between the Generator Case and Battery Ground side.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 5

---

5. GENERATOR FIELD COIL HIGH RESISTANCE

Turn the ignition off.

Disconnect the Generator Field harness connector at back of the Generator.

Measure resistance across the Generator Field Terminals at the Generator.

Is the resistance above 15 ohms?

Yes >> Replace or repair the Generator as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

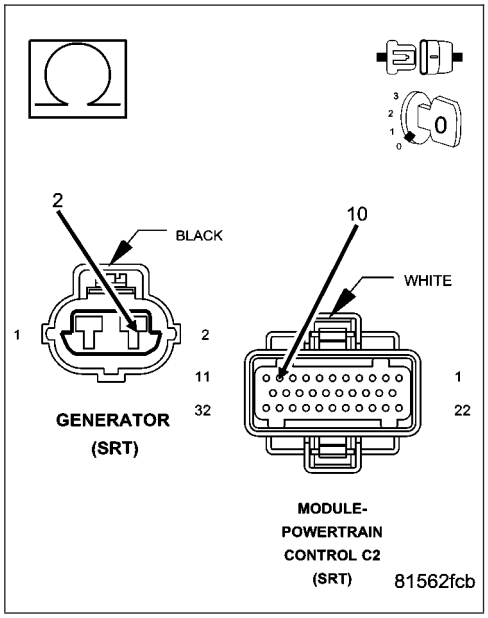
No >> Go To 6

***CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

6. (K20) GEN FIELD CONTROL CIRCUIT OPEN

Disconnect the C3 PCM harness connector.

Measure the resistance of the (K20) Generator Field Driver circuit between the C3 PCM harness connector and the Generator harness connector.



Is the resistance below 5.0 ohms?

Yes >> Go To 7

No >> Repair the open in the (K20) Gen Field Control circuit.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

7. PCM

NOTE: Before continuing, check the PCM harness connector terminals for corrosion, damage, or terminal push out. Repair as necessary.

Using the schematics as a guide, inspect the wire harness and connectors. Pay particular attention to all Power and Ground circuits.

If there are no possible causes remaining, view repair.

Repair

Replace and program the Powertrain Control Module per Service Information.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

---

8. GENERATOR BELT CONDITION

Turn the ignition off.

NOTE: Battery condition must be verified prior to this test.

Inspect the Generator Belt tension and condition.

Is the Generator Belt OK?

Yes >> Go To 9

No >> Repair as necessary.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING CHARGING SYSTEM OPERATION WITH NO DTCS (CONTINUED)**

9. ACTIVE DTC SET

Start the engine.
Turn on all accessories.
Raise engine speed to 2000 RPM for 30 seconds then return to idle.
With the scan tool, read DTCs.

Are there any ″Charging System″ Trouble Codes?

Yes >> Refer to DTC list for the related Charging DTCs.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 10

---

10. WIRE HARNESS INSPECTION

Ignition on, engine not running.
With the scan tool, actuate the Generator Field Driver.
Using a 12-volt test light, backprobe the Generator Field Driver Terminal at the back of the Generator.

NOTE: The test light should blink On and Off every 1.4 seconds.
While monitoring the 12-volt test light, wiggle the Field Terminals back to the PCM and ASD Relay.

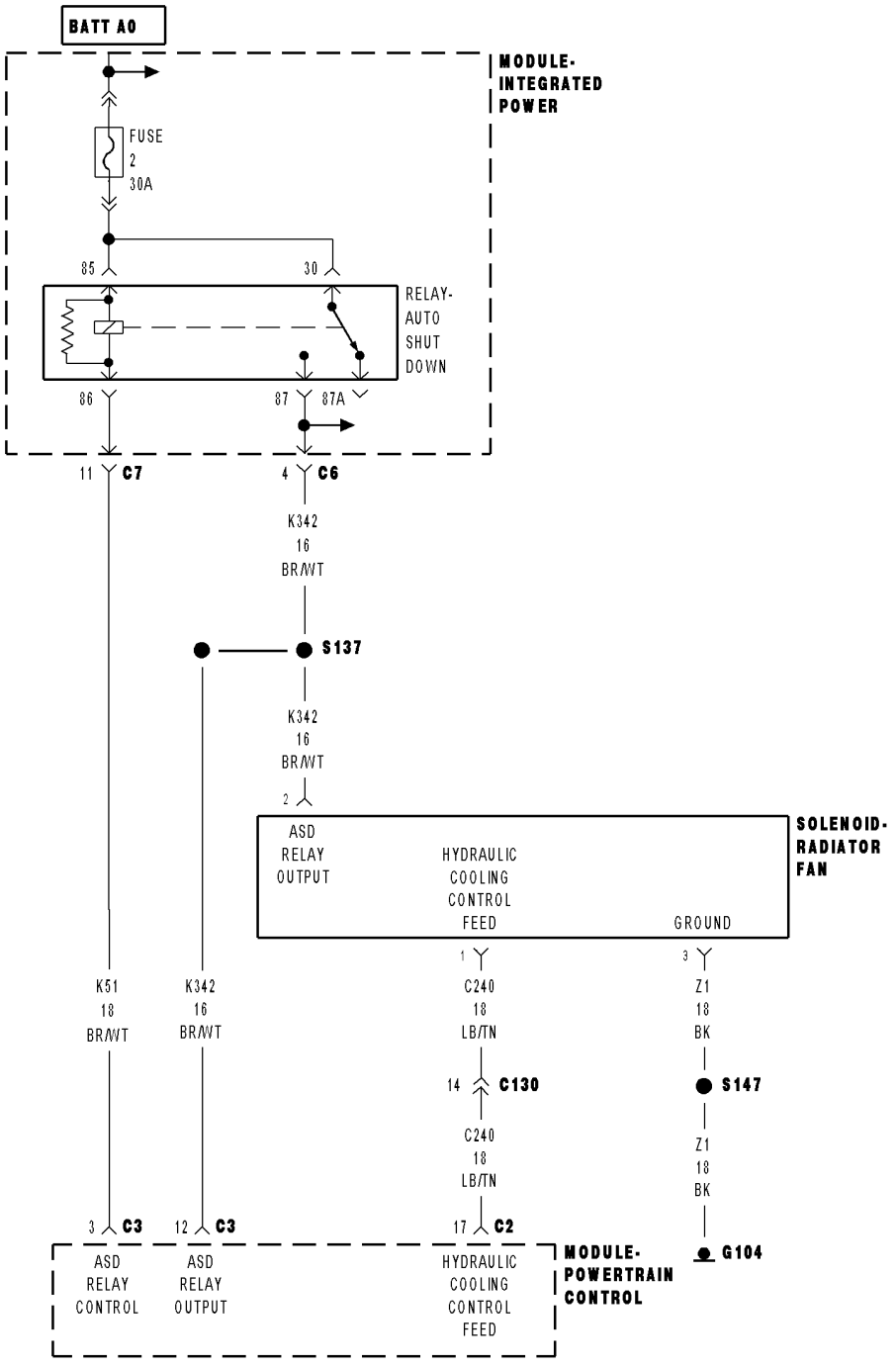
Was there any interruption in the normal cycle of the test light?

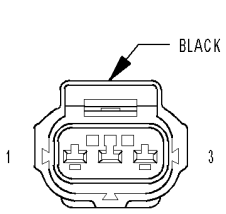
Yes >> Repair the wire or connector where the wiggling interrupted the voltage cycle.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

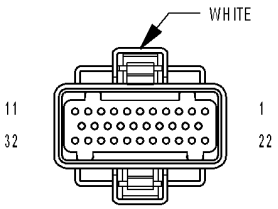
---

*CHECKING RADIATOR FAN OPERATION

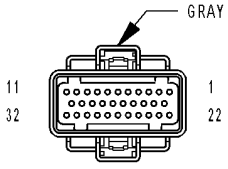




SOLENOID-
RADIATOR FAN
(SRT)



MODULE-
POWERTRAIN
CONTROL C2
(SRT)



MODULE-
POWERTRAIN
CONTROL C3
(SRT)

8156673d

***CHECKING RADIATOR FAN OPERATION (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
HARNESS INSPECTION
HYDRAULIC FAN

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

Diagnostic Test

1. FAN OPERATION

Ignition on, engine not running.

With the scan tool select Engine Test, Systems Test, and Hydraulic Fan Solenoid Test.

Actuate the Hydraulic Fan Solenoid Test.

Does the fan operate properly?

Yes >> Test Complete.

No >> Go To 2

---

2. HARNESS INSPECTION

Turn the ignition off.

Check to see if the fan wire harness is properly connected at the upper right corner of the fan shroud.

Check to see if the fan wire harness is properly connected at the fan solenoid on the fan motor.

Check the harness for continuity from the Hydraulic Fan Relay to the solenoid.

Inspect connector terminals for proper pin fit and corrosion.

Inspect the related fuse and relay.

Were any problems found?

Yes >> Repair any defective wire harness concerns.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Go To 3

---

3. HYDRAULIC FAN

Turn the ignition off.

Inspect the hydraulic circuit for leaks and repair as necessary.

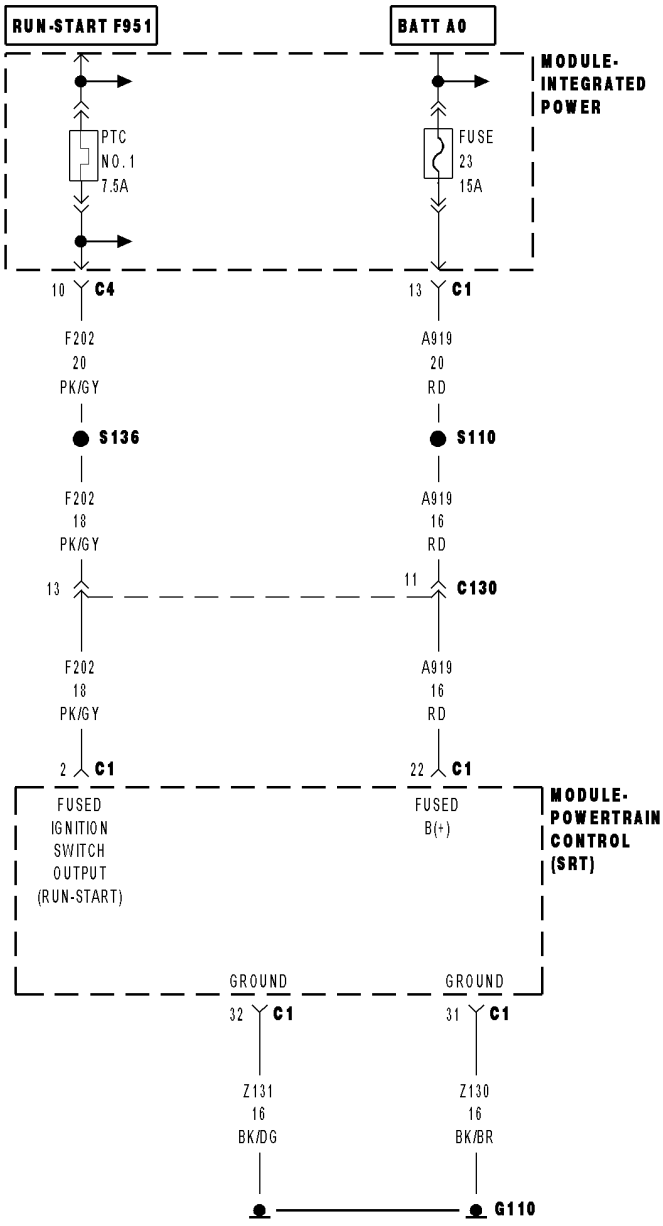
Were any problems found?

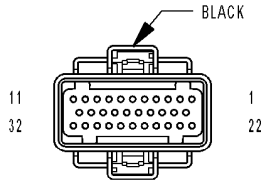
Yes >> Repair the Hydraulic leaks and/or replace the Hydraulic Fan assembly.
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

No >> Test Complete.

---

*CHECKING THE PCM POWER AND GROUNDS





MODULE-
POWERTRAIN
CONTROL C1
(SRT)

8156680f

***CHECKING THE PCM POWER AND GROUNDS (CONTINUED)**

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS).

For a complete wiring diagram **Refer to Section 8W**.

Possible Causes
(A919) PCM FUSED B+ CIRCUIT
(F202) PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT
(Z130) AND (Z131) PCM GROUND CIRCUITS

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)

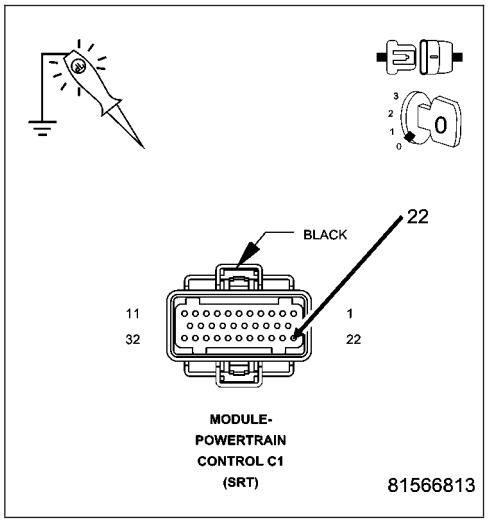
Diagnostic Test

1. (A919) PCM FUSED B+ CIRCUIT

Turn the ignition off.

Disconnect the PCM harness connectors.

Using a 12-volt test light connected to ground, probe the (A919) PCM Fused B+ circuit in the C1 PCM harness connector.



Does the test light illuminate brightly?

Yes >> Go To 2

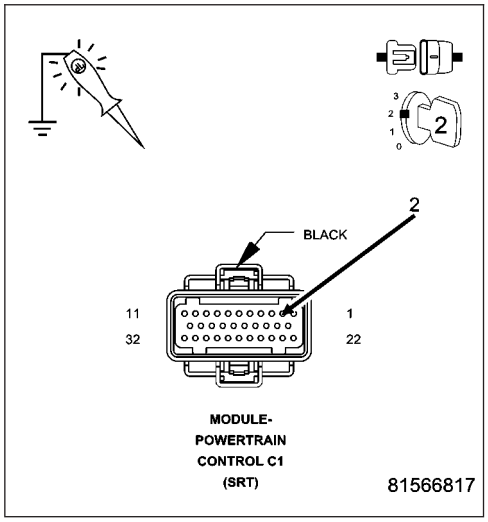
No >> Repair the open in the (A1919) Fused B+ circuit. Inspect the related fuse and repair as necessary.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

2. (F202) PCM FUSED IGNITION SWITCH OUTPUT CIRCUIT

Ignition on, engine not running.

Using a 12-volt test light connected to ground, probe the (F202) PCM Fused Ignition Switch Output circuit in the C1 PCM harness connector.



Does the test light illuminate brightly?

Yes >> Go To 3

No >> Repair the open in the (F202) Fused Ignition Switch Output circuit.

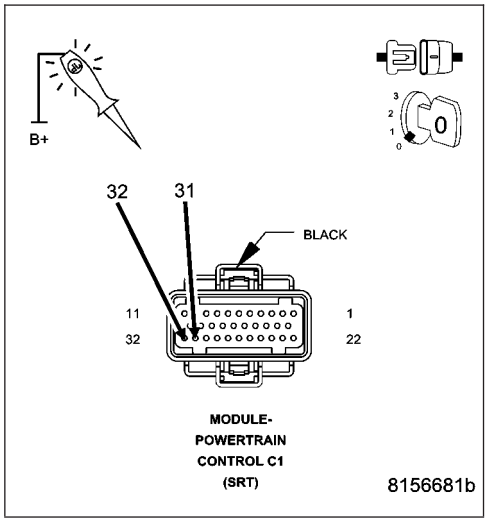
Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

***CHECKING THE PCM POWER AND GROUNDS (CONTINUED)**

3. (Z130) AND (Z131) PCM GROUND CIRCUITS

Turn the ignition off.

Using a 12-volt test light connected to battery voltage, probe the (Z130) and (Z131) PCM ground circuits in the C1 PCM harness connector.



Does the test light illuminate brightly?

Yes >> Test Complete.

No >> Repair the open in the (Z130) and (Z131) PCM ground circuits.

Perform the POWERTRAIN VERIFICATION TEST. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

STANDARD PROCEDURE

POWERTRAIN VERIFICATION TEST

For the Engine circuit diagram (Refer to 9 - ENGINE - SCHEMATICS AND DIAGRAMS)

For a complete wiring diagram **Refer to Section 8W**.

Diagnostic Test

1. SELECTING THE PROPER VERIFICATION TEST

The following verification test are for different repairs. Select the appropriate Verification test for the repair that has been completed.

Speed Control repair
Go To 2

Charging System repair
Go To 3

NVLD System repair
Go To 4

All other repairs
Go To 5

POWERTRAIN VERIFICATION TEST (CONTINUED)

2. POWERTRAIN VERIFICATION TEST 1

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all engine components are properly installed and connected.

6. Connect the scan tool to the data link connector and erase all codes.

7. Turn the speed control ON (if equipped, cruise light will be on).

8. Depress and release the SET Switch when the vehicle speed is greater than 35 MPH. The speed control should engage and hold the selected speed.

9. Press and hold the RESUME/ACCEL Switch. The vehicle speed should increase by at least 2 MPH.

10. Press and hold the COAST switch. The vehicle speed should decrease.

11. Using caution, press and release the brake pedal. The speed control should disengage.

12. Bring the vehicle speed back up to 35 MPH.

13. Press the RESUME/ACCEL switch. The speed control should resume the previously set speed.

14. Hold down the SET switch. The vehicle should decelerate.

15. Make sure vehicle speed is greater than 35 mph and release the SET Switch. The vehicle should adjust and set a new vehicle speed.

16. Press and release the CANCEL switch. The speed control should disengage.

17. Bring the vehicle speed back up above 35 mph and engage speed control.

18. Turn the Speed Control Off. (Cruise light will be off). The speed control should disengage.

NOTE: OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET.

20. If the vehicle operator repeatedly presses and releases the SET button with their foot off of the accelerator (referred to as ″lift foot set″), the vehicle may accelerate and exceed the desired set speed by up to 5 mph (8 km/h).

21. It may also decelerate to less than the desired set speed, before finally achieving the desired set speed.

22. The Speed Control System has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths.

23. When the speed control is set with the vehicles operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts accordingly.

24. If the ″lift foot sets″ are continually used, a speed control overshoot/undershoot condition will develop.

25. To ″unlearn″ the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed using the accelerator pedal (not decelerating or accelerating).

26. Then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds.

27. This procedure must be performed approximately 10-15 times to completely unlearn the overshoot/undershoot condition.

Did the Speed Control pass the above test?

Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

POWERTRAIN VERIFICATION TEST (CONTINUED)

3. POWERTRAIN VERIFICATION TEST 2

1. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly has been replaced use a scan tool to perform the ETC RELEARN function.

NOTE: 2. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 3. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 4. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

5. Inspect the vehicle to make sure that all components related to the repair are properly installed and connected.
6. With the scan tool, clear DTCs.
7. Perform generator output test. Refer to the appropriate service information as necessary.
8. Start the engine and set engine speed to 2000 RPM for at least thirty seconds.
9. Cycle the ignition key off and on.
10. With the scan tool, read the DTCs.

Are any DTCs or symptoms remaining?

Yes >> Check for any Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

No >> Repair is complete.

---

4. POWERTRAIN VERIFICATION TEST 3

1. Install the Miller Tool #8404 Evaporative Emission Leak Detector (EELD) according to the instructions in the previous DTC table.
2. Set the smoke/air control switch to AIR.
3. Insert the tester's AIR supply tip (clear hose) into the appropriate calibration orifice on the tester's control panel (based on DTC leak size).
4. Press the remote smoke/air start button.
5. Position the red flag on the air flow meter so it is aligned with the indicator ball.
6. When the calibration is complete, release the remote button. The EELD flow meter is now calibrated in liters per minute to the size of leak indicated by the DTC set in the PCM.
7. Install the service port adapter #8404-14 on the vehicle's service port.
8. Connect the Air supply hose from the EELD to the vehicle.
9. Press the remote button to activate AIR flow.

NOTE: 10. Larger volume fuel tanks, lower fuel levels or if the vehicle is equipped with a Flow Management Valve may indicate high flow and will require 4 to 5 minutes to fill.

11. Compare the flow meter indicator ball reading to the red flag.
12. ABOVE the red flag indicates a leak present.
13. BELOW the red flag indicates a sealed system.

NOTE: If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

15. If the indicator ball shows a leak present, perform the smoke test indicated in the previous test and identify the leak and repair. Perform this verification test when the repair is complete.

Did the indicator ball indicate the a leak is present?

Yes >> Repeat the DTC test to identify the leak and repair.

No >> Repair is complete.

POWERTRAIN VERIFICATION TEST (CONTINUED)

5. POWERTRAIN VERIFICATION TEST 4

NOTE: 1. After completing the Powertrain Verification Test the Transmission Verification Test must be performed.

NOTE: 2. If the PCM has been replaced and the correct VIN and mileage have not been programmed, a DTC will set in the ABS Module, Airbag Module and the SKIM/SKREEM.

NOTE: 3. If the vehicle is equipped with a Sentry Key Remote Entry, Secret Key data must be updated. Refer to the Service Information for the PCM, SKIM/SKREEM and the Transponder (ignition key) for programming information. Using the scan tool, program the Secret Key information into the PCM using the PCM replaced function under the WCM menu.

NOTE: 4. If this vehicle is equipped with an Electronic Throttle Control system, and the APP Sensors, PCM, or Throttle Body Assembly have been replaced, use the scan tool to perform the ETC RELEARN function.

NOTE: 5. When replacing an O2 Sensor, the PCM RAM memory must be cleared, either by disconnecting the PCM C1 connector or momentarily disconnecting the Battery negative terminal.

6. The NGC learns the characteristics of each O2 heater element and these old values should be cleared when installing a new O2 sensor. The customer may experience driveability issues if this is not performed.

7. Inspect the vehicle to make sure that all engine components are properly installed and connected. Reassemble and reconnect components as necessary.

8. Connect the scan tool to the data link connector.

9. Make sure the fuel tank has at least a quarter tank of fuel. Turn off all accessories.

10. If the Catalyst was replaced, with the scan tool go to the Miscellaneous Menu Option ″Catalyst Replaced″ and press enter.

11. If a Comprehensive Component DTC was repaired, perform steps 12 - 14. If a Major OBDII Monitor DTC was repaired skip those steps and continue verification.

12. After the ignition has been off for at least 10 seconds, restart the vehicle and run 2 minutes.

13. With the scan tool, monitor the appropriate pre-test enabling conditions until all conditions have been met. Once the conditions have been met, switch screen to the appropriate OBDII monitor, (Audible beeps when the monitor is running).

14. If the repaired OBDII trouble code has reset or was seen in the monitor while on the road test, the repair is not complete. Check for any related technical service bulletins or flash updates and return to Engine Electrical Diagnostic List.

15. If the conditions cannot be duplicated, erase all DTCs with the Scan tool.

16. If another DTC has set, return to the Engine Electrical Diagnostic List and follow the path specified for that DTC.

Did the OBDII Monitor run successfully and has the Good Trip Counter changed to one or more?

Yes >> Repair is complete.

No >> Check for any related Technical Service Bulletins and/or refer to the appropriate Diagnostic Procedure.

ENGINE - 3.7L - SERVICE INFORMATION

TABLE OF CONTENTS

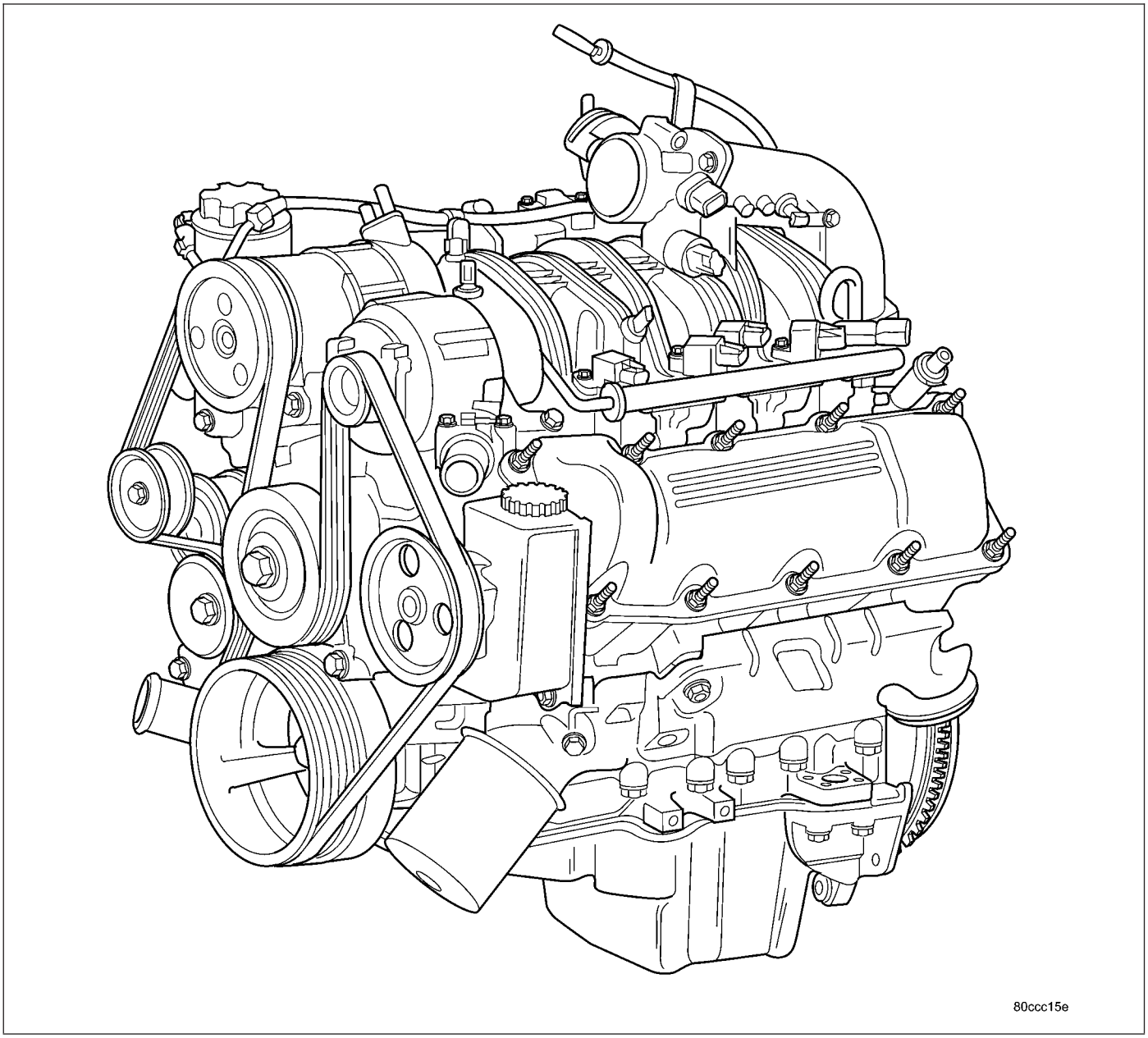
page

ENGINE - 3.7L - SERVICE INFORMATION
DESCRIPTION 2039
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION 2040
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE 2040
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL 2042
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION 2043
DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE 2044
DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE 2044
STANDARD PROCEDURE
STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS 2045
STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS 2045
STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION 2046
REMOVAL 2047
INSTALLATION 2051
SPECIFICATIONS
SPECIFICATIONS - 3.7L ENGINE 2055
TORQUE 2060
SPECIAL TOOLS 2061
ELEMENT - AIR CLEANER
REMOVAL 2066
INSTALLATION 2067
CYLINDER HEAD - LEFT
DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET 2067
REMOVAL 2068
INSTALLATION 2070
CAMSHAFT
DESCRIPTION 2072
REMOVAL 2072
INSTALLATION 2074
COVER - CYLINDER HEAD
DESCRIPTION 2075
REMOVAL 2075
INSTALLATION 2076
VALVES & SEATS - INTAKE/EXHAUST
DESCRIPTION 2076
STANDARD PROCEDURE - REFACING 2077
REMOVAL 2077
INSTALLATION 2078
ROCKER ARM - VALVE
DESCRIPTION 2079
REMOVAL 2079
INSTALLATION 2080
SEALS - VALVE GUIDE
DESCRIPTION 2080
SPRINGS VALVE
DESCRIPTION 2080
REMOVAL 2080
INSTALLATION 2081
CYLINDER HEAD - RIGHT
DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER 2081
REMOVAL 2082
INSTALLATION 2084
CAMSHAFT
DESCRIPTION 2087
REMOVAL 2088
INSTALLATION 2091
COVER - CYLINDER HEAD
REMOVAL 2092
INSTALLATION 2093
ROCKER ARM - VALVE
DESCRIPTION 2093
REMOVAL 2094
SEALS - VALVE GUIDE
DESCRIPTION 2094
SPRINGS - VALVE
DESCRIPTION 2094
REMOVAL 2094
INSTALLATION 2095
ENGINE BLOCK
DESCRIPTION 2095
STANDARD PROCEDURE - CYLINDER BORE HONING 2096
CLEANING 2096
INSPECTION 2097
CRANKSHAFT
DESCRIPTION 2098
REMOVAL 2099
INSPECTION 2100
INSTALLATION 2100
BEARINGS - CRANKSHAFT MAIN
STANDARD PROCEDURE
MAIN BEARING FITTING 2102
SEAL - CRANKSHAFT OIL - FRONT
REMOVAL 2104
INSTALLATION 2105
SEAL - CRANKSHAFT OIL - REAR
DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS 2105
REMOVAL 2106
INSTALLATION 2106

FLEX PLATE
REMOVAL 2107
INSTALLATION 2108
PISTON & CONNECTING ROD
DESCRIPTION 2108
STANDARD PROCEDURE
CONNECTING ROD BEARING FITTING . . . 2109
STANDARD PROCEDURE - PISTON FITTING 2112
REMOVAL 2112
CLEANING 2113
INSPECTION 2113
INSTALLATION 2114
RINGS - PISTON
STANDARD PROCEDURE - PISTON RING FITTING 2115
DAMPER - CRANKSHAFT
REMOVAL 2118
INSTALLATION 2119
COVER - STRUCTURAL
DESCRIPTION 2119
OPERATION 2119
REMOVAL 2120
INSTALLATION 2120
MOUNT - FRONT
REMOVAL 2120
INSTALLATION 2122
MOUNT - REAR
REMOVAL 2124
INSTALLATION 2124
LUBRICATION
DESCRIPTION 2125
OPERATION 2125
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - ENGINE OIL LEAK 2127
DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE 2128
DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS 2128
PAN -ENGINE OIL
DESCRIPTION 2129
REMOVAL 2130
CLEANING 2131
INSPECTION 2131
INSTALLATION 2131
SWITCH - OIL PRESSURE
DESCRIPTION 2132
OPERATION 2132
REMOVAL 2133
INSTALLATION 2133
PUMP - ENGINE OIL
REMOVAL 2133
DISASSEMBLY 2133
INSPECTION 2134
ASSEMBLY 2136
INSTALLATION 2136
FILTER - ENGINE OIL
REMOVAL 2137
INSTALLATION 2137
OIL
STANDARD PROCEDURE - ENGINE OIL SERVICE 2138
MANIFOLD - INTAKE
DESCRIPTION 2139
DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS 2139
REMOVAL 2140
INSTALLATION 2140
MANIFOLD - EXHAUST
DESCRIPTION 2141
REMOVAL 2142
INSTALLATION 2143
VALVE TIMING
DESCRIPTION 2144
OPERATION 2144
STANDARD PROCEDURE
MEASURING TIMING CHAIN WEAR 2145
SERVICE PROCEDURE - TIMING VERIFICATION 2146
SHAFT - BALANCE
REMOVAL 2149
INSTALLATION 2150
SHAFT - IDLER
REMOVAL 2150
INSTALLATION 2151
COVER - TIMING
REMOVAL 2151
INSTALLATION 2152
TIMING CHAIN & SPROCKETS
REMOVAL 2153
INSPECTION 2156
INSTALLATION 2156

ENGINE - 3.7L - SERVICE INFORMATION

DESCRIPTION



The 3.7 liter (226 CID) six-cylinder engine is an 90° single overhead camshaft engine. The cast iron cylinder block is made up of two different components; the first component is the cylinder bore and upper block, the second component is the bedplate that comprises the lower portion of the cylinder block and houses the lower half of the crankshaft main bearings. The cylinders are numbered from front to rear with the left bank being numbered 1,3, and 5 and the right bank being numbered 2,4, and 6. The firing order is 1–6–5–4–3–2. The engine serial number is located at the right front side of the engine block.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Incorrect right bank cam timing.	6. Refer to engine timing in this section.
	7. Dirt or water in fuel system.	7. Clean system and replace fuel filter.
	8.Faulty fuel pump, relay or wiring.	8.Repair or replace as necessary.
	9. Faulty cam or crank sensor	9. Refer to Ignition system.
ENGINE STALLS OR ROUGH IDLE	1. Vacuum leak.	1. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	2. Faulty crank position sensor	2. Replace crank position sensor.
	3. Faulty coil.	3. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).

CONDITION	POSSIBLE CAUSE	CORRECTION
	4. Incorrect cam timing.	4. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
1. ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL PUMP - DIAGNOSIS AND TESTING).
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), repair as necessary.
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	9. Incorrect cam timing.	9. Refer to Engine TIming in this section.
1. ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replcae as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
1. ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
	8. Excessive runout of valve seats on valve faces.	8. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings.	1.
	(a) Misaligned or damaged.	(a) Replace as necessary.
	(b) Loose fasteners, broken or porous metal parts.	(b) Tighten fasteners, Repair or replace metal parts.
	2. Crankshaft rear seal	2. Replace as necessary (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - REAR - REMOVAL).
	3. Crankshaft seal flange. Scratched, nicked or grooved.	3. Polish or replace crankshaft.
	4. Oil pan flange cracked.	4. Replace oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
	5. Timing chain cover seal, damaged or misaligned.	5. Replace seal (Refer to 9 - ENGINE/ENGINE BLOCK/ CRANKSHAFT OIL SEAL - FRONT - REMOVAL).
	6. Scratched or damaged vibration damper hub.	6. Polish or replace damper.
OIL PRESSURE DROP	1. Low oil level.	1. Check and correct oil level.
	2. Faulty oil pressure sending unit.	2. Replace sending unit (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR/SWITCH - REMOVAL).
	3. Low oil pressure.	3. Check oil pump and bearing clearance.
	4. Clogged oil filter.	4. Replace oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
	5. Worn oil pump.	5. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	6. Thin or diluted oil.	6. Change oil and filter.
	7. Excessive bearing clearance.	7. Replace as necessary.
	8. Oil pump relief valve stuck.	8. Replace oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).
	9. Oil pick up tube loose, damaged or clogged.	9. Replace as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings.	1. Hone cylinder bores and replace rings.
	2. Carbon in oil ring slots.	2. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	3. Incorrect ring size installed.	3. Replace rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
	4. Worn valve guides.	4. Ream guides and replace valves (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
	5. Leaking valve guide seals.	5. Replace valve guide seals.

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
4. Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
7. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

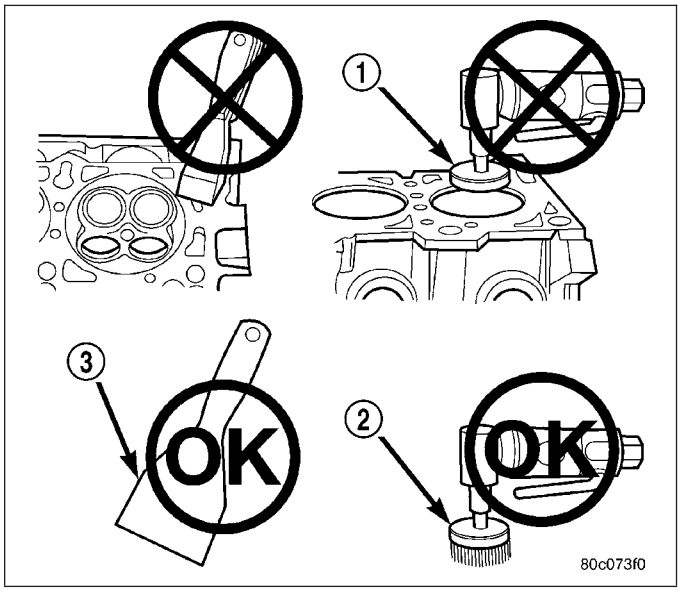
Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper (3).
- Abrasive pad (1) or paper to clean cylinder block and head.
- High speed power tool (1) with an abrasive pad or a wire brush.



NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

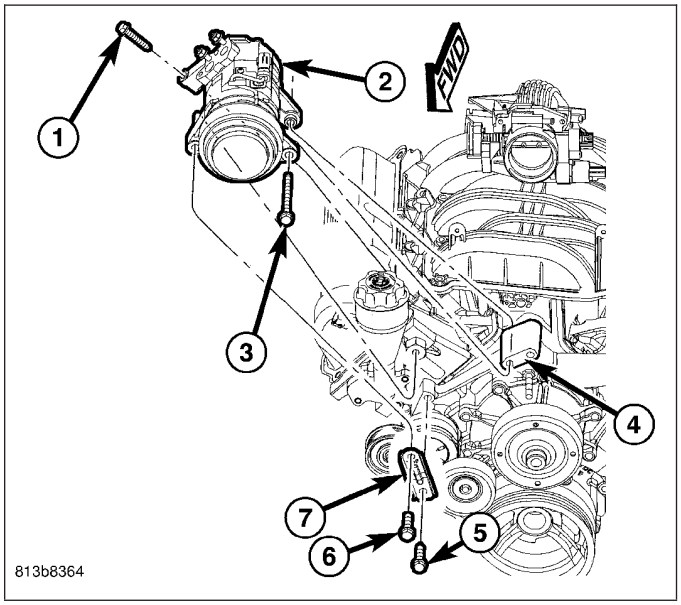
Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper.
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow).

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

REMOVAL

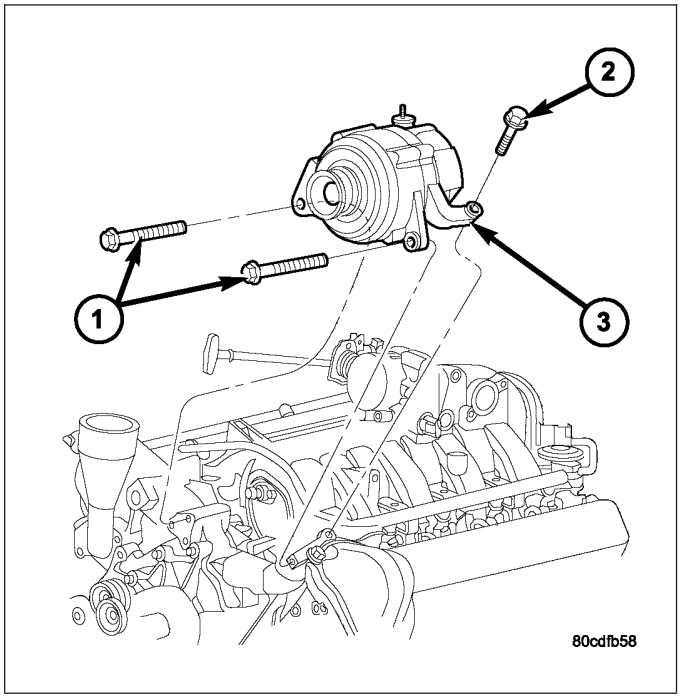
1. Disconnect the battery negative cable.
2. Remove air cleaner assembly.
3. Remove radiator core support bracket.
4. Remove fan shroud with viscous fan assembly.
5. Remove drive belt.
6. Remove A/C compressor (2) and secure away from engine.



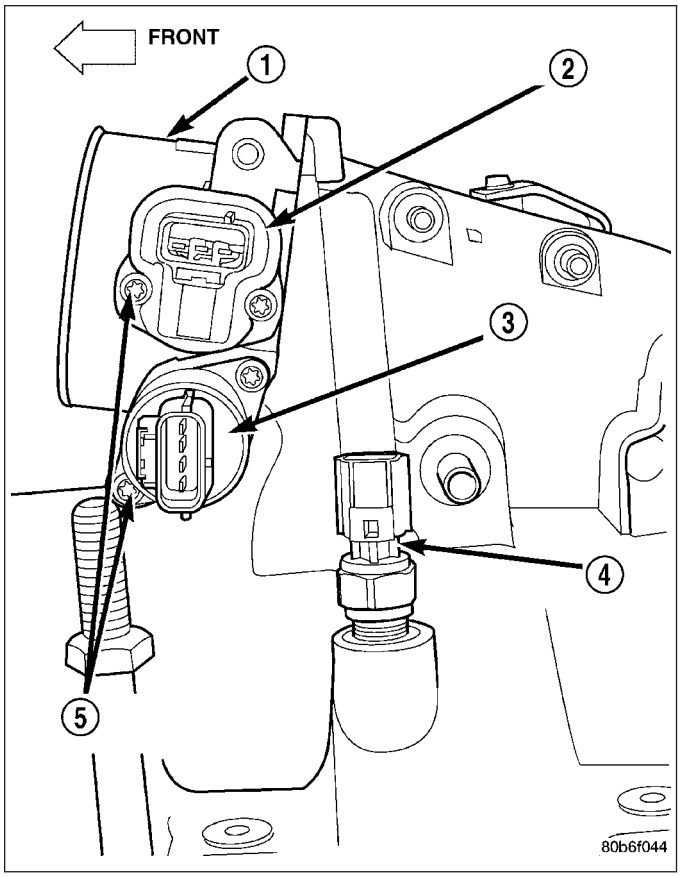
7. Remove generator (3) and secure away from engine.

NOTE: Do NOT remove the phenolic pulley from the P/S pump. It is not required for P/S pump removal.

8. Remove power steering pump with lines attached and secure away from engine.
9. Drain cooling system.
10. Disconnect the heater hoses from the engine.
11. Disconnect heater hoses from heater core and remove hose assembly.
12. Disconnect throttle and speed control cables.
13. Remove upper radiator hose from engine.
14. Remove lower radiator hose from engine.
15. Remove radiator/cooling module assembly.
16. Disconnect the engine to body ground straps at the left side of cowl.



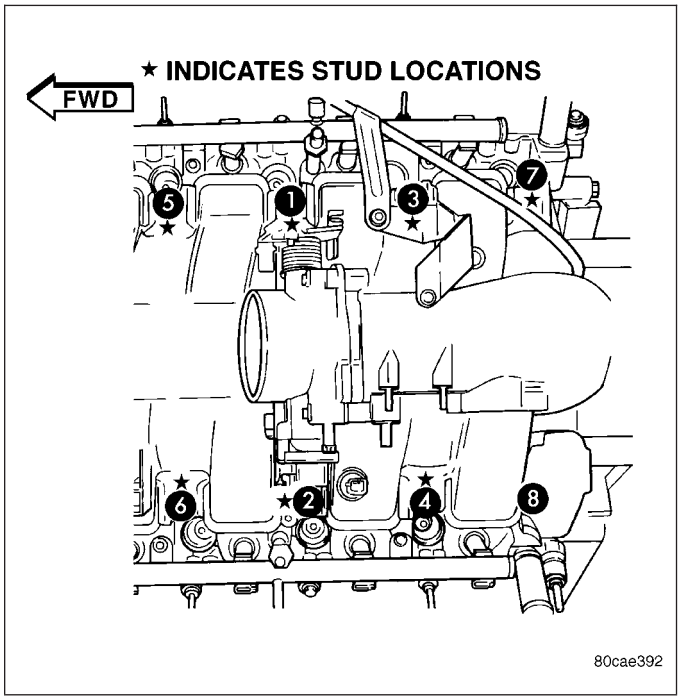
17. Disconnect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
    - Crankshaft Position Sensor
18. Remove coil over plugs.



19. Release fuel rail pressure.
20. Remove fuel rail and secure away from engine.

NOTE: It is not necessary to release the quick connect fitting from the fuel supply line for engine removal.

21. Remove the PCV hose.
22. Remove the breather hoses.
23. Remove the vacuum hose for the power brake booster.
24. Disconnect knock sensors.
25. Remove engine oil dipstick tube.
26. Remove intake manifold.



27. Install engine lifting fixture,special tool#8247, using original fasteners from the removed intake manifold, and fuel rail. Torque to factory specifications.

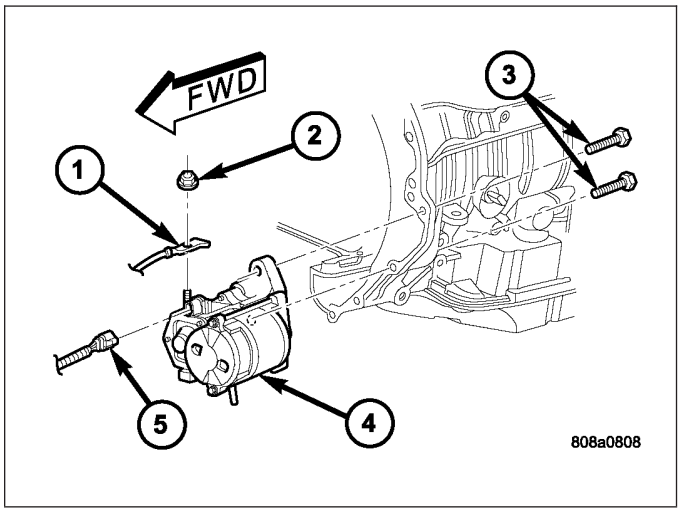
NOTE: Recheck bolt torque for engine lift plate before removing engine.

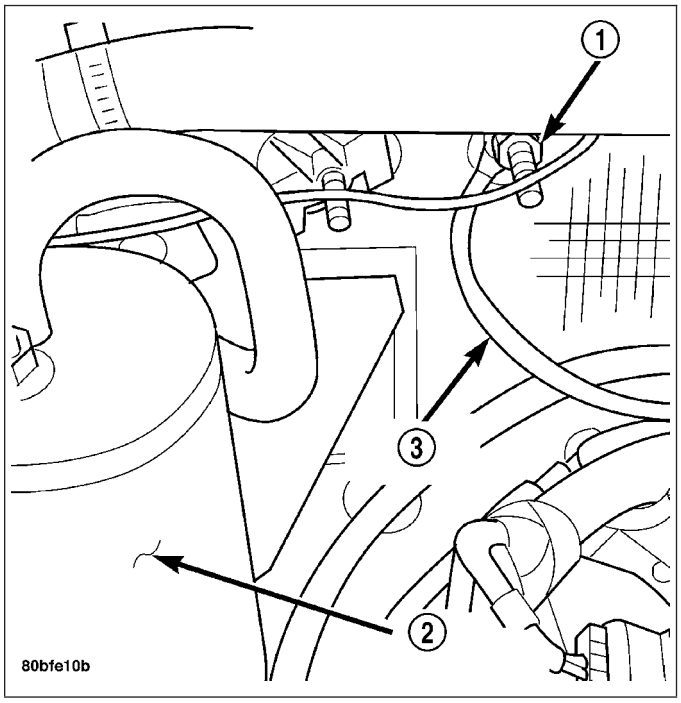
28. Secure the left and right engine wiring harnesses away from engine.

29. Raise vehicle.
30. Disconnect oxygen sensor wiring.
31. Disconnect crankshaft postion sensor.
32. Disconnect the engine block heater power cable, if equipped.
33. Disconnect the front propshaft at the front differential and secure out of way.

NOTE: It is necessary to disconnect the front propshaft for access to the starter and left side exhaust flange.

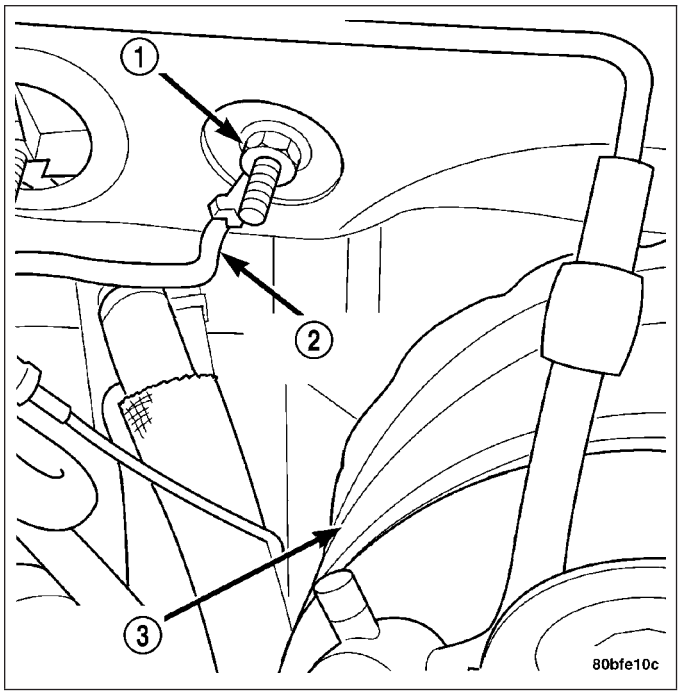
34. Remove the starter (4).



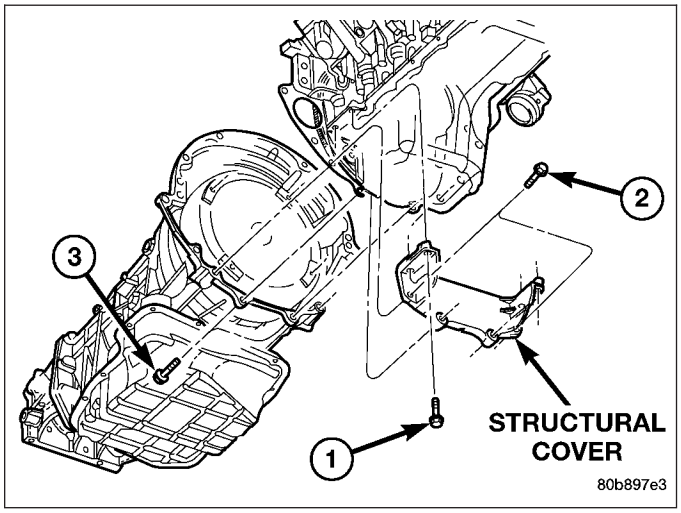


35. Remove the ground straps from the left (2) and right (3) side of the block.
36. Disconnect the right and left exhaust pipes at the manifolds and from the crossover, and remove from the vehicle.

NOTE: The exhaust clamps at the manifolds cannot be reused. New clamps must be used or leaks may occur.

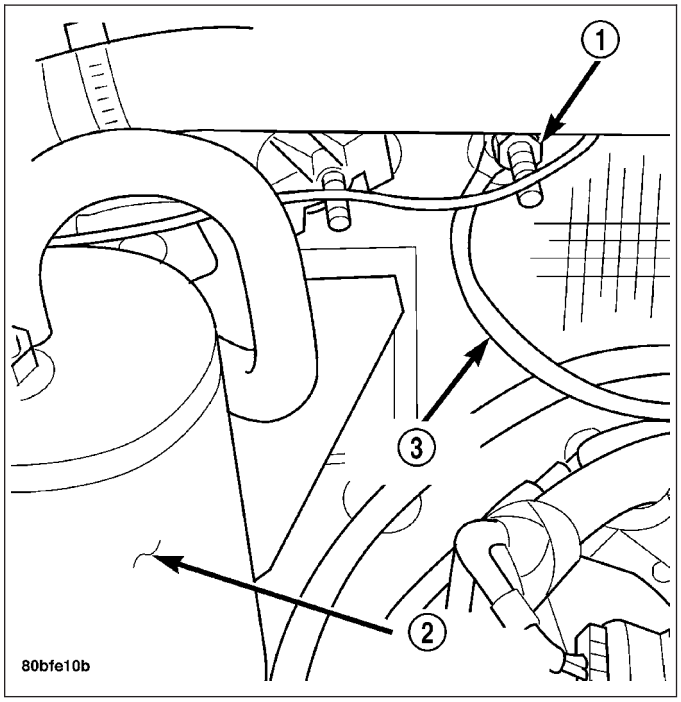


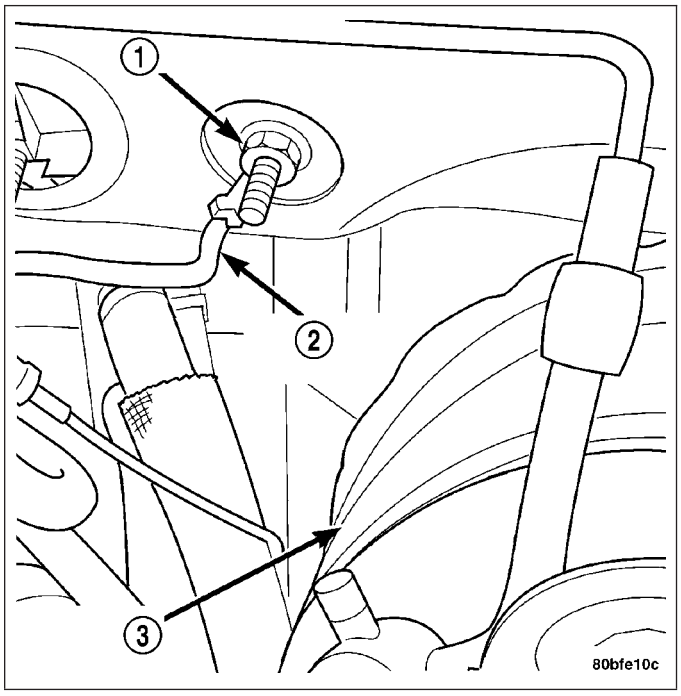
37. Remove the structural cover.
38. Remove torque convertor bolts, and mark location for reassembly.
39. Remove transmission bellhousing to engine bolts.
40. Remove left and right engine mount thru bolts.
41. Lower the vehicle.
42. Support the transmission with a suitable jack.
43. Connect a suitable engine hoist to the engine lift plate.
44. Remove engine from vehicle.



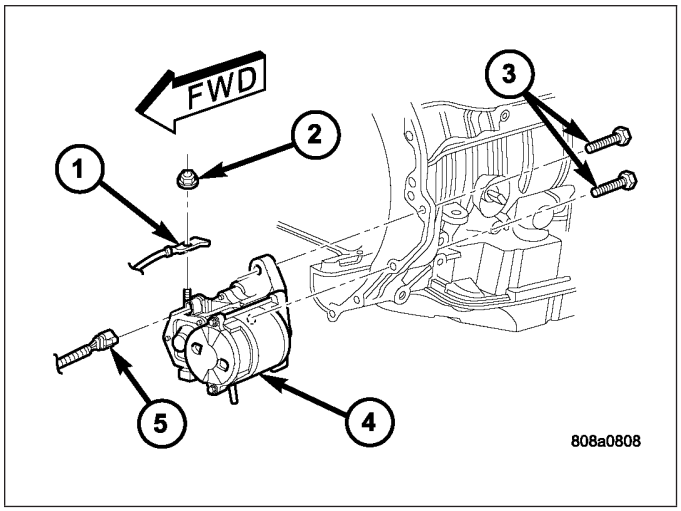
INSTALLATION

1. Position the engine in the vehicle.
2. Install both left and right side engine mounts onto engine.
3. Raise the vehicle.
4. Install the transmission bellhousing to engine mounting bolts. Tighten the bolts to 41 N·m (30ft. lbs.).
5. Tighten the engine mount thru bolts.
6. Install the torque convertor bolts.
7. Connect the ground straps on the left (2) and right (3)side of the engine.





8. Install the starter(4).
9. Connect the crankshaft position sensor.
10. Install the engine block heater power cable, if equipped.

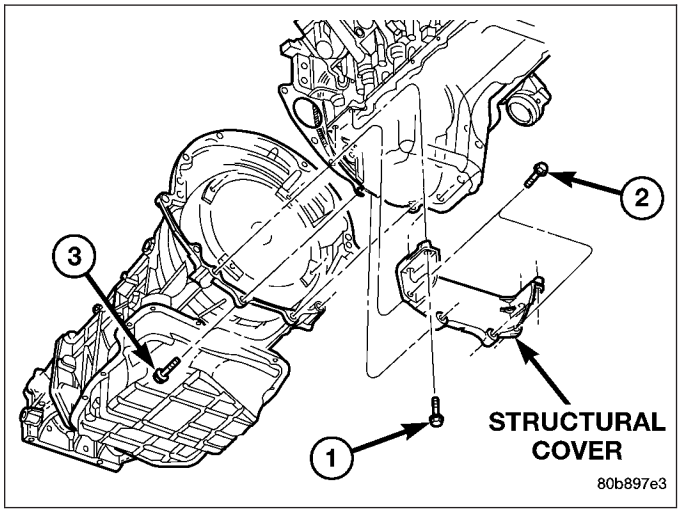


CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

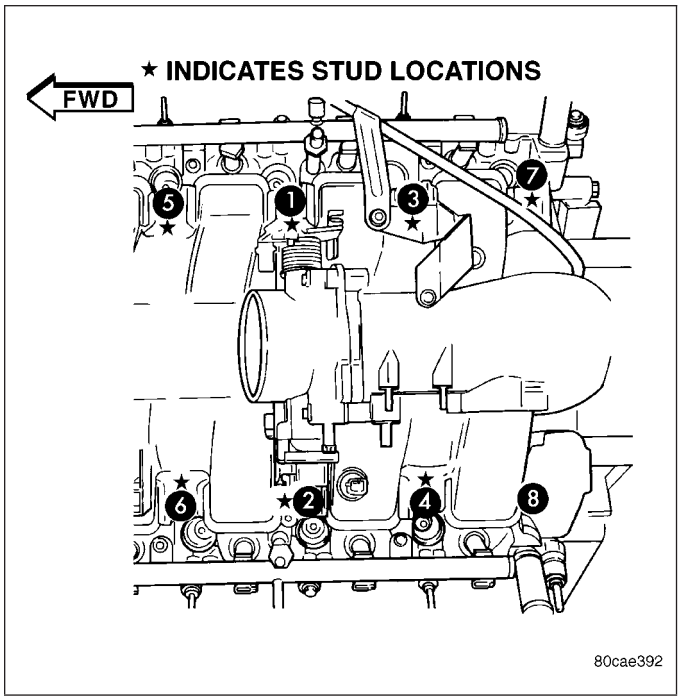
11. Install the structural cover.

NOTE: New clamps must be used on exhaust manifold flanges. Failure to use new clamps may result in exhaust leaks.

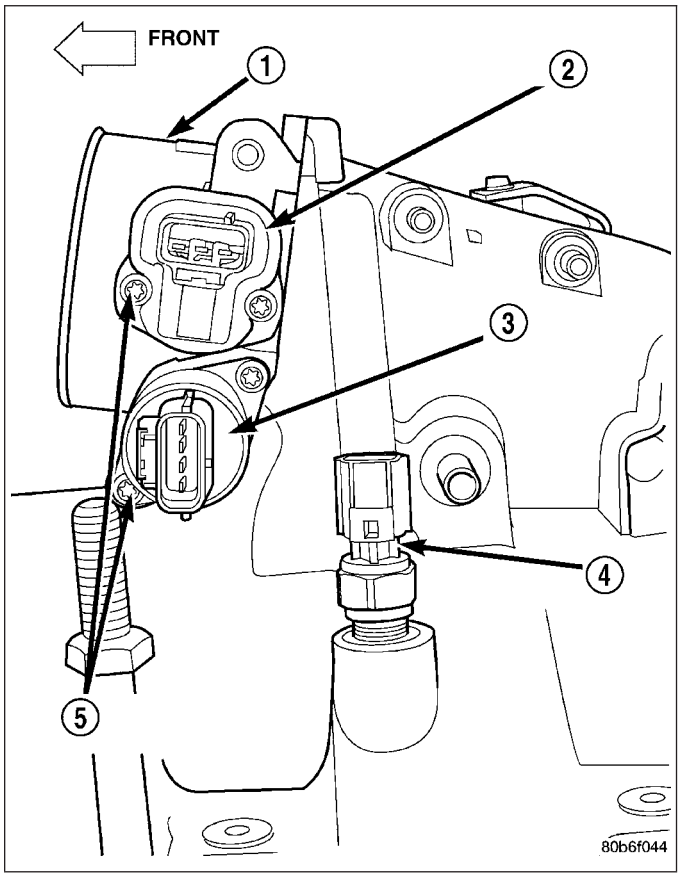
12. Install the left and right exhaust pipes.
13. Connect the left and right oxygen sensors.
14. Lower vehicle.
15. Remove the engine lift plate.
16. Connect the knock sensors.
17. Connect the engine to body ground straps at the left side of the cowl.



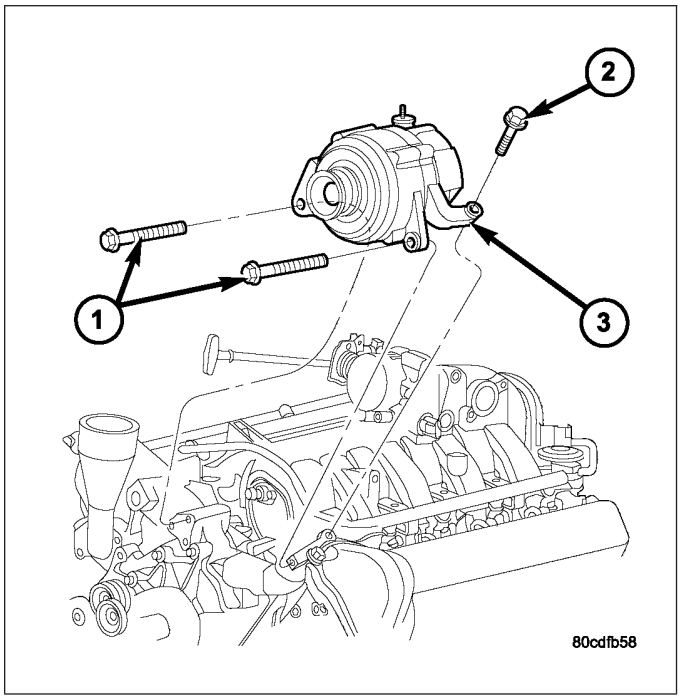
18. Install the intake manifold.
19. Install the engine oil dipstick tube.
20. Install the power brake booster vacuum hose.
21. Install the breather hoses.
22. Install the PCV hose.
23. Install the fuel rail.
24. Install the coil over plugs.



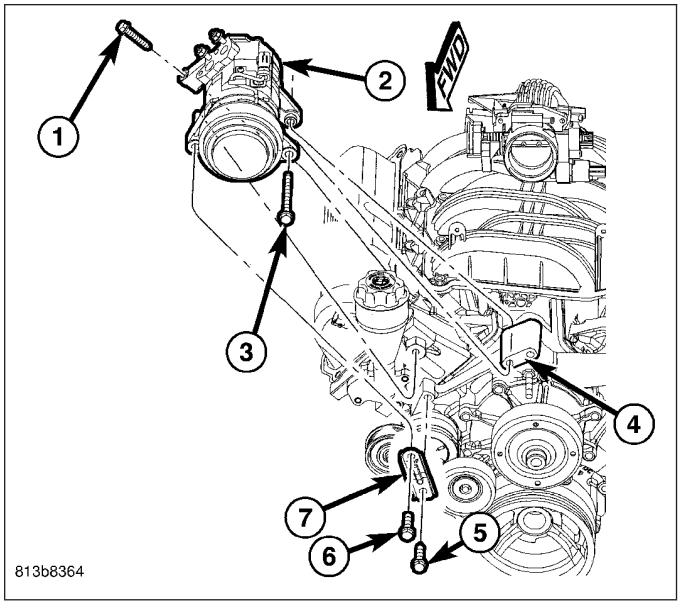
25. Connect the engine wiring harness at the following points:
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
    - Crankshaft Position Sensor



26. Reinstall the radiator/cooling module assembly.
27. Connect lower radiator hose.
28. Connect upper radiator hose.
29. Connect throttle and speed control cables.
30. Install the heater hose assembly.
31. Install coolant recovery bottle.
32. Install the power steering pump.
33. Install the generator (3).



34. Install the A/C compressor (2).
35. Install the drive belt.
36. Install the fan shroud with the viscous fan assembly.
37. Install the radiator core support bracket.
38. Install the air cleaner assembly.
39. Refill the engine cooling system.
40. Recharge the air conditioning.
41. Check and fill engine oil.
42. Connect the battery negative cable.
43. Start the engine and check for leaks.



SPECIFICATIONS

SPECIFICATIONS - 3.7L ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	90° SOHC V6 12 Valve	
Number of Cylinders	6	
Firing Order	1-6-5-4-3-2	
Lead Cylinder	No. 1 Left Bank	
Compression Ratio	9.6:1	
Max. Variation Between Cylinders	25%	
	Metric	**Standard**
Displacement	3.7 Liters	226 Cubic Inches
Bore	93.0 mm	3.66 in.
Stroke	90.8 mm	3.40 in.
Horsepower	211 @ 5200 RPM	
Torque	236ft. lbs.@4000 PRM	
Compression Pressure	1172-1551 kPa	170-225 psi

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Bore Diameter	93.013 ± .0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Diameter	92.975 mm	3.6605 in.
Weight	365.0 grams	12.87 oz
Ring Groove Diameter		
No. 1	85.37 - 83.13 mm	3.282 - 3.273 in
No. 2	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	**Standard**
Clearance In Piston	0.006 - 0.015 mm	0.0002 - 0.0005 in.
Diameter	24.017 - 24.020 mm	0.9455 - 0.9456 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails)	0.25 - 0.76 mm	0.0099 - 0.30 in.
Side Clearance		
Top Compression Ring	.051 - .094 mm	0.0020 - 0.0037 in.
Second Compression Ring	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring)	.019 - .229 mm	.0007 - .0091 in.
Ring Width		
Top Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails)	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.006 - 0.044 mm	0.0002 - 0.0017 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Clearance	.015 - .028 mm	0.0006 - 0.0011 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	612 grams	21.588 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.002 - 0.046 mm	0.00008 - 0.0018 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	57.908 - 57.892 mm	2.2798 - 2.2792 in.
Bearing Clearance	0.006 - 0.044	0.0002 - 0.0011 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.006 mm	0.0002 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.975 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	.075 - .200 mm	0.003 - 0.0079 in.
End Play (MAX)	.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	5.6°
Closes (ATDC)	240.1°
Duration	245.7°
Exhaust	
Opens (BTDC)	241.5°
Closes (ATDC)	20.1°
Duration	261.6°
Valve Overlap	25.7°

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle	45° - 45.5°	
Head Diameter		
Intake	48.52 - 48.78 mm	1.9103 - 1.9205 in.
Exhaust	36.87 - 37.13 mm	1.4516 - 1.4618 in.
Length (Overall)		
Intake	113.45 - 114.21 mm	4.4666 - 4.4965 in.
Exhaust	114.92 - 115.68 mm	4.5244 - 4.5543 in.
Stem Diameter		
Intake	6.931 - 6.957 mm	0.2729 - 0.2739 in.
Exhaust	6.902 - 6.928 mm	0.2717 - 0.2728 in.
Stem-to-Guide Clearance		
Intake	0.018 - 0.069 mm	0.0008 - 0.0028 in.
Exhaust	0.047 - 0.098 mm	0.0019 - 0.0039 in.

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Max. Allowable Stem-to-Guide Clearance (Rocking Method)		
Intake	0.069 mm	0.0028 in.
Exhaust	0.098 mm	0.0039 in.
Valve Lift (Zero Lash)		
Intake	12.00 mm	0.472 in.
Exhaust	12.00 mm	0.472 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length (Approx)		
Intake	48.18 mm	1.896 in.
Exhaust - w/damper	48.2 mm	1.897 in.
Spring Force (Valve Closed)		
Intake	332.0 - 368.0 N @ 40.12 mm	74.63 - 82.72 lbs. @ 1.5795 in.
Exhaust - (without damper)	356 - 394 N @ 39.12 mm	80.031 - 88.57 lbs. @ 1.54 in.
Spring Force (Valve Open)		
Intake	948.0 - 1038.0 N @ 28.12 mm	213.2 - 233.8 lbs. @ 1.107 in.
Exhaust - without damper	974 - 956 N @ 27.12 mm	218.8 - 215.1 lbs. @ 1.067 in.
Number of Coils		
Intake	7.30	
Exhaust	7.15	
Wire Diameter		
Intake	4.77 × 3.80mm	0.1878 × 0.1496 in.
Exhaust	4.66 × 3.72mm	0.1843 × .1464 in.
Installed Height (Spring Seat to Bottom of Retainer)		
Nominal		
Intake	40.12 mm	1.579 in.
Exhaust - w/damper	40.12 mm	1.579 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	0.7 mm	(0.0276 in.)
Valve Seat Angle	44.5° - 45.0°	
Valve Seat Runout (MAX)	0.051 mm	0.002 in.
Valve Seat Width		
Intake	1.75 - 2.36 mm	0.0698 - 0.0928 in.
Exhaust	1.71 - 2.32 mm	0.0673 - 0.0911 in.
Guide Bore Diameter (Std.)	6.975 - 7.00 mm	0.2747 - 0.2756 in.
Cylinder Head Warpage (Flatness)	0.0508 mm	0.002 in.

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors/End Face (MAX)	0.095 mm	0.0038 in.
Cover Out - of -Flat (MAX)	0.025 mm	0.001 in.
Inner and Outer Rotor Thickness	12.02 mm	0.4731 in.
Outer Rotor to pocket (Diametral) clearance (MAX)	.235 mm	.0093 in.
Outer Rotor Diameter (MIN)	85.925 mm	0.400 in.
Tip Clearance Between Rotors (MAX)	0.150 mm	0.006 in.

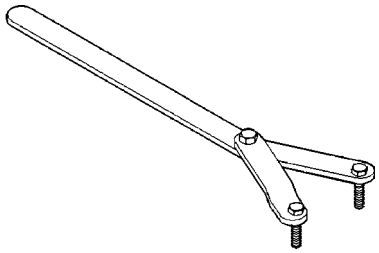
OIL PRESSURE

SPECIFICATION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed (MIN)*	25 kPa	4 psi
@ 3000 rpm	170 - 758 kPa	25 - 110 psi
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**		

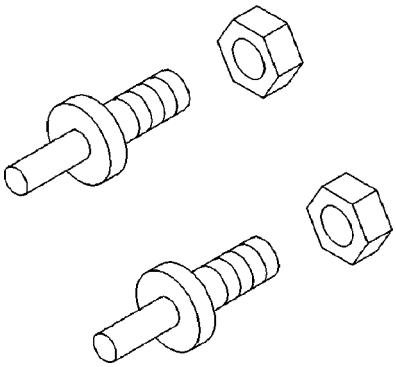
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt - Camshaft			
Non - Oiled Sprocket Bolt	122	90	-
Bearing Cap Bolts	11	-	100
Bolt - Counterbalance shaft retaining	28	-	250
Bolts - Timing Chain Cover	58	43	-
Bolts - Connecting Rod Cap	27	20	-
	PLUS 90° TURN		
Bolts - Bed Plate	Refer to Procedure		
Bolt - Crankshaft Damper	175	130	-
Bolts - Cylinder Head			
M11 Bolts	Refer To Procedure		
M8 Bolts	Refer To Procedure		
Bolts - Cylinder Head Cover	12	-	105
Bolts - Exhaust Manifold	25	18	-
Nuts - Exhaust Manifold Heat Shield	8	-	72
	Then loosen 45°		
Bolts - Flexplate	95	70	-
Bolts - Engine Mount Bracket to Block	61	45	-
Bolts - Rear Mount to Transmission	46	34	-
Bolts - Generator Mounting			
M10 Bolts	54	40	-
M8 Bolts	28	-	250
Bolts - Intake Manifold	12	-	105
	Refer to Procedure for Tightening Sequence		
Bolts - Oil Pan	15	-	130
Plug - Oil Pan-Drain	34	25	-
Bolts - Oil Pump	28	-	250
Bolts - Oil Pump Cover	12	-	105
Bolt and Nut - Oil Pickup Tube	28	-	250
Bolt - Oil Dipstick Tube to Engine Block	15	-	130
Bolts - Oil Fill Tube	12	-	105
Bolts - Timing Chain Guide	28	-	250
Timing Chain Tensioner Arm	28	-	250
Bolts - Hydraulic Tensioner	28	-	250
Bolts - Timing Chain Primary Tensioner	28	-	250
Bolt - Timing Drive Idler Sprocket	34	25	-
Bolts - Thermostat Housing	12	-	105
Bolts - Water Pump	58	43	-

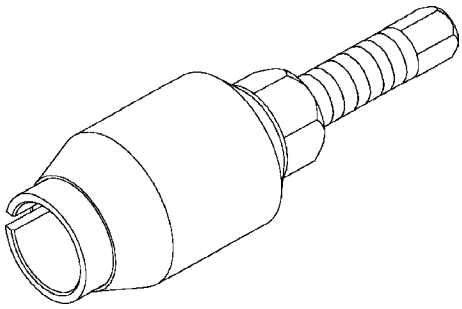
SPECIAL TOOLS



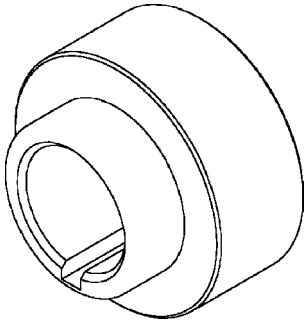
Spanner Wrench 6958



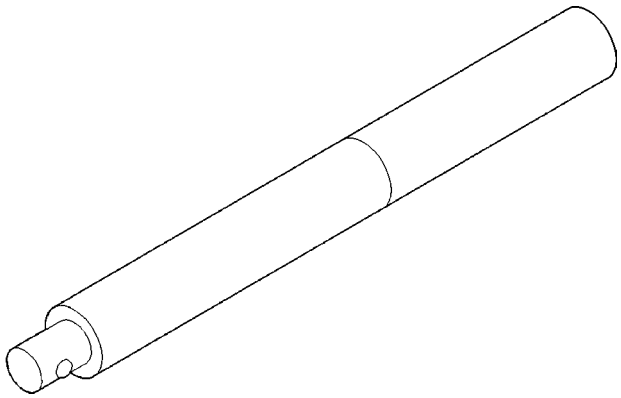
Adapter Pins 8346



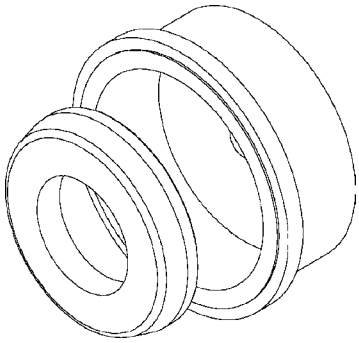
Front Crankshaft Seal Remover 8511



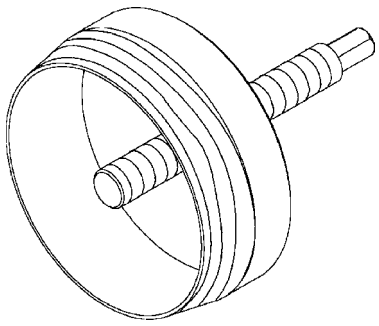
Front Crankshaft Seal Installer 8348



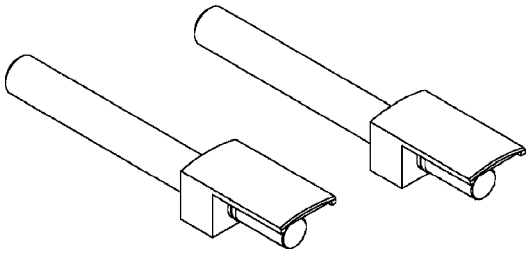
Handle C-4171



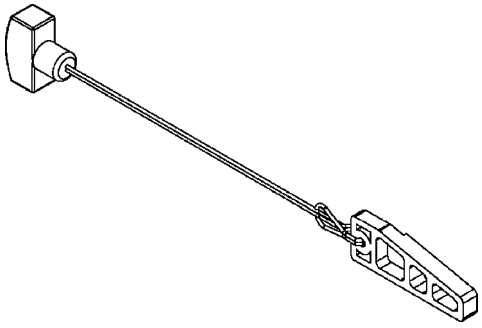
Rear Crankshaft Seal Installer 8349



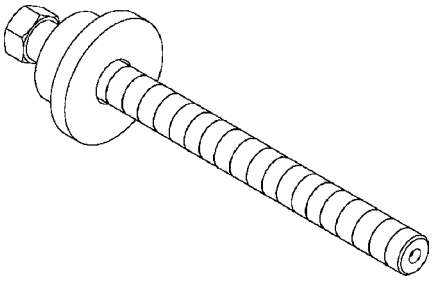
Rear Crankshaft Seal Remover 8506



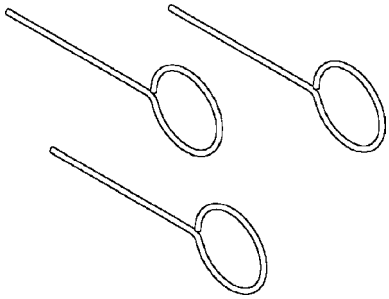
Connecting Rod Guides 8507



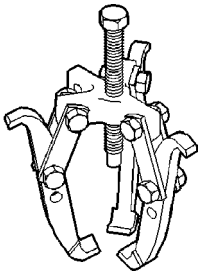
Chain Tensioner Wedge 8379



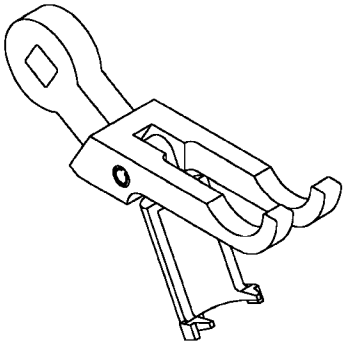
Crankshaft Damper Installer 8512



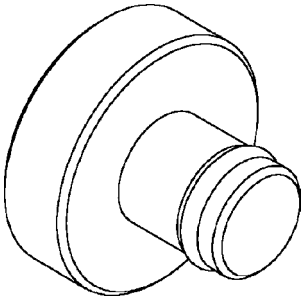
Chain Tensioner Pins 8514



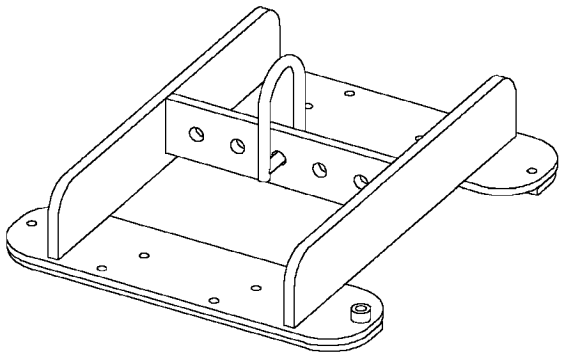
Puller 1026



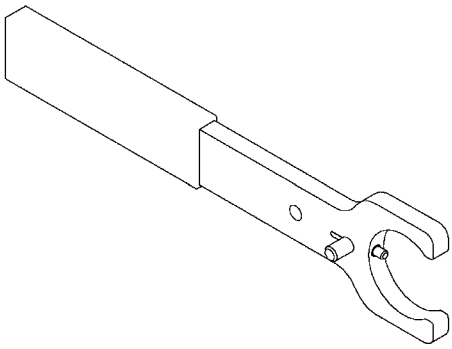
VALVE SPRING COMPRESSOR 8426



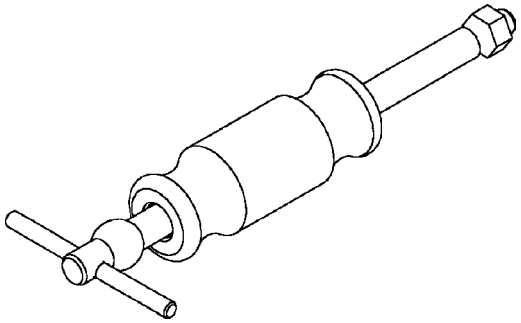
Crankshaft Damper Removal Insert 8513



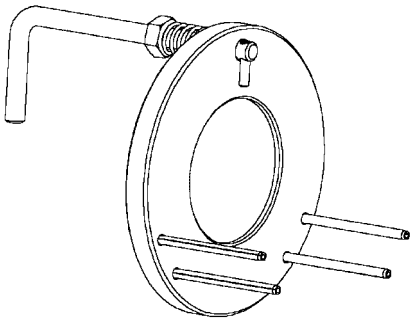
ENGINE LIFTING FIXTURE 8427



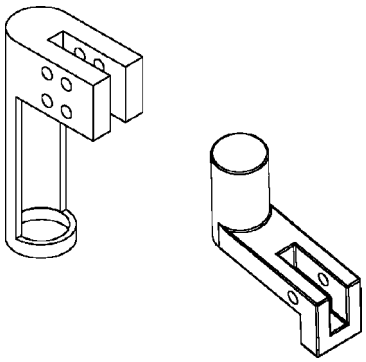
CAMSHAFT HOLDER 8428



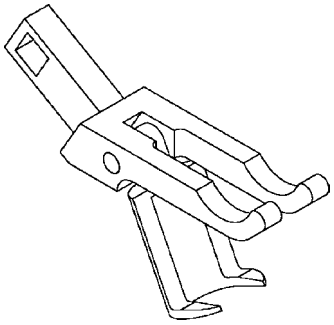
Idler Shaft Remover 8517



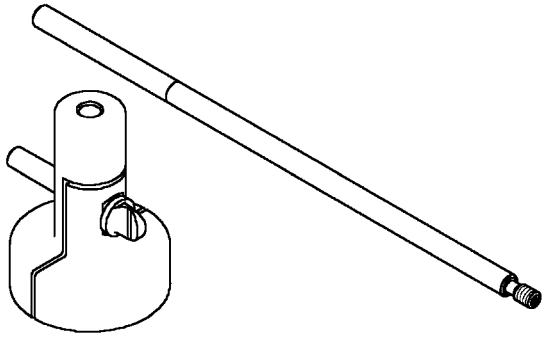
HOLDER SECONDARY CAMSHAFT CHAIN 8429



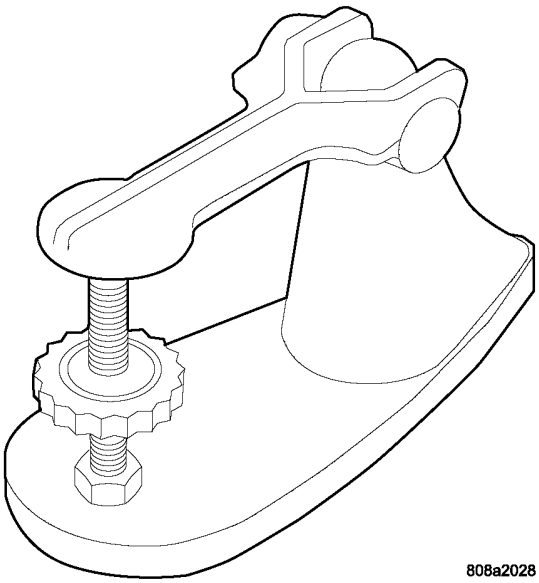
Valve Spring Compressor Adapters 8519



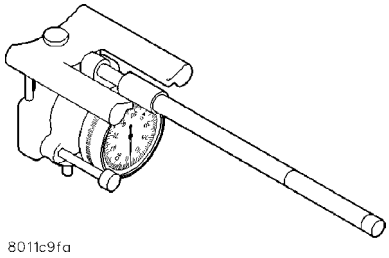
Remover, Rocker Arm 8516



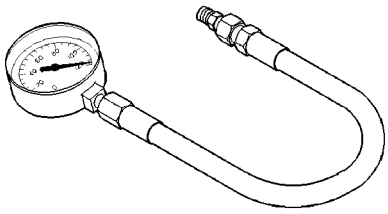
INSTALLER - REMOVER - COUNTER BALANCE SHAFT 8641



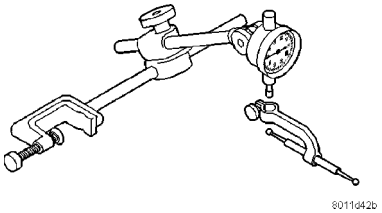
Valve Spring Tester C-647



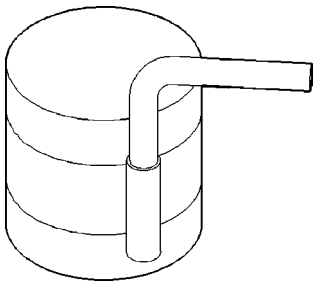
Bore Size Indicator C-119



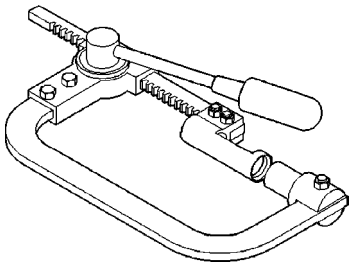
Oil Pressure Gauge C-3292



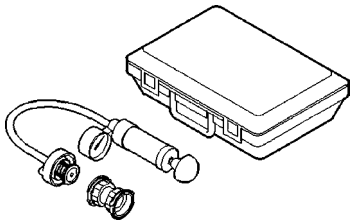
Dial Indicator C-3339



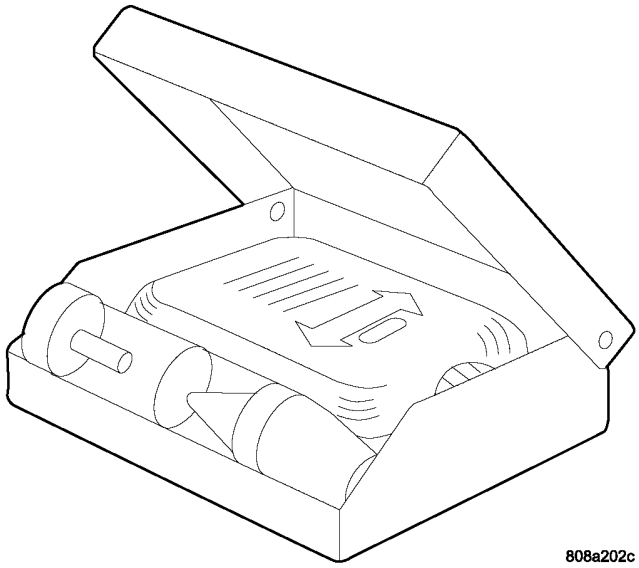
Piston Ring Compressor C-385



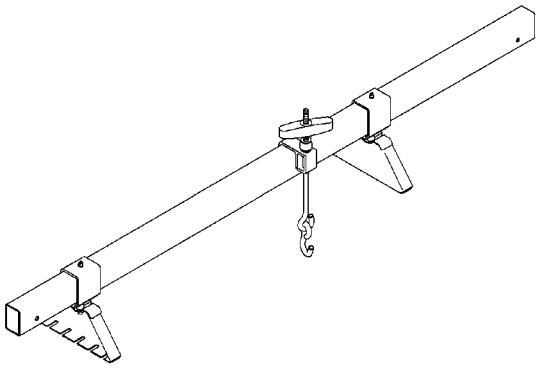
Valve Spring Compressor C-3422-B



Pressure Tester Kit 7700



Bloc–Chek–Kit C-3685–A



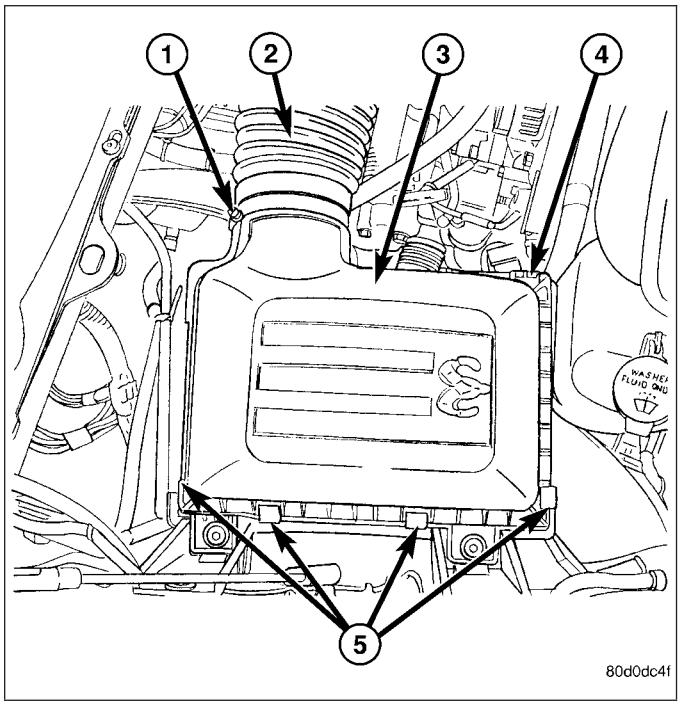
ENGINE SUPPORT FIXTURE 8534

ELEMENT - AIR CLEANER

REMOVAL

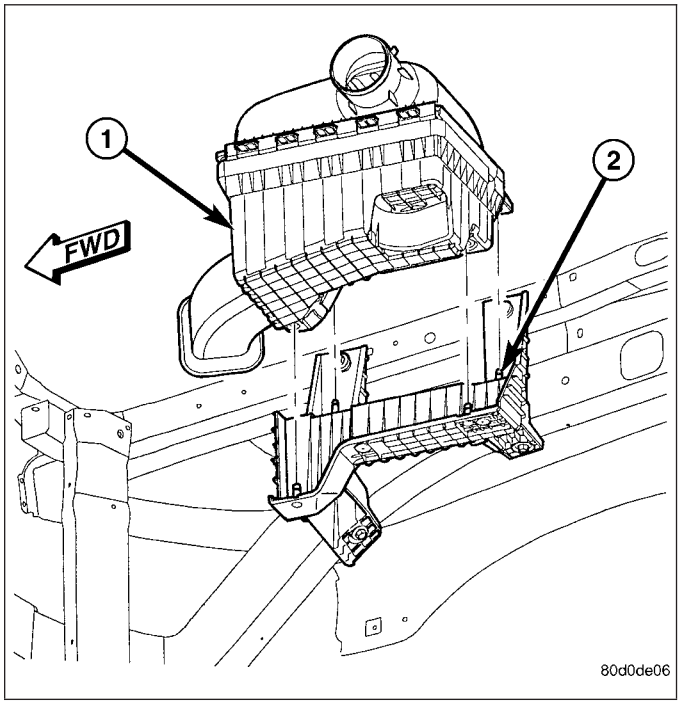
Filter Element Only

1. Housing removal is not necessary for element (filter) replacement.
2. Loosen clamp and disconnect air duct at air cleaner cover.
3. Pry over 4 spring clips (5) from housing cover (3) (spring clips retain cover to housing).
4. Release housing cover (3) from locating tabs on housing and remove cover.
5. Remove air cleaner element (filter) from housing.
6. Clean inside of housing before replacing element.



Housing Assembly

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Lift entire housing (1) assembly from 4 locating pins (2).



INSTALLATION

1. Install filter element into housing.
2. Position housing cover into housing locating tabs.
3. Pry up 4 spring clips and lock cover to housing.
4. Install air duct to air cleaner cover and tighten hose clamp to 3 N·m (30 in. lbs.) torque.
5. If any other hose clamps were removed from air intake system, tighten them to 3.4 N·m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4.5 N·m (40 in. lbs.) torque.

CYLINDER HEAD - LEFT

DIAGNOSIS AND TESTING - CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

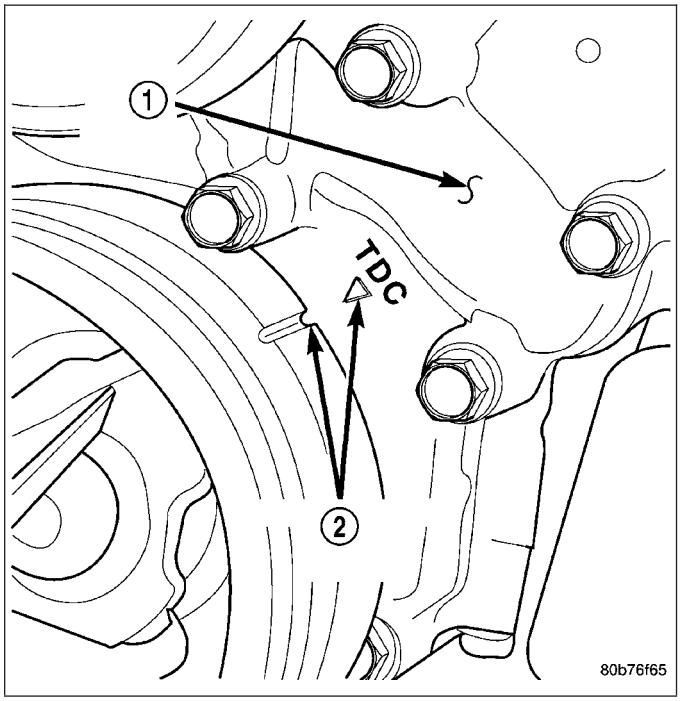
Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

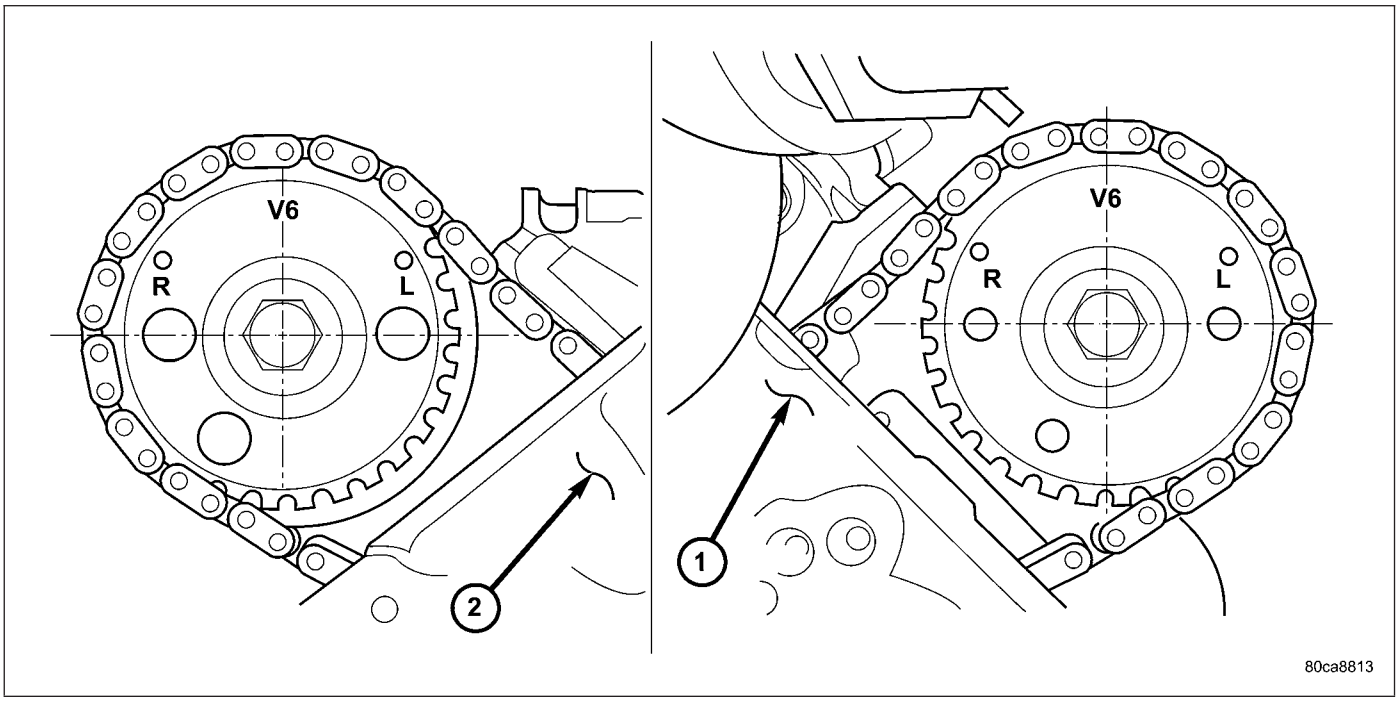
CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the master cylinder and booster assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - REMOVAL).
8. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
9. Remove the fan shroud and fan blade assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).

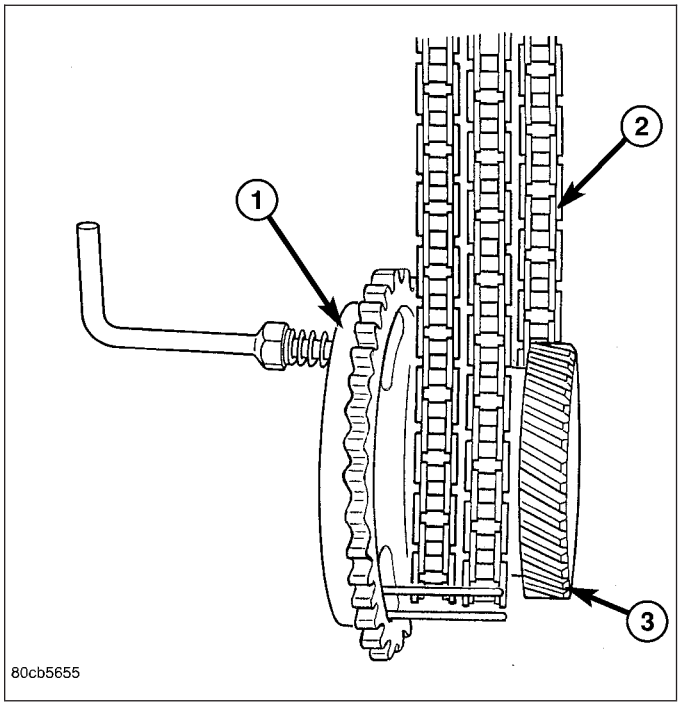




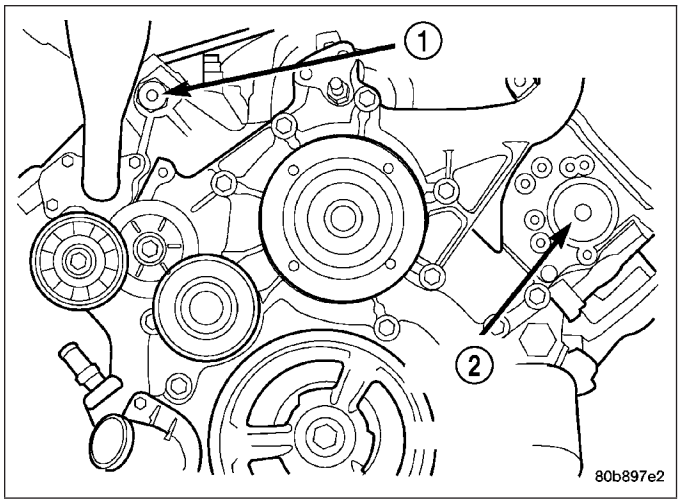
13. Verify the V6 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
15. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
16. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture.

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain, one link on each side of the V6 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner. Refer to Timing Chain and Sprockets.



19. Remove the cylinder head access plug.
20. Remove the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
21. Remove the retaining bolt and the camshaft drive gear.



CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with twelve bolts.

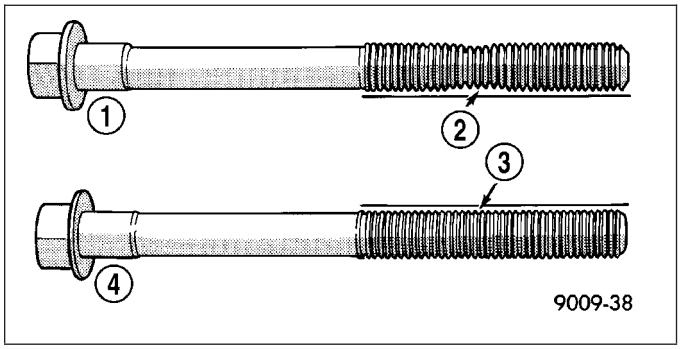
22. Remove the cylinder head retaining bolts.
23. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSTALLATION

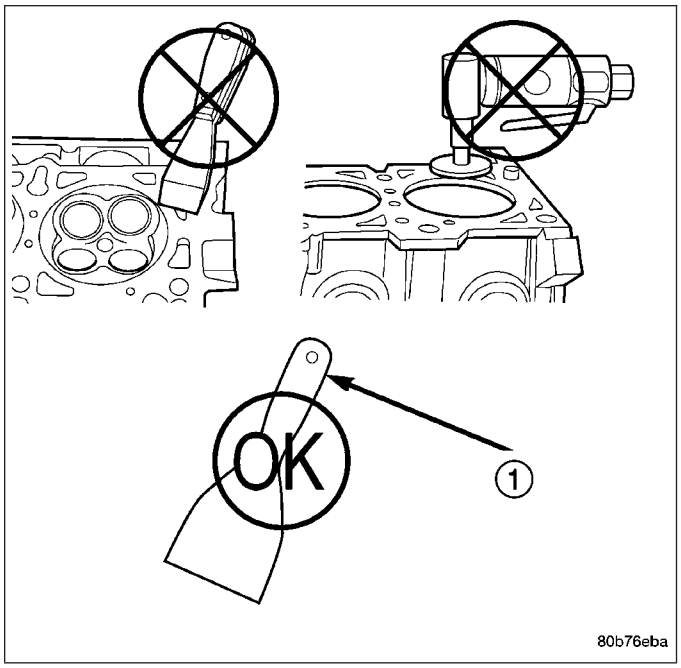
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper (1) because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

1. Clean the cylinder head and cylinder block mating surfaces.



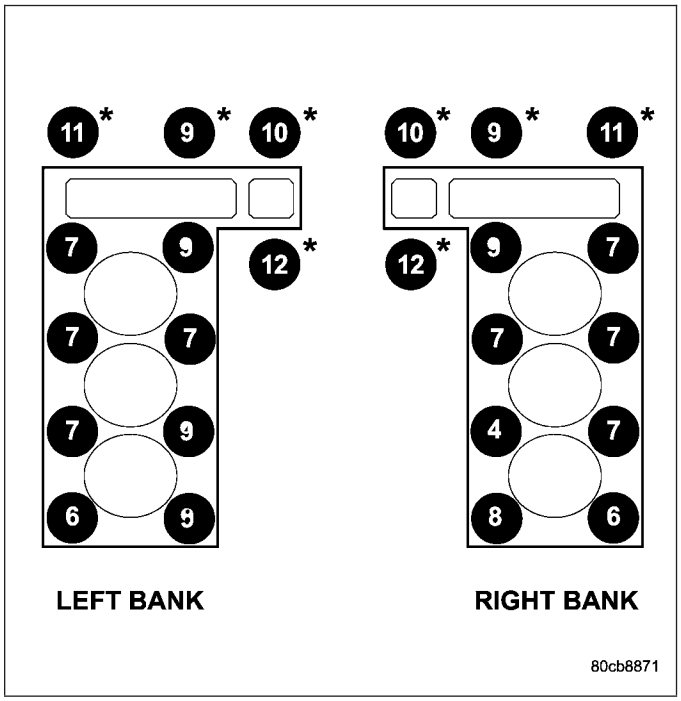
2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.



NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1-8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N·m (20 ft. lbs.), by repeating step 1 without loosening the bolts.
   - Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 degrees.
   - Step 4: Tighten bolts 1-8, 90 degrees, again. Tighten bolts 9-12, 26 N·m (19 ft. lbs.)
7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark on the gear then using Special Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
10. Install the cylinder head access plug.
11. Re-set and install the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
12. Remove Special Tool 8429.
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the master cylinder and booster assembly (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/POWER BRAKE BOOSTER - INSTALLATION).
19. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the left exhaust manifold.
23. Lower the vehicle.
24. Connect the negative cable to the battery.
25. Start the engine and check for leaks.

CAMSHAFT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

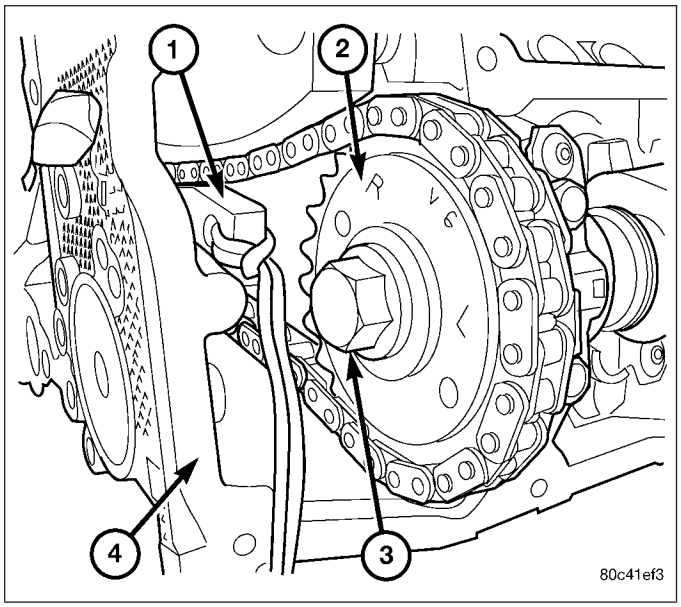
REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8379 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

1. Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

2. Set engine to TDC cylinder #1, camshaft sprocket V6 marks at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.



CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

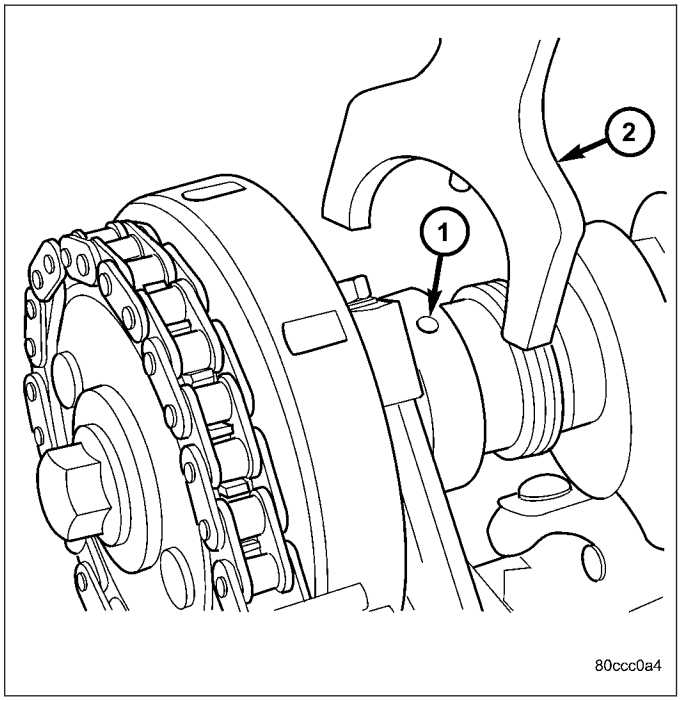
4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Special Tool 8379 timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

6. Hold the camshaft with Special Tool 8428 Camshaft Wrench , while removing the camshaft sprocket bolt and sprocket.
7. Using Special Tool 8428 Camshaft Wrench, gently allow the camshaft to rotate 5° clockwise until the camshaft is in the neutral position (no valve load).
8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.



CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.

INSTALLATION

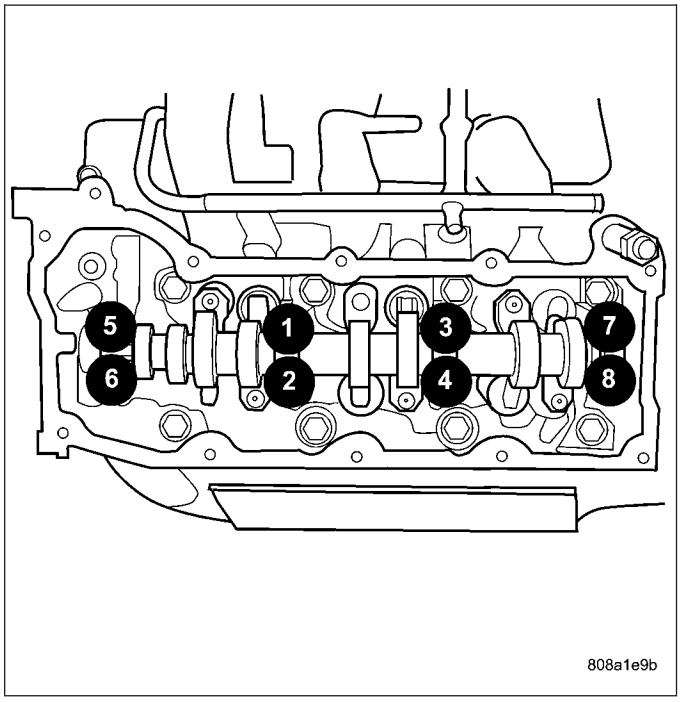
1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 thru 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.

4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).



6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).
7. Using Special Tool 8428 Camshaft Wrench, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

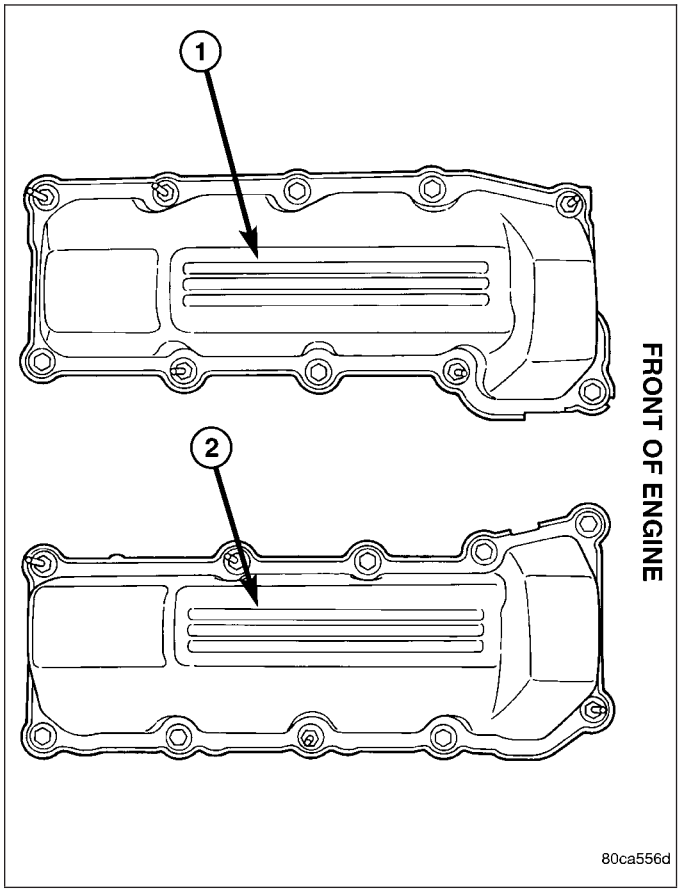
CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.
9. Remove Special Tool 8379 timing chain wedge.
10. Using Special Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

COVER - CYLINDER HEAD

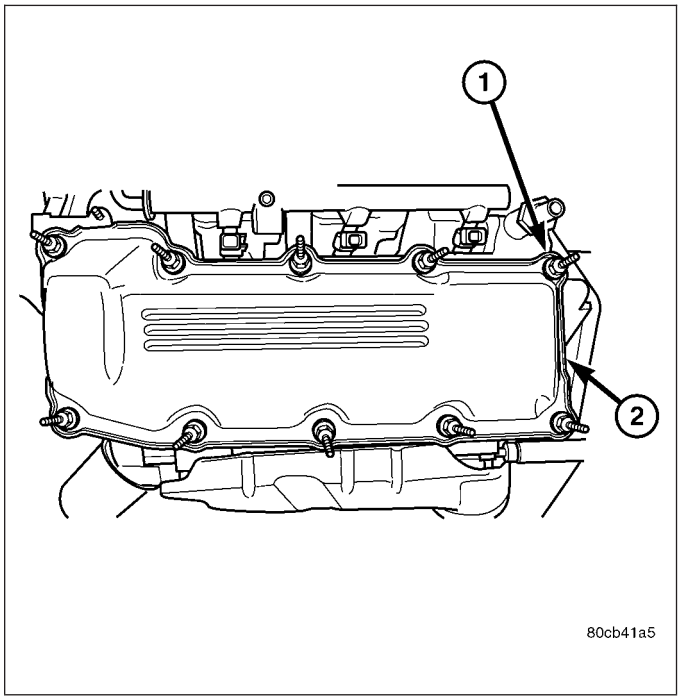
DESCRIPTION

The cylinder head covers (1,2) are made of glass re-enforced thermoset plastic, and are not interchangable from side-to-side.



REMOVAL

1. Disconnect negative cable from battery.
2. Remove the resonator assemble and air inlet hose.
3. Disconnect injector connectors and un-clip the injector harness.
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts (1).
7. Remove cylinder head cover (1) and gasket.



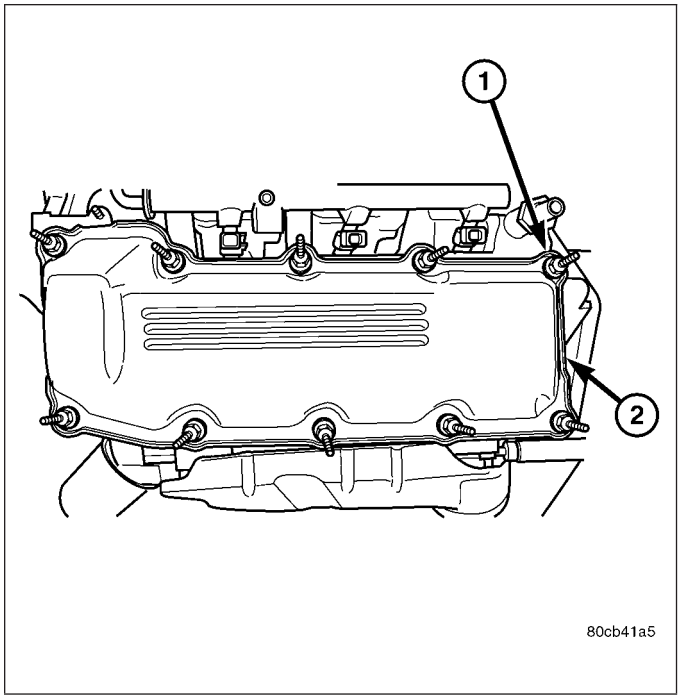
NOTE: The gasket may be used again, providing no cuts, tears, or deformation has occurred.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover (2).
3. Tighten cylinder head cover bolts (1) and double ended studs to 12 N·m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Connect injector electrical connectors and injector harness retaining clips.
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.



VALVES & SEATS - INTAKE/EXHAUST

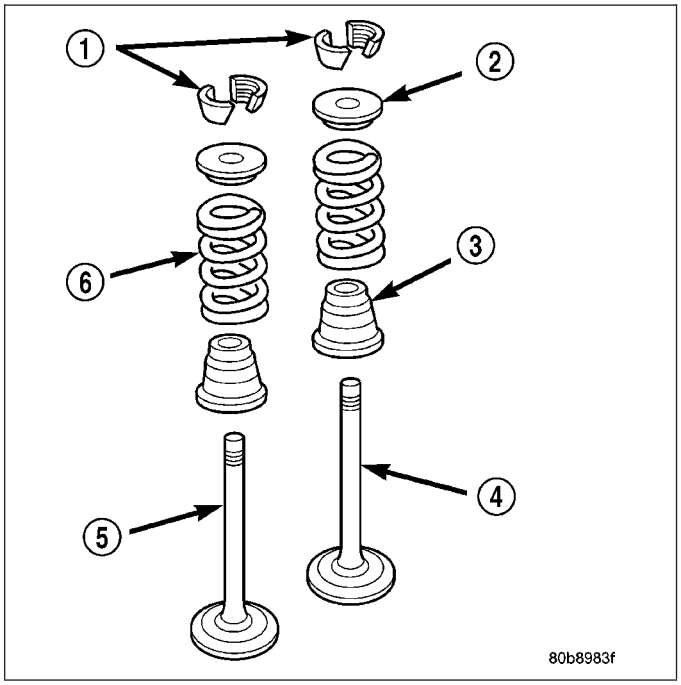
DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

STANDARD PROCEDURE - REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

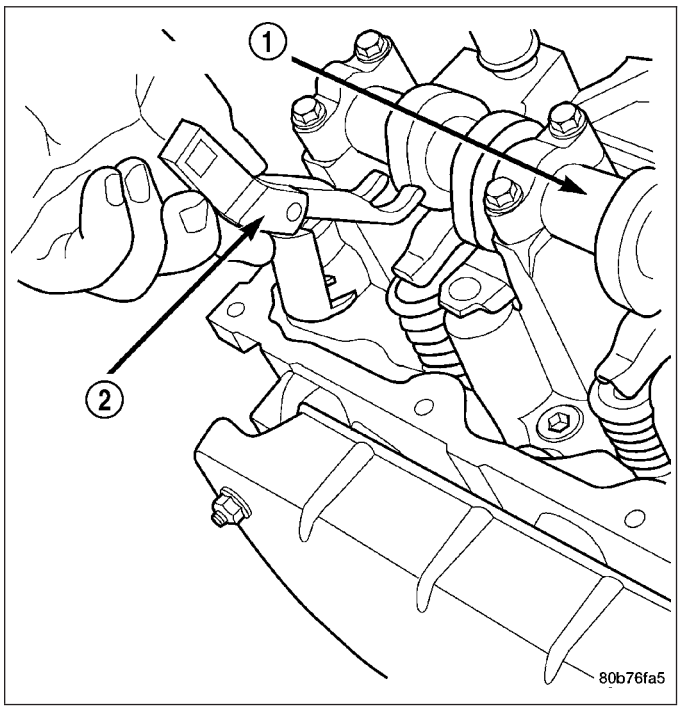
NOTE: When refacing valves (4) and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.



1. Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.75 - 2.36 mm (0.0689 - 0.0928 in.) and the exhaust seat must be 1.71 - 2.32 mm (0.0673 - 0.0911 in.).
4. Check the valve spring (6) installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.74 mm (1.6039 in.).
5. The valve seat and valve face must maintain a face angle of 44.5 - 45 ° angle .

REMOVAL

NOTE: The cylinder heads must be removed in order to perform this procedure.



1. Remove rocker arms and lash adjusters (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
2. Remove the camshaft bearing caps and the camshaft.

NOTE: All six valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

3. Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

4. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

5. Remove the valve spring compressor.
6. Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

7. Remove the valve from the cylinder head.

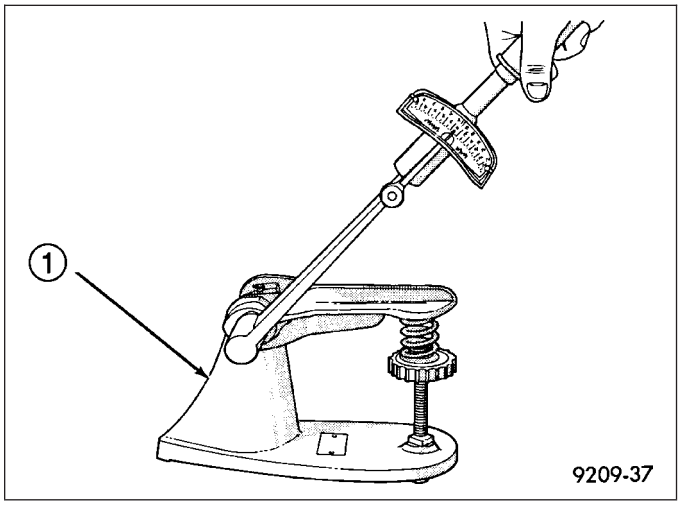
NOTE: The valve stem seals are common between intake and exhaust.

8. Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

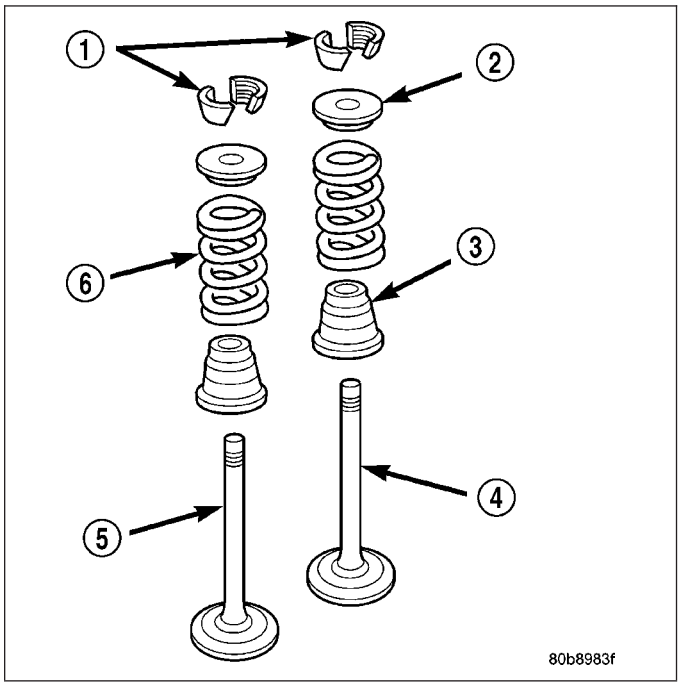
NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 (1) until surface is in line with the 40.12 mm (1.579 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until a Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

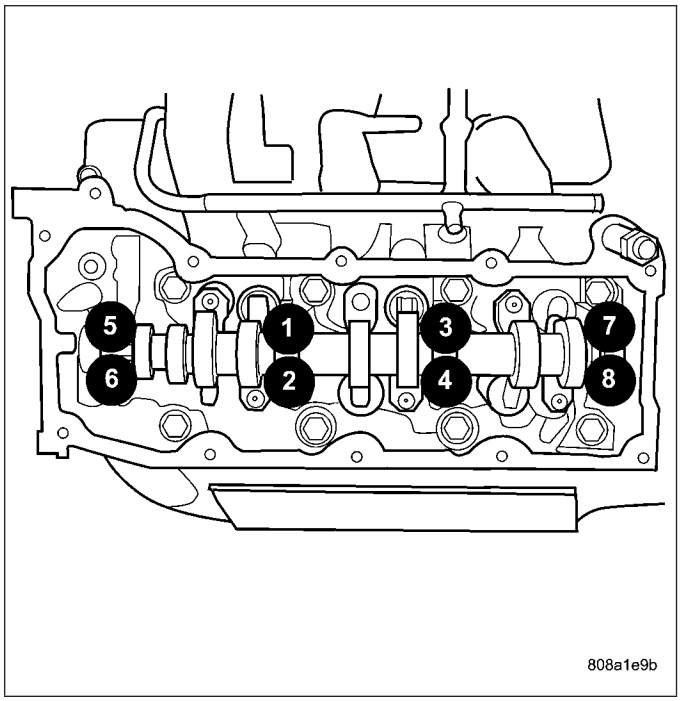


INSTALLATION

1. coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring and the spring retainer.
4. Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.
5. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.



6. lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9-13 N·m (100 in. lbs.) in 1/2 turn increments in the sequence shown.
8. Position the hydraulic lash adjusters and rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - INSTALLATION).



ROCKER ARM - VALVE

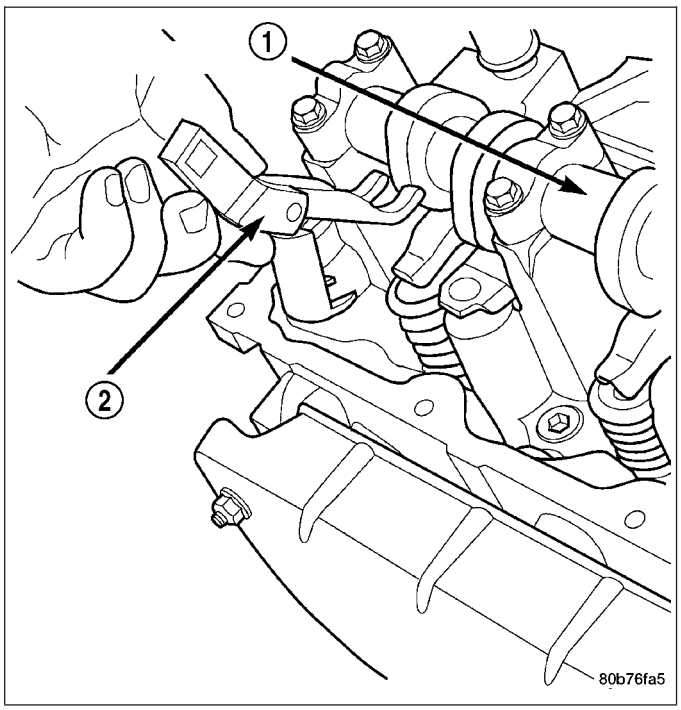
DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

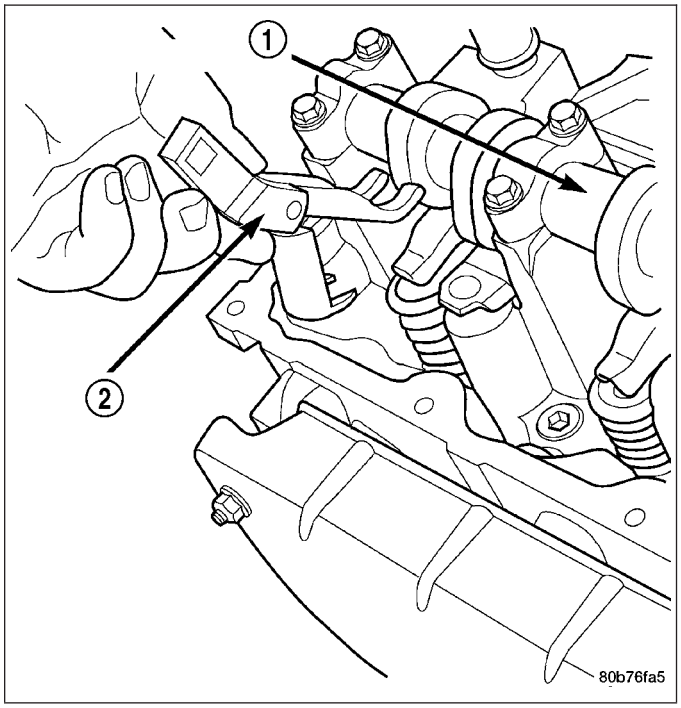
1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using special tool 8516 Rocker Arm Remover (2) , press downward on the valve spring, remove rocker arm.



INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.



1. For rocker arm installation on cylinders No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
2. For rocker arm installation on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
3. For rocker arm installation on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
4. For rocker arm installation on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
5. Using special tool 8516 (2) press downward on the valve spring, install rocker arm.
6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

SEALS - VALVE GUIDE

DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

SPRINGS VALVE

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are NOT common for intake and exhaust applications. The exhaust spring has an external damper. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed.

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.

NOTE: The valve springs are NOT common between intake and exhaust.

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

NOTE: The valve stem seals are common between intake and exhaust.

2. Install the valve stem seal.

NOTE: The valve springs are NOT common between intake and exhaust.

3. Install the spring retainer, and the spring.
4. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.
5. Install the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.
9. Using Special Tool 8516 Valve Spring Compressor, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

CYLINDER HEAD - RIGHT

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

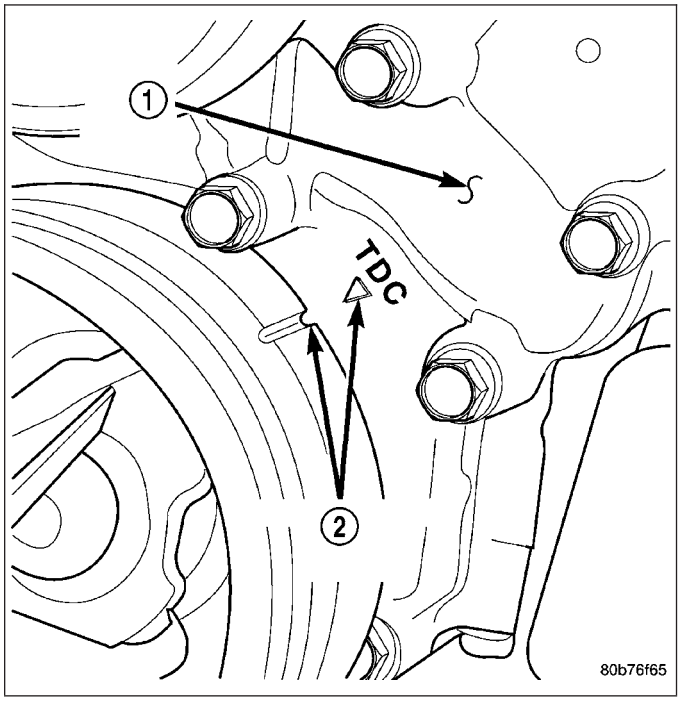
A tappet-like noise may be produced from several items. Check the following items.

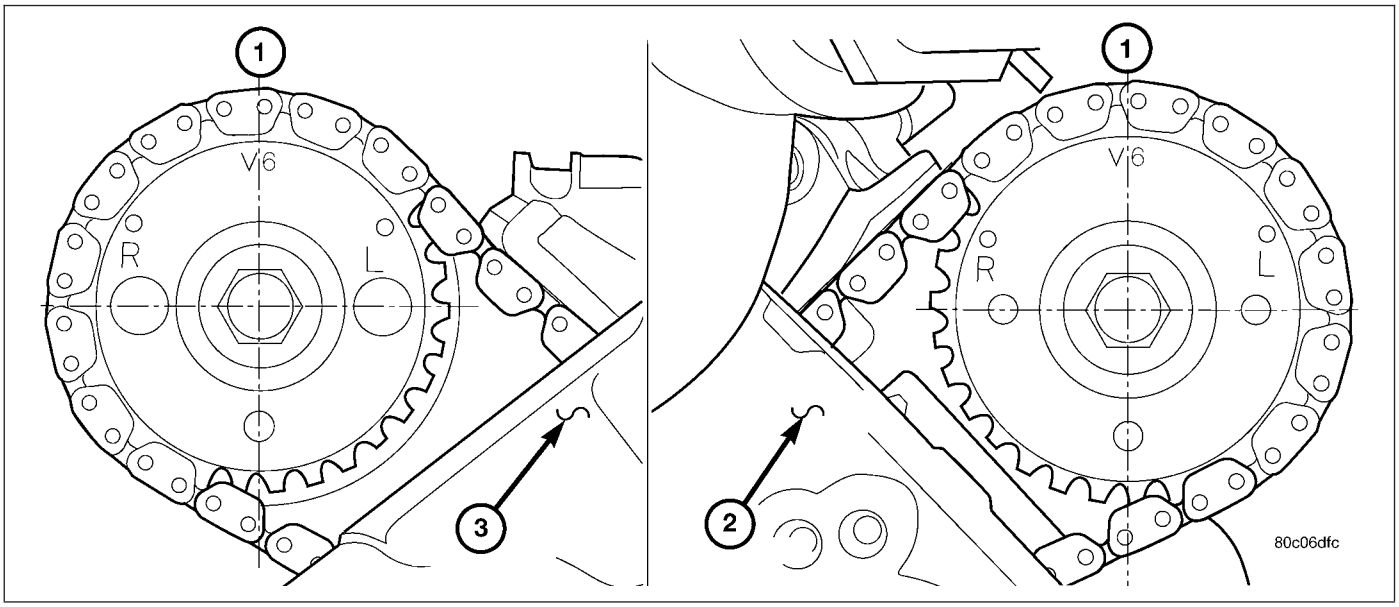
1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.

8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.
    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel firm when pressed quickly. When pressed very slowly, lash adjusters should collapse.
    b. Remove suspected lash adjusters, and replace.
    c. Before installation, make sure adjusters are full of oil. This can be verified by little plunger travel when lash adjuster is depressed quickly.

REMOVAL

1. Disconnect battery negative cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/ MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
8. Remove the fan shroud (Refer to 7 - COOLING/ ENGINE/RADIATOR FAN - REMOVAL).
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).



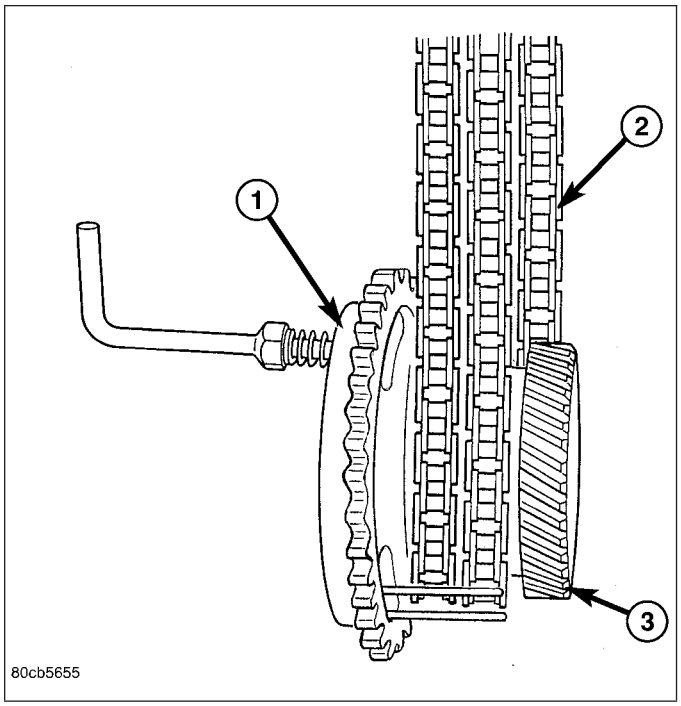


12. Verify the V6 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
14. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

15. Lock the secondary timing chains to the idler sprocket using Special Tool 8429 Timing Chain Holding Fixture (1).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V6 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

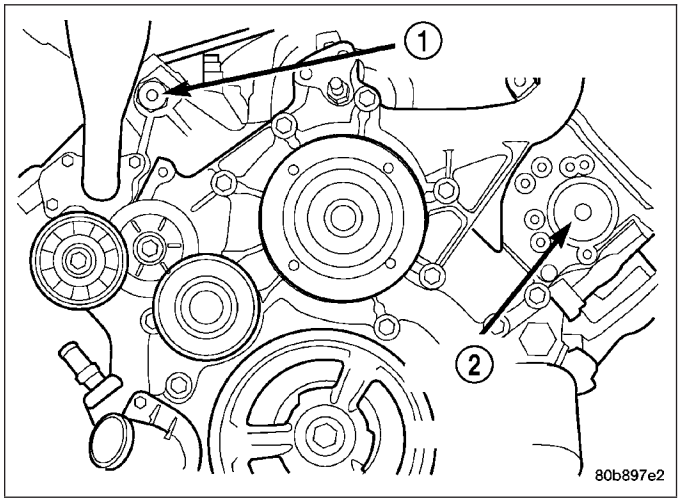


18. Remove the cylinder head access plug (1,2).
19. Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed, torque nut to 5 N·m (44 in. lbs.).

20. Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.



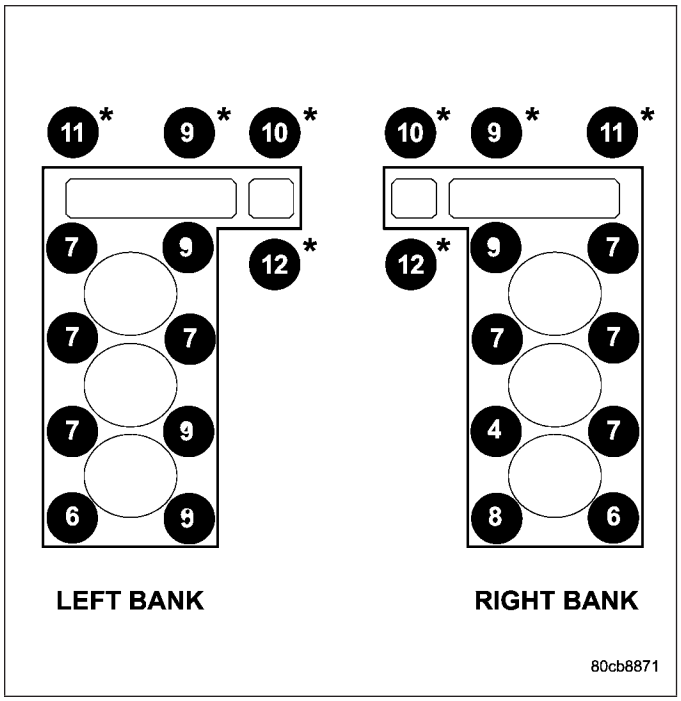
CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with twelve bolts.

21. Remove the cylinder head retaining bolts.
22. Remove the cylinder head and gasket. Discard the gasket.

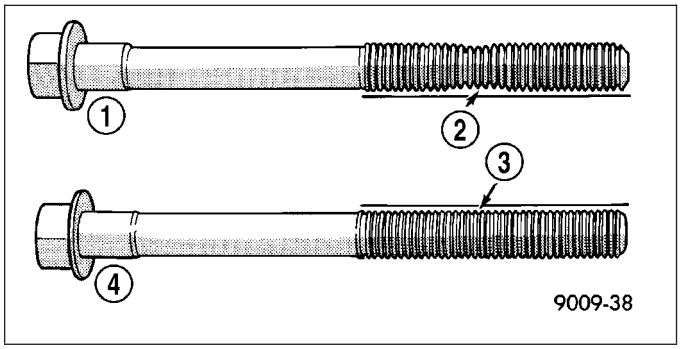
CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.



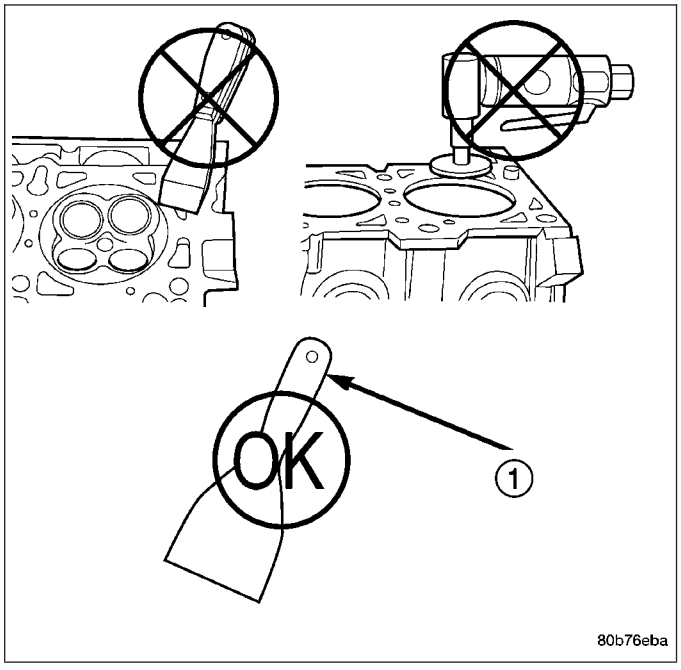
INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (1) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).



1. Clean the cylinder head and cylinder block mating surfaces.

2. Position the new cylinder head gasket on the locating dowels.

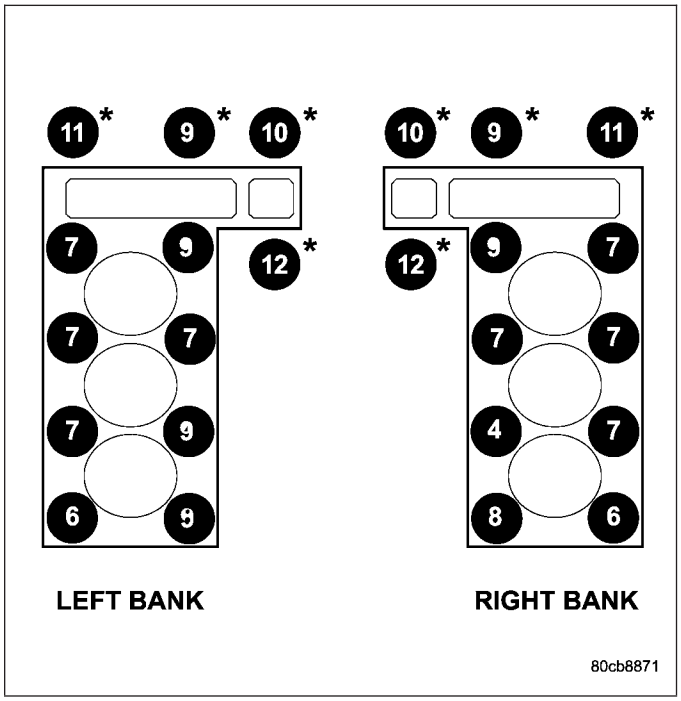
CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

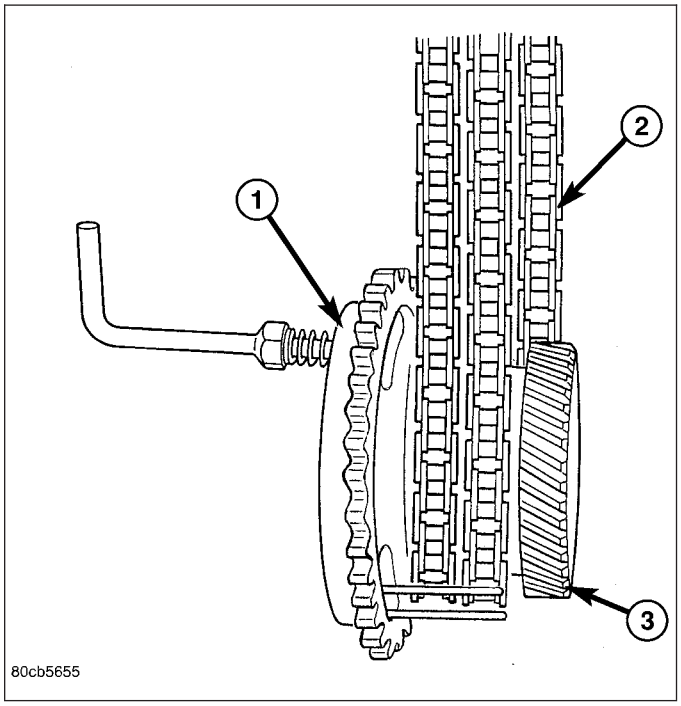
NOTE: The four M8 cylinder head mounting bolts (1) require sealant to be added to them before installing. Failure to do so may cause leaks.

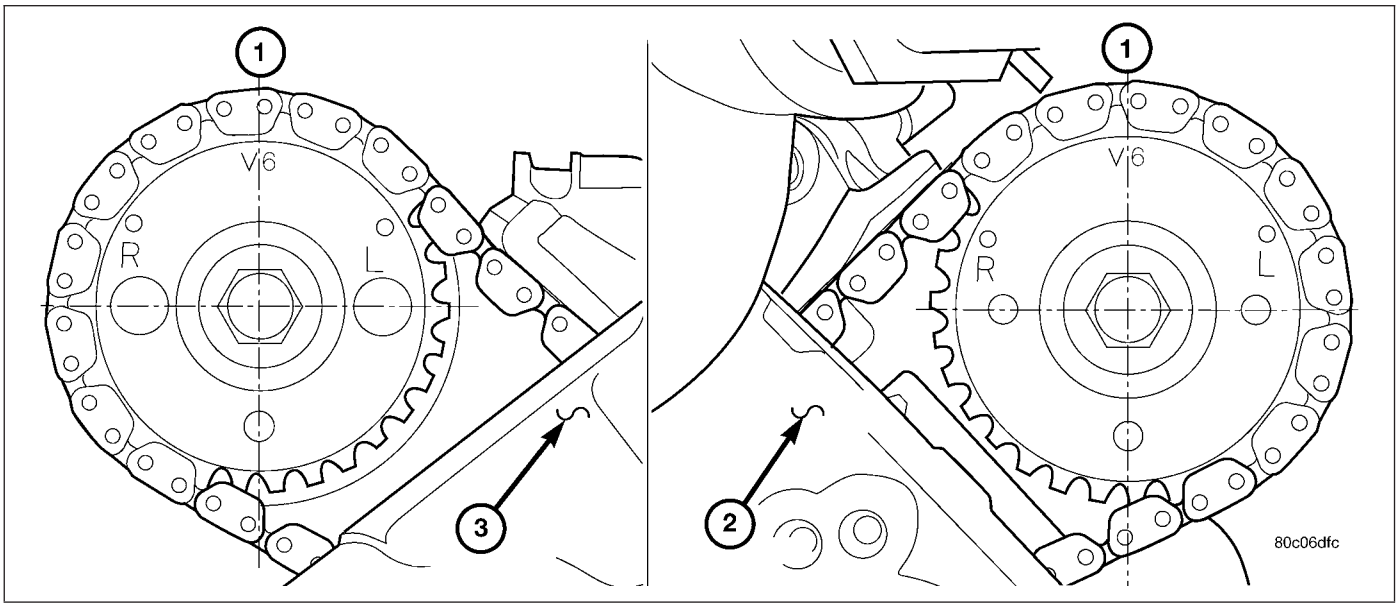
4. Lubricate the cylinder head bolt threads with clean engine oil and install the eight M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.



6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1-8, 27 N·m (20 ft. lbs.).
   - Step 2: Verify that bolts 1-8, all reached 27 N·m (20 ft. lbs.), by repeating step 1 without loosening the bolts. Tighten bolts 9 thru 12 to 14 N·m (10 ft. lbs.).
   - Step 3: Tighten bolts 1-8, 90 °.
   - Step 4: Tighten bolts 1-8, 90 °, again. Tighten bolts 9-12, 26 N·m (19 ft. lbs.)





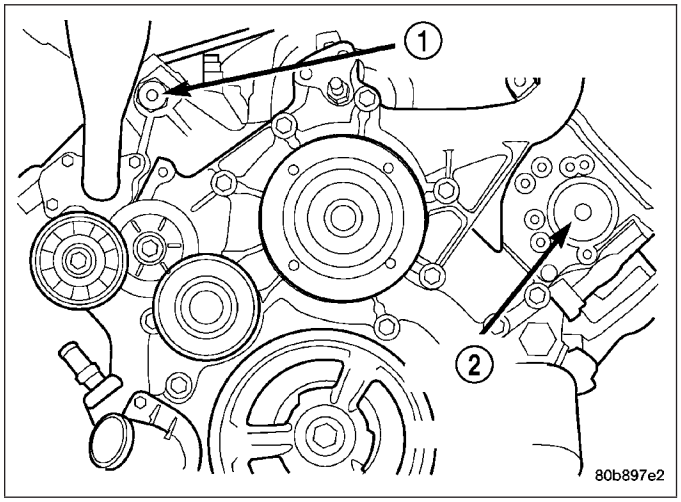
CAUTION: The nut on the right side camshaft sprocket should not be removed for any reason, as the sprocket and camshaft sensor target wheel is serviced as an assembly. If the nut was removed, torque nut to 5 NM (60 in. lbs.).

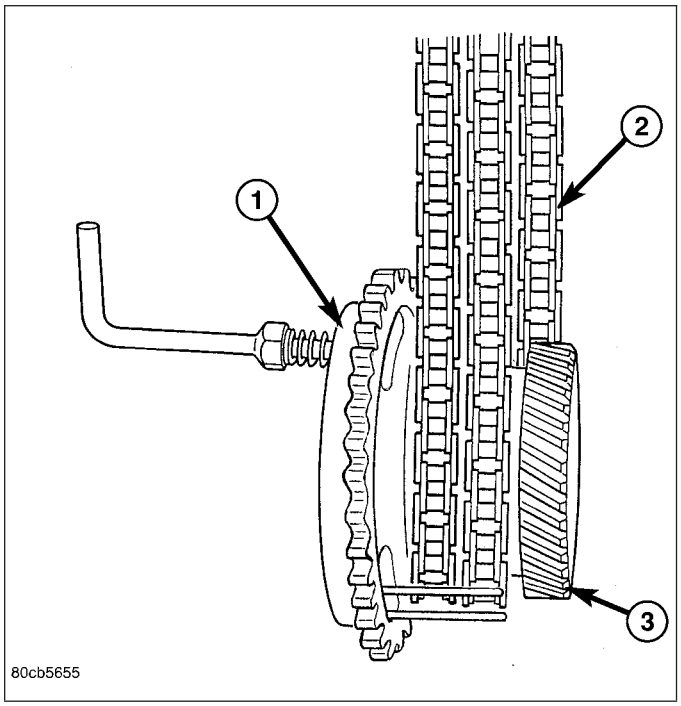
7. Position the secondary chain (2) onto the camshaft drive gear, making sure one marked chain link is on either side of the V6 mark (1) on the gear then using Special Tool 8428 Camshaft Wrench, position the gear onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torquing of bolt resulting in bolt failure.

8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

10. Install the cylinder head access plug (1,2).
11. Re-set and install the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).





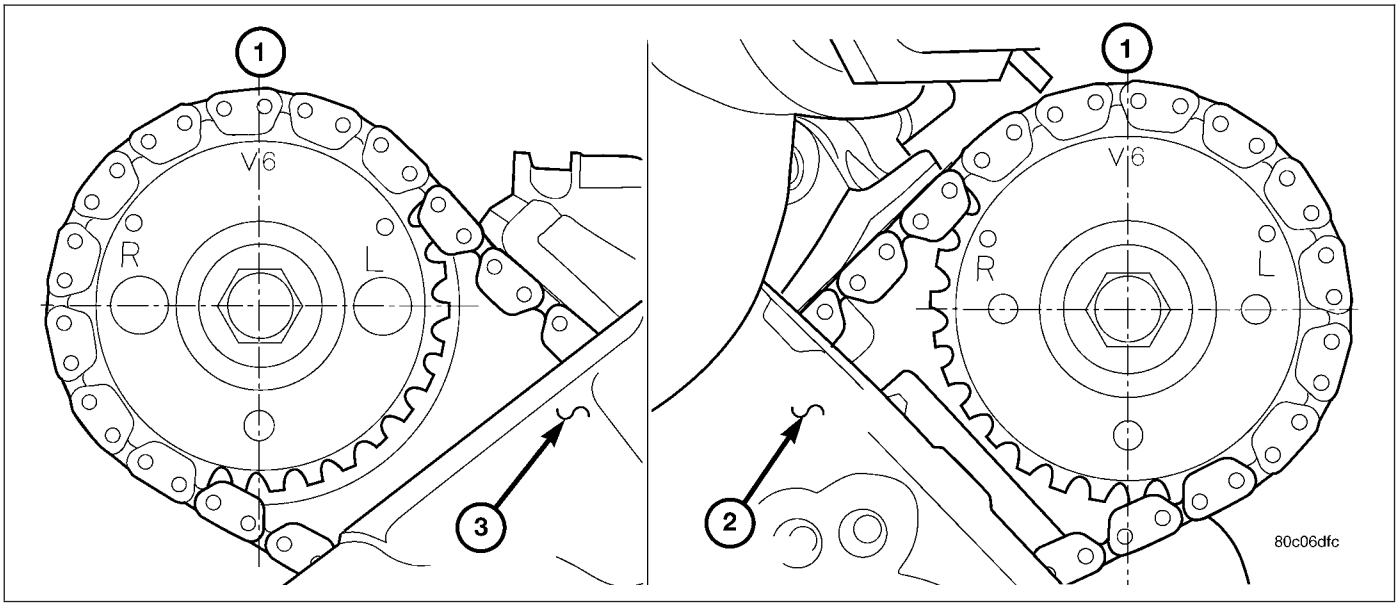
12. Remove Special Tool 8429 (1).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Tighten damper bolt 175 N·m (130 Ft. Lbs.).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Install the fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negative cable.
25. Start the engine and check for leaks.

CAMSHAFT

DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. Four bearing journals are machined into the camshaft. Camshaft end play is controlled by two thrust walls that border the nose piece journal.

REMOVAL



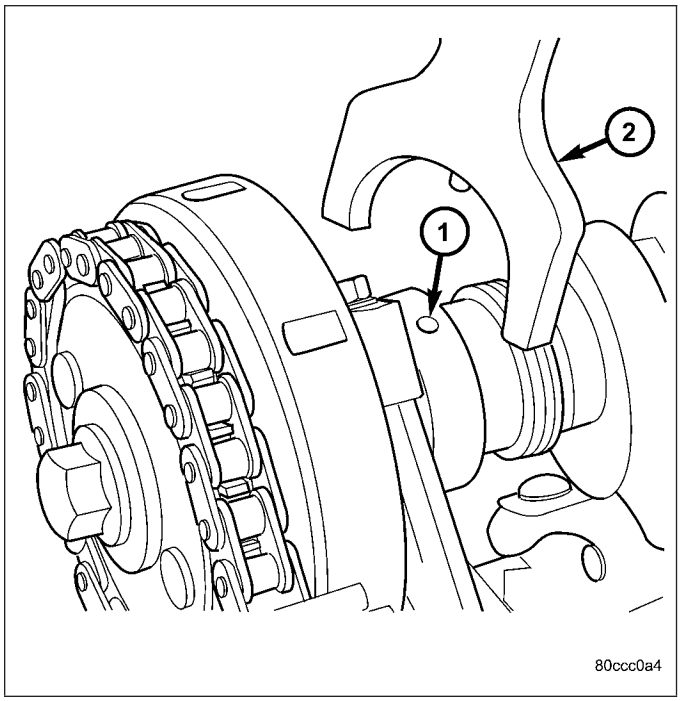
CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8379 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Set engine to TDC cylinder No. 1, camshaft sprocket V6 marks at the 12 o'clock position (1).
3. Mark one link on the secondary timing chain on both sides of the V6 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

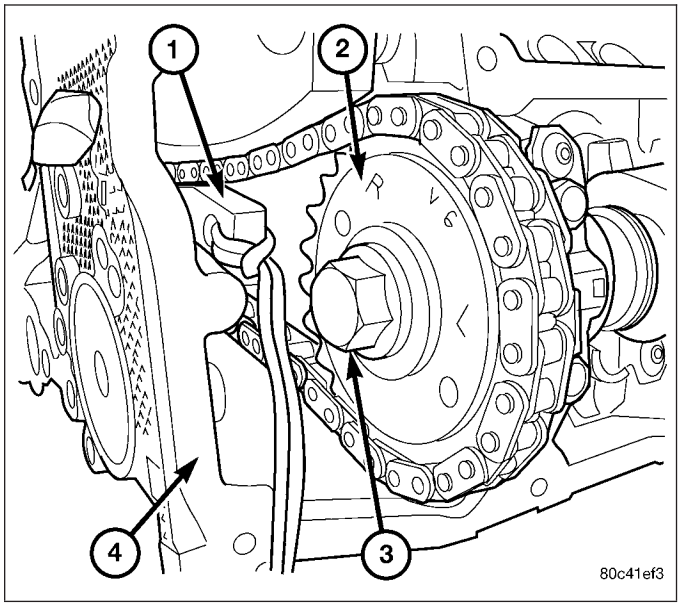
4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.



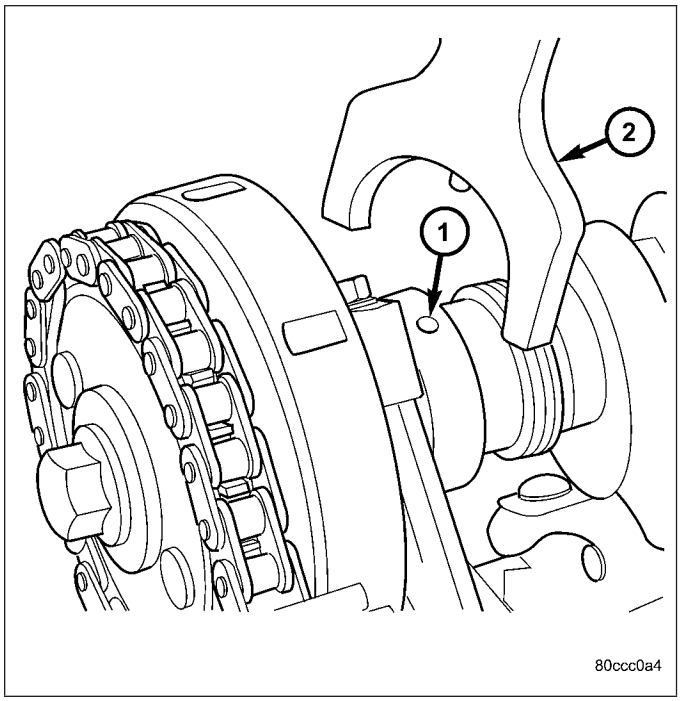
NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Special Tool 8379 timing chain wedge (1) between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.



6. Remove the camshaft position sensor.
7. Hold the camshaft with Special Tool 8428 Camshaft Wrench (2), while removing the camshaft sprocket bolt and sprocket.

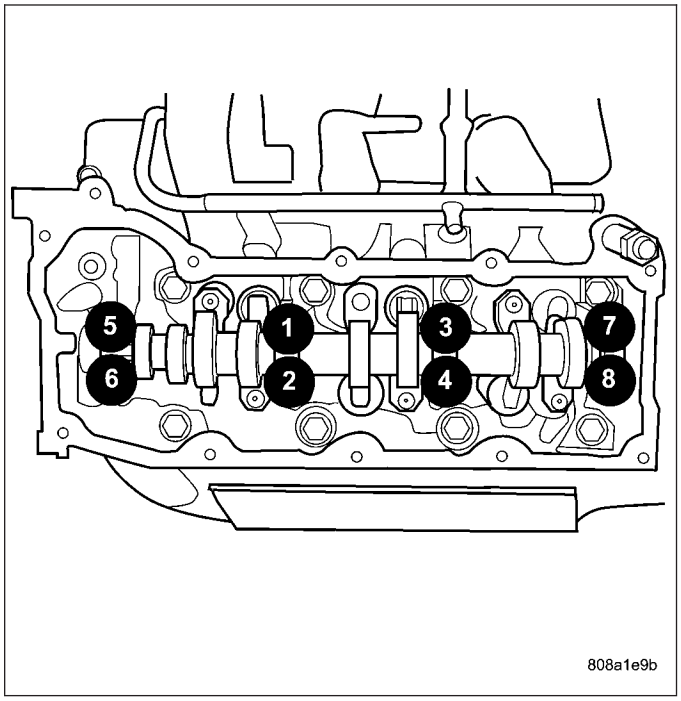


8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.



INSTALLATION

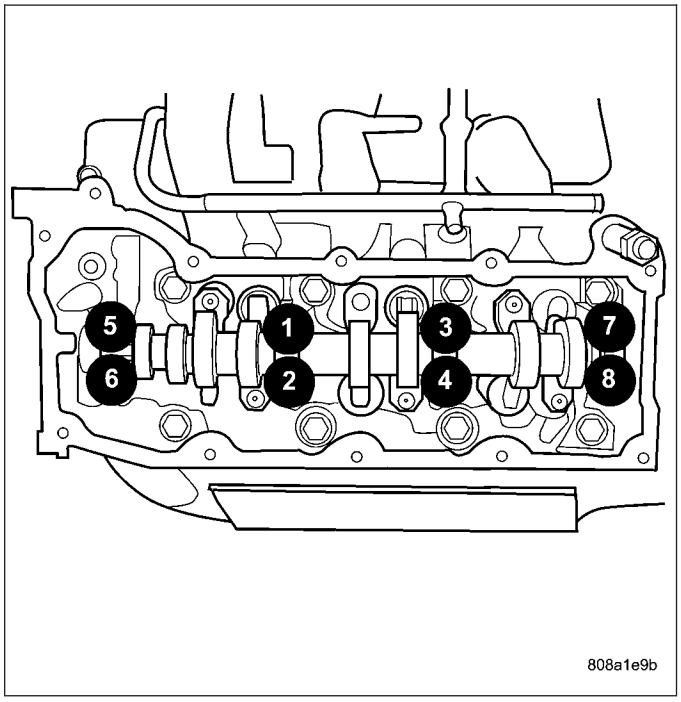
1. Lubricate camshaft journals with clean engine oil.

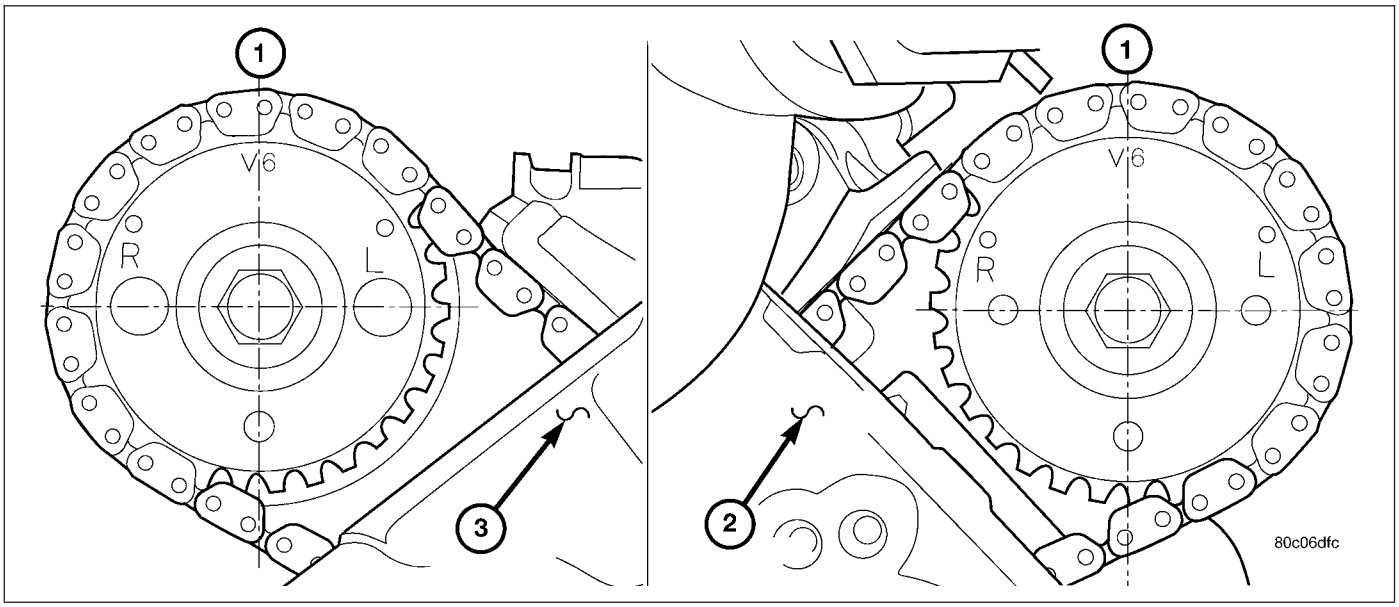
NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.

NOTE: Caps should be installed so that the stamped numbers on the caps are in numerical order, (1 thru 4) from the front to the rear of the engine. All caps should be installed so that the stamped arrows on the caps point toward the front of the engine.

4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).



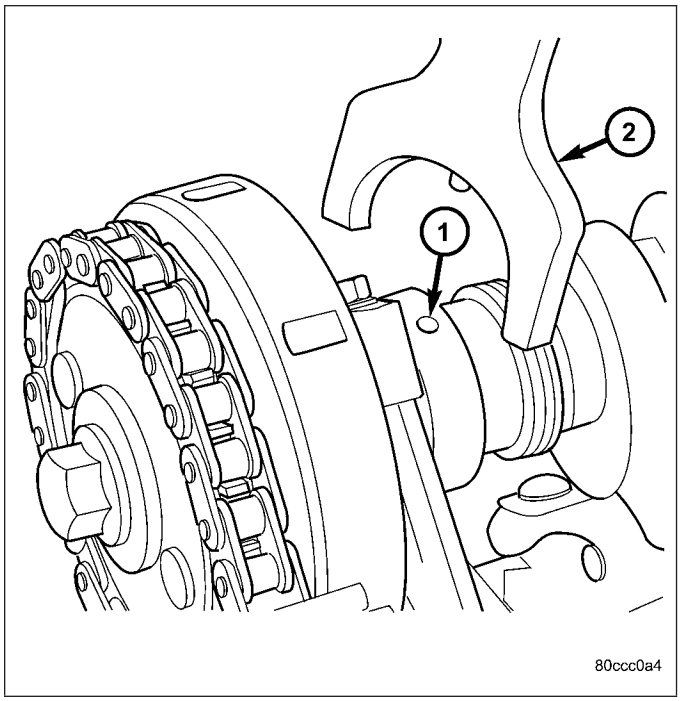


6. Position the camshaft drive gear into the timing chain aligning the V6 mark between the two marked chain links (Two links marked during removal).

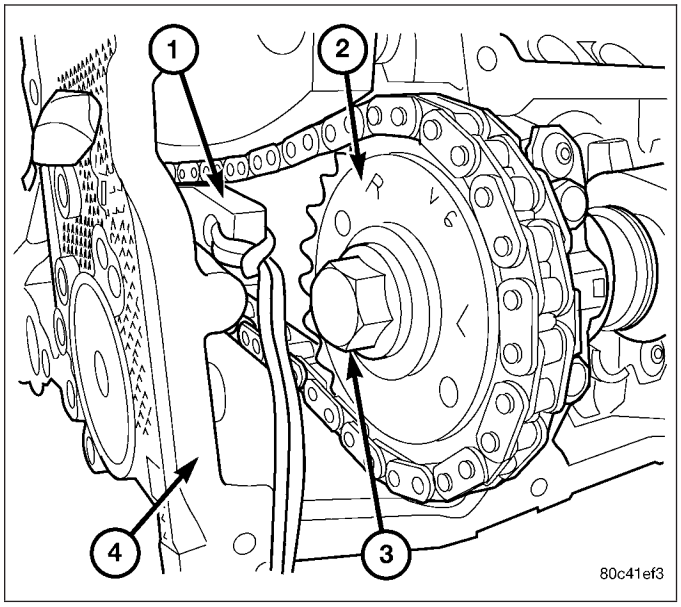
7. Using Special Tool 8428 Camshaft Wrench (2), rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.



9. Remove timing chain wedge special tool 8379 (1).
10. Using Special Tool 6958 spanner wrench with adapter pins 8346, torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).
11. Install the camshaft position sensor.
12. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



COVER - CYLINDER HEAD

REMOVAL

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system, below the level of the heater hoses (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect injector and ignition coil connectors.
8. Disconnect and remove positive crankcase ventilation (PCV) hose.

9. Remove oil fill tube.
10. Un-clip injector and ignition coil harness and move away from cylinder head cover.
11. Remove right rear breather tube and filter assembly.
12. Remove cylinder head cover retaining bolts.
13. Remove cylinder head cover.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).
3. Install right rear breather tube and filter assembly.
4. Connect injector, ignition coil electrical connectors and harness retaining clips.
5. Install the oil fill tube.
6. Install PCV hose.
7. Install heater hoses.
8. Install air conditioning compressor retaining bolts.
9. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Fill Cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Install air cleaner assembly, resonator assembly and air inlet hose.
12. Connect battery negative cable.

ROCKER ARM - VALVE

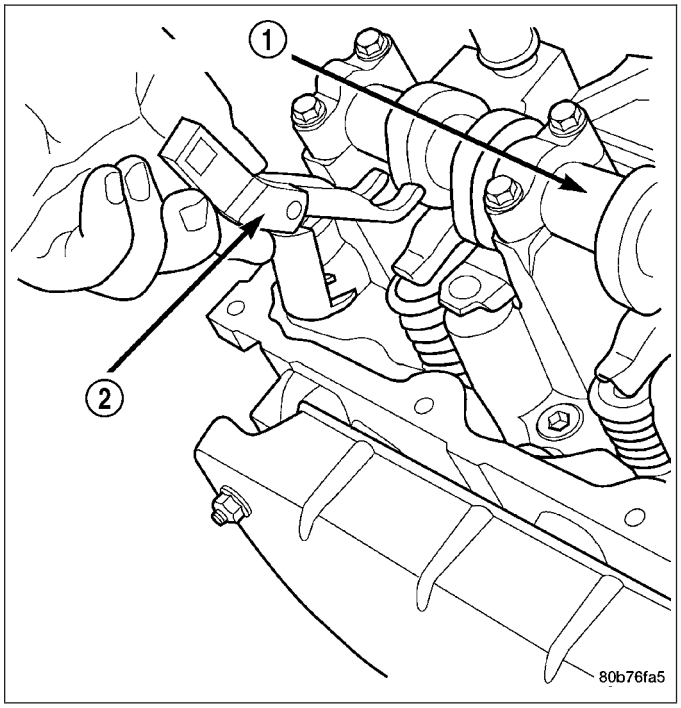
DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 0.5 mm oil hole in the lash adjuster socket for roller and camshaft lubrication.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinder No. 4, Rotate the crankshaft until cylinder No. 1 is at BDC intake stroke.
3. For rocker arm removal on cylinder No. 1, Rotate the crankshaft until cylinder No. 1 is at BDC combustion stroke.
4. For rocker arm removal on cylinders No. 3 and No. 5, Rotate the crankshaft until cylinder No. 1 is at TDC exhaust stroke.
5. For rocker arm removal on cylinders No. 2 and No. 6, Rotate the crankshaft until cylinder No. 1 is at TDC ignition stroke.
6. Using special tool 8516 Rocker Arm Remover (2) , press downward on the valve spring, remove rocker arm.



SEALS - VALVE GUIDE

DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

SPRINGS - VALVE

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. There are different springs for intake and exhaust applications. The exhaust spring has an external damper. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed.

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.

NOTE: The valve springs are NOT common between intake and exhaust.

8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

NOTE: All six valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

1. Apply shop air to the cylinder to hold the valves in place while the spring is installed.

NOTE: The valve stem seals are common between intake and exhaust.

2. Install the valve stem seal.

NOTE: The valve springs are NOT common between intake and exhaust.

3. Install the spring retainer, and the spring.
4. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.
5. Install the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

6. Remove the valve spring compressor.
7. Disconnect the shop air to the cylinder.
8. Install the spark plug for the cylinder the valve spring and seal was installed on.
9. Using Special Tool 8516 Valve Spring Compressor, install the rocker arms and the hydraulic lash adjusters.
10. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

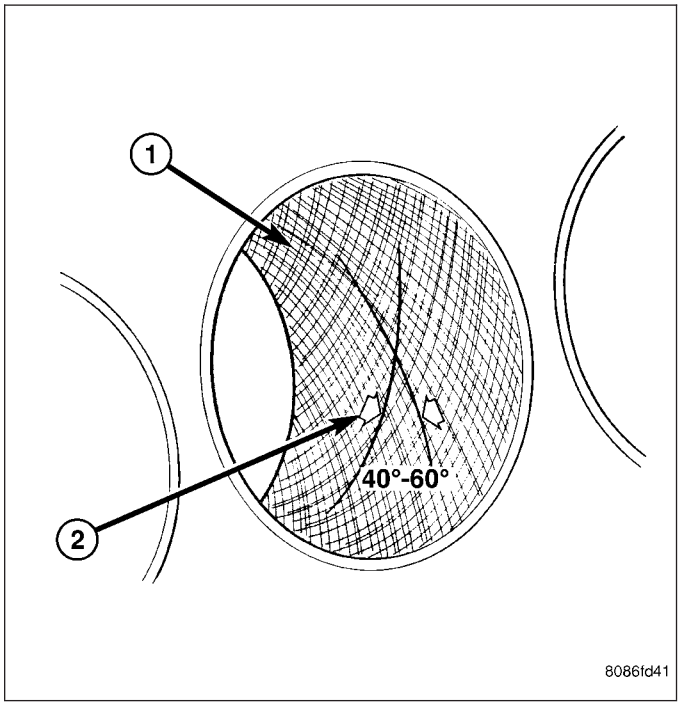
STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.



CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

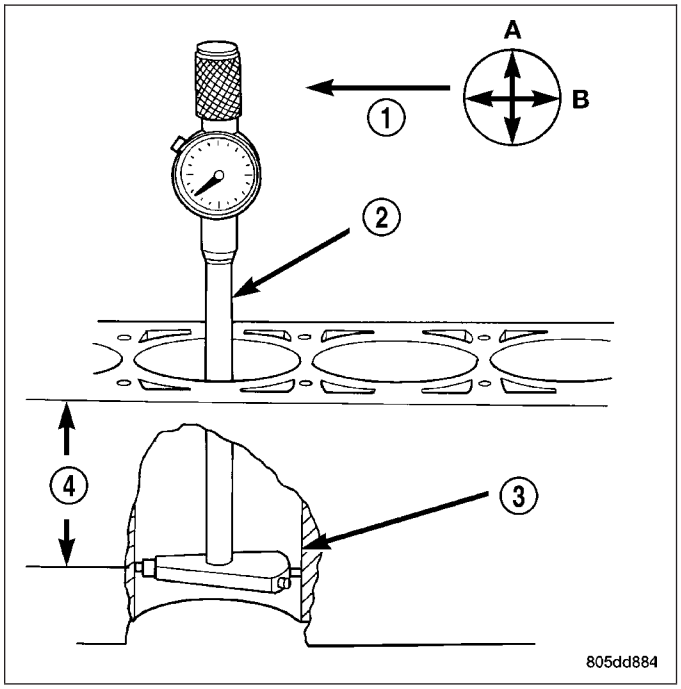
Thoroughly clean the oil pan and engine block gasket surfaces.

Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the 1/4 inch NPT plugs to 20 N·m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N·m (240 in. lbs.) torque.

INSPECTION

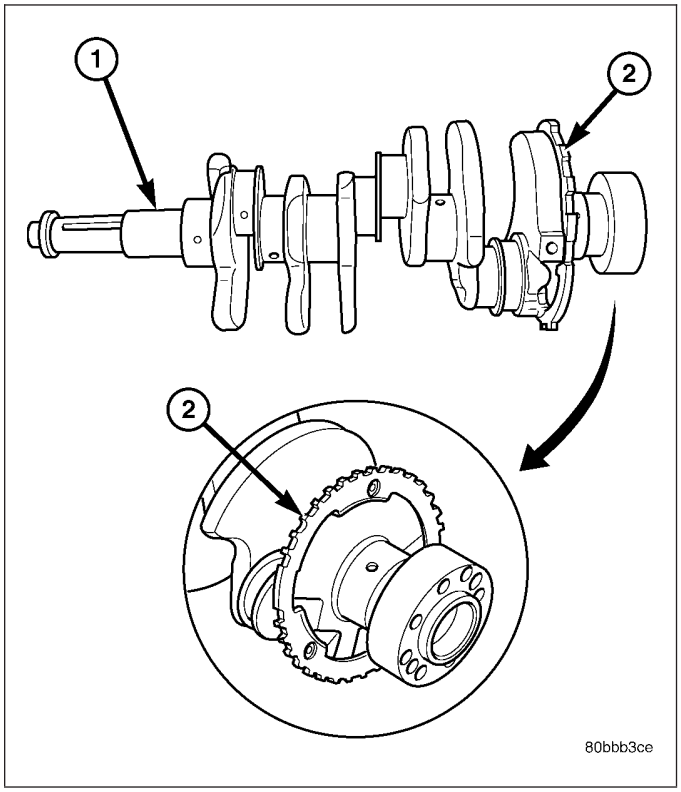


1. It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.
7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

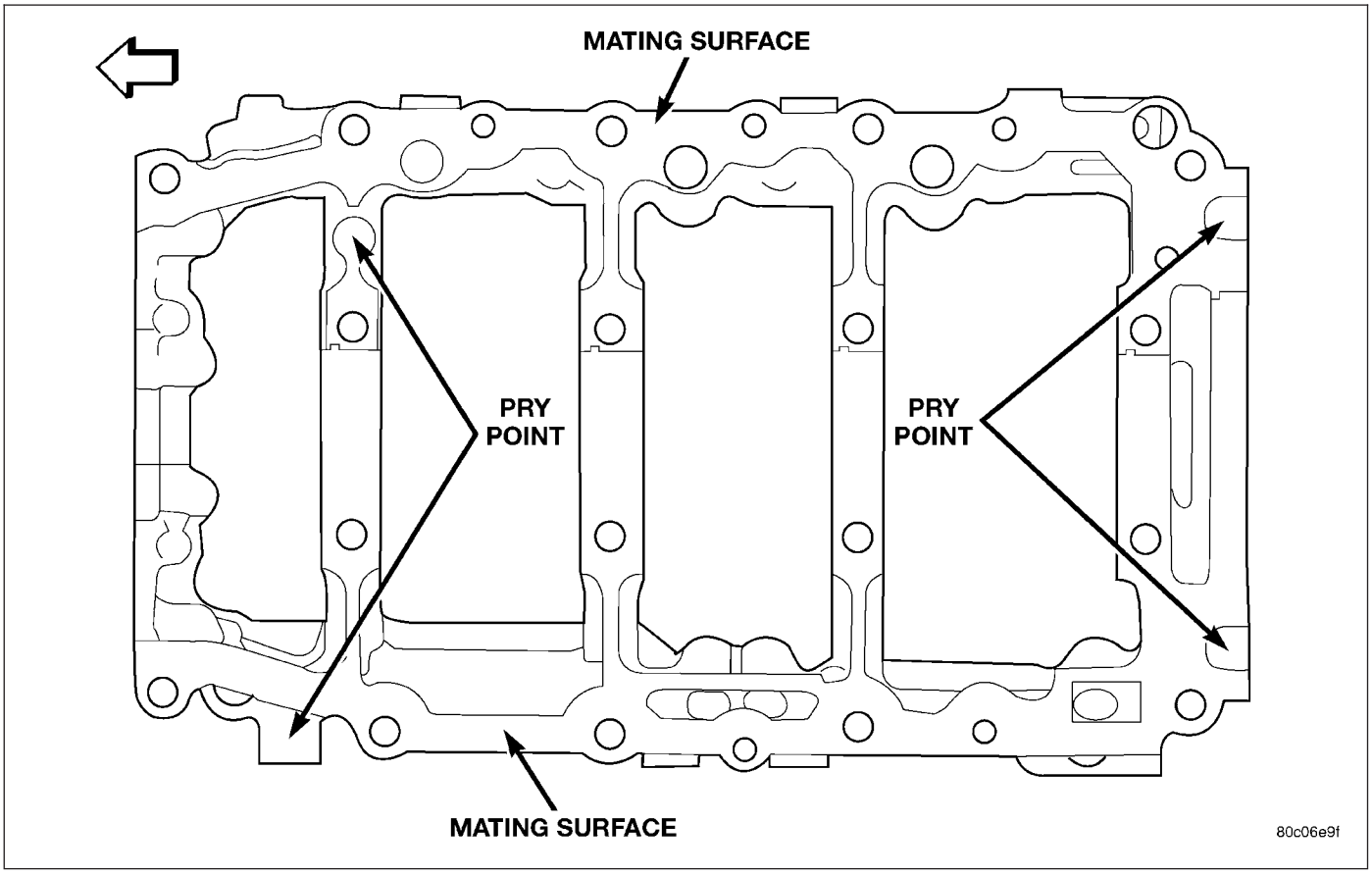
CRANKSHAFT

DESCRIPTION

The crankshaft (1) is constructed of nodular cast iron. The crankshaft is a three throw split pin design with six counterweights for balancing purposes. The crankshaft is supported by four select fit main bearings with the No. 2 serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The No. 6 counterweight has provisions for crankshaft position sensor target wheel (2) mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.



REMOVAL



NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine (Refer to 9 - ENGINE - REMOVAL).
2. Remove the engine oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove the bedplate mounting bolts. Note the location of the two stud bolts for installation.
4. Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause severe damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are shown below.

5. Carefully pry on the pry points to loosen the bedplate then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

6. Remove the crankshaft.

7. Remove the crankshaft tone wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washers.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

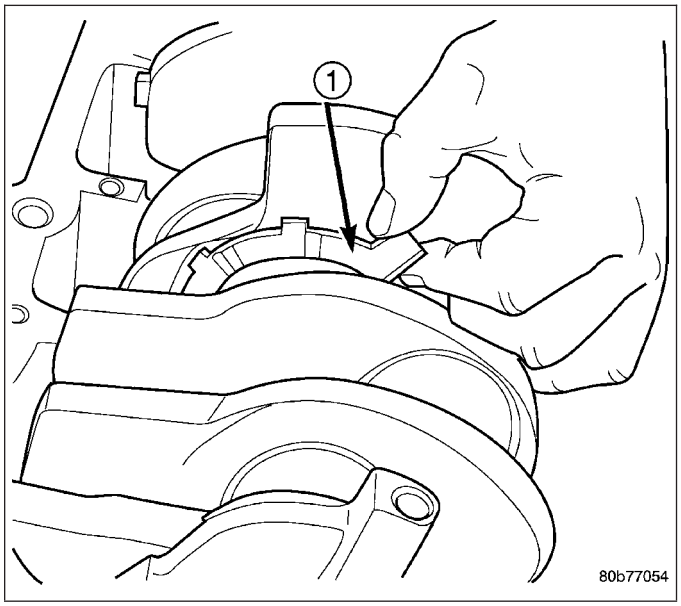
INSTALLATION

CAUTION: Main bearings are select fit. Refer to Crankshaft Main Bearings in this section for proper bearing selections.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the tone wheel retaining screws prior to installation.

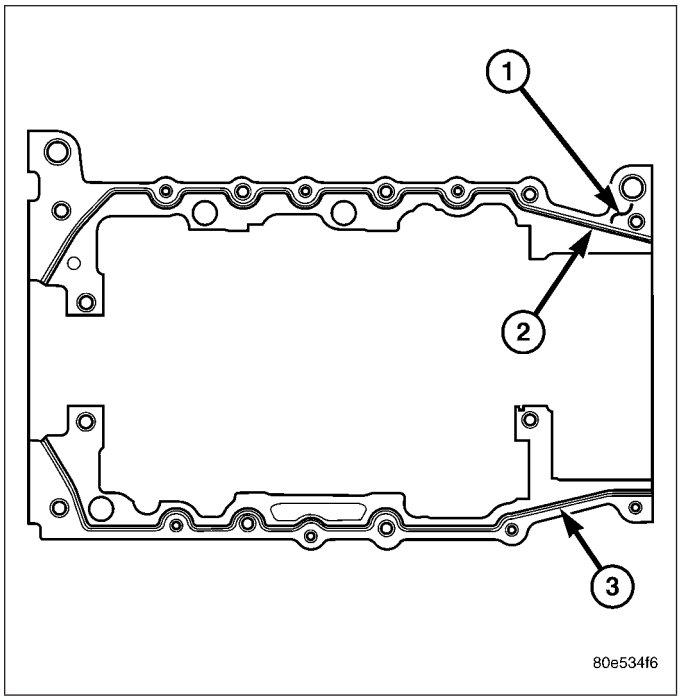
1. Lubricate upper main bearing halves with clean engine oil.
2. Install the crankshaft tone wheel. Torque the mounting screws to 15 N·m (11 ft. lbs.).
3. Position crankshaft in cylinder block.
4. Install the thrust washers (1).

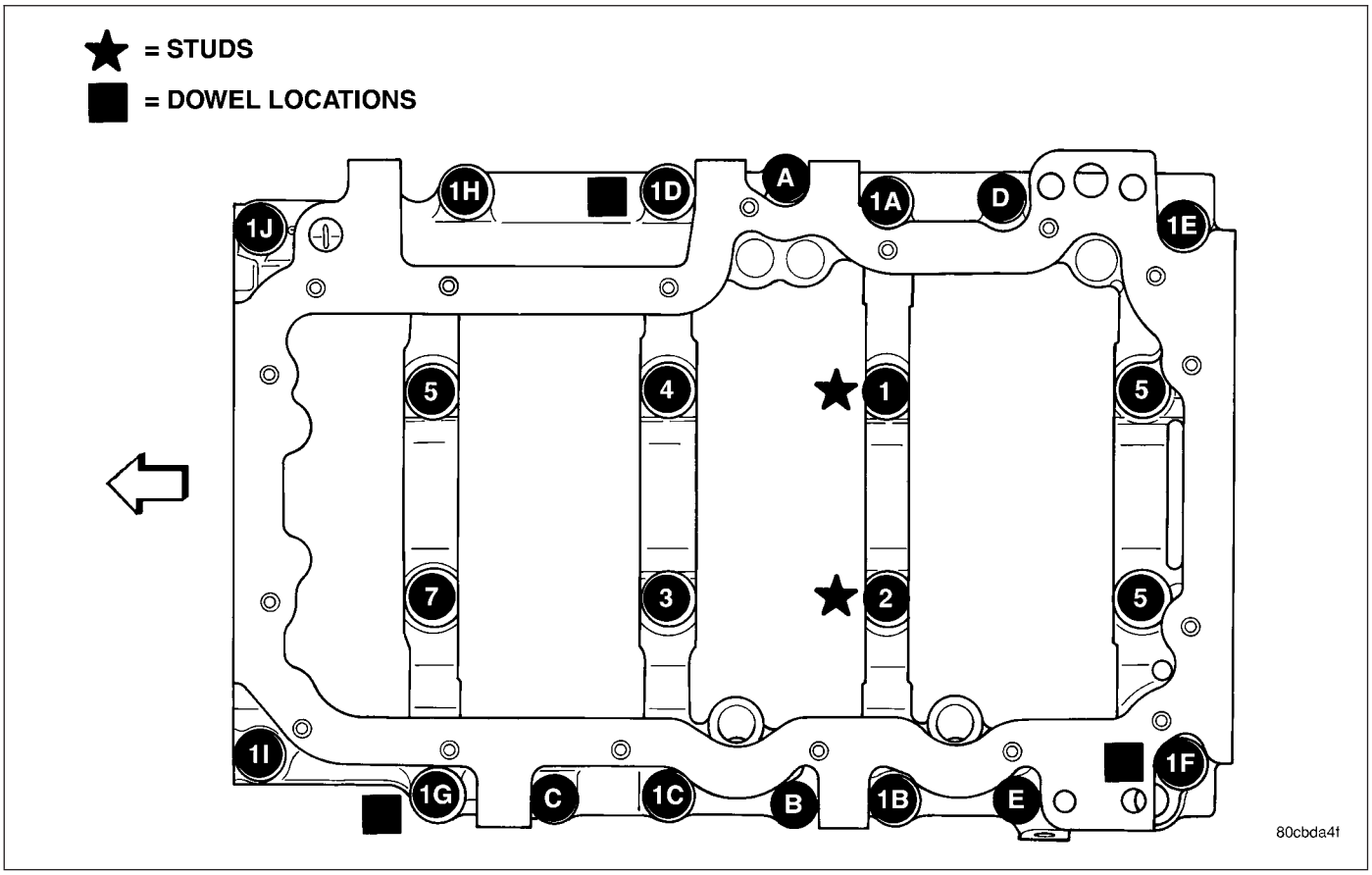


CAUTION: The bedplate to cylinder block mating surface must be coated with Mopar® Engine RTV sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

5. Apply a 2.5mm (0.100 inch) bead of Mopar® Engine RTV sealant to the cylinder block-to-bedplate mating surface (2,3) as shown.





6. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

7. Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown.
   - Hand tighten bolts **1D,1G and 1F** until the bedplate contacts the block.

- Tighten bolts **1A - 1J** to 54 N·m (40 ft. lbs.)
- Tighten bolts **1 - 8** to 7 N·m (5 ft. lbs.)
- Turn bolts **1 - 8** an additional 90°.
- Tighten bolts **A - E** 27 N·m (20 ft. lbs.).

8. Measure crankshaft end play.
9. Install the connecting rods and measure side clearance (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).
10. Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
11. Install the engine (Refer to 9 - ENGINE - INSTALLATION).

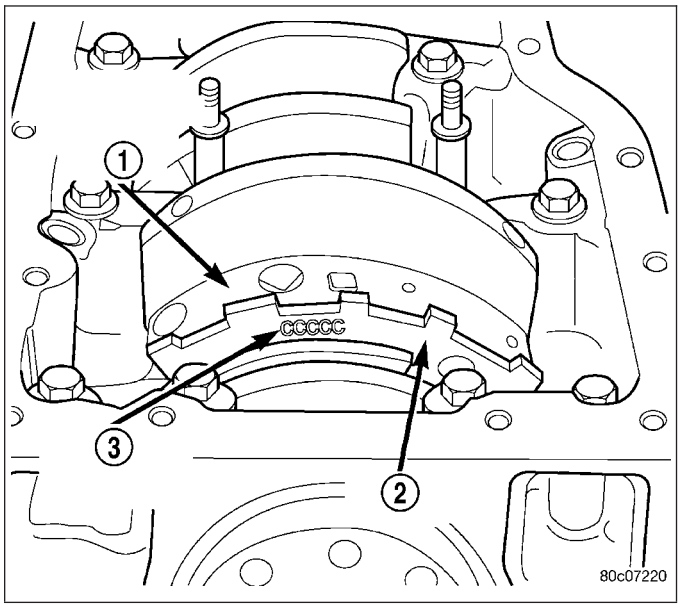
BEARINGS - CRANKSHAFT MAIN

STANDARD PROCEDURE

MAIN BEARING FITTING

SELECT FIT IDENTIFICATION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel (2) has grade identification marks stamped into it. These marks are read from left to right, corresponding with journal number 1, 2, 3, 4. The crankshaft position sensor target wheel is mounted to the number 6 counter weight (1) on the crankshaft.



INSPECTION

Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

Install the crankshaft into the cylinder block (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - INSPECTION).

Check crankshaft end play.

CRANKSHAFT MAIN BEARING SELECTION

Crankshaft Marking	**JOURNAL SIZE SIZE mm (in.)**	
″R″ Size	63.488 - 63.496 mm (2.4995 - 2.4998 in.)	
″S″ Size	63.496 - 63.500 mm (2.4998 - 2.4999 in.)	
″T″ Size	63.500 - 63.504 mm (2.4999 - 2.501 in.)	
″U″ Size	63.504 - 63.512 mm (2.5001 - 2.5004 in.)	
Bearing size		
Bearing Code	Size	Application
Upper Bearing		
A	.2.443 - 2.447 mm (.0961 - .0963 in.)	Use with crankshaft size ″R″
B	2.439 - 2.443 mm (0.960 - .0961 in.)	Use with crankshaft ″S, T″
C	2.435 - 2.439 mm (.0958 - .0960 in.)	Use with crankshaft ″U″
Lower Bearing Main ″1″ and ″4″		
″1″	2.441 - 2.447 mm (.0961 -.0963 in.)	Use with crankshaft ″R, S″
″2″	2.435 - 2.441 mm (.0958 - .0962 in.)	Use with crankshaft ″T, U″
Lower Main Bearing ″2″ and ″3″		
″3″	2.429 - 2.435 mm (.0956 - .0958 in.)	Use with crankshaft ″R, S″
″4″	2.423 - 2.429 mm (.0953 - .0956 in.)	Use with crankshaft ″T, U″
Bearing Clearances		
Main ″1, 4″		
Crankshaft ″R″	.004 - .034 mm (.00015 - .0013 in.)	
Crankshaft ″S″	.004 - .030 mm (.00015 - .0011 in.)	
Crankshaft ″T″	.006 - .032 mm (.0002 - .0012 in.)	
Crankshaft ″U″	.002 - .032 mm (.00007 -. 0012 in.)	
Main ″2, 3″		
Crankshaft ″R″	.016 - .046 mm (.0006 - .0018 in.)	
Crankshaft ″S″	.016 - .042 mm (.00062 - .016 in.)	
Crankshaft ″T″	.018 - .044 mm (.0007 - .0017 in.)	
Crankshaft ″U″	.014 - .044 mm (.0005 - .0017 in.)	

1. Service main bearings are available in four grades. The chart below identifies the four service grades available.

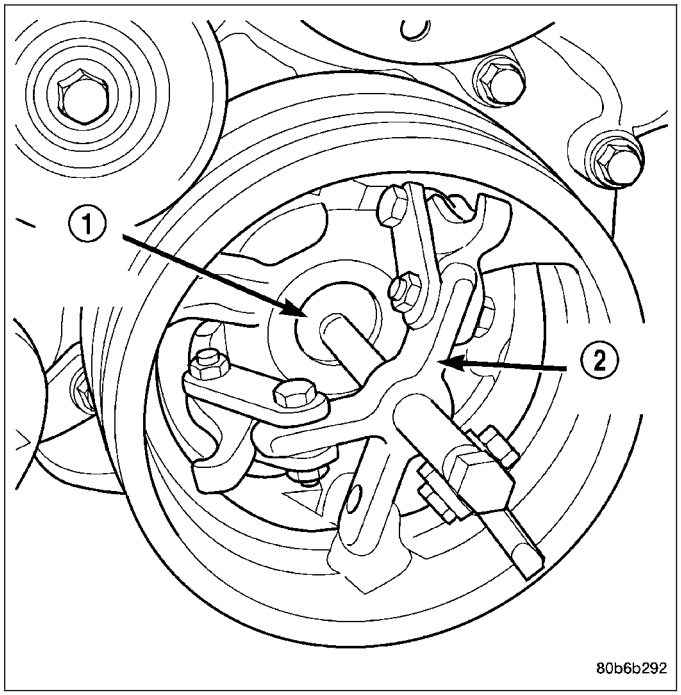
SEAL - CRANKSHAFT OIL - FRONT

REMOVAL

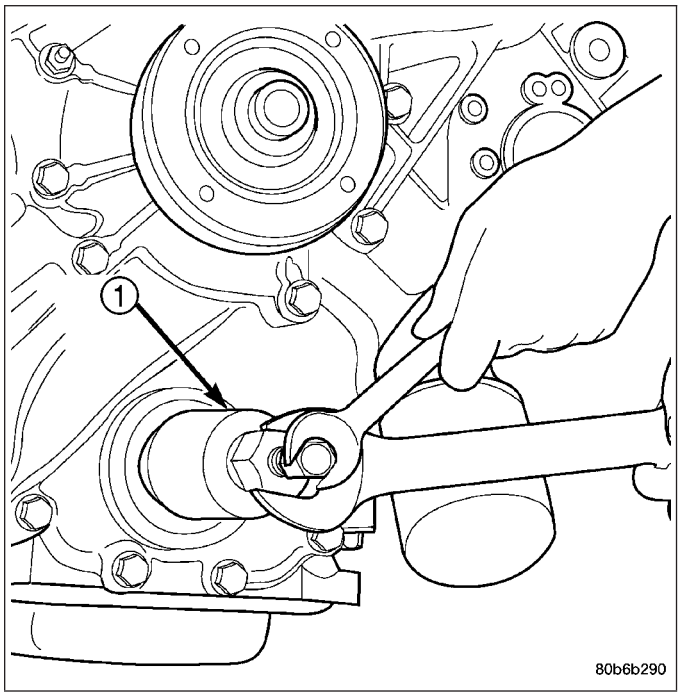
1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove A/C compressor mouning fasteners and set aside.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

8. Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).



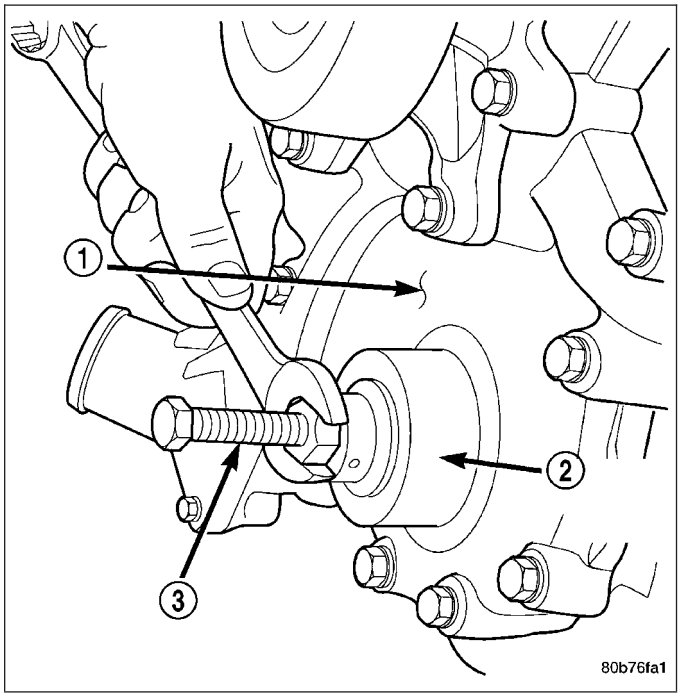
11. Using Special Tool 8511 (1), remove crankshaft front seal.



INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Special Tool 8348 and 8512 (2,3), install crankshaft front seal.
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).
6. Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.



SEAL - CRANKSHAFT OIL - REAR

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

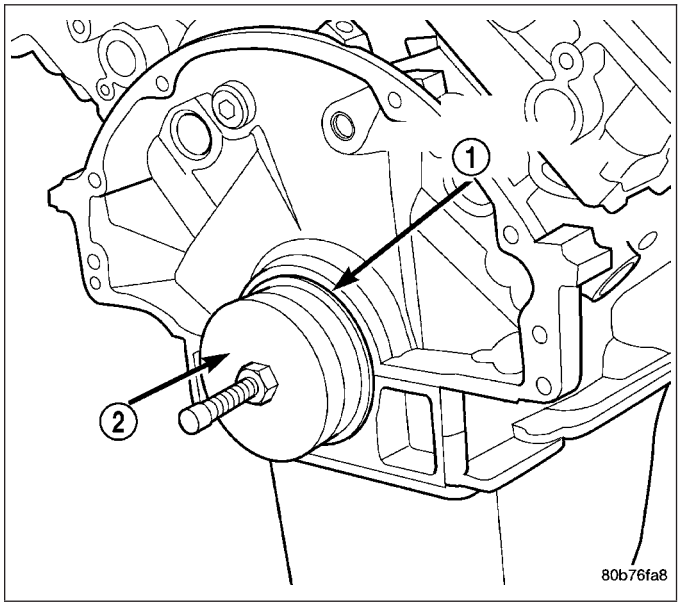
REMOVAL

NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

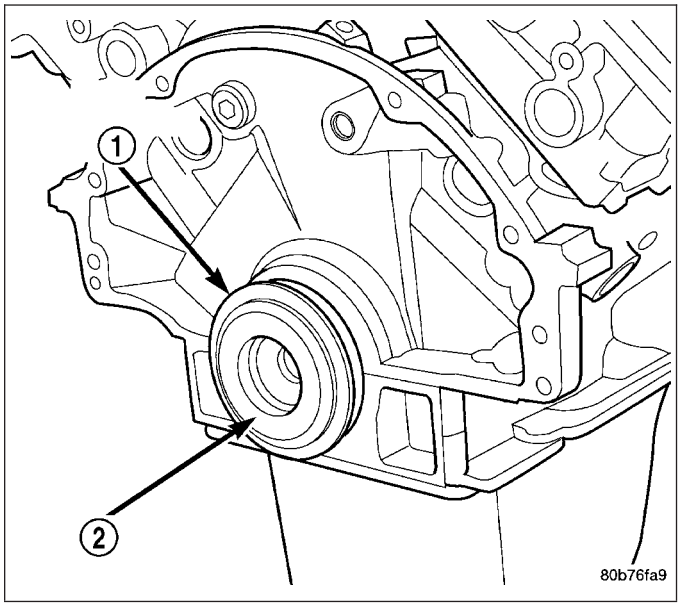
NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.



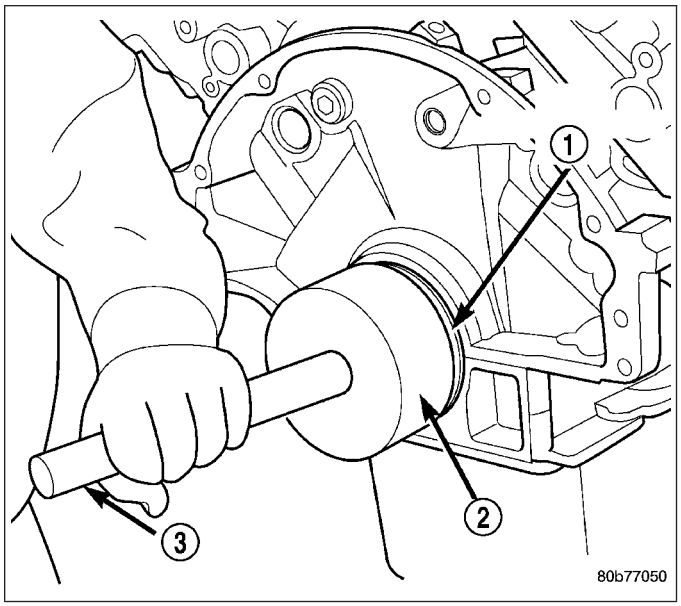
3. Using Special Tool 8506 (2), remove the crankshaft rear oil seal (1)

INSTALLATION

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide Special Tool 8349-2 onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).



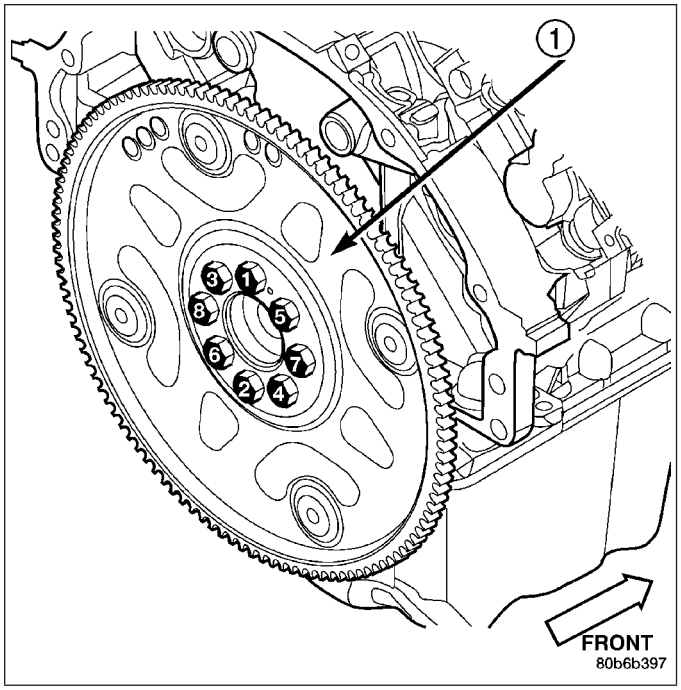
3. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (2) and C-4171 Driver Handle (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.



FLEX PLATE

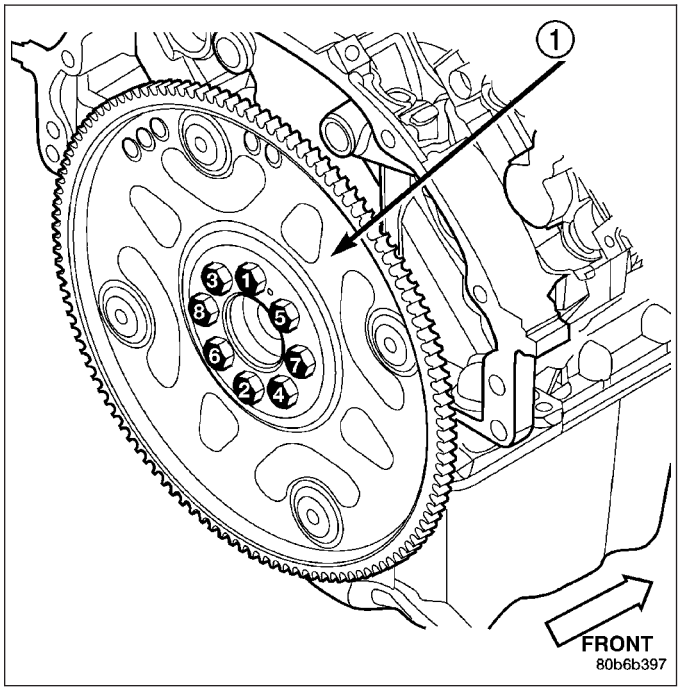
REMOVAL

1. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - REMOVAL).
2. Remove the bolts and flexplate (1).



INSTALLATION

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate (1) retaining bolts to 95 N·m (70 ft. lbs.) in the sequence shown.
3. Install the transmission.

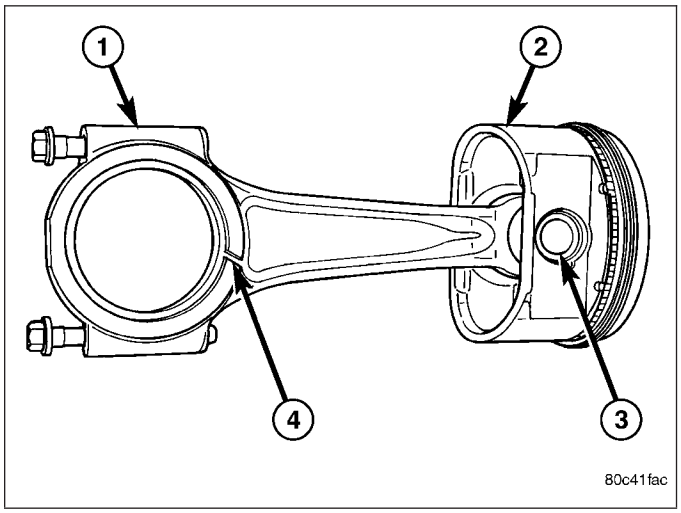


PISTON & CONNECTING ROD

DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons (2) are made of a high strength aluminum alloy. The connecting rods (1) are made of forged powdered metal, with a “fractured cap” design. A full floating piston pin is used to attach the piston to the connecting rod.



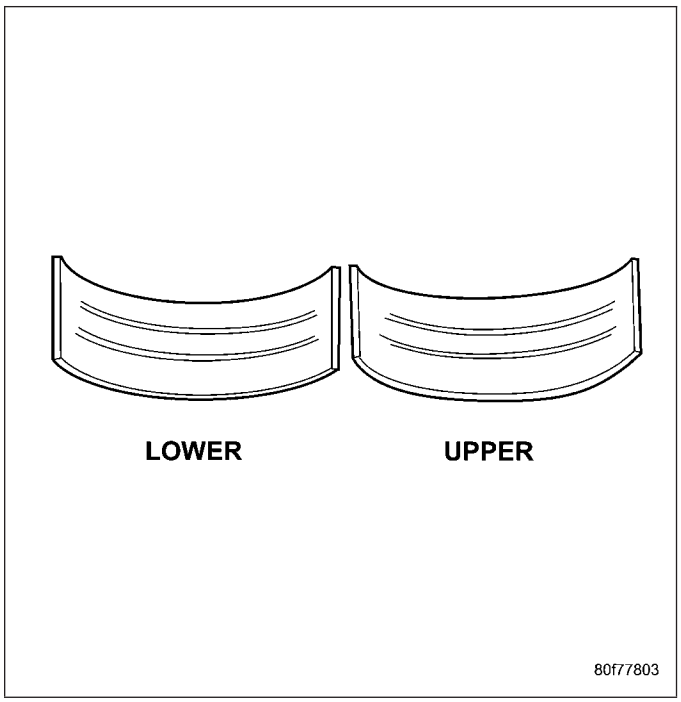
STANDARD PROCEDURE

CONNECTING ROD BEARING FITTING

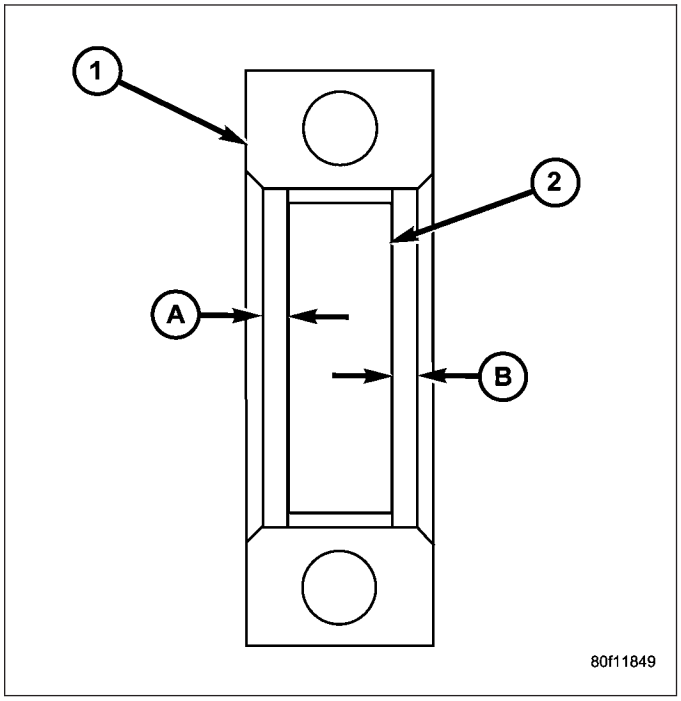
Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

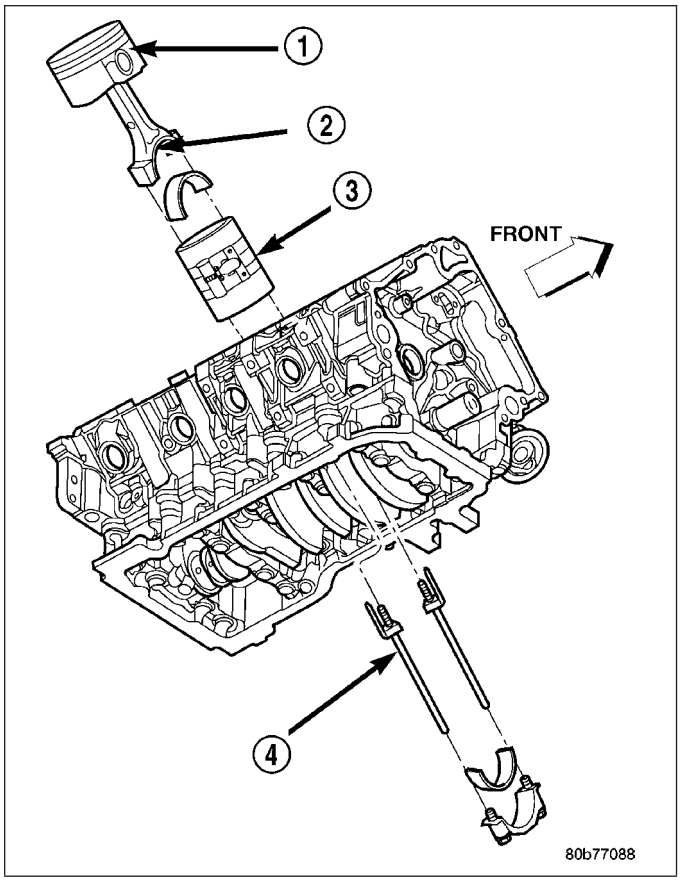
Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.



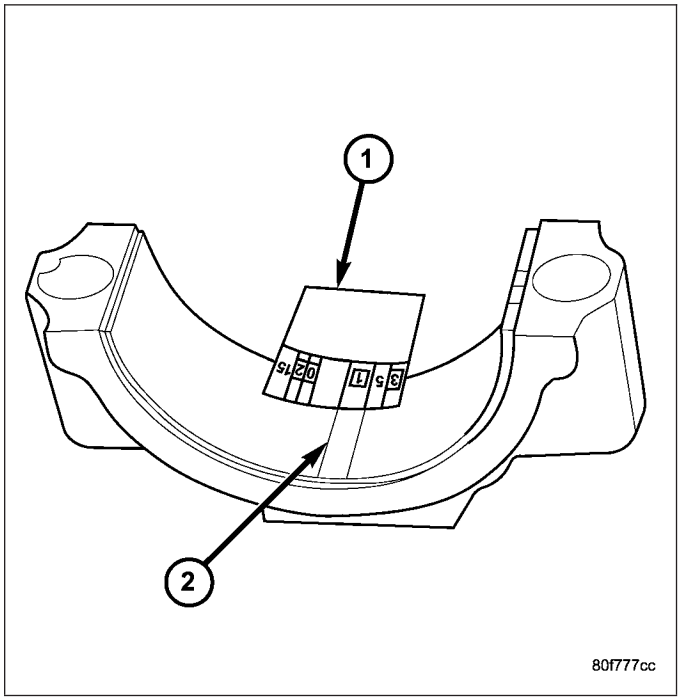
1. Wipe the oil from the connecting rod journal.
2. Lubricate the upper bearing insert and position in connecting rod. **Center bearing insert (2) in connecting rod (1)**



3. Use piston ring compressor (3) and Guide Pins Special Tool 8507 to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s near the piston wrist pin bore (1) should point to the front of the engine.



4. Install the lower bearing insert in the bearing cap. **Center bearing insert in connecting rod.**. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.
5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage from crankshaft journal and bearing insert. Proceed with installation.



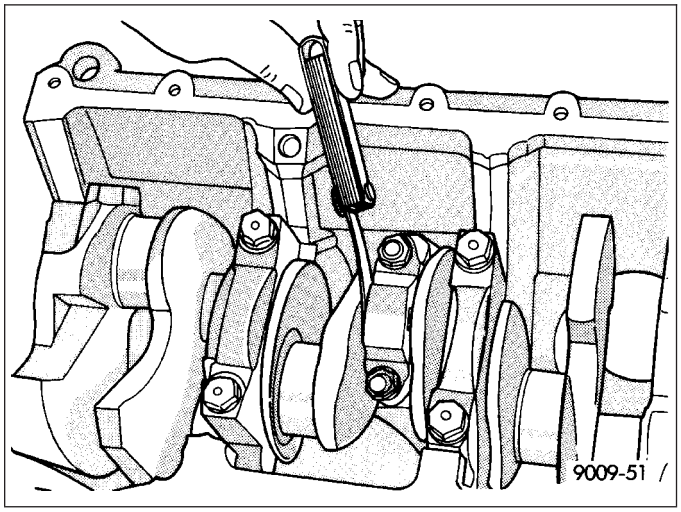
Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	57.883-57.867 mm (2.2788-2.2783 in.)
Std.	STANDARD	57.908-57.892 mm (2.2798-2.2792 in.)
.250 US	.250 mm (.010 in.)	57.658-57.646 mm (2.2700-2.2695 in.)

8. If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

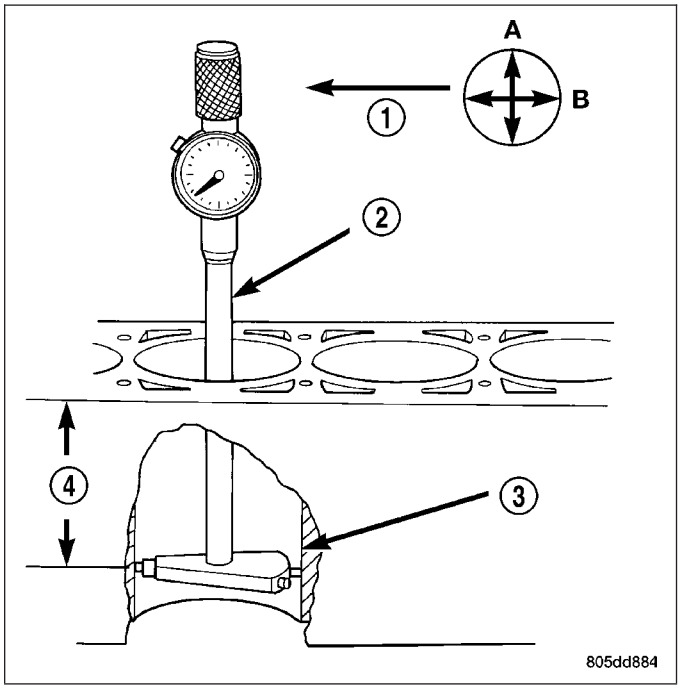
9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

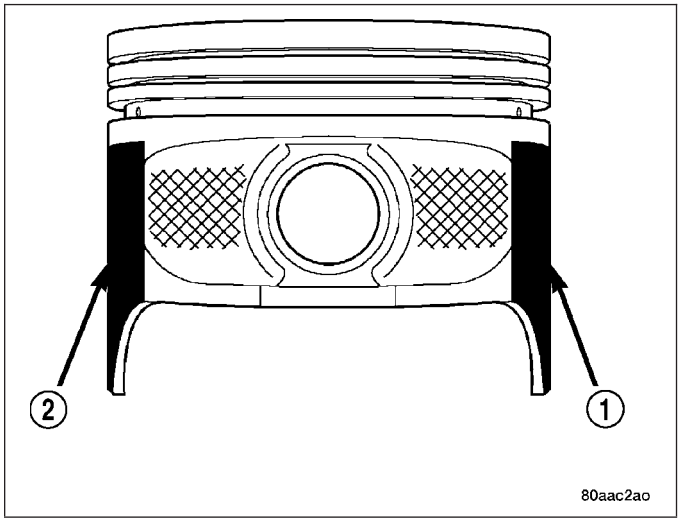


STANDARD PROCEDURE - PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge (2), capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore (3) at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.



3. The coated pistons (1,2) will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston (1,2) will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.



REMOVAL

1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
   - Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods

must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/ CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

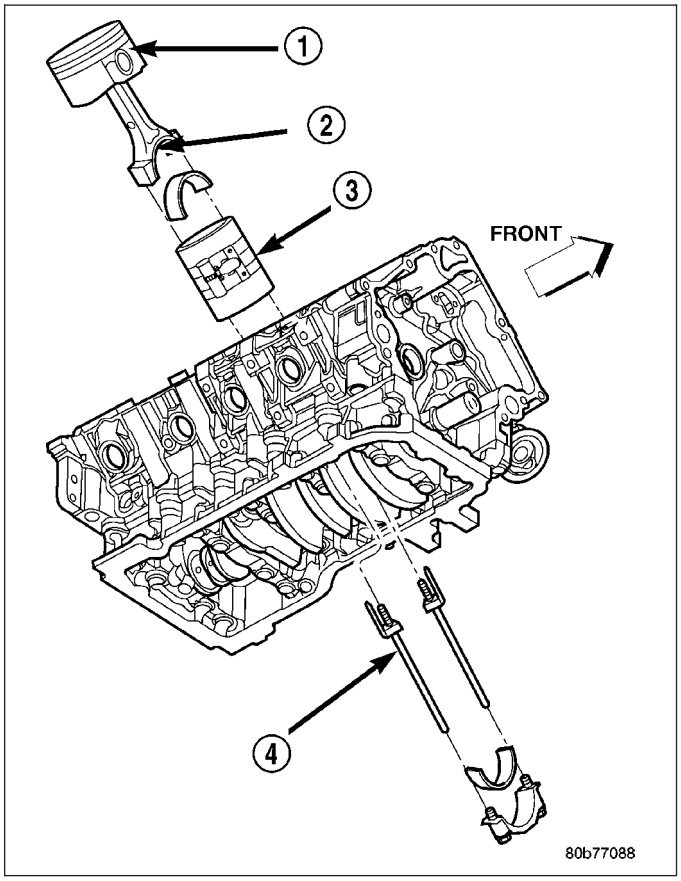
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

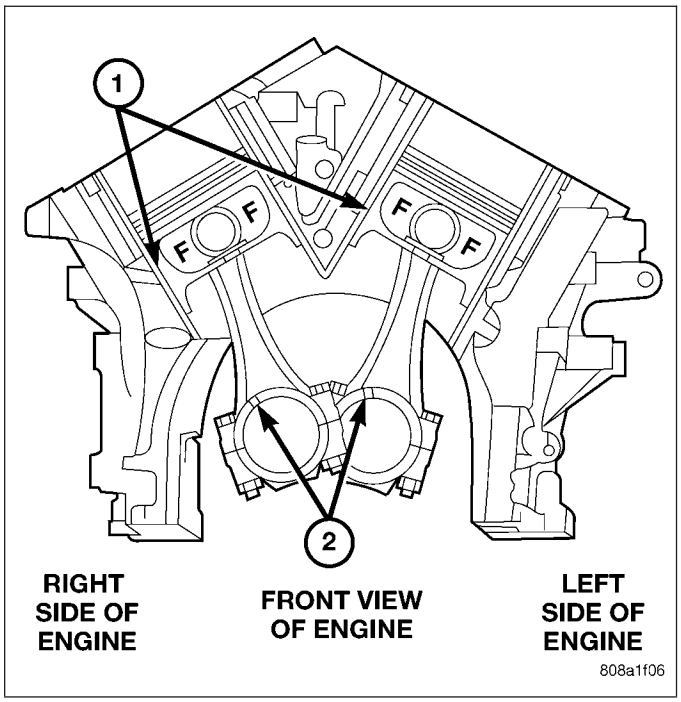
1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.



5. The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position (1). This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.
10. Install the following components:



- Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
- Timing chain and cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
- Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
- Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

RINGS - PISTON

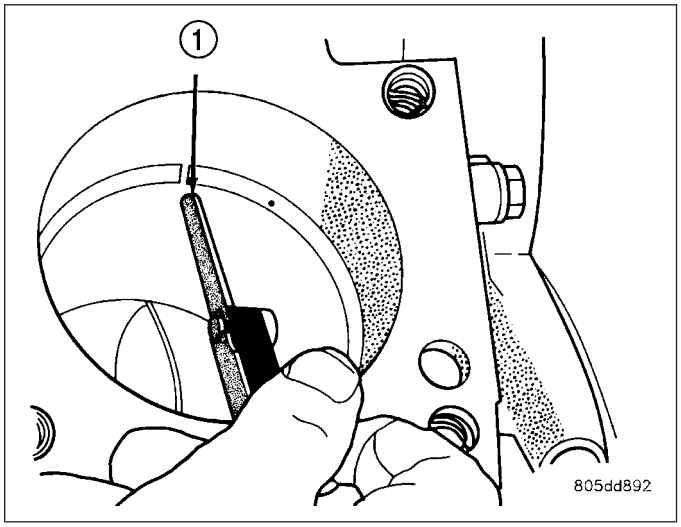
STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

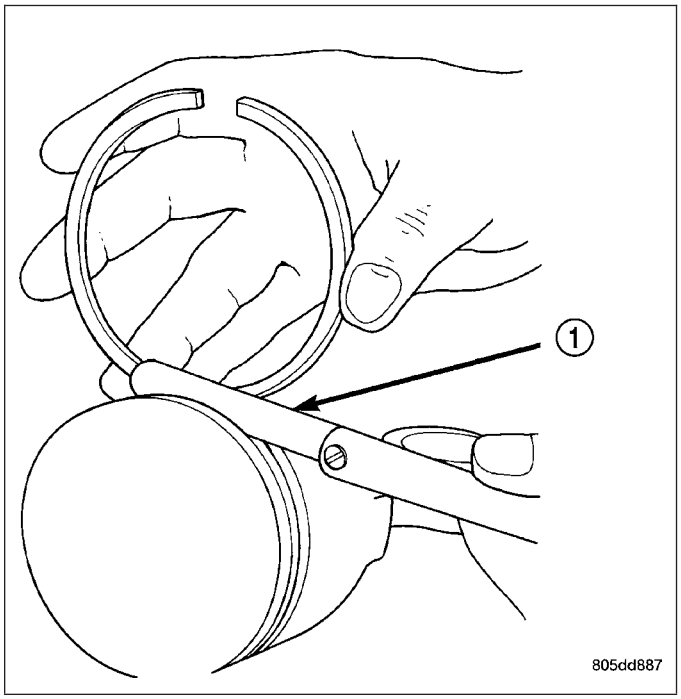
NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.



PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

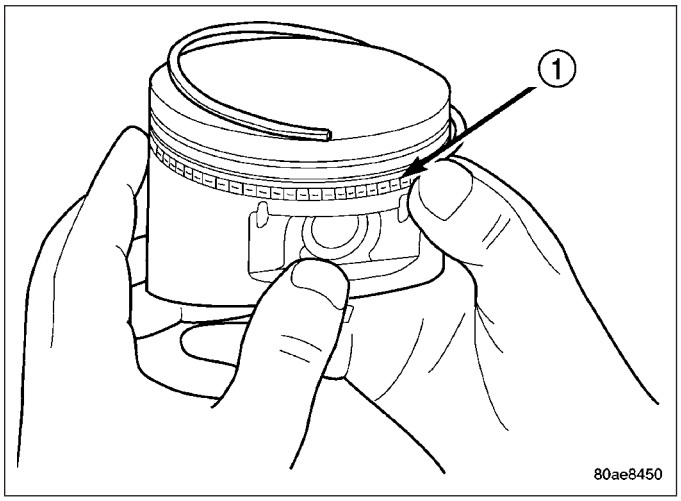


5. Measure the ring side clearance as shown make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094 mm (0.0020-.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04-0.08 mm (0.0016-0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229 mm (.0007-.0090 in.)	.25 mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.20-0.36 mm (0.0079-0.0142 in.)	0.43 mm (0.0017 in.)
Intermediate Ring	0.37-0.63 mm (0.0146-0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025-0.76 mm (0.0099- 0.03 in.)	1.55 mm (0.061 in.)

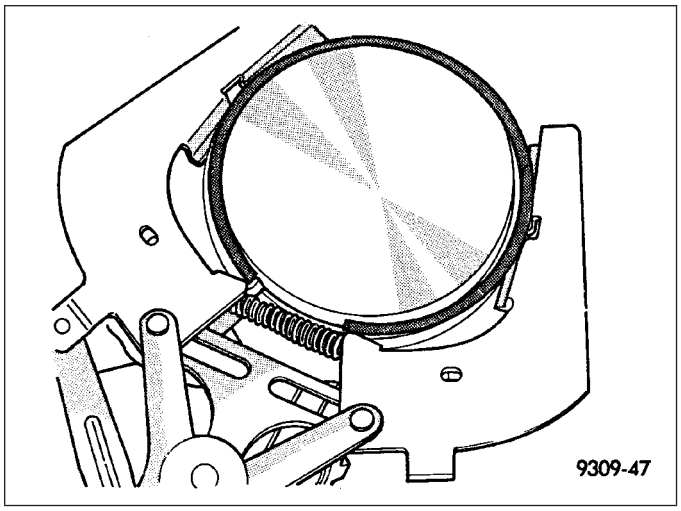
7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.



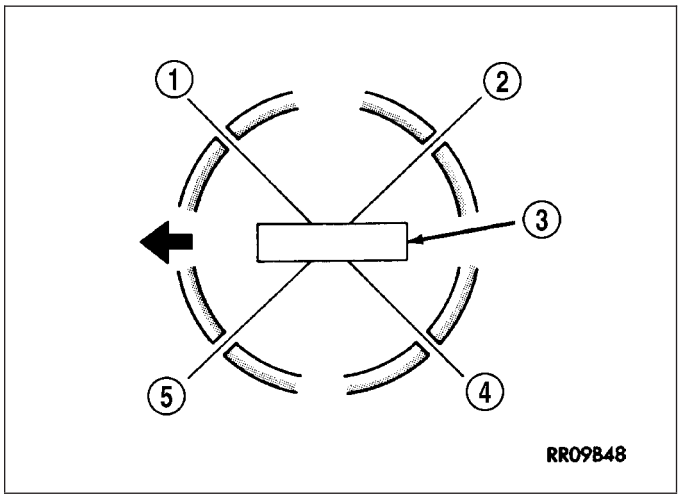
NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

8. Install the oil ring expander.
9. Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



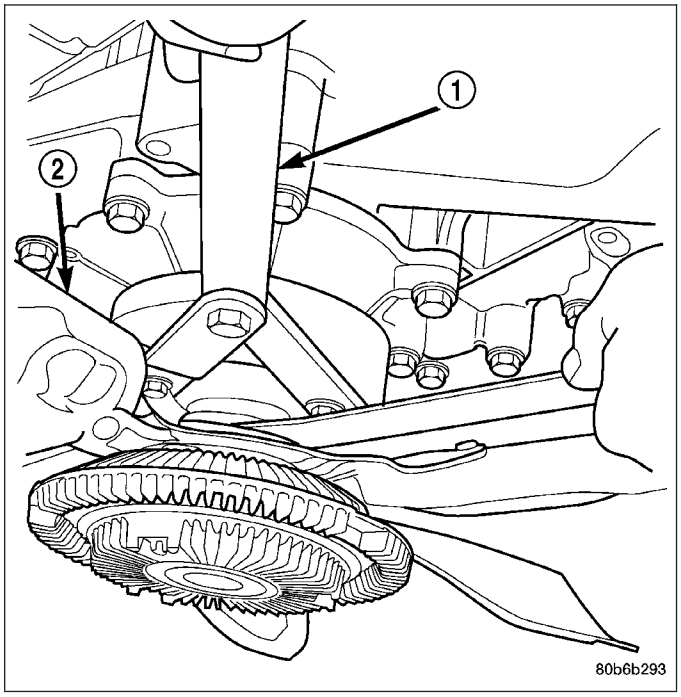
12. Position piston ring end gaps as shown in. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.



DAMPER - CRANKSHAFT

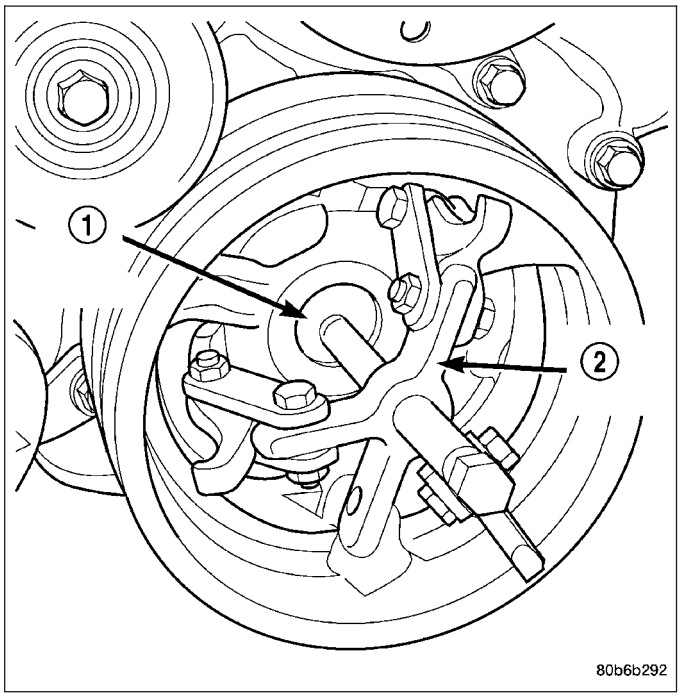
REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove radiator upper hose.
5. Remove upper fan shroud.
6. Using Special Tools 6958 Spanner with Adapter Pins 8346 (1), loosen fan and viscous assembly from water pump.
7. Remove fan and viscous assembly.
8. Disconnect electrical connector for fan mounted inside radiator shroud.



NOTE: Transmission cooler line snaps into shroud lower right hand corner.

9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).

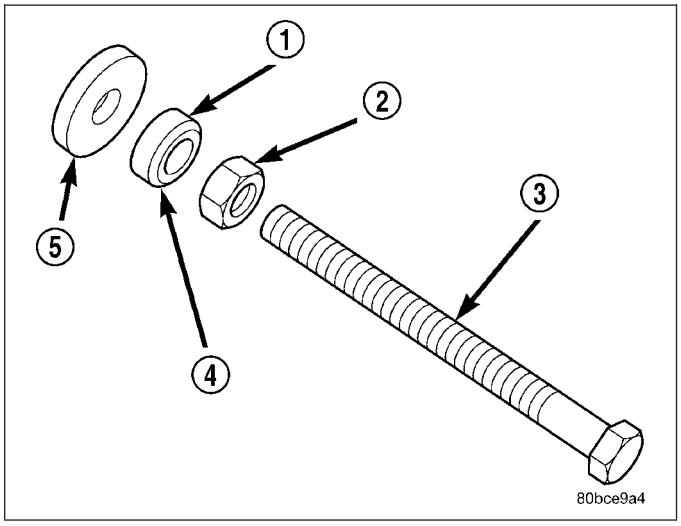


INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512–A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

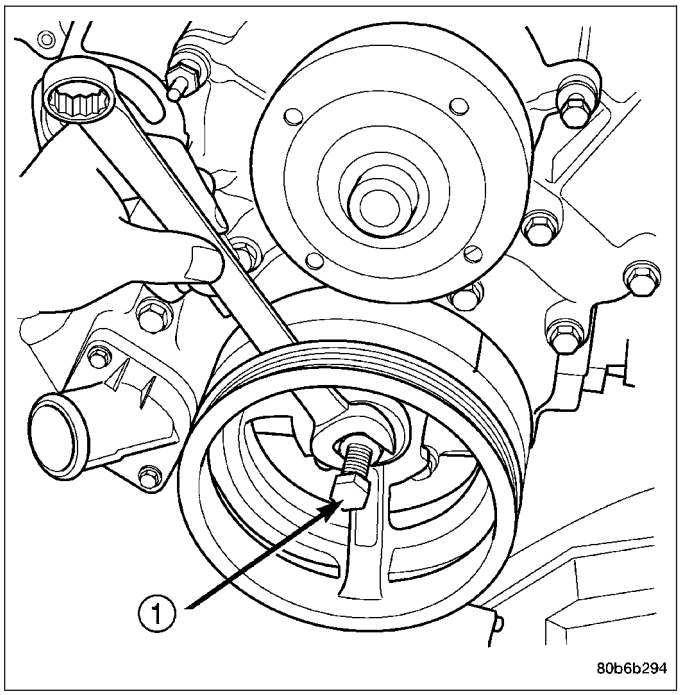
1. Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512–A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.



2. Assemble Special Tool 8512–A as follows, The nut (2) is threaded onto the shaft first. Then the roller bearing (1) is placed onto the threaded rod (3) (The hardened bearing surface of the bearing (1) **MUST**face the nut (2). Then the hardened washer (5)slides onto the threaded rod. Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or equivalent.

3. Using Special Tool 8512–A, press damper onto crankshaft (1).
4. Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).
5. Install fan blade assembly (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
6. Install radiator upper shroud and tighten fasteners to 11 N·m (95 in. lbs.).
7. Connect electrical connector for shroud fan.
8. Install radiator upper hose.
9. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect negative cable to battery.



COVER - STRUCTURAL

DESCRIPTION

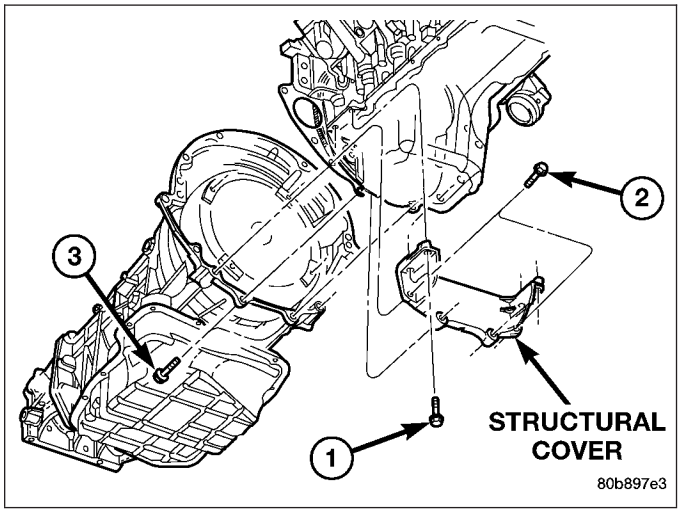
The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

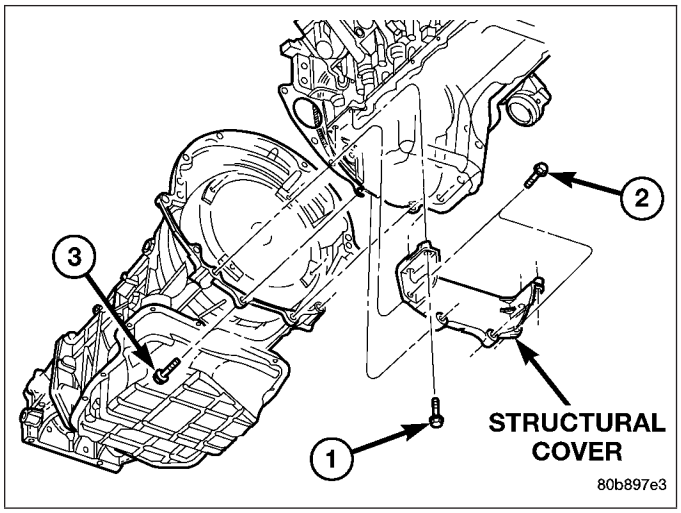
1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1,2,3) retaining structural cover in the sequence shown.
5. Pivot the exhaust pipe downward and remove the structural cover.



INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts (1,2,3)retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts (1,2,3). Do NOT tighten at this time.



CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

MOUNT - FRONT

REMOVAL

2WD

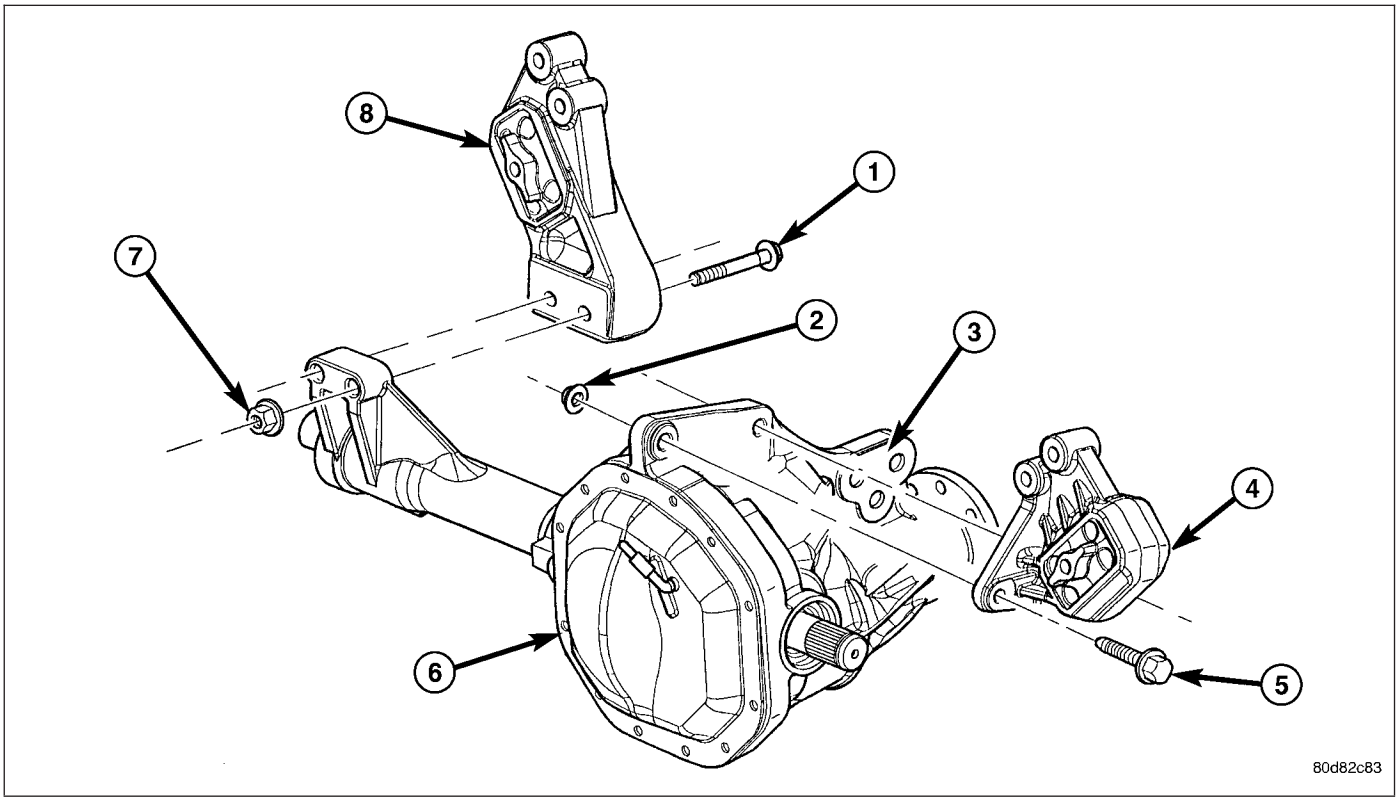
1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Raise the vehicle.

4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the (4) bolts that attach the engine mounts to the front axle.
9. Remove the (3) bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the (8) mount to engine attaching bolts
14. Remove the engine mounts.

4WD



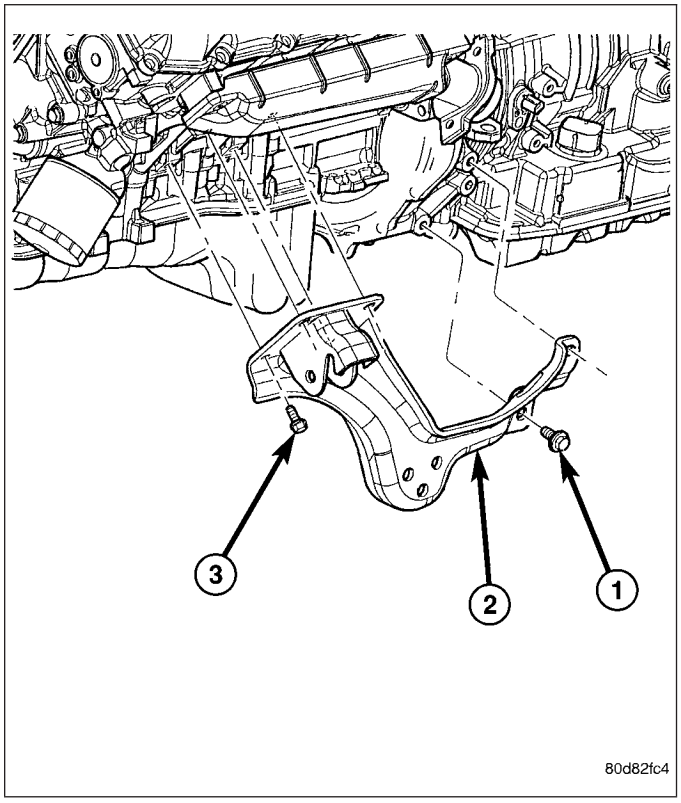
1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the 4 bolts that attach the engine mounts to the front axle.
11. Remove the 3 bolts that attach the front axle to the left engine bracket.

12. Lower the front axle.
13. Remove the 6 through bolts
14. Raise the engine far enough to be able to remove the left (4) and right (8) engine mounts.
15. Remove the mounts.

16. Remove the engine mount brackets (2).

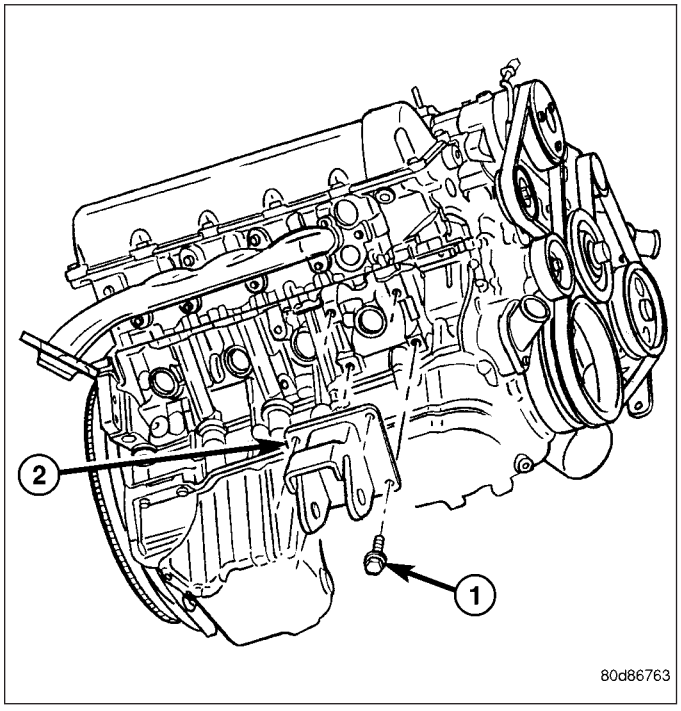


INSTALLATION

2WD

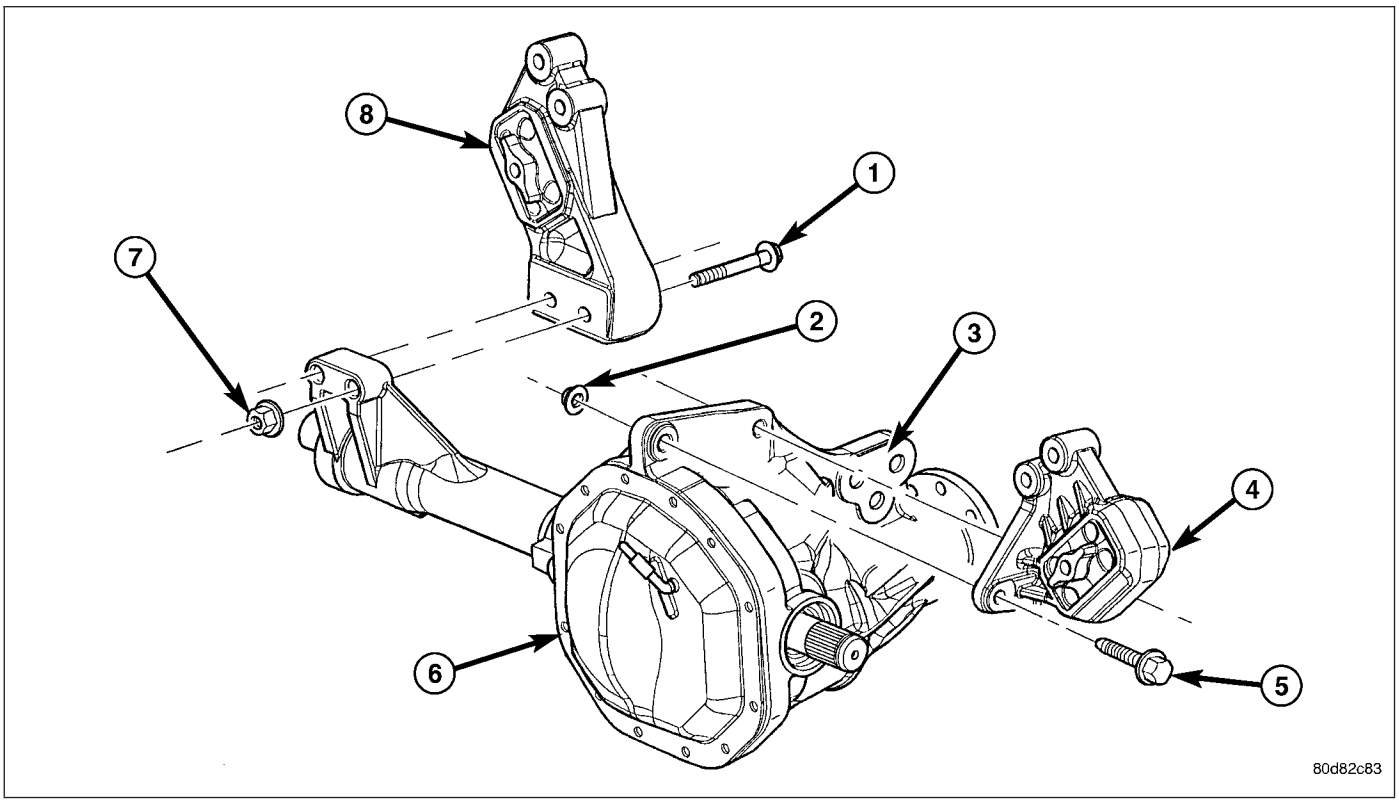
NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts to the engine block with (8) bolts. Torque bolts to 54 N·m (40 ft. lbs.).
2. Insert the (2) through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.
4. Tighten the through bolt nuts to 94 N·m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.



8. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Reconnect the negative battery cable.

4WD



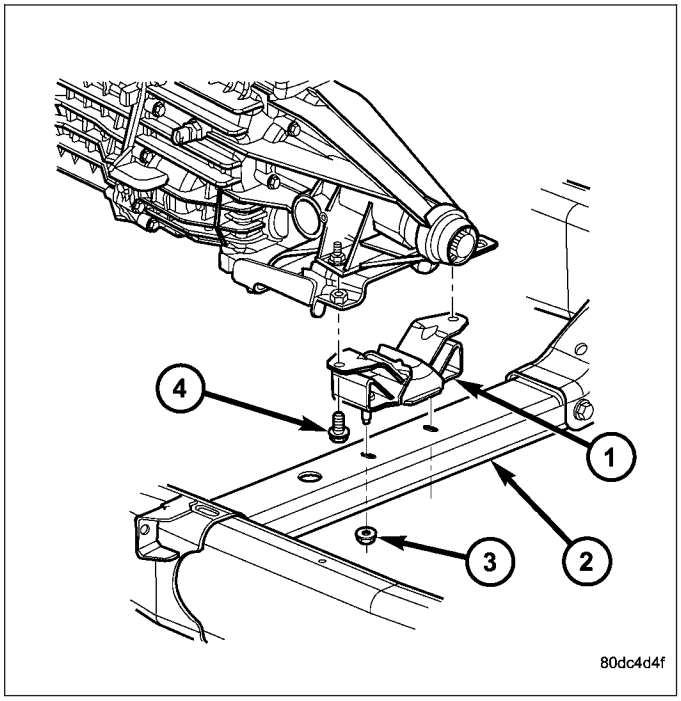
NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts (4,8)to the front axle. Torque nuts to 94 N·m (70 ft. lbs.).
2. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N·m (70 ft. lbs.).
3. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
4. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
5. Loose assemble the 3 bolts that attach the front axle to the left engine bracket.
6. Loose assemble the lower through bolts.
7. Torque the nuts for the 4 through bolts to 101 N·m (75 ft. lbs.).
8. Torque the 3 bolts that attach the front axle to the left engine bracket to 101 N·m (75 ft. lbs.).
9. Install the oil drain trough.
10. Install the engine oil filter.
11. Install the front crossmember.
12. Install the skid plate.
13. Lower the vehicle.
14. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
15. Reconnect the negative battery cable.

MOUNT - REAR

REMOVAL

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2).
6. Remove the mount (1).



INSTALLATION

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61N·m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54N·m (40 ft. lbs.).

LUBRICATION

DESCRIPTION

The lubrication system is a full flow filtration pressure feed type.

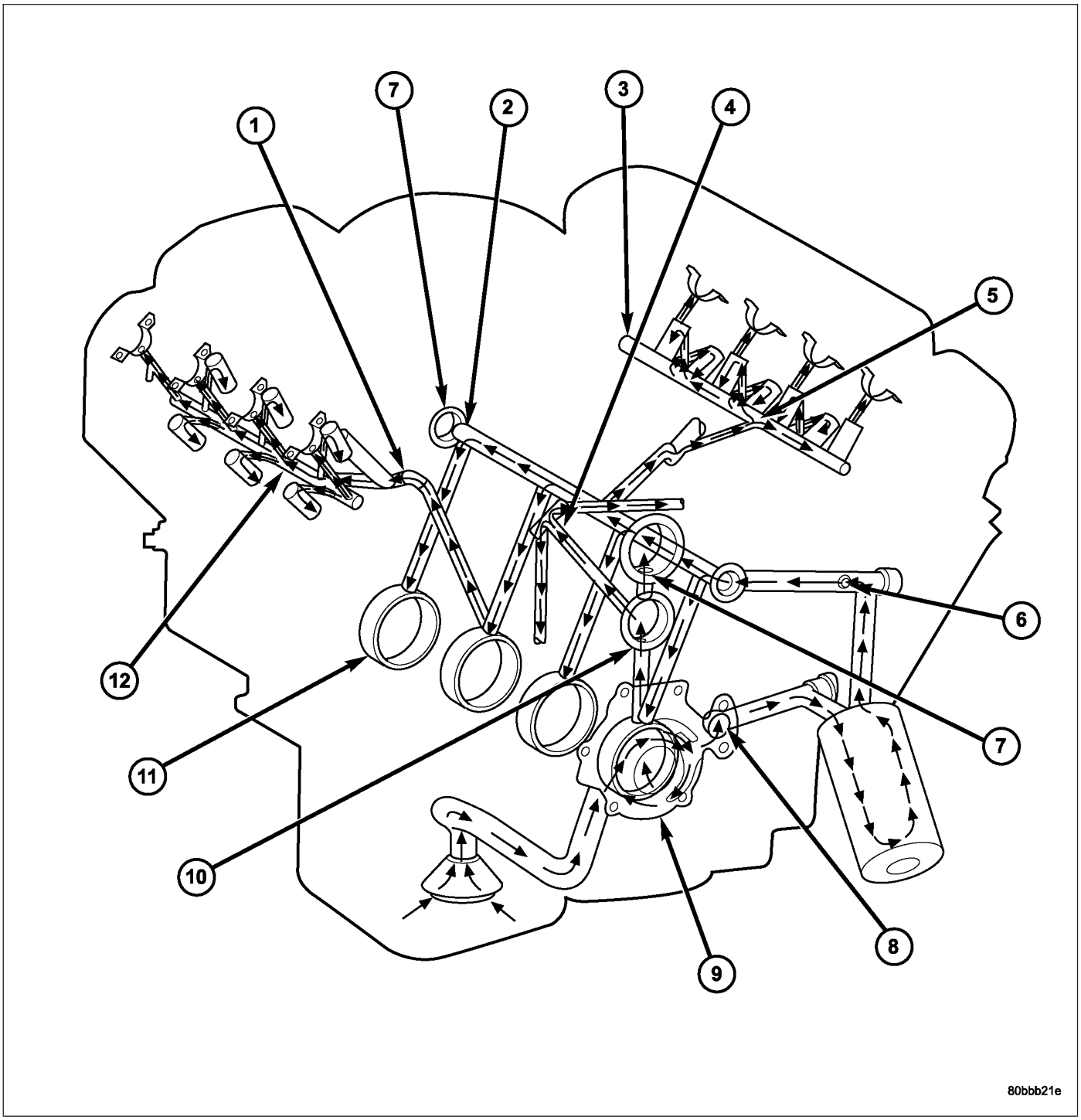
OPERATION

Engine Lubrication Flow Chart - Block: Table 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head* 4. Counterbalance Shaft Rear Journal
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Counterbalance Shaft - Front Journal 3. Both Secondary Chain Tensioners
Left Cylinder Head	Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2
Right Cylinder Head	Refer to Engine Lubrication Flow Chart - Cylinder Heads: Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads	

Engine Lubrication Flow Chart - Cylinder Heads: Table 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	



Oil from the oil pan is pumped by a gerotor type oil pump (9) directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orientation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the No. 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.If the oil leak source is not positively identified at this time, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
5. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

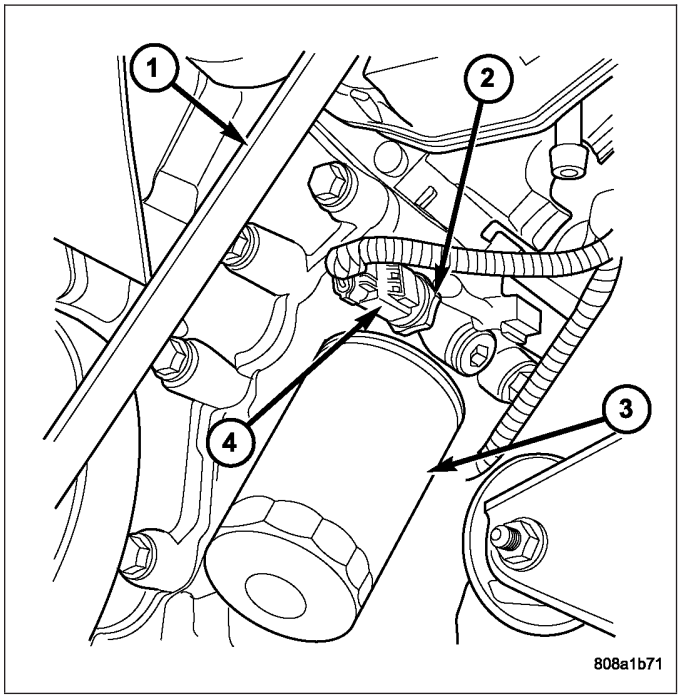
5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sending unit (2) and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle - 25 kPa (4 psi) minimum
   - 3000 rpm - 170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.



DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

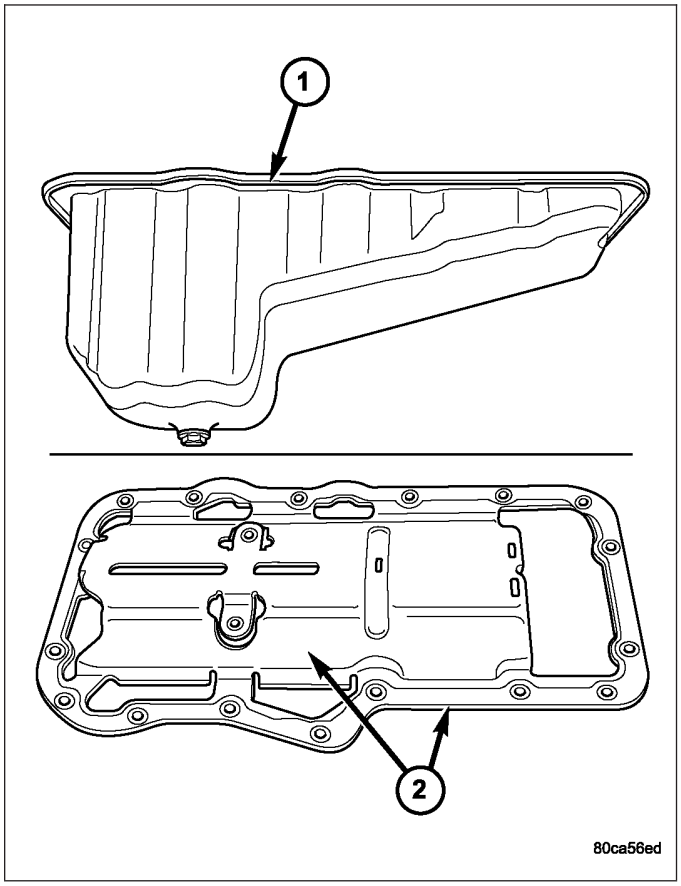
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

PAN -ENGINE OIL

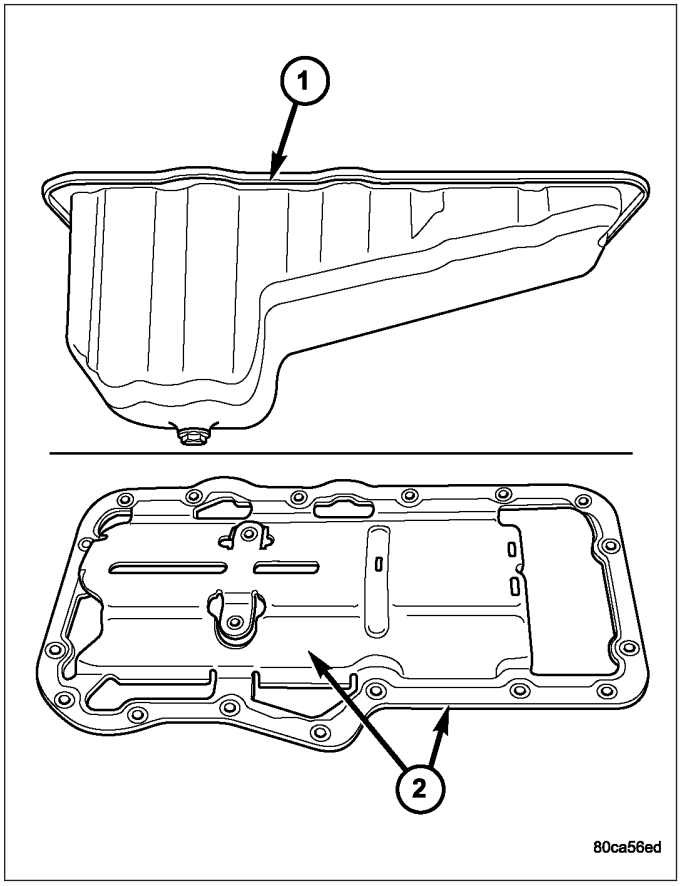
DESCRIPTION

The engine oil pan (1)is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray (2) and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.



REMOVAL

1. Disconnect the negative battery cable.
2. Install engine support fixture special tool # 8534. **Do not raise engine at this time.**
3. Loosen both left and right side engine mount through bolts. Do not remove bolts.
4. Remove the structural dust cover, if equipped.
5. Drain engine oil.
6. Remove the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL).

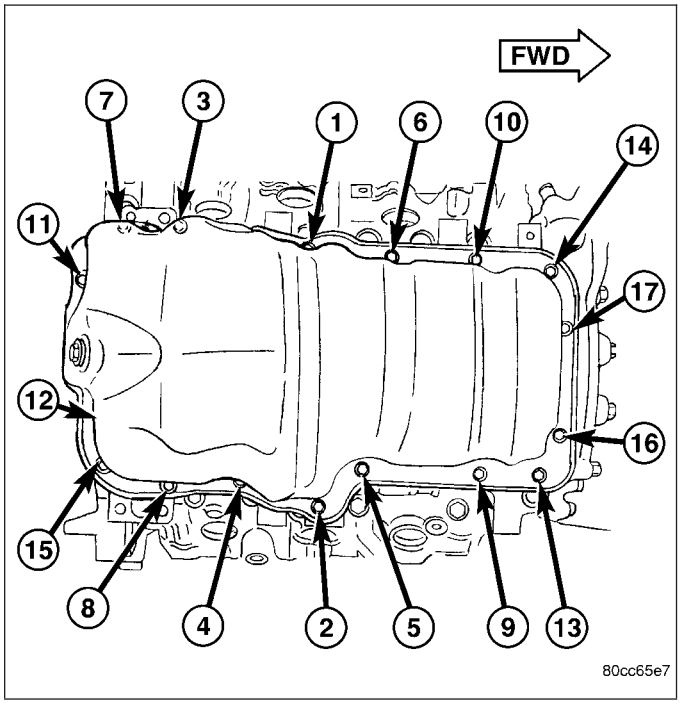


CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

7. Raise engine using special tool 8534 to provide clearance to remove oil pan.

NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

8. Remove the oil pan mounting bolts and oil pan (1).
9. Unbolt oil pump pickup tube and remove tube.
10. Inspect the integral windage tray and gasket (2) and replace as needed.



CLEANING

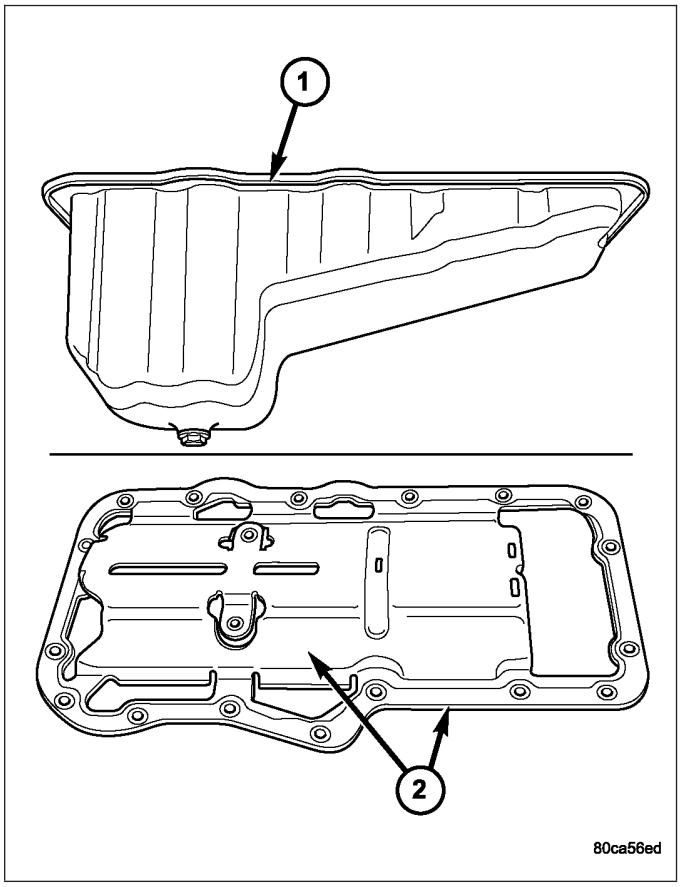
1. Clean oil pan in solvent and wipe dry with a clean cloth.
2. Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.
3. Clean oil screen and tube thoroughly in clean solvent.

INSPECTION

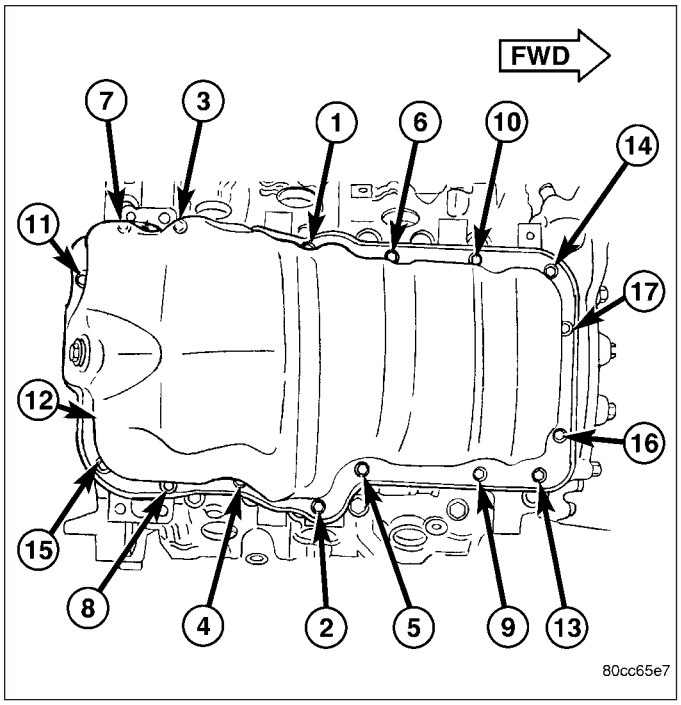
1. Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.
2. Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

INSTALLATION

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Inspect integrated oil pan gasket (2), and replace as necessary.
3. Position the integrated oil pan gasket/windage tray assembly (2).
4. Install the oil pickup tube.
5. Install the mounting bolt and nuts. Tighten nuts to 28 N·m (20 ft. lbs.).



1. If removed, install stud at position No. 9.
2. Position the oil pan and install the mounting bolts and nut. Tighten the mounting bolts and nut to 15 N·m (11 ft. lbs.) in the sequence shown.
3. Lower the engine into mounts using special tool 8534.
4. Install both the left and right side engine mount through bolts. Tighten the nuts to 68 N·m (50 ft. lbs.).
5. Remove special tool 8534.
6. Install structural dust cover, if equipped.
7. Install the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - INSTALLATION).
8. Fill engine oil.
9. Reconnect the negative battery cable.
10. Start engine and check for leaks.



SWITCH - OIL PRESSURE

DESCRIPTION

The 3 wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

The oil pressure sensor uses three circuits. They are:

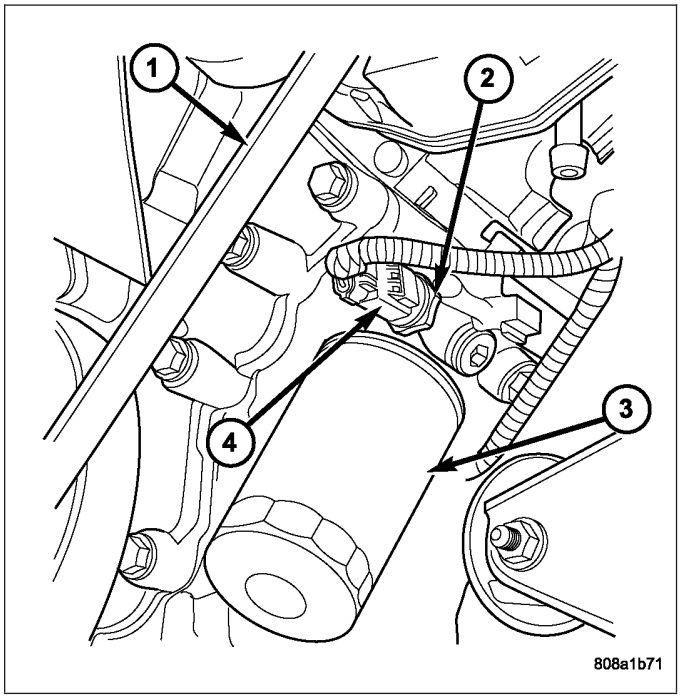
- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2).



INSTALLATION

1. Install oil pressure sender.
2. Connect oil pressure sender wire.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

PUMP - ENGINE OIL

REMOVAL

1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

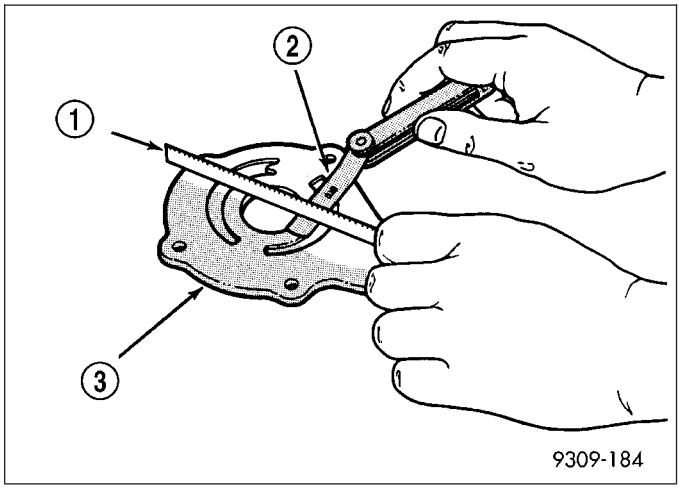
NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

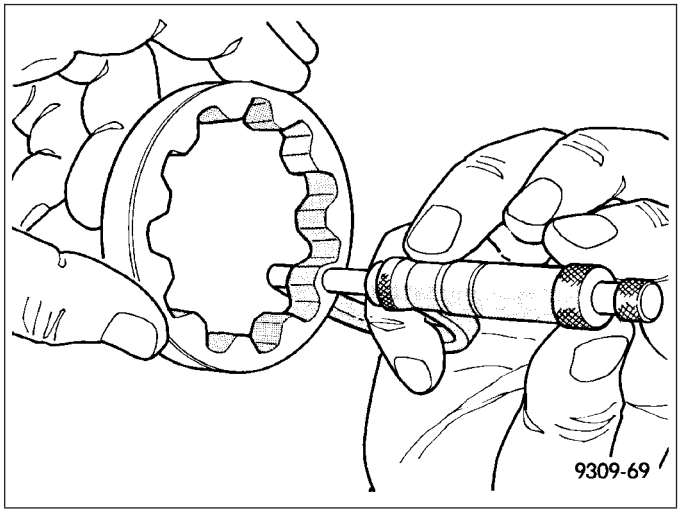
INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

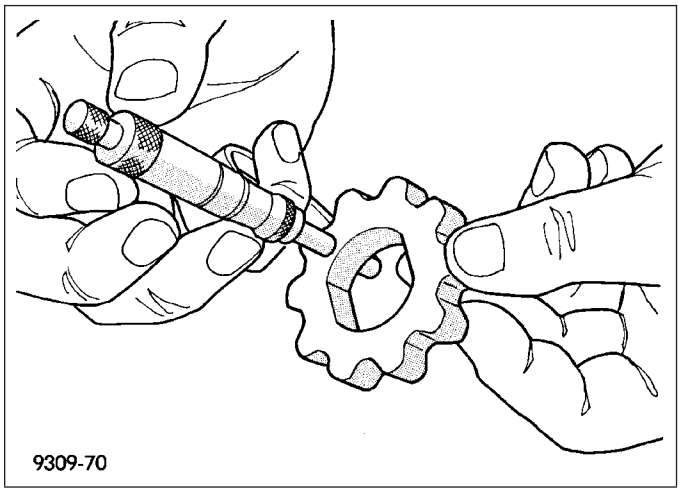
1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.



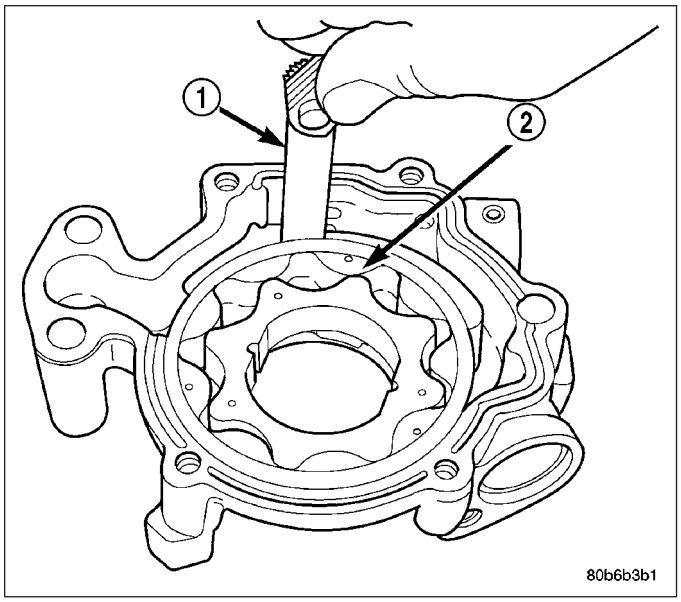
3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.



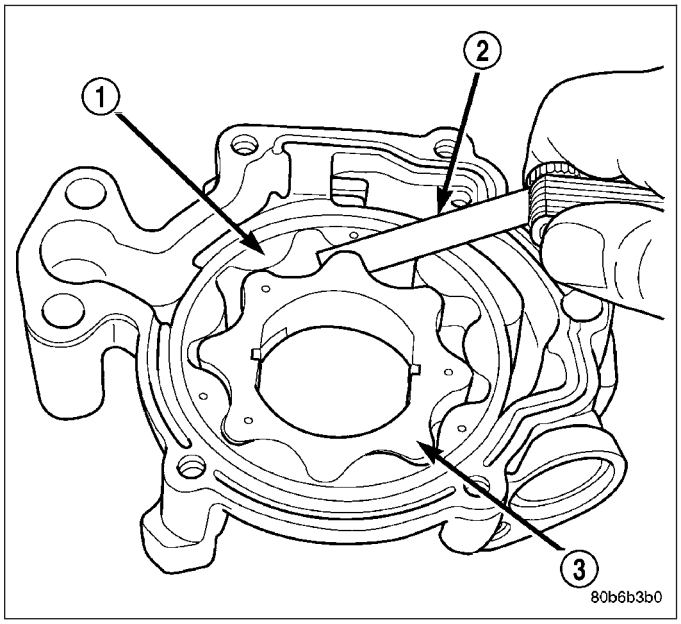
5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



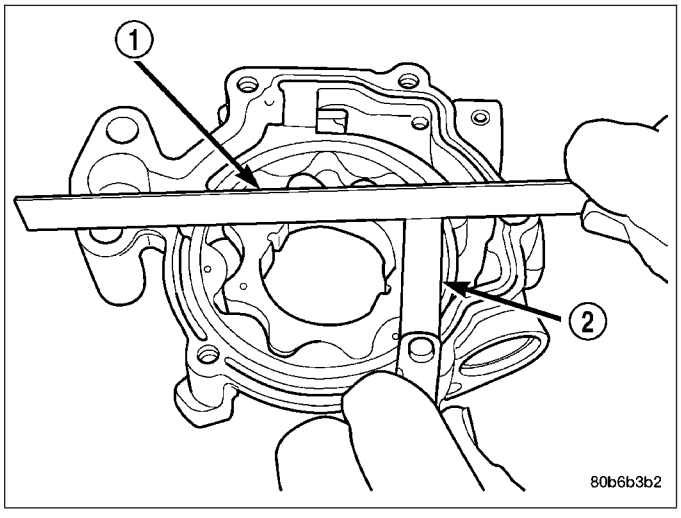
6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.



7. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.



8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.



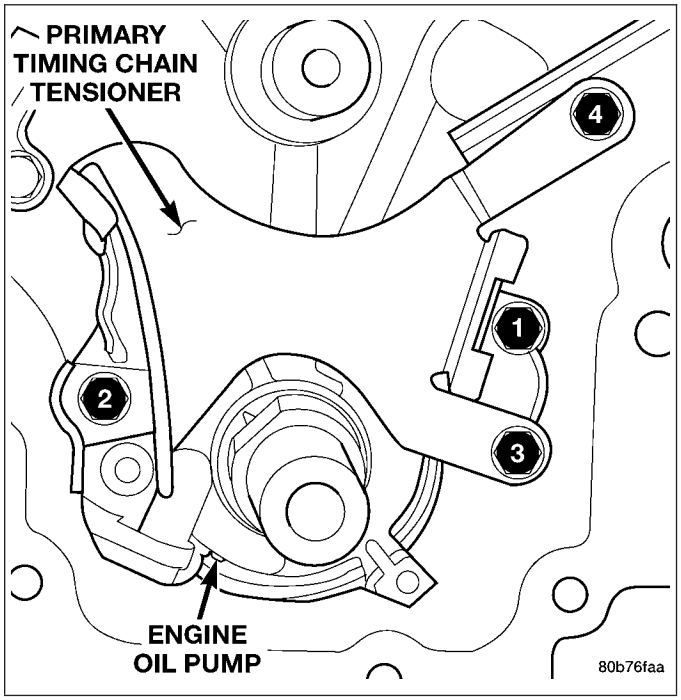
NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolts.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown.
4. Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
5. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



FILTER - ENGINE OIL

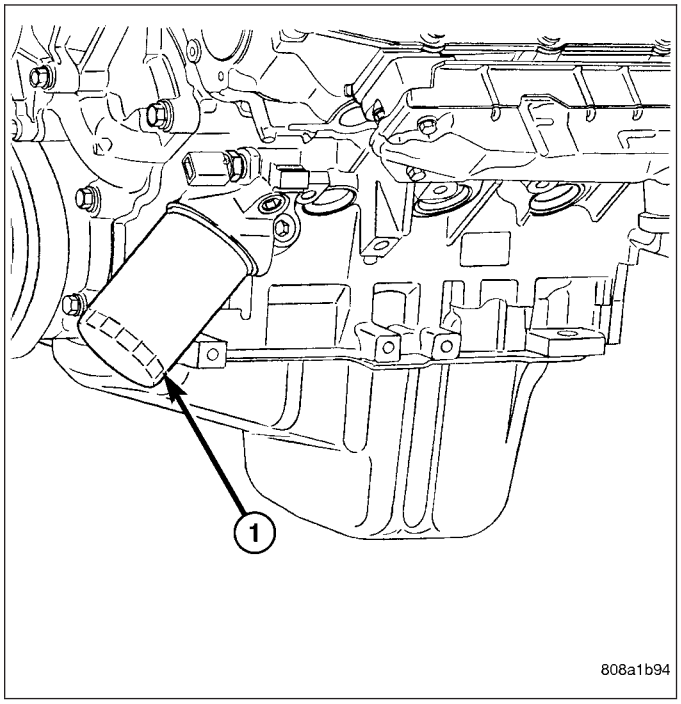
REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter (1). DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

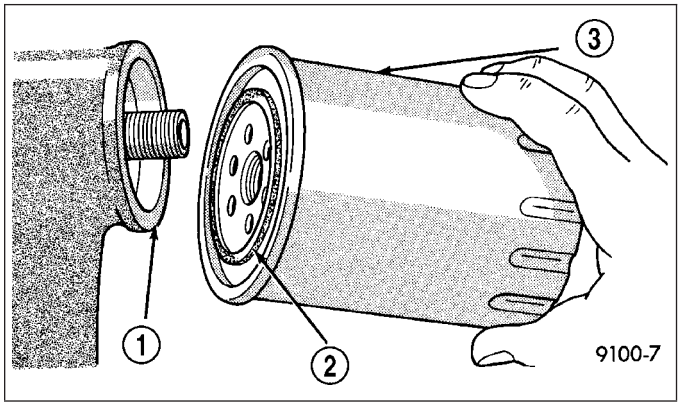
NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.



INSTALLATION

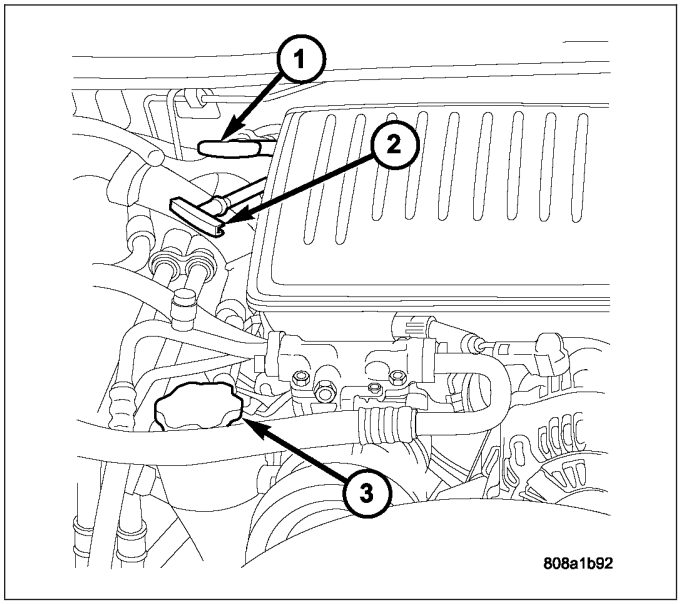
1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.



OIL

STANDARD PROCEDURE - ENGINE OIL SERVICE

The engine oil level indicator (1) is located at the right rear of the engine on the 3.7L/4.7L engines.



CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.

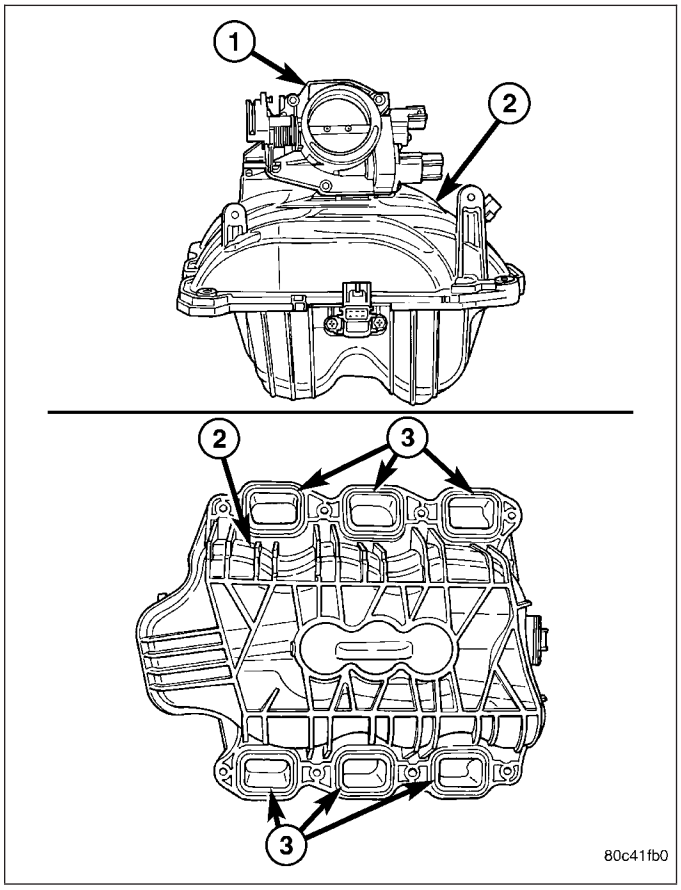
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE:
Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

MANIFOLD - INTAKE

DESCRIPTION

The intake manifold (2) is made of a composite material and features 300 mm (11.811 in.) long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of six individual press in place port gaskets to prevent leaks. The throttle body attaches directly to the intake manifold. Eight studs and two bolts are used to fasten the intake to the head.



DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

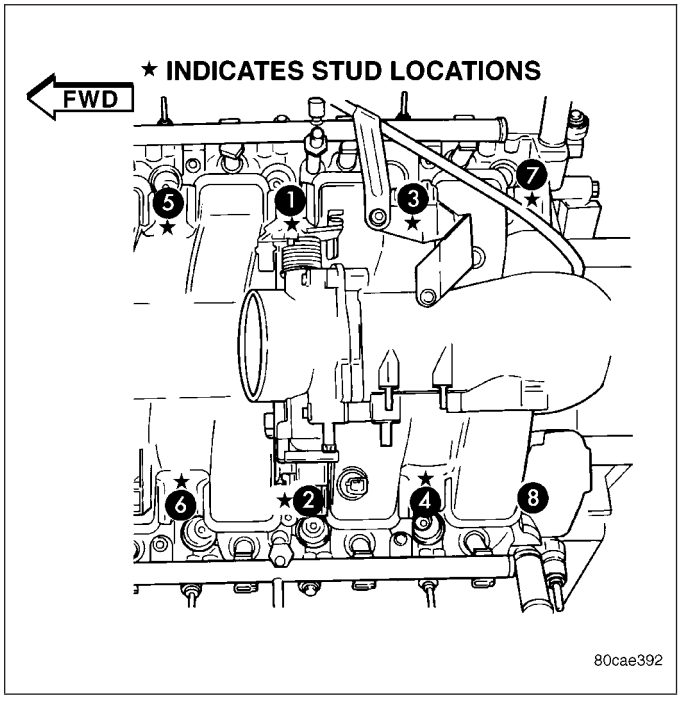
1. Start the engine.
2. Spray a small stream of water (spray bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect throttle and speed control cables.
4. Disconnect electrical connectors for the following components: Refer to FUEL SYSTEM for component locations.
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor
5. Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive crankcase ventilation (PCV) hose.
6. Disconnect generator electrical connections.
7. Disconnect air conditioning compressor electrical connections.
8. Disconnect left and right radio suppressor straps.
9. Disconnect and remove ignition coil towers.
10. Remove top oil dipstick tube retaining bolt and ground strap.
11. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
12. Remove fuel rail.
13. Remove throttle body assembly and mounting bracket.
14. Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).
15. Remove the heater hoses from the engine front cover and the heater core.
16. Unclip and remove heater hoses and tubes from intake manifold.
17. Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMP SENSOR - REMOVAL).
18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.

INSTALLATION

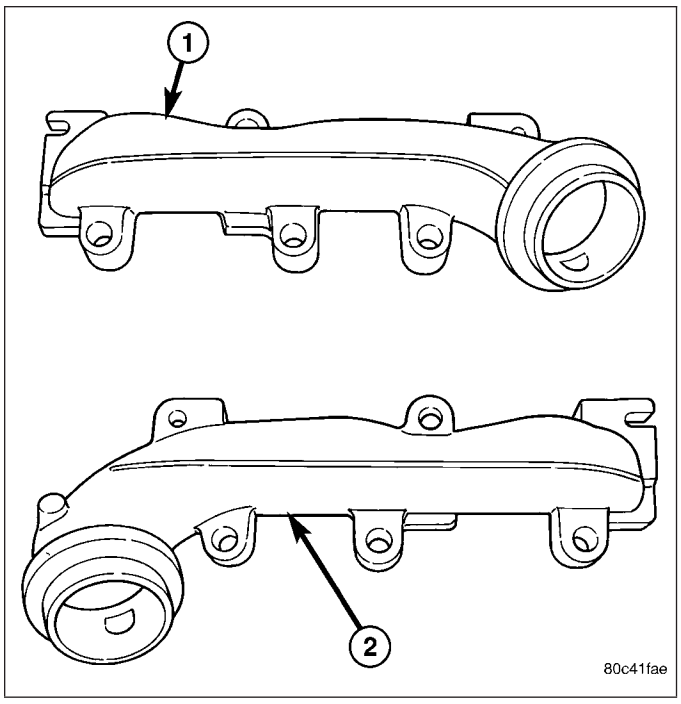
1. Install intake manifold gaskets.
2. Install intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in to 12 N·m (105 in. lbs.).
4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Connect throttle cable and speed control cable to throttle body.
7. Install fuel rail.



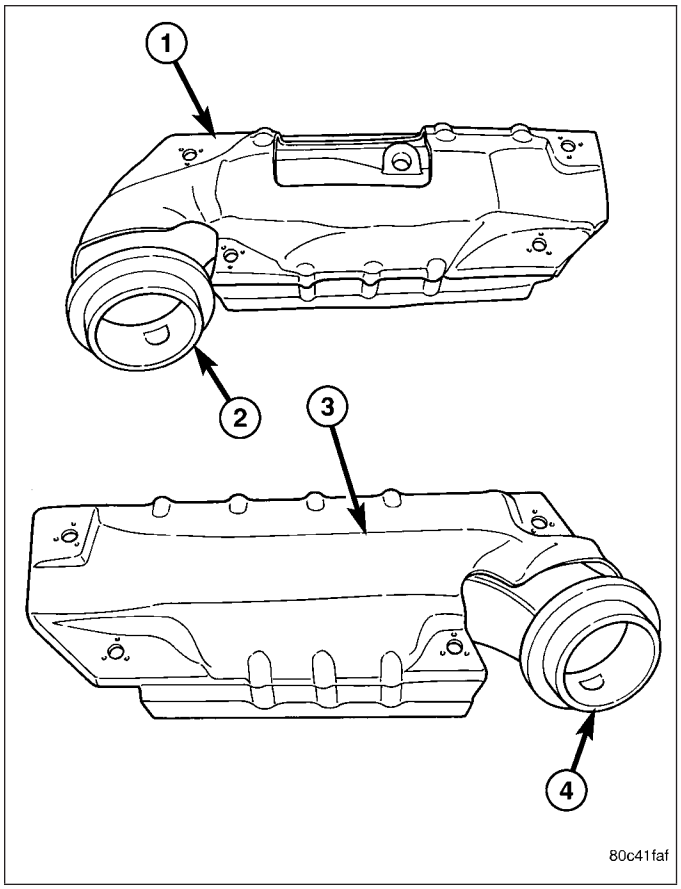
8. Install ignition coil towers.
9. Position and install heater hoses and tubes onto intake manifold.
10. Install the heater hoses to the heater core and engine front cover.
11. Connect electrical connectors for the following components:
    - Manifold Absolute Pressure (MAP) Sensor
    - Intake Air Temperature (IAT) Sensor
    - Throttle Position (TPS) Sensor
    - Coolant Temperature (CTS) Sensor
    - Idle Air Control (IAC) Motor
    - Ignition coil towers
    - Fuel injectors
12. Install top oil dipstick tube retaining bolt and ground strap.
13. Connect generator electrical connections.
14. Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive crankcase ventilation (PCV) hose.
15. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Install resonator assembly and air inlet hose.
17. Connect negative cable to battery.

MANIFOLD - EXHAUST

DESCRIPTION



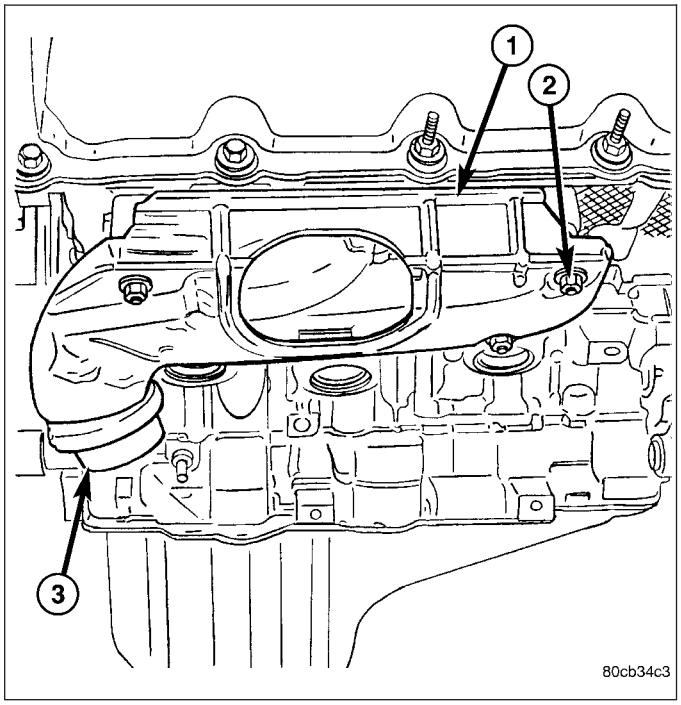
The exhaust manifolds (1,2) are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield (3) for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.



REMOVAL

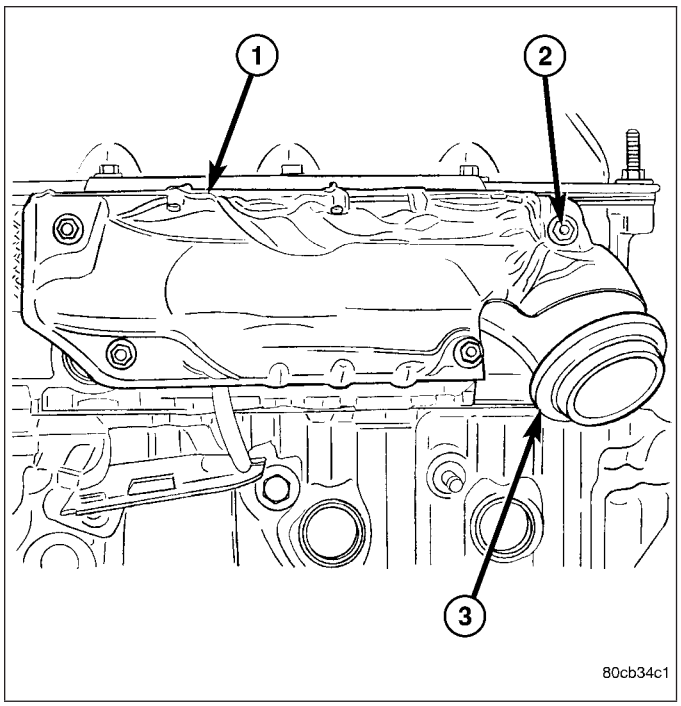
RIGHT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shield (1).
6. Remove bolts, nuts and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.



LEFT EXHAUST MANIFOLD

1. Disconnect the negative cable from the battery.
2. Raise and support the vehicle.
3. Remove the bolts and nuts attaching the exhaust pipe to the engine exhaust manifold.
4. Lower the vehicle.
5. Remove the exhaust heat shields (1).
6. Remove bolts, nuts and washers attaching manifold to cylinder head.
7. Remove manifold and gasket from the cylinder head.



INSTALLATION

RIGHT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

LEFT EXHAUST MANIFOLD

CAUTION: If the studs came out with the nuts when removing the engine exhaust manifold, install new studs. Apply sealer on the coarse thread ends. Water leaks may develop at the studs if this precaution is not taken.

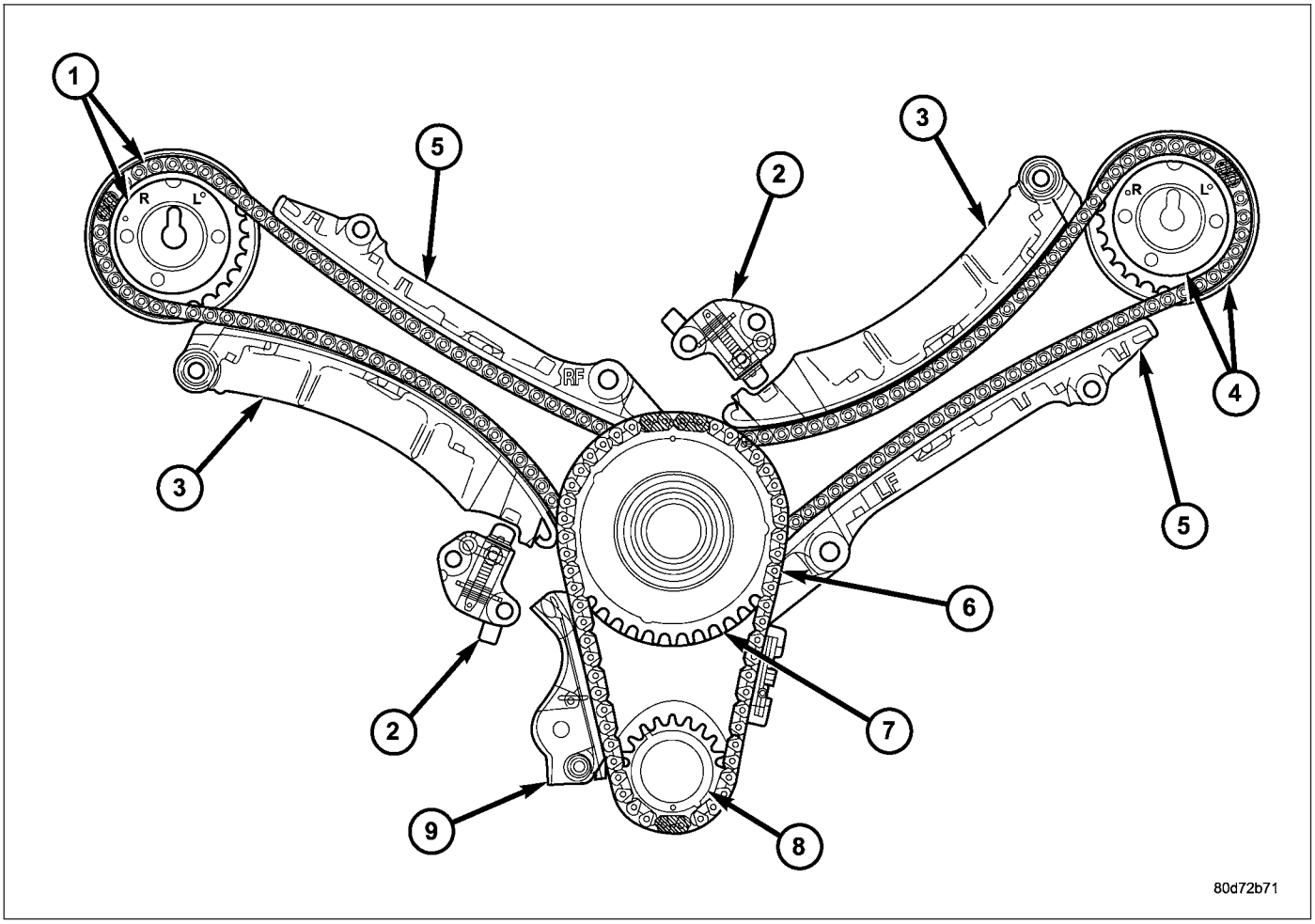
1. Position the engine exhaust manifold and gasket on the two studs located on the cylinder head. Install conical washers and nuts on these studs.
2. Install remaining conical washers. Starting at the center arm and working outward, tighten the bolts and nuts to 25 N·m (18 ft. lbs.) torque.
3. Install the exhaust heat shields.
4. Raise and support the vehicle.

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

5. Assemble exhaust pipe to manifold and secure with bolts, nuts and retainers. Tighten the bolts and nuts to 34 N·m (25 ft. lbs.) torque.

VALVE TIMING

DESCRIPTION



The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain (6), two secondary timing chain drives (1,4) and a counterbalance shaft drive.

OPERATION

The primary timing chain is a single inverted tooth chain type. The primary chain drives the large 50 tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and designed oil pump leakage. The idler sprocket assembly connects the primary chain drive, secondary chain drives, and the counterbalance shaft. The idler sprocket assembly consists of two integral 26 tooth sprockets a 50 tooth sprocket and a helical gear that is press-fit to the assembly. The spline joint for the 50 tooth sprocket is a non serviceable press fit anti rattle type. A spiral ring is installed on the outboard side of the 50 tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is a light press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust move-

ment. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

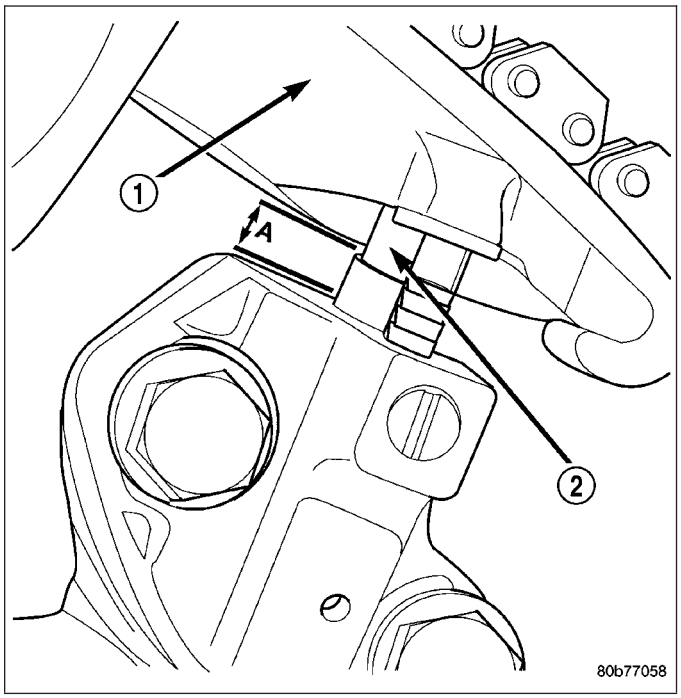
There are two secondary drive chains, both are roller type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a 26 tooth cam sprocket directly from the 26 tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner incorporates a controlled leak path through a device known as a vent disc located in the nose of the piston to manage chain loads. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

STANDARD PROCEDURE

MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

1. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15mm (.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

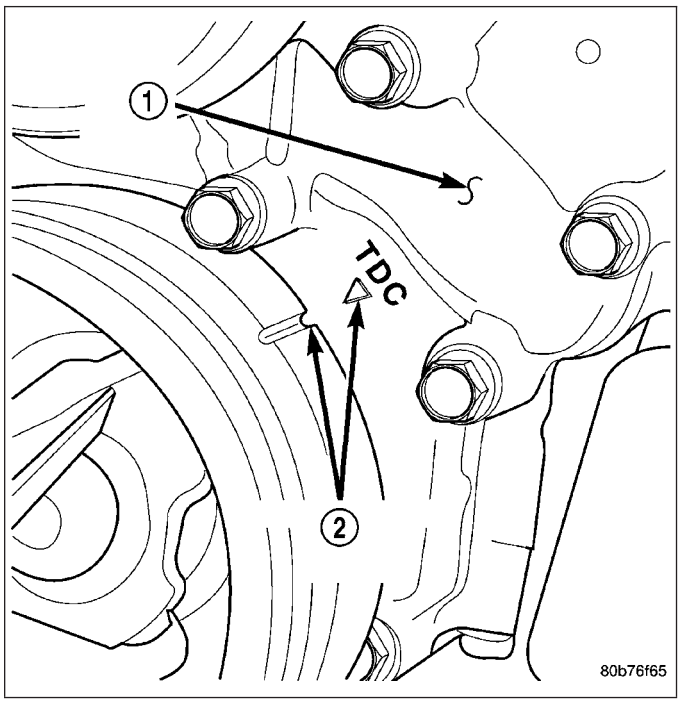


SERVICE PROCEDURE - TIMING VERIFICATION

CAUTION: The 3.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

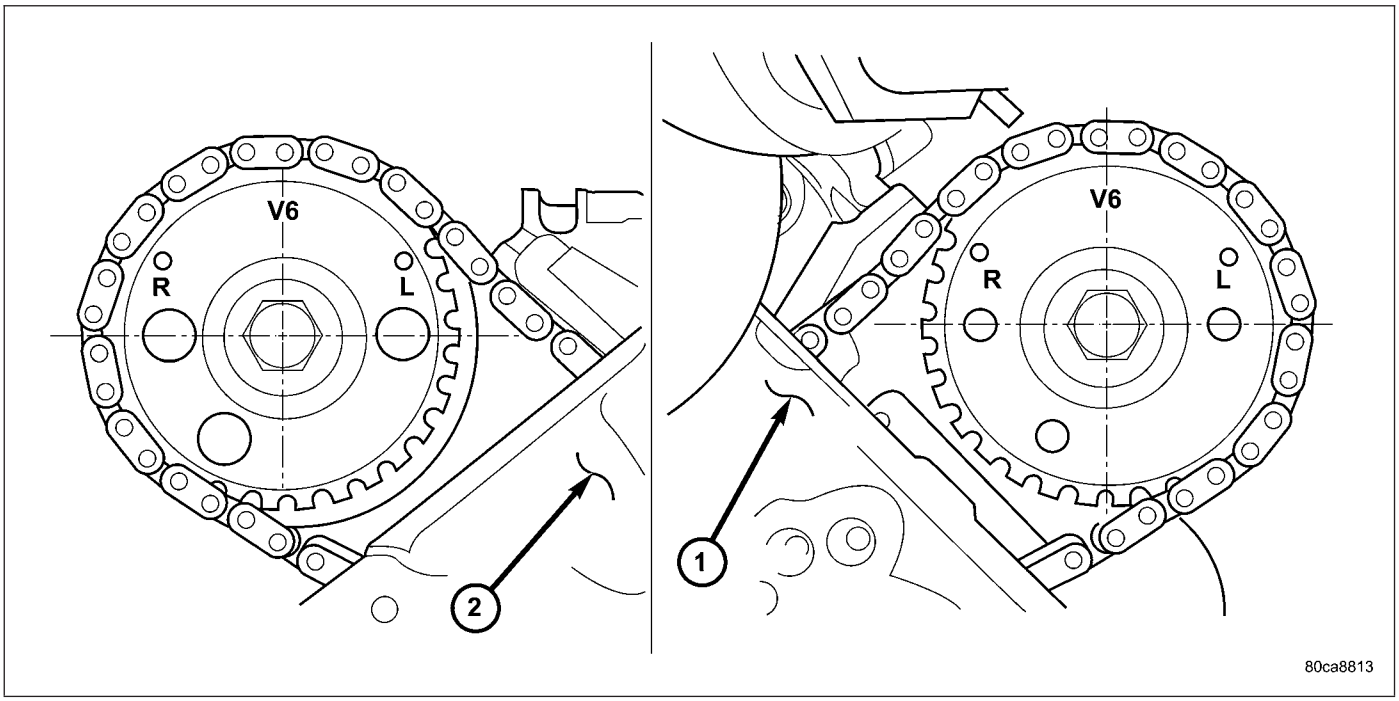
NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.



Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers. Refer to the procedure in this section.
2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper (2) is aligned with the TDC arrow on the front cover (2). The engine is now at TDC.

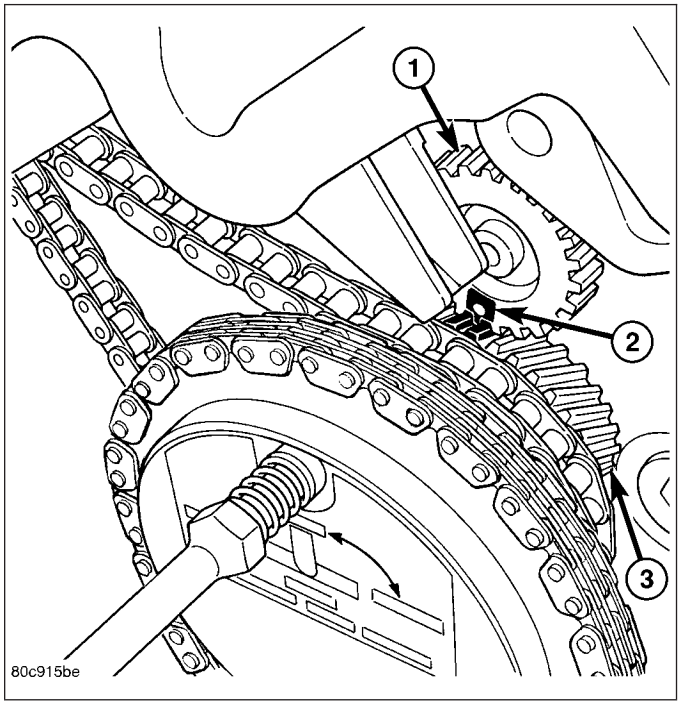


3. Note the location of the V6 mark stamped into the camshaft drive gears (1,2). If the V6 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V6 mark on each gear is at the six o'clock position, the engine is at TDC on the compression stroke.
4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.

5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.
6. If both camshaft drive gear V6 marks are at the twelve o'clock or the six o'clock position the engine base timing is correct. Reinstall the cylinder head covers.

COUNTER BALANCE SHAFT TIMING

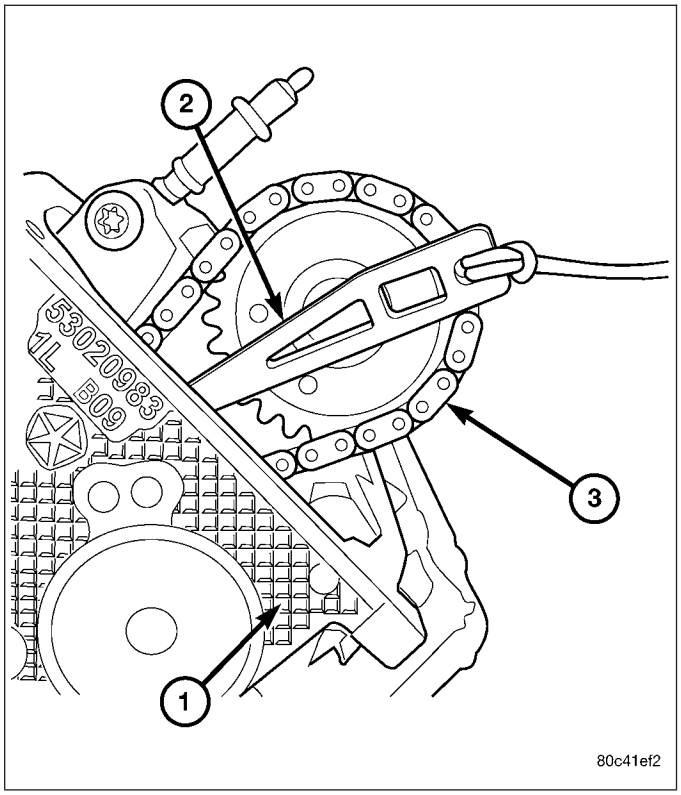
1. Ensure that the engine is at TDC with both camshaft sprocket V6 marks in the 12 o'clock position.
2. Look down the left cylinder head chain cavity. The timing dot (2) on the counter balance shaft drive gear should be in the 6 o'clock position.



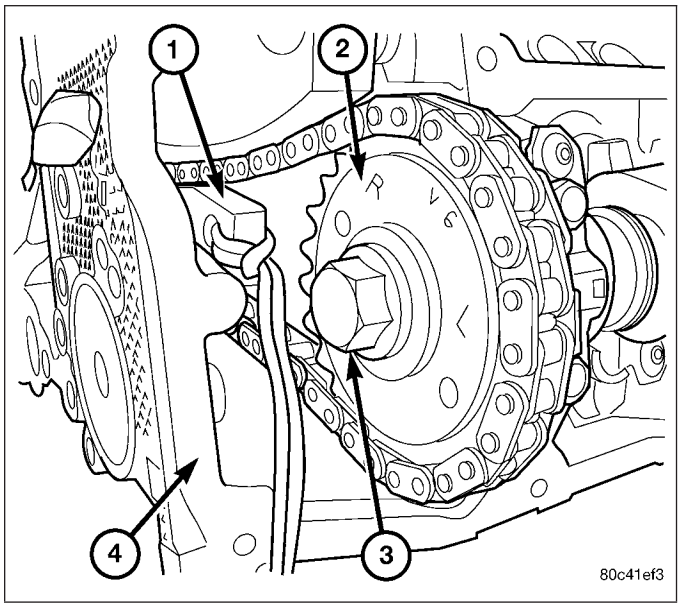
TIMING - SINGLE CAMSHAFT

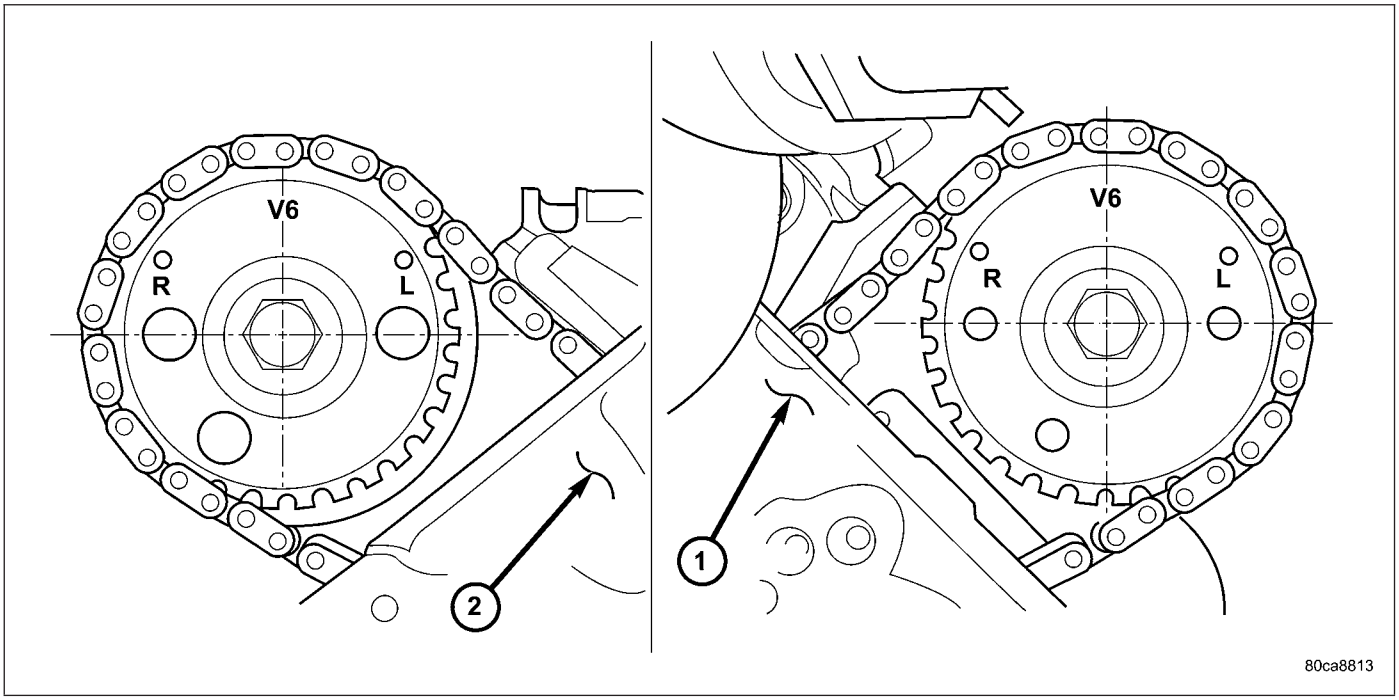
NOTE: to adjust the timing on one camshaft, preform the following procedure.

1. Using Chain Tensioner Wedge, Special Tool 8379 (2), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.



2. Remove the camshaft drive gear retaining bolt (3).
3. Carefully remove the camshaft drive gear from the camshaft.





4. Re-index the camshaft drive gear in the chain until the V6 mark is at the same position as the V6 mark on the opposite camshaft drive gear (1,2).
5. Using Special Tool 8428 Camshaft Wrench, rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear.

CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

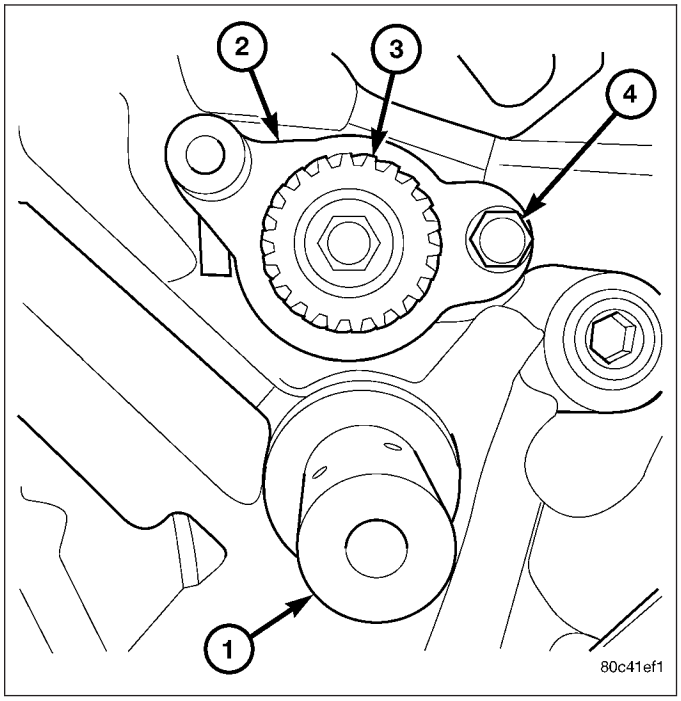
6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench, Tighten retaining bolt to 122 N·m (90 ft. Lbs.).
7. Remove Special Tool 8379.
8. Rotate the crankshaft two full revolutions, then verify that the camshaft drive gear V6 marks are in fact aligned.
9. Install the cylinder head covers. Refer to Cylinder Head Cover in this section.

SHAFT - BALANCE

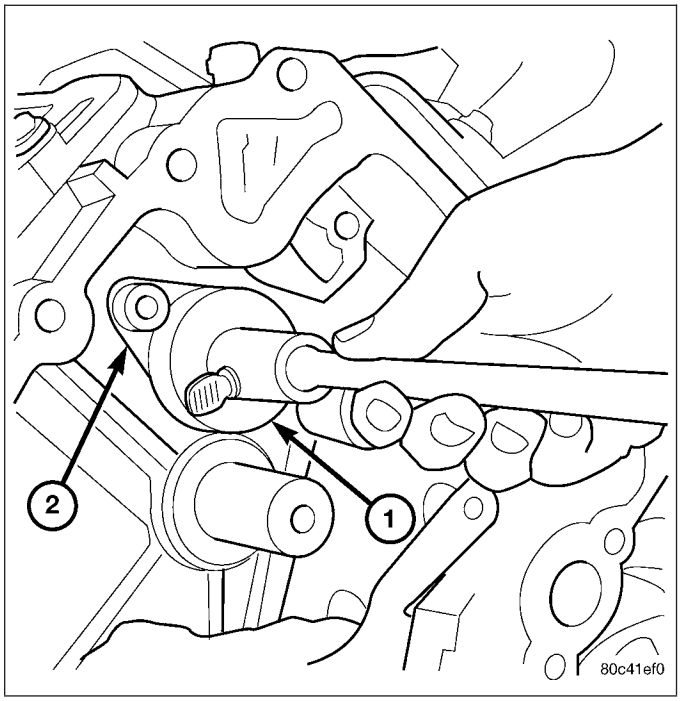
REMOVAL

1. Remove the primary and secondary timing chains. Refer to TIMING CHAIN and SPROCKET.

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.Remove the retaining bolt (4) from the counterbalance shaft thrust plate (2).



2. Using Special Tool 8641 Counterbalance shaft remover/installer tool (1), remove the counterbalance shaft from the engine .



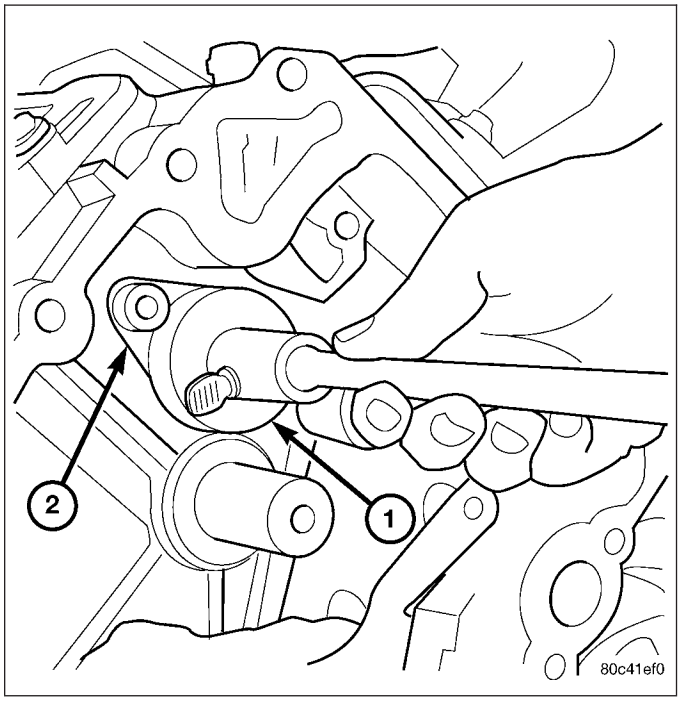
INSTALLATION

NOTE: The balance shaft and gear are serviced as an assembly. Do not attempt to remove the gear from the balance shaft.

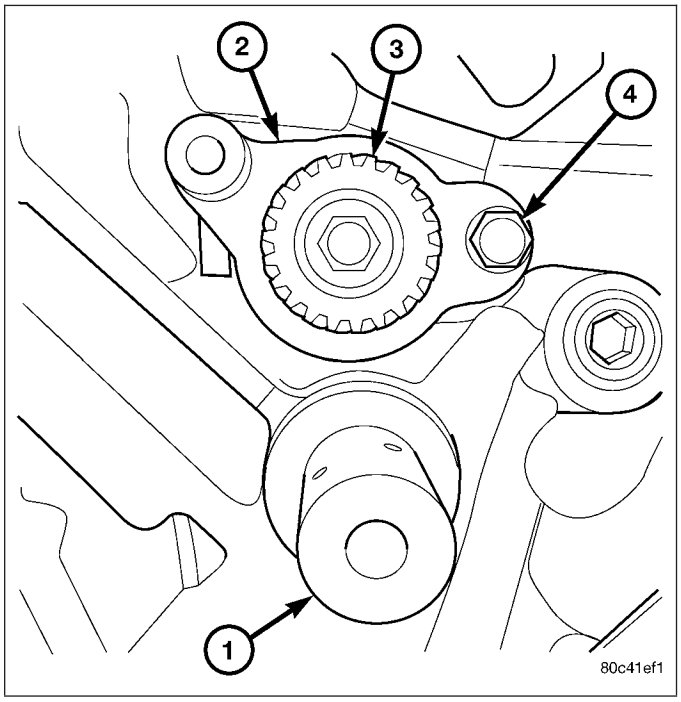
1. Coat counterbalance shaft bearing journals with clean engine oil.

NOTE: The balance shaft is heavy, and care should be used when installing shaft, so bearings are not damaged.

2. Using Special Tool 8641 Counterbalance shaft remover/installer tool (1), carefully install counterbalance shaft into engine.



3. Install Counterbalance shaft thrust plate retaining bolt (4) finger tight.Do not tighten bolt at this time.
4. Position the right side of the thrust plate with the right chain guide bolt, install bolt finger tight.
5. Torque the thrust plate retaining bolt (4) to 28 N·m (250 in. lbs.).
6. Remove the chain guide bolt so that guide can be installed.



SHAFT - IDLER

REMOVAL

1. Remove the primary and secondary timing chains and sprockets. Refer to procedure in this section.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator cooling fins with the slide hammer.

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

INSTALLATION

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

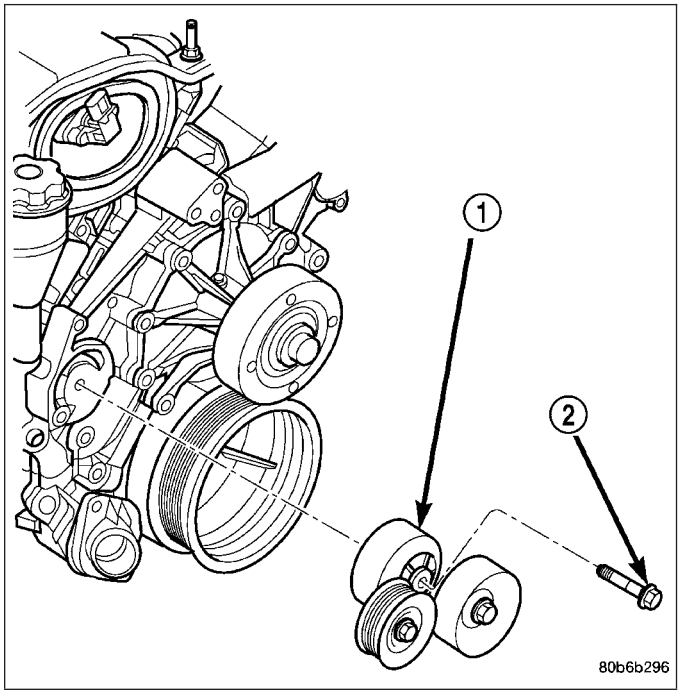
NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets. Refer to procedure in this section.

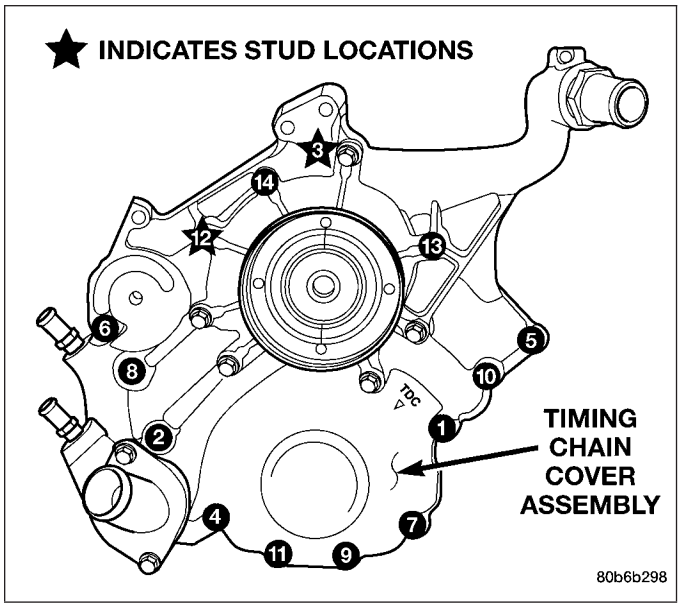
COVER - TIMING

REMOVAL

1. Disconnect the battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove electric cooling fan and fan shroud assembly.
4. Remove fan and fan drive assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
5. Disconnect both heater hoses at timing cover.
6. Disconnect lower radiator hose at engine.
7. Remove accessory drive belt tensioner assembly (1).



8. Remove crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
9. Remove the generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - REMOVAL).
10. Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).



CAUTION: The 3.7L engine uses an anerobic sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

11. Remove the bolts holding the timing cover to engine block.
12. Remove the timing cover.

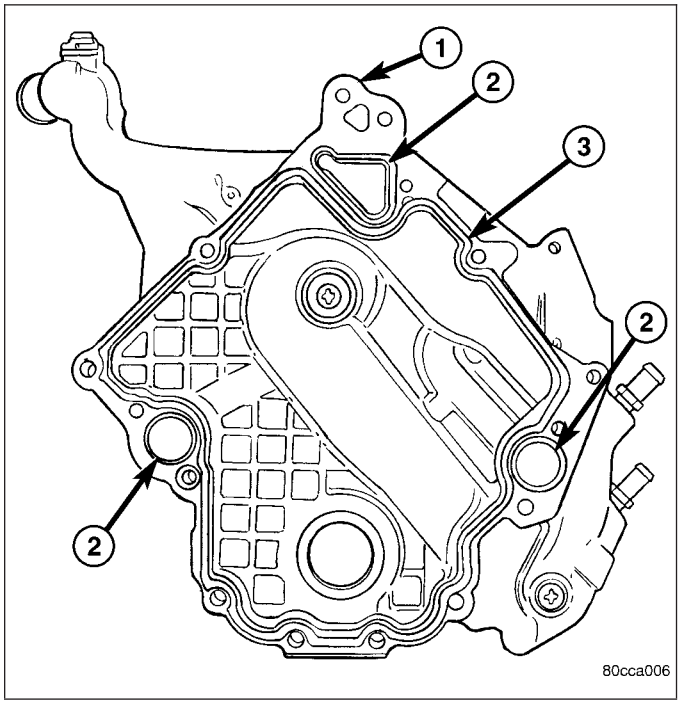
INSTALLATION

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

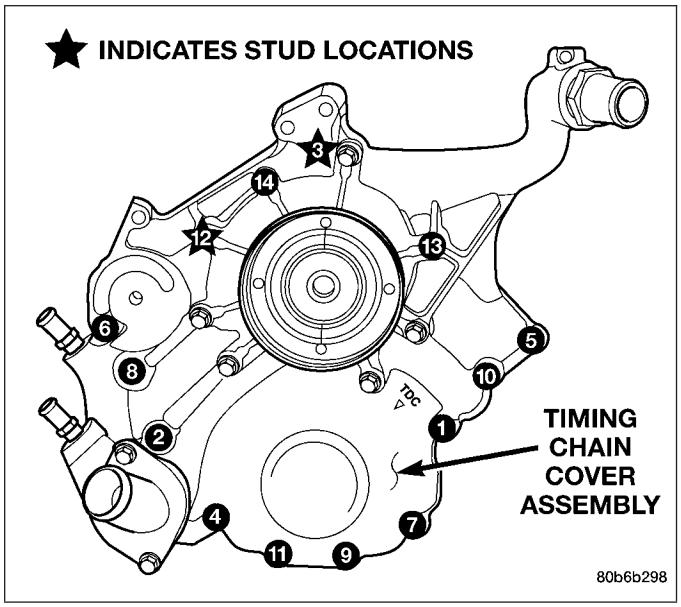
1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 3.7L uses a special anerobic sealer instead of a gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Engine Grey RTV must be used as a substitute.

2. Inspect the water passage o-rings for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer (3) to front cover (1) following the path provided using a 3 to 4mm thick bead (3).

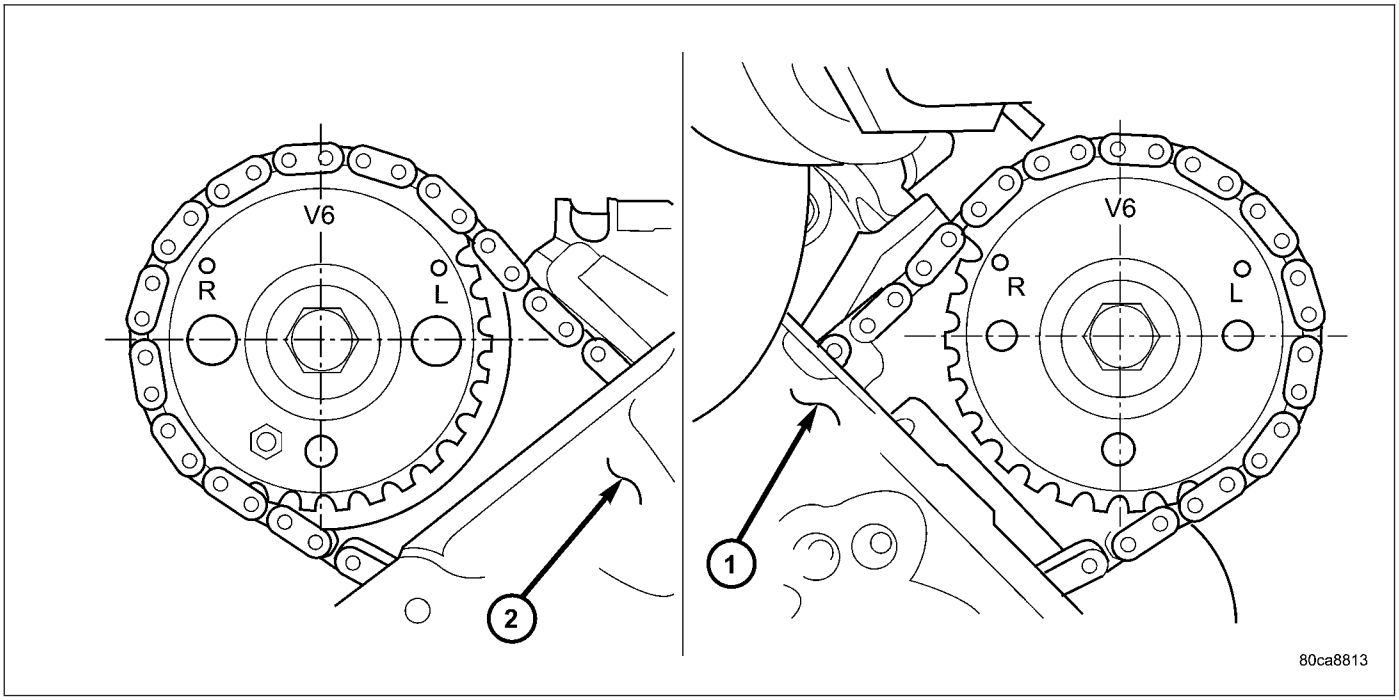


4. Install cover. Tighten fasteners in sequence as shown in to 58 N·m (43 ft. lbs.).
5. Install crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
6. Install the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).
7. Install the generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).
8. Install accessory drive belt tensioner assembly (Refer to 7 - COOLING/ACCESSORY DRIVE/BELT TENSIONERS - INSTALLATION).
9. Install radiator upper and lower hoses.
10. Install both heater hoses.
11. Install electric fan shroud and viscous fan drive assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
12. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
13. Connect the battery negative cable.

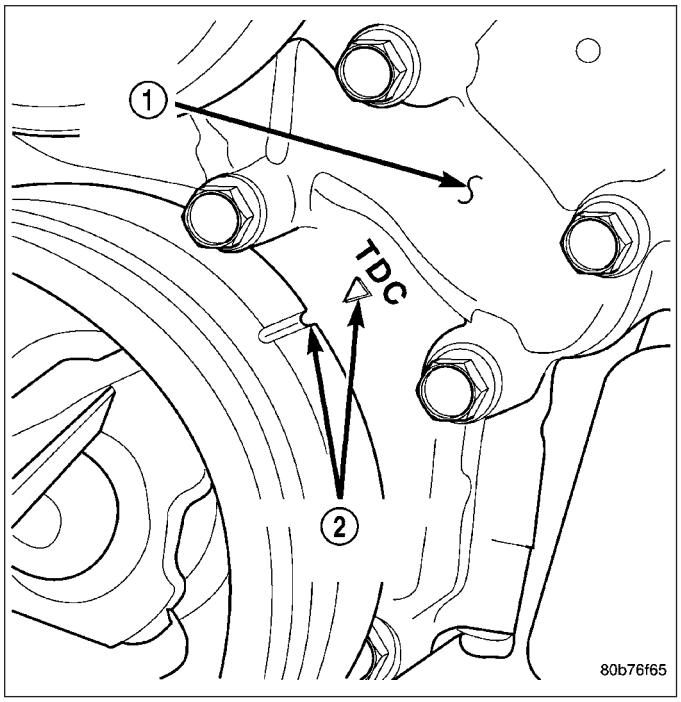


TIMING CHAIN & SPROCKETS

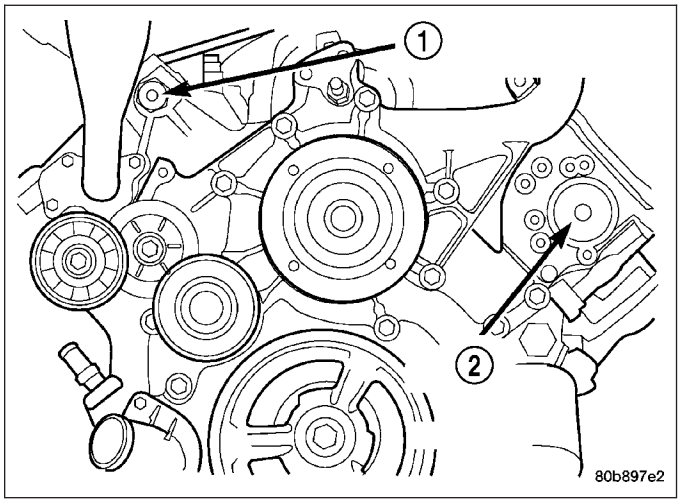
REMOVAL



1. Disconnect negative cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Remove radiator fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
5. Rotate engine until timing mark on crankshaft damper (2) aligns with TDC mark on timing chain cover (2) and the camshaft sprocket “V6” marks are at the 12 o’clock position (No. 1 TDC exhaust stroke).



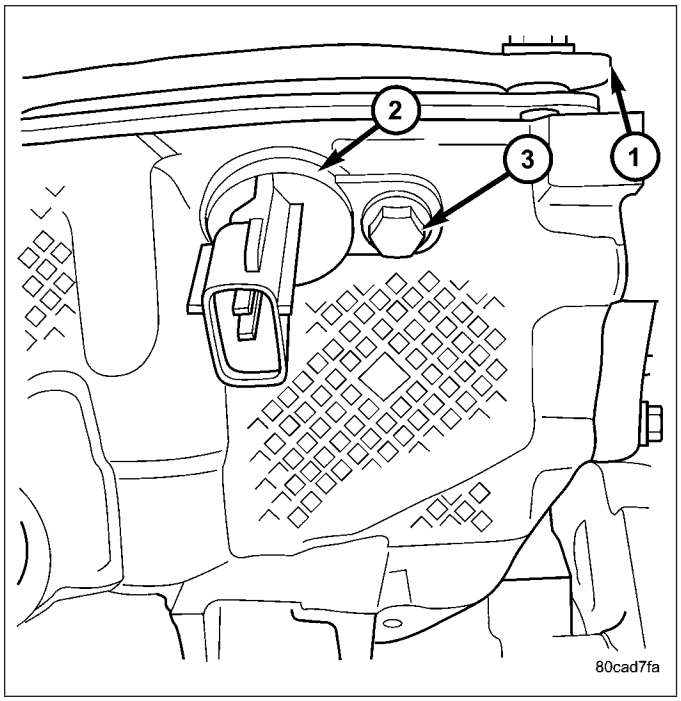
6. Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).
7. Remove access plug from left and right cylinder heads for access to chain guide fasteners.
8. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
9. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).



10. Collapse and pin primary chain tensioner.

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

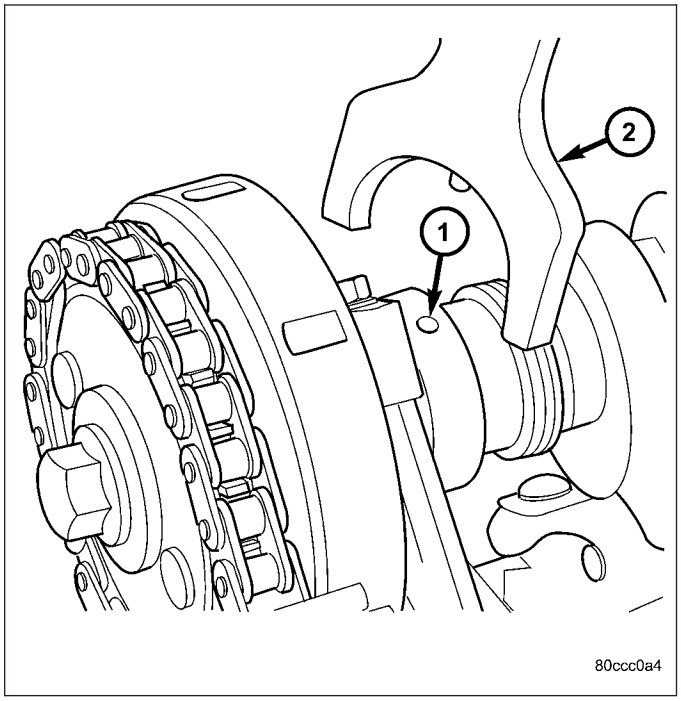
11. Remove secondary chain tensioners.
12. Remove camshaft position sensor (2).



CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.

13. Remove left and right camshaft sprocket bolts.
14. While holding the left camshaft steel tube with Special Tool 8428 Camshaft Wrench (2), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 5 degrees clockwise to a neutral position.
15. While holding the right camshaft steel tube with Special Tool 8428 Camshaft Wrench (2), remove the right camshaft sprocket.



16. Remove idler sprocket assembly bolt.
17. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
18. Remove both pivoting tensioner arms and chain guides.
19. Remove primary chain tensioner.

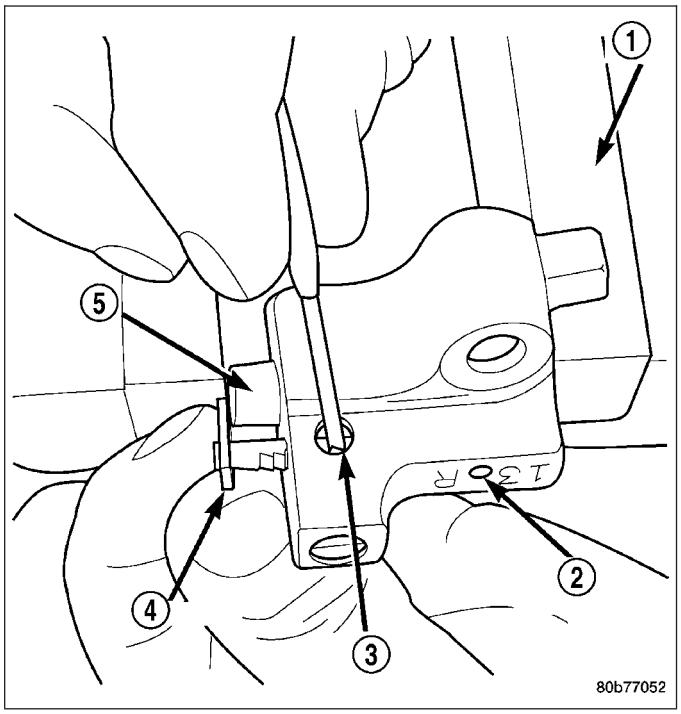
INSPECTION

Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner tensioner arm and chain should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

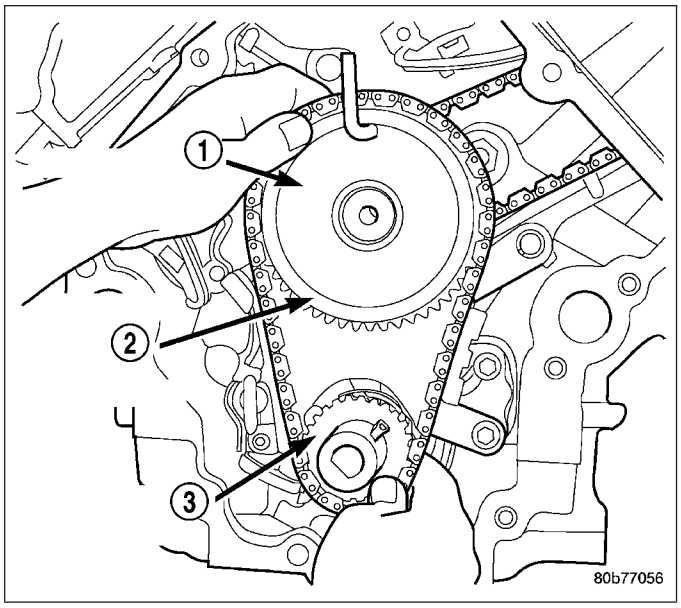
1. Using a vise, lightly compress the secondary chain tensioner piston (5) until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (3) into hole on front of tensioner. Slowly open vise (1) to transfer piston spring force to lock pin.
2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).



3. Install right side chain tensioner arm. Install Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).

CAUTION: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

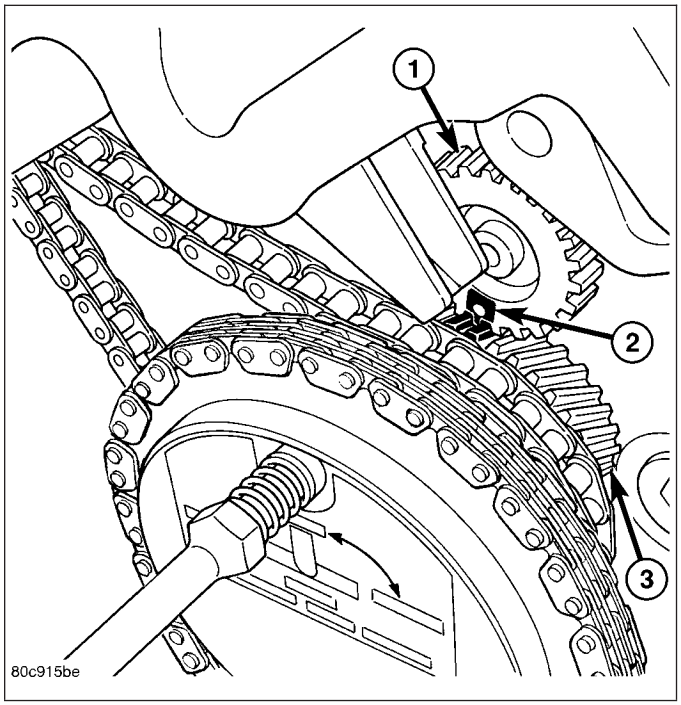
4. Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).
5. Install left side chain tensioner arm, and Torx® bolt. Tighten Torx® bolt to 28 N·m (250 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).
7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8429 (1) to hold chains in place for installation.

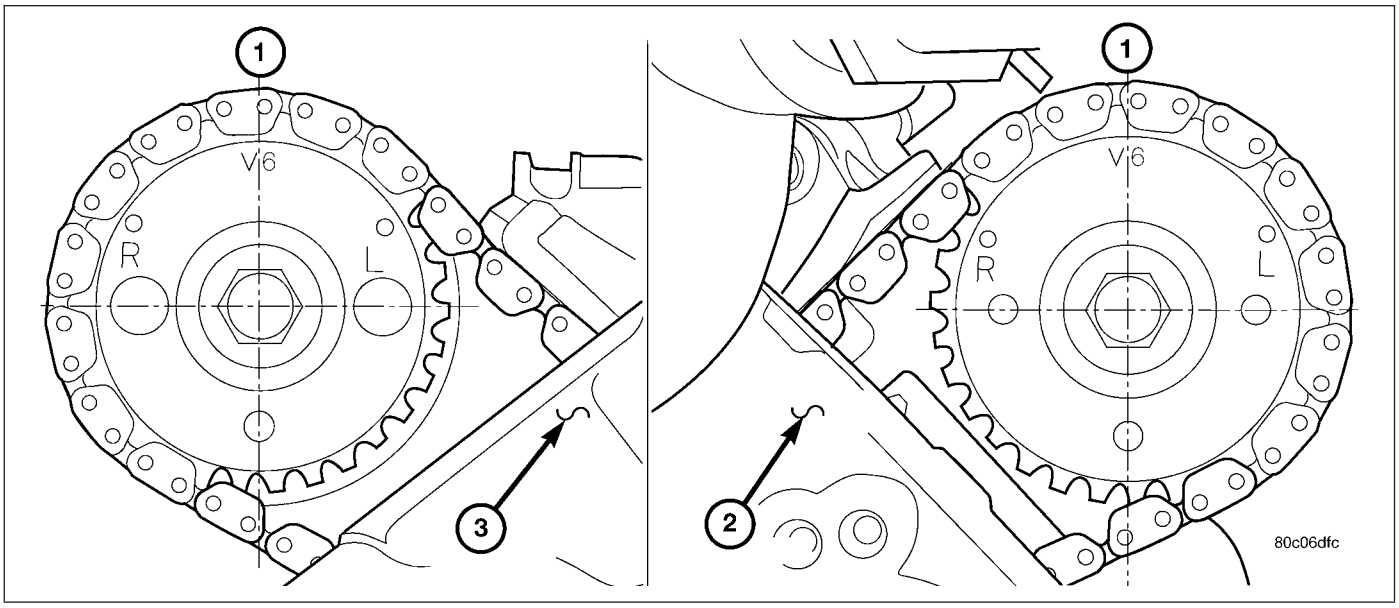


8. Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket.
9. Lubricate idler shaft and bushings with clean engine oil.

NOTE: The idler sprocket must be timed to the counterbalance shaft drive gear before the idler sprocket is fully seated.

10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or equivalent. This will maintain tension on chains to aid in installation. Align the timing mark (2) on the idler sprocket gear (3) to the timing mark on the counterbalance shaft drive gear (1), then seat idler sprocket fully. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).



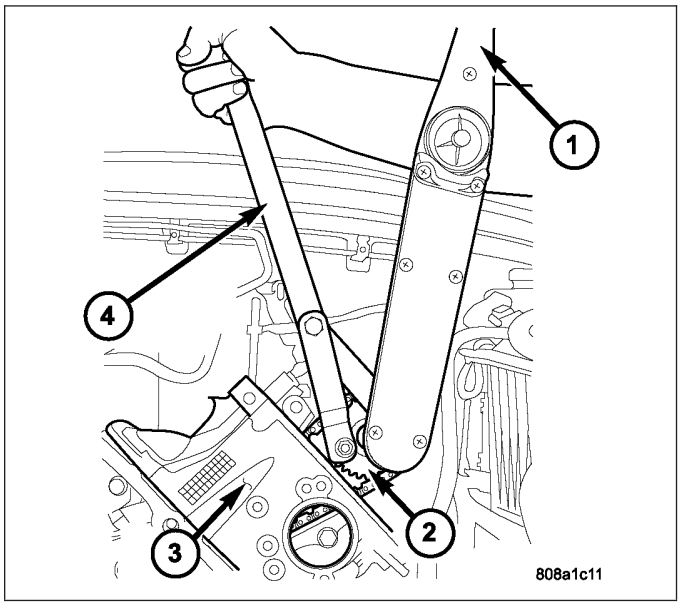


NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

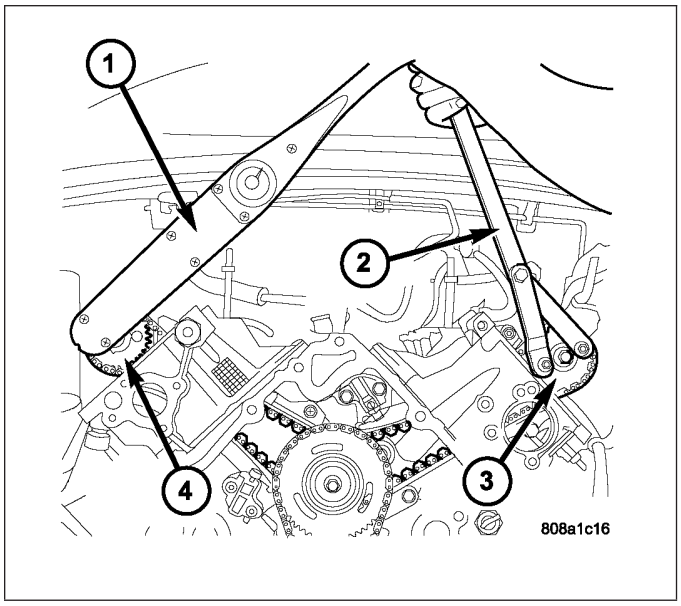
11. Align left camshaft sprocket “L” dot to plated link on chain.
12. Align right camshaft sprocket “R” dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

13. Remove Special Tool 8429, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the “V6” marks on camshaft sprockets are at the 12 o’clock position.



CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.



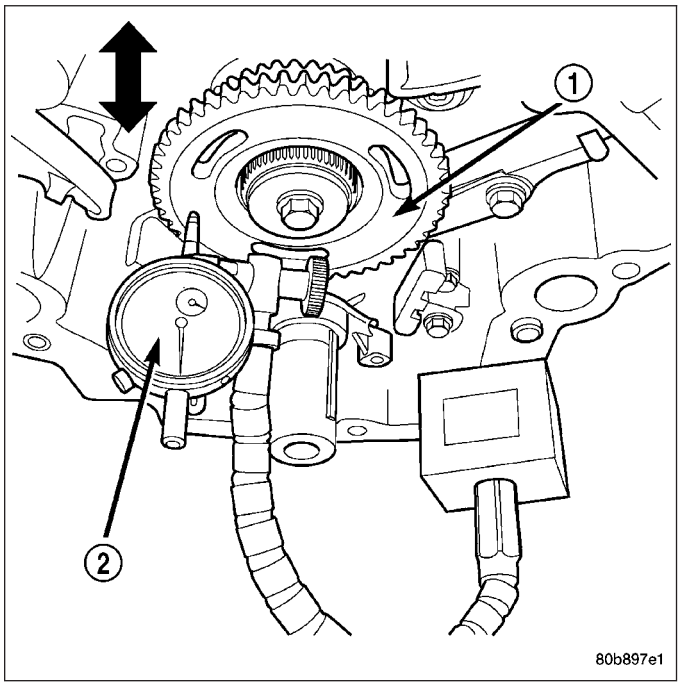
15. Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

16. Remove all 3 locking pins from tensioners.

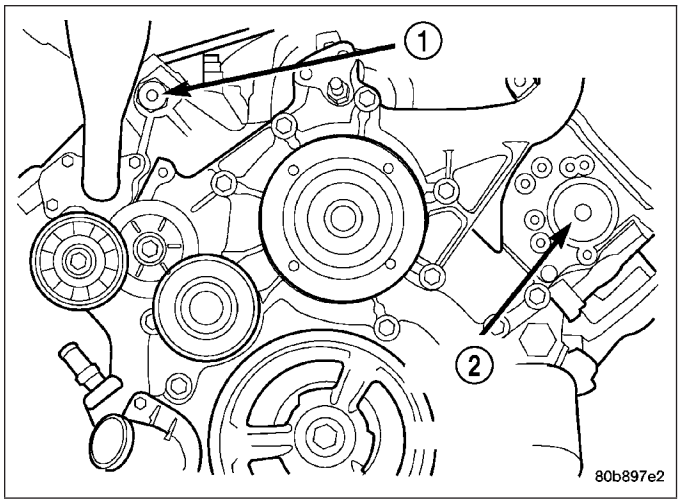
CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

17. Using Special Tool 6958, Spanner with Adaptor Pins 8346, (4) tighten left and right. camshaft sprocket bolts to 122 N·m (90 ft. lbs.).
18. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
    - primary chain idler sprocket dot is at 12 o'clock
    - primary chain crankshaft sprocket dot is at 6 o'clock
    - secondary chain camshaft sprockets "V6" marks are at 12 o'clock
    - counterbalancer shaft drive gear dot is aligned to the idler sprocket gear dot
19. Lubricate all three chains with engine oil.
20. After installing all chains, it is recommended that the idler gear end play be checked. The end play must be within 0.10 -0.25 mm (0.004 - 0.010 in.). If not within specification, the idler gear must be replaced.
21. Install timing chain cover and crankshaft damper. Refer to procedures.
22. Install cylinder head covers (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

23. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head (1) and tighten to 81 N·m (60 ft. lbs.).
24. Install the oil fill housing.
25. Install access plug in left cylinder head (2).
26. Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).
27. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
28. Connect negative cable to battery.



ENGINE - 4.7L - SERVICE INFORMATION

TABLE OF CONTENTS

page

ENGINE - 4.7L - SERVICE INFORMATION
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE 2163
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL 2165
DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE 2166
DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE 2166
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION 2167
STANDARD PROCEDURE
STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS 2167
STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS 2167
REMOVAL 2168
INSTALLATION 2174
SPECIFICATIONS
SPECIFICATIONS - 4.7L ENGINE 2179
TORQUE 2184
SPECIAL TOOLS
4.7L ENGINE 2186
ELEMENT - AIR CLEANER
REMOVAL 2190
INSTALLATION 2191
CYLINDER HEAD
DESCRIPTION
DESCRIPTION - CYLINDER HEAD 2191
DESCRIPTION - VALVE GUIDES 2191
DIAGNOSIS AND TESTING
CYLINDER HEAD GASKET 2191
REMOVAL
REMOVAL - LEFT CYLINDER HEAD 2192
REMOVAL - RIGHT CYLINDER HEAD 2195
CLEANING 2198
INSPECTION 2198
INSTALLATION
INSTALLATION - LEFT CYLINDER HEAD . . 2198
INSTALLATION - RIGHT CYLINDER HEAD . 2201
CAMSHAFT - LEFT
DESCRIPTION 2203
REMOVAL 2204
INSTALLATION 2206
CAMSHAFT - RIGHT
DESCRIPTION 2209
REMOVAL 2209
INSTALLATION 2212
COVER - CYLINDER HEAD
DESCRIPTION 2215
REMOVAL
REMOVAL - RIGHT SIDE 2215
REMOVAL - LEFT SIDE 2216
CLEANING 2216
INSTALLATION
INSTALLATION - RIGHT SIDE 2216
INSTALLATION - LEFT SIDE 2217
VALVES & SEATS - INTAKE/EXHAUST
DESCRIPTION 2217
REMOVAL 2217
INSTALLATION 2218
ROCKER ARM - VALVE
DESCRIPTION 2219
DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER 2219
REMOVAL 2220
INSTALLATION 2220
SPRINGS-VALVE
DESCRIPTION 2220
REMOVAL 2221
INSTALLATION 2221
SEALS-VALVE GUIDE
DESCRIPTION 2222
ENGINE BLOCK
DESCRIPTION 2222
STANDARD PROCEDURE - CYLINDER BORE HONING 2222
CLEANING 2222
INSPECTION 2223
BEARINGS - CONNECTING ROD
STANDARD PROCEDURE - CONNECTING ROD BEARING FITTING 2223
PLUGS - CORE
REMOVAL 2226
INSTALLATION 2226
CRANKSHAFT
DESCRIPTION 2227
REMOVAL 2227
INSPECTION 2227
INSTALLATION 2228
BEARINGS - CRANKSHAFT MAIN
STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING 2230
INSPECTION 2231
SEAL - CRANKSHAFT OIL - FRONT
REMOVAL 2232
INSTALLATION 2233
SEAL - CRANKSHAFT OIL - REAR
DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS 2233
REMOVAL 2234

INSTALLATION 2234
FLEX PLATE
REMOVAL 2235
INSTALLATION 2236
ROD - PISTON & CONNECTING
DESCRIPTION 2236
STANDARD PROCEDURE - PISTON FITTING 2237
REMOVAL 2237
CLEANING 2238
INSPECTION 2238
INSTALLATION 2239
RINGS - PISTON
STANDARD PROCEDURE - PISTON RING FITTING 2240
DAMPER - CRANKSHAFT
REMOVAL 2243
INSTALLATION 2244
COVER - STRUCTURAL
DESCRIPTION 2244
OPERATION 2244
REMOVAL 2245
INSTALLATION 2245
MOUNT - FRONT
REMOVAL 2245
INSTALLATION 2247
MOUNT - REAR
REMOVAL 2249
INSTALLATION 2249
LUBRICATION
DESCRIPTION 2250
OPERATION 2250
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE 2252
DIAGNOSIS AND TESTING - ENGINE OIL LEAK 2252
OIL
STANDARD PROCEDURE - ENGINE OIL SERVICE 2253
FILTER - ENGINE OIL
REMOVAL 2255
INSTALLATION 2255
PAN - ENGINE OIL
REMOVAL 2255
INSTALLATION 2256
SWITCH - OIL PRESSURE
DESCRIPTION
DESCRIPTION 2256
DESCRIPTION 2256
OPERATION
OPERATION 2257
OPERATION 2257
REMOVAL 2257
INSTALLATION 2257
PUMP - ENGINE OIL
REMOVAL 2258
DISASSEMBLY 2258
CLEANING 2258
INSPECTION 2258
ASSEMBLY 2260
INSTALLATION 2261
MANIFOLD - INTAKE
DESCRIPTION 2261
DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE 2261
REMOVAL 2261
CLEANING 2263
INSPECTION 2263
INSTALLATION 2263
MANIFOLD - EXHAUST
DESCRIPTION 2264
REMOVAL 2264
CLEANING 2266
INSPECTION 2266
INSTALLATION 2266
VALVE TIMING
DESCRIPTION - TIMING DRIVE SYSTEM . . . 2268
OPERATION - TIMING DRIVE SYSTEM 2268
STANDARD PROCEDURE
STANDARD PROCEDURE - MEASURING TIMING CHAIN WEAR 2269
STANDARD PROCEDURE - ENGINE TIMING - VERIFICATION 2269
COVER - TIMING
REMOVAL 2274
INSTALLATION 2275
TIMING CHAIN & SPROCKETS
REMOVAL 2276
INSPECTION 2280
INSTALLATION 2281
SHAFT - IDLER
REMOVAL 2284
INSTALLATION 2284

ENGINE - 4.7L - SERVICE INFORMATION

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/ STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump, relay or wiring.	7. Repair or replace as necessary.
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/IDLE AIR CONTROL MOTOR - REMOVAL).
	2. Idle mixture too lean or too rich.	2. Refer to Powertrain Diagnosis Information.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect engine timing.	5. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Refer to the Appropriate Diagnostic Information
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replcae as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
	8. Excessive runout of valve seats on valve faces.	8. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
4. Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
7. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

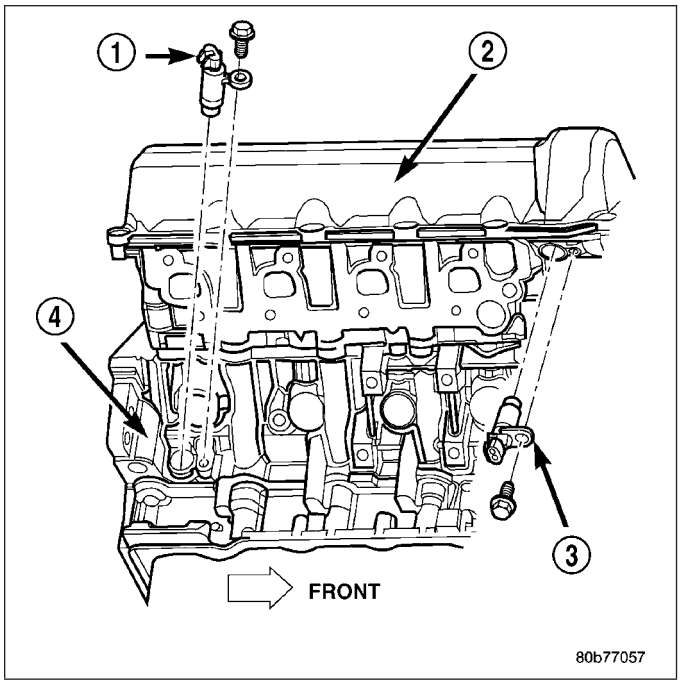
Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

REMOVAL

NOTE: This procedure applies to both the 4X2 and 4X4 vehicles, steps that apply to the 4X4 vehicle only, are identified.

1. Release fuel rail pressure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE) then disconnect the fuel supply quick connect fitting at the fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ QUICK CONNECT FITTING - STANDARD PROCEDURE).
2. Disconnect the battery negative and positive cables.
3. Raise vehicle on hoist.
4. Remove exhaust crossover pipe from exhaust manifolds.
5. **4X4 vehicles** Disconnect axle vent tube from left side engine mount.
6. Remove the through bolt retaining nut and bolt from both the left and right side engine mounts.
7. **4X4 vehicles** Remove locknut from left and right side engine mount brackets.
8. Disconnect two ground straps from the lower left hand side and one ground strap from the lower right hand side of the engine.

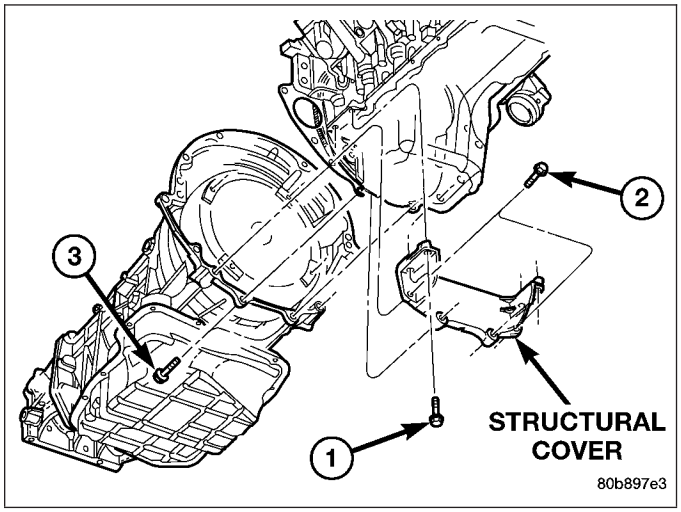
9. Disconnect crankshaft position sensor (1).



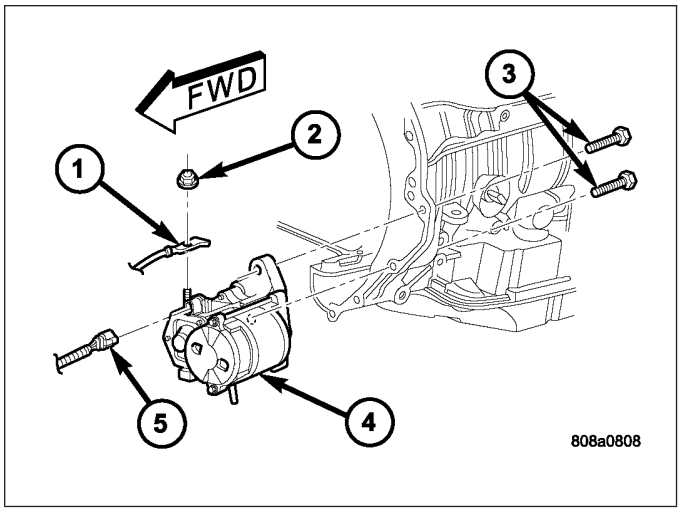
NOTE: The following step applies to 4X4 vehicles equipped with automatic transmission only.

10. **4X4 vehicles** Remove the axle isolator bracket from the engine, transmission and the axle.

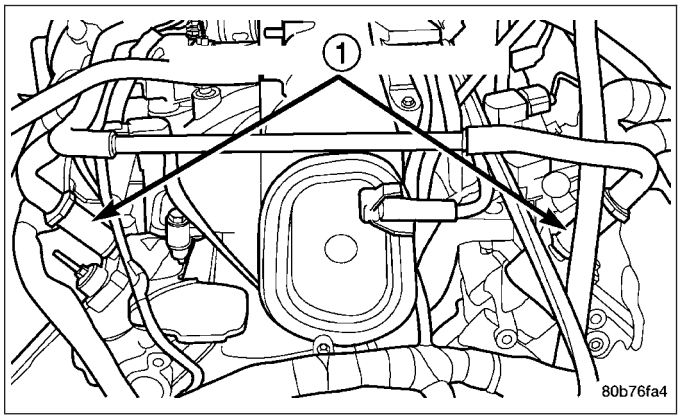
11. Remove structural cover (Refer to 9 - ENGINE/ ENGINE BLOCK/STRUCTURAL COVER - REMOVAL).



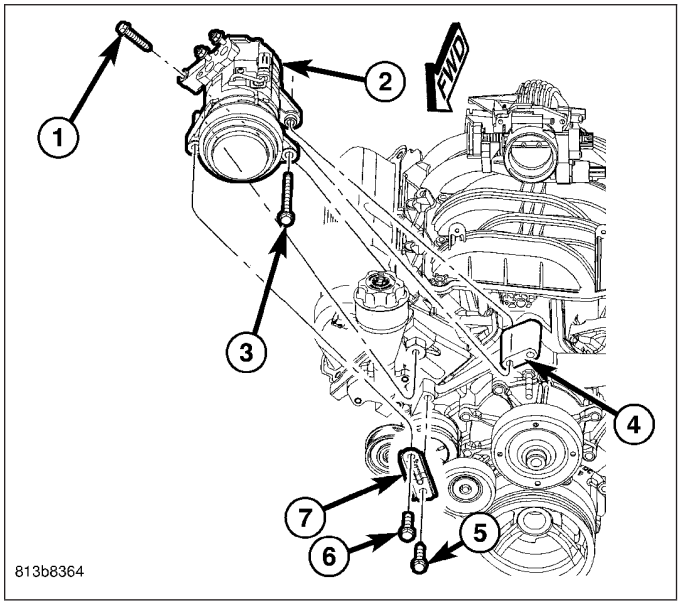
12. Remove starter (4) (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - REMOVAL).



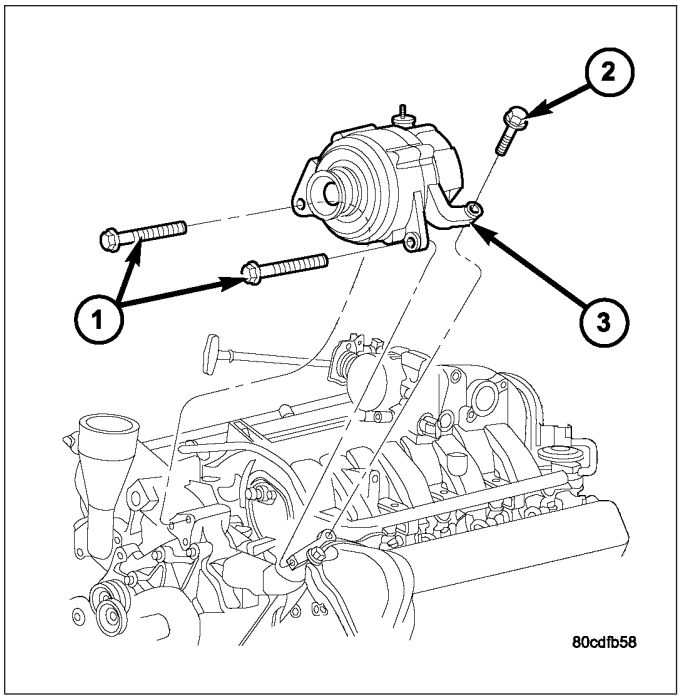
13. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
14. Remove torque converter bolts (Automatic Transmission Only).
15. Remove transmission to engine mounting bolts.
16. Disconnect the engine block heater power cable from the block heater, if equipped.
17. Lower vehicle.
18. Remove throttle body resonator assembly and air inlet hose.
19. Disconnect throttle and speed control cables.
20. Disconnect tube from both the left and right side crankcase breathers (1). Remove breathers
21. Discharge A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
22. Remove A/C compressor (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).



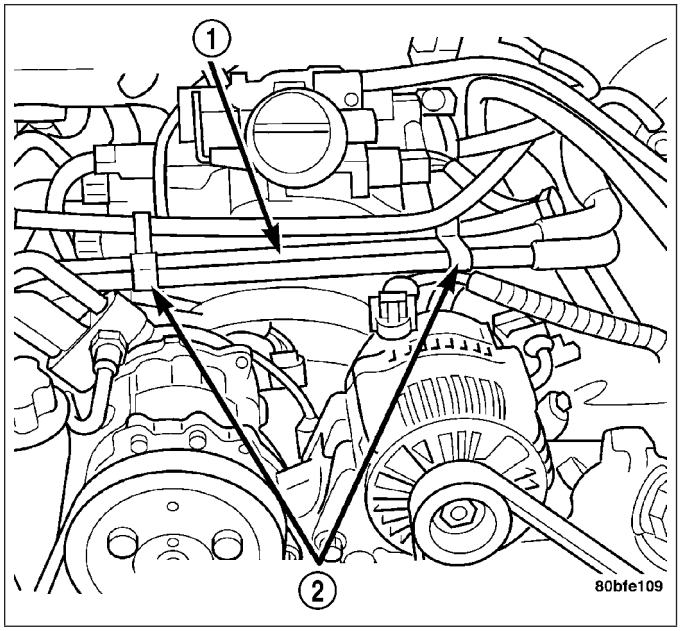
23. Remove shroud, fan assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL) and accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/ DRIVE BELTS - REMOVAL).
24. Disconnect transmission oil cooler lines at the radiator.
25. Disconnect radiator upper and lower hoses.
26. Remove radiator (Refer to 7 - COOLING/ENGINE/ RADIATOR - REMOVAL), A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - REMOVAL) and transmission oil cooler.



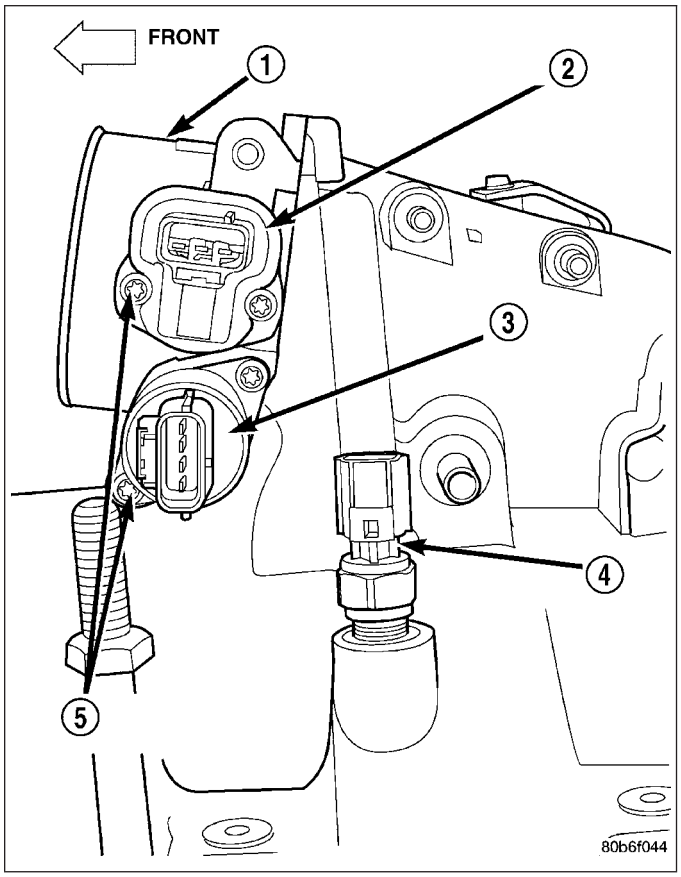
27. Remove generator (3) (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - REMOVAL).



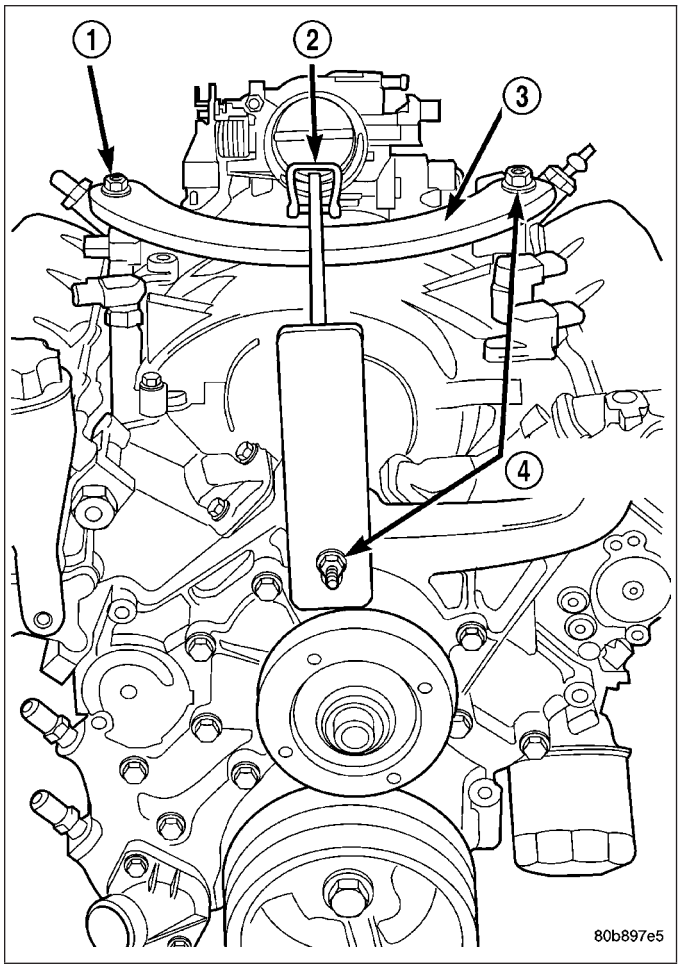
28. Disconnect the two heater hoses from the timing chain cover and heater core.
29. Unclip (2) and remove heater hoses (1) and tubes from the intake manifold.



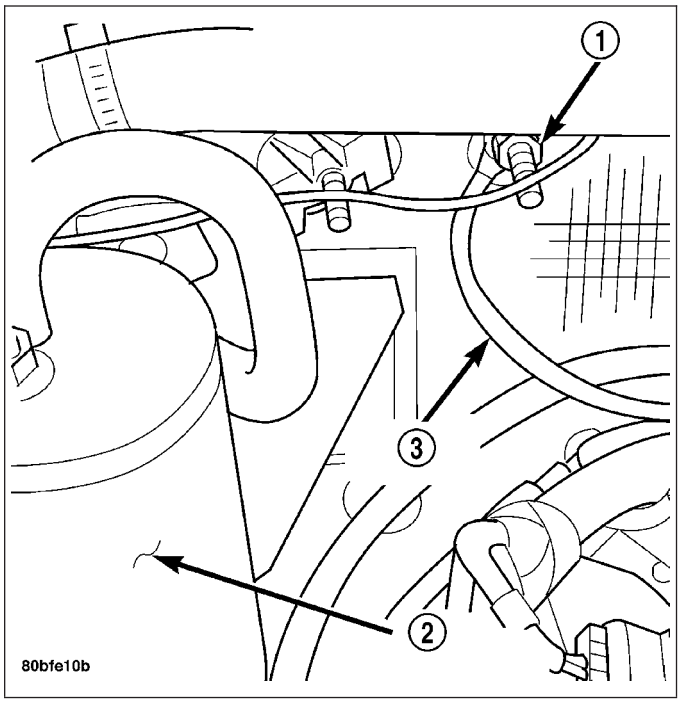
30. Disconnect engine harness at the following points :
    - Intake air temperature (IAT) sensor (4)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Idle Air Control (IAC) Motor (3)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold absolute pressure (MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs
31. Disconnect the vacuum lines at the throttle body and intake manifold.
32. Remove power steering pump and position out of the way.



33. Install Special Tools 8400 Lifting Studs, into the cylinder heads.
34. Install Engine Lifting Fixture Special Tool 8347 (3) following these steps.
    - Holding the lifting fixture at a slight angle, slide the large bore in the front plate over the hex portion of the lifting stud.
    - Position the two remaining fixture arms onto the two Special Tools 8400 Lifting Studs, in the cylinder heads.
    - Pull foward and upward on the lifting fixture so that the lifting stud rest in the slotted area below the large bore.
    - Secure the lifting fixture to the three studs using three 7/16 – 14 N/C locknuts.
    - Make sure the lifting loop in the lifting fixture is in the last hole (closest to the throttle body) to minimize the angle of engine during removal.



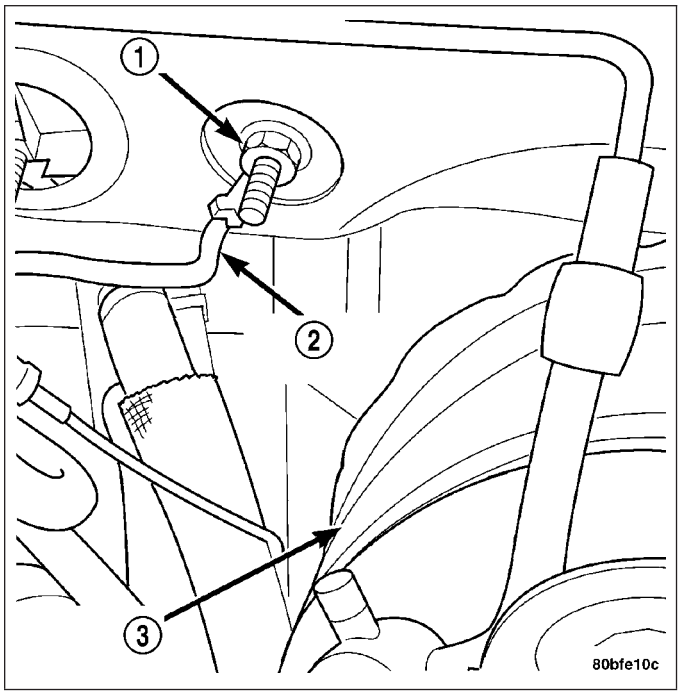
35. Disconnect body ground strap (3) at the right side cowl.



36. Disconnect body ground strap (2) at the left side cowl.

NOTE: It will be necessary to support the transmission in order to remove the engine.

37. Position a suitable jack under the transmission.
38. Remove engine from the vehicle.

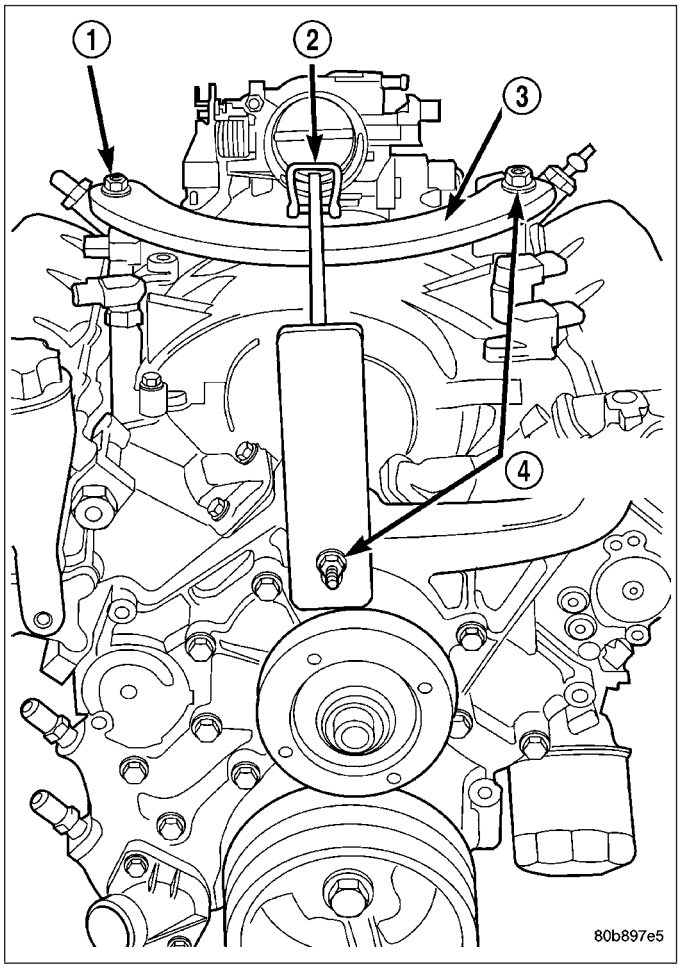


INSTALLATION

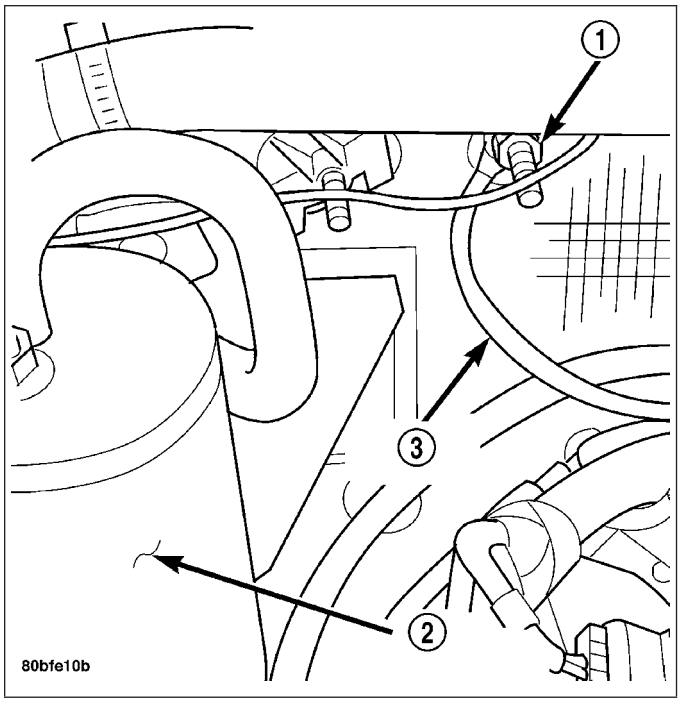
1. Position engine in the vehicle.

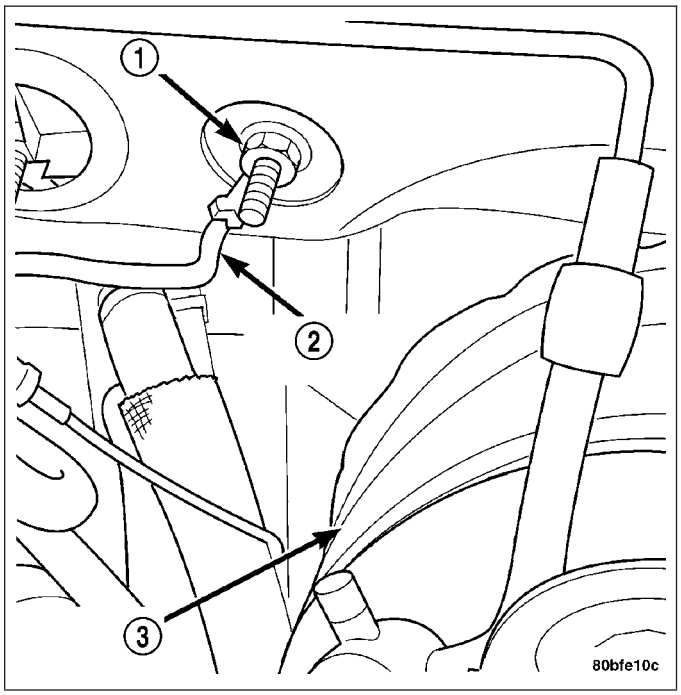
Position both the left and right side engine mount brackets and install the through bolts and nuts. Tighten nuts to **4X2 vehicles**95 N·m (70 ft. lbs.).**4X4 vehicles**102 N·m (75 ft. lbs.).

2. **4X4 vehicles**Install locknuts onto the engine mount brackets. Tighten locknuts to 41 N·m (30 ft. lbs.).
3. Remove jack from under the transmission.
4. Remove Engine Lifting Fixture Special Tool 8347 (3).
5. Remove Special Tools 8400 Lifting Studs.

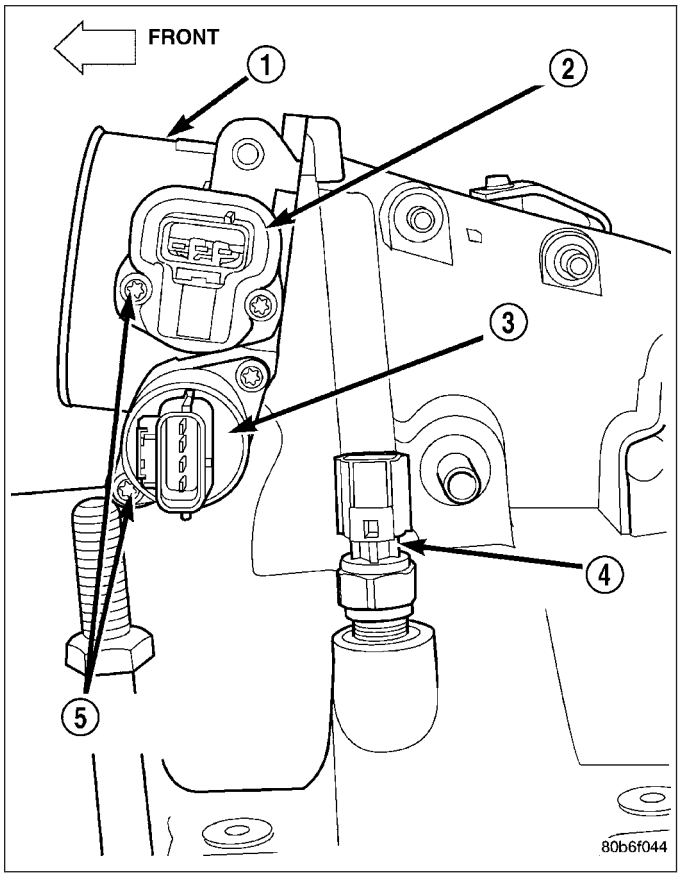


6. Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.
7. Connect both left (2) and right (3) side body ground straps.
8. Install power steering pump.
9. Connect fuel supply line quick connect fitting (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
10. Connect the vacuum lines at the throttle body and intake manifold.

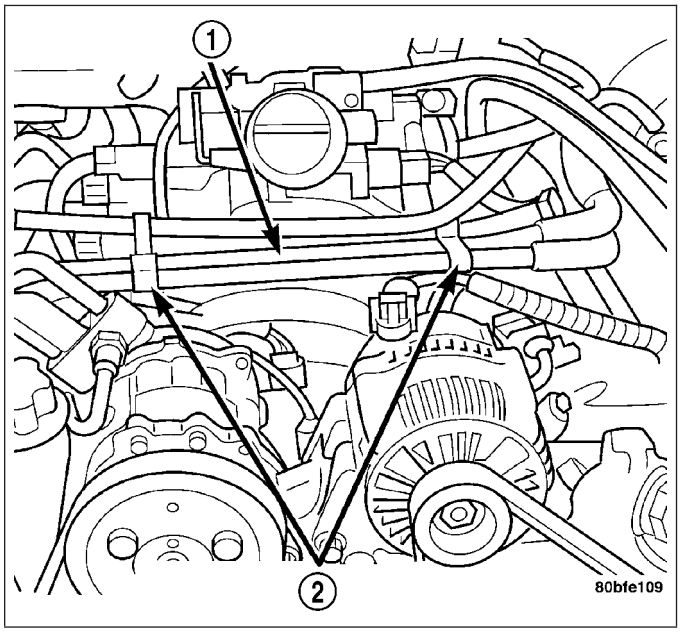




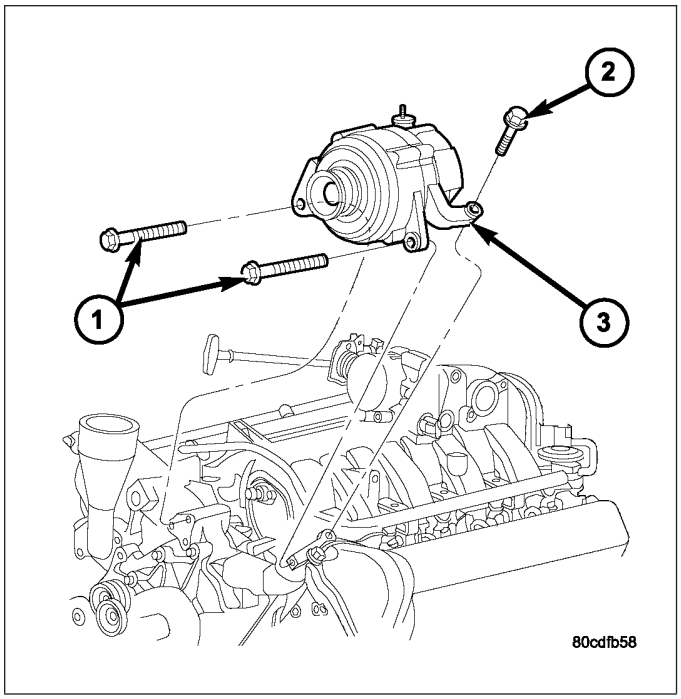
11. Connect engine harness at the following points:
    - Intake Air Temperature (IAT) Sensor (4)
    - Idle Air Control (IAC) Motor (3)
    - Fuel Injectors
    - Throttle Position (TPS) Switch (2)
    - Engine Oil Pressure Switch
    - Engine Coolant Temperature (ECT) Sensor
    - Manifold Absolute Pressure (MAP) Sensor
    - Camshaft Position (CMP) Sensor
    - Coil Over Plugs



12. Position and install heater hoses (1) and tubes onto intake manifold.
13. Install the heater hoses onto the heater core and the engine front cover, and install clips (2).

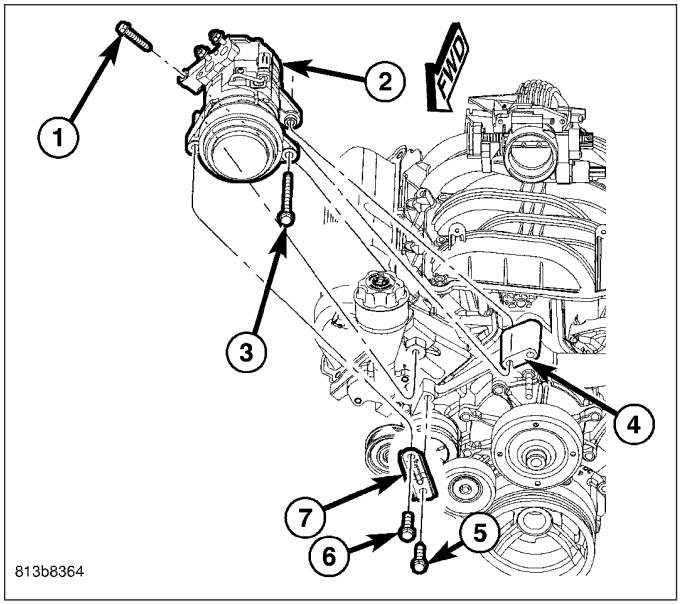


14. Install generator (3) (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).

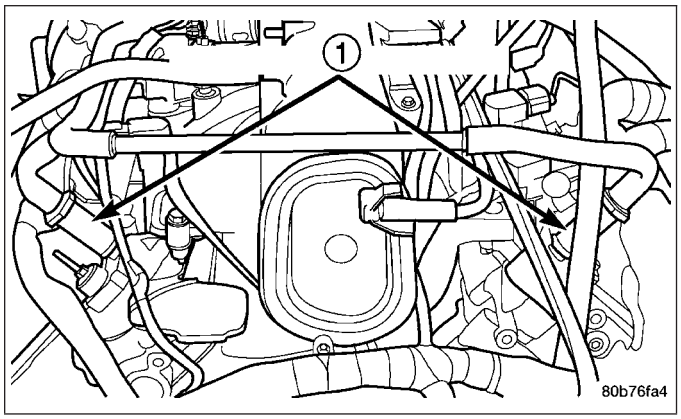


15. Install A/C condenser (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C CONDENSER - INSTALLATION), radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION) and transmission oil cooler.
16. Connect radiator upper and lower hoses.
17. Connect the transmission oil cooler lines to the radiator.
18. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION), fan assembly and shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).

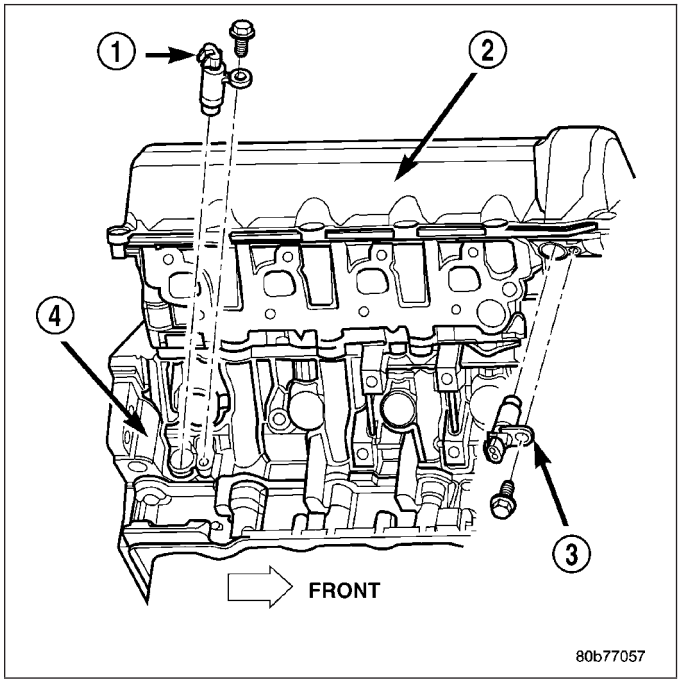
19. Install A/C compressor (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).



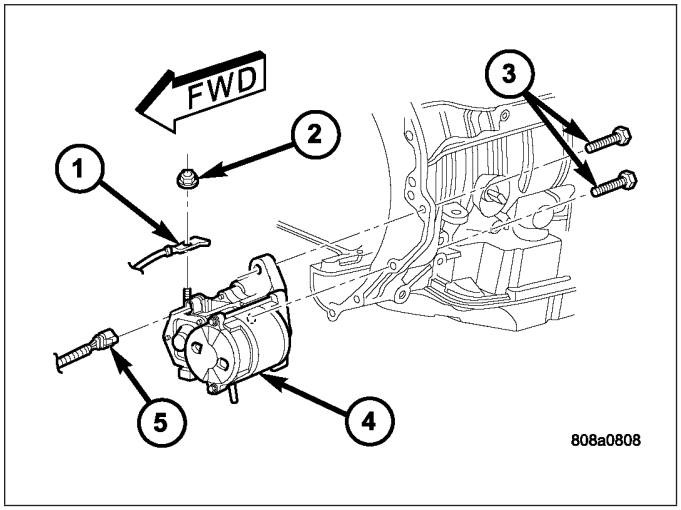
20. Install both breathers (1). Connect tube to both crankcase breathers.
21. Connect throttle and speed control cables.
22. Install throttle body resonator assembly and air inlet hose. Tighten clamps 4 N·m (35 in. lbs.).
23. Raise vehicle.



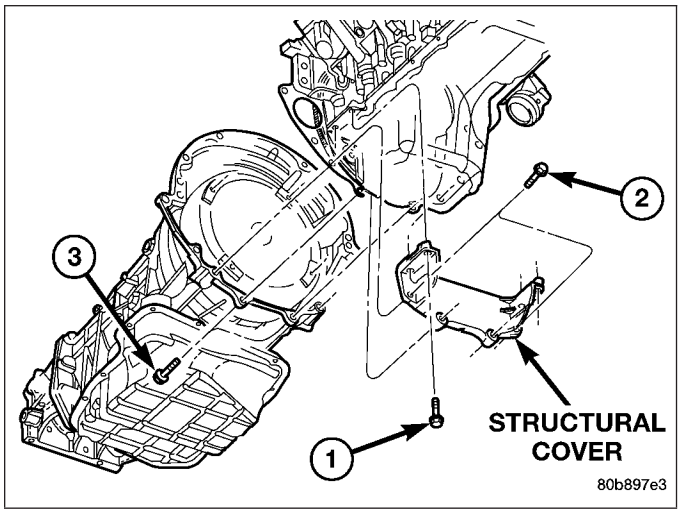
24. Install transmission to engine mounting bolts. Tighten the bolts to 41 N·m (30 ft. lbs.).
25. Install torque converter bolts (Automatic Transmission Only).
26. Connect crankshaft position sensor (1).
27. **4X4 vehicles**Position and install the axle isolator bracket onto the axle, transmission and engine block. Tighten bolts to specification (Refer to 9 - ENGINE - SPECIFICATIONS).



28. Install starter (4) (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - INSTALLATION).



CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.



29. Install structural cover (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).
30. Install exhaust crossover pipe.
31. Install engine block heater power cable, If equipped.
32. **4X4 vehicles**Connect axle vent tube to left side engine mount.
33. Lower vehicle.
34. Check and fill engine oil.
35. Recharge the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
36. Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
37. Connect the battery positive and negative cables.
38. Start the engine and check for leaks.

SPECIFICATIONS

SPECIFICATIONS - 4.7L ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters / 4701 cc 287 (Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.0:1
Horsepower	235 BHP @ 4800 RPM
Torque	295 LB-FT @ 3200 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	93.010 ± .0075 mm	3.6619 ± 0.0003 in.
Out of Round (MAX)	0.076 mm	0.003 in.
Taper (MAX)	0.051 mm	0.002 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter	92.975 mm	3.6605 in.
Weight	366 grams	12.9 oz
Ring Groove Diameter		
No. 1	83.37 - 83.13 mm	3.282 - 3.273 in
No. 2	82.833 - 83.033 mm	3.261 - 3.310 in.
No. 3	83.88 - 84.08 mm	3.302 - 3.310 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance In Piston	0.010 - 0.019 mm	0.0004 - 0.0008 in.
Diameter	24.013 - 24.016 mm	0.9454 - 0.9455 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.20 - 0.36 mm	0.0079 - 0.0142 in.
Second Compression Ring	0.37 - 0.63 mm	0.0146 - 0.0249 in.
Oil Control (Steel Rails)	0.25 - 0.76 mm	0.0099 - 0.30 in.
Side Clearance		
Top Compression Ring	.051 - .094 mm	0.0020 - 0.0037 in.
Second Compression Ring	0.040 - 0.080 mm	0.0016 - 0.0031 in.
Oil Ring (Steel Ring)	.019 - .229 mm	.0007 - .0091 in.
Ring Width		
Top Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Second Compression Ring	1.472 - 1.490 mm	0.057 - 0.058 in.
Oil Ring (Steel Rails)	0.445 - 0.470 mm	0.017 - 0.018 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.015 - 0.055 mm	0.0006 - 0.0022 in.
Side Clearance	0.10 - 0.35 mm	0.004 - 0.0138 in.
Piston Pin Bore Diameter (Interference Fit)	.025 - .048 mm	0.001 - 0.0019 in.
Bearing Bore Out of Round (MAX)	0.004 mm	0.0002 in.
Total Weight (Less Bearing)	555 grams	19.5771 ounces

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	63.488 - 63.512 mm	2.4996 - 2.5005 in.
Bearing Clearance	0.004 - 0.034 mm	0.0002 - 0.0013 in.
Out of Round (MAX)	0.005 mm	0.0004 in.
Taper (MAX)	0.008 mm	0.0004 in.
End Play	0.052 - 0.282 mm	0.0021 - 0.0112 in.
End Play (MAX)	0.282 mm	0.0112 in.
Connecting Rod Journal Diameter	50.992 - 51.008 mm	2.0076 - 2.0082 in.
Bearing Clearance	0.010 - 0.048	0.0004 - 0.0019 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.008 mm	0.0004 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bore Diameter	26.02 - 26.04 mm	1.0245 - 1.0252 in.
Bearing Journal Diameter	25.975 - 25.995 mm	1.0227 - 1.0235 in.
Bearing Clearance	0.025 - 0.065 mm	0.001 - 0.0026 in.
Bearing Clearance (MAX)	0.065 mm	0.0026 in.
End Play	.075 - .200 mm	0.003 - 0.0079 in.
End Play (MAX)	.200 mm	0.0079 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	4.4°
Closes (ATDC)	239.1°
Duration	243.5°
Exhaust	
Opens (BTDC)	240.5°
Closes (ATDC)	13.2°
Duration	253.70°
Valve Overlap	17.6°

VALVES

DESCRIPTION	SPECIFICATION
Face Angle	45° - 45.5°
Head Diameter	
Intake	48.52 - 48.78 mm (1.9103 - 1.9205 in.)
Exhaust	36.87 - 37.13 mm (1.4516 - 1.4618 in.)
Length (Overall)	
Intake	113.45 - 114.21 mm (4.4666 - 4.4965)
Exhaust	114.92 - 115.68 mm (4.5244 - 4.5543 in.)
Stem Diameter	
Intake	6.931 - 6.957 mm (0.2729 - 0.2739 in.)
Exhaust	6.902 - 6.928 mm (0.2717 - 0.2728 in.)
Stem - to - Guide Clearance	
Intake	0.018 - 0.069 mm (0.0008 - 0.0028 in.)
Exhaust	0.047 - 0.098 mm (0.0019 - 0.0039 in.)
Max. Allowable Stem - to - Guide Clearance (Rocking Method)	
Intake	0.069 mm (0.0028 in.)
Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)	
Intake	11.25 mm (0.443 in.)
Exhaust	10.90 mm (0.4292 in.)

VALVE SPRING

DESCRIPTION	SPECIFICATION
Free Length (Approx)	
Intake	49.0 mm (1.9291 in.)
Exhaust	49.0 mm (1.9291 in.)
Spring Force (Valve Closed)	
Intake and Exhaust	313.0 - 354.0 N @ 40.12 mm (70.365 - 79.582 lbs. @ 1.5795 in.)
Spring Force (Valve Open)	
Intake and Exhaust	776.0 - 870.0 N @ 28.88 mm (174.451 - 195.583 lbs. @ 1.137 in.)
Number of Coils	
Intake	7.3
Exhaust	7.3
Wire Diameter	
Intake and Exhaust	4.6 × 3.67mm (0.1811 - 0.1445 in.)
Installed Height (Spring Seat to Bottom of Retainer) Nominal	
Intake	40.12 mm (1.579 in.)
Exhaust	40.12 mm (1.579 in.)

CYLINDER HEAD

DESCRIPTION	SPECIFICATION
Gasket Thickness (Compressed)	0.7 mm (0.0276 in.)
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.051 mm (0.002 in.)
Valve Seat Width	
Intake	1.75 - 2.36 mm (0.0698 - 0.0928 in.)
Exhaust	1.71 - 2.32 mm (0.0673 - 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 - 7.00 mm (0.2747 - 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)

OIL PUMP

DESCRIPTION	SPECIFICATION
Clearance Over Rotors/End Face (MAX)	0.095 mm (0.0038 in.)
Cover Out - of -Flat (MAX)	0.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.02 mm (0.4731 in.)
Outer Rotor to pocket (Diametral) clearance (MAX)	.235 mm (.0093 in.)
Outer Rotor Diameter (MIN)	85.925 mm (0.400 in.)
Tip Clearance Between Rotors (MAX)	0.150 mm (0.006 in.)

OIL PRESSURE

SPECIFICATION	SPECIFICATION
At Curb Idle Speed (MIN)*	48 kPa (7 psi)
@ 3000 rpm	240 - 725 kPa (35 - 105 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.**	

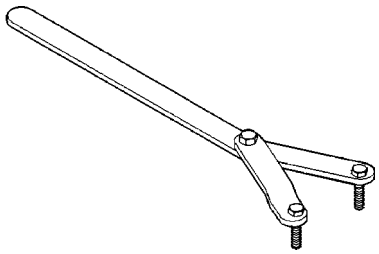
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft			
Non - Oiled Sprocket Bolt	122	90	—
Bearing Cap Bolts	11	—	100
Timing Chain Cover—Bolts	58	43	—
Connecting Rod Cap—Bolts	27	20	—
	PLUS 90° TURN		
Bed Plate—Bolts	Refer to Procedure		
Cylinder Head—Bolts	Refer to Procedure		
Crankshaft Damper—Bolt	175	130	—
Cylinder Head Cover—Bolts	12	—	105
Exhaust Manifold—Bolts	25	18	—
Exhaust Manifold Heat Shield—Nuts	8	—	72
	Then loosen 45°		
Flexplate—Bolts	60	45	—
Engine Mount Bracket to Block—Bolts	61	45	—
Rear Mount to Transmission—Bolts	46	34	—
Generator Mounting—Bolts			
M10 Bolts	54	40	—
M8 Bolts	28	—	250
Intake Manifold—Bolts	12	—	105
	Refer to Procedure for Tightening Sequence		
Oil Pan—Bolts	15	—	130
Oil Pan—Drain Plug	34	25	—
Oil Pump—Bolts	28	—	250

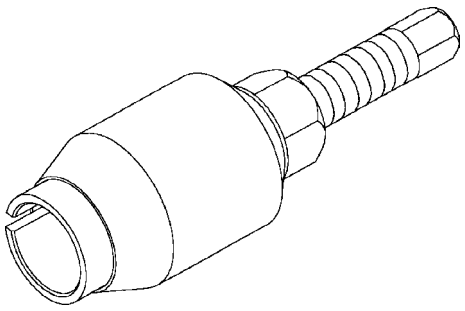
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Oil Pump Cover—Bolts	12	—	105
Oil Pickup Tube—Bolt and Nut	28	—	250
Oil Dipstick Tube to Engine Block—Bolt	15	—	130
Oil Fill Tube—Bolts	12	—	105
Timing Chain Guide—Bolts	28	—	250
Timing Chain Tensioner Arm—Special Pin Bolt	17	—	150
Hydraulic Tensioner—Bolts	28	—	250
Timing Chain Primary Tensioner—Bolts	28	—	250
Timing Drive Idler Sprocket—Bolt	34	25	—
Thermostat Housing—Bolts	13	—	115
Water Pump—Bolts	58	43	—

SPECIAL TOOLS

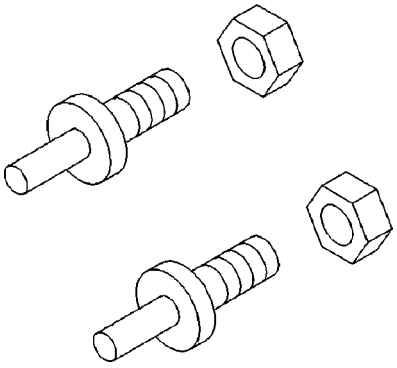
4.7L ENGINE



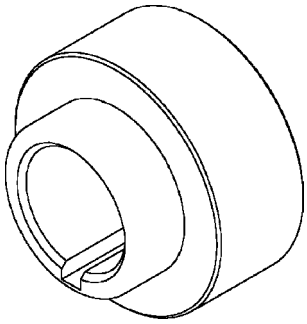
Spanner Wrench 6958



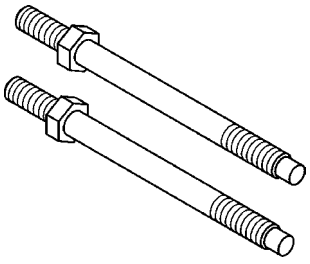
Front Crankshaft Seal Remover 8511



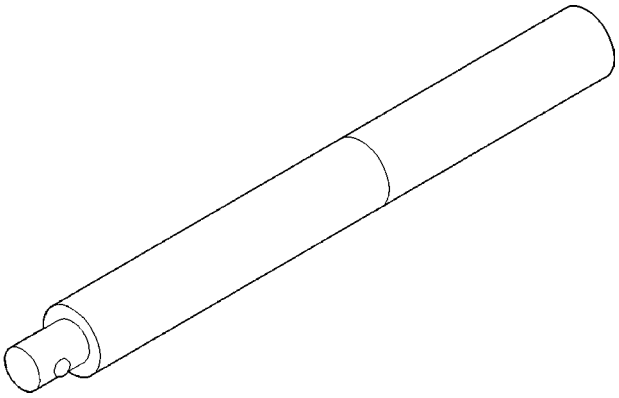
Adapter Pins 8346



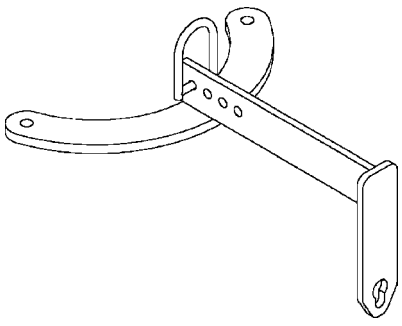
Front Crankshaft Seal Installer 8348



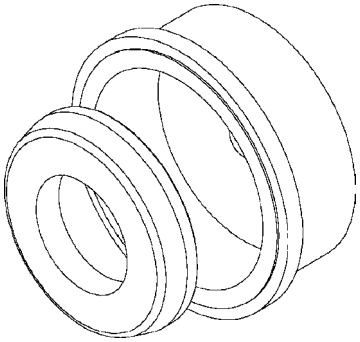
Engine Lifting Studs 8400



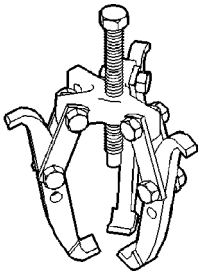
Handle C-4171



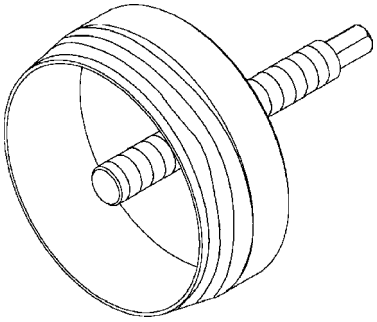
Engine Lift Fixture 8347



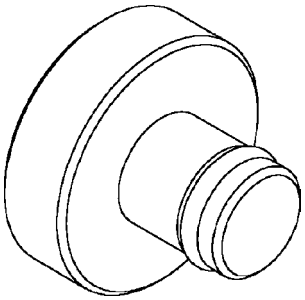
Rear Crankshaft Seal Installer 8349



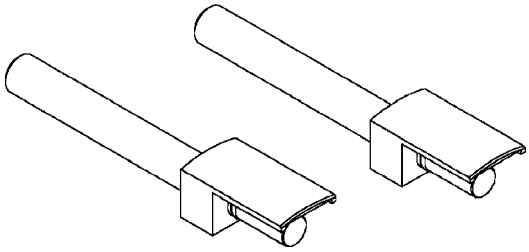
Puller 1026



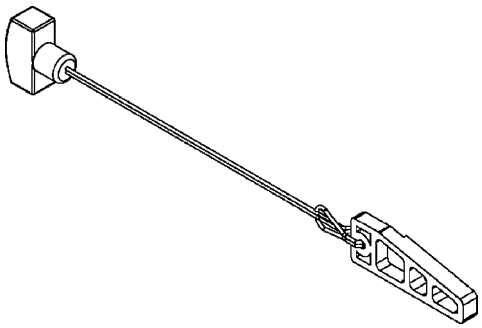
Rear Crankshaft Seal Remover 8506



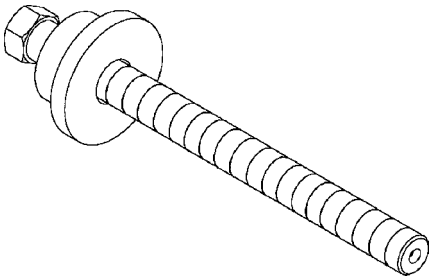
Crankshaft Damper Removal Insert 8513



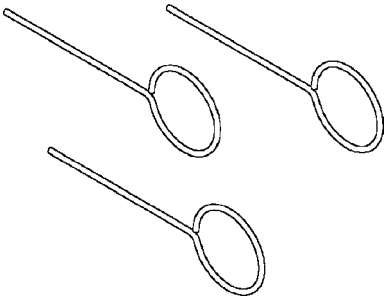
Connecting Rod Guides 8507



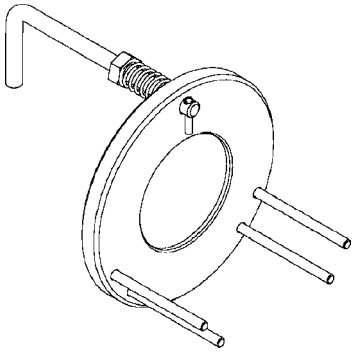
Chain Tensioner Wedge 8379



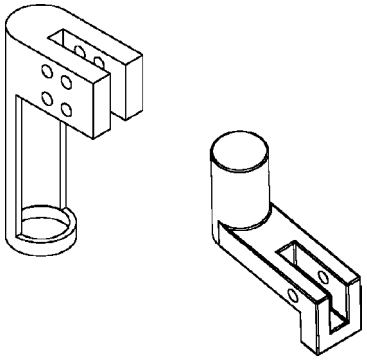
Crankshaft Damper Installer 8512



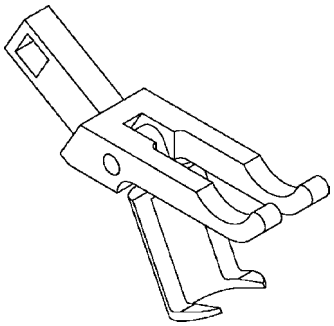
Chain Tensioner Pins 8514



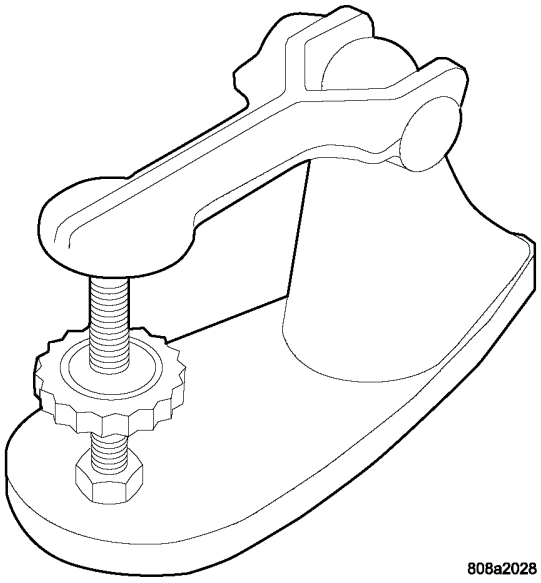
Secondary Chain Holder 8515



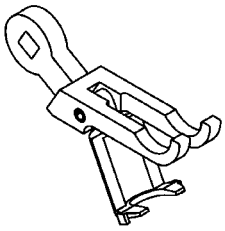
Valve Spring Compressor Adapters 8519



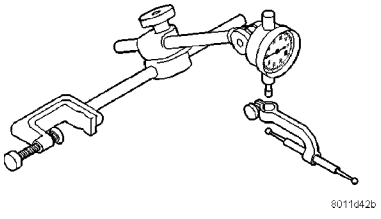
Remover, Rocker Arm 8516



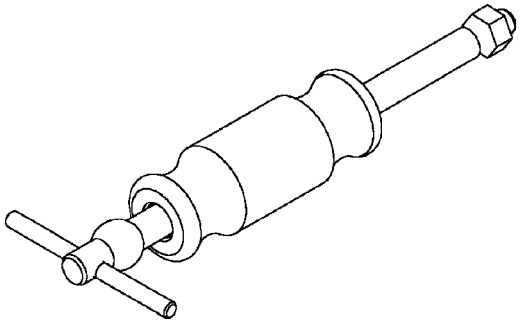
Valve Spring Tester C-647



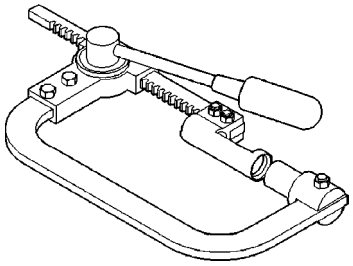
Valve Spring Compressor 8387



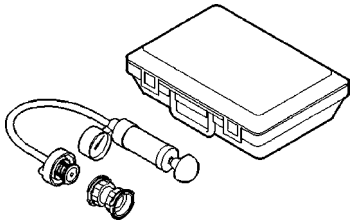
Dial Indicator C-3339



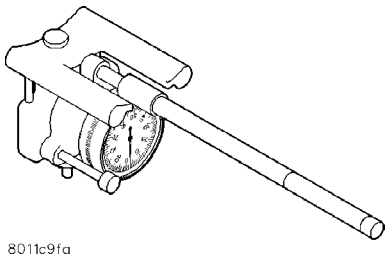
Idler Shaft Remover 8517



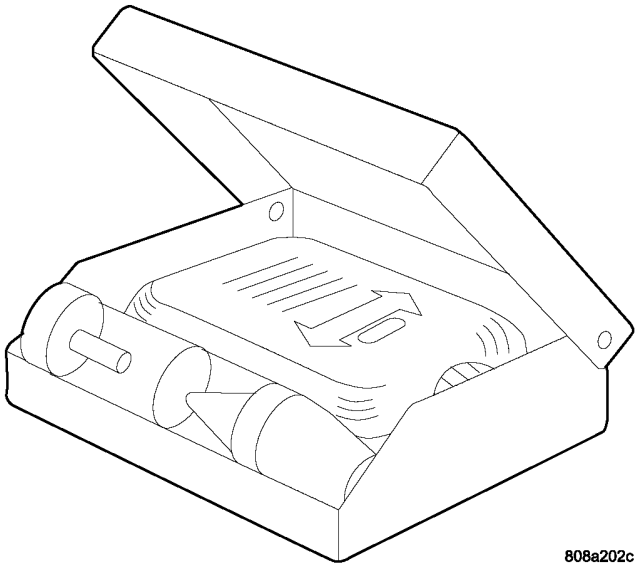
COMPRESSOR VALVE SPRING C-3422-C



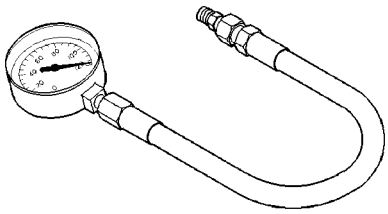
Pressure Tester Kit 7700



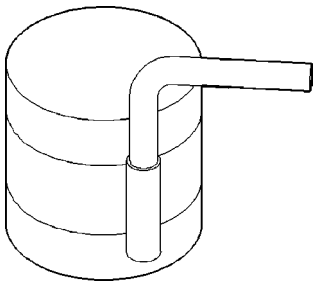
INDICATOR CYLINDER BORE C-119



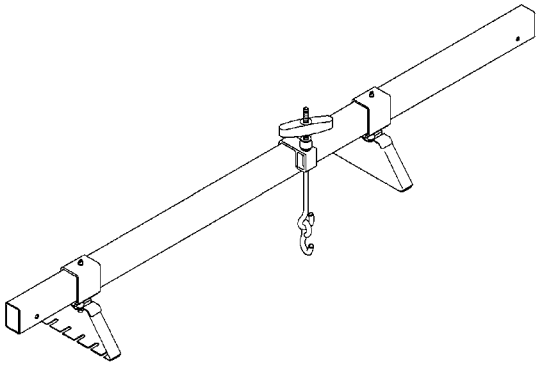
BLOC-CHEK KIT C-3685



GAUGE OIL PRESSURE - C-3292



Piston Ring Compressor C-385



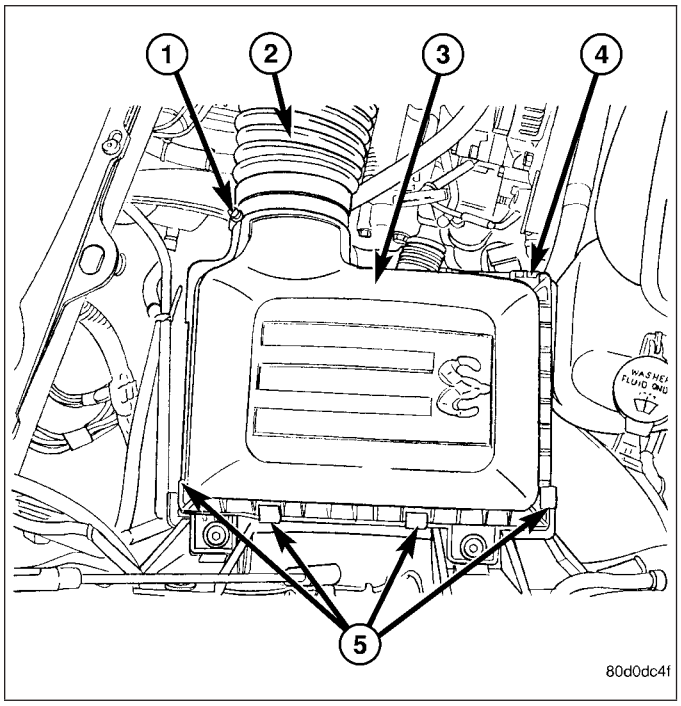
ENGINE SUPPORT FIXTURE 8534

ELEMENT - AIR CLEANER

REMOVAL

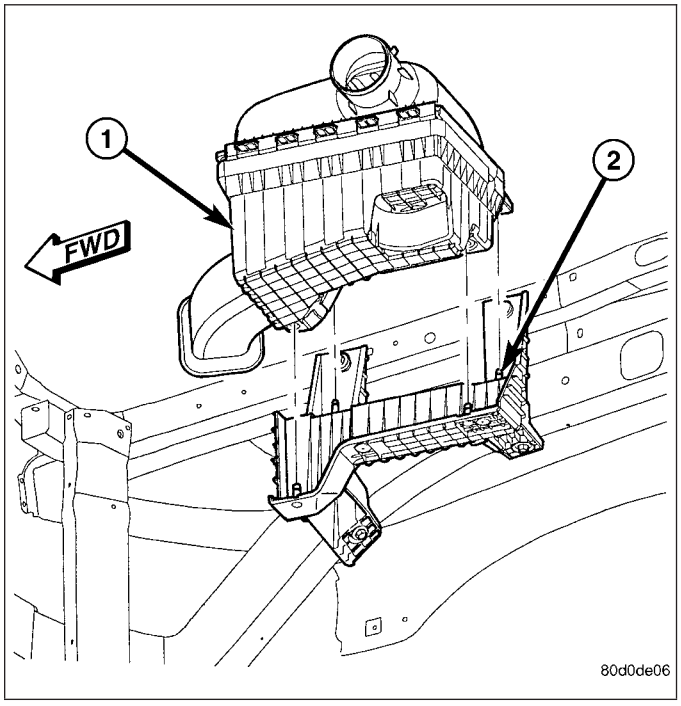
Filter Element Only

1. Housing removal is not necessary for element (filter) replacement.
2. Loosen clamp and disconnect air duct at air cleaner cover.
3. Pry over 4 spring clips (5) from housing cover (3) (spring clips retain cover to housing).
4. Release housing cover (3) from locating tabs on housing and remove cover.
5. Remove air cleaner element (filter) from housing.
6. Clean inside of housing before replacing element.



Housing Assembly

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Lift entire housing (1) assembly from 4 locating pins (2).



INSTALLATION

1. Install filter element into housing.
2. Position housing cover into housing locating tabs.
3. Pry up 4 spring clips and lock cover to housing.
4. Install air duct to air cleaner cover and tighten hose clamp to 3 N·m (30 in. lbs.) torque.
5. If any other hose clamps were removed from air intake system, tighten them to 3.4 N·m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4.5 N·m (40 in. lbs.) torque.

CYLINDER HEAD

DESCRIPTION

DESCRIPTION - CYLINDER HEAD

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DIAGNOSIS AND TESTING

CYLINDER HEAD GASKET

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING). An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50 - 70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

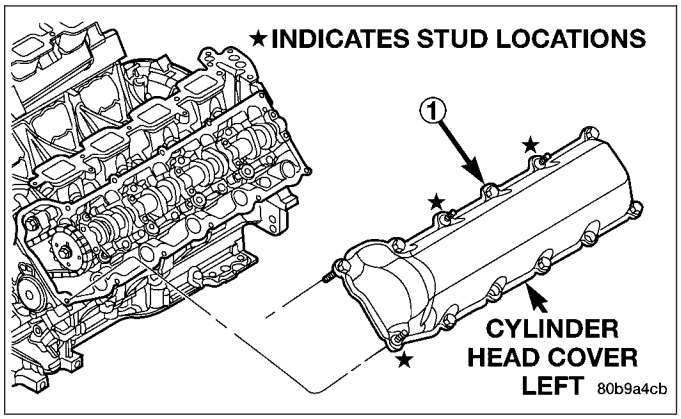
CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

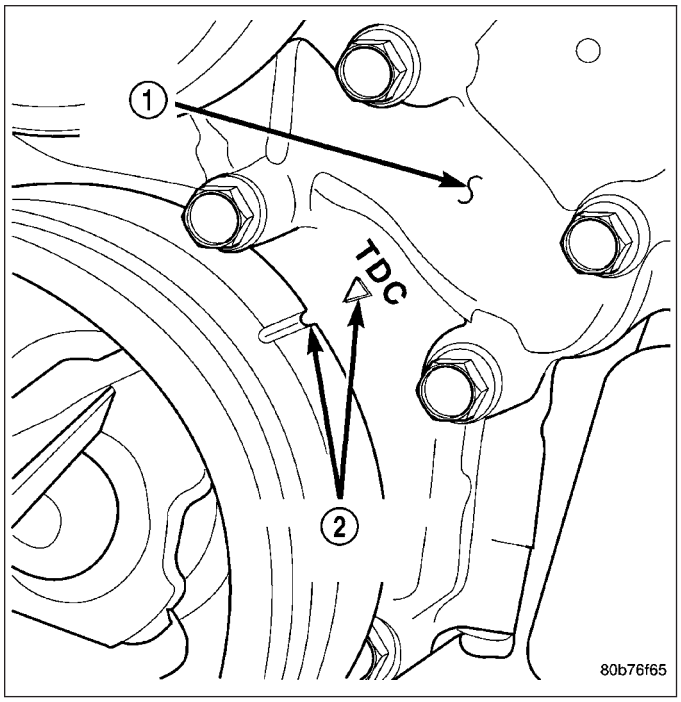
REMOVAL

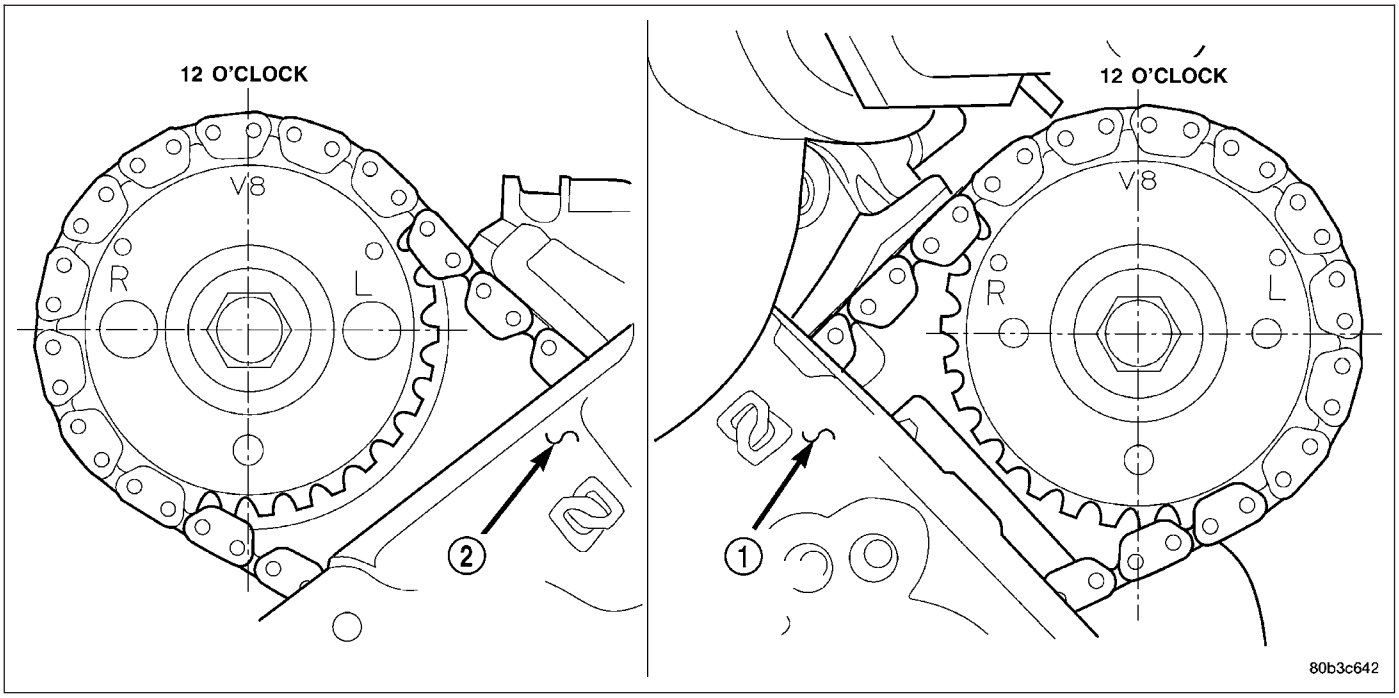
REMOVAL - LEFT CYLINDER HEAD

1. Disconnect the negative cable from the battery.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the left side exhaust manifold.
4. Drain the engine coolant. Refer to COOLING SYSTEM.
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the master cylinder and booster assembly. Refer to section 5 brakes.
8. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



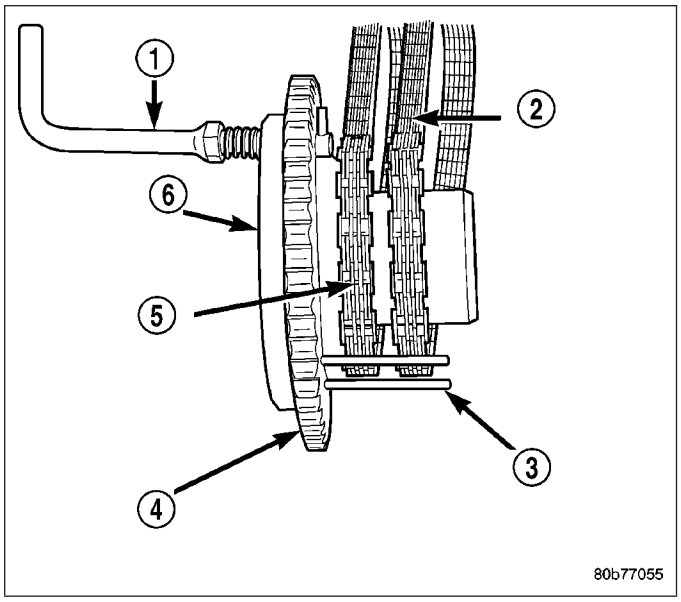
9. Remove the fan shroud and fan blade assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Remove the power steering pump and set aside.
12. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark.

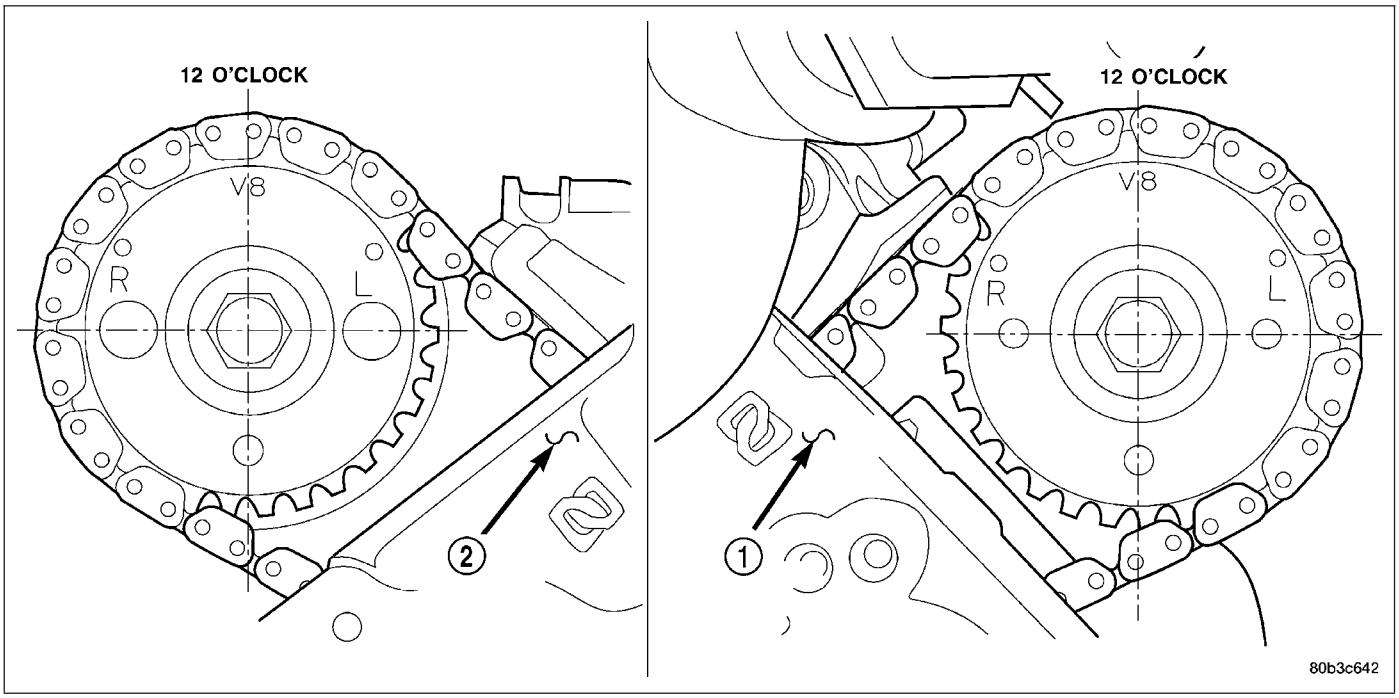




13. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position. Rotate the crankshaft one turn if necessary.
14. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
15. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

16. Lock the secondary timing chains to the idler sprocket using Special Tool 8515.



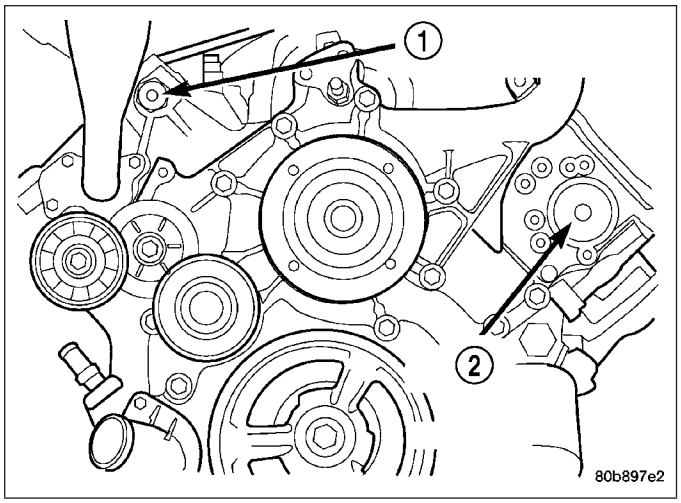


NOTE: Mark the secondary timing chain prior to removal to aid in installation.

17. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
18. Remove the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

19. Remove the cylinder head access plug (2).
20. Remove the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
21. Remove the retaining bolt and the camshaft drive gear.

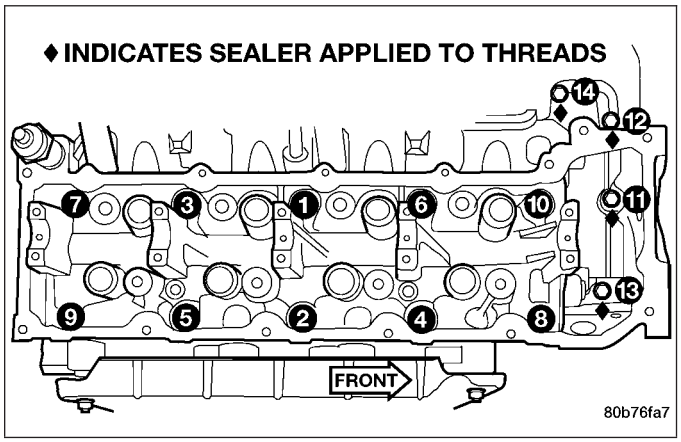
CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.



CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

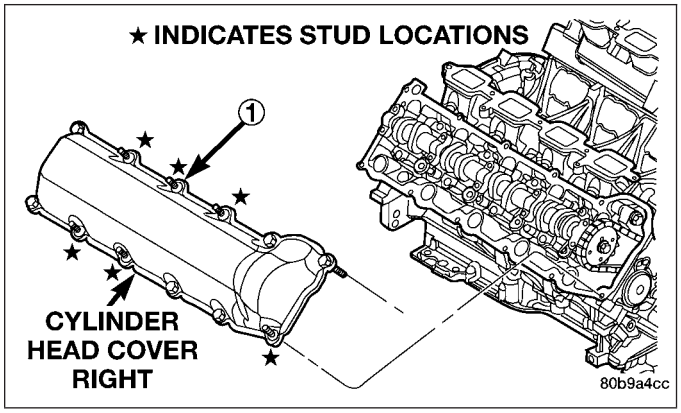
22. Remove the cylinder head retaining bolts using the sequence provided.
23. Remove the cylinder head and gasket. Discard the gasket.



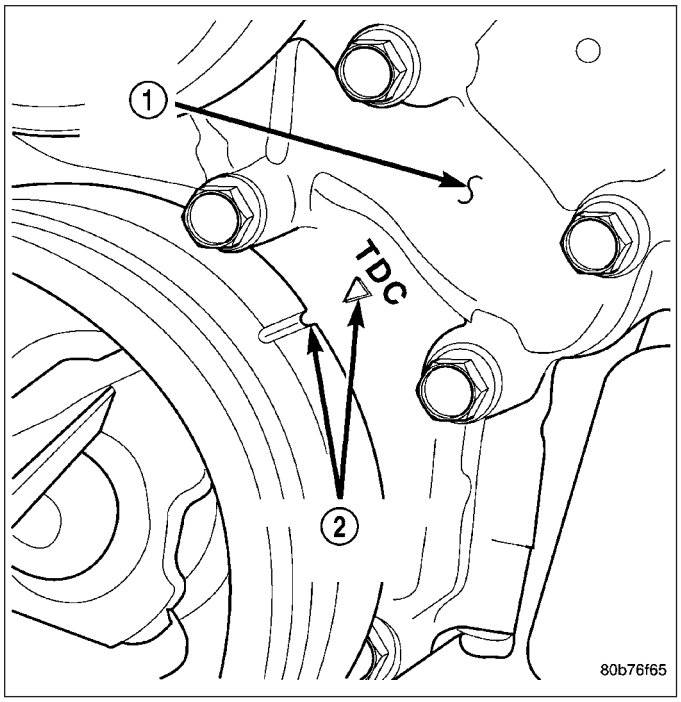
CAUTION: Do not lay the cylinder head on its gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

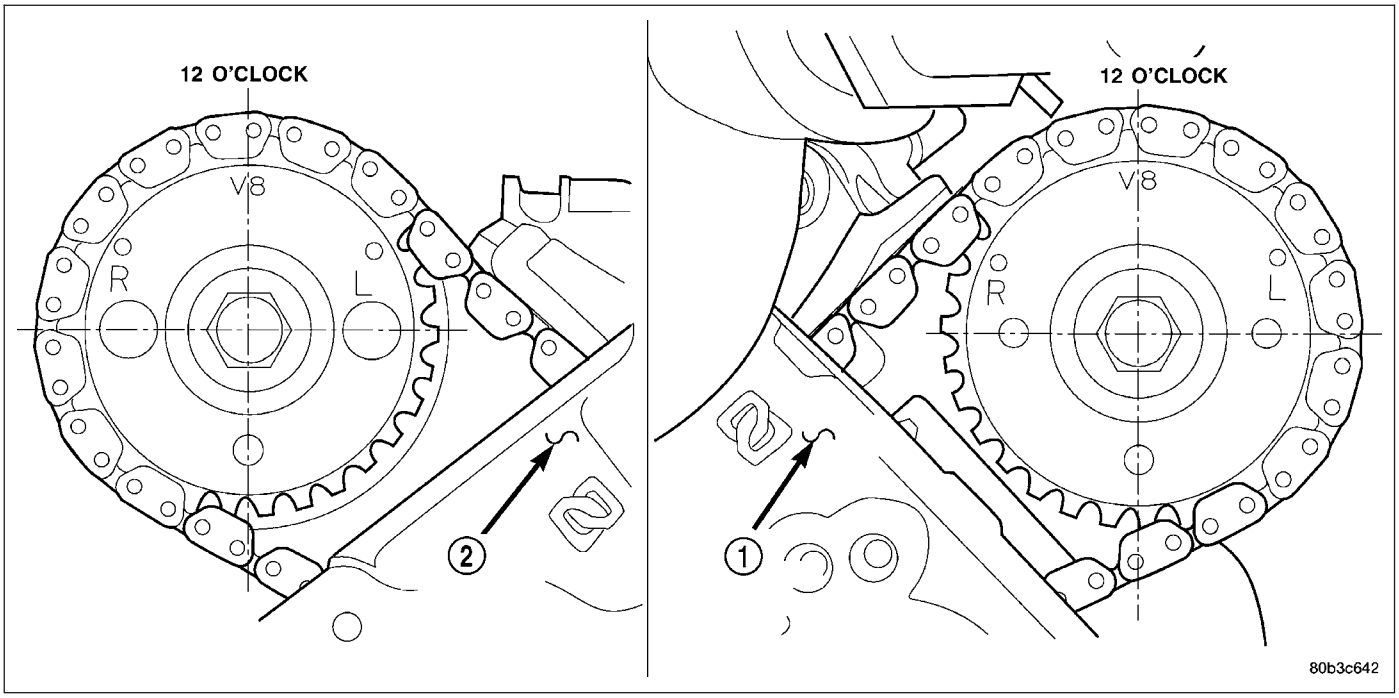
REMOVAL - RIGHT CYLINDER HEAD

1. Disconnect battery negitive cable.
2. Raise the vehicle on a hoist.
3. Disconnect the exhaust pipe at the right side exhaust manifold.
4. Drain the engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower the vehicle.
6. Remove the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
7. Remove the cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



8. Remove the fan shroud (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Remove oil fill housing from cylinder head.
10. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (2).



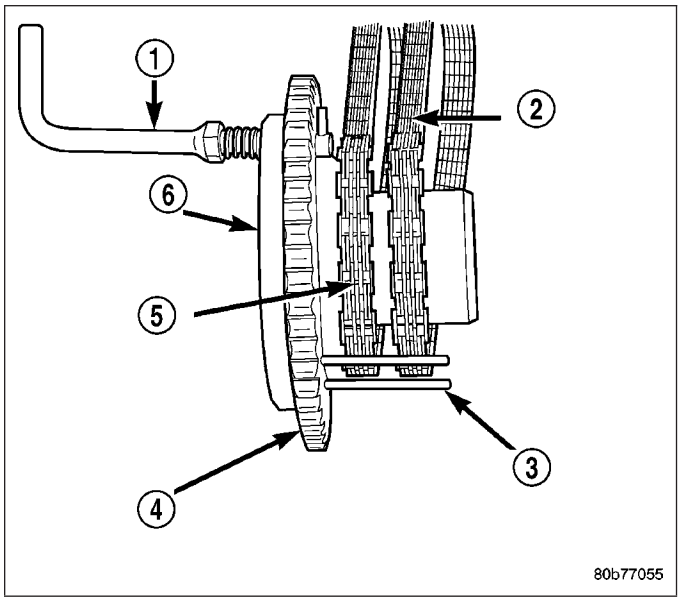


12. Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (2). Rotate the crankshaft one turn if necessary.
13. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
14. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

15. Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (6).

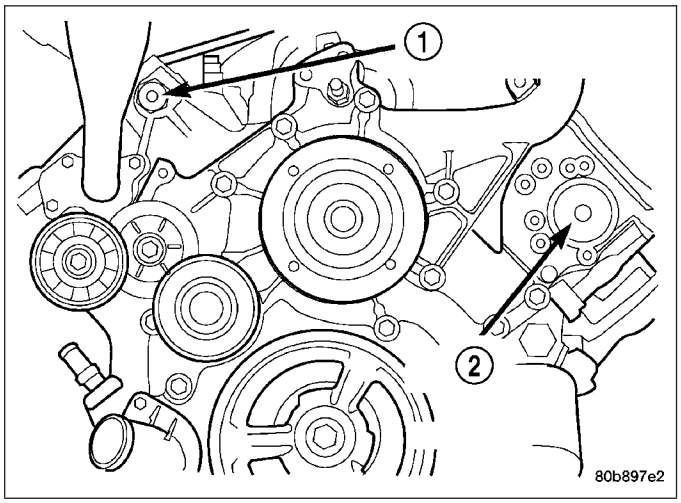
NOTE: Mark the secondary timing chain prior to removal to aid in installation.

16. Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear.
17. Remove the right side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).



18. Remove the cylinder head access plug (1).
19. Remove the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
20. Remove the retaining bolt and the camshaft drive gear.

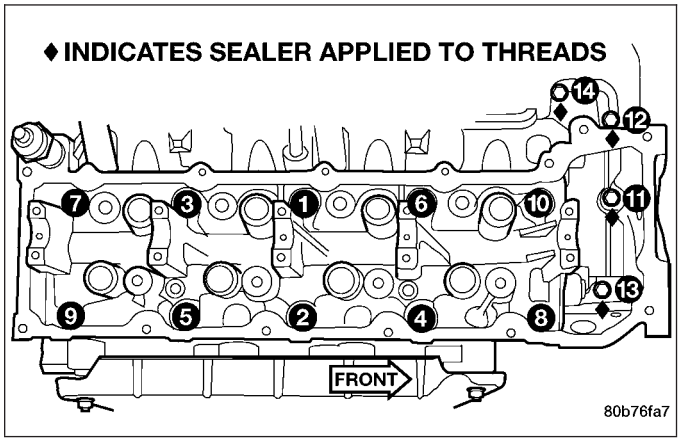
CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.



CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.



21. Remove the cylinder head retaining bolts using the sequence provided.
22. Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on its gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

CLEANING

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components. (Refer to 9 - ENGINE - STANDARD PROCEDURE)

INSPECTION

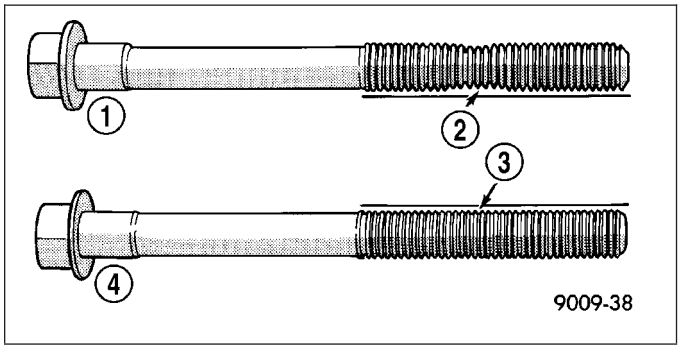
1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

INSTALLATION

INSTALLATION - LEFT CYLINDER HEAD

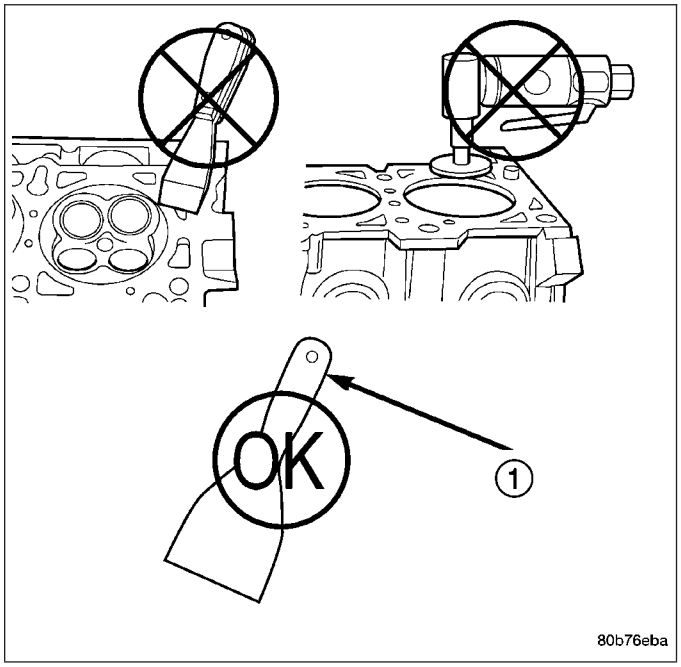
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.

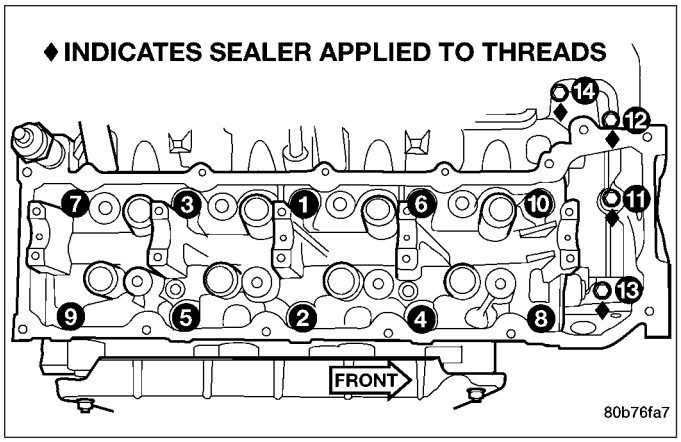


2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

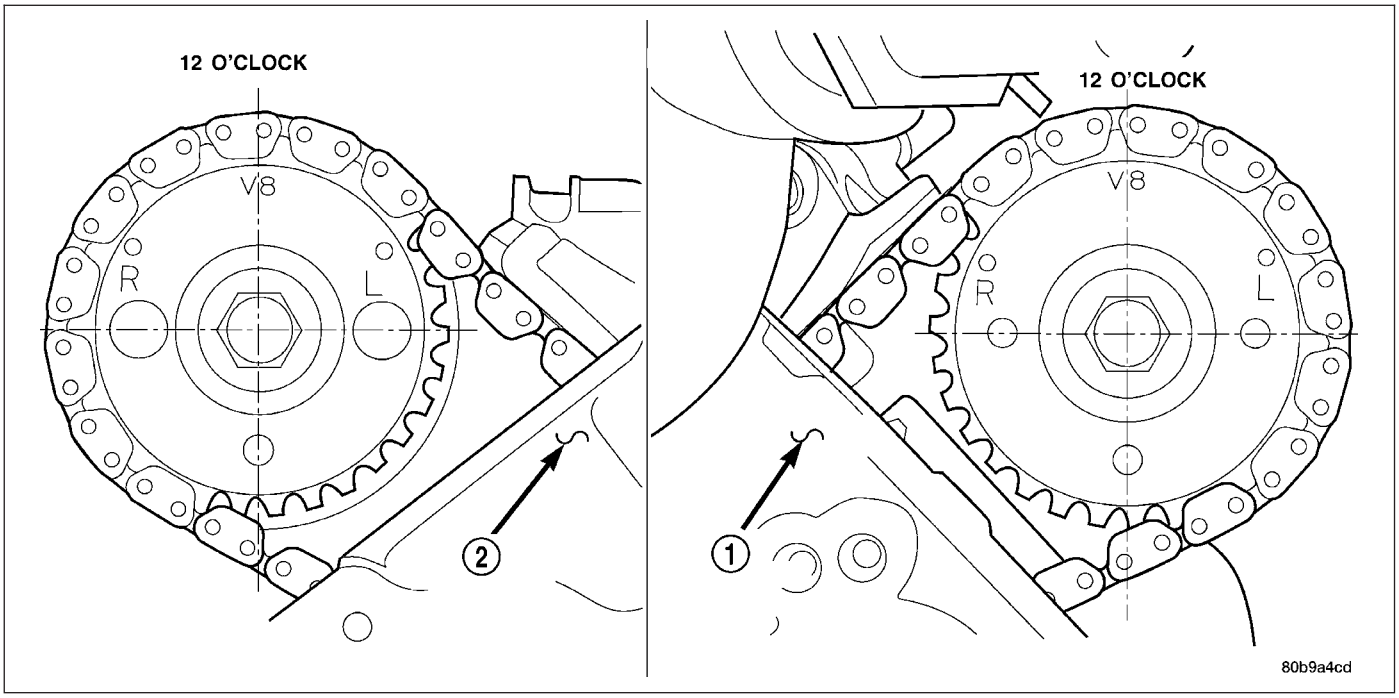
NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.



4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

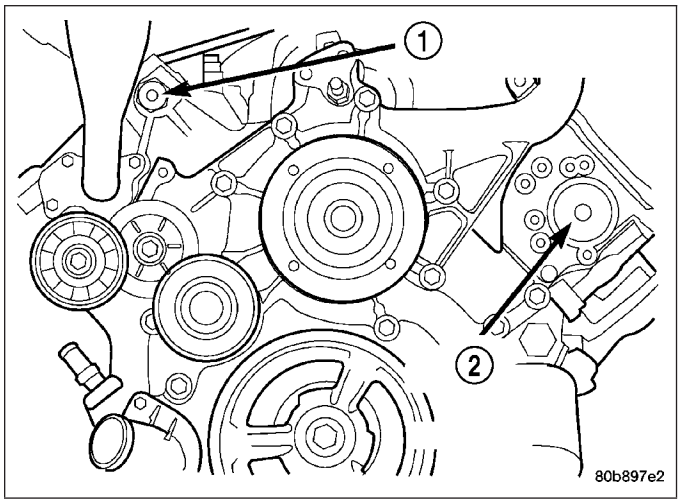
NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
   - Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
   - Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

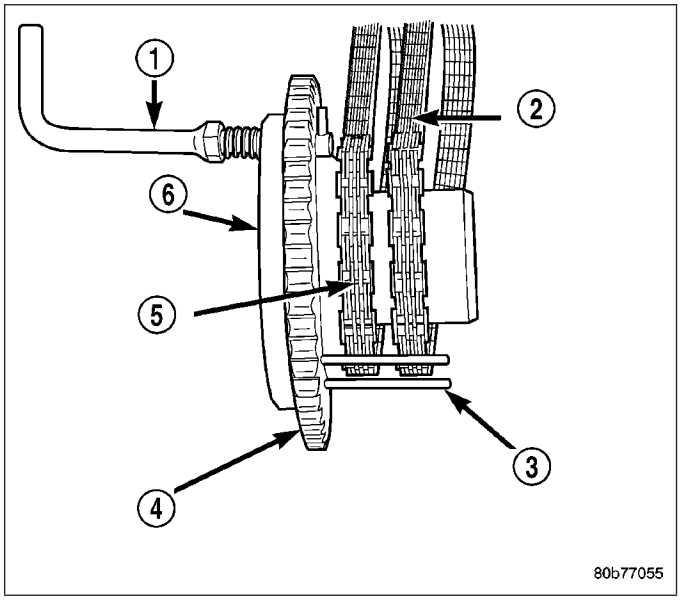


7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the left side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

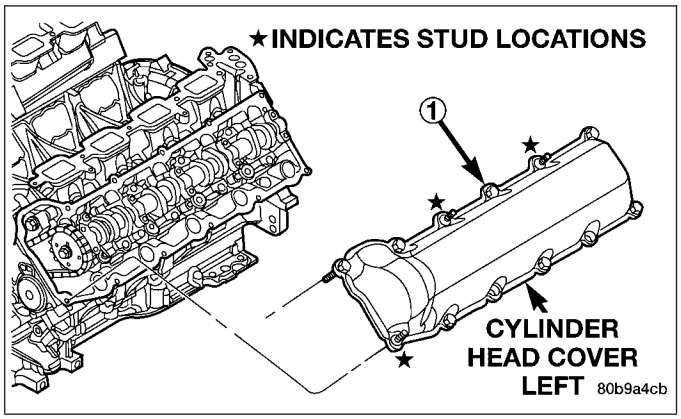
10. Install the cylinder head access plug (2).
11. Re-set and Install the left side secondary chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/ TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).



12. Remove Special Tool 8515 (6).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
15. Install the power steering pump.
16. Install the fan blade assembly and fan shroud (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).



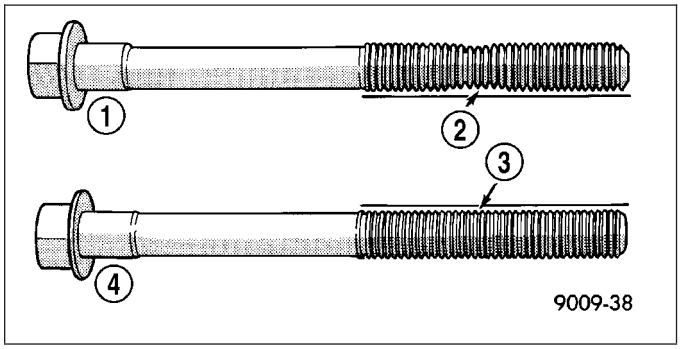
17. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Reinstall the master cylinder and booster assembly. Refer to section 5 brakes.
19. Install the intake manifold (Refer to 9 - ENGINE/ MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the left exhaust manifold.
23. Lower the vehicle.
24. Connect the negative cable to the battery.
25. Start the engine and check for leaks.



INSTALLATION - RIGHT CYLINDER HEAD

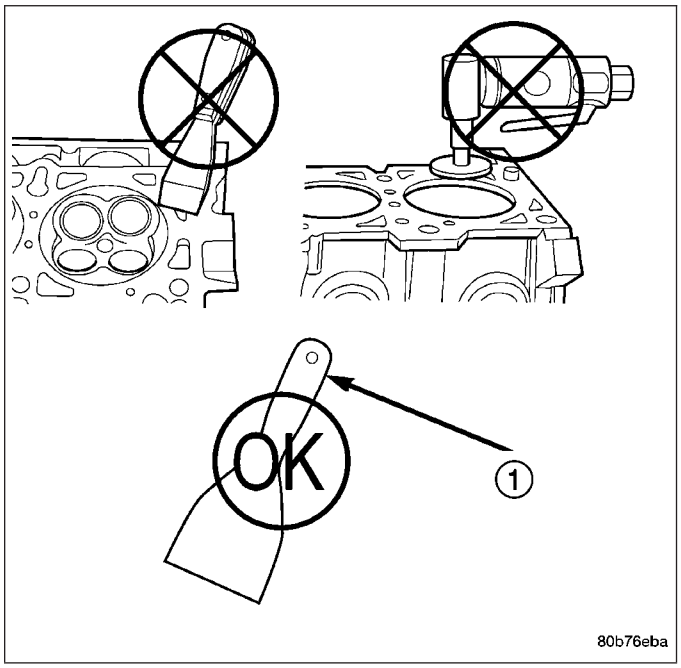
NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down (2) the bolts should be replaced.

Necking (2) can be checked by holding a straight edge against the threads. If all the threads do not contact the scale (2), the bolt should be replaced.



CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper (1).

1. Clean the cylinder head and cylinder block mating surfaces.

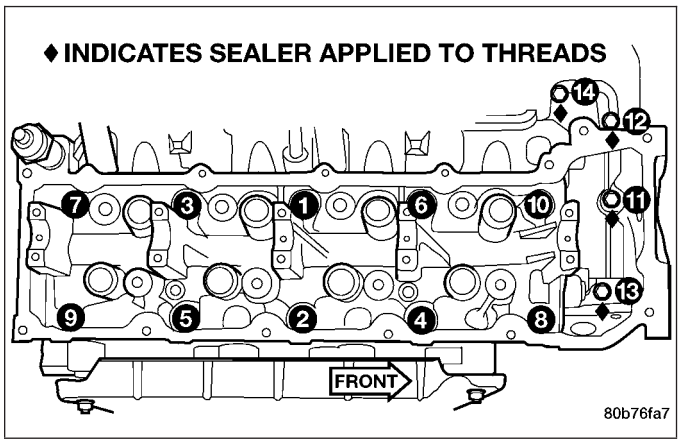


2. Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

3. Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

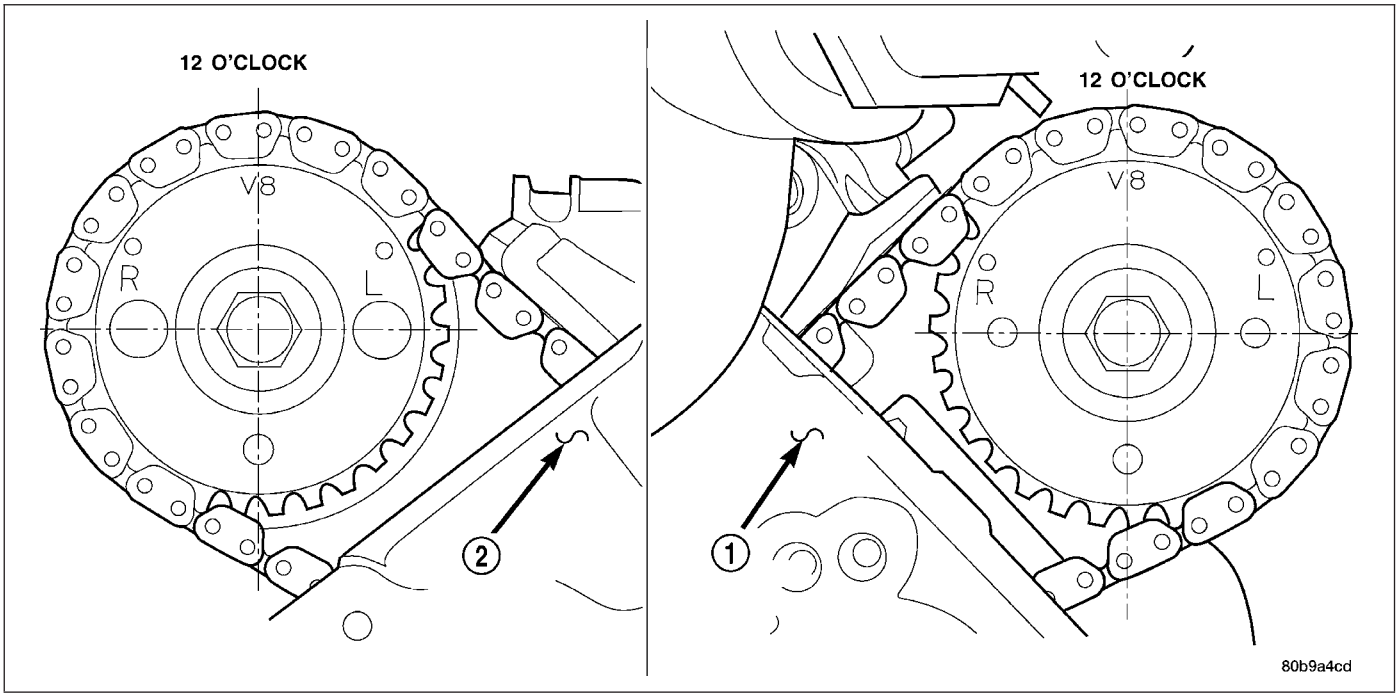
NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.



4. Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.
5. Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

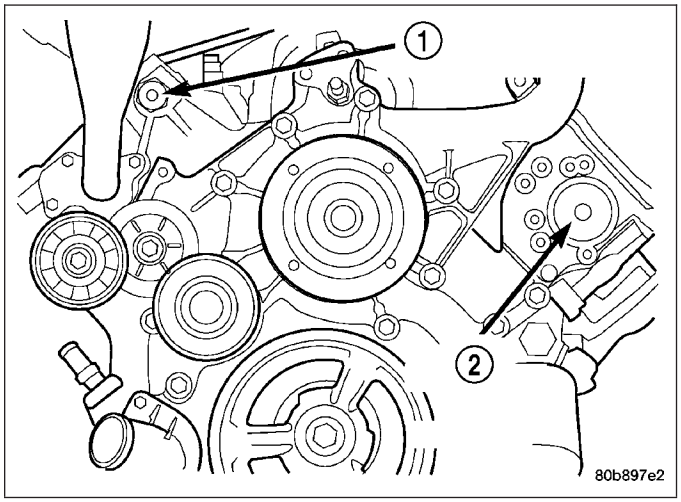
NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

6. Tighten the bolts in sequence using the following steps and torque values:
   - Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
   - Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
   - Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

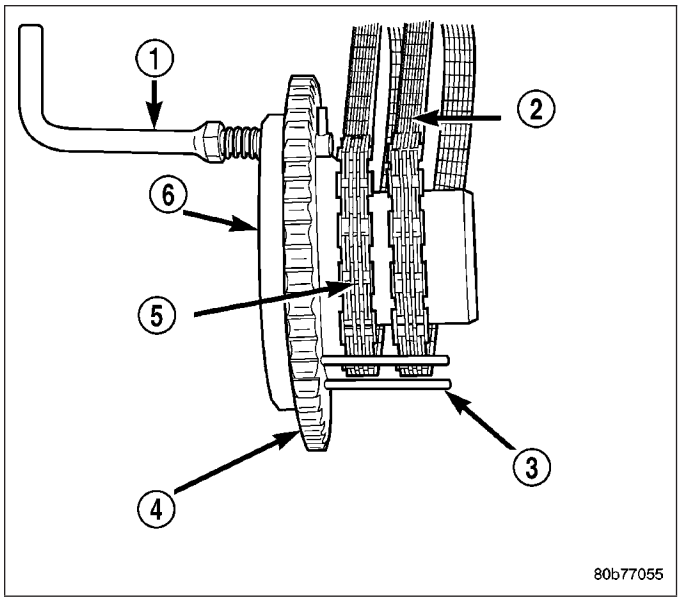


7. Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear (2) and position the gear onto the camshaft.
8. Install the camshaft drive gear retaining bolt.
9. Install the right side secondary chain guide (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

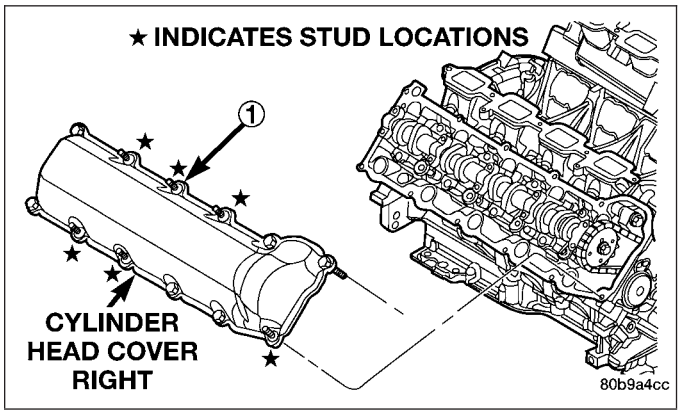
10. Install the right side cylinder head access plug (1).
11. Re-set and install the right side secondary chain tensioner.



12. Remove Special Tool 8515 (6).
13. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
14. Install the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
15. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Install the fan shroud.



17. Install the cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
18. Install the intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
19. Install oil fill housing onto cylinder head.
20. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
21. Raise the vehicle.
22. Install the exhaust pipe onto the right exhaust manifold.
23. Lower the vehicle.
24. Reconnect battery negitive cable.
25. Start the engine and check for leaks.



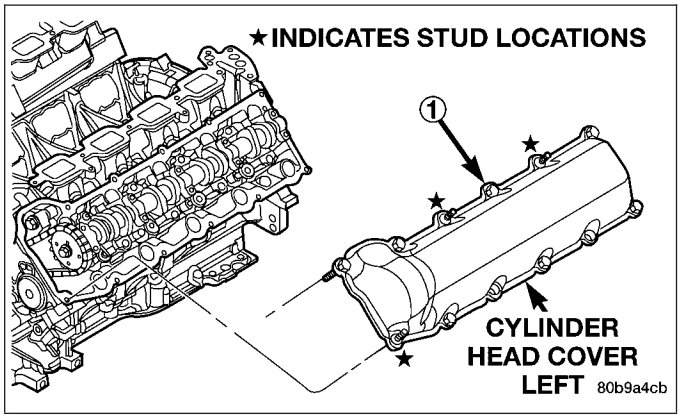
CAMSHAFT - LEFT

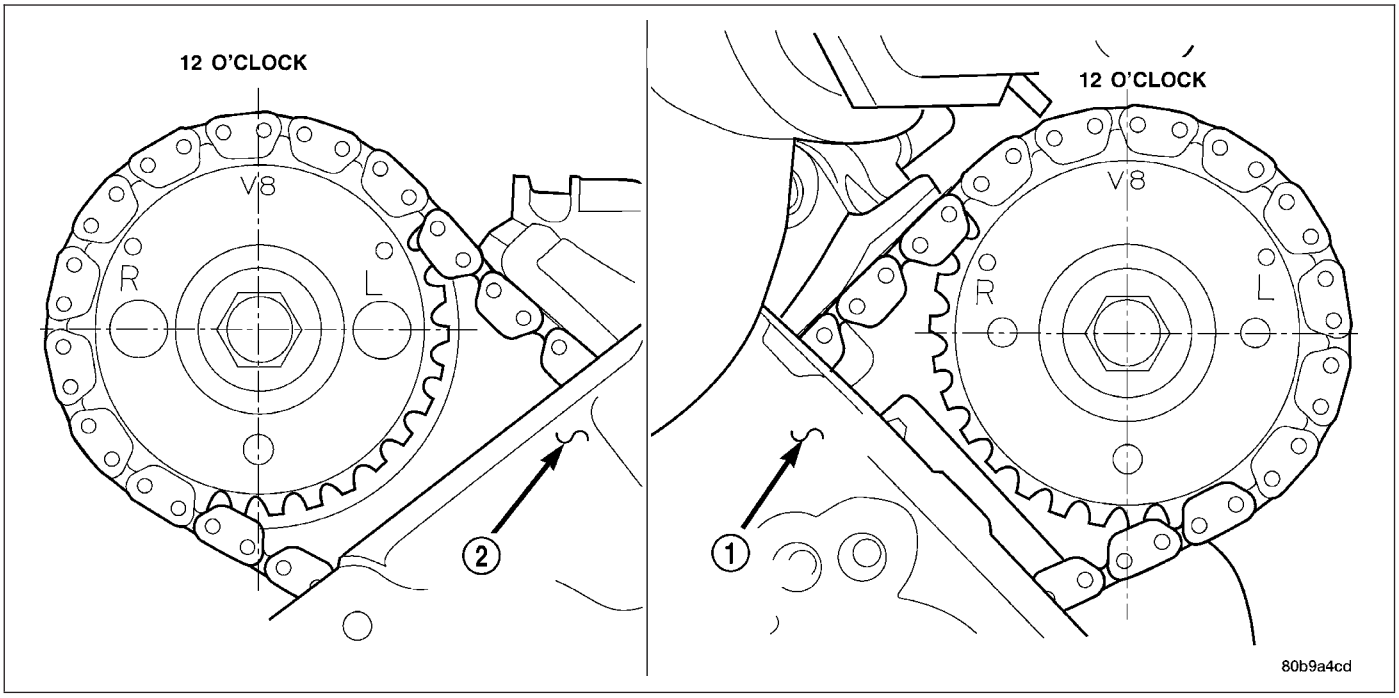
DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

REMOVAL

1. Remove cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).





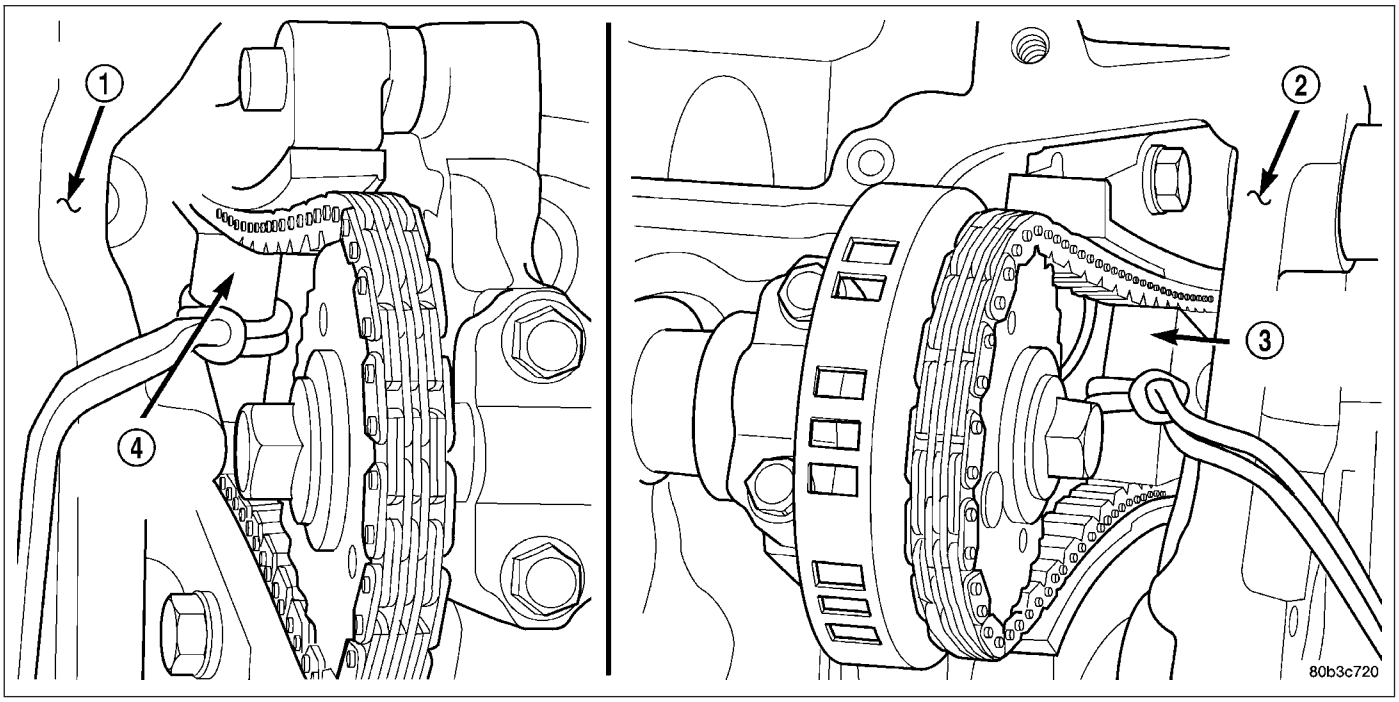
CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8350 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

2. Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position (1).
3. Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.



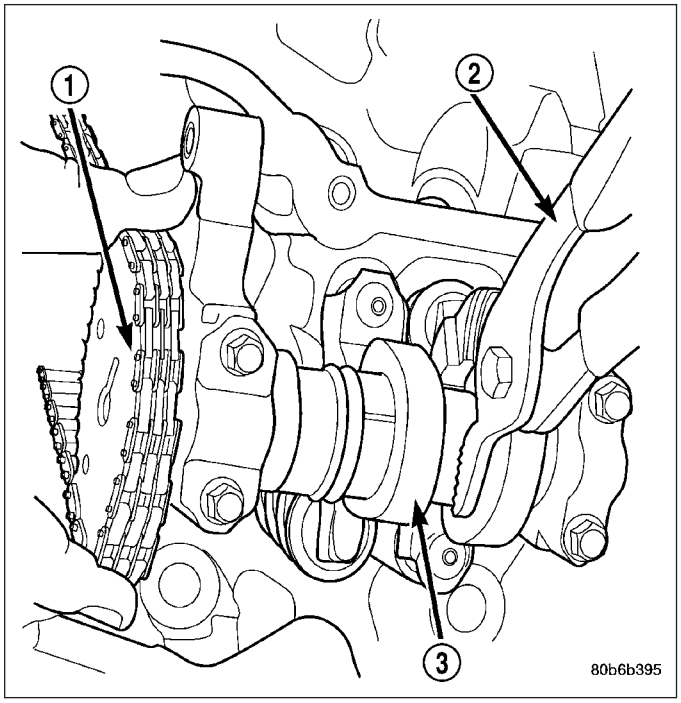
NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

5. Position Special Tool 8350 (4) timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide.

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

6. Hold the camshaft (3) with adjustable pliers (2) while removing the camshaft sprocket bolt and sprocket (1).
7. Using the pliers, gently allow the camshaft to rotate 15° clockwise until the camshaft is in the neutral position (no valve load).

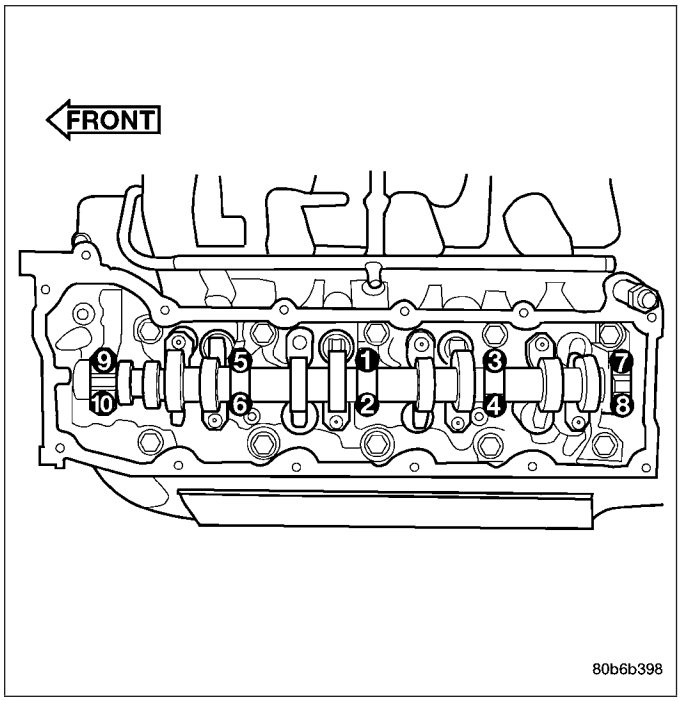


8. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

9. Remove the camshaft bearing caps and the camshaft.

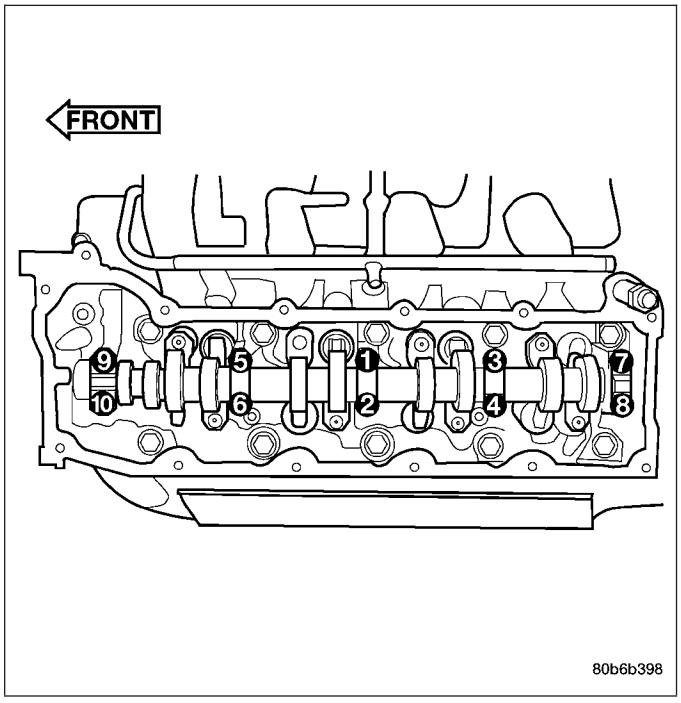


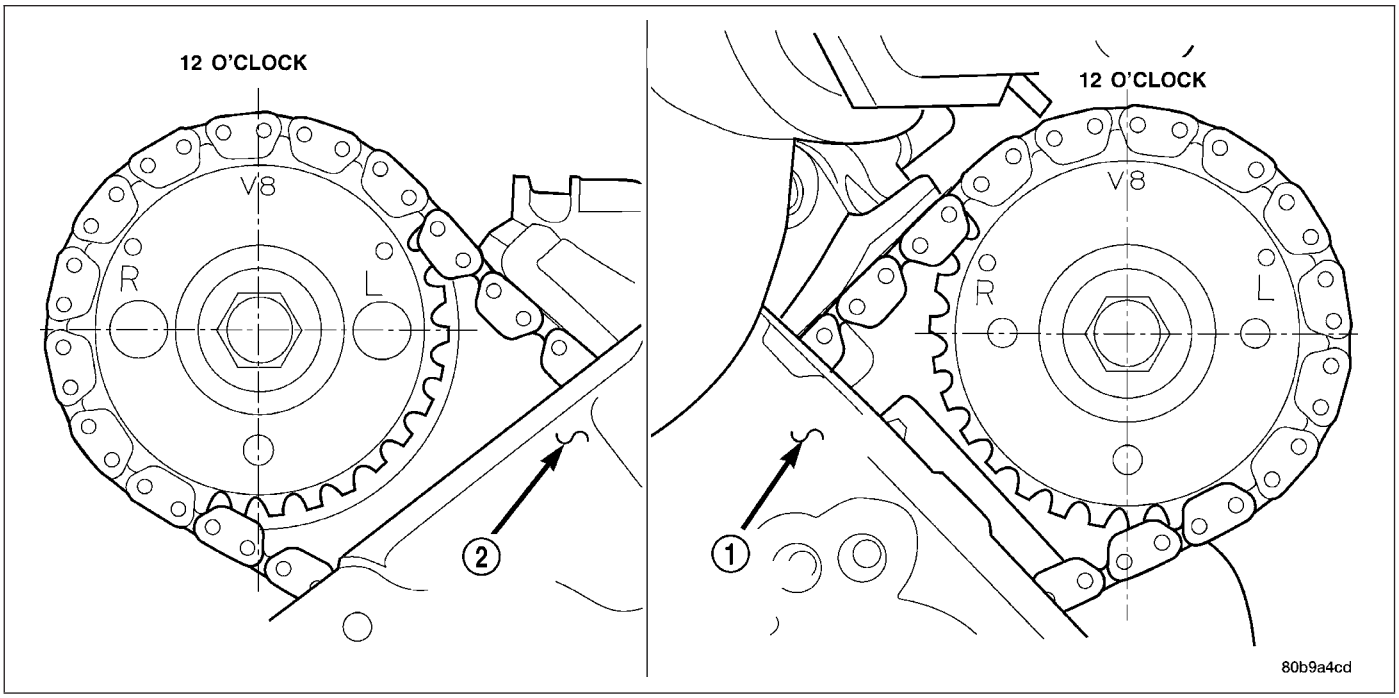
INSTALLATION

1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.
4. Working in ½ turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).





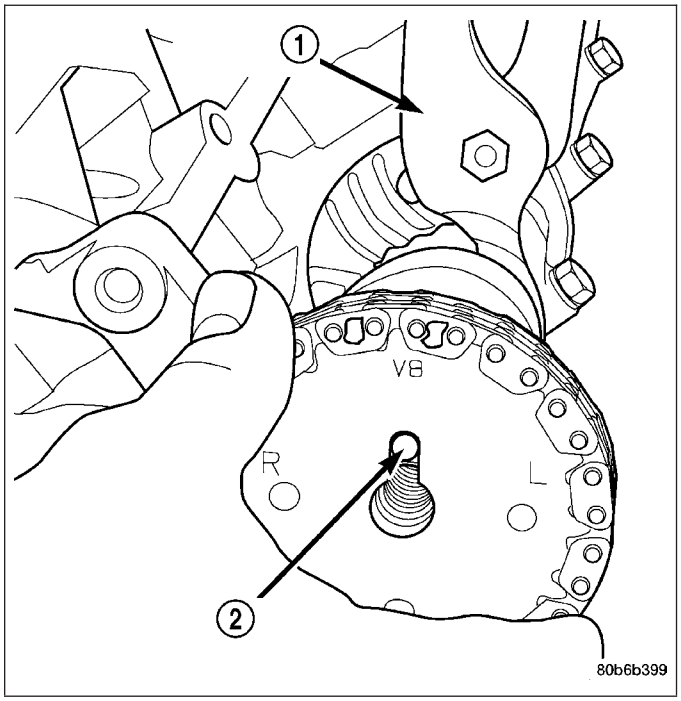
6. Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (1).

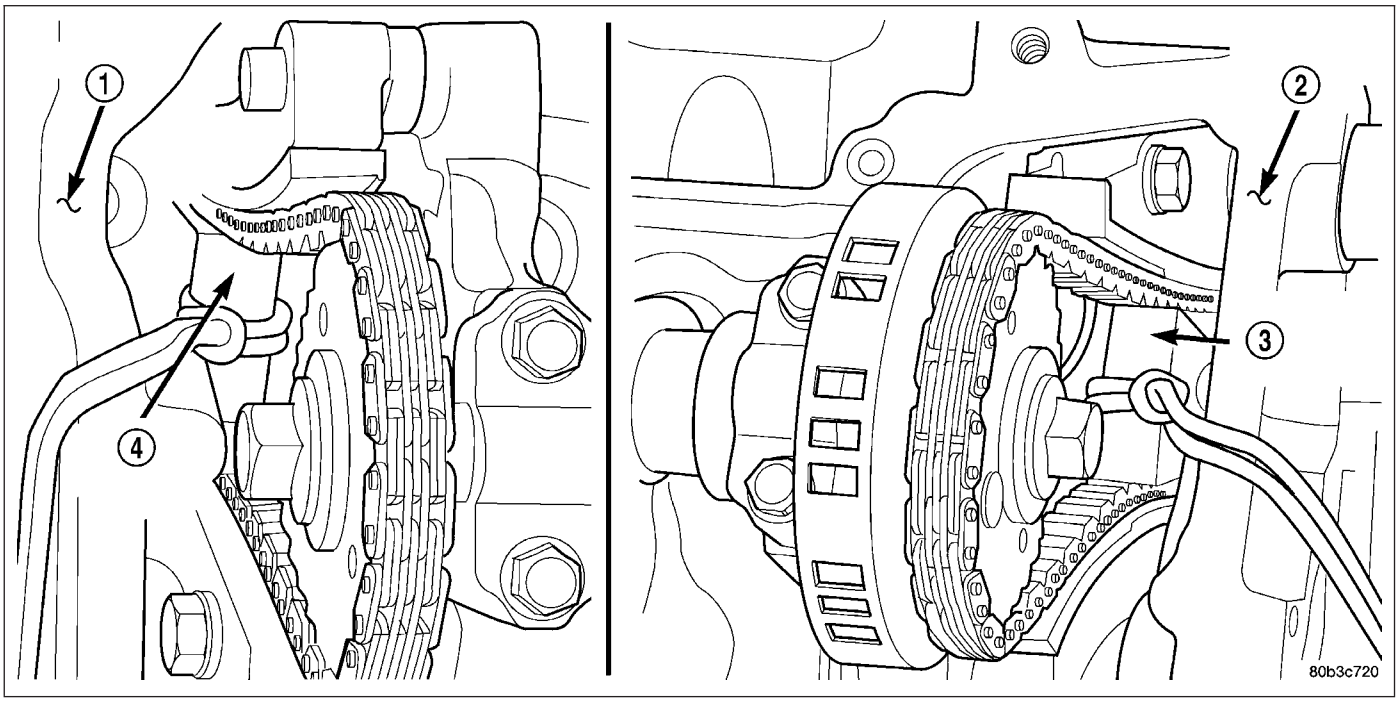
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Using the adjustable pliers (1), rotate the camshaft until the camshaft sprocket dowel (2) is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

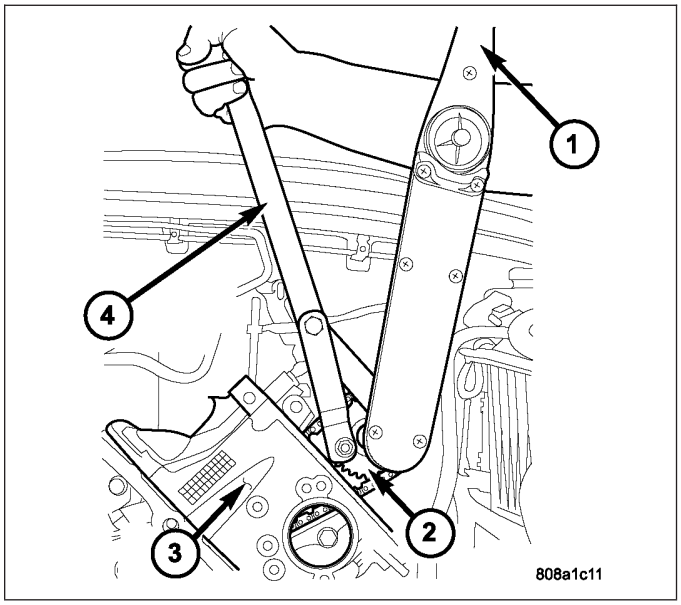
8. Remove excess oil from bolt, then install the camshaft sprocket retaining bolt and hand tighten.



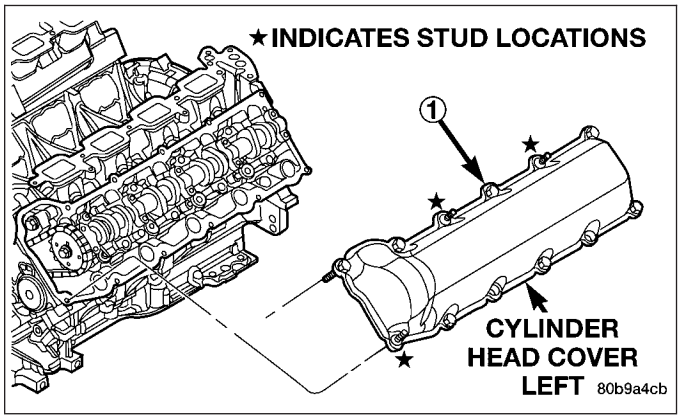


9. Remove Special Tool 8350 timing chain wedge (4).

10. Using Special Tool 6958 spanner wrench (4)with adapter pins 8346, torque the camshaft sprocket retaining bolt (2) to 122 N·m (90 ft. lbs.).



11. Install the cylinder head cover (1).



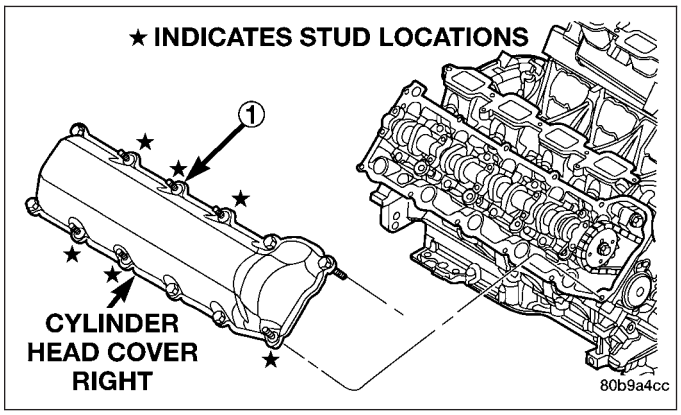
CAMSHAFT - RIGHT

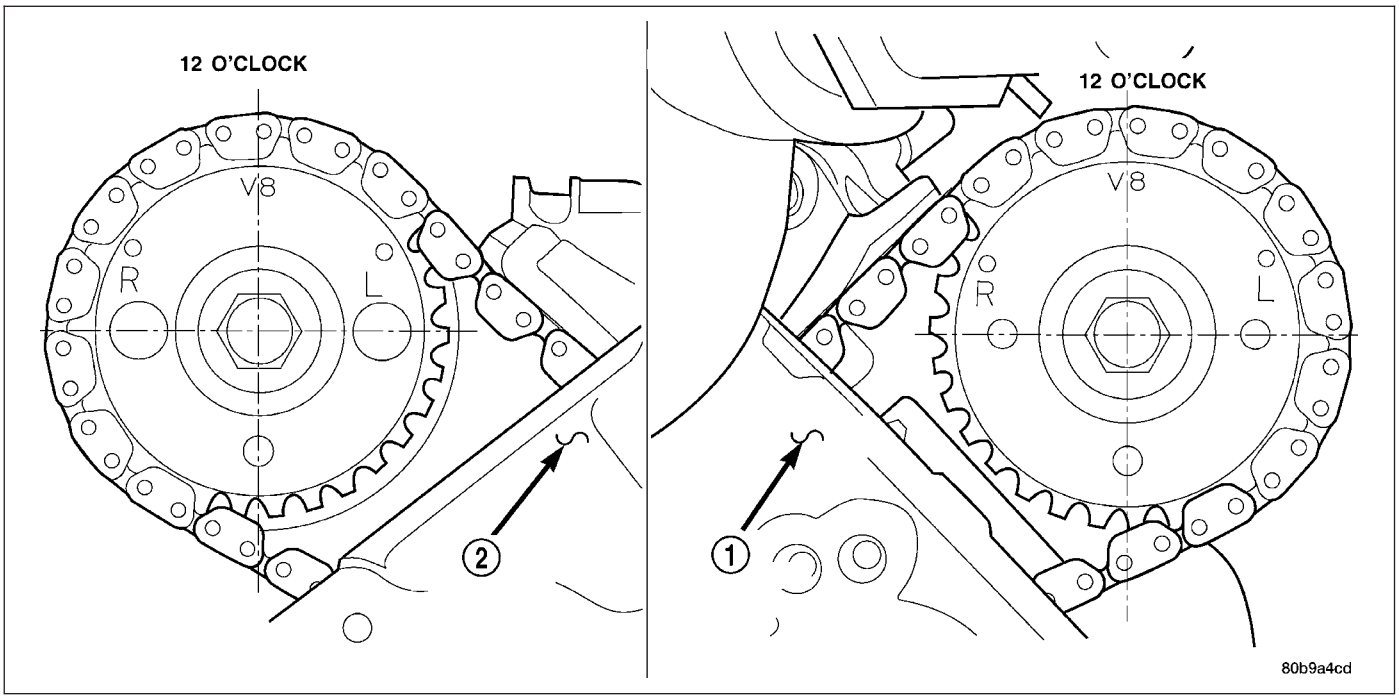
DESCRIPTION

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction-welded to the steel camshaft tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

REMOVAL

1. Remove the cylinder head covers (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).





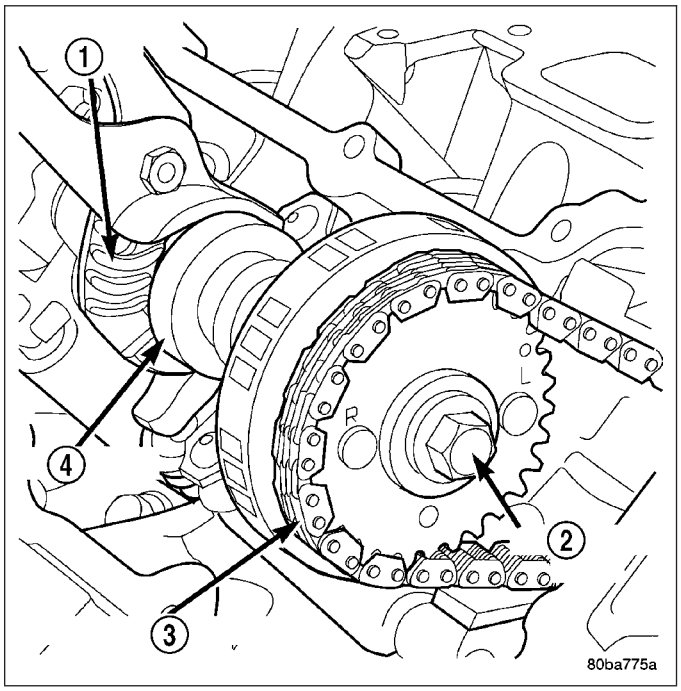
CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

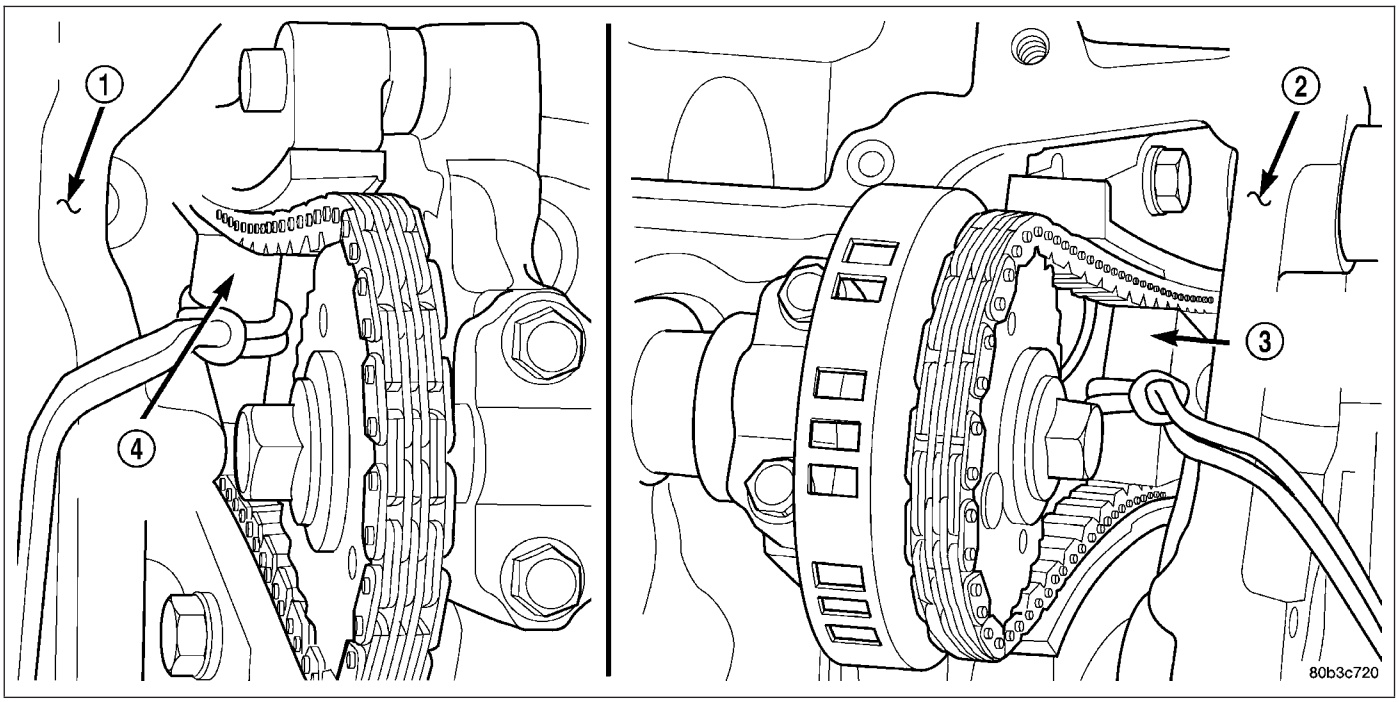
CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8350 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

2. Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.
3. Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket (2) to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

4. Loosen but **DO NOT** remove the camshaft sprocket retaining bolt (2). Leave bolt snug against sprocket (3).



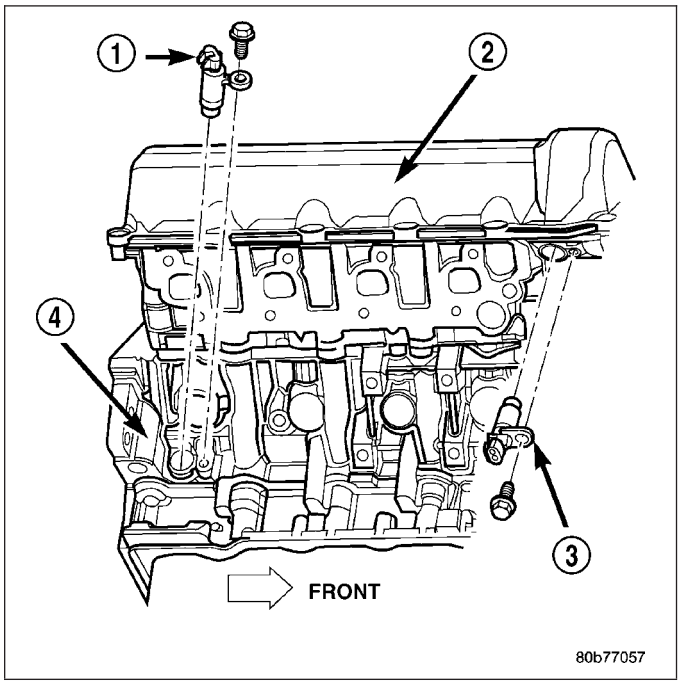


NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge (3) past the narrowest point between the chain strands. Damage to the tensioners may occur.

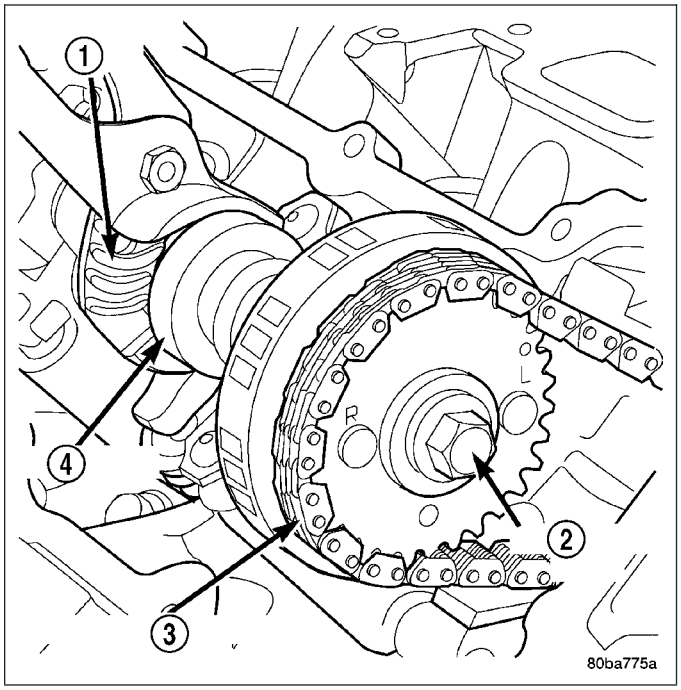
5. Position Special Tool 8350 timing chain wedge (3) between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide.

6. Remove the camshaft position sensor (1).



NOTE: When gripping the camshaft, place the pliers (1) on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Hold the camshaft with adjustable pliers (1) while removing the camshaft sprocket bolt (2)and sprocket (3).
8. Using the pliers (1), gently allow the camshaft to rotate 45° counter-clockwise until the camshaft is in the neutral position (no valve load).

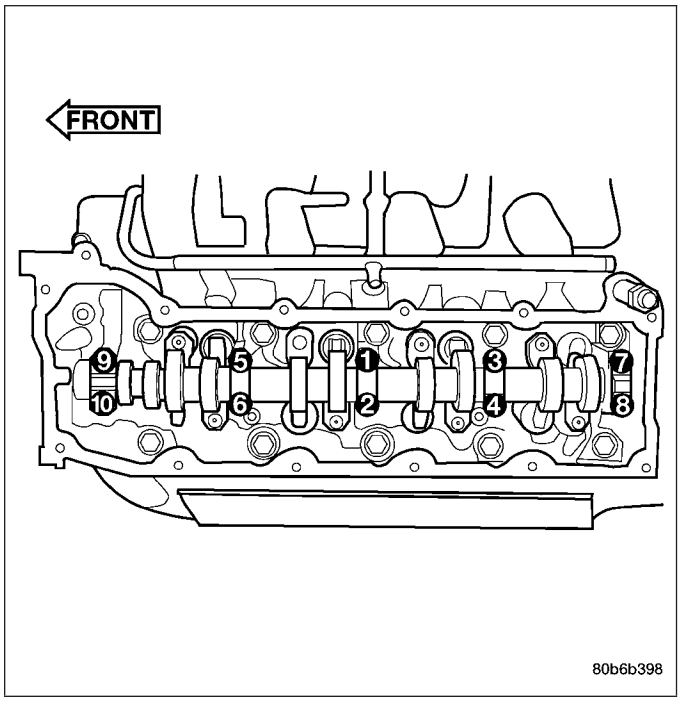


9. Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

10. Remove the camshaft bearing caps and the camshaft.

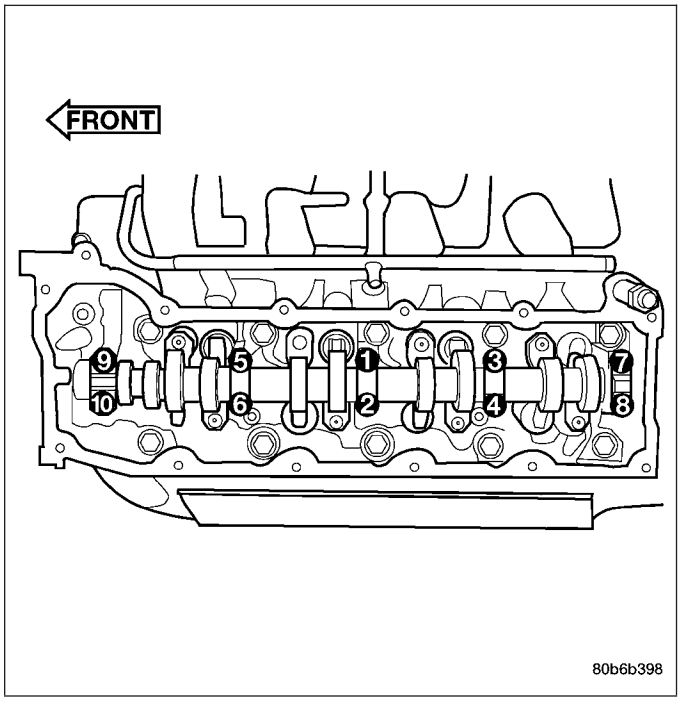


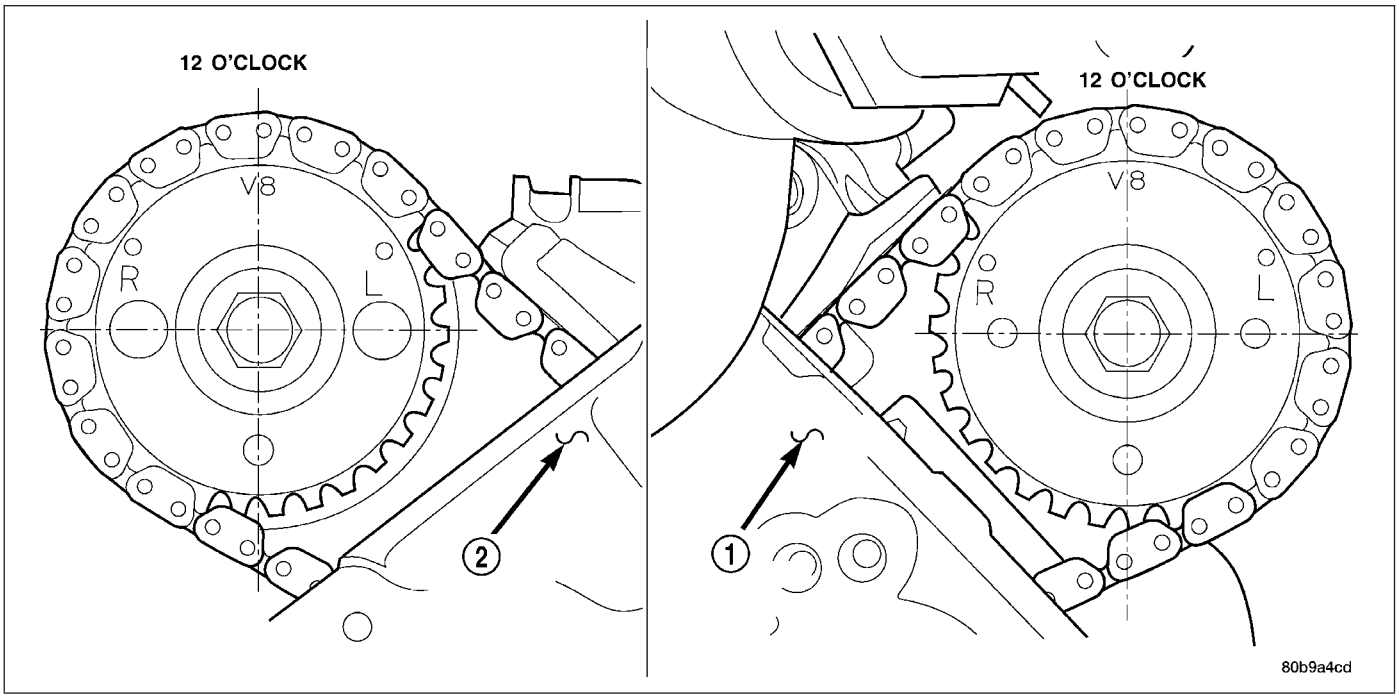
INSTALLATION

1. Lubricate camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

2. Position the camshaft into the cylinder head.
3. Install the camshaft bearing caps, hand tighten the retaining bolts.
4. Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward.
5. Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).





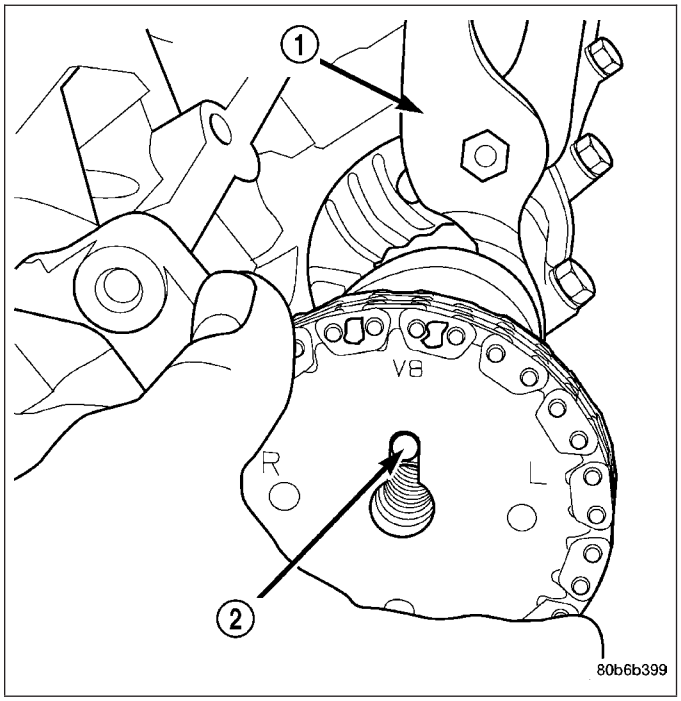
6. Position the camshaft drive gear into the timing chain aligning the V8 mark (2) between the two marked chain links (Two links marked during removal).

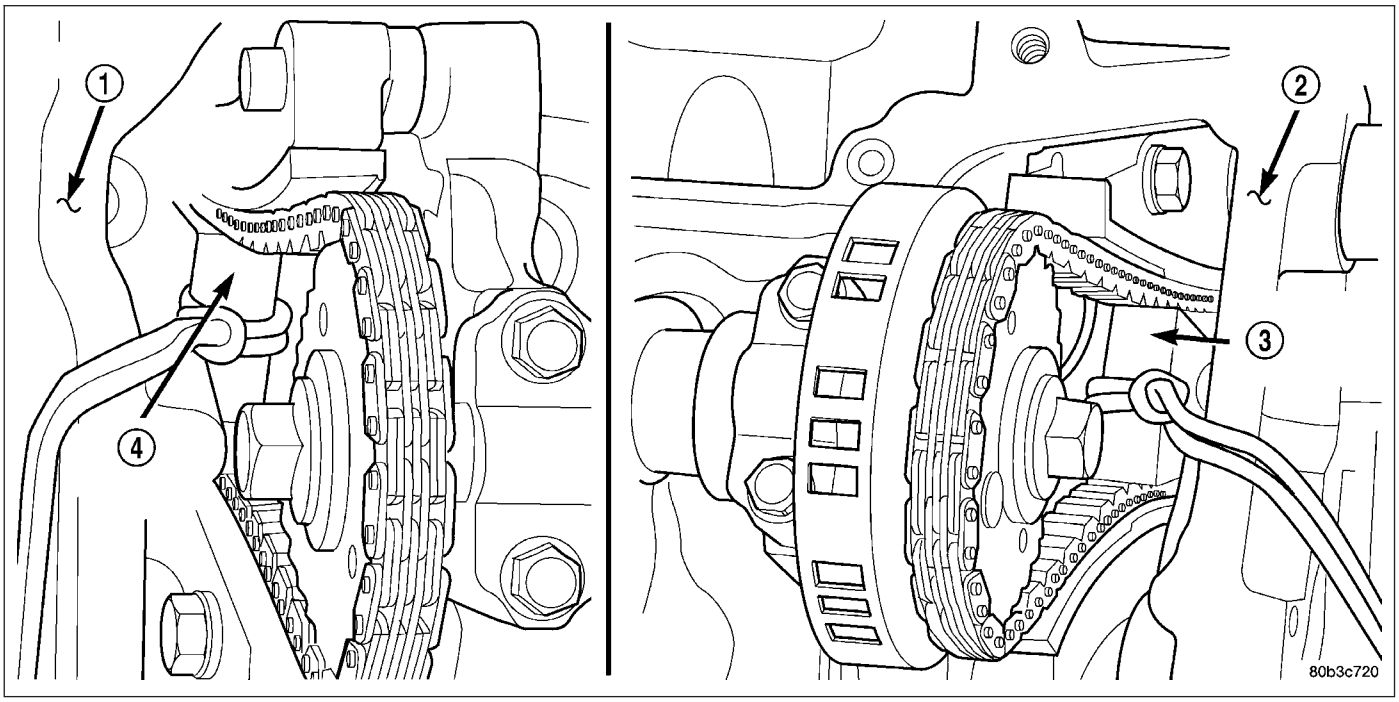
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

7. Using the adjustable pliers (1), rotate the camshaft until the camshaft sprocket dowel (2) is aligned with the slot in the camshaft sprocket (2). Install the sprocket onto the camshaft.

CAUTION: Remove excess oil from camshaft sprocket bolt. Failure to do so can cause bolt over-torque resulting in bolt failure.

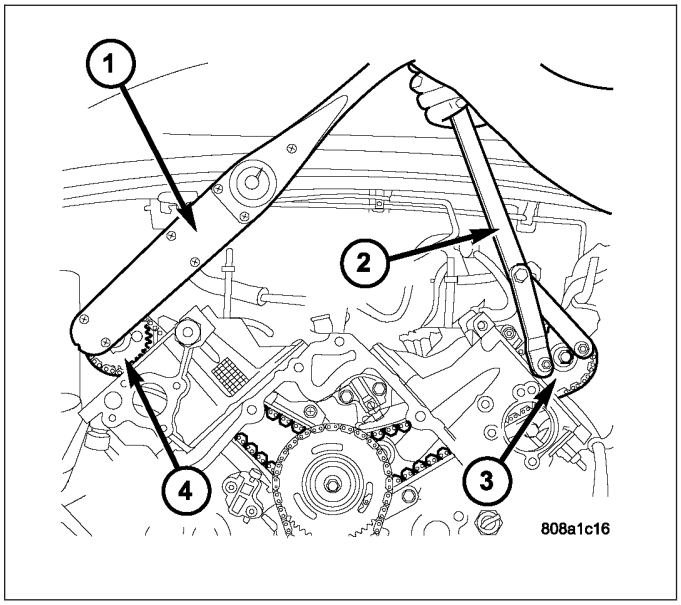
8. Remove excess oil from camshaft sprocket bolt, then install the camshaft sprocket retaining bolt and hand tighten.



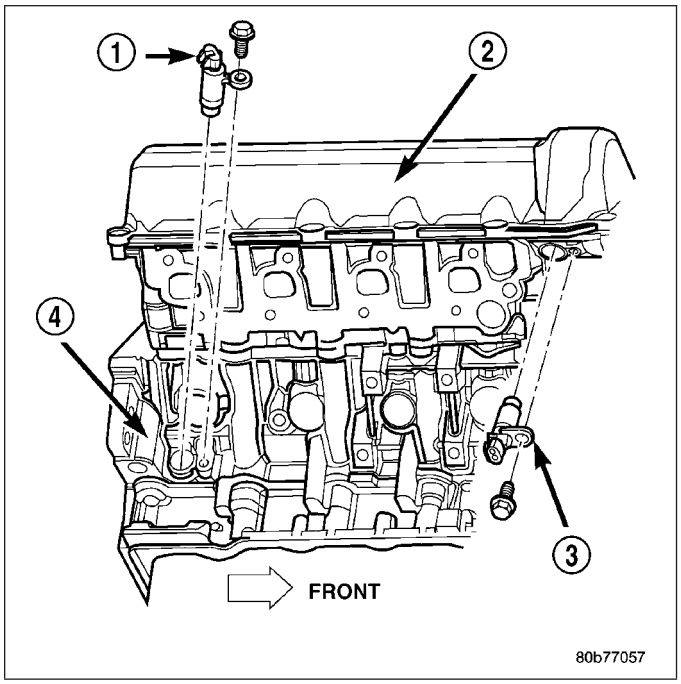


9. Remove timing chain wedge special tool 8350 (3).

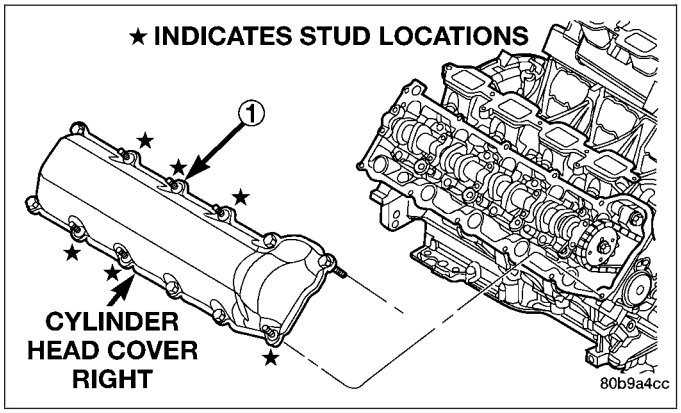
10. Using Special Tool 6958 spanner wrench with adapter pins 8346 (2), torque the camshaft sprocket retaining bolt (4) to 122 N·m (90 ft. lbs.).



11. Install the camshaft position sensor.



12. Install the cylinder head cover (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



COVER - CYLINDER HEAD

DESCRIPTION

The cylinder head covers are made of injection molded thermo-set plastic, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

REMOVAL

REMOVAL - RIGHT SIDE

1. Disconnect battery negative cable.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
5. Remove air conditioning compressor retaining bolts and move compressor to the left.
6. Remove heater hoses.
7. Disconnect injector and ignition coil connectors.
8. Disconnect and remove positive crankcase ventilation (PCV) hose.

9. Remove oil fill tube.
10. Un-clip injector and ignition coil harness and move away from cylinder head cover.
11. Remove right rear breather tube and filter assembly.
12. Remove cylinder head cover retaining bolts.
13. Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

REMOVAL - LEFT SIDE

1. Disconnect negative cable from battery.
2. Remove the resonator assemble and air inlet hose.
3. Disconnect injector connectors and un-clip the injector harness.
4. Route injector harness in front of cylinder head cover.
5. Disconnect the left side breather tube and remove the breather tube.
6. Remove the cylinder head cover mounting bolts.
7. Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

CLEANING

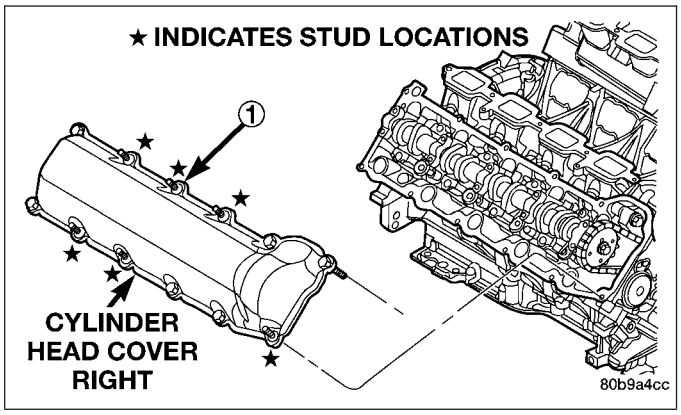
Clean cylinder head cover gasket surface.

Clean head rail, if necessary.

INSTALLATION

INSTALLATION - RIGHT SIDE

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

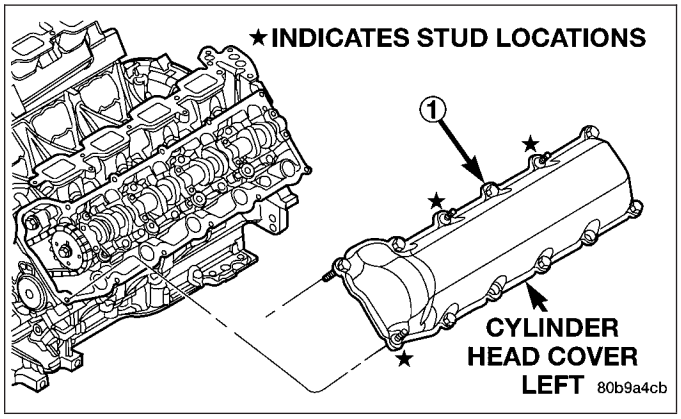


1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners (1). Verify that all double ended studs are in the correct location shown in.
3. Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).
4. Install right rear breather tube and filter assembly.
5. Connect injector, ignition coil electrical connectors and harness retaining clips.
6. Install the oil fill tube.
7. Install PCV hose.
8. Install heater hoses.
9. Install air conditioning compressor retaining bolts.
10. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Fill Cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
12. Install air cleaner assembly, resonator assembly and air inlet hose.
13. Connect battery negative cable.

INSTALLATION - LEFT SIDE

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

1. Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.
2. Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location shown in.
3. Tighten cylinder head cover bolts (1) and double ended studs to 12 N·m (105 in. lbs.).
4. Install left side breather and connect breather tube.
5. Connect injector electrical connectors and injector harness retaining clips.
6. Install the resonator and air inlet hose.
7. Connect negative cable to battery.



VALVES & SEATS - INTAKE/EXHAUST

DESCRIPTION

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

REMOVAL

NOTE: The cylinder heads must be removed in order to perform this procedure.

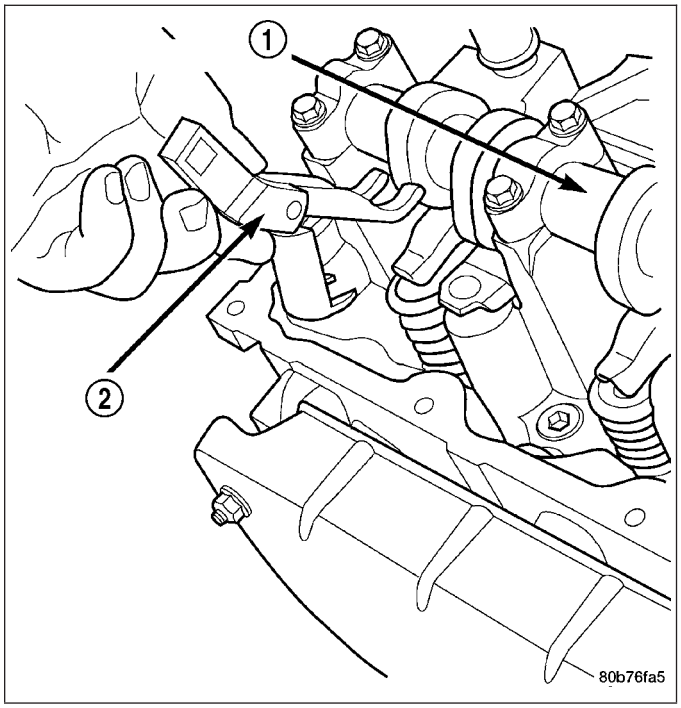
1. Remove rocker arms and lash adjusters (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL).
2. Remove the camshaft bearing caps and the camshaft.

NOTE: All six valve springs and valves are removed in the same manner; this procedure only covers one valve and valve spring.

3. Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

4. Remove the two spring retainer lock halves.



NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

5. Remove the valve spring compressor.

6. Remove the spring retainer, and the spring.

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

7. Remove the valve from the cylinder head.

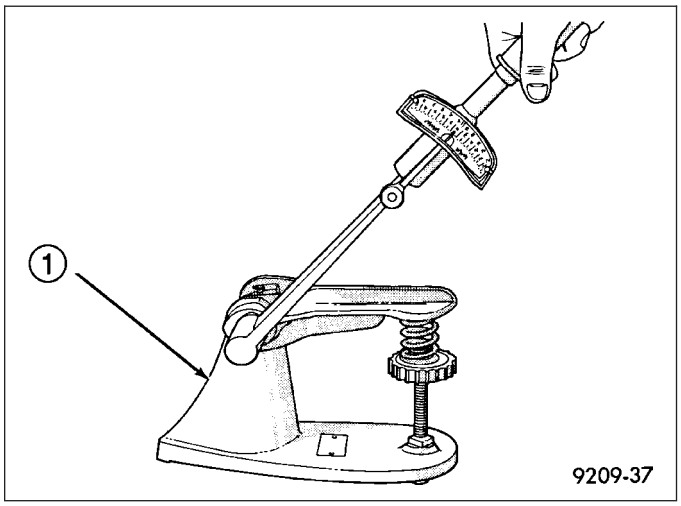
NOTE: The valve stem seals are common between intake and exhaust.

8. Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

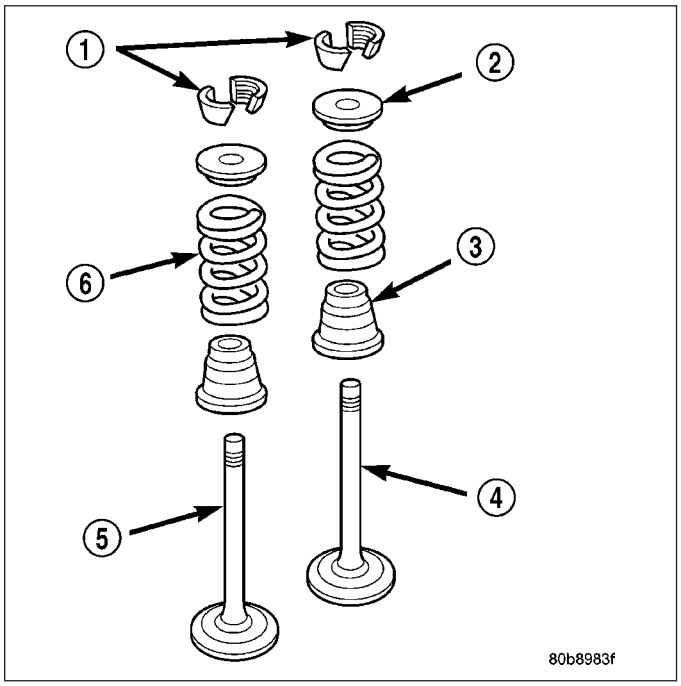
NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 (1) until surface is in line with the 40.12 mm (1.579 in.) mark on the threaded stud and the zero mark on the front. Place spring over the stud on the table and lift compressing lever to set tone device. Pull on torque wrench until a Ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications.

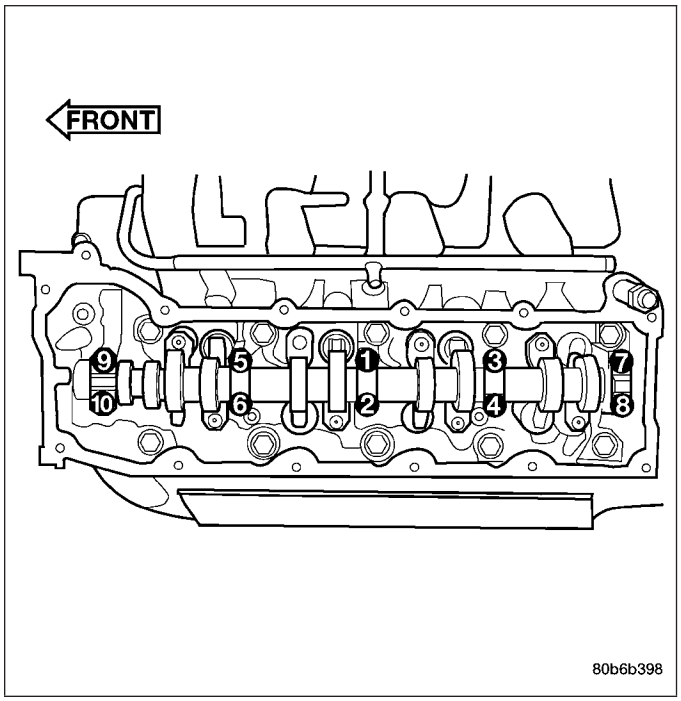


INSTALLATION

1. Coat the valve stem with clean engine oil and insert it into the cylinder head.
2. Install the valve stem seal (3). make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
3. Install the spring (6) and the spring retainer (2).
4. Using the valve spring compressor, compress the spring (6) and install the two valve locks (1).
5. Release the valve spring compressor and make sure the two valve locks and the spring retainer are fully seated.



6. lubricate the camshaft journal with clean engine oil then Position the camshaft (with the sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.
7. Install the camshaft bearing cap retaining bolts. Tighten the bolts 9–13 N·m (100 in. lbs.) in ½ turn increments in the sequence shown.
8. Position the hydraulic lash adjusters and rocker arms.



ROCKER ARM - VALVE

DESCRIPTION

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

DIAGNOSIS AND TESTING - HYDRAULIC LASH ADJUSTER

A tappet-like noise may be produced from several items. Check the following items.

1. Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
2. Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
3. Turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
4. Low oil pressure.
5. The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.
6. Air ingested into oil due to broken or cracked oil pump pick up.
7. Worn valve guides.
8. Rocker arm ears contacting valve spring retainer.
9. Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
10. Oil leak or excessive cam bore wear in cylinder head.
11. Faulty lash adjuster.

    a. Check lash adjusters for sponginess while installed in cylinder head and cam on camshaft at base circle. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

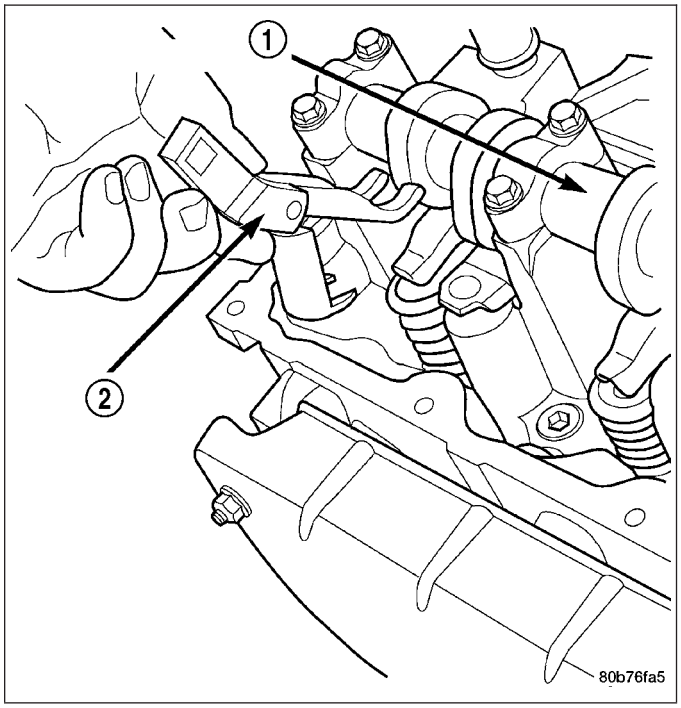
    b. Remove suspected lash adjusters, and replace.

    c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
3. For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
4. For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
5. For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
6. Using special tool 8516 Rocker Arm Remover (2), press downward on the valve spring, remove rocker arm.



INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

NOTE: Coat the rocker arms with clean engine oil prior to installation.

1. For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.
2. For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.
3. For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.
4. For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.
5. Using special tool 8516 press downward on the valve spring, install rocker arm.
6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

SPRINGS-VALVE

DESCRIPTION

The valve springs are made from high strength chrome silicon steel. The springs are common for intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

REMOVAL

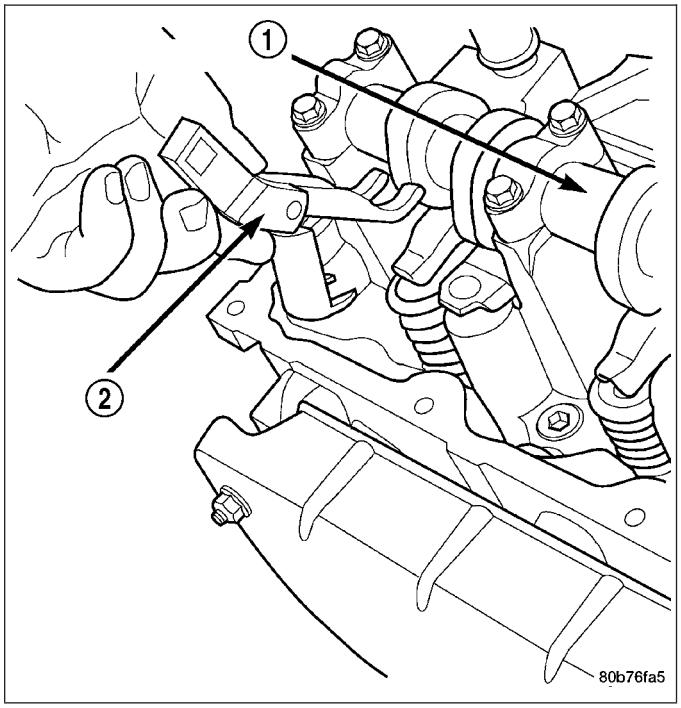
1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Using Special Tool 8516 Rocker Arm Remover (2), remove the rocker arms and the hydraulic lash adjusters.
3. Remove the spark plug for the cylinder the valve spring and seal are to be removed from.
4. Apply shop air to the cylinder to hold the valves in place when the spring is removed

NOTE: All eight valve springs and seals are removed in the same manner; this procedure only covers one valve seal and valve spring.

5. Using Special Tool 8387 Valve Spring Compressor, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

6. Remove the two spring retainer lock halves.



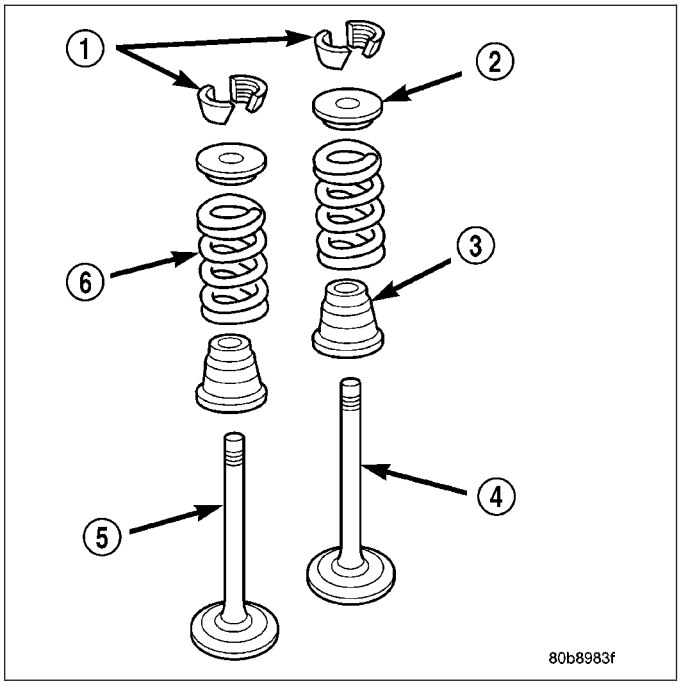
NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

7. Remove the valve spring compressor.
8. Remove the spring retainer, and the spring.
9. Remove the valve stem seal.

NOTE: The valve stem seals are common between intake and exhaust.

INSTALLATION

1. Coat the valve stem with clean engine oil and install the valve stem seal. Make sure the seal is fully seated and that the garter spring at the top of the seal is intact.
2. Install the spring (6) and the spring retainer (2).
3. Using Special Tool 8387 Valve Spring Compressor, compress the spring and install the two valve spring retainer halves.
4. Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.
5. Position the hydraulic lash adjusters and rocker arms.
6. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



SEALS-VALVE GUIDE

DESCRIPTION

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

ENGINE BLOCK

DESCRIPTION

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant bypass to a single poppet inlet thermostat is included in the cast aluminum front cover.

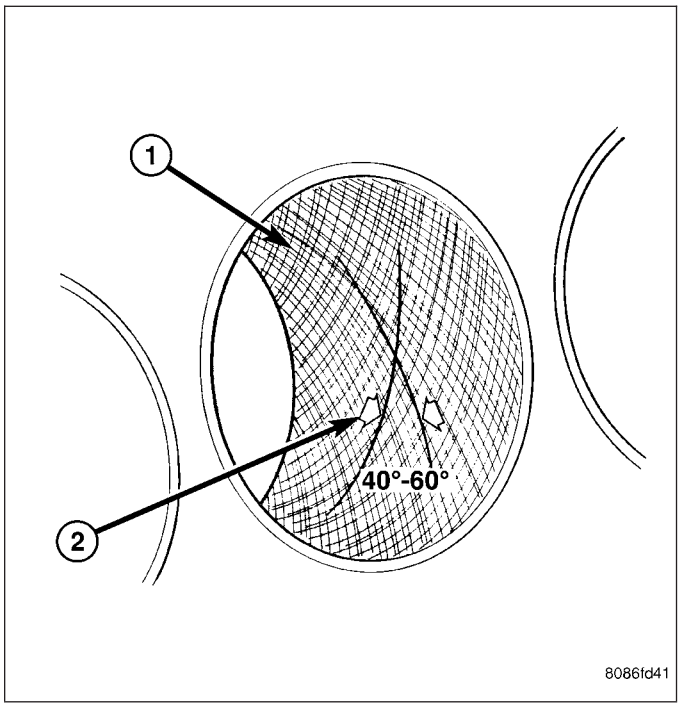
STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.



CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern (1). The hone marks should INTERSECT at 50° to 60° for proper seating of rings (2).
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

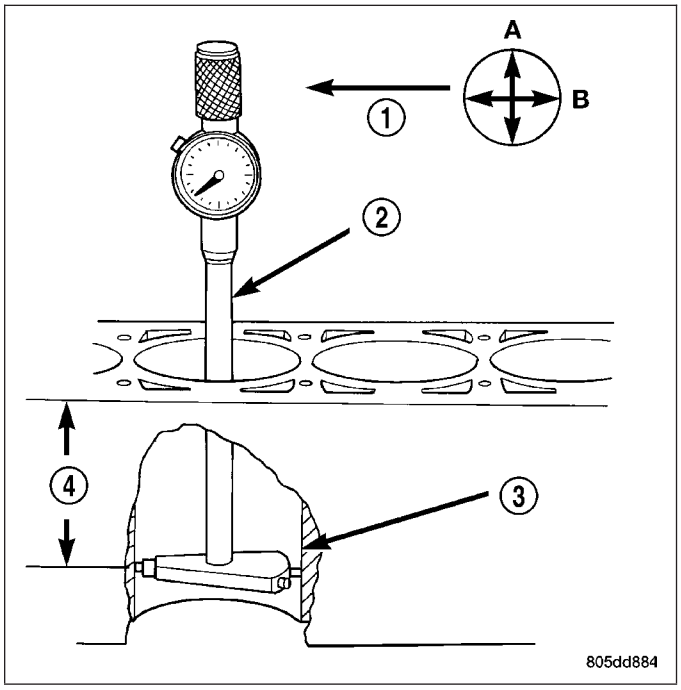
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.

- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the 1/4 inch NPT plugs to 20 N·m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N·m (240 in. lbs.) torque.

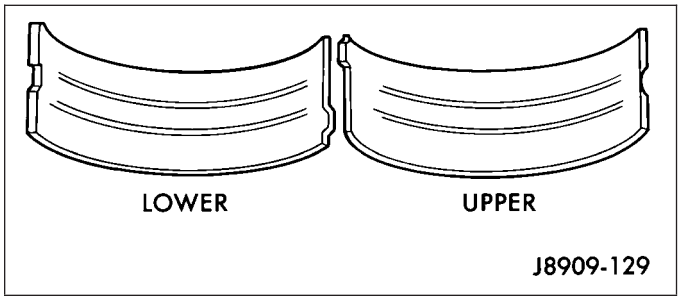
INSPECTION



1. It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.
7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

BEARINGS - CONNECTING ROD

STANDARD PROCEDURE - CONNECTING ROD BEARING FITTING



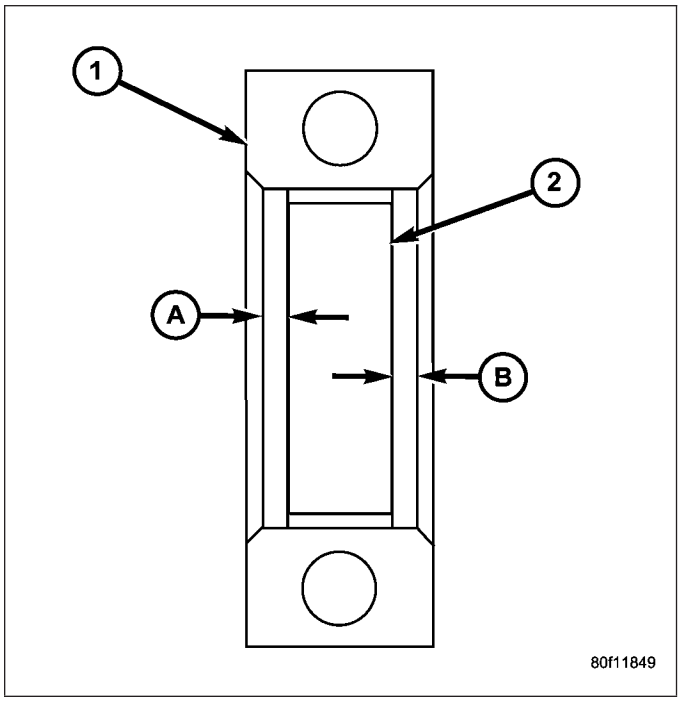
Inspect the connecting rod bearings for scoring. Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting. Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

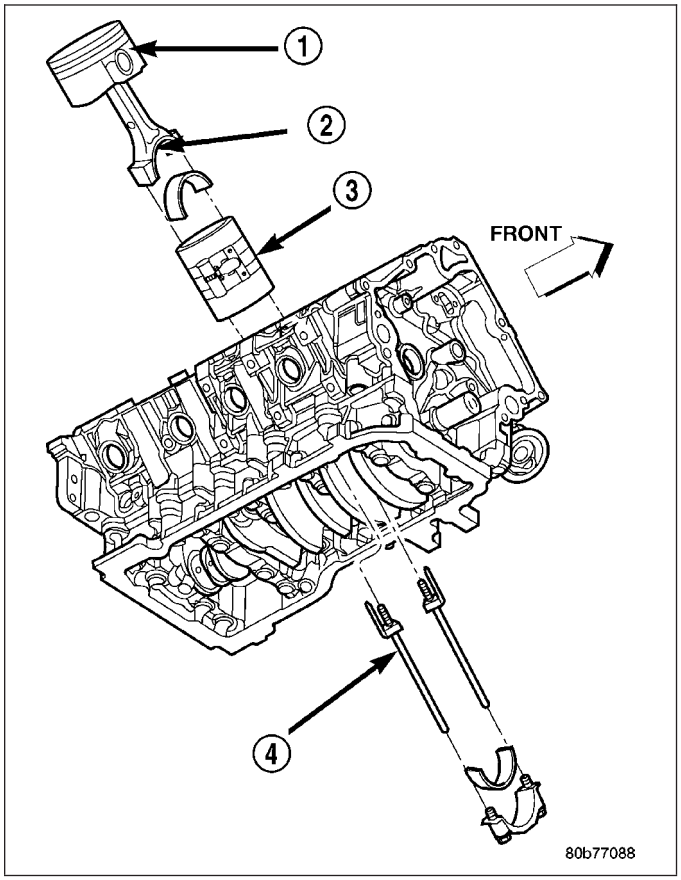
Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft connecting rod journals. If wear patterns or damage to any of these components indicate the probability of a misaligned connecting rod, inspect it for correct rod alignment. Replace misaligned, bent or twisted connecting rods.

1. Wipe the oil from the connecting rod journal.

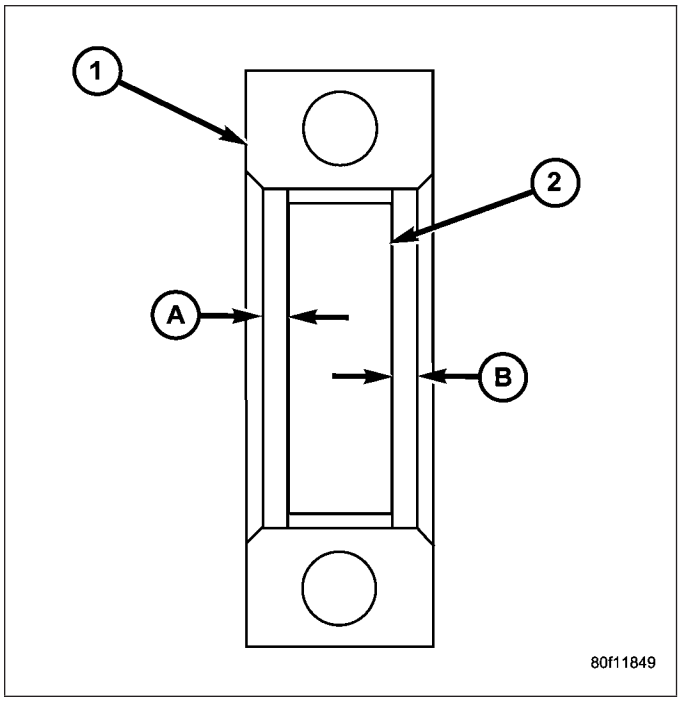
2. Lubricate the upper bearing insert (2) and install in connecting rod (1). **Center bearing insert (2) in connecting rod.**



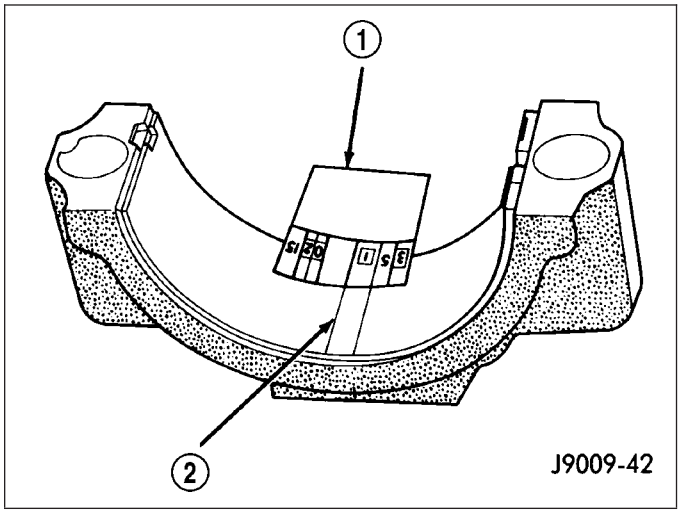
3. Use piston ring compressor (3) and Guide Pins Special Tool 8507 (4) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s near the piston wrist pin bore should point to the front of the engine.



4. Install the lower bearing insert in the bearing cap **Center bearing insert (2) in connecting rod (1).**. The lower insert must be dry. Place strip of Plastigage across full width of the lower insert at the center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.



5. Install bearing cap and connecting rod on the journal and tighten bolts to 27 N·m (20 ft. lbs.) plus a 90° turn. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.
6. Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (2). Refer to Engine Specifications for the proper clearance. **Plastigage should indicate the same clearance across the entire width of the insert. If the clearance varies, it may be caused by either a tapered journal, bent connecting rod or foreign material trapped between the insert and cap or rod.**
7. If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove the Plastigage (2) from crankshaft journal and bearing insert. Proceed with installation.



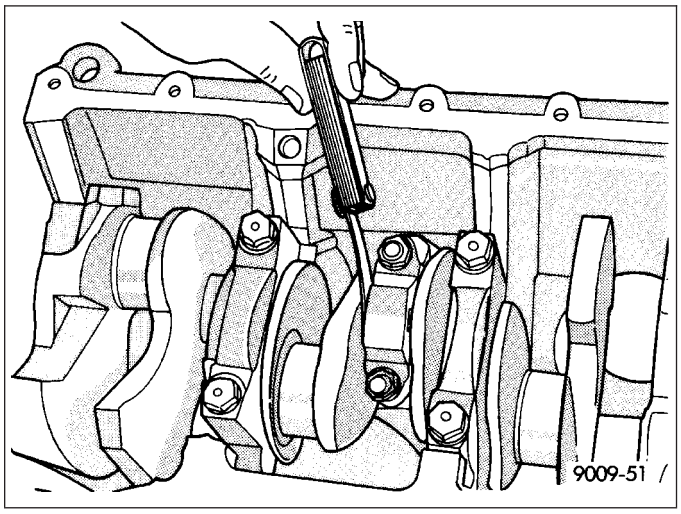
Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.)	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.)	50.758-50.742 mm (1.9984-1.9978 in.)

8. If bearing-to-journal clearance exceeds the specification, determine which service bearing set to use, using the following bearing sizes:

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.
10. Once you have selected the proper insert, install the insert and cap. Tighten the connecting rod bolts to 27 N·m (20 ft. lbs.) plus a 90° turn.

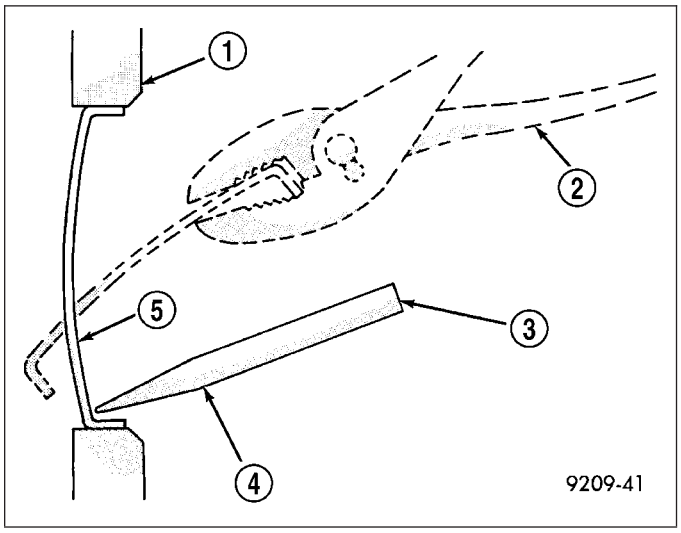
Slide snug-fitting feeler gauge between the connecting rod and crankshaft journal flange. Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.



PLUGS - CORE

REMOVAL

1. Drain the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
2. Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (5).
3. Using a suitable pair of pliers, grasp the core plug (2) and remove.



INSTALLATION

NOTE: Thoroughly clean core plug bore, remove all of the old sealer.

1. Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

2. Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.
3. Refill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

CRANKSHAFT

DESCRIPTION

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select fit main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting. The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

1. Remove the engine. (Refer to 9 - ENGINE - REMOVAL).
2. Remove the engine oil pump. (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

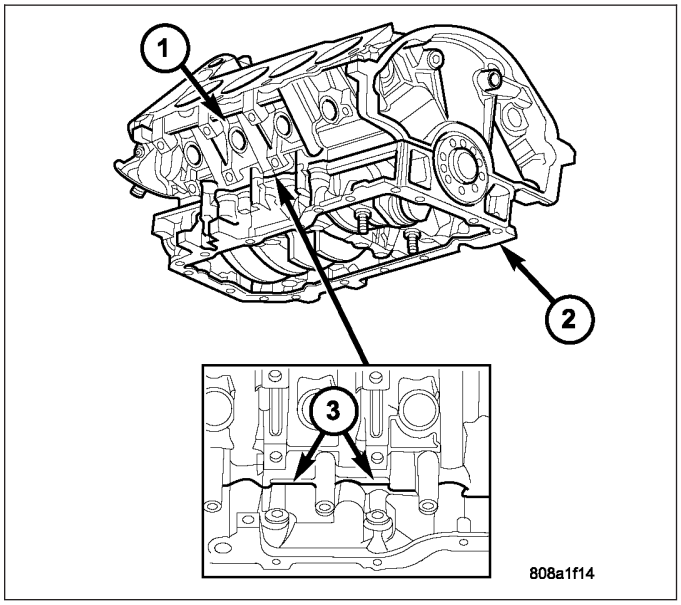
CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

3. Remove oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove the oil pump pickup tube and oil pan gasket /windage tray.
5. Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.
6. Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause sever damage to the crankshaft.

NOTE: The bedplate has pry points cast into it. Use these points only. The pry points are on both the left and right sides, only the left side is shown.



7. Carefully pry on the pry points to loosen the bedplate then remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

8. Remove the crankshaft.
9. Remove the crankshaft target wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

1. If required, remove the main bearing halves from the cylinder block and bedplate.
2. Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.
3. Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.
4. Inspect the crankshaft thrust washers for scoring, scratches, wear or blueing. If either condition exist replace the thrust washer.
5. Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

INSTALLATION

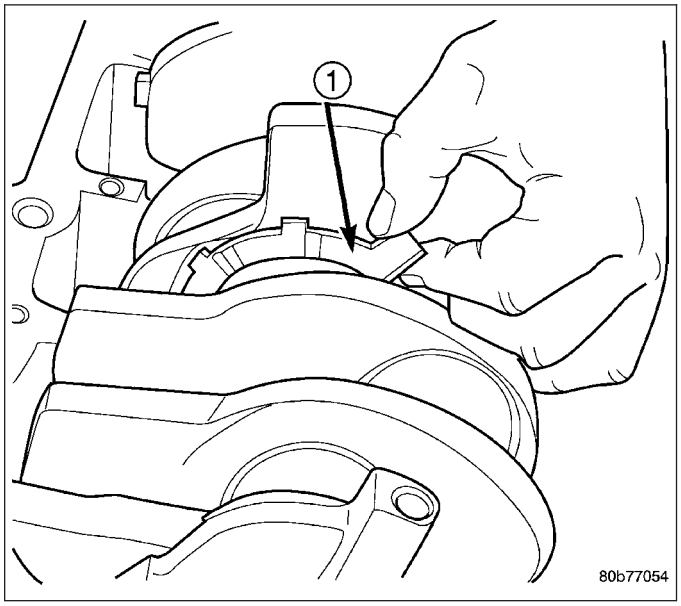
CAUTION: Main bearings are select fit. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE) for proper bearing selections.

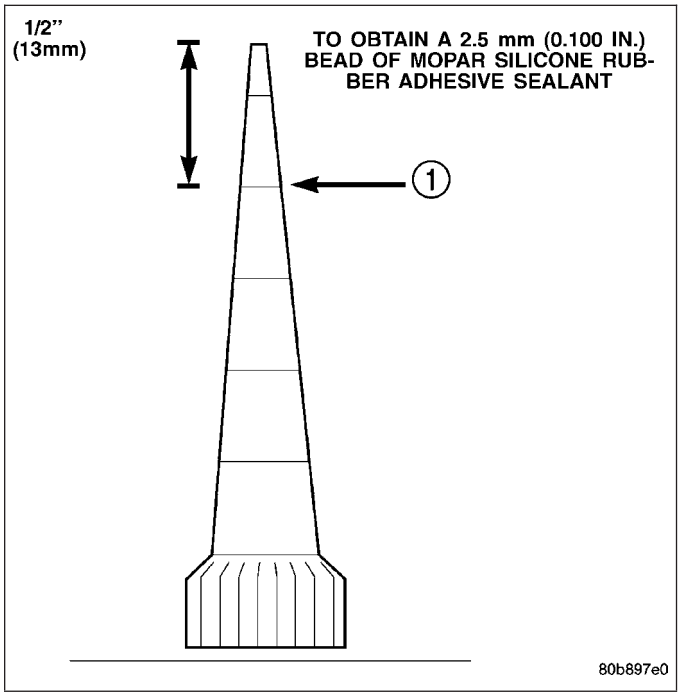
1. Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the target wheel retaining screws prior to installation.

2. Install the crankshaft target wheel. Torque the mounting screws to 15 N·m (12 ft. lbs.).
3. Position crankshaft in cylinder block.
4. Install the thrust washers (1).

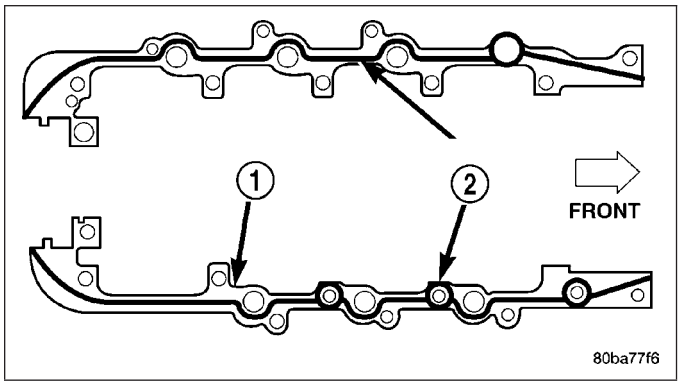




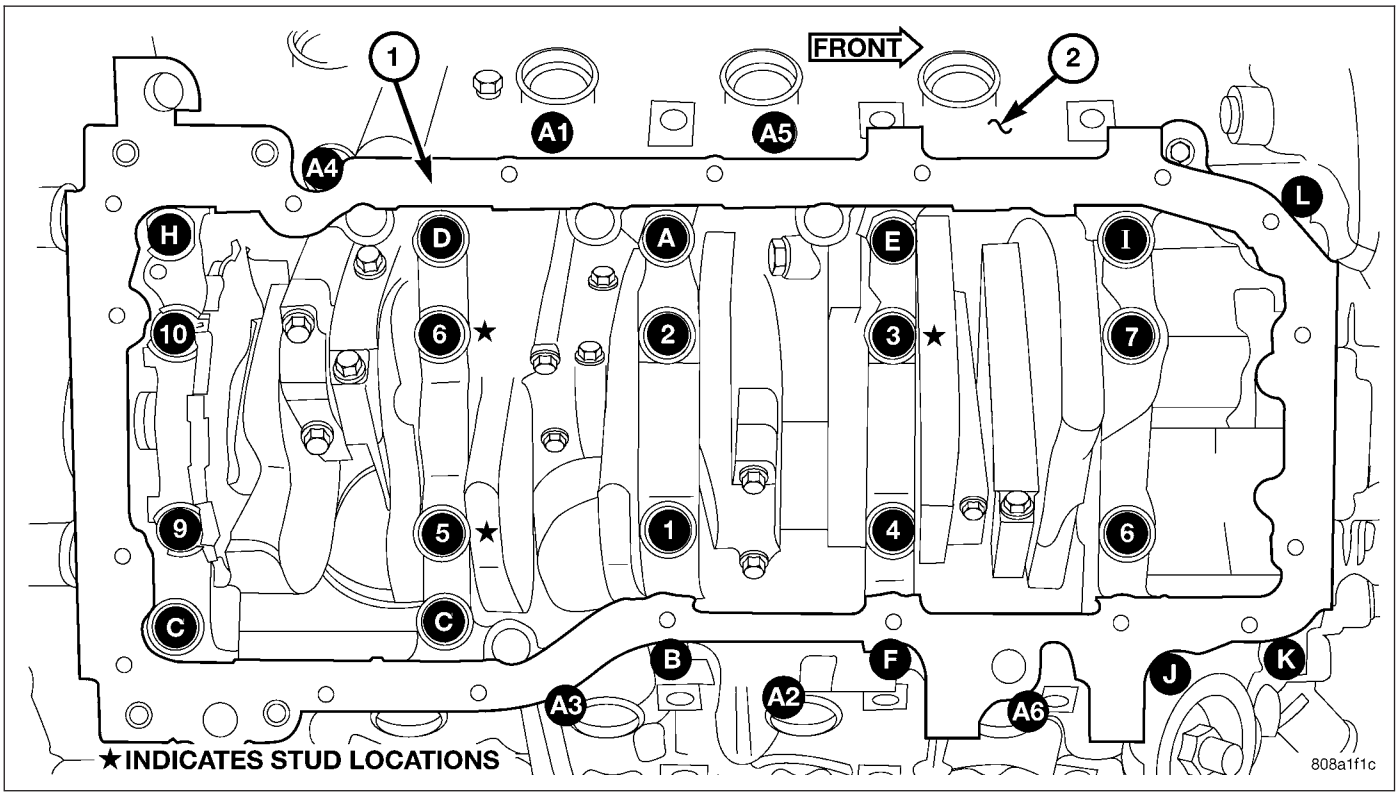
CAUTION: The bedplate to cylinder block mateing surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The installation time to install the bedplate after the sealant has been applied is critical.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.



5. Apply a 2.5mm (0.100 inch) bead of Mopar® Gen II Silicone Rubber Adhesive sealant (2) to the cylinder block-to-bedplate mating surface (1) as shown.
6. Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

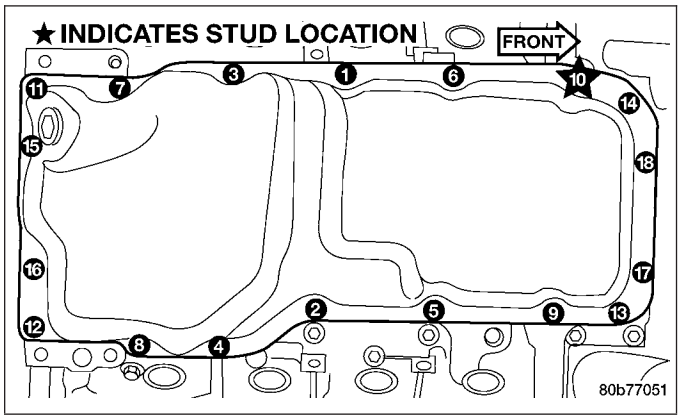


NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

7. Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown.
   - Tighten bolts **A – L** to 54 N·m (40 ft. lbs.)
   - Tighten bolts **1–10** to 2.8 N·m (25 in. lbs.)
   - Turn bolts **1–10** an additional 90°.
   - Tighten bolts **A1– A6** to 27 N·m (20 ft. lbs.)
8. Measure crankshaft end play. (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - STANDARD PROCEDURE).

9. Install the connecting rods and measure side clearance. (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

10. Position the oil pan gasket/windage tray, using a new o-ring, install the oil pickup tube. Torque the bolt to 28N·n (20 ft. lbs.) torque the nuts to 28N·m (20 ft. lbs.).
11. Install the oil pan. Torque the retaining bolts to 15 N·m (11 ft. lbs.) in the sequence shown.
12. Install the engine (Refer to 9 - ENGINE - INSTALLATION).



BEARINGS - CRANKSHAFT MAIN

STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

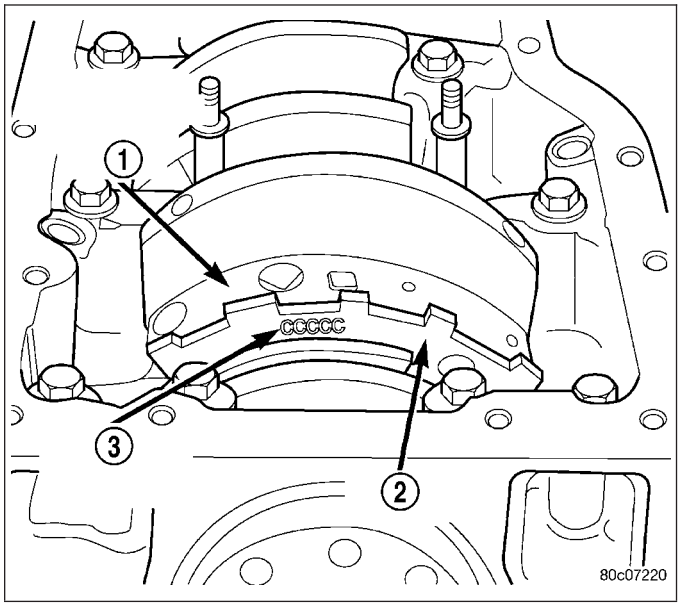
Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (2). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel (2) is mounted to the number 8 counter weight (1) on the crankshaft.



NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART - 4.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm U/S (0.0004 in.) U/S	63.488–63.496 mm (2.4996–2.4999 in.)
B	NOMINAL	63.496–63.504 mm (2.4999–2.5002 in.)
C	0.008 mm O/S (0.0004 in.) O/S	63.504–63.512 mm (2.5002–2.5005 in.)

INSPECTION

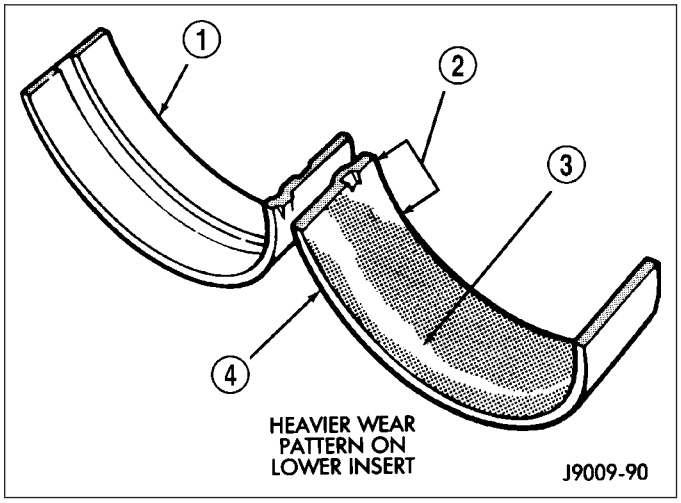
Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

Replace all damaged or worn bearing inserts.



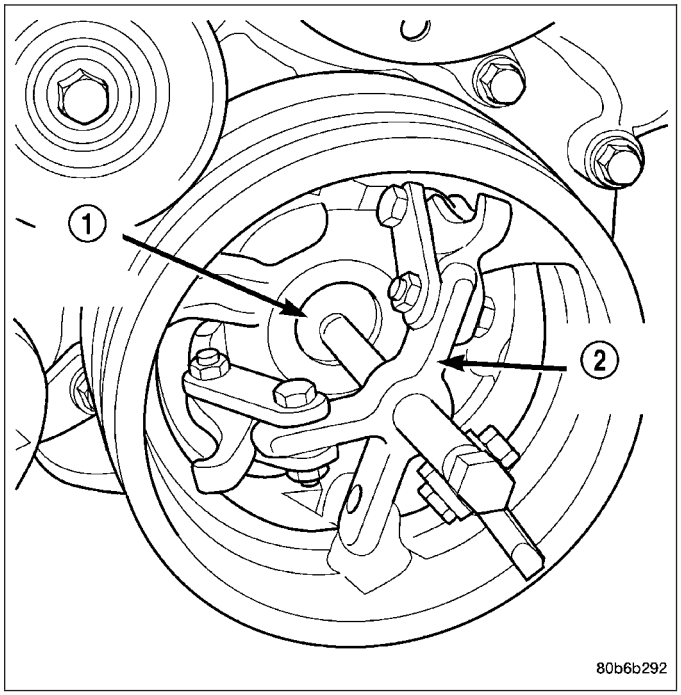
SEAL - CRANKSHAFT OIL - FRONT

REMOVAL

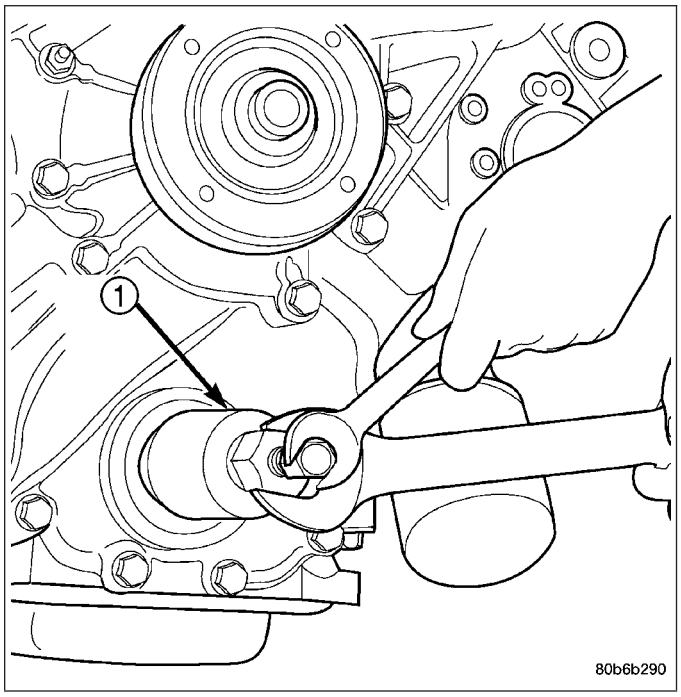
1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove A/C compressor mouning fasteners and set aside.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove upper radiator hose.
6. Disconnect electrical connector for fan mounted inside radiator shroud.
7. Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

8. Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).



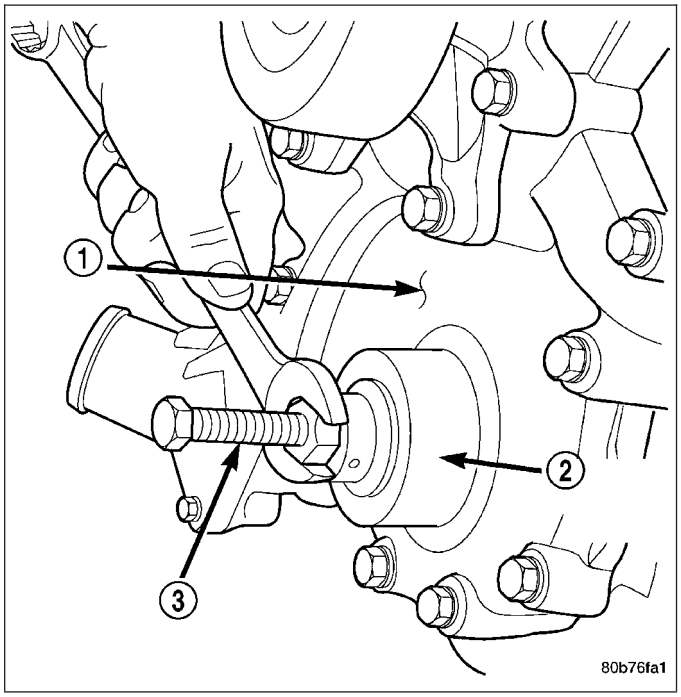
11. Using Special Tool 8511 (1), remove crankshaft front seal.



INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Using Special Tool 8348 and 8512 (2,3), install crankshaft front seal.
2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).
6. Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.



SEAL - CRANKSHAFT OIL - REAR

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.
4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

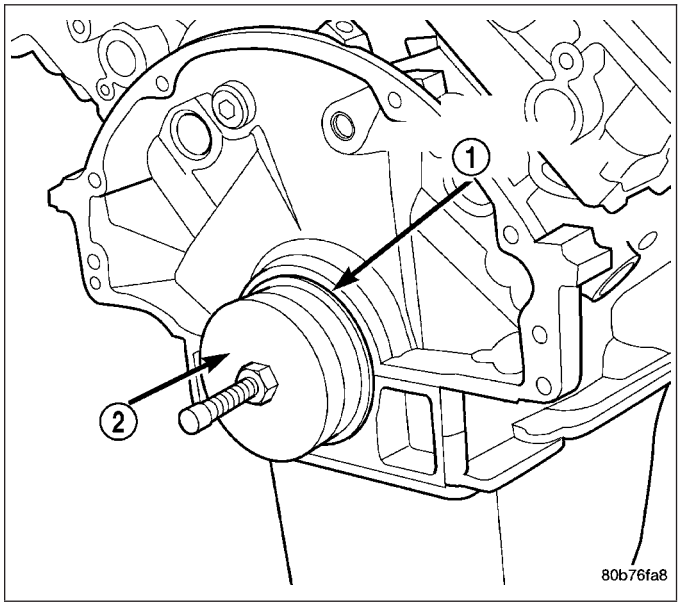
REMOVAL

NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

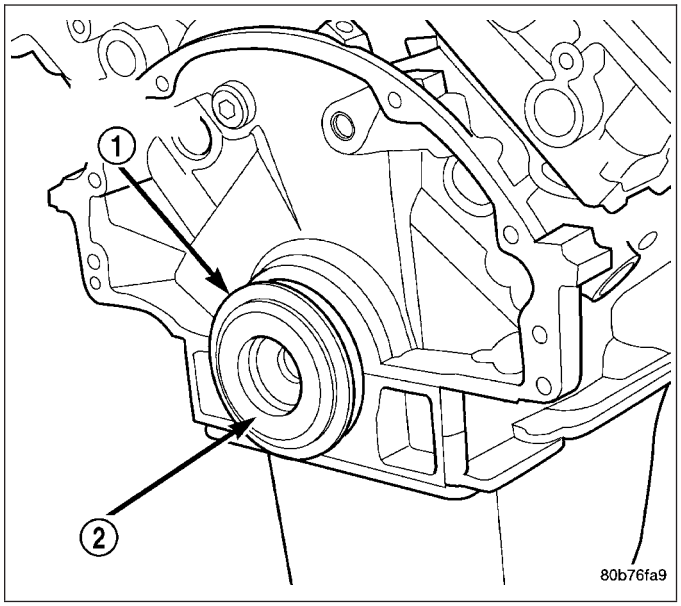
NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.



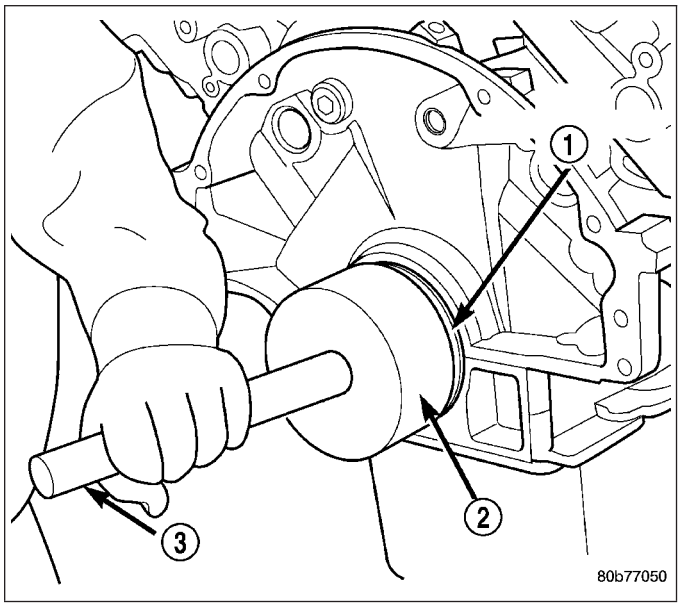
3. Using Special Tool 8506 (2), remove the crankshaft rear oil seal (1)

INSTALLATION

1. Lubricate the crankshaft flange with engine oil.
2. Position the magnetic seal guide Special Tool 8349-2 onto the crankshaft rear face. Then position the crankshaft rear oil seal (1) onto the guide (2).



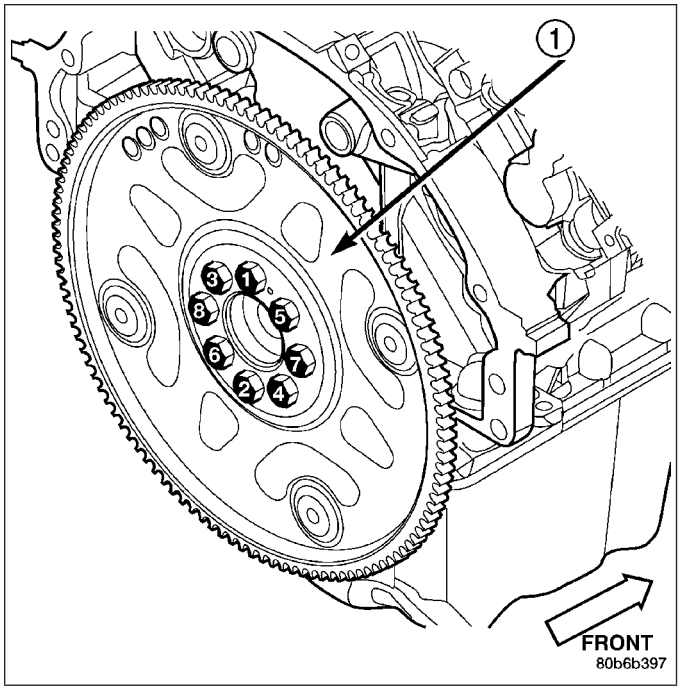
3. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (2) and C-4171 Driver Handle (3), with a hammer, tap the seal (1) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
4. Install the flexplate.
5. Install the transmission.



FLEX PLATE

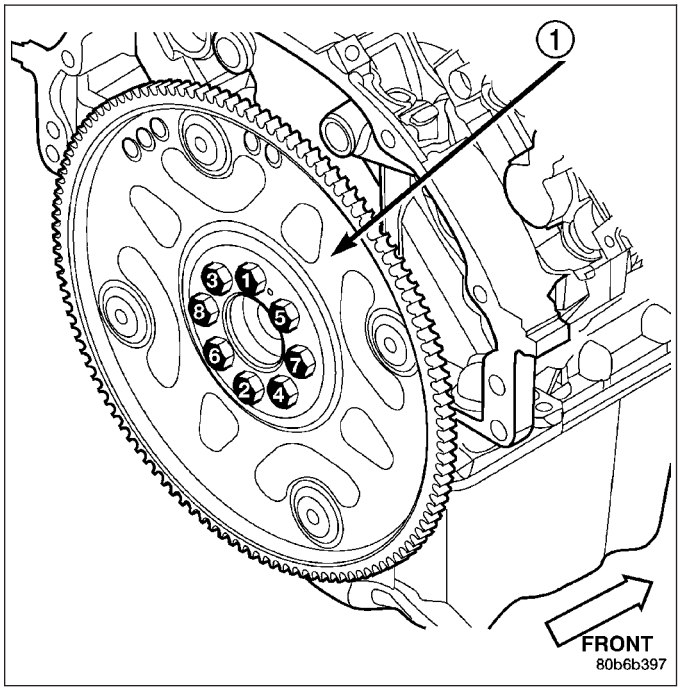
REMOVAL

1. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - REMOVAL).
2. Remove the bolts and flexplate (1).



INSTALLATION

1. Position the flexplate onto the crankshaft and install the bolts hand tight.
2. Tighten the flexplate retaining bolts to 60 N·m (45 ft. lbs.) in the sequence shown.
3. Install the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - 45RFE/545RFE - INSTALLATION).



ROD - PISTON & CONNECTING

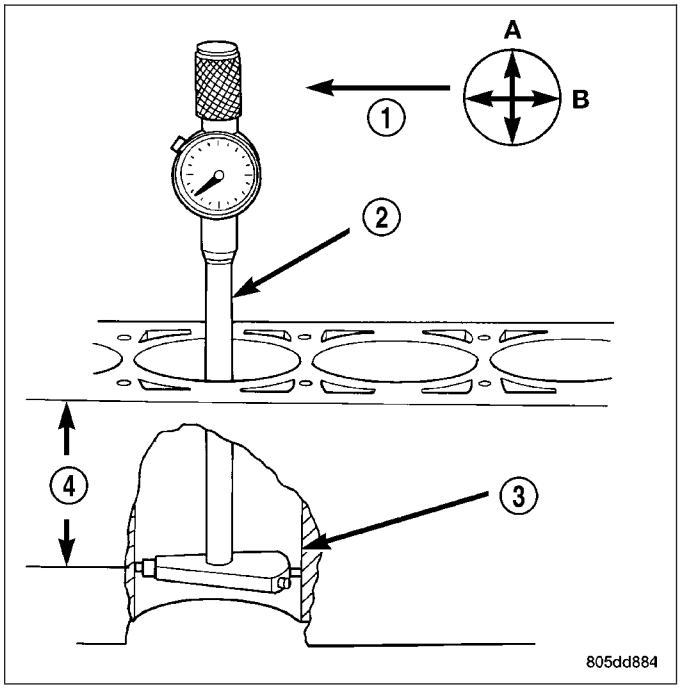
DESCRIPTION

CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

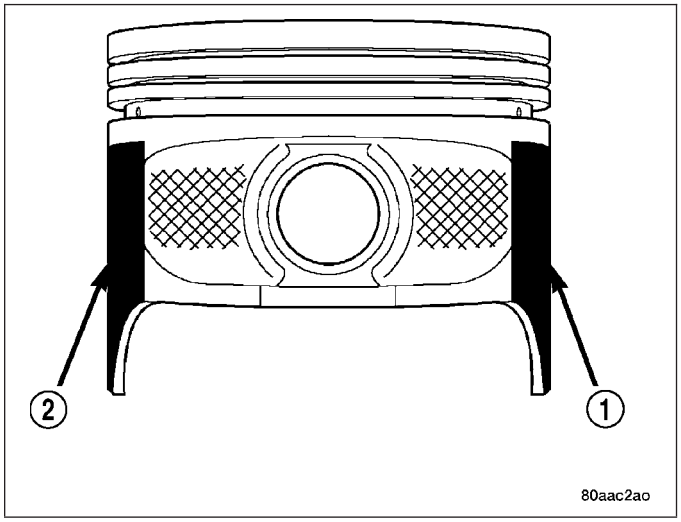
The pistons are made of a high strength aluminum alloy. The anodized top ring groove and crown has been replaced with a coated top ring that is blue in color on the bottom surface. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of forged powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

STANDARD PROCEDURE - PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge (2), capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore (3) at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.



3. The coated pistons (1,2) will be serviced with the piston pin and connecting rod pre-assembled.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston (1,2) will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.



REMOVAL

1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
   - Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods

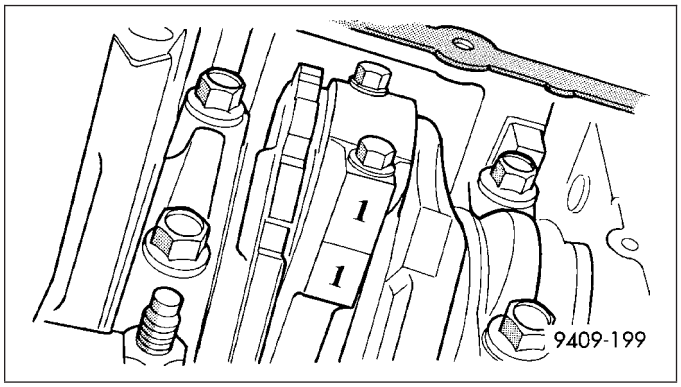
must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.



5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
7. Carefully remove piston rings from piston(s), starting from the top ring down.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/ CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

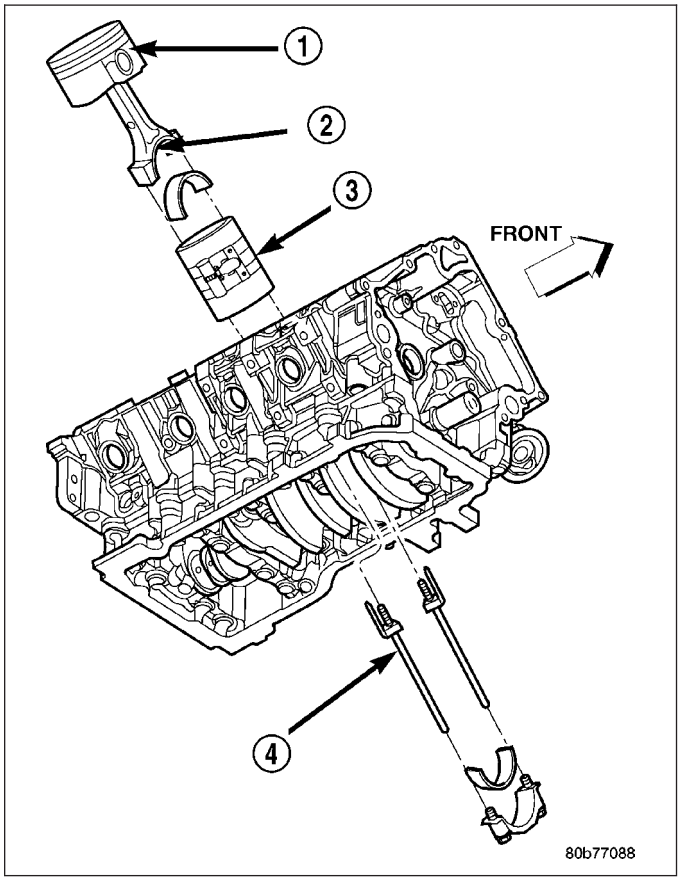
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

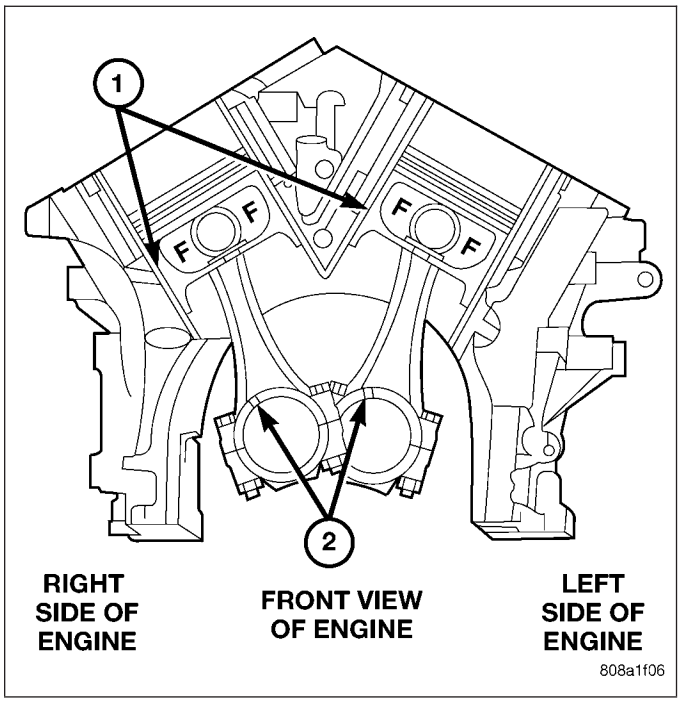
1. Before installing piston and connecting rod assemblies into the bore, install the piston rings.
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor (3) over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides (4) into connecting rod bolt threads.



5. The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position (1). This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine.
6. Wipe cylinder bore clean and lubricate with engine oil.
7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 27 N·m (20 ft. lbs.) plus 90°.
10. Install the following components:



- Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
- Timing chain and cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
- Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
- Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

RINGS - PISTON

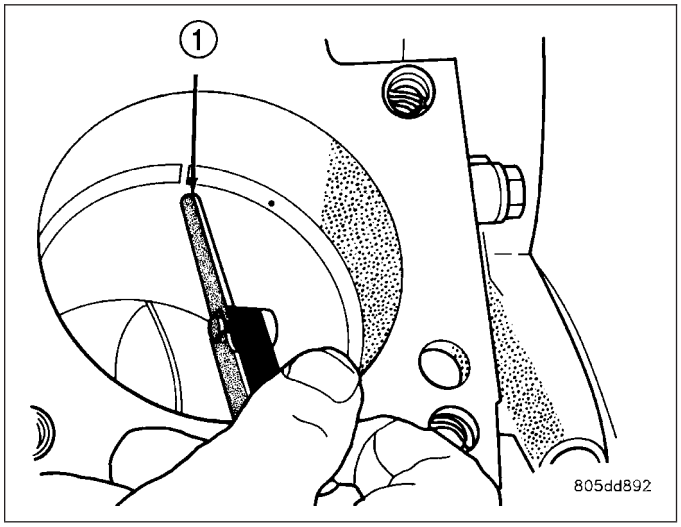
STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

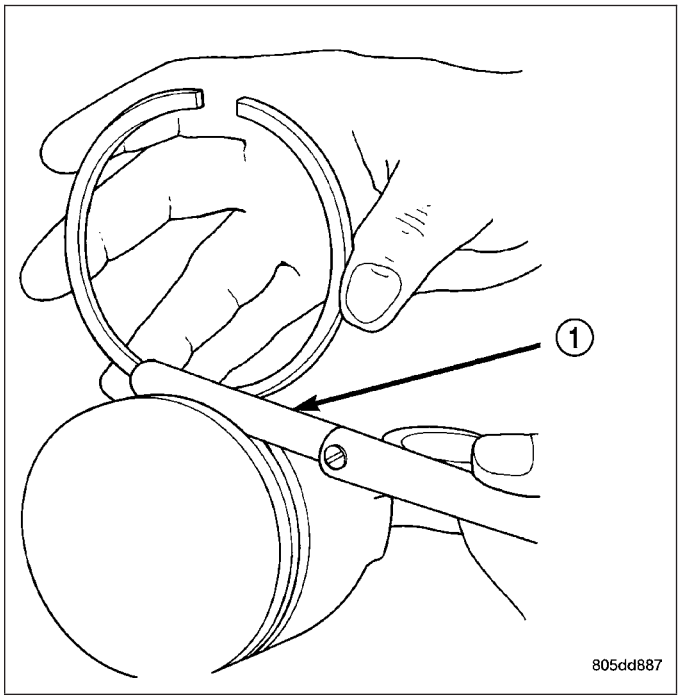
NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge (1) check the ring end gap. Replace any rings not within specification.



PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

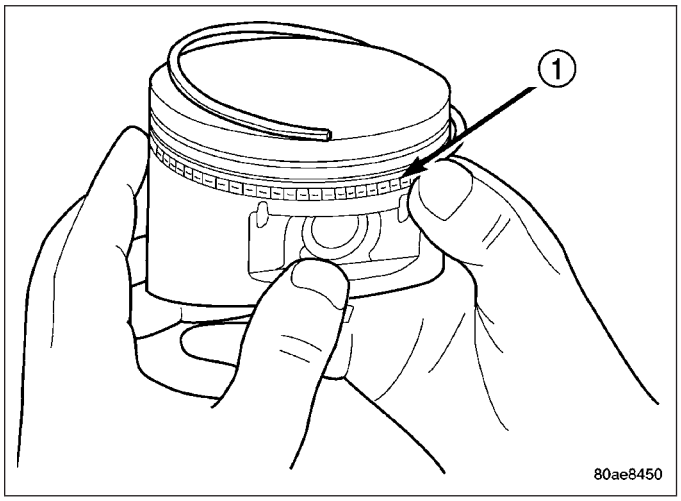


5. Measure the ring side clearance as shown make sure the feeler gauge (1) fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094 mm (0.0020-.0037 in.)	0.11 mm (0.004 in.)
Intermediate Ring	0.04-0.08 mm (0.0016-0.0031 in.)	0.10 mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229 mm (.0007-.0090 in.)	.25 mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.20-0.36 mm (0.0079-0.0142 in.)	0.43 mm (0.0017 in.)
Intermediate Ring	0.37-0.63 mm (0.0146-0.0249 in.)	0.74 mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.025-0.76 mm (0.0099- 0.03 in.)	1.55 mm (0.061 in.)

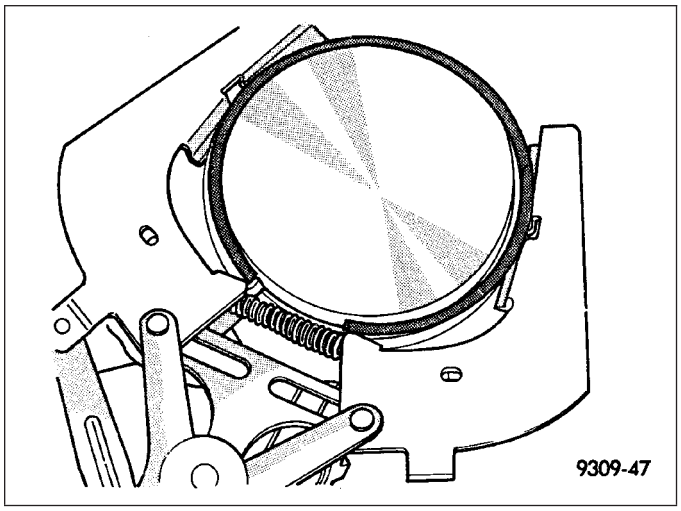
7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.



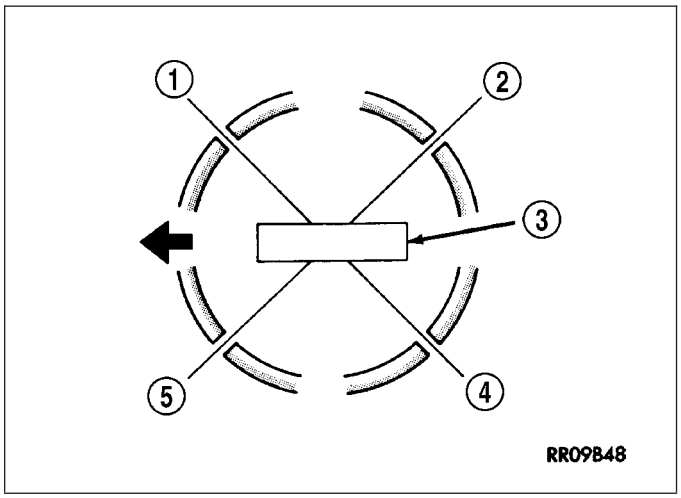
NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

8. Install the oil ring expander.
9. Install upper side rail (1) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



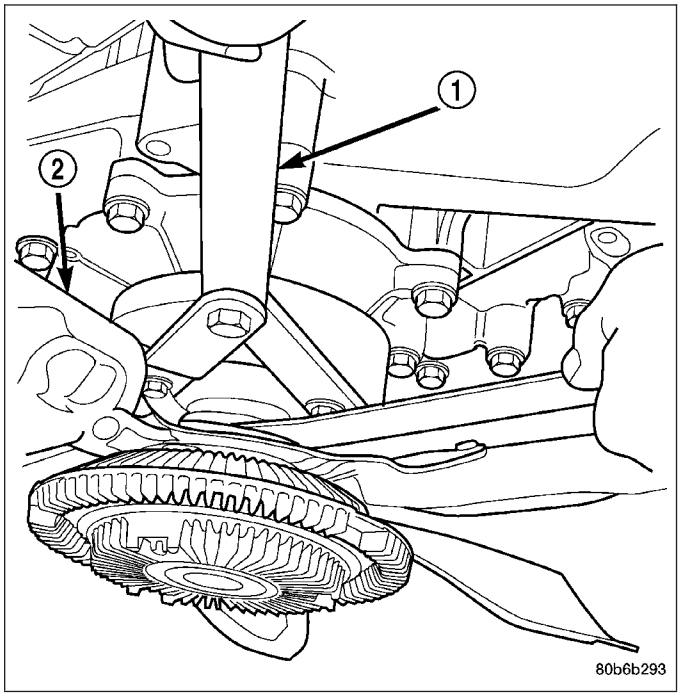
12. Position piston ring end gaps as shown in. It is important that expander ring gap (5) is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.



DAMPER - CRANKSHAFT

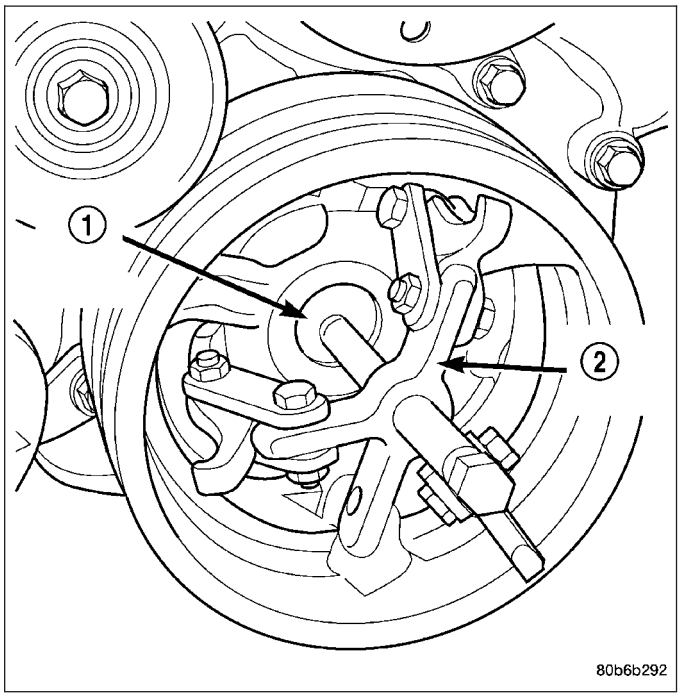
REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove radiator upper hose.
5. Remove upper fan shroud.
6. Using Special Tools 6958 Spanner with Adapter Pins 8346 (1), loosen fan and viscous assembly from water pump.
7. Remove fan and viscous assembly.
8. Disconnect electrical connector for fan mounted inside radiator shroud.



NOTE: Transmission cooler line snaps into shroud lower right hand corner.

9. Remove crankshaft damper bolt.
10. Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (2).

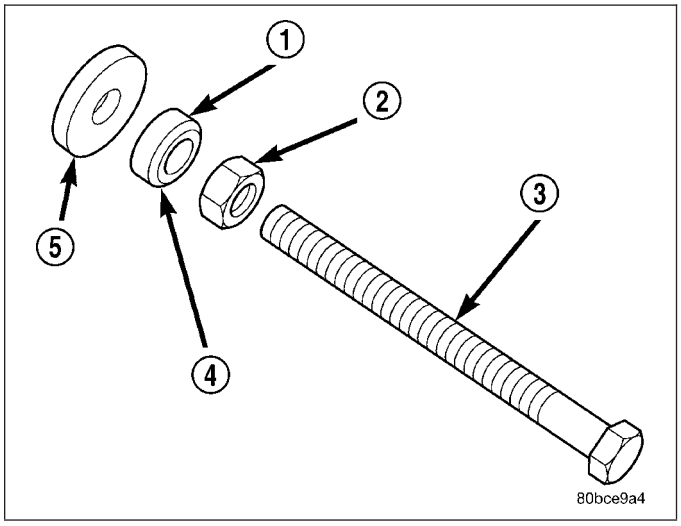


INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512–A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

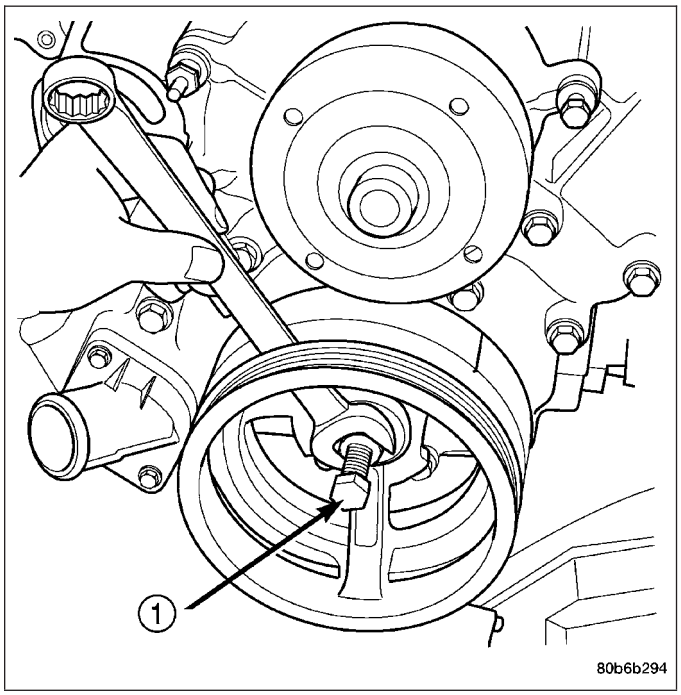
1. Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512–A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.



2. Assemble Special Tool 8512–A as follows, The nut (2) is threaded onto the shaft first. Then the roller bearing (1) is placed onto the threaded rod (3) (The hardened bearing surface of the bearing (1) **MUST**face the nut (2). Then the hardened washer (5)slides onto the threaded rod. Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or equivalent.

3. Using Special Tool 8512–A, press damper onto crankshaft (1).
4. Install then tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).
5. Install fan blade assembly (Refer to 7 - COOLING/ ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
6. Install radiator upper shroud and tighten fasteners to 11 N·m (95 in. lbs.).
7. Connect electrical connector for shroud fan.
8. Install radiator upper hose.
9. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
10. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect negative cable to battery.



COVER - STRUCTURAL

DESCRIPTION

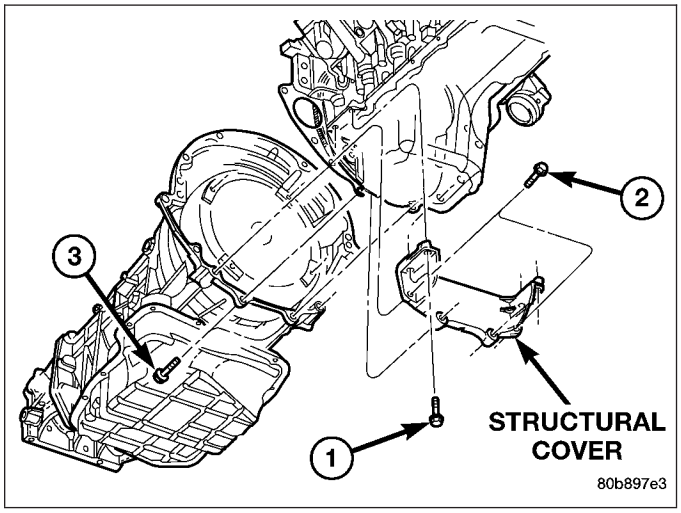
The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate.

OPERATION

The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

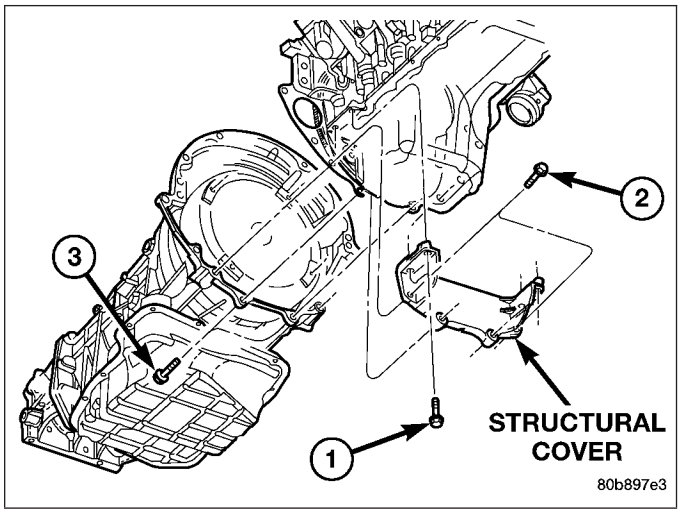
1. Raise vehicle on hoist.
2. Remove the left hand exhaust pipe from exhaust manifold.
3. Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.
4. Remove the eight bolts (1,2,3) retaining structural cover in the sequence shown.
5. Pivot the exhaust pipe downward and remove the structural cover.



INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts (1,2,3)retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts (1,2,3). Do NOT tighten at this time.



CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

4. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.
5. Install the exhaust pipe on left hand exhaust manifold.
6. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

MOUNT - FRONT

REMOVAL

2WD

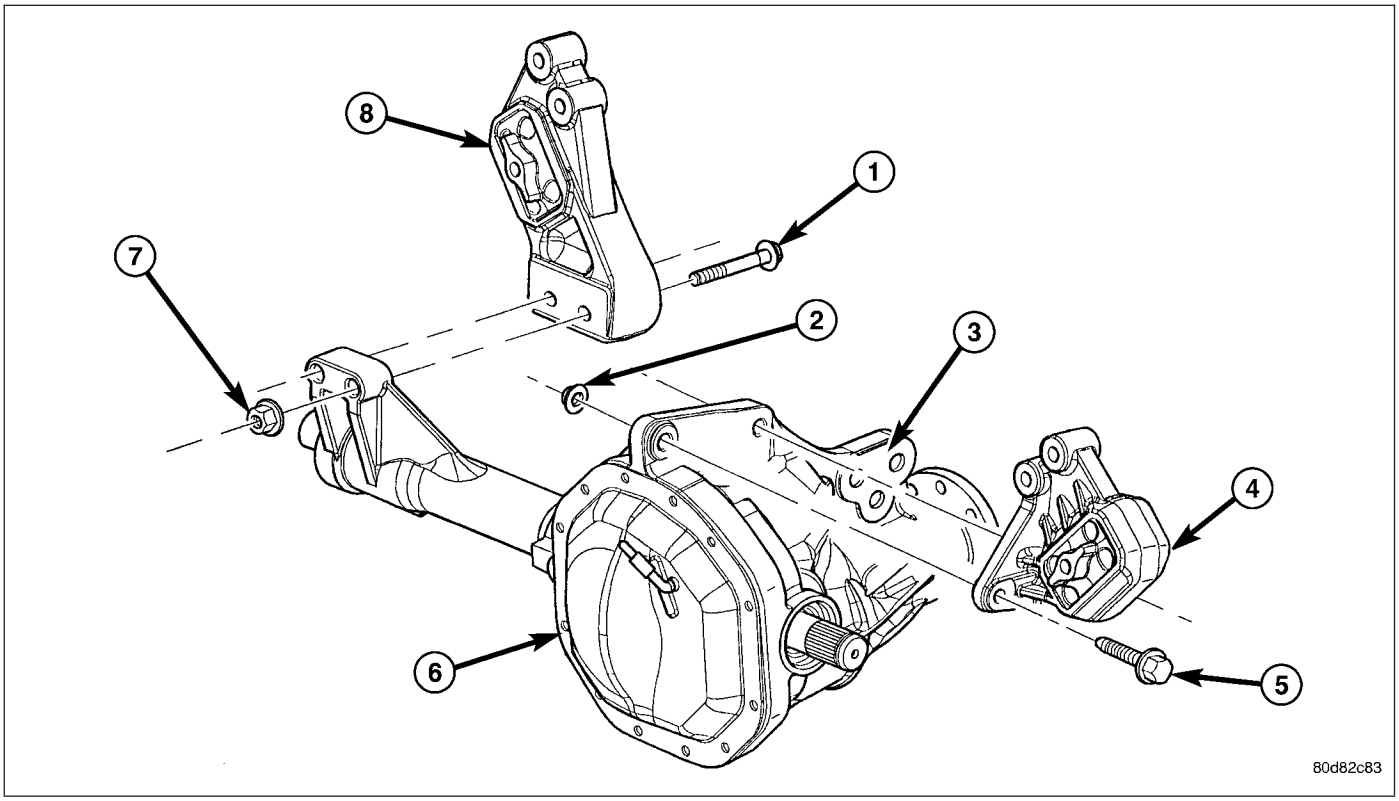
1. Disconnect the negative cable from the battery.

CAUTION: Remove the viscous fan before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

2. Remove the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
3. Raise the vehicle.

4. Remove the engine oil filter.
5. Remove the oil drain trough.
6. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
7. Support the front axle with a suitable jack.
8. Remove the (4) bolts that attach the engine mounts to the front axle.
9. Remove the (3) bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the through bolts
12. Raise the engine far enough to be able to remove the left and right engine mounts.
13. Remove the (8) mount to engine attaching bolts
14. Remove the engine mounts.

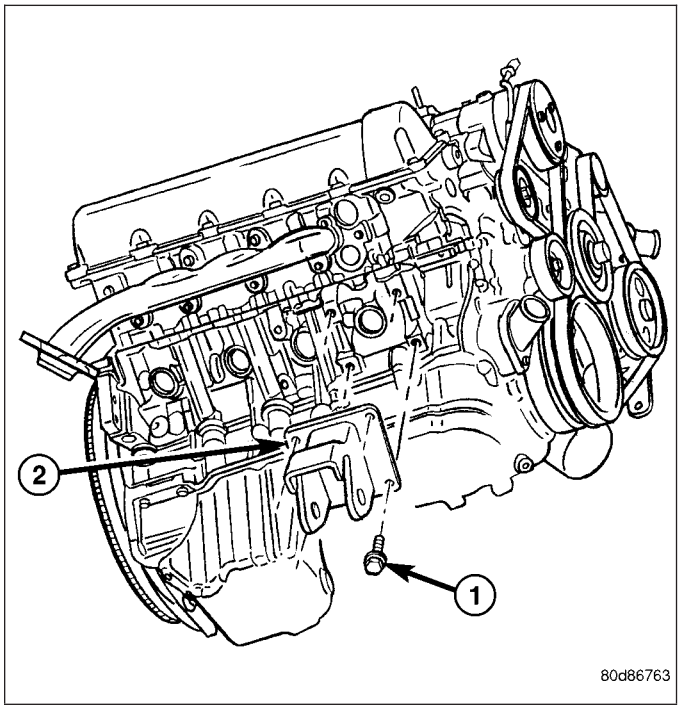
4WD



1. Disconnect the negative cable from the battery.
2. Remove the viscous fan.
3. Raise the vehicle.
4. Remove the skid plate.
5. Remove the front crossmember.
6. Remove the engine oil filter.
7. Remove the oil drain trough.
8. Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.
9. Support the front axle with a suitable jack.
10. Remove the 4 bolts that attach the engine mounts to the front axle (6).
11. Remove the 3 bolts (3) that attach the front axle to the left engine bracket.
12. Lower the front axle.
13. Remove the through bolts
14. Raise the engine far enough to be able to remove the left and right engine mounts.

15. Remove the engine mounts (4,8).

16. Remove the engine mount brackets (2).

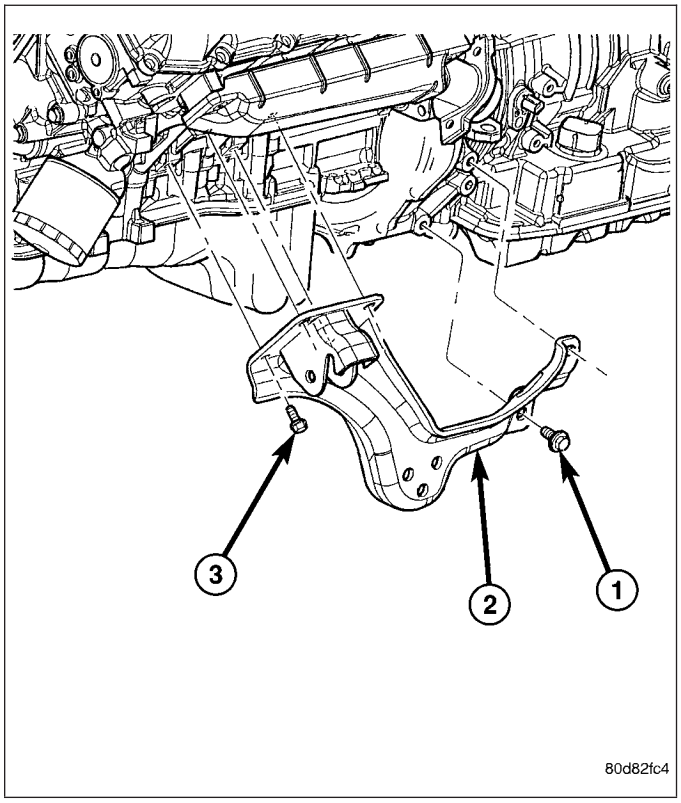


INSTALLATION

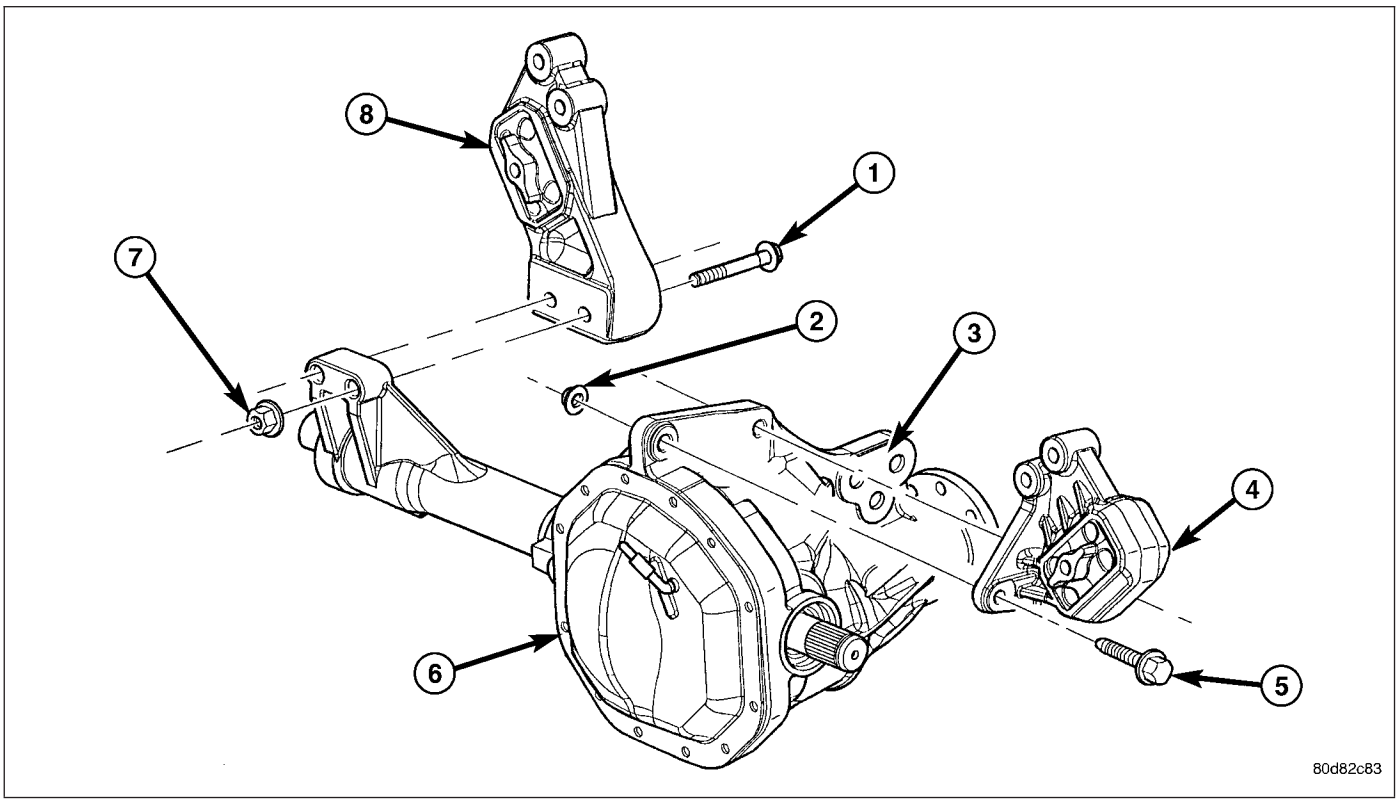
2WD

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts to the engine block with (8) bolts. Torque bolts to 54 N·m (40 ft. lbs.).
2. Insert the (2) through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
3. Lower the engine until the through bolts rest onto the slots in the frame brackets.
4. Tighten the through bolt nuts to 94 N·m (70 ft. lbs.).
5. Install the oil drain trough.
6. Install the engine oil filter.
7. Lower the vehicle.
8. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
9. Reconnect the negative battery cable.



4WD



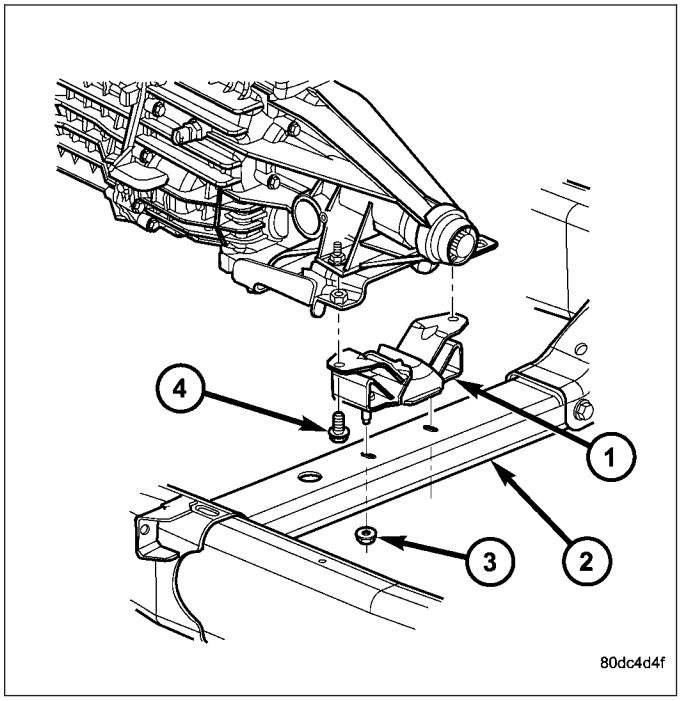
NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right and left side engine mounts (4,8) to the front axle (6). Torque nuts to 94 N·m (70 ft. lbs.).
2. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N·m (70 ft. lbs.).
3. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
4. Lower the engine until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
5. Loose assemble the (3) bolts that attach the front axle to the left engine bracket.
6. Loose assemble the lower through bolts.
7. Torque the nuts for the (4) through bolts to 101 N·m (75 ft. lbs.).
8. Torque the (3) bolts that attach the front axle to the left engine bracket to 101 N·m (75 ft. lbs.).
9. Install the oil drain trough.
10. Install the engine oil filter.
11. Install the front crossmember.
12. Install the skid plate.
13. Lower the vehicle.
14. Install the viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
15. Reconnect the negative battery cable.

MOUNT - REAR

REMOVAL

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount (1).
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember (2).
6. Remove the mount (1).



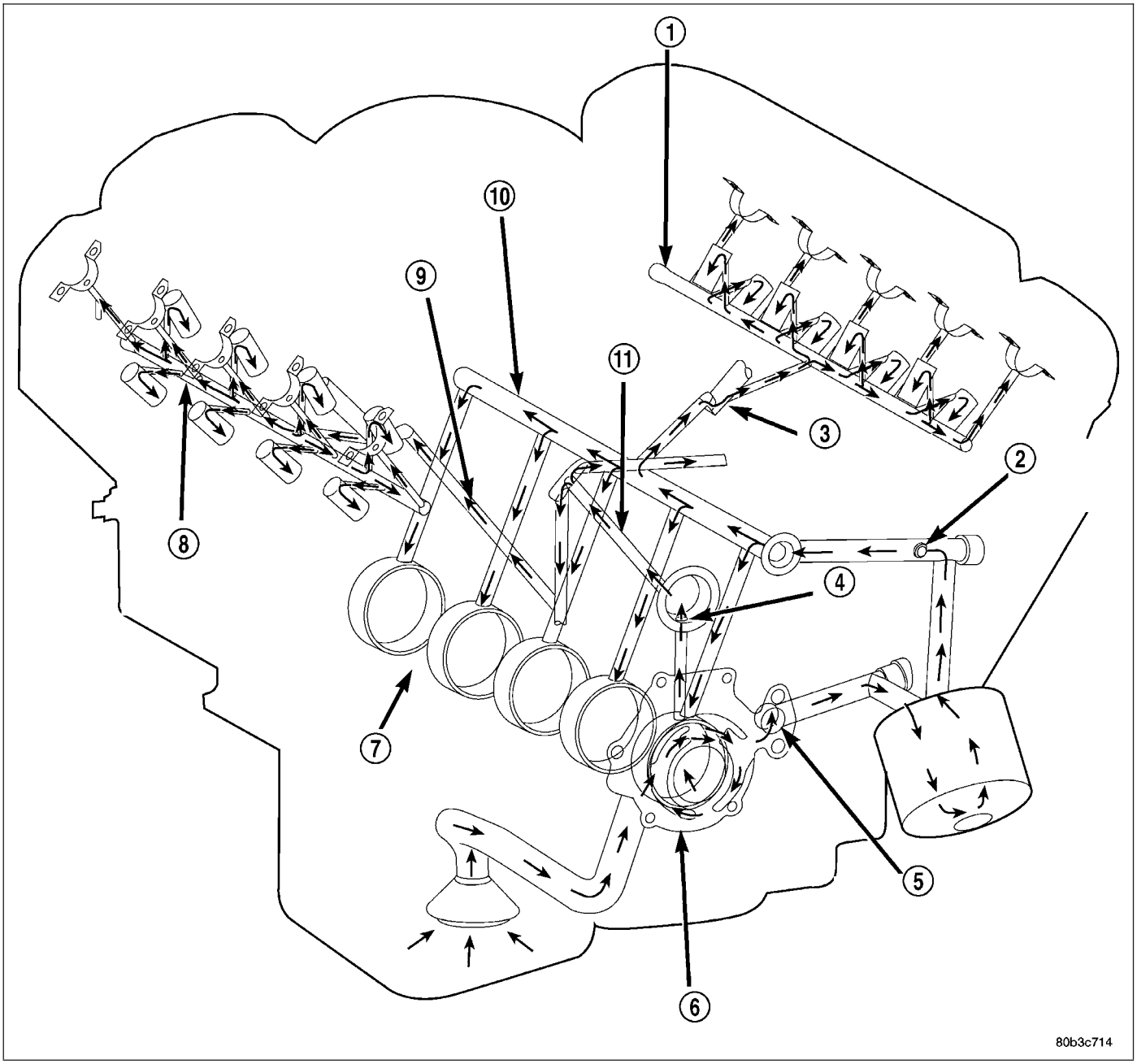
INSTALLATION

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61N·m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54N·m (40 ft. lbs.).

LUBRICATION

DESCRIPTION



The lubrication system is a full flow filtration pressure feed type.

OPERATION

Oil from the oil pan is pumped by a gerotor type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing.

The camshaft exhaust valve lobes and rocker arms are lubricated through a small hole in the rocker arm; oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the orentation of the rocker arm, the camshaft intake lobes are not lubed in the same manner as the exhaust lobes. The intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, and as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to

enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubricating the lobes and the rocker arms.

Engine Lubrication Flow Chart—Block: Table 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1.Front Timing Chain Idler Shaft 2.Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2
Right Cylinder Head	See Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

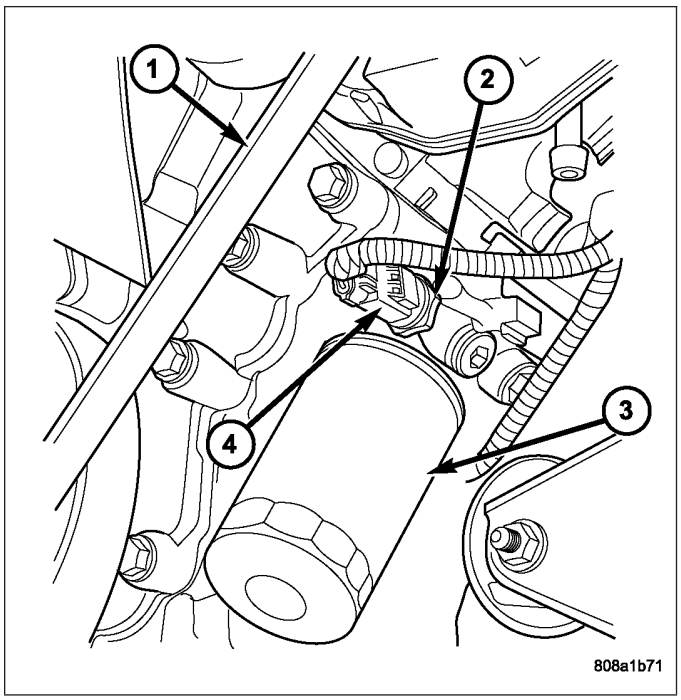
Engine Lubrication Flow Chart—Cylinder Heads: Table 2

FROM	TO
Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sending unit (2) and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle - 25 kPa (4 psi) minimum
   - 3000 rpm - 170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.



DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.If the oil leak source is not positively identified at this time, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Disconnect the breather cap to air cleaner hose at the breather cap end. Cap or plug breather cap nipple.
2. Remove the PCV valve from the cylinder head cover. Cap or plug the PCV valve grommet.
3. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

4. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
5. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve and breather cap hose.

7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

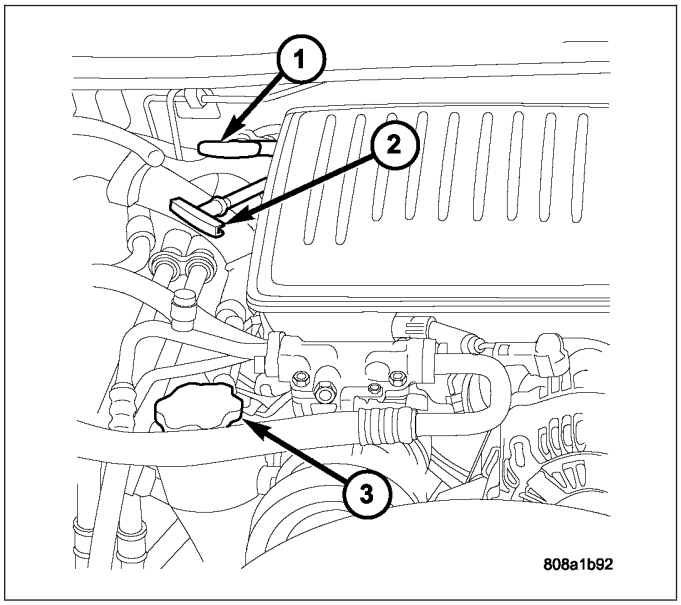
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE - ENGINE OIL SERVICE

The engine oil level indicator (2) is located at the right rear of the engine on the 4.7L engines.



CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.
3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase.
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

NOTE: Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

FILTER - ENGINE OIL

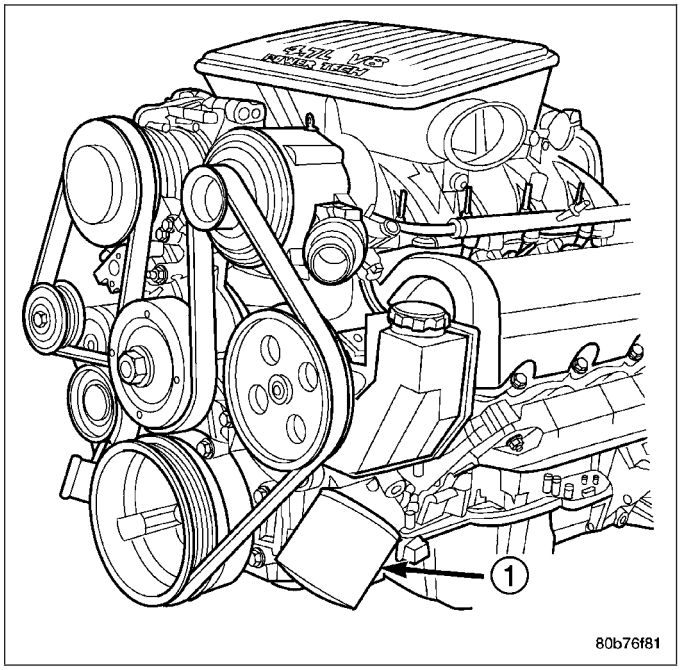
REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter.
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

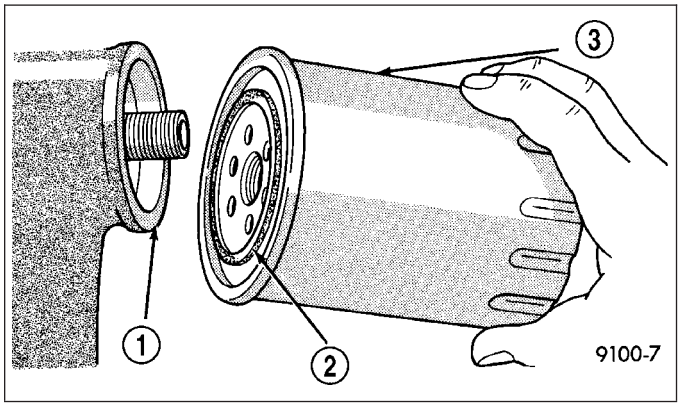
NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.



INSTALLATION

1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one full turn, do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.



PAN - ENGINE OIL

REMOVAL

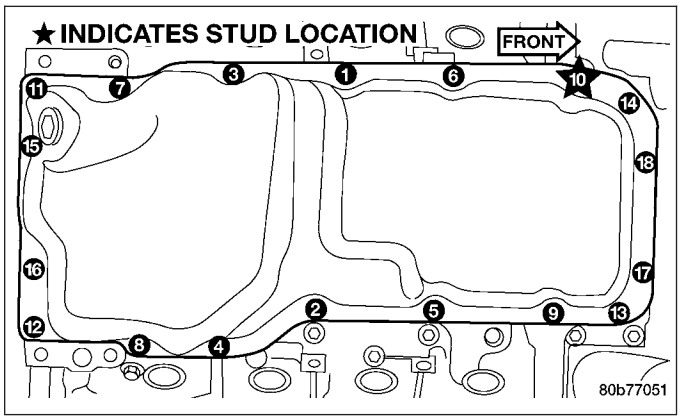
1. Disconnect the negative battery cable.
2. Install engine support fixture special tool # 8534. **Do not raise engine at this time.**
3. Loosen both left and right side engine mount through bolts. Do not remove bolts.
4. Remove the structural dust cover, if equipped.
5. Drain engine oil.
6. Remove the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL).

CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

7. Raise engine using special tool # 8534 to provide clearance to remove oil pan.

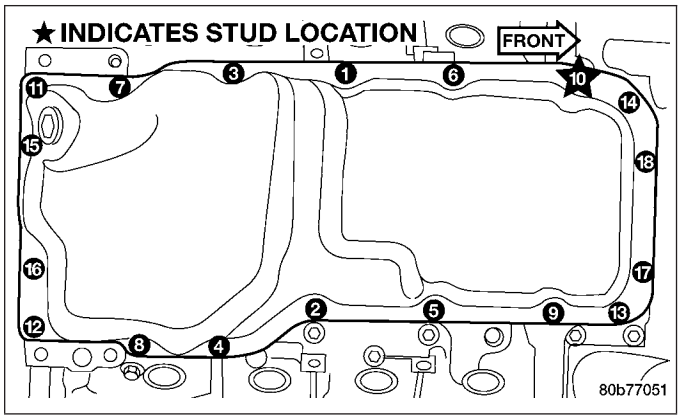
NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

8. Remove the oil pan mounting bolts and oil pan.
9. Unbolt oil pump pickup tube and remove tube.
10. Inspect the integral windage tray and gasket and replace as needed.



INSTALLATION

1. Clean the oil pan gasket mating surface of the bedplate and oil pan.
2. Position the oil pan gasket and pickup tube with new o-ring. Install the mounting bolt and nuts. Tighten bolt and nuts to 28 N·m (20 ft. lbs.).
3. Position the oil pan and install the mounting bolts. Tighten the mounting bolts to 15 N·m (11 ft. lbs.) in the sequence shown.



4. Lower the engine into mounts using special tool # 8534.
5. Install both the left and right side engine mount through bolts. Tighten the nuts to 68 N·m (50 ft. lbs.).
6. Remove special tool # 8534.
7. Install structural dust cover, if equipped.
8. Install the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - INSTALLATION).
9. Fill engine oil.
10. Reconnect the negative battery cable.
11. Start engine and check for leaks.

SWITCH - OIL PRESSURE

DESCRIPTION

DESCRIPTION

The 3 wire, solid-state engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

DESCRIPTION

The 3–wire, electrical/mechanical engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

OPERATION

The oil pressure sensor uses three circuits. They are:

- A 5 volt power supply from the Powertrain Control Module (PCM)
- A sensor ground through the PCM's sensor return
- A signal to the PCM relating to engine oil pressure

The oil pressure sensor has a 3 wire electrical function very much like the Manifold Absolute Pressure (MAP) sensor. Meaning different pressures relate to different output voltages.

A 5 volt supply is sent to the sensor from the PCM to power up the sensor. The sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on either a CCD or PCI bus circuit (depending on vehicle line) to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

OPERATION

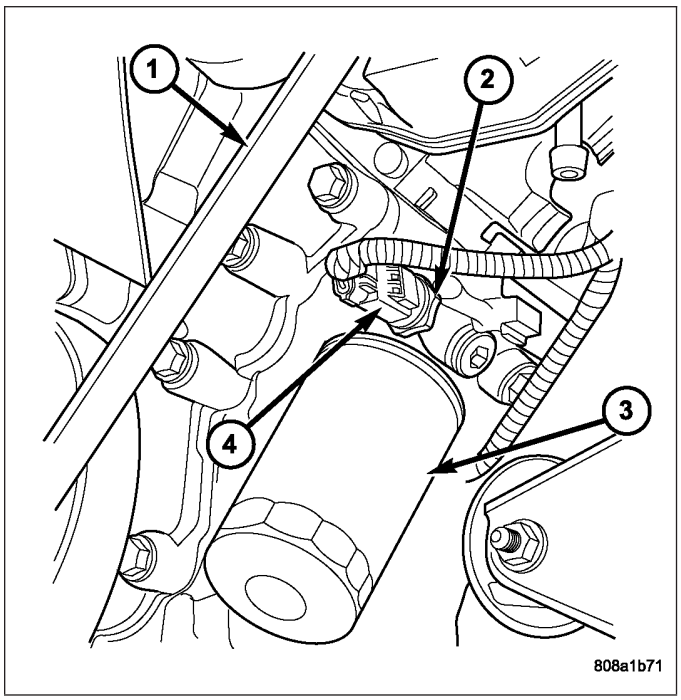
The oil pressure sensor uses two circuits. They are:

- A signal to the PCM relating to engine oil pressure
- A sensor ground through the PCM's sensor return

The oil pressure sensor returns a voltage signal back to the PCM relating to engine oil pressure. This signal is then transferred (bussed) to the instrument panel on a CCD bus circuit to operate the oil pressure gauge and the check gauges lamp. Ground for the sensor is provided by the PCM through a low-noise sensor return.

REMOVAL

1. Disconnect the negative cable from the battery.
2. Raise vehicle on hoist.
3. Remove front splash shield.
4. Disconnect oil pressure sender wire (4).
5. Remove the pressure sender (2).



INSTALLATION

1. Install oil pressure sender.
2. Connect oil pressure sender wire.
3. Install front splash shield.
4. Lower vehicle.
5. Connect the negative battery cable.

PUMP - ENGINE OIL

REMOVAL

1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the timing chains and tensioners (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
4. Remove the four bolts, primary timing chain tensioner and the oil pump.

DISASSEMBLY

1. Remove oil pump cover screws and lift off cover plate.
2. Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

3. If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

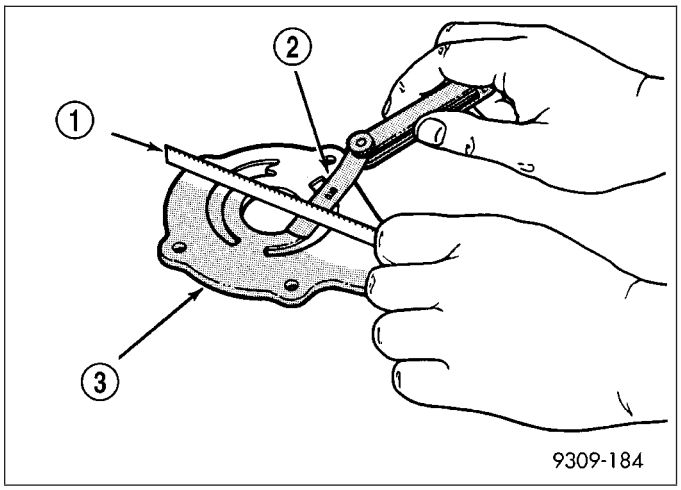
CLEANING

1. Wash all parts in a suitable solvent.

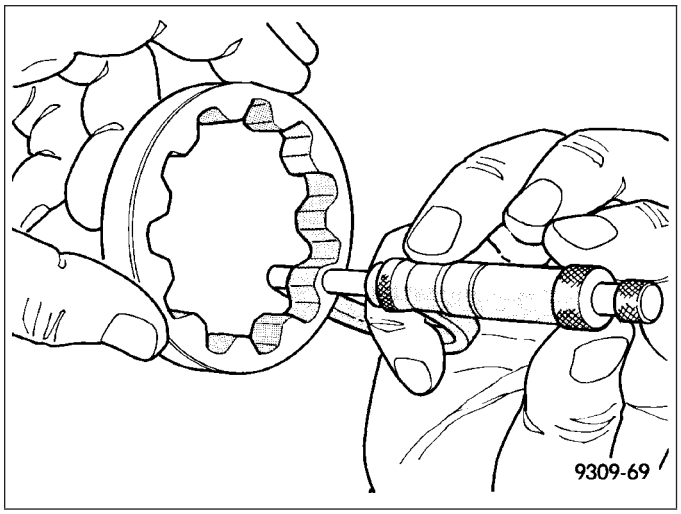
INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

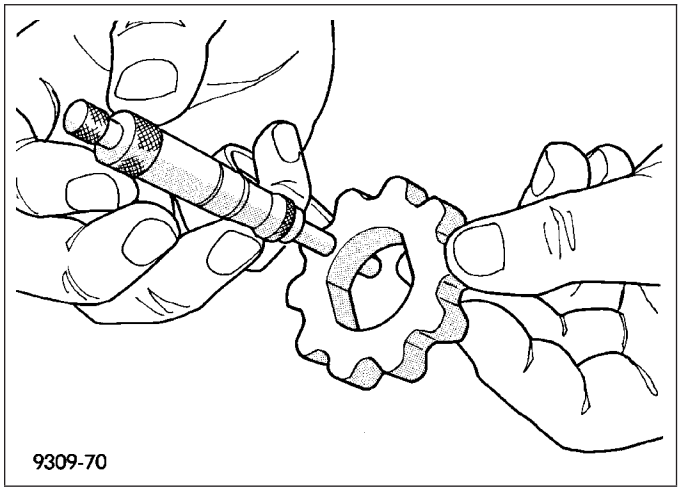
1. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
2. Lay a straight edge across the pump cover surface (3). If a 0.025 mm (0.001 in.) feeler gauge (2) can be inserted between the cover and the straight edge the oil pump assembly should be replaced.



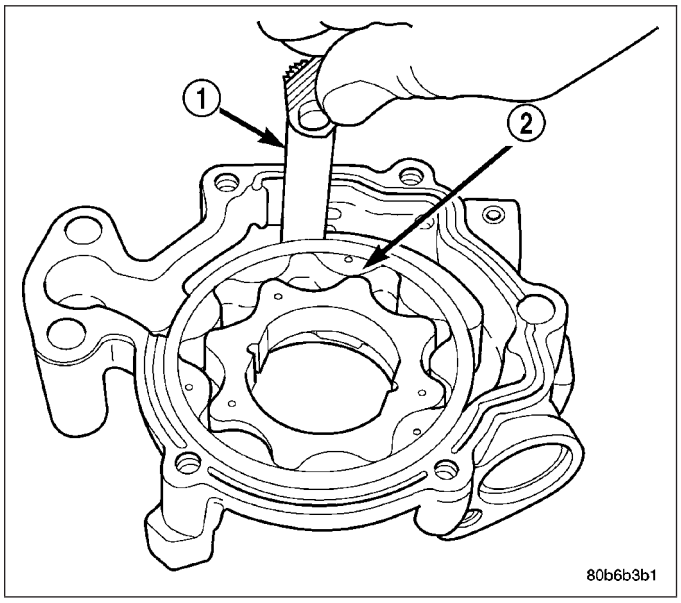
3. Measure the thickness of the outer rotor. If the outer rotor thickness measures at 12.005 mm (0.472 in.) or less the oil pump assembly must be replaced.
4. Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (3.382 in.) or less the oil pump assembly must be replaced.



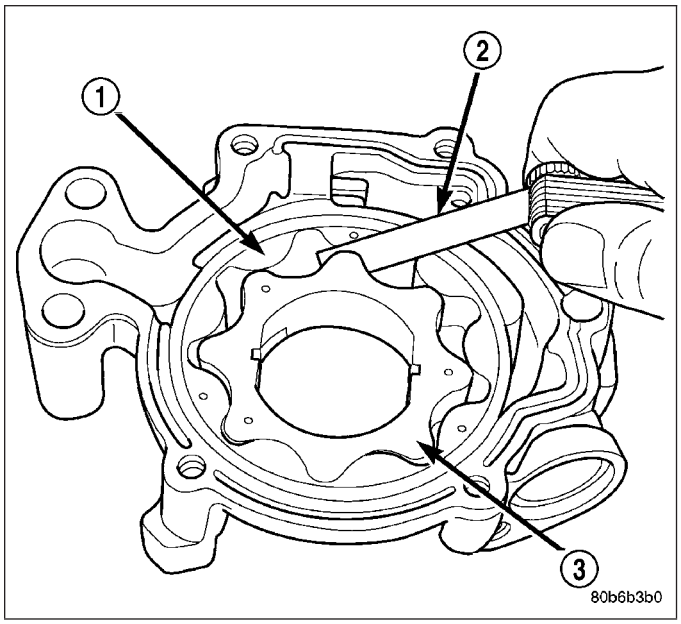
5. Measure the thickness of the inner rotor. If the inner rotor thickness measures at 12.005 mm (0.472 in.) or less then the oil pump assembly must be replaced.



6. Slide outer rotor (2) into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.

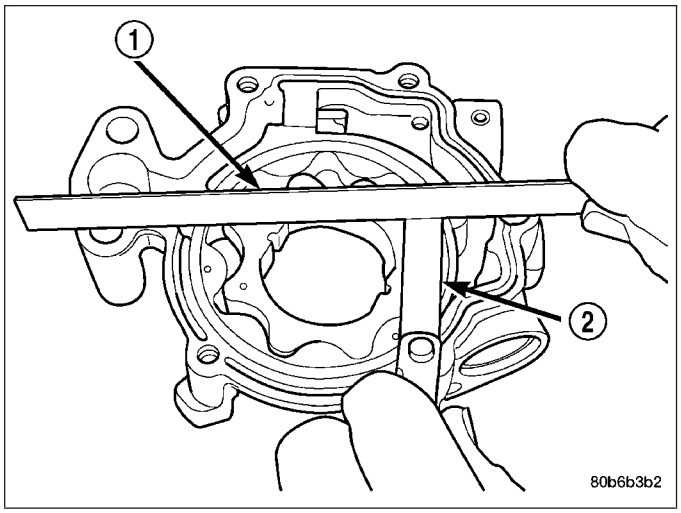


7. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner (3) and outer (1) rotors. If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.



8. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.

NOTE: The 3.7L/4.7L Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

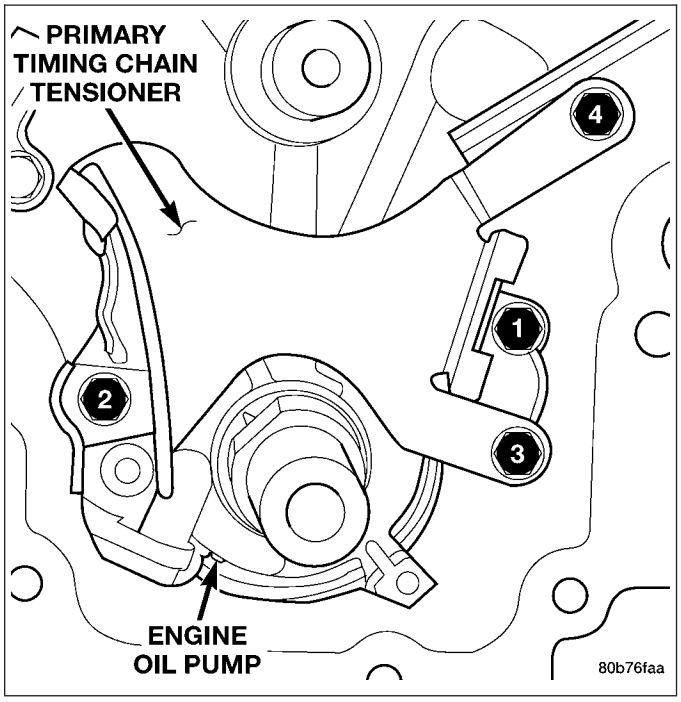


ASSEMBLY

1. Wash all parts in a suitable solvent and inspect carefully for damage or wear.
2. Install inner and outer rotors
3. Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).
4. Prime oil pump before installation by filling rotor cavity with engine oil.
5. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

INSTALLATION

1. Position the oil pump onto the crankshaft and install one oil pump retaining bolts.
2. Position the primary timing chain tensioner and install three retaining bolts.
3. Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown.
4. Install the secondary timing chain tensioners and timing chains (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
5. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
6. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



MANIFOLD - INTAKE

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks. Eight studs and two bolts are used to fasten the intake to the head.

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

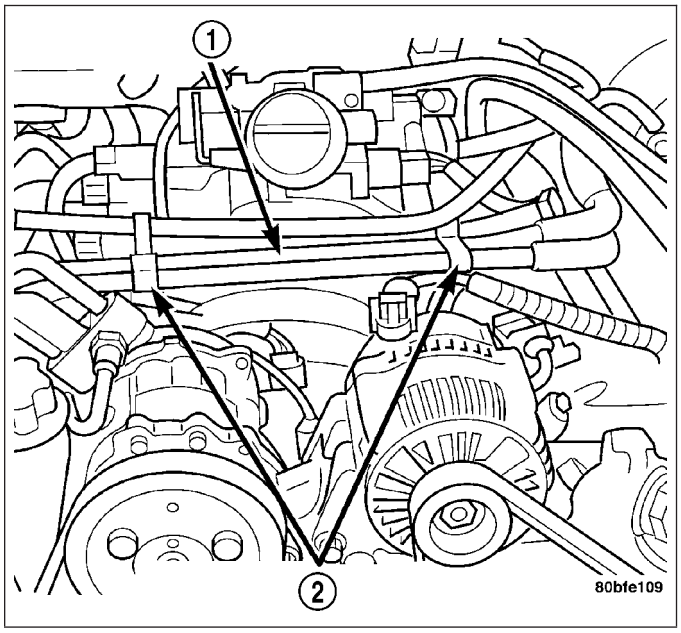
WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

1. Start the engine.
2. Spray a small stream of water at the suspected leak area.
3. If a change in RPM is observed the area of the suspected leak has been found.
4. Repair as required.

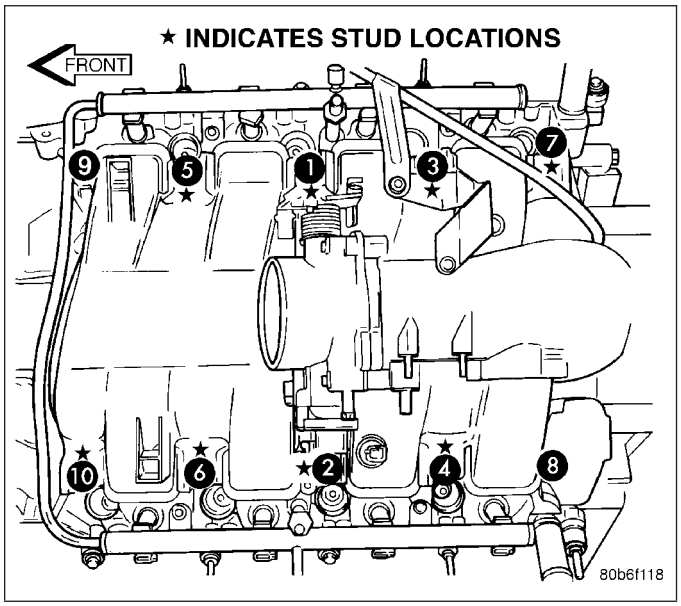
REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect throttle and speed control cables.
4. Disconnect electrical connectors for the following components:
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor

5. Disconnect brake booster hose and positive crankcase ventilation (PCV) hose.
6. Disconnect generator electrical connections.
7. Disconnect air conditioning compressor electrical connections.
8. Disconnect left and right radio suppressor straps.
9. Disconnect and remove ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).
10. Remove top oil dipstick tube retaining bolt and ground strap.
11. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
12. Remove fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - REMOVAL).
13. Remove throttle body assembly and mounting bracket.
14. Drain cooling system below coolant temperature level (Refer to 7 - COOLING - STANDARD PROCEDURE).
15. Remove the heater hoses (1) from the engine front cover and the heater core.
16. Unclip (2) and remove heater hoses and tubes from intake manifold.
17. Remove coolant temperature sensor (Refer to 7 - COOLING/ENGINE/ENGINE COOLANT TEMPERATURE SENSO - REMOVAL).



18. Remove intake manifold retaining fasteners in reverse order of tightening sequence.
19. Remove intake manifold.



CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

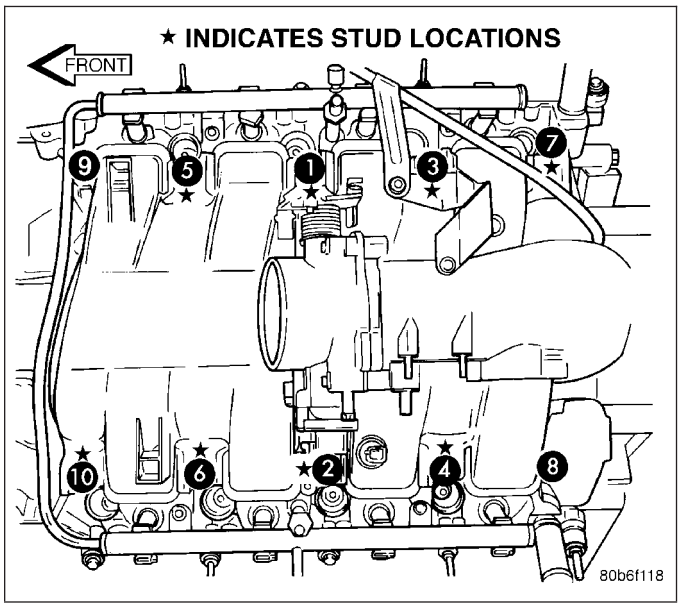
Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

1. Inspect the intake sealing surface for cracks, nicks and distortion.
2. Inspect the intake manifold vacuum hose fittings for looseness or blockage.
3. Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

INSTALLATION

1. Install intake manifold gaskets.
2. Position intake manifold.
3. Install intake manifold retaining bolts and tighten in sequence shown in to 12 N·m (105 in. lbs.).
4. Install left and right radio suppressor straps.
5. Install throttle body assembly.
6. Install throttle cable bracket.
7. Connect throttle cable and speed control cable to throttle body.
8. Install fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL RAIL - INSTALLATION).
9. Install ignition coil towers (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - INSTALLATION).



10. Position and install heater hoses and tubes onto intake manifold.
11. Install the heater hoses to the heater core and engine front cover.
12. Connect electrical connectors for the following components:
    - Manifold Absolute Pressure (MAP) Sensor
    - Intake Air Temperature (IAT) Sensor
    - Throttle Position (TPS) Sensor
    - Coolant Temperature (CTS) Sensor
    - Idle Air Control (IAC) Motor
    - Ignition coil towers
    - Fuel injectors
13. Install top oil dipstick tube retaining bolt and ground strap.
14. Connect generator electrical connections.
15. Connect Brake booster hose and Positive crankcase ventilation (PCV) hose.
16. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
17. Install resonator assembly and air inlet hose.
18. Connect negative cable to battery.

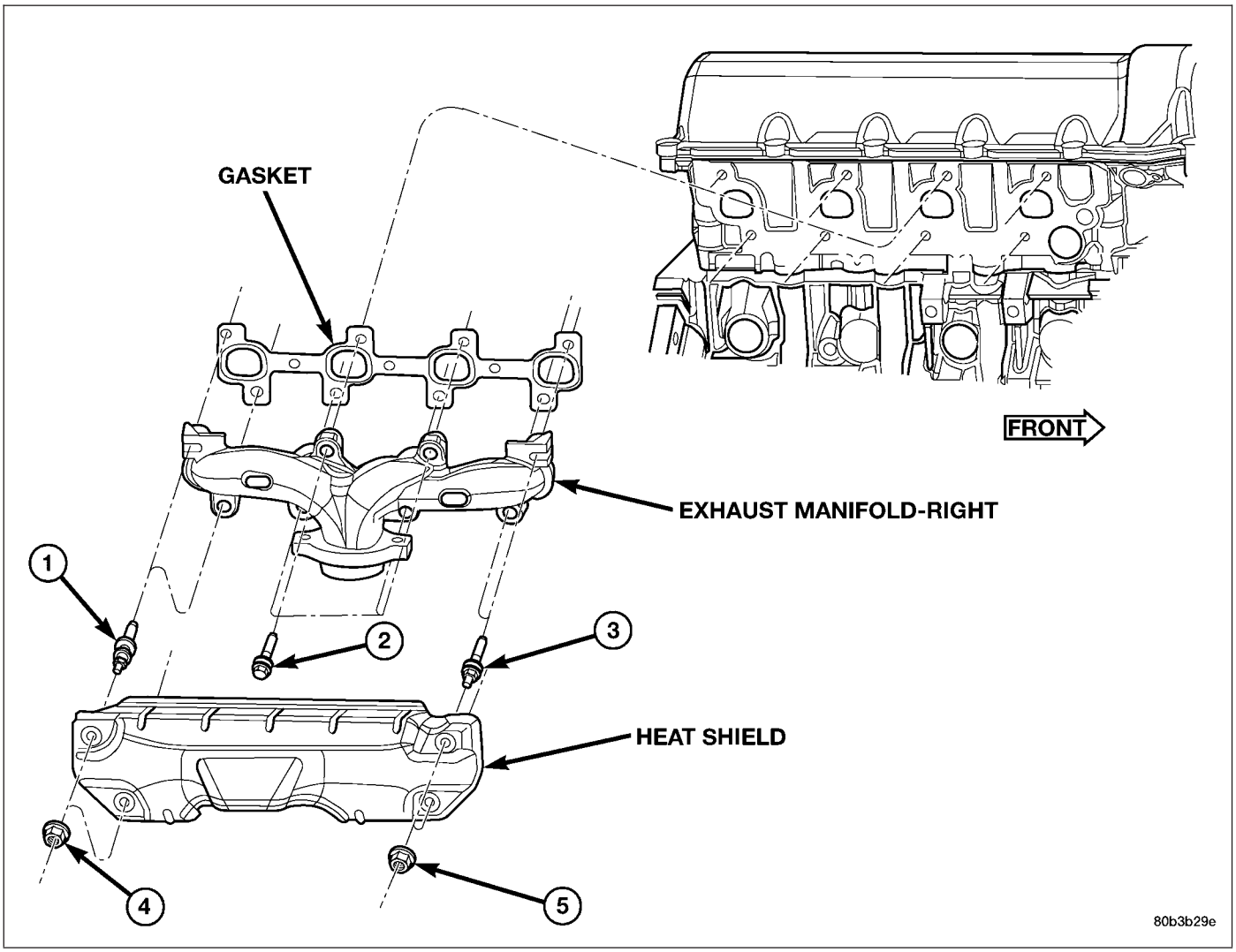
MANIFOLD - EXHAUST

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

REMOVAL

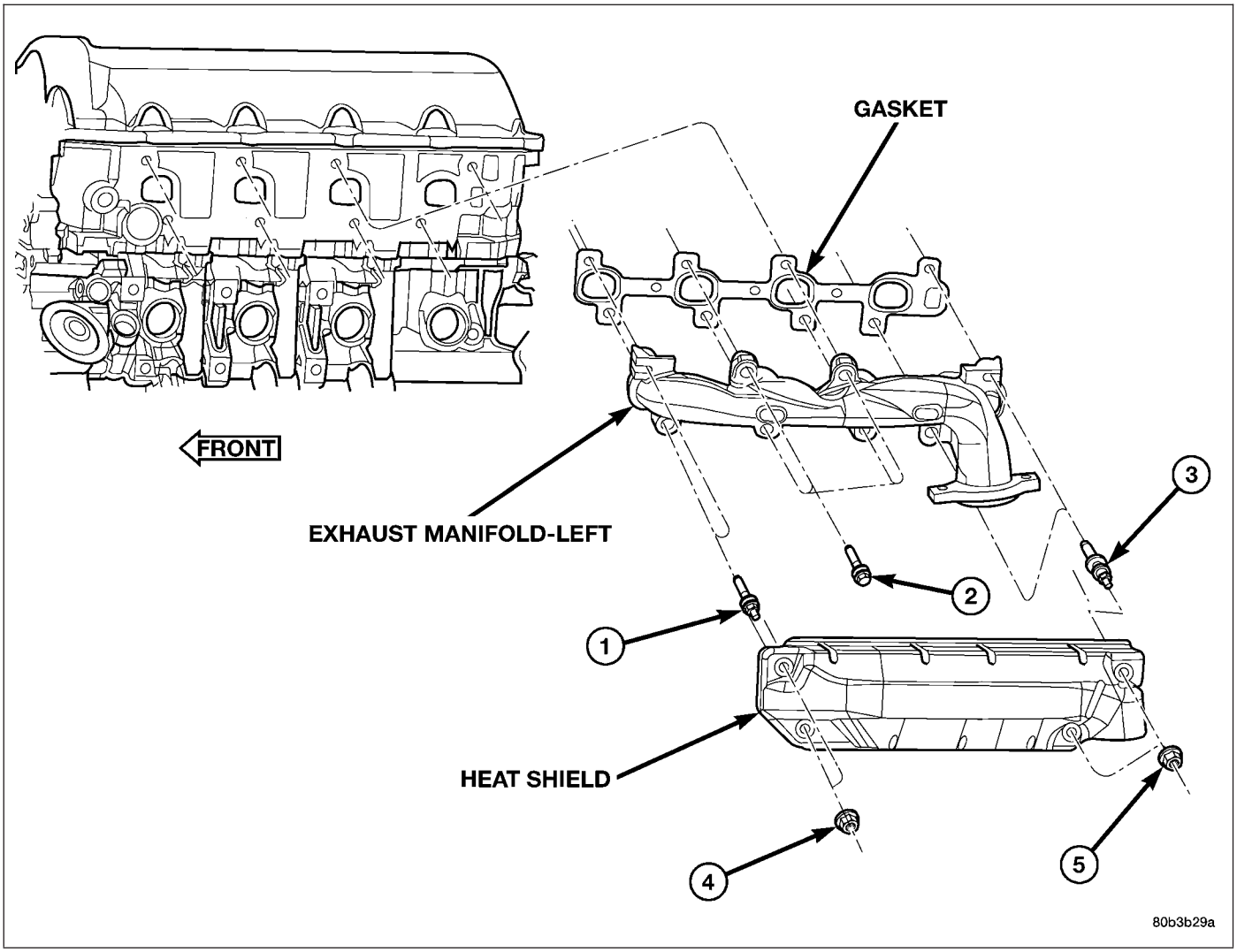
RIGHT EXHAUST MANIFOLD



1. Disconnect negative cable for battery.
2. Remove air cleaner assembly, resonator assembly and air inlet hose.
3. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).
5. Remove A/C accumulator support bracket fastener.
6. Drain coolant below heater hose level (Refer to 7 - COOLING - STANDARD PROCEDURE).
7. Remove heater hoses at engine.
8. Remove fasteners(4,5) attaching exhaust manifold heat shield.

9. Remove heat shield.
10. Remove upper exhaust manifold attaching fasteners (1,3).
11. Raise vehicle on hoist.
12. Disconnect exhaust pipe from manifold.
13. Remove fasteners attaching starter. Move starter aside.
14. Remove lower exhaust manifold attaching fasteners.
15. Remove exhaust manifold and gasket. Manifold is removed from below the engine compartment.

LEFT EXHAUST MANIFOLD



1. Disconnect negative cable for battery.
2. Hoist vehicle.
3. Disconnect exhaust pipe at manifold.
4. Lower vehicle.
5. Remove the front two exhaust heat shield retaining fasteners (4,5). Raise vehicle and remove the fasteners at rear of heat shield.
6. Remove heat shield.
7. Lower vehicle and remove the upper exhaust manifold retaining bolts (2).
8. Raise vehicle and remove the lower exhaust manifold retaining bolts (3).
9. Remove exhaust manifold and gasket. Manifold is removed from below the engine compartment.

CLEANING

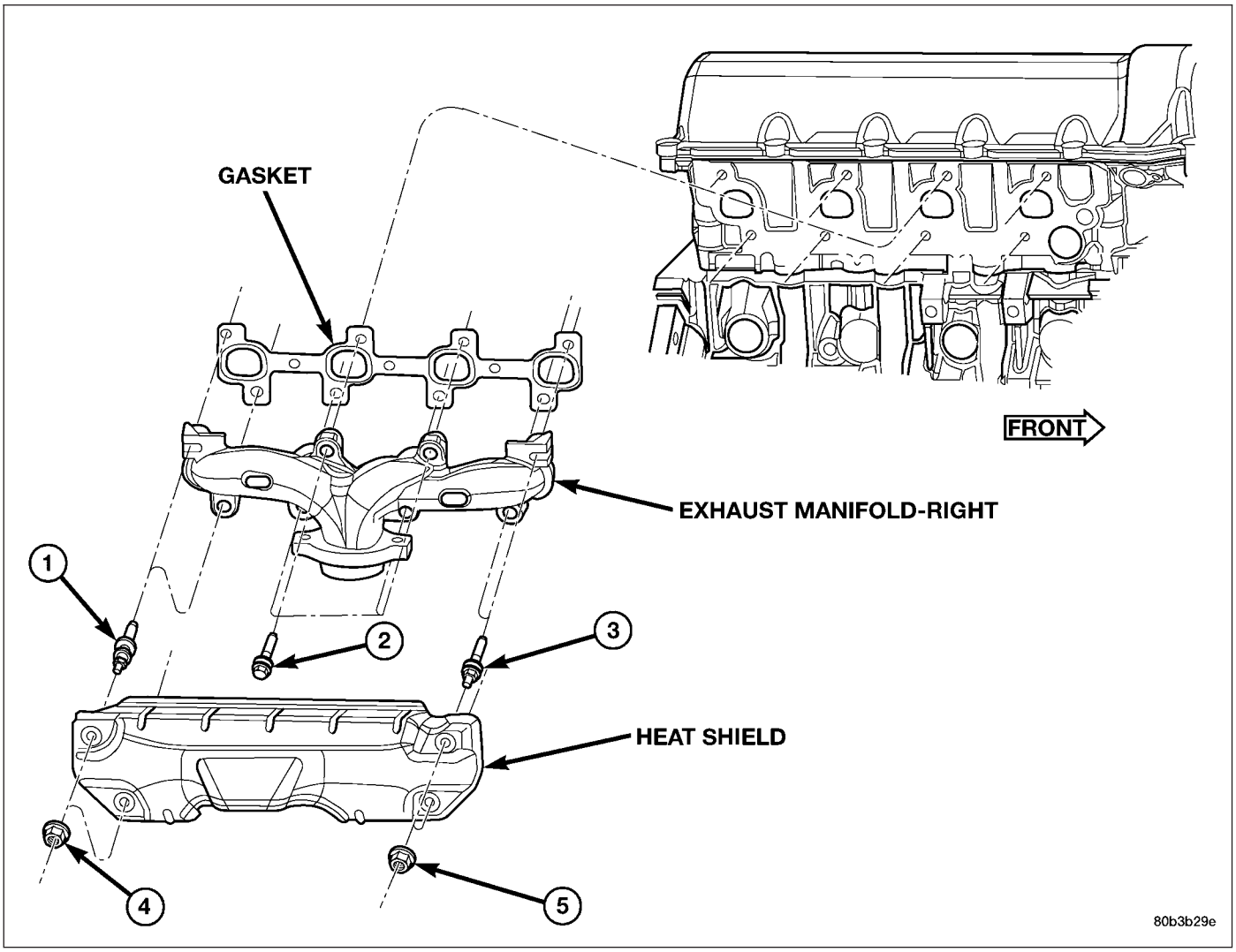
1. Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.
2. Clean all gasket residue from the manifold mating surface.

INSPECTION

1. Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.
2. Using a straight edge and a feeler gauge, check the mating surface for warp and twist.
3. Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

INSTALLATION

RIGHT EXHAUST MANIFOLD



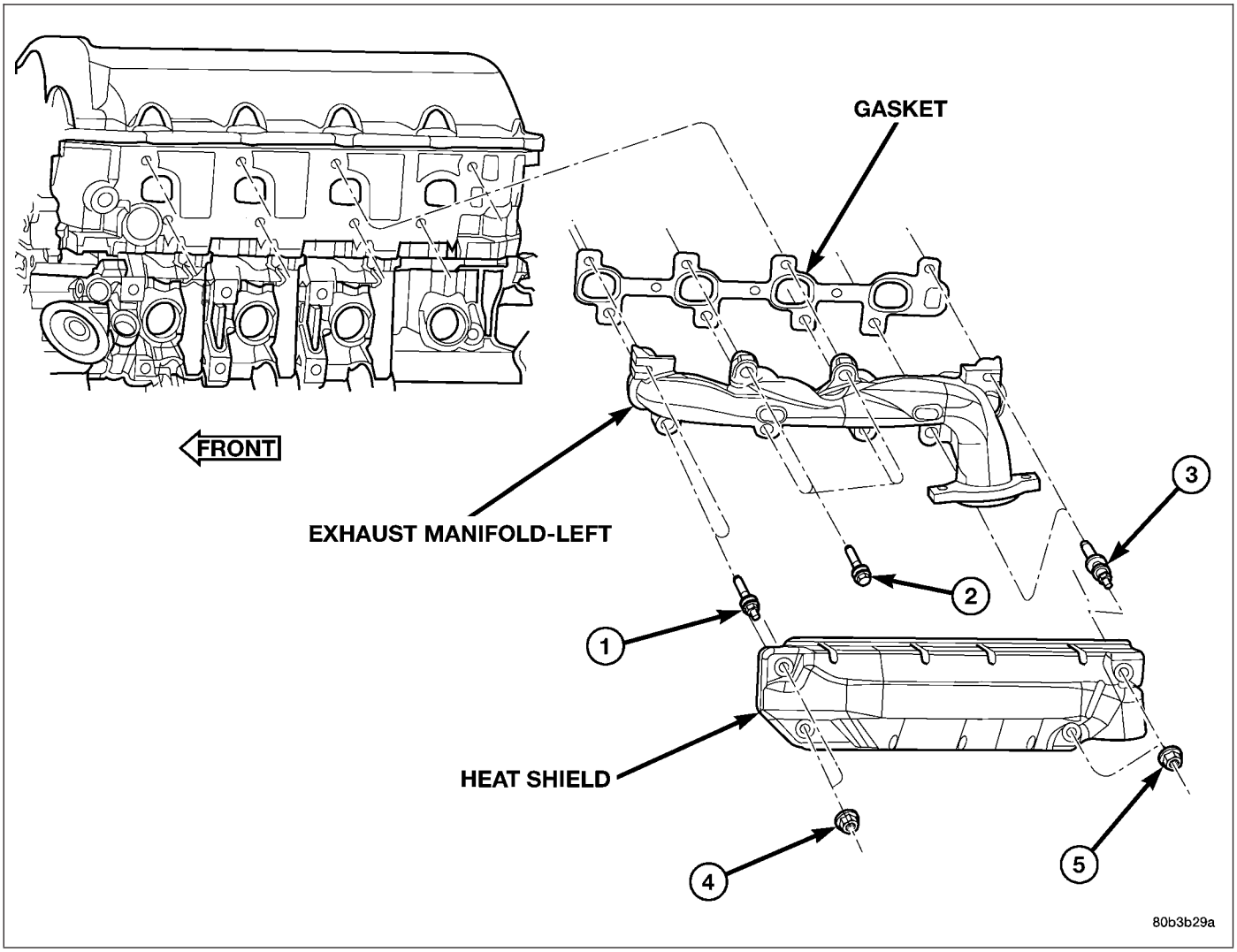
1. Install exhaust manifold and gasket from below engine compartment.
2. Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.
3. Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts 91,2,3) starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

4. Install exhaust manifold heat shield. Tighten fasteners (4,5) to 8 N·m (72 in. lbs.), then loosen 45 degrees.

5. Install starter and fasteners.
6. Connect exhaust pipe to manifold.
7. Connect heater hoses at engine.
8. Install fastener attaching A/C accumulator.
9. Install A/C compressor and fasteners.
10. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
11. Install air cleaner assembly, resonator assembly and air inlet hose.
12. Install battery and connect cables.
13. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

LEFT EXHAUST MANIFOLD



1. Install exhaust manifold and gasket from below engine compartment.
2. Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.
3. Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts (2,3) starting at center and working outward to 25 N·m (18 ft. lbs.).

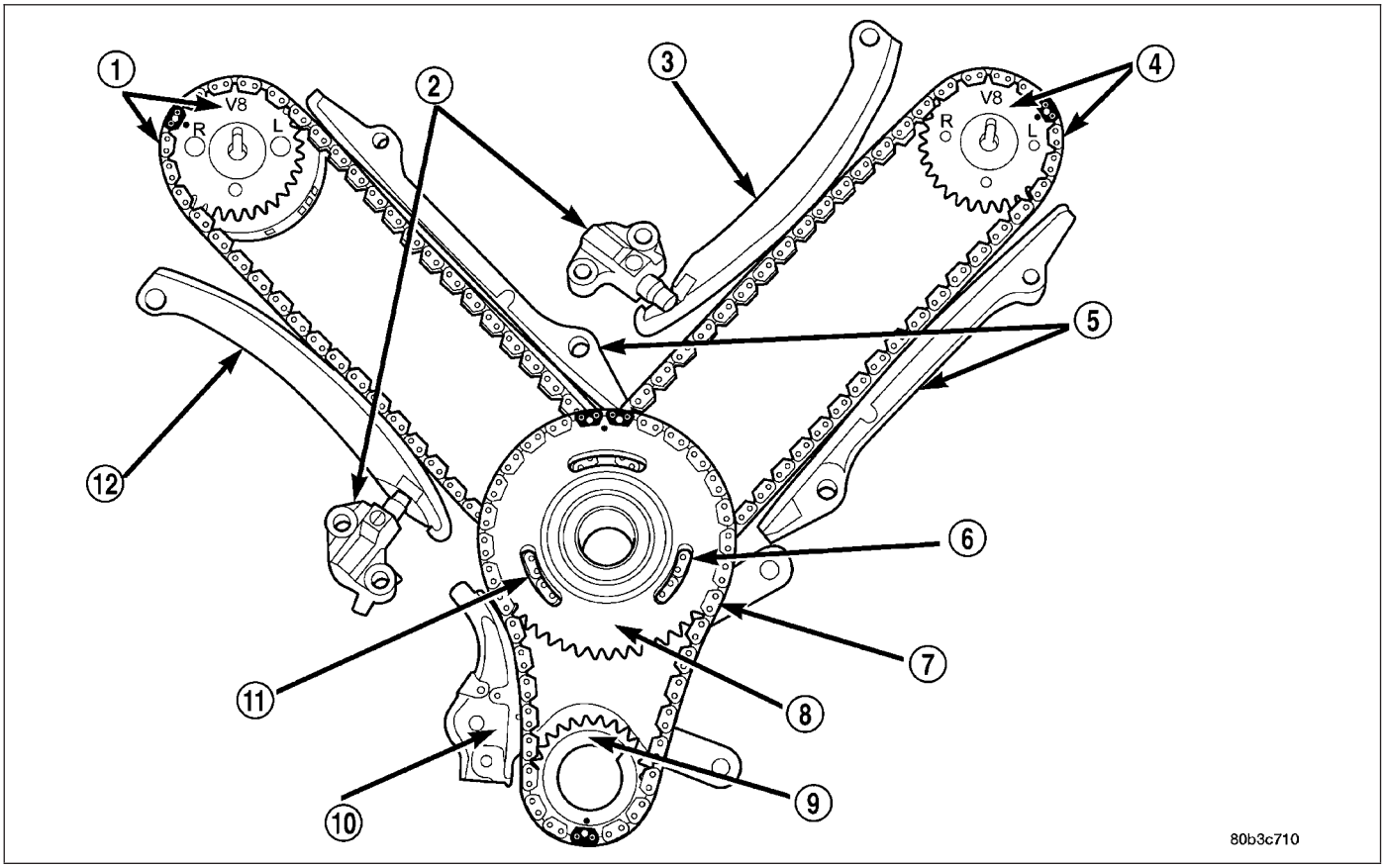
CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

4. Install exhaust manifold heat shield. Tighten fasteners (4,5) to 8 N·m (72 in. lbs.), then loosen 45 degrees.
5. Connect exhaust pipe to manifold.

6. Connect negative cable to battery.

VALVE TIMING

DESCRIPTION - TIMING DRIVE SYSTEM



The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non-free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consists of a primary chain and two secondary timing chain drives.

OPERATION - TIMING DRIVE SYSTEM

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral thirty tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a non – serviceable press fit anti rattle type. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press-fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are inverted tooth type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a thirty tooth cam sprocket directly from the thirty tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tension in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after

engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

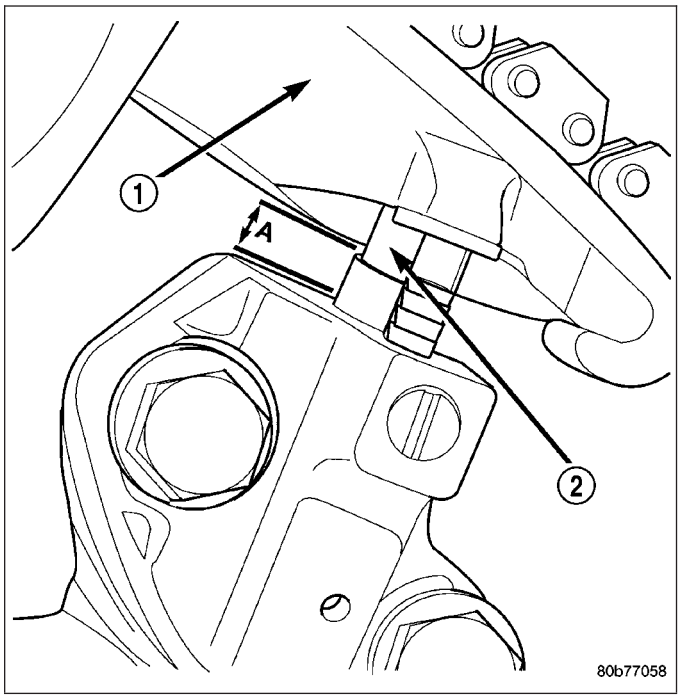
STANDARD PROCEDURE

STANDARD PROCEDURE - MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

1. Remove the timing chain cover. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
2. To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston (2) extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston. The measurement at point (A) must be less than 15mm (0.5906 inches).
3. If the measurement exceeds the specification the secondary timing chains are worn and require replacement. (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: If the secondary chains are to be replaced the primary chain must also be replaced.



STANDARD PROCEDURE - ENGINE TIMING - VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

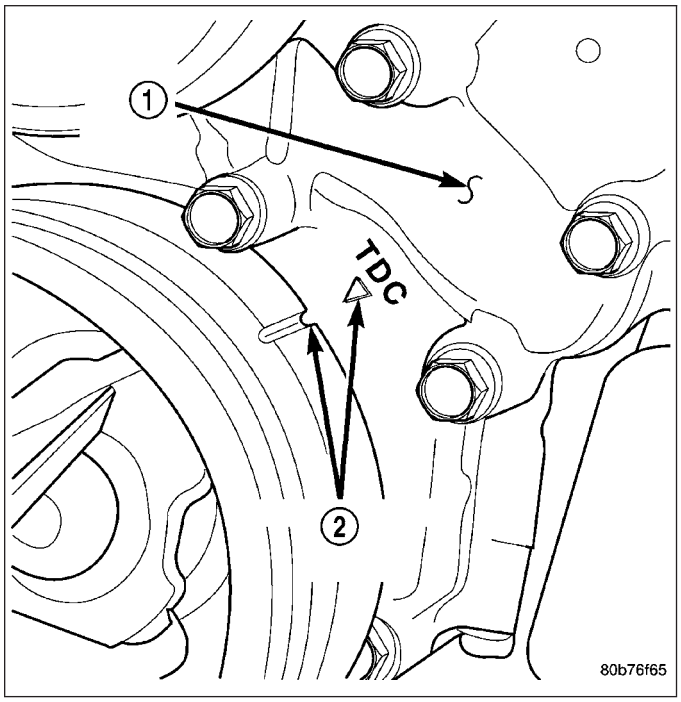
NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

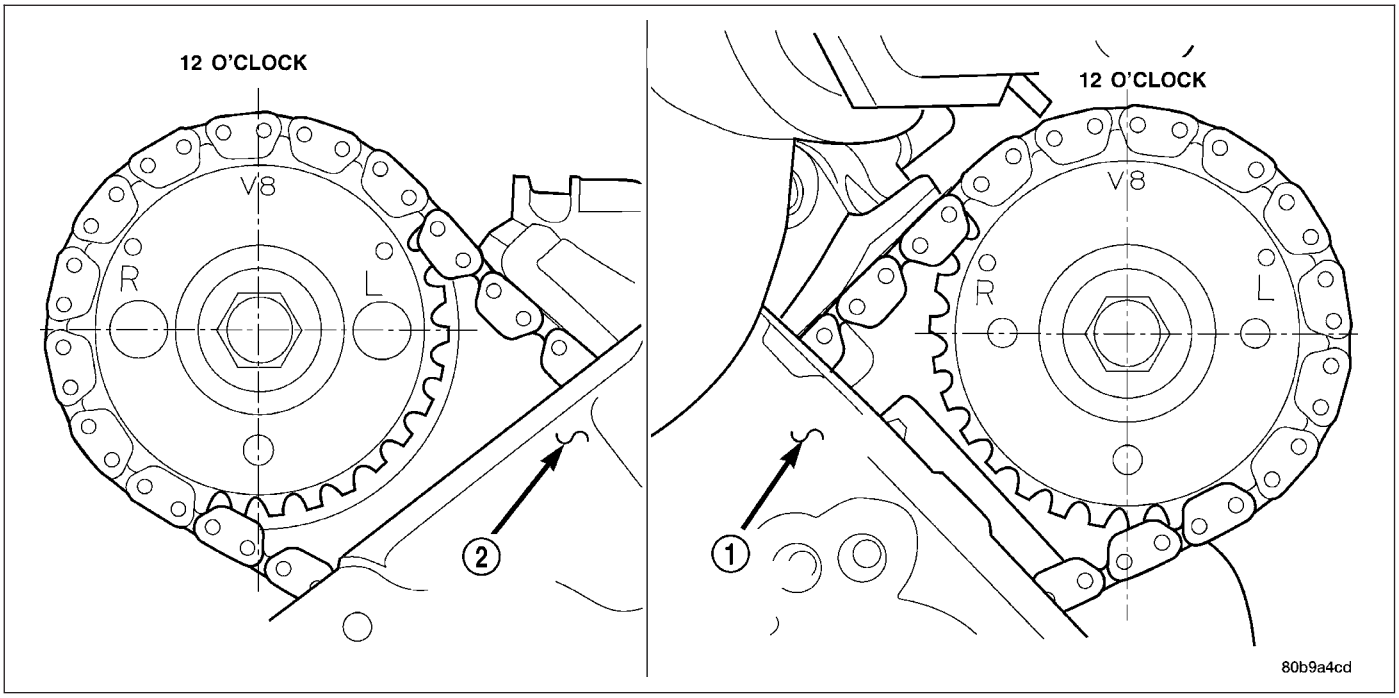
NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

1. Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

2. Using a mirror, locate the TDC arrow on the front cover. Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

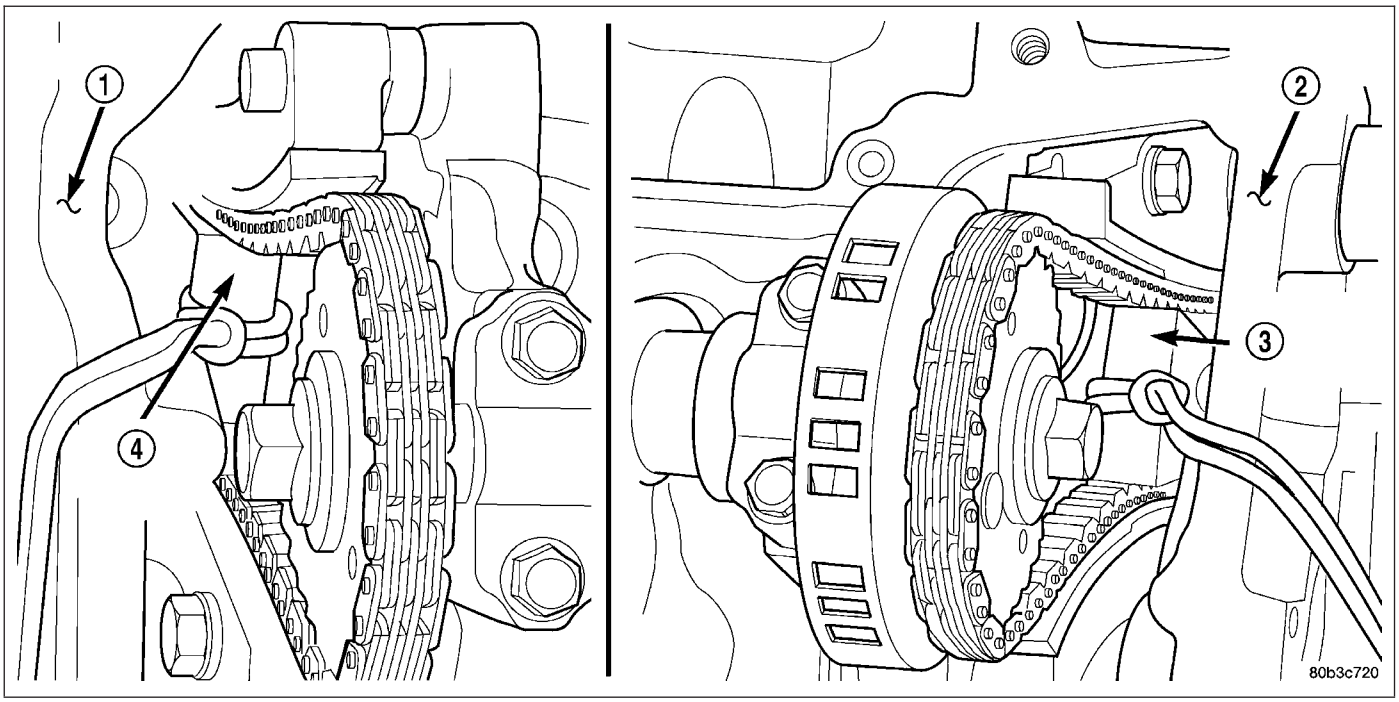




3. Note the location of the V8 mark stamped into the camshaft drive gears. If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC (cylinder #1) on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC (cylinder #1) on the compression stroke.
4. If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.
5. If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.
6. If both camshaft drive gear V8 marks are at the twelve o'clock or the six o' clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

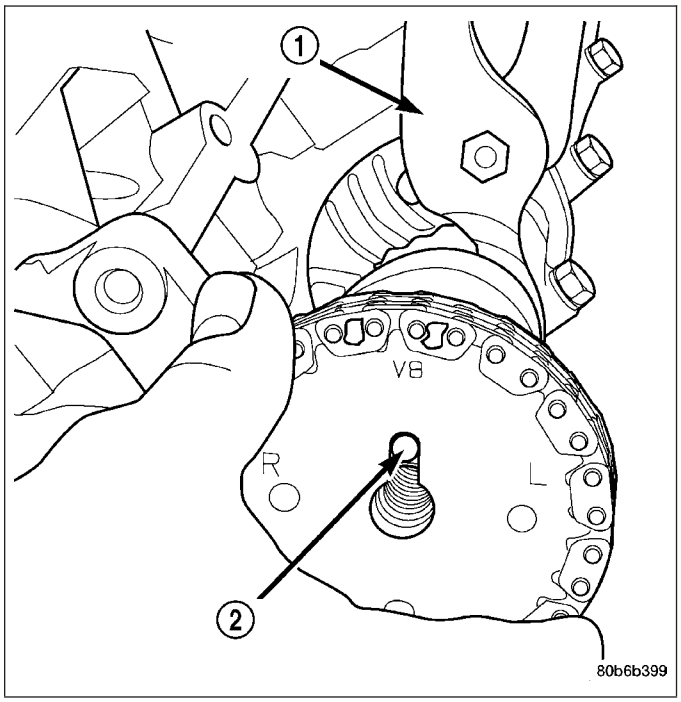
NOTE: to adjust the timing on one camshaft, peform the following procedure.



1. Using Chain Tensioner Wedge, special tool 8350 (3), stabilize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.
2. Remove the camshaft drive gear retaining bolt.
3. Carefully remove the camshaft drive gear from the camshaft.
4. Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

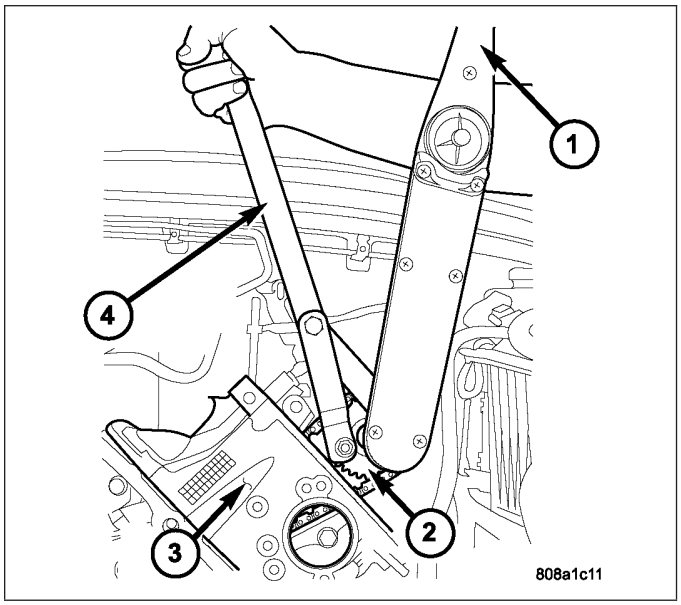
NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

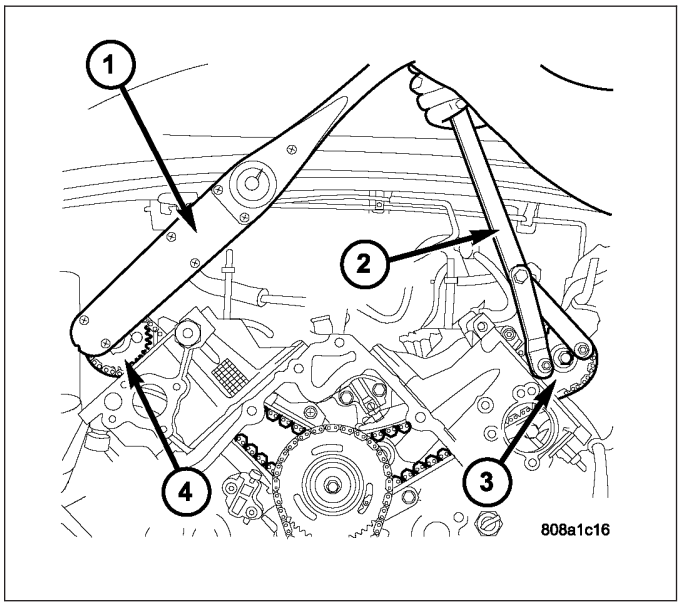
5. Using a suitable pair of adjustable pliers (1), rotate the camshaft until the alignment dowel (2) on the camshaft is aligned with the slot in the camshaft drive gear.

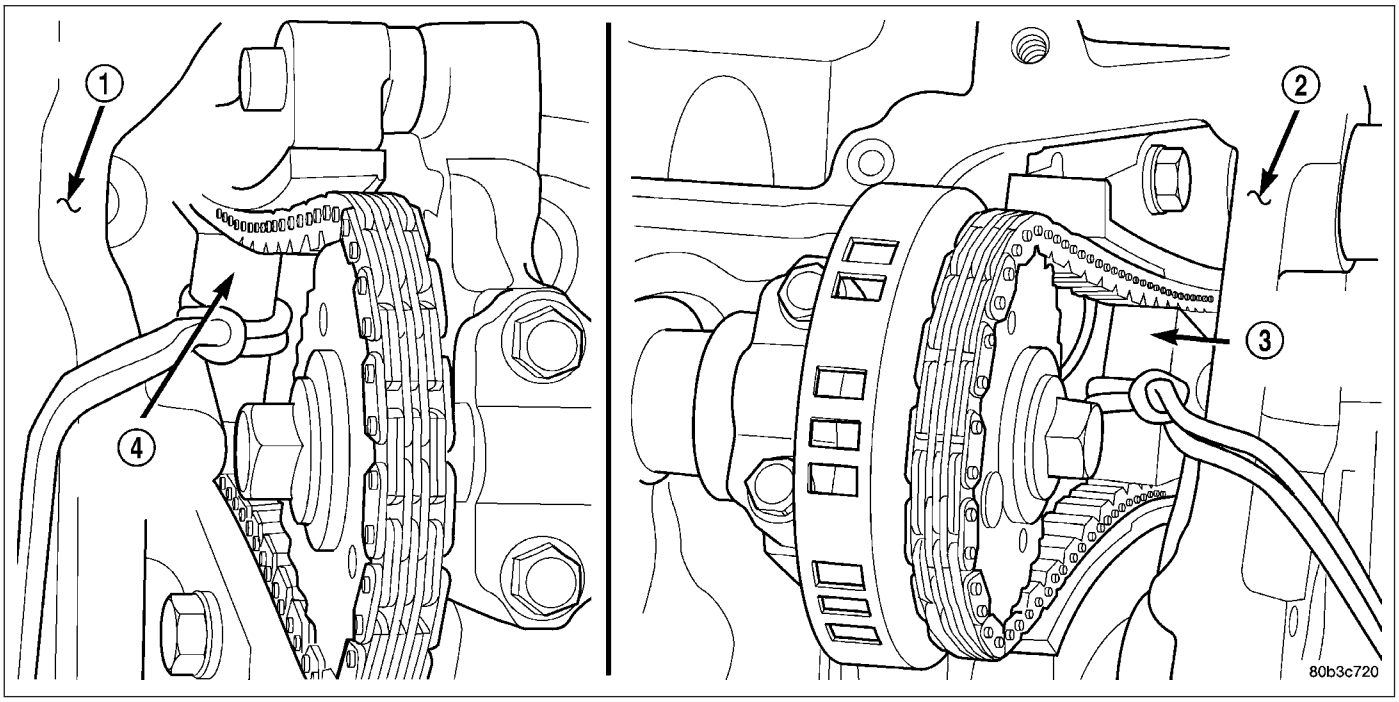


CAUTION: Remove excess oil from camshaft sprocket retaining bolt before reinstalling bolt. Failure to do so may cause over-torqueing of bolt resulting in bolt failure.

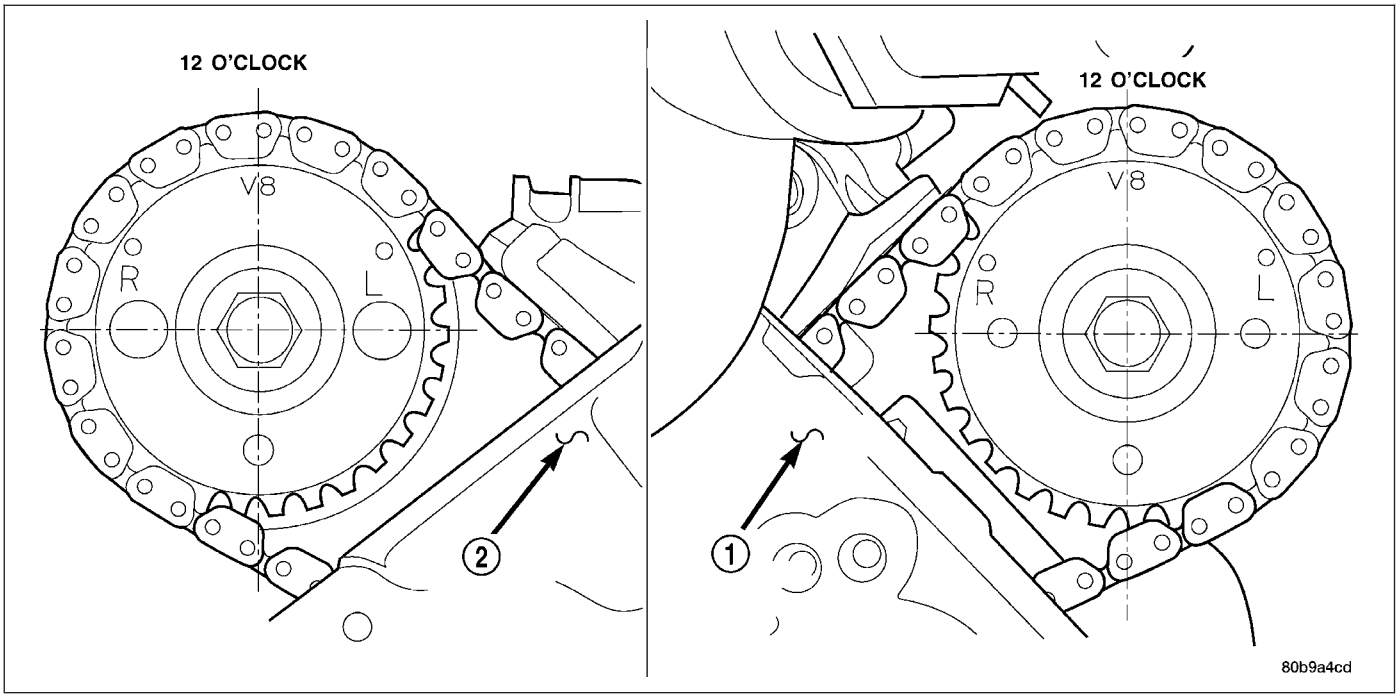
6. Position the camshaft drive gear onto the camshaft, remove oil from bolt then install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench (1), Tighten retaining bolt to 122N·m (90 ft. Lbs.).







7. Remove special tool 8350 (3,4).

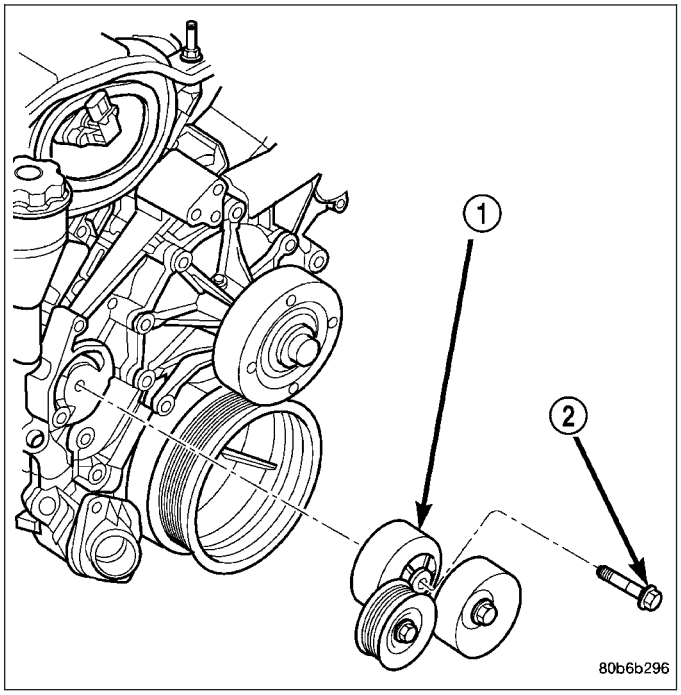


8. Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.
9. Install the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

COVER - TIMING

REMOVAL

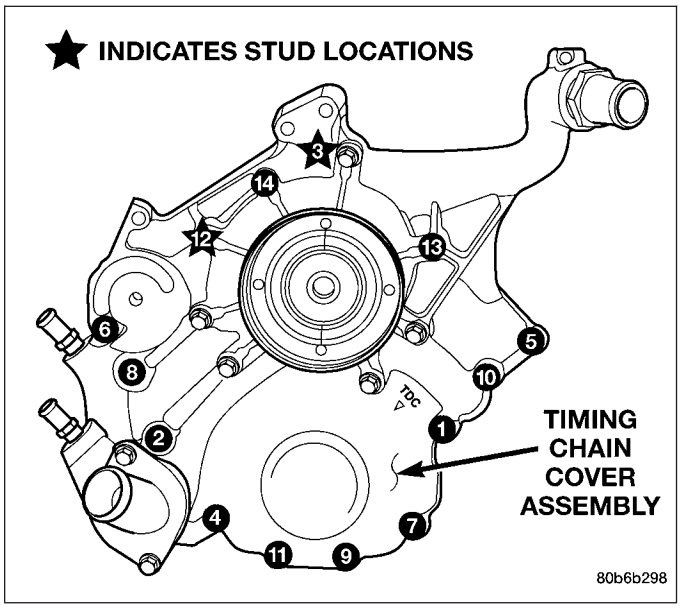
1. Disconnect the battery negative cable.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Disconnect both heater hoses at timing cover.
4. Disconnect lower radiator hose at engine.
5. Remove crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove accessory drive belt tensioner assembly (1).
7. Remove the generator and A/C compressor.



CAUTION: The 4.7L engine uses an RTV sealer instead of a gasket to seal the front cover to the engine block, from the factory. For service, Mopar® Grey Engine RTV sealant must be substituted.

NOTE: It is not necessary to remove the water pump for timing cover removal.

8. Remove the bolts holding the timing cover to engine block.
9. Remove cover.



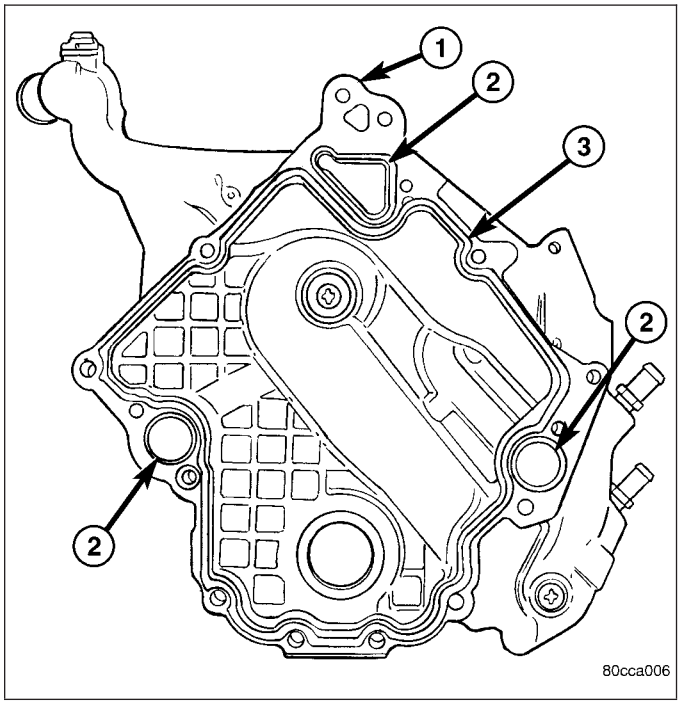
INSTALLATION

CAUTION: Do not use oil based liquids to clean timing cover or block surfaces. Use only rubbing alcohol, along with plastic or wooden scrapers. Use no wire brushes or abrasive wheels or metal scrapers, or damage to surfaces could result.

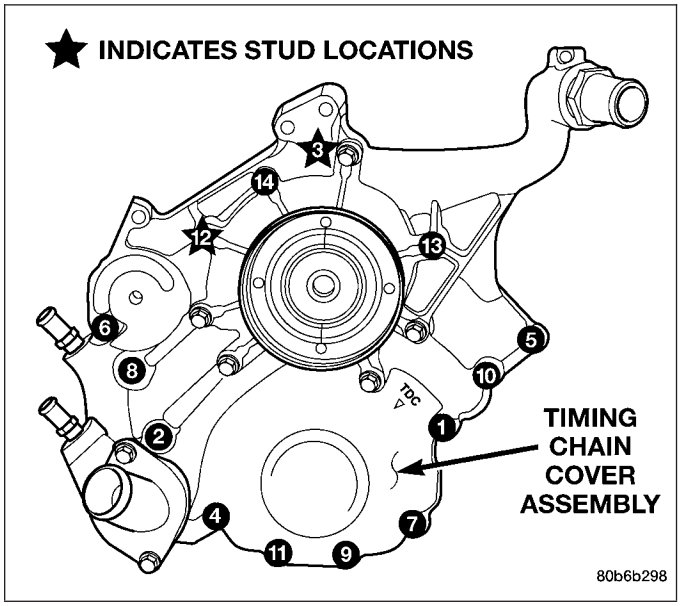
1. Clean timing chain cover and block surface using rubbing alcohol.

CAUTION: The 4.7L can use a special RTV sealer instead of a carrier gasket to seal the timing cover to the engine block, from the factory. For service repairs, Mopar® Grey Engine RTV must be used as a substitute, if RTV is present. If the front cover being used has no provisions for the water passage o-rings, then Mopar® Grey Engine RTV must be applied around the water passages.

2. Inspect the water passage o-rings, if equipped for any damage, and replace as necessary.
3. Apply Mopar® Grey Engine RTV sealer to the front cover following the path above, using a 3 to 4mm thick bead.



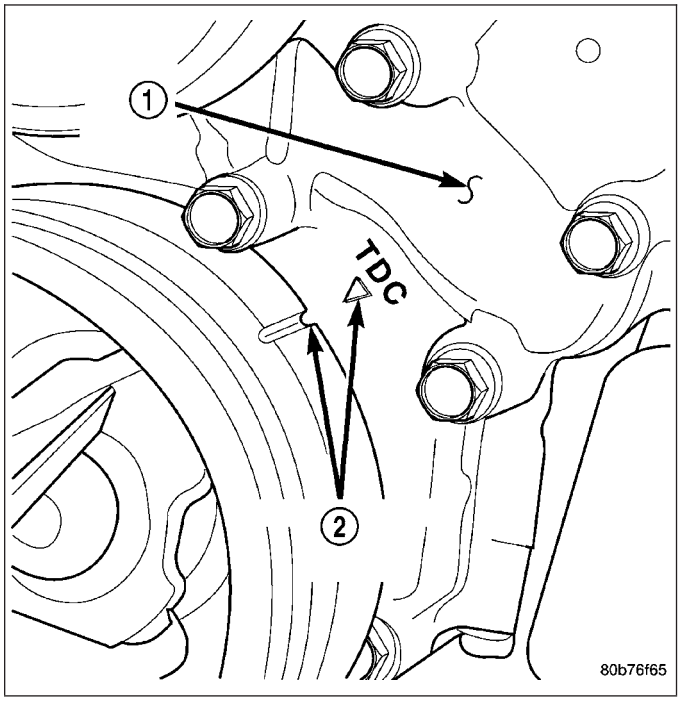
4. Install cover. Tighten flange head fasteners in sequence as shown in to 58 N·m (43 ft. lbs.).
5. Install the A/C compressor and generator.
6. Install crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
7. Install accessory drive belt tensioner assembly. Tighten fastener to 54 N·m (40 ft. lbs.).
8. Install lower radiator hose.
9. Install both heater hoses.
10. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
11. Connect the battery negative cable.

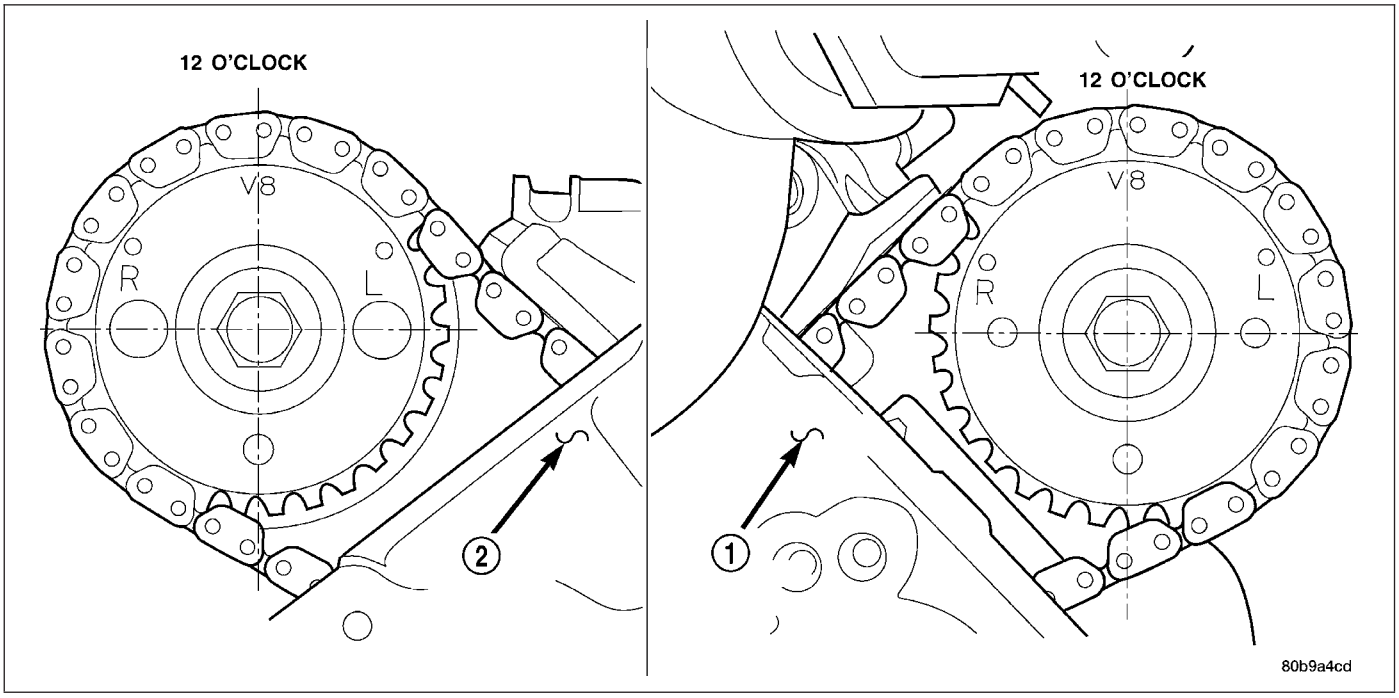


TIMING CHAIN & SPROCKETS

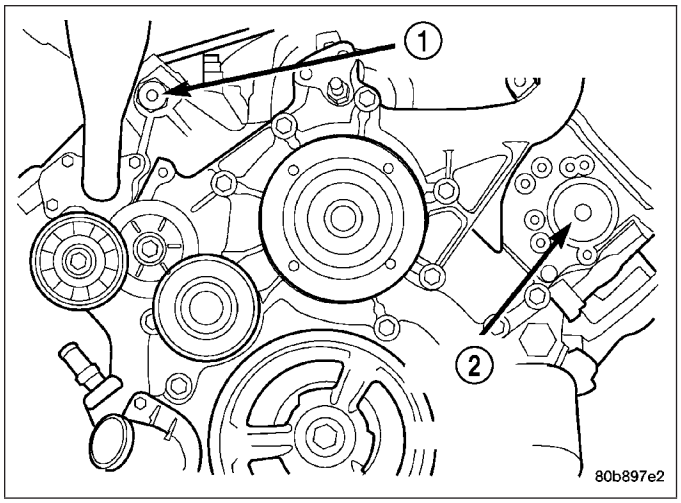
REMOVAL

1. Disconnect negative cable from battery.
2. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
3. Remove right and left cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Remove radiator fan shroud.
5. Rotate engine until timing mark (2) on crankshaft damper aligns with TDC mark on timing chain cover (2) (#1 cylinder exhaust stroke) and the camshaft sprocket “V8” marks are at the 12 o’clock position (1,2).





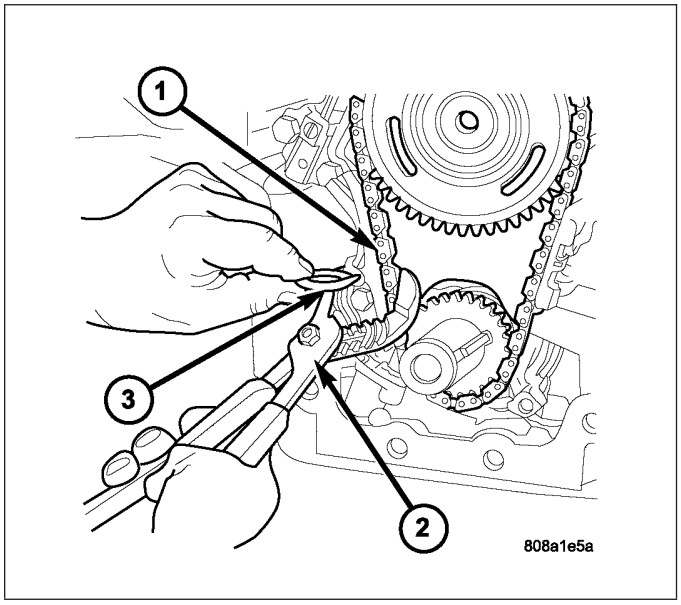
6. Remove power steering pump (Refer to 19 - STEERING/PUMP - REMOVAL).
7. Remove access plugs (1,2) from left and right cylinder heads for access to chain guide fasteners.
8. Remove the oil fill housing to gain access to the right side tensioner arm fastener.
9. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).



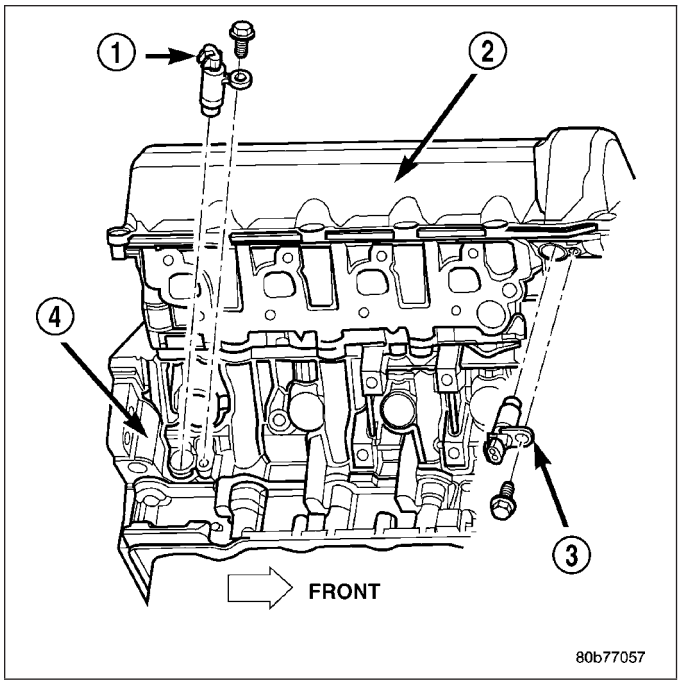
10. Collapse and pin primary chain tensioner (1).

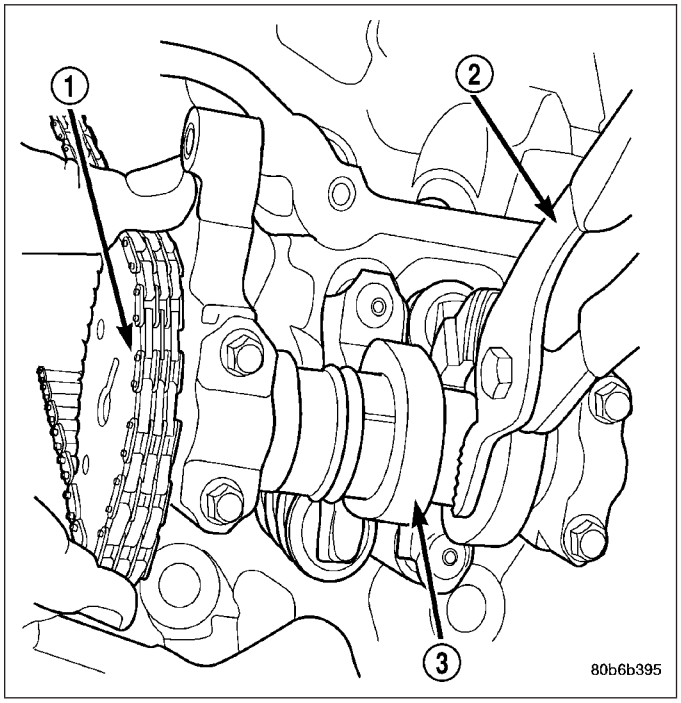
CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

11. Remove secondary chain tensioners.



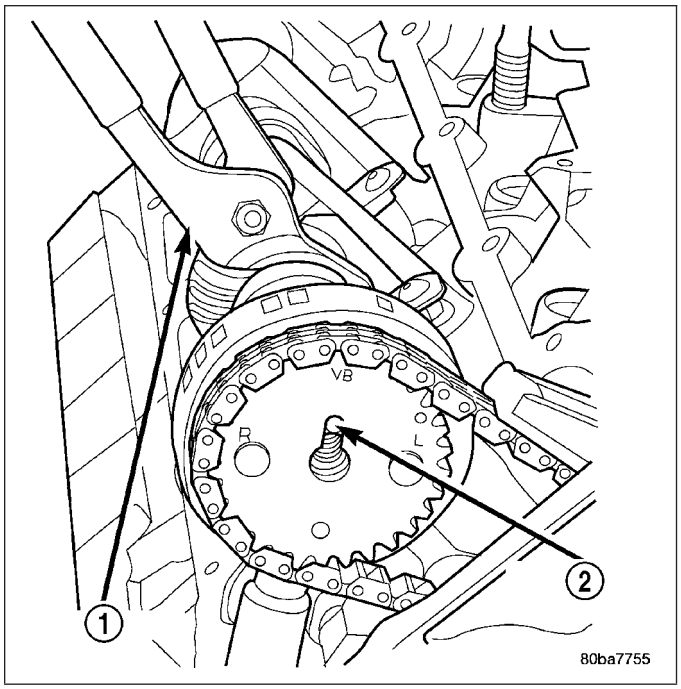
12. Remove camshaft position sensor (1) from right cylinder head.





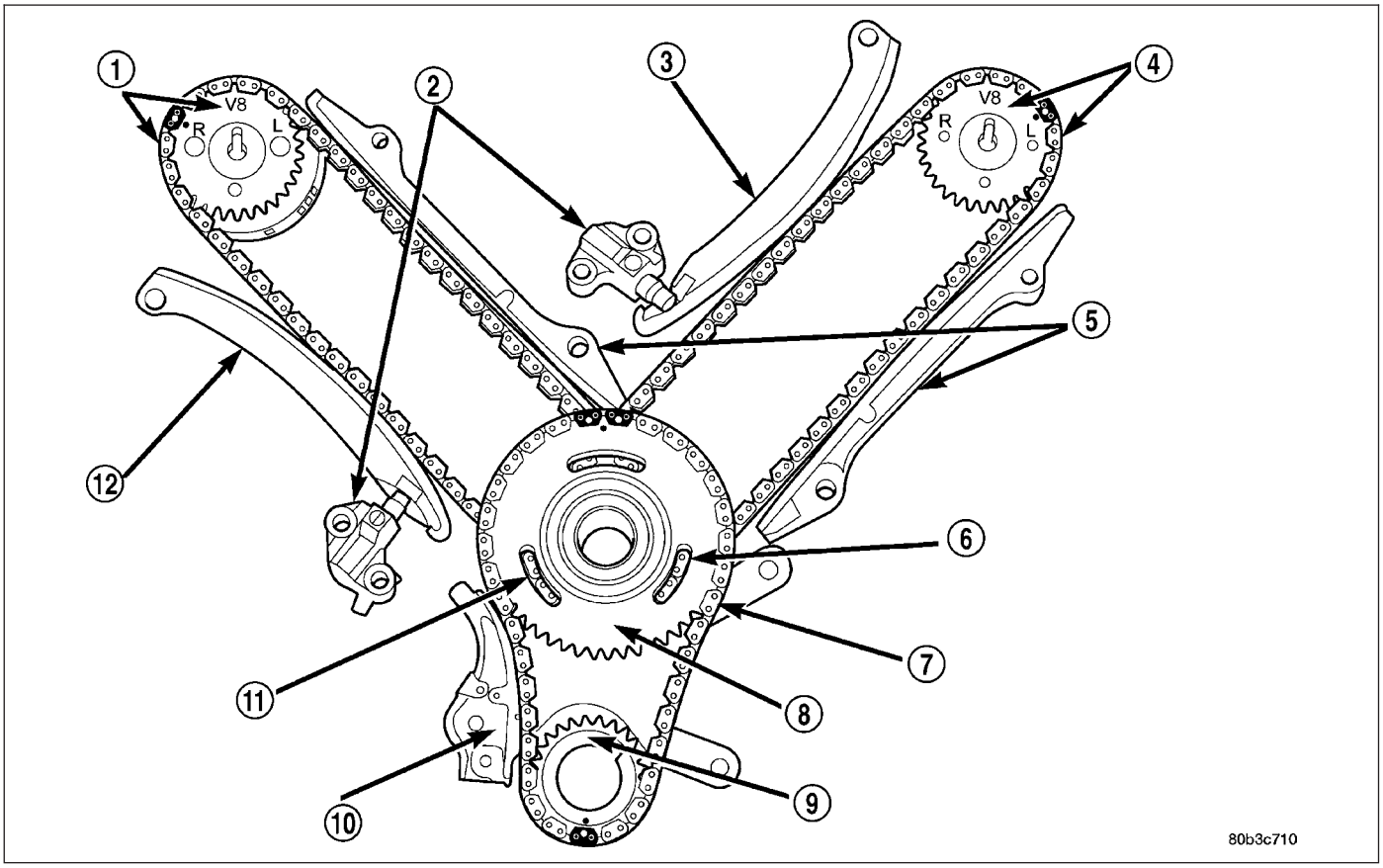
CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental starter engagement.



13. Remove left and right camshaft sprocket bolts.
14. While holding the left camshaft steel tube with adjustable pliers (1), remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.
15. While holding the right camshaft steel tube with adjustable pliers (1), remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.
16. Remove idler sprocket assembly bolt.
17. Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.
18. Remove both pivoting tensioner arms and chain guides.
19. Remove chain tensioner.

INSPECTION

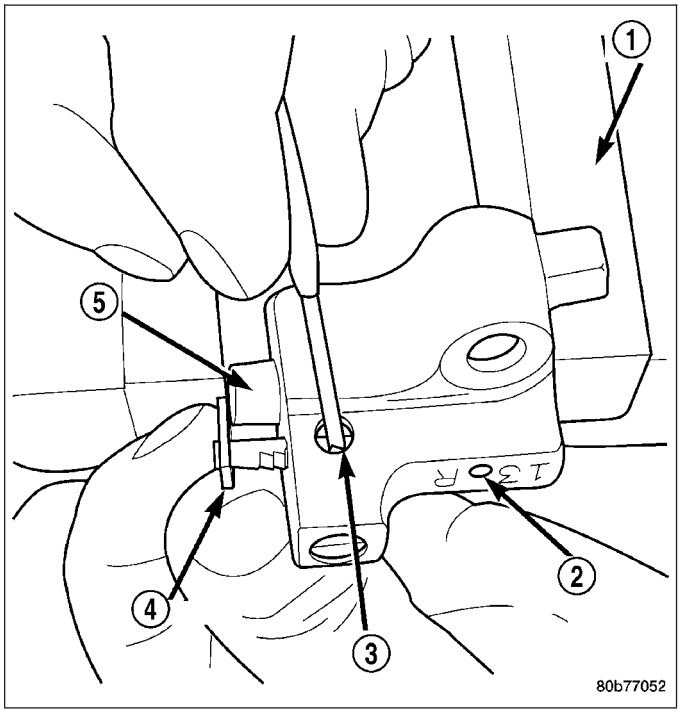


Inspect the following components:

- Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.
- Idler sprocket assembly bushing and shaft for excessive wear.
- Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.
- Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.
- Secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between tensioner piston and tensioner arm. If this condition exist the tensioner and tensioner arm should be replaced.
- Primary chain tensioner plastic faces. Replace as required.

INSTALLATION

1. Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin (3) into hole on front of tensioner (2). Slowly open vise to transfer piston spring force to lock pin.



2. Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

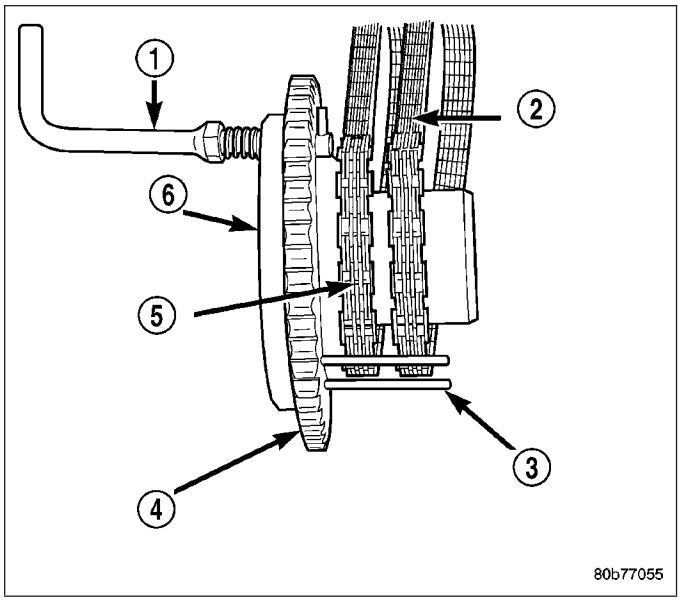
3. Install right side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

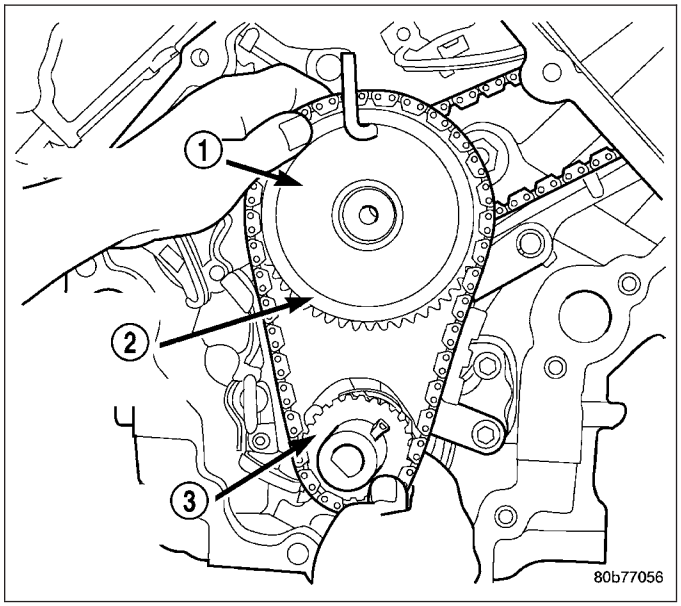
4. Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

CAUTION: Overtightening the tensioner arm torx® bolt can cause severe damage to the cylinder head. Tighten torx® bolt to specified torque only.

5. Install left side chain tensioner arm. Apply Mopar® Lock N, Seal to torx® bolt, tighten bolt to 17 N·m (150 in. lbs.).
6. Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).



7. Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8515 (6) to hold chains in place for installation.
8. Align primary chain double plated links with the timing mark at 12 o'clock (1) on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (3).



9. Lubricate idler shaft and bushings with clean engine oil.
10. Install all chains, crankshaft sprocket, and idler sprocket as an assembly. After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

11. Align left camshaft sprocket "L" dot to plated link on chain.
12. Align right camshaft sprocket "R" dot to plated link on chain.

CAUTION: Remove excess oil from the camshaft sprocket bolt. Failure to do so can result in over-torque of bolt resulting in bolt failure.

13. Remove Special Tool 8515, then attach both sprockets to camshafts. Remove excess oil from bolts, then Install sprocket bolts, but do not tighten at this time.
14. Verify that all plated links are aligned with the marks on all sprockets and the "V8" marks on camshaft sprockets are at the 12 o'clock position.

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

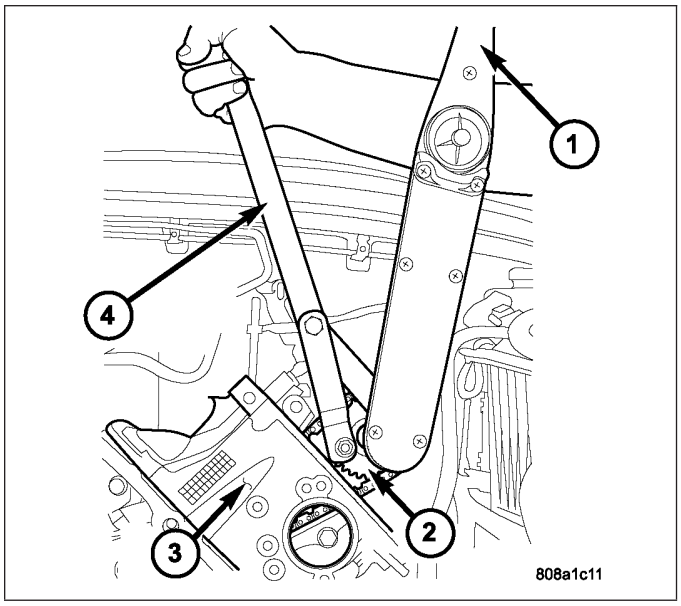
15. Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

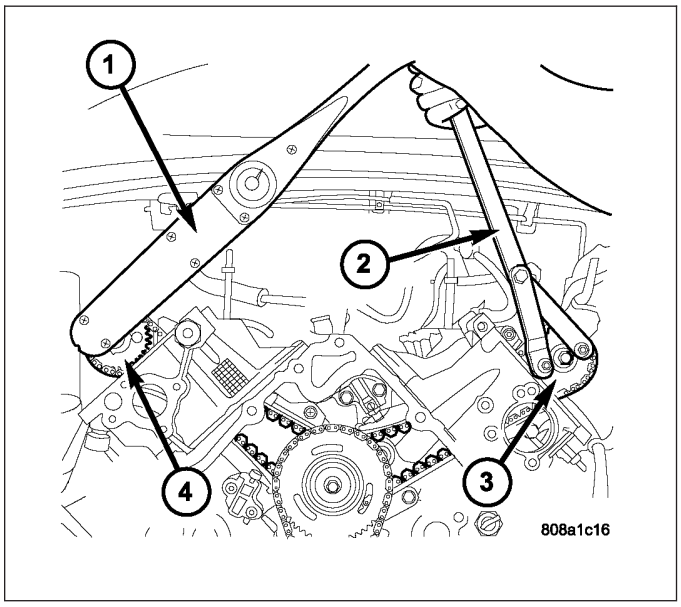
16. Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).
17. Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

18. Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (3) and right (4), camshaft sprocket bolts to 122 N·m (90 ft. lbs.).
19. Rotate engine two full revolutions. Verify timing marks are at the follow locations:
    - primary chain idler sprocket dot is at 12 o'clock
    - primary chain crankshaft sprocket dot is at 6 o'clock
    - secondary chain camshaft sprockets "V8" marks are at 12 o'clock
20. Lubricate all three chains with engine oil.



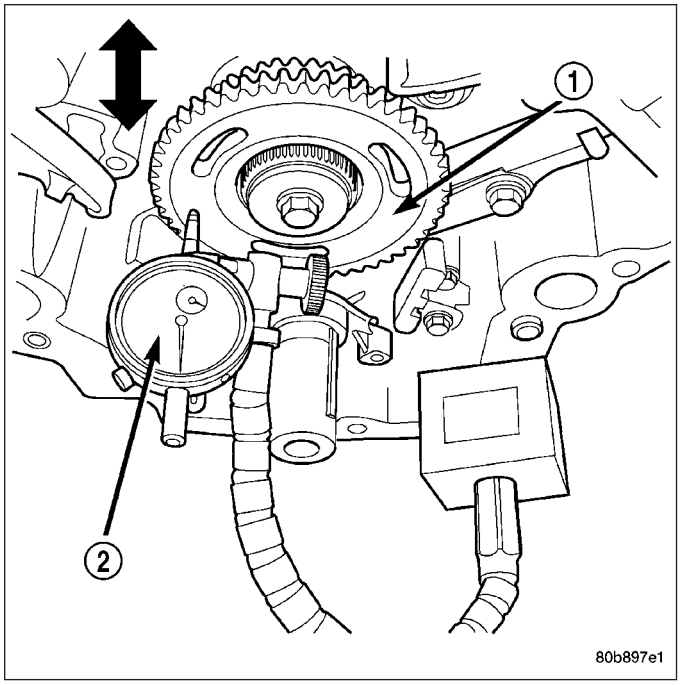
21. After installing all chains, it is recommended that the idler gear (1) end play be checked. The end play must be within 0.10–0.25 mm (0.004–0.010 in.). If not within specification, the idler gear must be replaced.



22. Install timing chain cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION) and crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
23. Install cylinder head covers (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

24. Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon**, then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.).
25. Install the oil fill housing.
26. Install access plug in left cylinder head.



27. Install power steering pump (Refer to 19 - STEERING/PUMP - INSTALLATION).
28. Install radiator fan shroud.
29. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
30. Connect negative cable to battery.

SHAFT - IDLER

REMOVAL

1. Remove the primary and secondary timing chains and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL) .

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft, to install the removal tool.

2. Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore.
3. Cover the radiator core with a suitable cover.

CAUTION: Use care when removing the idler shaft, Do not strike the radiator cooling fins with the slide hammer.

4. Using Special Tool 8517 Slide Hammer, remove the idler shaft.

INSTALLATION

1. Thoroughly clean the idler shaft bore.
2. Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft, with clean engine oil.

3. Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.
4. Coat the idler shaft with clean engine oil.
5. Install the timing chains and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION) .

ENGINE - 5.7L - SERVICE INFORMATION

TABLE OF CONTENTS

page

ENGINE - 5.7L - SERVICE INFORMATION
DESCRIPTION 2287
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION 2288
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE 2288
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL 2290
DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE 2290
DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE 2291
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION 2292
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL 2293
STANDARD PROCEDURE
STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS 2295
STANDARD PROCEDURE—HYDROSTATIC LOCK 2295
REMOVAL 2296
INSTALLATION 2301
SPECIFICATIONS
5.7L ENGINE 2306
TORQUE 2312
SPECIAL TOOLS
5.7L ENGINE 2314
ELEMENT - AIR CLEANER
REMOVAL 2318
INSTALLATION 2319
CYLINDER HEAD
OPERATION—CYLINDER HEAD 2320
DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET FAILURE 2320
REMOVAL 2321
CLEANING 2323
INSPECTION 2323
INSTALLATION 2324
COVER - CYLINDER HEAD
REMOVAL 2328
INSTALLATION 2331
VALVES & SEATS - INTAKE/EXHAUST
DESCRIPTION
DESCRIPTION - VALVE GUIDES 2333
DESCRIPTION 2333
STANDARD PROCEDURE - REFACING 2333
REMOVAL 2334
INSTALLATION 2334

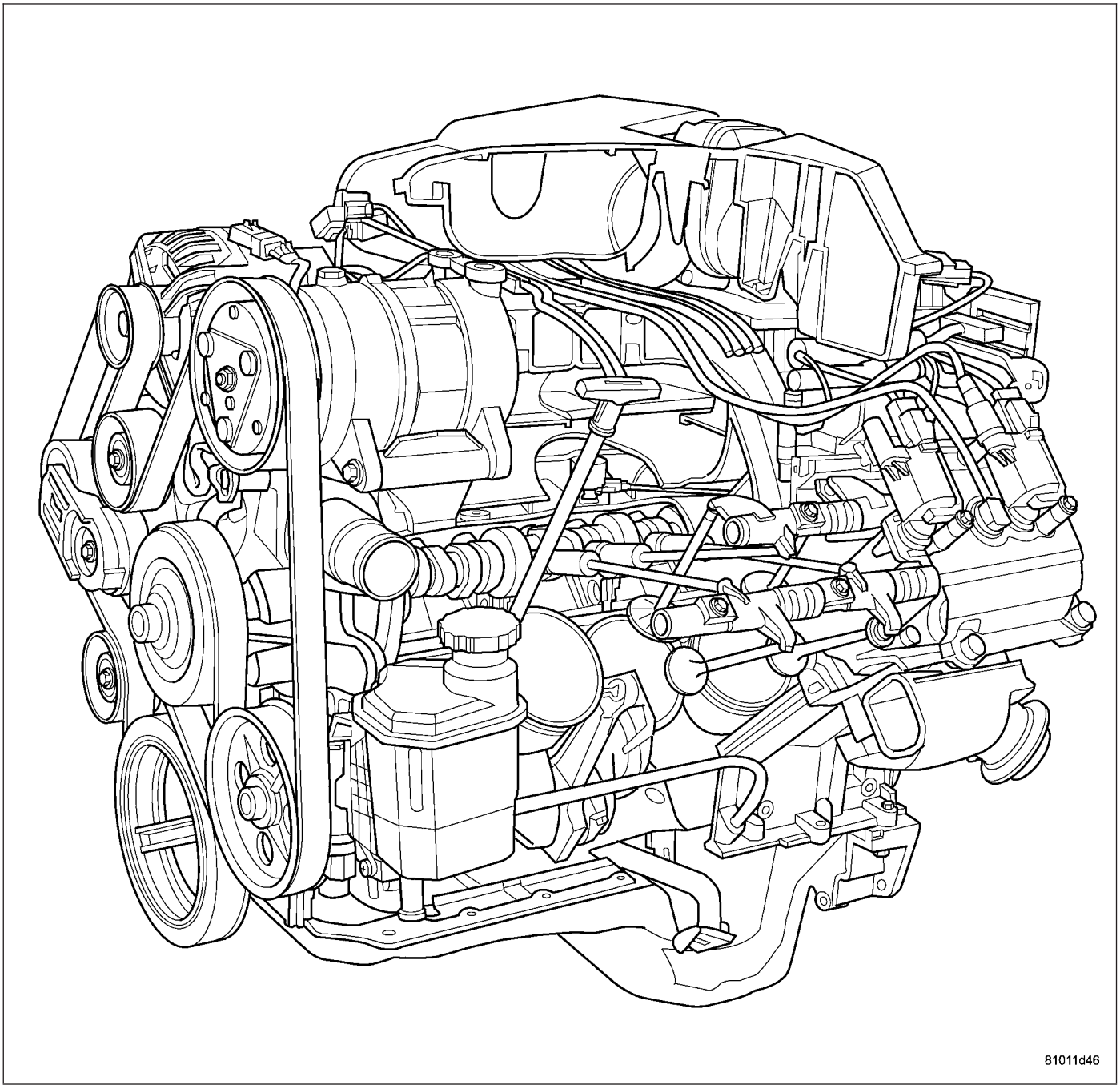
page

ROCKER ARM
REMOVAL 2335
INSTALLATION 2337
SEALS - VALVE GUIDE
DESCRIPTION 2339
SPRINGS - VALVE
REMOVAL 2339
INSTALLATION 2345
ENGINE BLOCK
CLEANING 2349
INSPECTION 2350
CAMSHAFT
REMOVAL
REMOVAL - CAMSHAFT CORE HOLE PLUG 2350
REMOVAL - CAMSHAFT 2351
INSPECTION 2355
INSTALLATION
INSTALLATION - CAMSHAFT CORE HOLE PLUG 2356
INSTALLATION - CAMSHAFT 2356
CRANKSHAFT
REMOVAL 2363
INSTALLATION 2367
BEARINGS - CRANKSHAFT MAIN
STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING 2372
INSPECTION 2372
SEAL - CRANKSHAFT OIL - FRONT
REMOVAL 2373
INSTALLATION 2374
SEAL - CRANKSHAFT OIL - REAR
DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS 2374
REMOVAL 2375
INSTALLATION 2376
RETAINER - CRANK REAR OIL - SEAL
REMOVAL 2376
INSTALLATION 2377
FLEX PLATE
REMOVAL 2377
INSTALLATION 2378
TAPPETS - HYDRAULIC ROLLER
DIAGNOSIS AND TESTING - HYDRAULIC TAPPETS 2378
REMOVAL 2379
INSTALLATION 2380
PISTON & CONNECTING ROD
DESCRIPTION 2380
STANDARD PROCEDURE - PISTON FITTING 2381

REMOVAL 2381
CLEANING 2383
INSPECTION 2383
INSTALLATION 2383
RINGS - PISTON
STANDARD PROCEDURE - PISTON RING FITTING 2384
DAMPER - CRANKSHAFT
REMOVAL 2387
INSTALLATION 2388
COVER - STRUCTURAL
DESCRIPTION 2389
OPERATION 2389
REMOVAL 2389
INSTALLATION 2389
MOUNT - FRONT
REMOVAL 2391
INSTALLATION 2393
MOUNT - REAR
REMOVAL 2394
INSTALLATION 2395
LUBRICATION
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE 2395
DIAGNOSIS AND TESTING - ENGINE OIL LEAK 2395
OIL
STANDARD PROCEDURE - ENGINE OIL SERVICE 2396
FILTER - ENGINE OIL
REMOVAL 2397
INSTALLATION 2397
PAN - ENGINE OIL
REMOVAL 2398
INSTALLATION 2399
PUMP - ENGINE OIL
DESCRIPTION 2402
REMOVAL 2403
CLEANING 2403
INSPECTION 2404
INSTALLATION 2405
MANIFOLD - INTAKE
DESCRIPTION 2406
DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE 2406
REMOVAL 2406
CLEANING 2406
INSPECTION 2406
INSTALLATION 2407
MANIFOLD - EXHAUST
DESCRIPTION 2407
OPERATION 2407
REMOVAL 2408
CLEANING 2408
INSPECTION 2408
INSTALLATION 2409
COVER - TIMING
REMOVAL 2410
INSTALLATION 2412
TIMING CHAIN & SPROCKETS
REMOVAL 2413
INSTALLATION 2416
TENSIONER - TIMING CHAIN
DESCRIPTION 2419
OPERATION 2419

ENGINE - 5.7L - SERVICE INFORMATION

DESCRIPTION



The 5.7L engine (345 CID) eight-cylinder engine is a 90° V-Type lightweight, deep skirt cast iron block, aluminum heads, single cam, overhead valve engine with hydraulic roller tappets. The heads incorporate splayed valves with a hemispherical style combustion chamber and dual spark plugs. The cylinders are numbered from front to rear; 1, 3, 5, 7 on the left bank and 2, 4, 6, 8 on the right bank. The firing order is 1-8-4-3-6-5-7-2.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., a strange noise).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING)—MECHANICAL for possible causes and corrections of malfunctions. (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING) and (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - DIAGNOSIS AND TESTING) for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that can not be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following diagnosis:

- Cylinder Compression Pressure Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Cylinder Combustion Pressure Leakage Test (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
- Engine Cylinder Head Gasket Failure Diagnosis (Refer to 9 - ENGINE/CYLINDER HEAD - DIAGNOSIS AND TESTING).
- Intake Manifold Leakage Diagnosis (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - DIAGNOSIS AND TESTING).

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery	1. Charge or replace as necessary.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to the terminals.
	3. Faulty starter.	3. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING).
	4. Faulty coil or control unit.	4. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect spark plug gap.	5. (Refer to 8 - ELECTRICAL/IGNITION CONTROL/SPARK PLUG - CLEANING).
	6. Dirt or water in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump, relay or wiring.	7. Repair or replace as necessary.

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE STALLS OR ROUGH IDLE	1. Idle speed set to low.	1. (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/IDLE AIR CONTROL MOTOR - REMOVAL).
	2. Idle mixture too lean or too rich.	2. Refer to Powertrain Diagnosis Information.
	3. Vacuum leak.	3. Inspect intake manifold and vacuum hoses, repair or replace as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	5. Incorrect engine timing.	5. (Refer to 9 - ENGINE/VALVE TIMING - STANDARD PROCEDURE).
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped spark plugs.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Refer to the Appropriate Diagnostic Information
	4. Blown cylinder head gasket.	4. Replace cylinder head gasket.
	5. Low compression.	5. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	6. Burned, warped or pitted valves.	6. Replace as necessary.
	7. Plugged or restricted exhaust system.	7. Inspect and replace as necessary.
	8. Faulty coil.	8. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES ON ACCELERATION	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Dirt in fuel system.	2. Clean fuel system.
	3. Burned, warped or pitted valves.	3. Replcae as necessary.
	4. Faulty coil.	4. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
ENGINE MISSES AT HIGH SPEED	1. Spark plugs dirty or incorrectly gapped.	1. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/SPARK PLUG - CLEANING).
	2. Faulty coil.	2. (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/IGNITION COIL - REMOVAL).
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTIONS
NOISY VALVES	1. High or low oil level in crankcase.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	4. Dirt in lash adjusters.	4. Replace as necessary.
	5. Worn rocker arms.	5. Replace as necessary.
	6. Worn lash adjusters	6. Replace as necessary.
	7. Worn valve guides.	7. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
	8. Excessive runout of valve seats on valve faces.	8. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE)
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Connecting rod journal out-of-round.	5. Service or replace crankshaft.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS)
	2. Low oil pressure.	2. Check oil pump, if Ok, check rod and main bearings for excessive wear.
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Replace as necessary.
	5. Excessive end play.	5. Check thrust washers for wear.
	6. Crankshaft journal out-of round.	6. Service or replace crankshaft.
	7. Loose flywheel or torque converter.	7. Tighten to correct torque

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Clean the spark plug recesses with compressed air.
2. Remove the spark plugs.
3. Disable the fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DESCRIPTION).
4. Remove the ASD relay (Refer to 8 - ELECTRICAL/IGNITION CONTROL/AUTO SHUT DOWN RELAY - REMOVAL).
5. Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.
6. Record the compression pressure on the 3rd revolution. Continue the test for the remaining cylinders.
7. (Refer to 9 - ENGINE - SPECIFICATIONS) for the correct engine compression pressures.

DIAGNOSIS AND TESTING - CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

1. Check the coolant level and fill as required. DO NOT install the radiator cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.
3. Remove the spark plugs.
4. Remove the oil filler cap.
5. Remove the air cleaner hose.
6. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum and 552 kPa (80 psi) recommended.
7. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. Set piston of cylinder to be tested at TDC compression,While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

Refer to CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART .

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary. Inspect valve springs. Replace as necessary.
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - LUBRICATION

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS	1. Gaskets and O-Rings. (a) Misaligned or damaged. (b) Loose fasteners, broken or porous metal parts. 2. Crankshaft rear seal 3. Crankshaft seal flange. Scratched, nicked or grooved. 4. Oil pan flange cracked. 5.Front cover seal, damaged or misaligned. 6. Scratched or damaged vibration damper hub. 7. Crankshaft Rear Flange Microporosity	1. (a) Replace as necessary. (b) Tighten fasteners, Repair or replace metal parts. 2. Replace as necessary. 3. Polish or replace crankshaft. 4. Replace oil pan. 5. Replace seal. 6. Polish or replace damper. 7. Replace Crankshaft
OIL PRESSURE DROP	1. Low oil level. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn oil pump. 6. Thin or diluted oil. 7. Excessive bearing clearance. 8. Oil pump relief valve stuck. 9. Oil pickup tube loose or damaged.	1. Check and correct oil level. 2. Replace sending unit. 3. Check pump and bearing clearance. 4. Replace oil filter. 5. Replace as necessary. 6. Change oil and filter. 7. Replace as necessary. 8. Replace oil pump. 9. Replace as necessary.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn or damaged rings. 2. Carbon in oil ring slots. 3. Incorrect ring size installed. 4. Worn valve guides. 5. Leaking intake gasket. 6. Leaking valve guide seals.	1. Hone cylinder bores and replace rings. 2. Replace rings. 3. Replace rings. 4. Ream guides and replace valves. 5. Replace intake gaskets. 6. Replace valve guide seals.

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

ENGINE MECHANICAL DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES/LIFTERS	1. High or low oil level in crankcase	1. Check for correct oil level. Adjust oil level by draining or adding as needed
	2. Thin or diluted oil	2. Change oil. (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE)
	3. Low oil pressure	3. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) for engine oil pressure test/ specifications
	4. Dirt in tappets/lash adjusters	4. Clean/replace hydraulic tappets/lash adjusters
	5. Bent push rod(s)	5. Install new push rods
	6. Worn rocker arms	6. Inspect oil supply to rocker arms and replace worn arms as needed
	7. Worn tappets/lash adjusters	7. Install new hydraulic tappets/lash adjusters
	8. Worn valve guides	8. Inspect all valve guides and replace as necessary
	9. Excessive runout of valve seats or valve faces	9. Grind valves and seats
CONNECTING ROD NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING) engine oil pressure test/specifications
	3. Thin or diluted oil	3. Change oil to correct viscosity. (Refer to 9 - ENGINE/ LUBRICATION/OIL - STANDARD PROCEDURE) for correct procedure/engine oil specifications
	4. Excessive connecting rod bearing clearance	4. Measure bearings for correct clearance with plasti-gage. Repair as necessary
	5. Connecting rod journal out of round	5. Replace crankshaft or grind journals
	6. Misaligned connecting rods	6. Replace bent connecting rods

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	1. Insufficient oil supply	1. Check engine oil level.
	2. Low oil pressure	2. Check engine oil level. If ok, Perform oil pressure test. (Refer to 9 - ENGINE/LUBRICATION - DIAGNOSIS AND TESTING)
	3. Thin or diluted oil	3. Change oil to correct viscosity.
	4. Excessive main bearing clearance	4. Measure bearings for correct clearance. Repair as necessary
	5. Excessive end play	5. Check crankshaft thrust bearing for excessive wear on flanges
	6. Crankshaft main journal out of round or worn	6. Grind journals or replace crankshaft
	7. Loose flywheel or torque converter	7. Inspect crankshaft, flexplate/ flywheel and bolts for damage. Tighten to correct torque
LOW OIL PRESSURE	1. Low oil level	1. Check oil level and fill if necessary
	2. Faulty oil pressure sending unit	2. Install new sending unit
	3. Clogged oil filter	3. Install new oil filter
	4. Worn oil pump	4. Replace oil pump assembly.
	5. Thin or diluted oil	5. Change oil to correct viscosity.
	6. Excessive bearing clearance	6. Measure bearings for correct clearance
	7. Oil pump relief valve stuck	7. Remove valve to inspect, clean and reinstall
	8. Oil pickup tube loose, broken, bent or clogged	8. Inspect oil pickup tube and pump, and clean or replace if necessary
	9. Oil pump cover warped or cracked	9. Install new oil pump
OIL LEAKS	1. Misaligned or deteriorated gaskets	1. Replace gasket
	2. Loose fastener, broken or porous metal part	2. Tighten, repair or replace the part
	3. Front or rear crankshaft oil seal leaking	3. Replace seal
	4. Leaking oil gallery plug or cup plug	4. Remove and reseal threaded plug. Replace cup style plug

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. CCV System malfunction	1. (Refer to 25 - EMISSIONS CONTROL/EVAPORATIVE EMISSIONS - DESCRIPTION) for correct operation
	2. Defective valve stem seal(s)	2. Repair or replace seal(s)
	3. Worn or broken piston rings	3. Hone cylinder bores. Install new rings
	4. Scuffed pistons/cylinder walls	4. Hone cylinder bores and replace pistons as required
	5. Carbon in oil control ring groove	5. Remove rings and de-carbon piston
	6. Worn valve guides	6. Inspect/replace valve guides as necessary
	7. Piston rings fitted too tightly in grooves	7. Remove rings and check ring end gap and side clearance. Replace if necessary

STANDARD PROCEDURE

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE—HYDROSTATIC LOCK

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

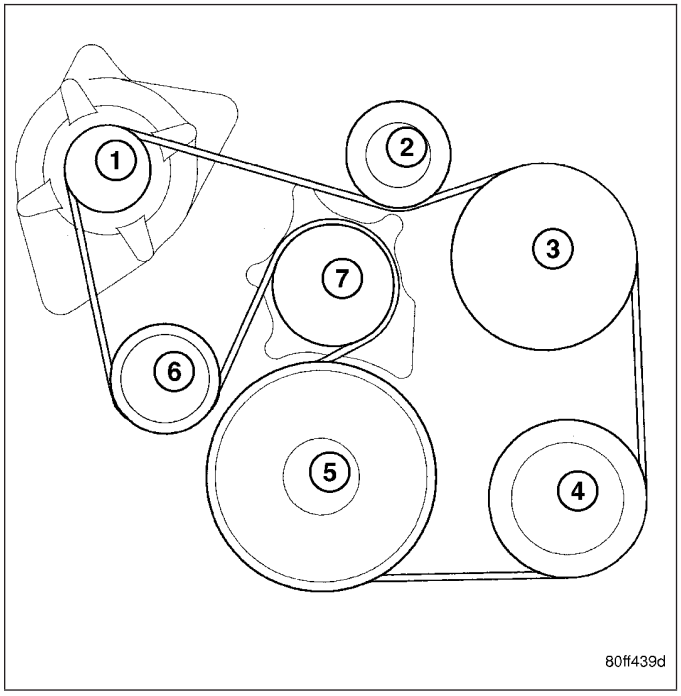
When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

1. Perform the Fuel Pressure Release Procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
2. Disconnect the negative cable(s) from the battery.
3. Inspect air cleaner, induction system, and intake manifold to ensure system is dry and clear of foreign material.
4. Place a shop towel around the spark plugs to catch any fluid that may possibly be under pressure in the cylinder head. Remove the spark plugs.
5. With all spark plugs removed, rotate the crankshaft using a breaker bar and socket.
6. Identify the fluid in the cylinders (coolant, fuel, oil, etc.).
7. Be sure all fluid has been removed from the cylinders.
8. Repair engine or components as necessary to prevent this problem from occurring again.
9. Squirt a small amount of engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.
10. Install new spark plugs. Tighten the spark plugs to 41 N·m (30 ft. lbs.) torque.
11. Drain engine oil. Remove and discard the oil filter.
12. Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.
13. Install a new oil filter.
14. Fill engine crankcase with the specified amount and grade of oil. (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS).

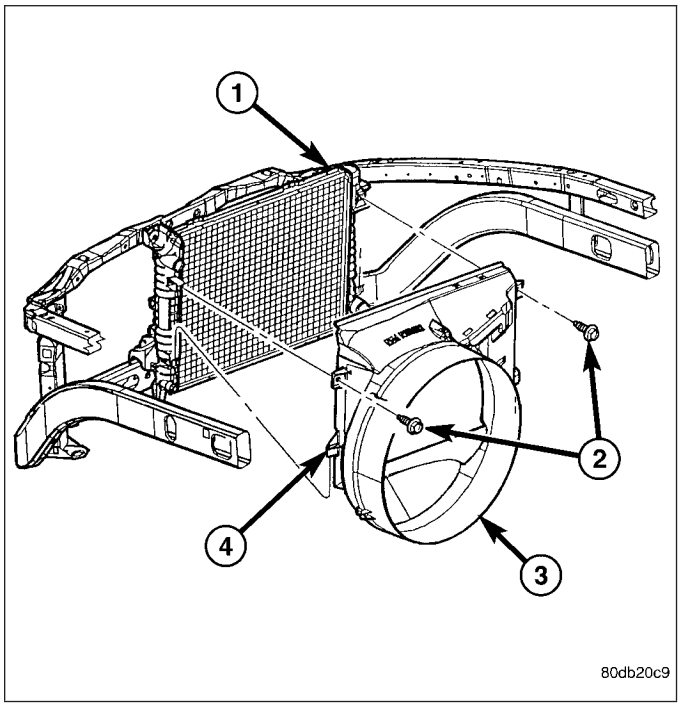
15. Connect the negative cable(s) to the battery.
16. Start the engine and check for any leaks.

REMOVAL

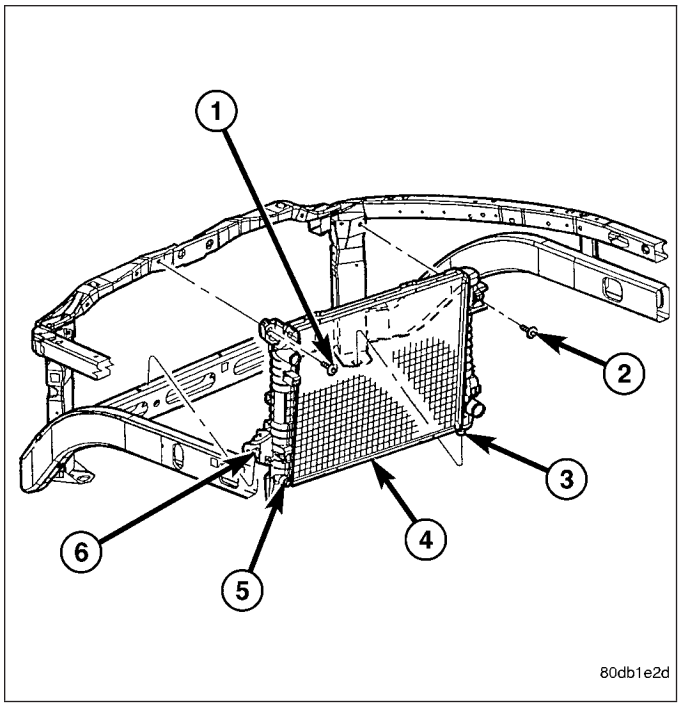
1. Perform the Fuel System Pressure Release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
2. Disconnect the battery negative cable.
3. Remove the air cleaner resonator and duct work as an assembly.
4. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Remove the viscous fan/drive (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).



7. Remove the fan shroud (3).

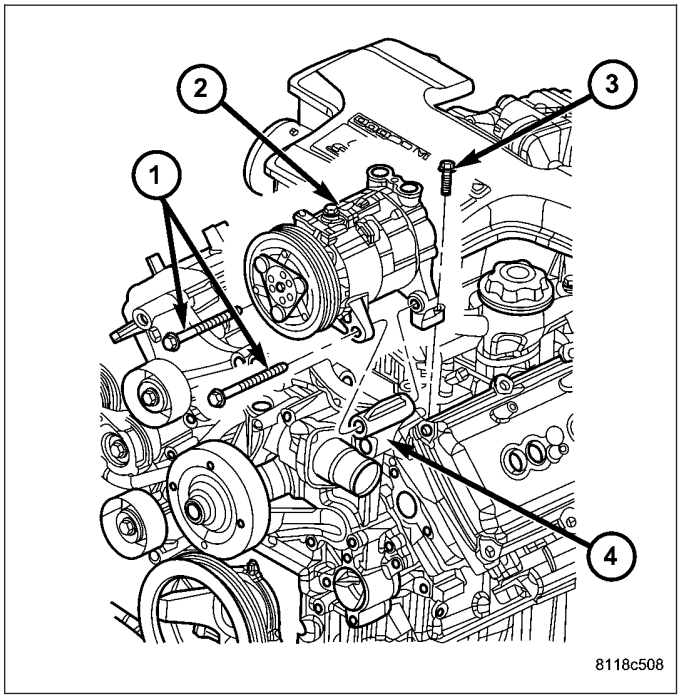


8. Remove radiator (1) (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
9. Remove the upper crossmember and top core support.



NOTE: It is not necessary to drain A/C system for engine removal.

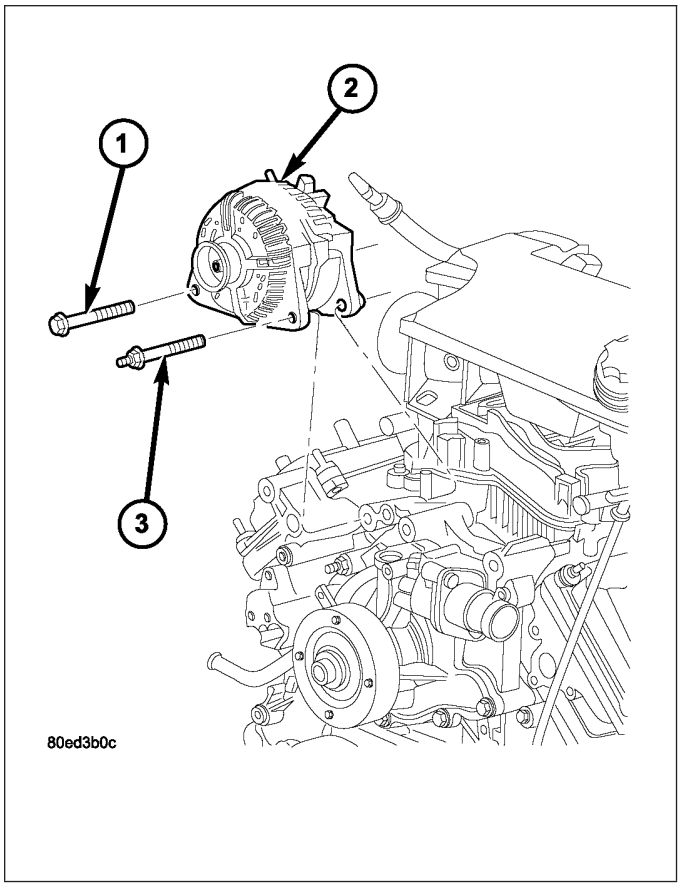
10. Remove the A/C compressor (2) with the lines attached. Secure compressor out of the way.



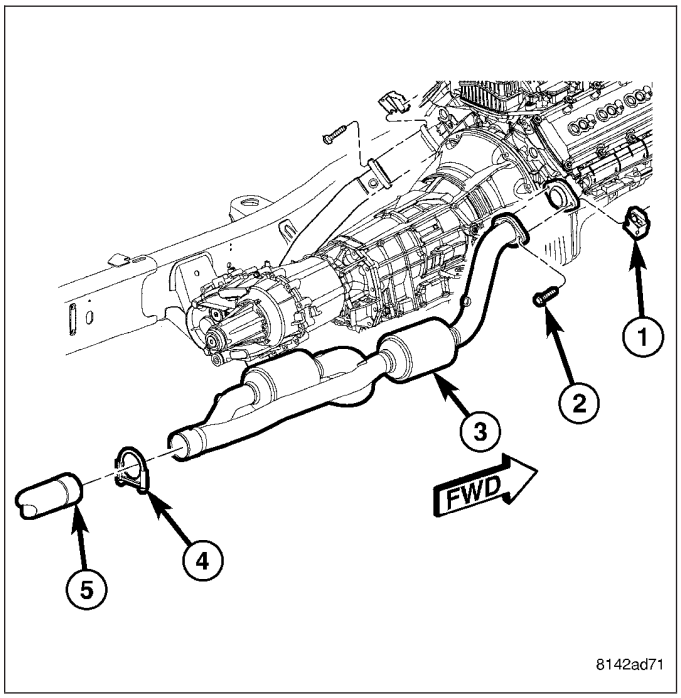
11. Remove generator assembly (2) (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
12. Remove the intake manifold and IAFM as an assembly (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
13. Disconnect the heater hoses.

NOTE: It is not necessary to disconnect P/S hoses from pump, for P/S pump removal.

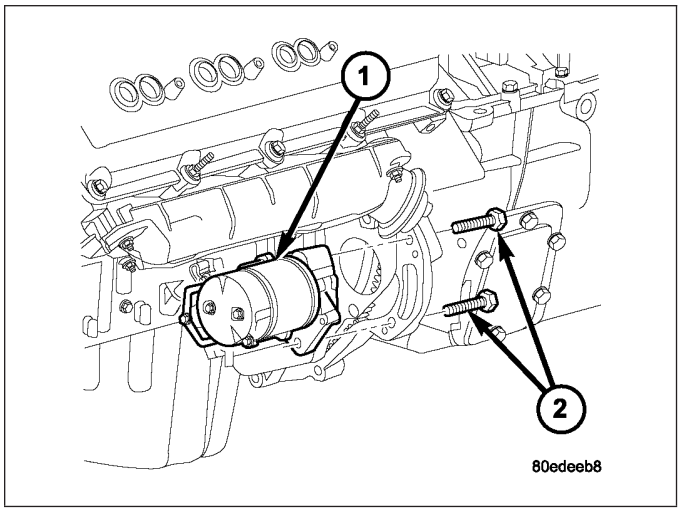
14. Remove the power steering pump and set aside.
15. Disconnect the fuel supply line (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
16. Raise and support the vehicle on a hoist and drain the engine oil.



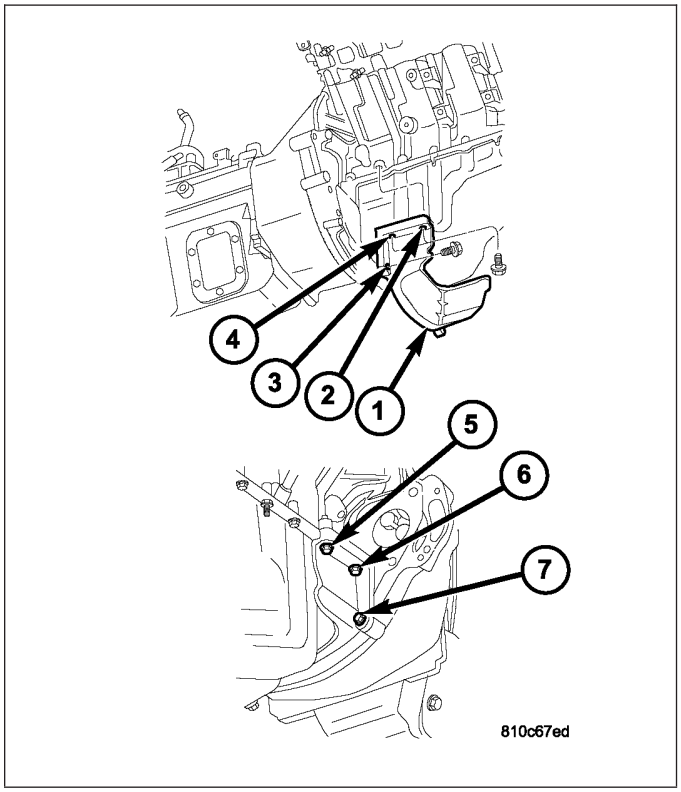
17. Remove engine front mount thru-bolt nuts.
18. Remove right side axle retaining bolts.
19. Disconnect the transmission oil cooler lines from their retainers at the oil pan bolts.
20. Disconnect exhaust pipe at manifolds (2).

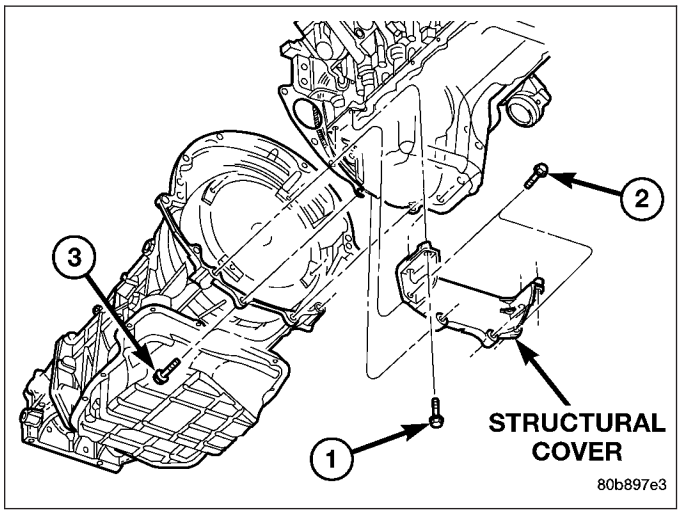


21. Disconnect the starter wires. Remove starter motor (1) (Refer to 8 - ELECTRICAL/STARTING/ STARTER MOTOR - REMOVAL).

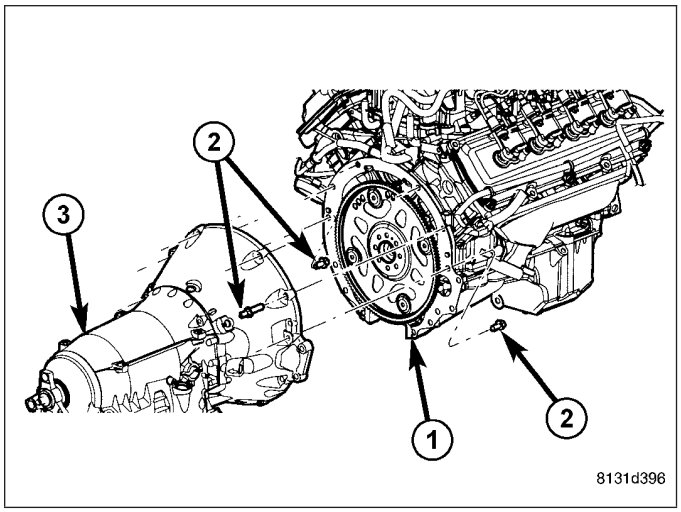


22. Remove the structural dust cover (1) and transmission inspection cover, (Refer to 9 - ENGINE/ ENGINE BLOCK/STRUCTURAL COVER - REMOVAL) .
23. Remove drive plate to converter bolts (Automatic transmission equipped vehicles).



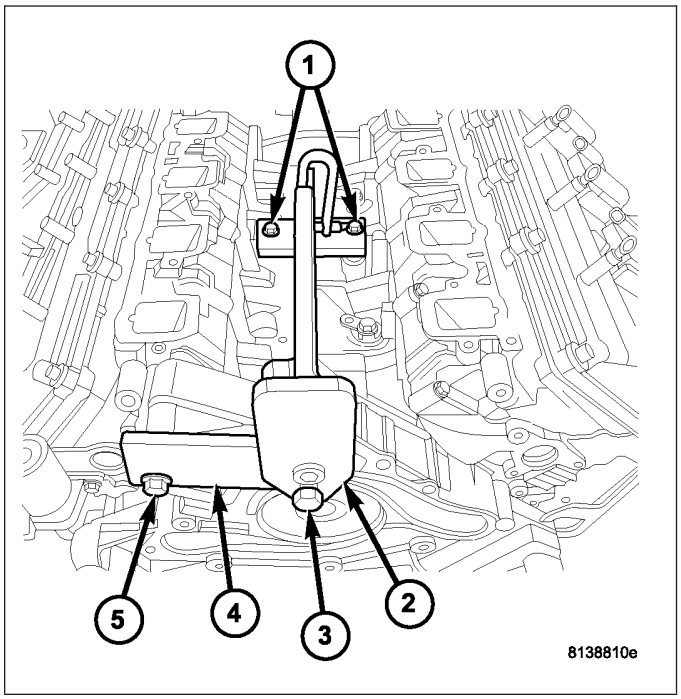


24. Remove transmission bell housing to engine block bolts (2).
25. Lower the vehicle.



NOTE: Do not use air tools to install engine lift fixture (2) special tool # 8984.

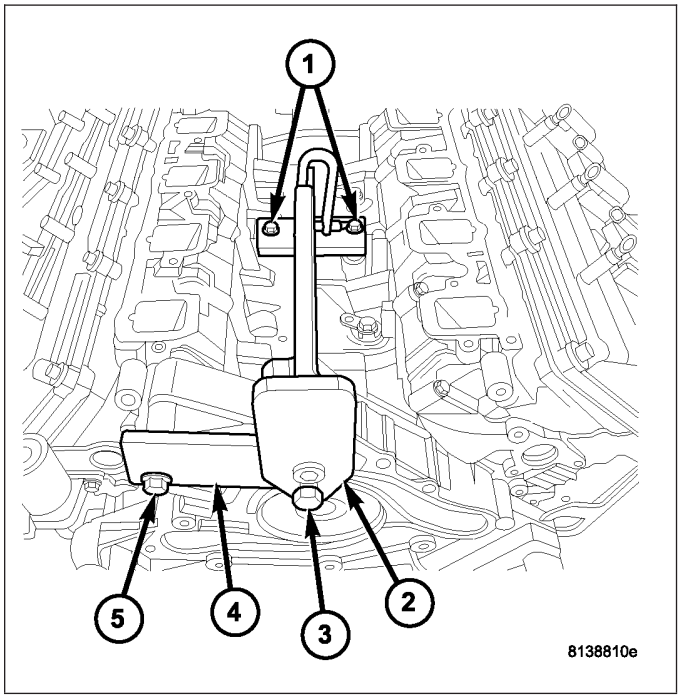
26. Install engine lift fixture (2), special tool # 8984. **Do not use adapter (4)**
27. Separate engine from transmission, remove engine from vehicle, and install engine assembly on a repair stand.



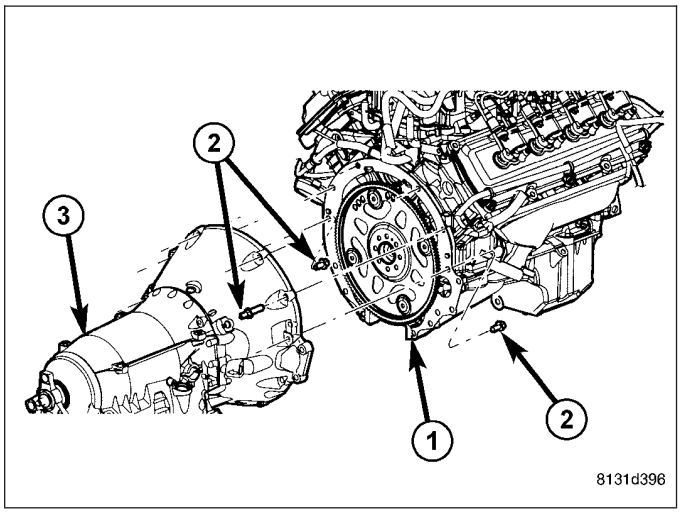
INSTALLATION

NOTE: Do not use air tools to install engine lift fixture (2) special tool # 8984.

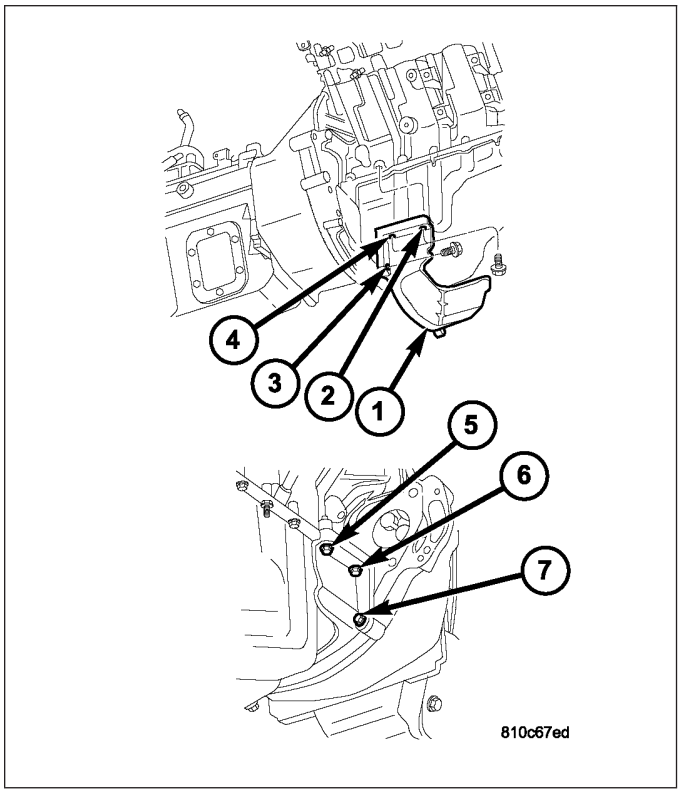
1. Install engine lift fixture (2), special tool # 8984. **Do not use adapter (4).**
2. Position the engine in the engine compartment.
3. Lower engine into compartment and align engine with transmission:
   - Manual Transmission: Align clutch disc assembly (if disturbed). Install transmission input shaft into clutch disc while mating engine and transmission surfaces. Install two transmission to engine block mounting bolts finger tight.
   - Automatic Transmission: Mate engine and transmission and install two transmission to engine block mounting bolts finger tight.



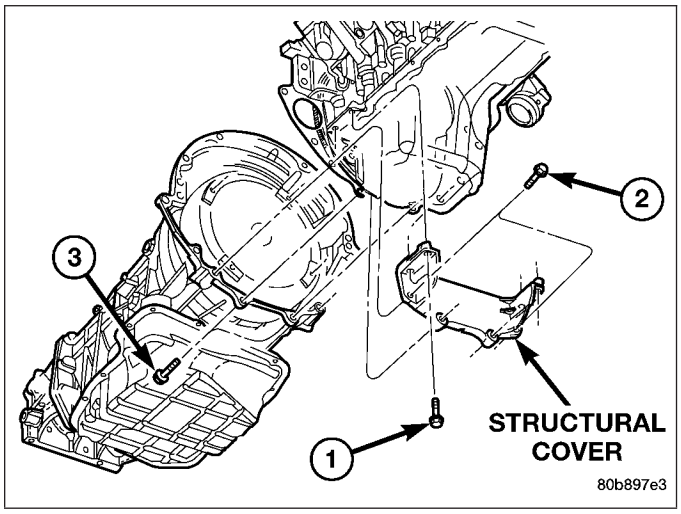
4. Position the thru-bolt into the support cushion brackets.
5. Lower engine assembly until engine mount through bolts rest in mount perches.
6. Install remaining transmission to engine block mounting bolts (2) and tighten.

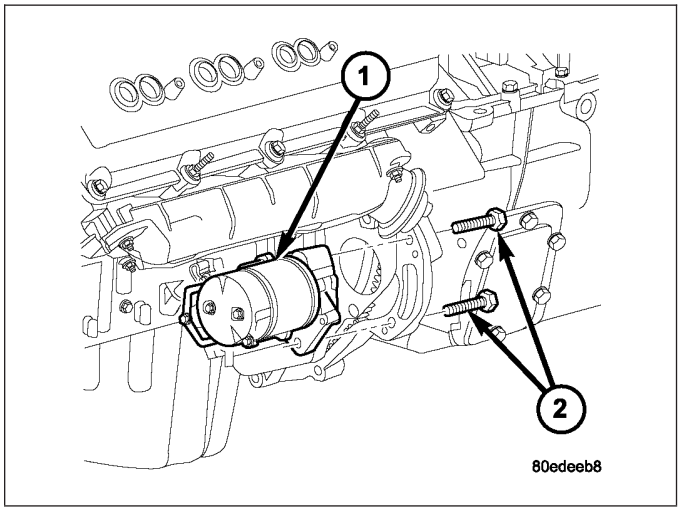


7. Tighten engine mount through bolts.
8. Install drive plate to torque converter bolts. (Automatic transmission models)
9. Install the structural dust cover (1) and transmission dust cover, (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION) .

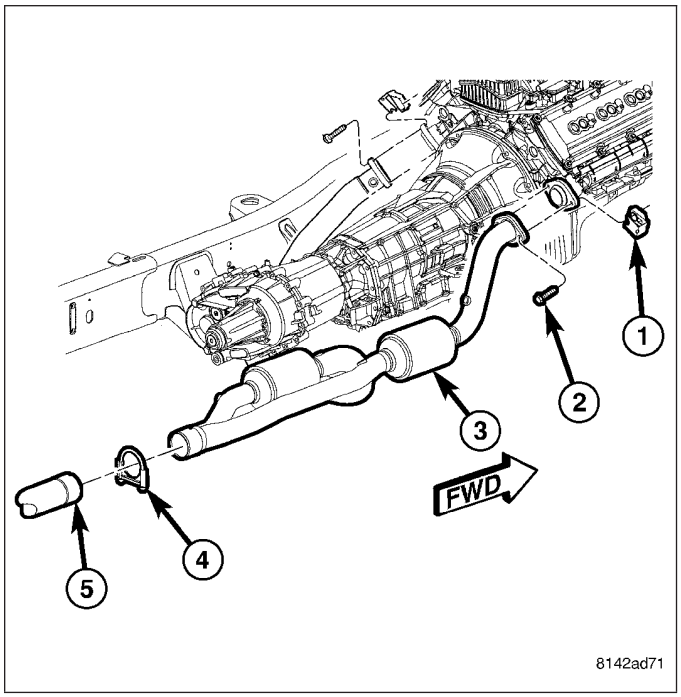


10. Install the starter (1) and connect the starter wires (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).



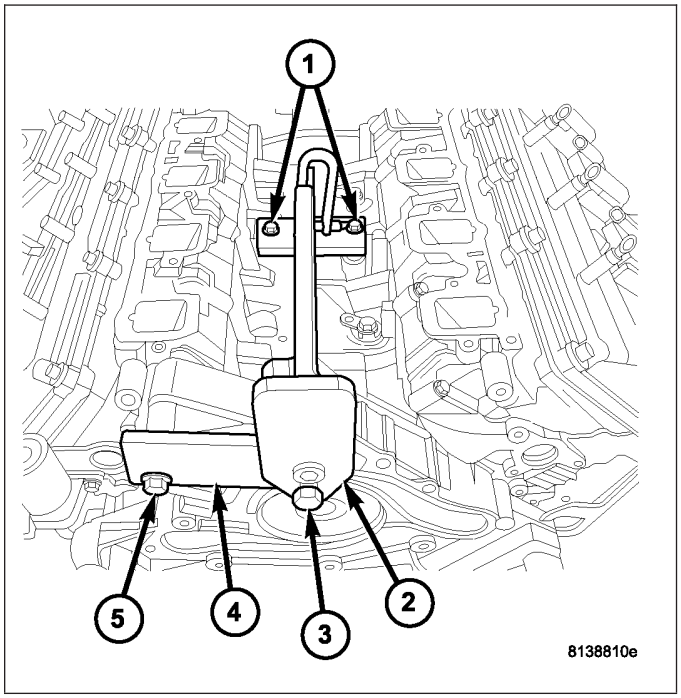


11. Install exhaust pipe to exhaust manifold bolts (2).
12. Lower the vehicle.

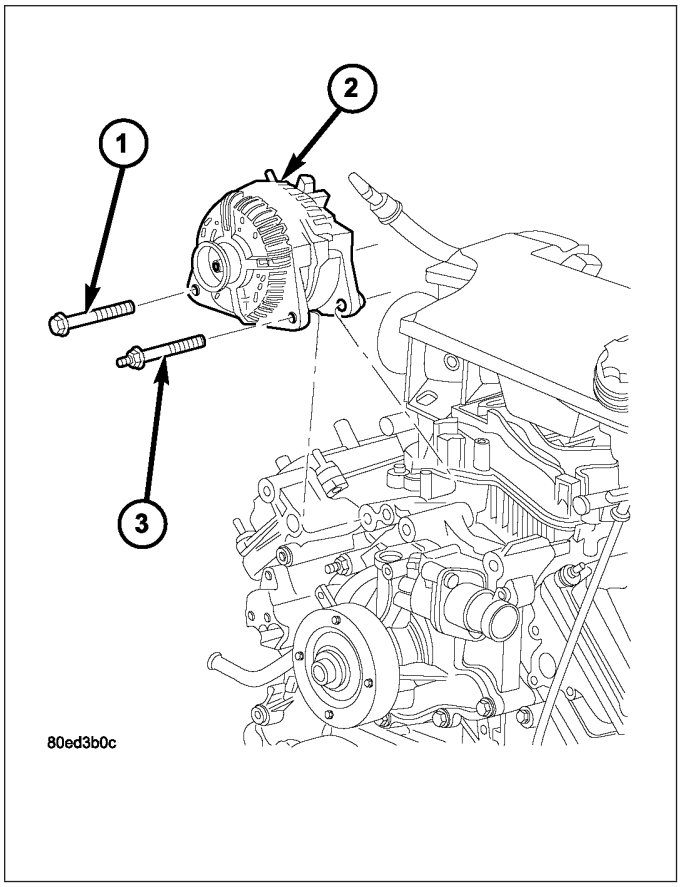


NOTE: Do not use air tools on engine lift fixture (2) special tool # 8984.

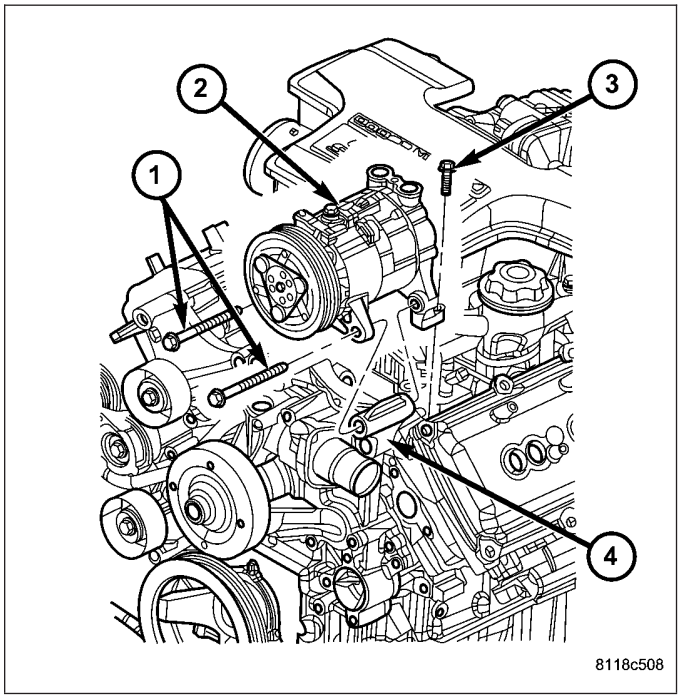
13. Remove engine lift fixture (2), special tool # 8984.
14. Connect the fuel supply line (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
15. Reinstall the power steering pump.
16. Connect the heater hoses.



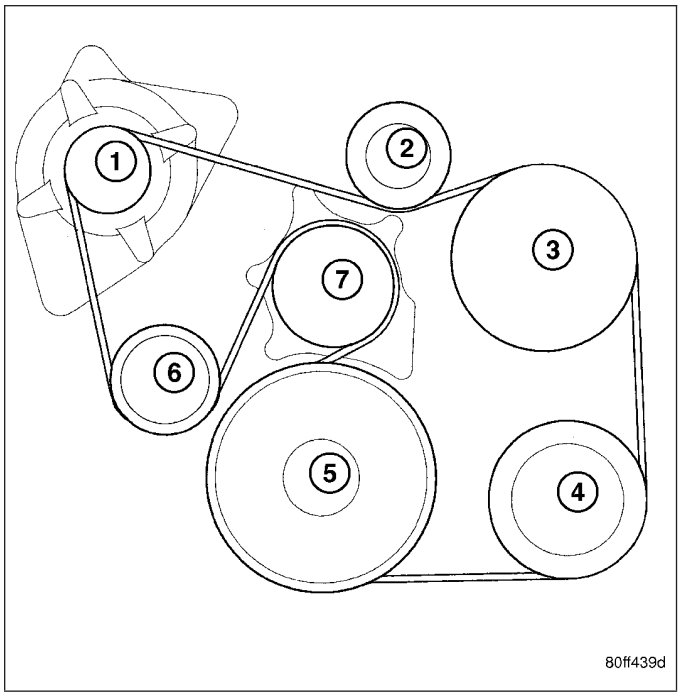
17. Install the intake manifold.
18. Using a new gasket, install throttle body (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/THROTTLE BODY - INSTALLATION).
19. Install the generator (2) and wire connections (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - INSTALLATION).



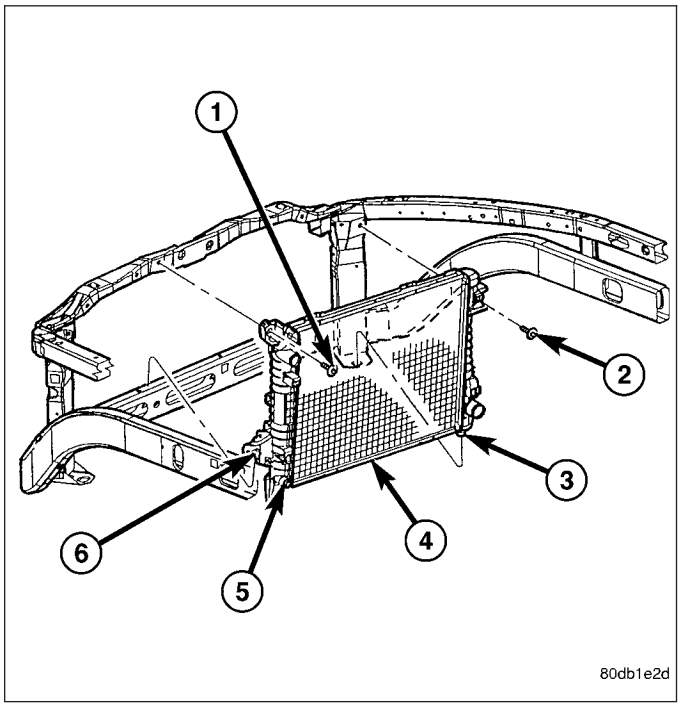
20. Install a/c compressor (2) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - INSTALLATION).



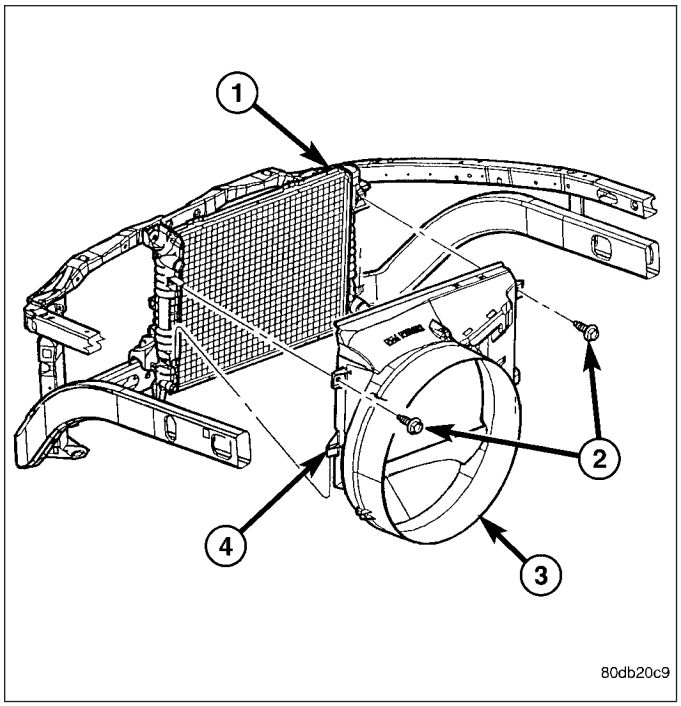
21. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
22. Install upper radiator support crossmember.



23. Install radiator (1) (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).
24. Connect the radiator lower hose.
25. Connect the transmission oil cooler lines to the radiator.



26. Install the fan shroud (3).
27. Install the fan (Refer to 7 - COOLING/ENGINE/ RADIATOR FAN - INSTALLATION).
28. Connect the radiator upper hose.
29. Install the washer bottle.
30. Connect the transmission cooler lines.
31. Install the air cleaner resonator and duct work..
32. Add engine oil to crankcase (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
33. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
34. Connect battery negative cable.
35. Start engine and inspect for leaks.
36. Road test vehicle.



SPECIFICATIONS

5.7L ENGINE

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	90° V-8 OHV
Displacement	5.7 Liters 345 (Cubic Inches)
Bore	99.5 mm (3.91 in.)
Stroke	90.9 mm (3.58 in.)
Compression Ratio	9.6:1
Firing Order	1-8-4-3-6-5-7-2
Lubrication	Pressure Feed - Full Flow Filtration
Cooling System	Liquid Cooled - Forced Circulation
Cylinder Block	Cast Iron
Cylinder Head	Aluminum
Crankshaft	Nodular Iron
Camshaft	Hollow Assembled Camshaft
Pistons	Aluminum Alloy
Connecting Rods	Powdered Metal

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Bore Diameter	99.50 mm	3.917 in.
Out of Round (MAX)	0.0076 mm	0003 in.
Taper (MAX)	0.0127 mm	0.0005 in.
Lifter Bore Diameter	21.45 - 21.425 mm	0.8444 - 0.8435 in.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Measured at 38.0 mm (1.5 in.) Below Deck	0.0215 - 0.0485 mm	0.0008 - 0.0019 in.
Ring Groove Diameter		
Groove #1	89.6 - 89.8 mm	3.527 - 3.535 in.
Groove #2	88.1 - 88.3 mm	3.468 - 3.476 in.
Weight	413 grams	14.56 oz
Piston Length	54.70 - 55.30	2.153 - 2.177 in.
Ring Groove Width		
No. 1	1.51 - 1.54 mm	0.0594 - 0.0606 in
No. 2	1.51 - 1.53 mm	0.0594 - 0.0602 in.
No. 3	3.030 - 3.055 mm	0.1192 - 0.1202 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance In Piston	0.009 - 0.018 mm	0.00035 - 0.0007 in.
Diameter	24.0 - 24.003 mm	0.9448 - 0.9449 in.
Length	70.53 - 71.03 mm	2.78 - 2.80 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Compression Ring	0.23 - 0.38 mm	0.0090 - 0.0149 in.
Second Compression Ring	0.35 - 0.60 mm	0.0137 - 0.0236 in.
Oil Control (Steel Rails)	0.15 - 0.66 mm	0.0059 - 0.0259 in.
Side Clearance		
Top Compression Ring	.02 - .068 mm	0.0007 - 0.0026 in.
Second Compression Ring	0.02 - 0.058 mm	0.0007 - 0.0022 in.
Oil Ring (Steel Ring)	.019 - .229 mm	.0007 - .0091 in.
Ring Width		
Top Compression Ring	1.472 - 1.490 mm	0.0579 - 0.0586 in.
Second Compression Ring	1.472 - 1.490 mm	0.0579 - 0.0586 in.
Oil Ring (Steel Rails)	0.447 - 0.473 mm	0.0175 - 0.0186 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Pin Bore Diameter	23.955 - 23.975 mm	0.9431 - 0.9438 in.
Side Clearance	0.10 - 0.35 mm	0.003 - 0.0137 in.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Main Bearing Journal Diameter	64.988 - 65.012 mm	2.5585 - 2.5595 in.
Bearing Clearance	0.023 - 0.051 mm	0.0009 - 0.002 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.003 mm	0.0001 in.
End Play	0.052 - 0.282 mm	0.002 - 0.011 in.
End Play (MAX)	0.282 mm	0.011 in.
Connecting Rod Journal Diameter	53.992 - 54.008 mm	2.125 - 2.126 in.
Bearing Clearance	0.020 - 0.060 mm	0.0007 - 0.0023 in.
Out of Round (MAX)	0.005 mm	0.0002 in.
Taper (MAX)	0.003 mm	0.0001 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Journal Diameter		
No. 1	58.2 mm	2.29 in.
No. 2	57.8 mm	2.27 in.
No. 3	57.4 mm	2.26 in.
No. 4	57.0 mm	2.24 in.
No. 5	43.633 mm	1.72 in.
Bearing To Journal Clearance Standard		
No. 1	0.040 - 0.080 mm	.0015 - .003 in.
No. 2	0.050 -0.090 mm	0.0019 - .0035 in.
No. 3	0.040 - 0.080 mm	.0015 - .003 in.
No. 4	0.050 - 0.090 mm	0.0019 - .0035 in.
No. 5	0.040 - 0.080 mm	.0015 - .003 in.
Camshaft End Play	.080 - 0.290mm	0.0031 - 0.0114 in.

VALVE TIMING

DESCRIPTION	SPECIFICATION
Intake	
Opens (BTDC)	7.0°
Closes (ATDC)	253.0°
Exhaust	
Opens (BTDC)	233°
Closes (ATDC)	27°
Duration	253.70°
Valve Overlap	34°

CYLINDER HEAD

DESCRIPTION	SPECIFICATION
Valve Seat Angle	44.5° - 45.0°
Valve Seat Runout (MAX)	0.05 mm (0.0019 in.)
Valve Seat Width (Finish)	
Intake	1.018 - 1.62 mm (0.0464 - 0.0637 in.)
Exhaust	1.48 - 1.92 mm (0.0582 - 0.0755 in.)
Guide Bore Diameter (Std.)	7.975 - 8.00 mm (0.313 - 0.314 in.)

HYDRAULIC TAPPETS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	21.387 - 21.405 mm	0.8420 - 0.8427 in.
Clearance (To Bore)	0.020 - 0.063 mm	0.0007 - 0.0024 in.
Dry Lash	3.0 mm (at the valve)	0.1181 in.

VALVES

DESCRIPTION	SPECIFICATION
Face Angle	45.0° - 45.5°
Head Diameter	
Intake	50.67 - 50.93 mm (1.99 - 2.00 in.)
Exhaust	39.27 - 39.53 mm (1.54 - 1.55 in.)
Length (Overall)	
Intake	123.38 - 123.76 mm (4.857 - 4.872 in.)
Exhaust	120.475 - 120.855 mm (4.743 - 4.758 in.)
Stem Diameter	
Intake	7.935 - 7.953 mm (0.312 - 0.313 in.)
Exhaust	7.905 - 7.925 mm (0.311 - 0.312 in.)
Stem - to - Guide Clearance	
Intake	0.022 - 0.065 mm (0.0008 - 0.0025 in.)
Exhaust	0.050 - 0.095 mm (0.0019 - 0.0037 in.)
Valve Lift (@ Zero Lash)	
Intake	12.0 mm (0.472 in.)
Exhaust	11.70 mm (0.460 in.)

VALVE SPRING

DESCRIPTION	SPECIFICATION
Spring Force (Valve Closed) Intake and Exhaust	418.0 N +/- 30.0 N @ 46 mm (93.0 lbs +/- 7.0 lbs. @ 1.811 in.)
Spring Force (Valve Open) Intake and Exhaust	1077.0 N +/- 47.0 N @ 33.6 mm. (242.0 lbs. +/- 11 lbs. @ 1.322 in.)
Free Length (approx)	57.3 mm (2.256 in.)
Number of Coils Intake and Exhaust	7.4
Wire Diameter Intake and Exhaust	5.39 × 4.52 mm (0.212 - 0.177 in.)
Installed Height (Spring Seat to Bottom of Retainer) Intake and Exhaust	46.0 mm (1.81 in.)

OIL PUMP

DESCRIPTION	SPECIFICATION
Clearance Over Rotors (MAX)	0.095 mm (0.0038 in.)
Outer Rotor to Pump Body Clearance (MAX)	.235 mm (.009 in.)
Tip Clearance Between Rotors (MAX)	0.150 mm (0.006 in.)

OIL PRESSURE

SPECIFICATION	SPECIFICATION
At Curb Idle Speed (MIN)*	25 kPa (4 psi)
@ 3000 rpm	170 - 758 kPa (25 - 110 psi)
*** CAUTION: If pressure is zero at curb idle, DO NOT run engine**	

TORQUE

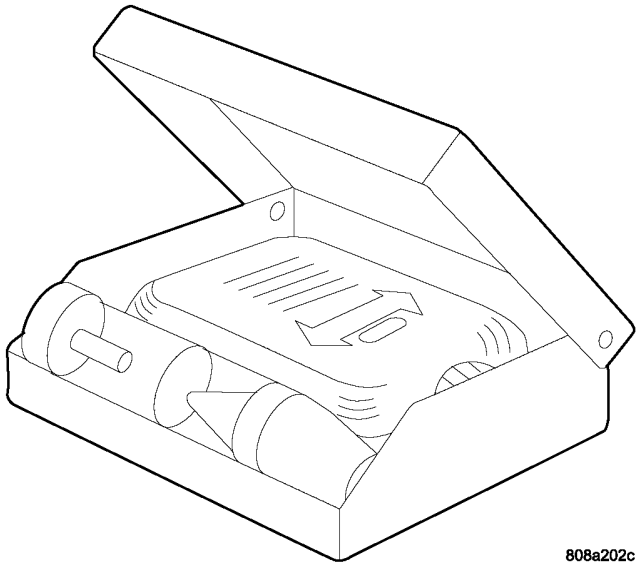
TORQUE CHART 5.7L ENGINE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Block Pipe Plugs (1/4 NPT)	20	—	177
(3/8 NPT)	27	—	240
Camshaft Sprocket—Bolt	122	90	—
Camshaft Tensioner Plate—Bolts	28	—	250
Timing Chain Case Cover—Bolts	28	—	250
Lifting Stud	55	40	—
Connecting Rod Cap—Bolts	21 plus 90° Turn	15 plus 90° Turn	—
Main Bearing Cap—Bolts M-12	27 plus 90° Turn	—	—
Crossbolts M-8	28	—	—
Cylinder Head—Bolts M-12 Bolts			
Step 1	34	25	—
Step 2	54	40	—
Step 3	Turn 90°	Turn 90°	—
M-8 Bolts			—
Step 1	20	15	—
Step 2	34	25	—
Cylinder Head Cover—Bolts	8	—	70
Exhaust Manifold to Cylinder Head	25	—	220
Flexplate to crankshaft—Bolts	95	70	—
Flywheel to crankshaft—Bolts	75	55	—
Front Insulator—Through bolt/nut	95	70	—
Front Insulator to Support Bracket			
—Stud Nut (4WD)	41	30	—
—Through Bolt/Nut (4WD)	102	75	—
Front Insulator to Block—Bolts (2WD)	95	70	—
Generator—Mounting Bolt	55	40	—
Intake Manifold—Bolts	Refer to Procedure		
Lifter Guide Holder	12	—	106
Oil Pan Bolts	12	-	105
Oil Dipstick Tube	12	—	105
Oil Pan—Drain Plug	34	25	—
Oil Pump—Attaching Bolts	28	—	250
Oil Pump Pickup Tube – Bolt and Nut	28	—	250
Rear Seal Retainer Attaching Bolts	15	—	132
Rear Insulator to Bracket— Through-Bolt (2WD)	68	50	—

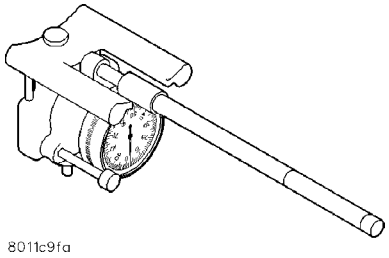
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Rear Insulator to Crossmember Support Bracket—Nut (2WD)	41	30	—
Rear Insulator to Crossmember—Nuts (4WD)	68	50	—
Rear Insulator to Transmission—Bolts (4WD)	68	50	—
Rear Insulator Bracket—Bolts (4WD Automatic)	68	50	—
Rear Support Bracket to Crossmember Flange—Nuts	41	30	—
Rear Support Plate to Transfer Case—Bolts	41	30	—
Rocker Arm—Bolts	22	—	195
Spark Plugs	—	—	—
Thermostat Housing—Bolts	28	—	250
Throttle Body—Bolts	12	—	105
Transfer Case to Insulator Mounting Plate—Nuts	204	105	—
Transmission Support Bracket—Bolts (2WD)	68	50	—
Vibration Damper—Bolt	176	129	—
Water Pump to Timing Chain Case Cover—Bolts	28	—	250

SPECIAL TOOLS

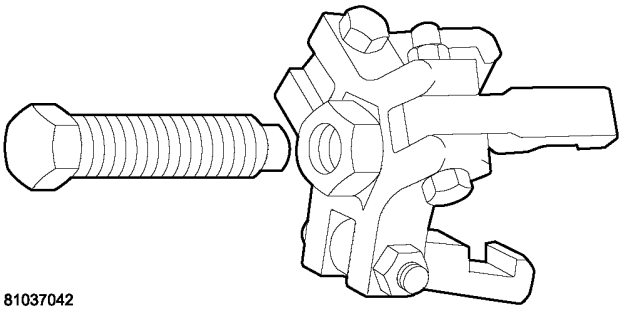
5.7L ENGINE



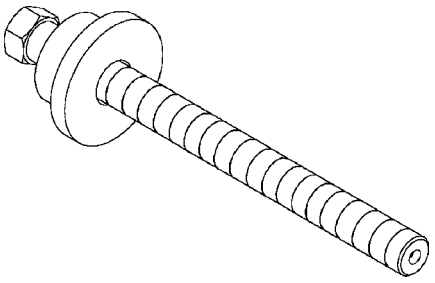
BLOC-CHEK KIT C-3685



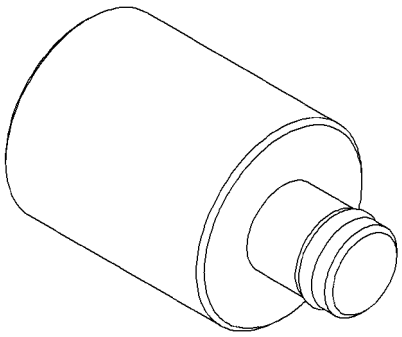
Bore Size Indicator C-119



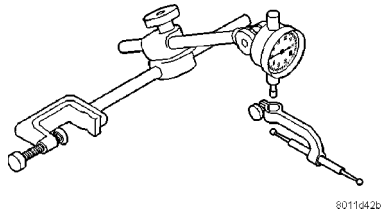
Puller 8454



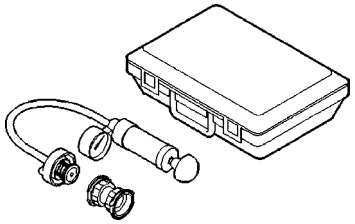
Crankshaft Damper Installer 8512



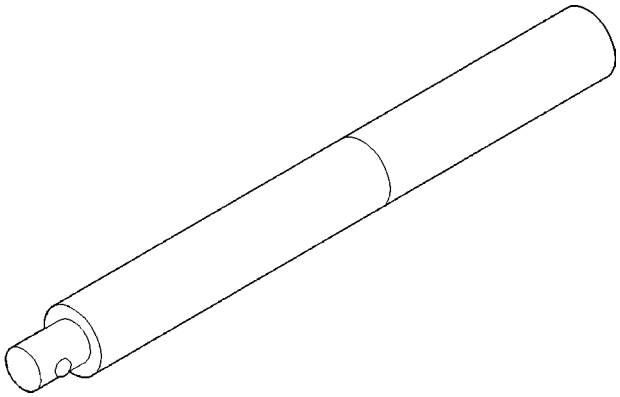
CRANKSHAFT DAMPER REMOVER INSERT - 8513-A



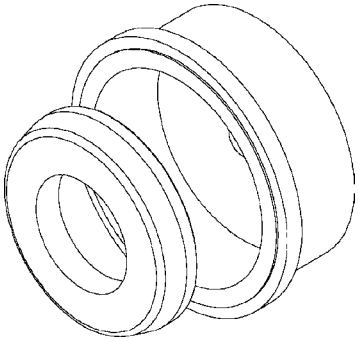
Dial Indicator C-3339



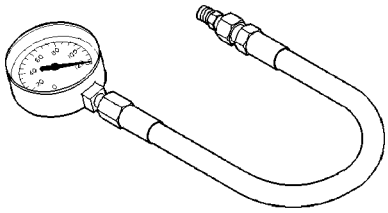
Pressure Tester Kit 7700



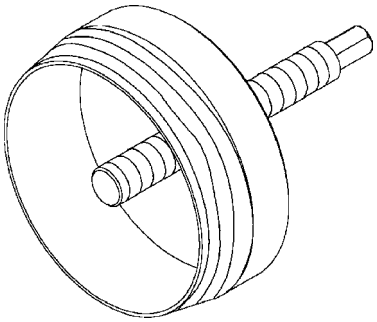
Handle C-4171



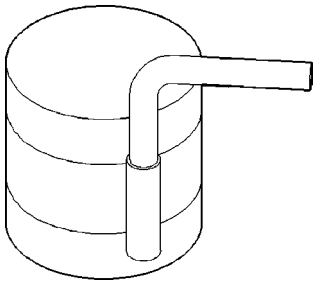
Rear Crankshaft Seal Installer 8349



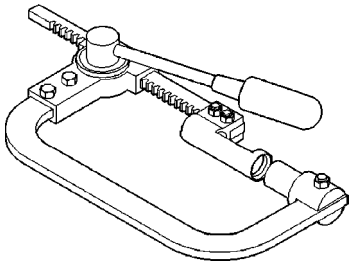
Oil Pressure Gauge C-3292



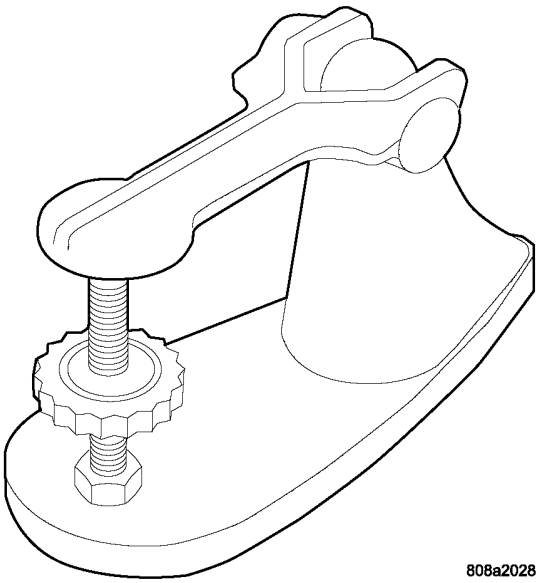
Rear Crankshaft Seal Remover 8506



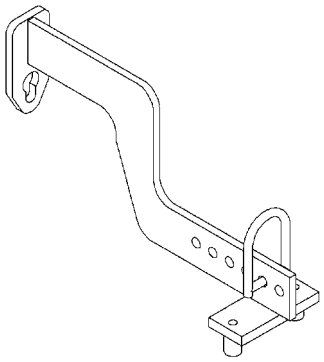
Piston Ring Compressor C-385



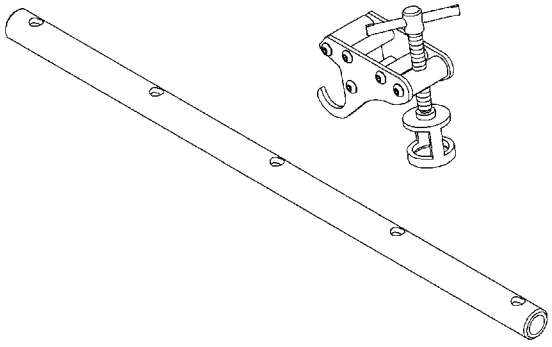
Valve Spring Compressor C-3422-B



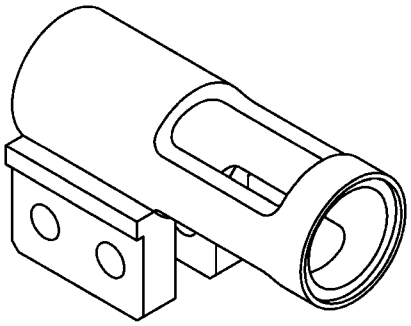
Valve Spring Tester C-647



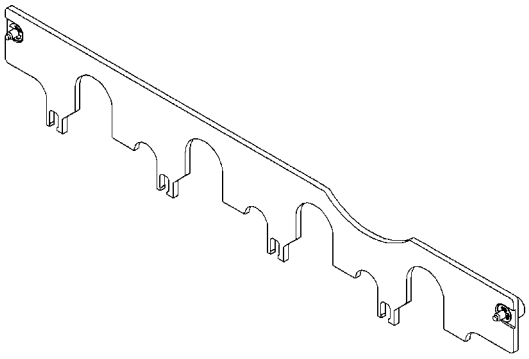
ENGINE LIFT FIXTURE 8984



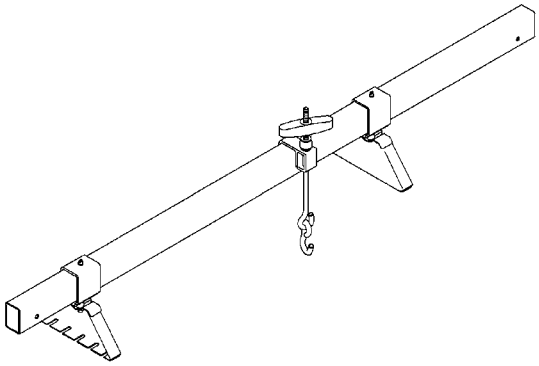
VALVE SPRING COMPRESSOR - 9065



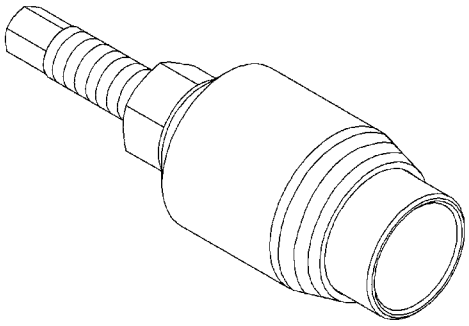
Adapter, Valve Spring Compressor Off-vehicle 8464



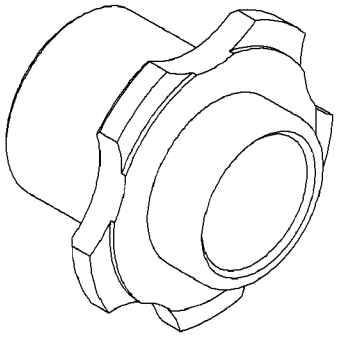
PUSHROD RETAINING PLATE - 9070



ENGINE SUPPORT FIXTURE 8534



FRONT CRANK SEAL REMOVER - 9071



FRONT CRANK SEAL INSTALLER 9072

ELEMENT - AIR CLEANER

REMOVAL

Filter Element Only

Housing removal is not necessary for element (filter) replacement.

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Pry over 4 spring clips (5) from housing cover (3) (spring clips retain cover to housing).
3. Release housing cover (3) from locating tabs (4) on housing and remove cover (3).
4. Remove air cleaner element (filter) from housing.
5. Clean inside of housing before replacing element.

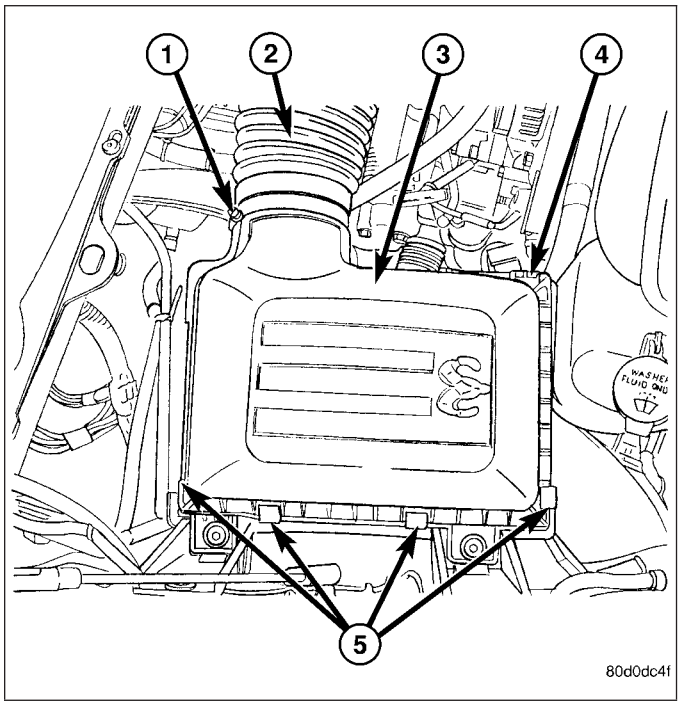


Fig. 1 AIR CLEANER COVER

1 - CLAMP
2 - AIR DUCT
3 - AIR CLEANER COVER
4 - LOCATING TABS
5 - CLIPS (4)

Housing Assembly

1. Loosen clamp and disconnect air duct at air cleaner cover.
2. Lift entire housing (1) assembly from 4 locating pins (2).

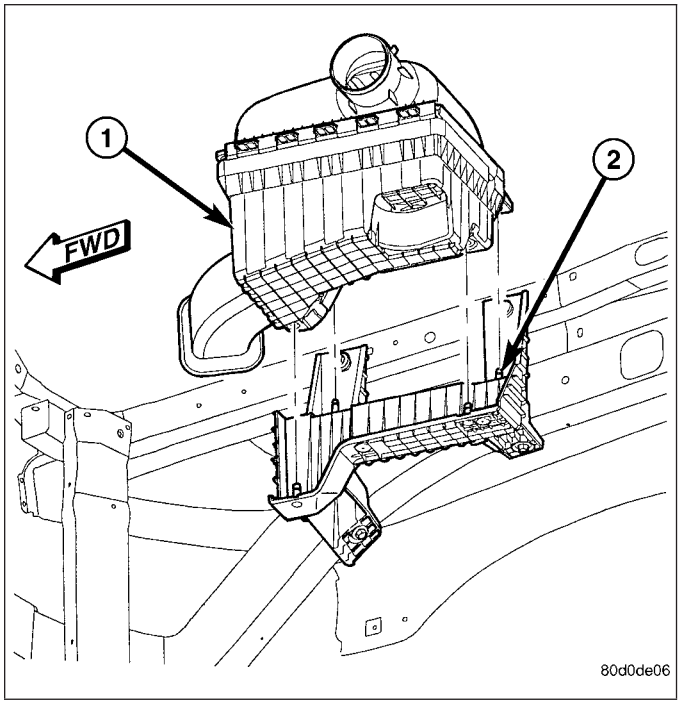
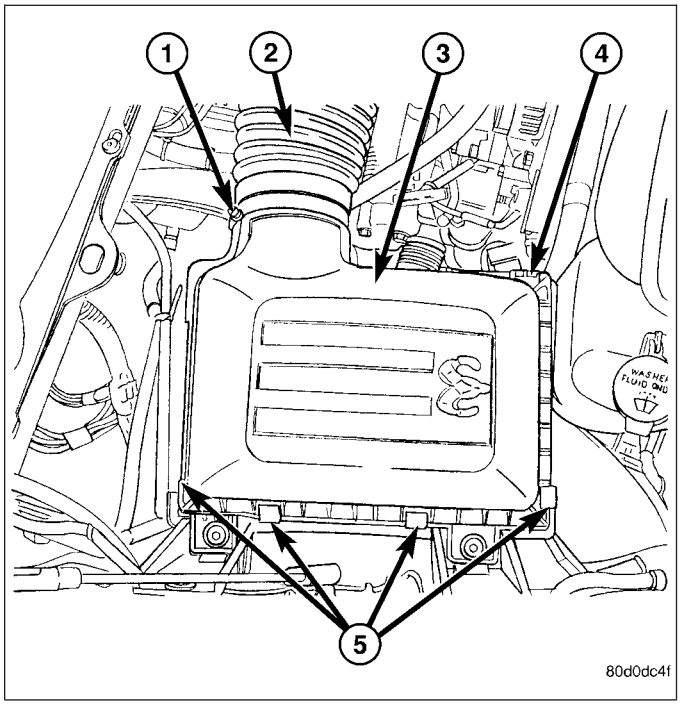


Fig. 2 AIR CLEANER HOUSING

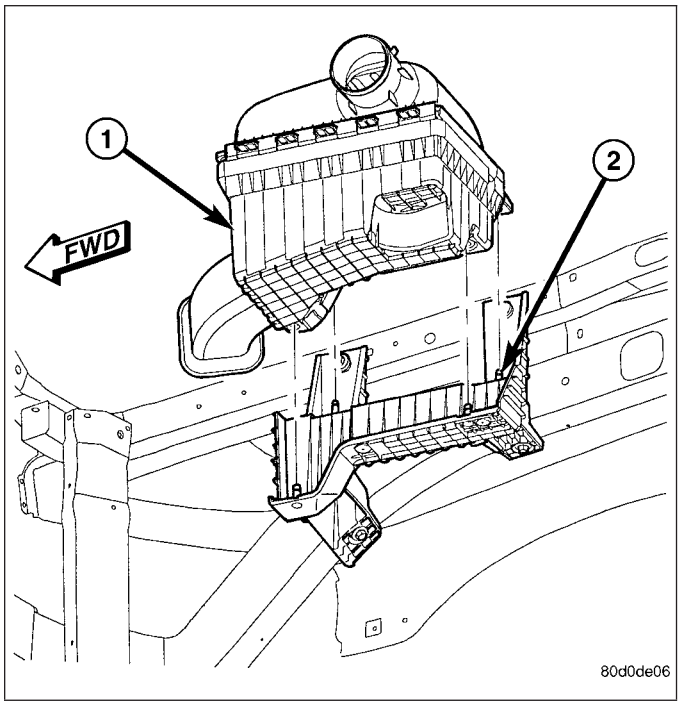
1 - AIR CLEANER HOUSING ASSEMBLY
2 - LOCATING PINS (4)

INSTALLATION

1. Install filter element into housing.
2. Position housing cover into housing locating tabs (4).
3. Pry up 4 spring clips(5) and lock cover to housing.
4. Install air duct to air cleaner cover and tighten hose clamp to 3 N·m (30 in. lbs.) torque.
5. If any other hose clamps were removed from air intake system, tighten them to 3.4 N·m (30 in. lbs.) torque.
6. If any bolts were removed from air resonator housing or air intake tubing, tighten them to 4.5 N·m (40 in. lbs.) torque.



7. Install filter housing (1) into locating pins (2).



CYLINDER HEAD

OPERATION—CYLINDER HEAD

The cylinder head closes the combustion chamber allowing the pistons to compress the air fuel mixture to the correct ratio for ignition. The valves located in the cylinder head open and close to either allow clean air into the combustion chamber or to allow the exhaust gases out, depending on the stroke of the engine.

DIAGNOSIS AND TESTING—CYLINDER HEAD GASKET FAILURE

A cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- Possible indications of the cylinder head gasket leaking between adjacent cylinders are:
  - Loss of engine power
  - Engine misfiring
  - Poor fuel economy
- Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:
  - Engine overheating
  - Loss of coolant
  - Excessive steam (white smoke) emitting from exhaust
  - Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50–70% reduction in compression pressure.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

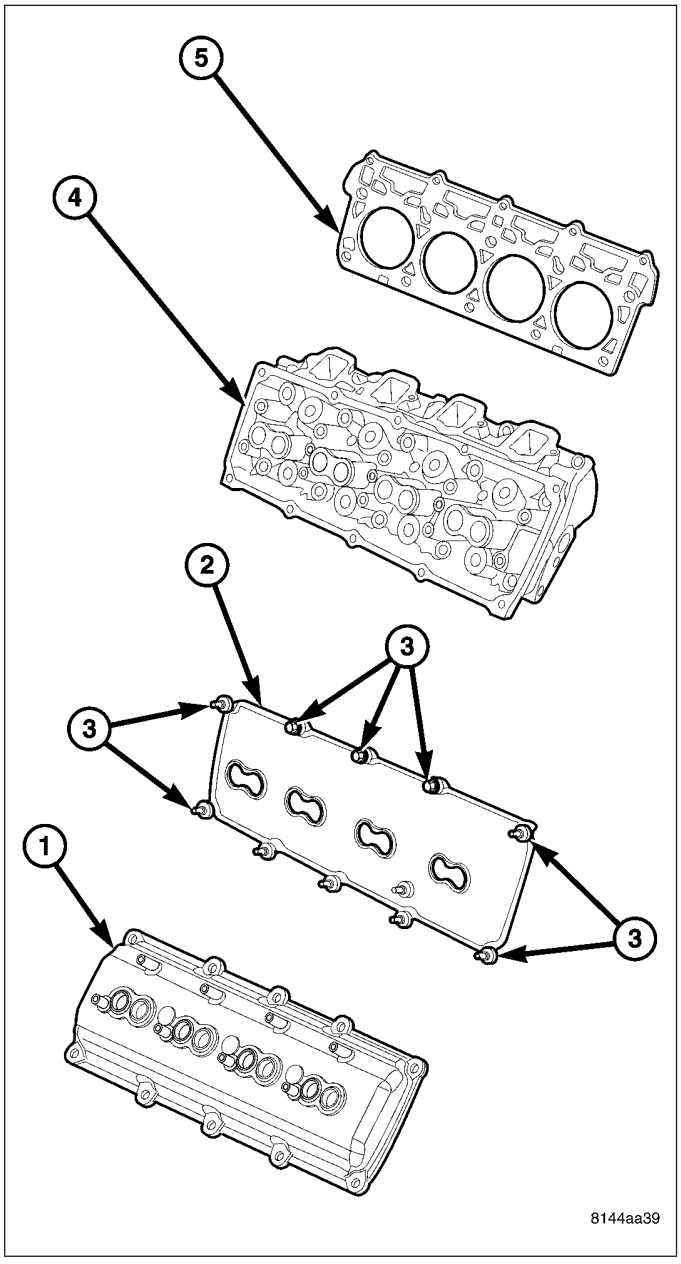
WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

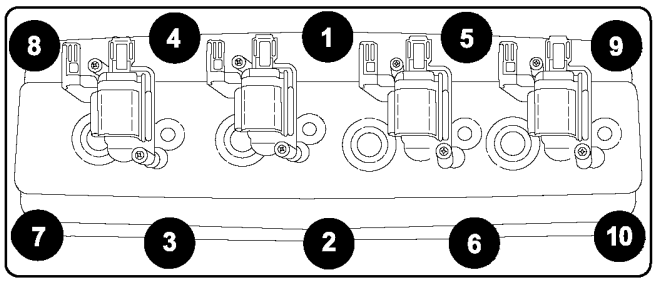
CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

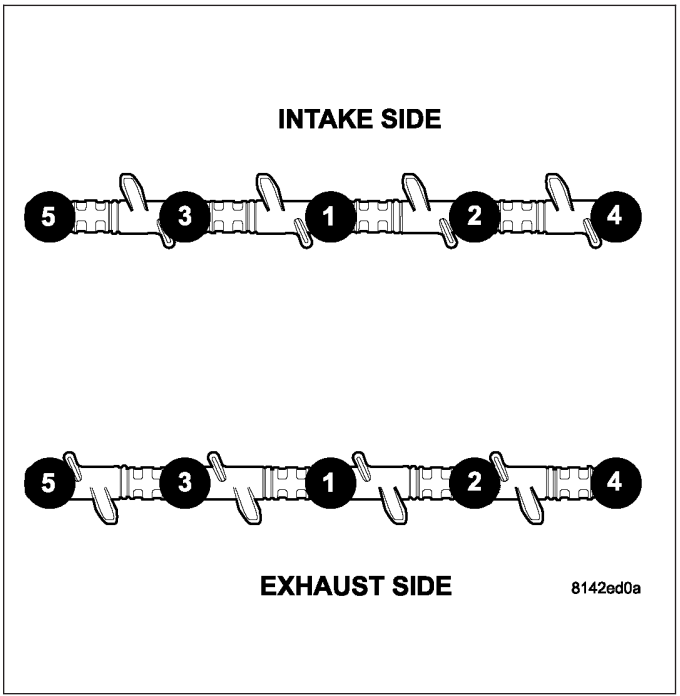
REMOVAL



1. Perform the Fuel System Pressure Release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE). Disconnect the fuel supply line (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).
2. Disconnect the battery negative cable.
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove the air cleaner resonator and duct work (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - REMOVAL).
5. Remove closed crankcase ventilation system.
6. Disconnect the exhaust at the exhaust manifolds.
7. Disconnect the evaporation control system.
8. Disconnect heater hoses.
9. Remove the power steering pump.
10. Remove cylinder head covers (1), using the sequence provided, and gaskets (2). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL)
    .
11. Remove intake manifold and throttle body as an assembly. (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
12. Remove rocker arm assemblies and push rods. Identify to ensure installation in original locations. (Refer to 9 - ENGINE/CYLINDER HEAD/ ROCKER ARM / ADJUSTER ASSY - REMOVAL).

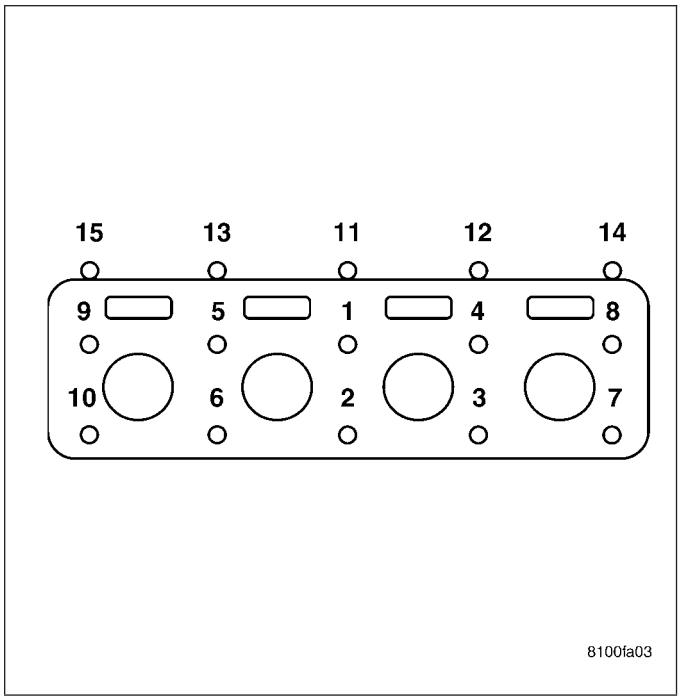


8142eaa1



8142ed0a

13. Remove the head bolts from each cylinder head, using the sequence provided, and remove cylinder heads. Discard the cylinder head gasket.



CLEANING

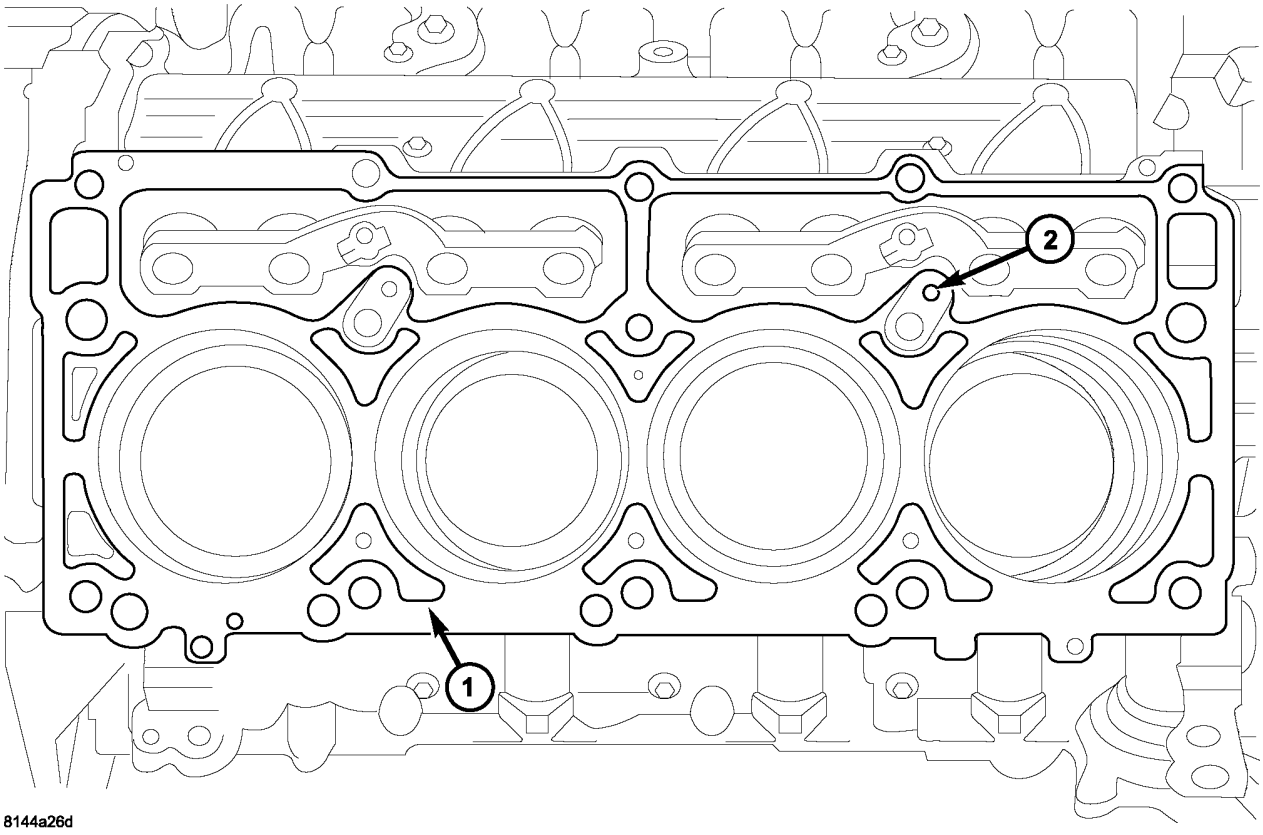
Clean all surfaces of cylinder block and cylinder heads.

Clean cylinder block front and rear gasket surfaces using a suitable solvent.

INSPECTION

1. Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.
2. Inspect the valve seats for damage. Service the valve seats as necessary.
3. Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.
4. Inspect pushrods. Replace worn or bent pushrods.

INSTALLATION

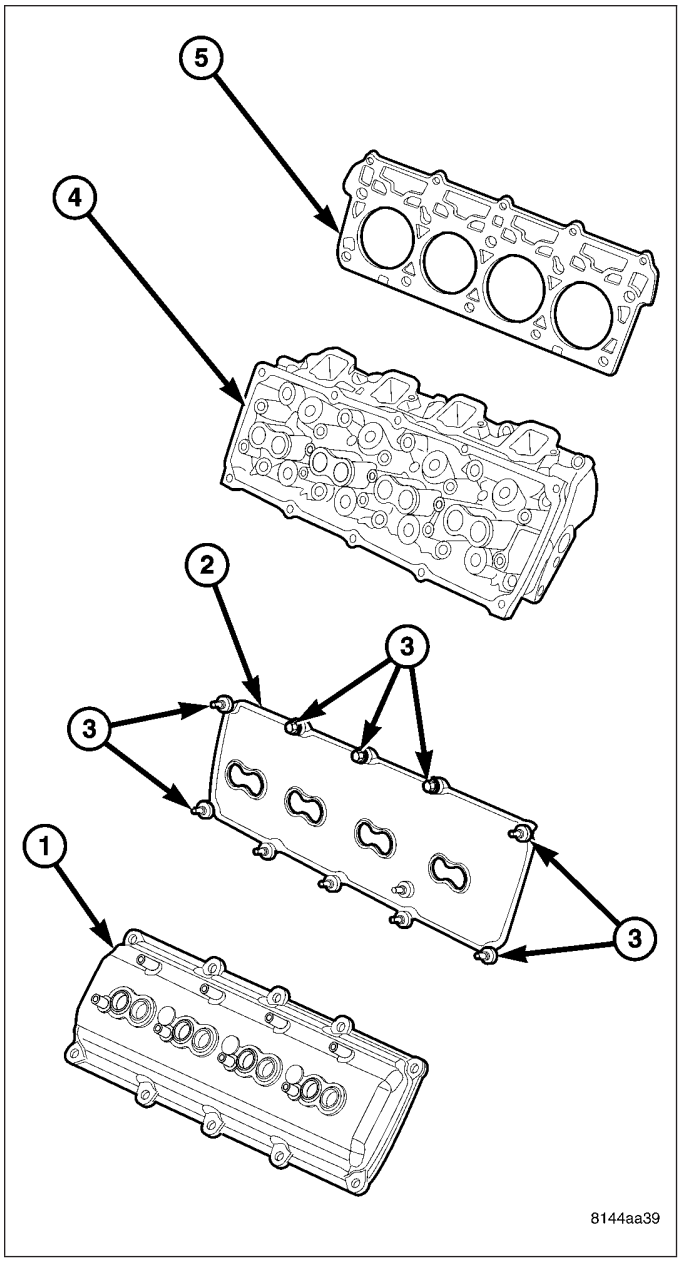


1. Clean all surfaces of cylinder block and cylinder heads.
2. Clean cylinder block front and rear gasket surfaces using a suitable solvent.

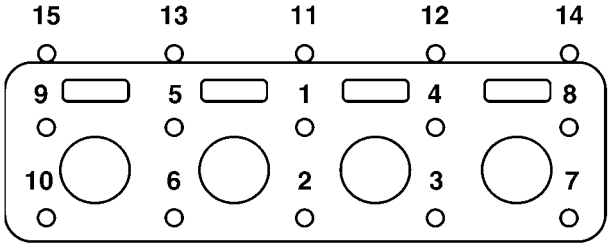
CAUTION: The head gaskets (1) are not interchangeable between left and right sides. They are marked “L” and “R” to indicate left and right sides.

CAUTION: The head gaskets (1) are marked “TOP” to indicate which side goes up.

3. Position new cylinder head gaskets (5) onto the cylinder block.
4. Position cylinder heads (4) onto head gaskets (5) and cylinder block.

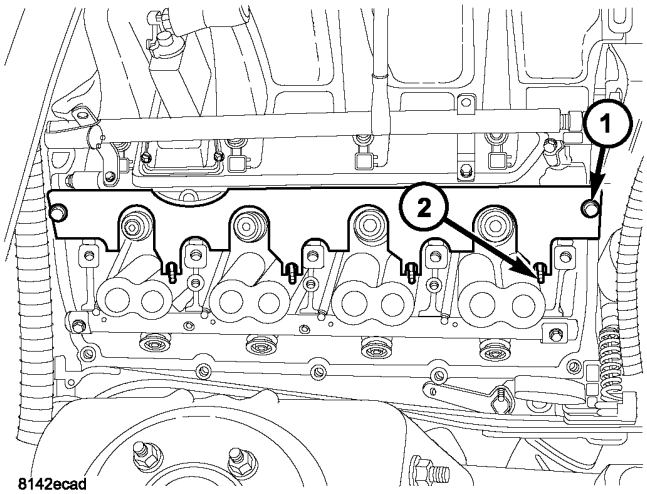


5. Tighten the cylinder head bolts in three steps using the sequence provided :
   - Step 1— Snug tighten M12 cylinder head bolts, in sequence, to 34 N·m (25 ft. lbs.) and M8 bolts to 20 N·m (15 ft. lbs.) torque.
   - Step 2— Tighten M12 cylinder head bolts, in sequence, to 54 N·m (40 ft. lbs.) and verify M8 bolts to 20 N·m (15 ft. lbs.) torque..
   - Step 3— Turn M12 cylinder head bolts, in sequence, 90 degrees and tighten M8 bolts to 34 N·m (25 ft. lbs.) torque.

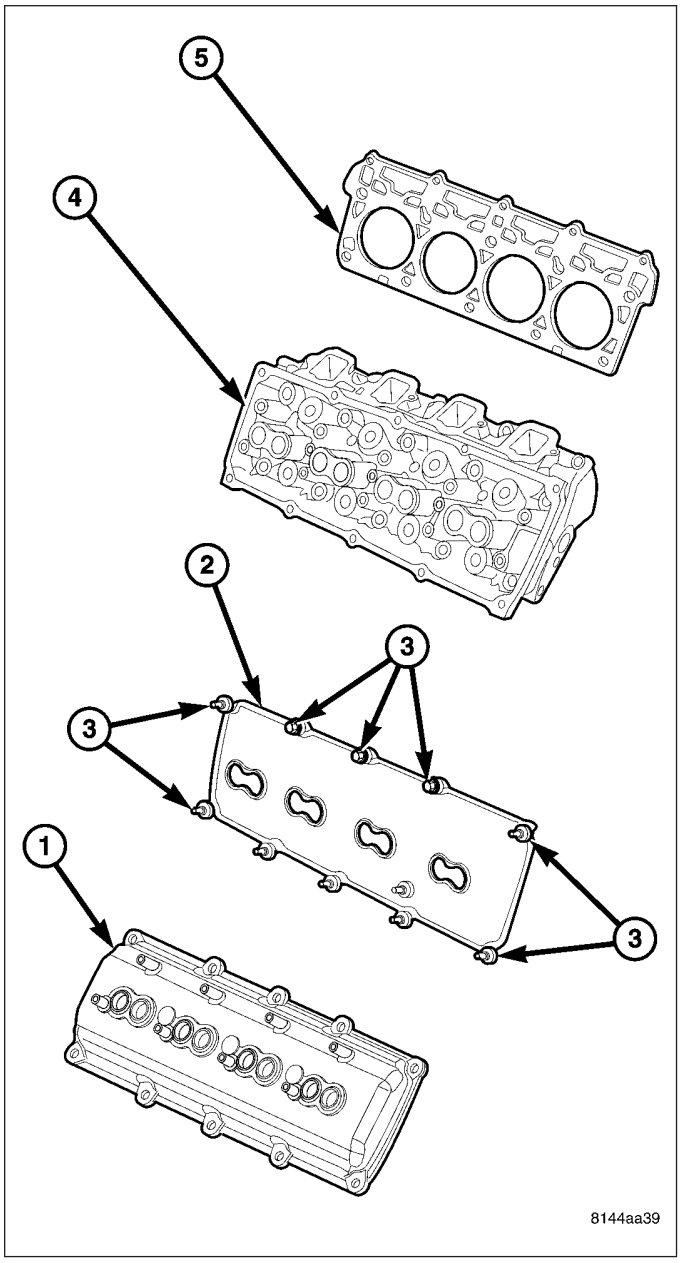


8100fa03

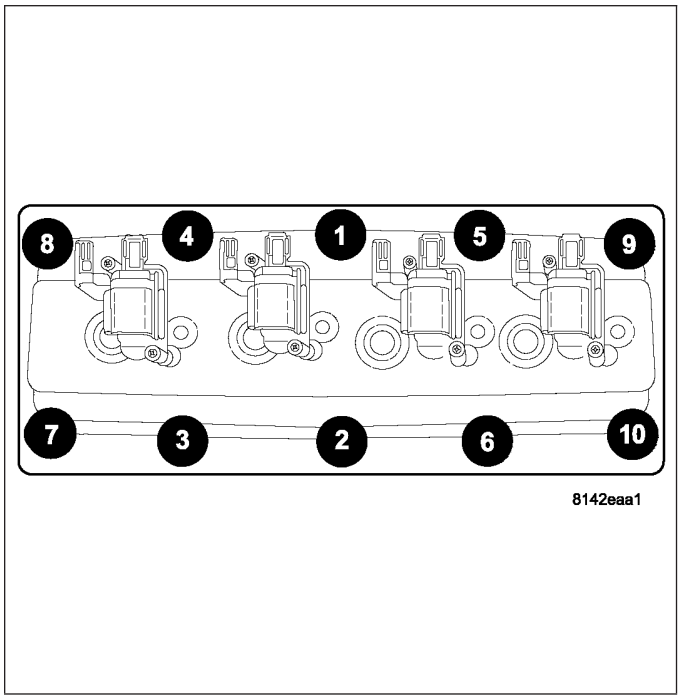
6. Install push rods and rocker arm assemblies in their original position, using pushrod retaining plate (1) special tool# 9070. (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).
7. Install the intake manifold and throttle body assembly (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
8. If required, adjust spark plugs to specifications. Install the plugs.
9. Connect the heater hoses.
10. Install the fuel supply line.
11. Install the power steering pump.
12. Install the drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).



8142ecad


5
4
2
3
3
1
3
8144aa39

13. Install cylinder head covers (1) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
14. Connect the evaporation control system.
15. Install the air cleaner (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - INSTALLATION).
16. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
17. Connect the negative cable to the battery.
18. Start engine check for leaks.

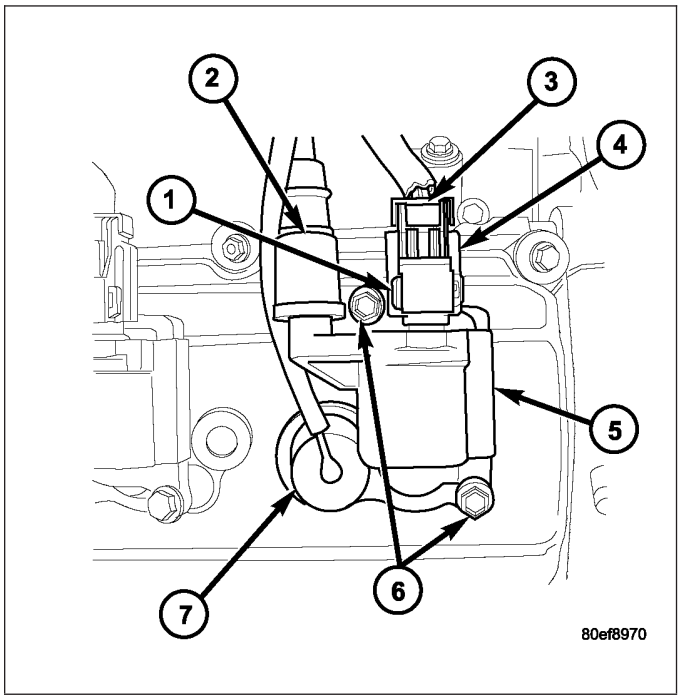


COVER - CYLINDER HEAD

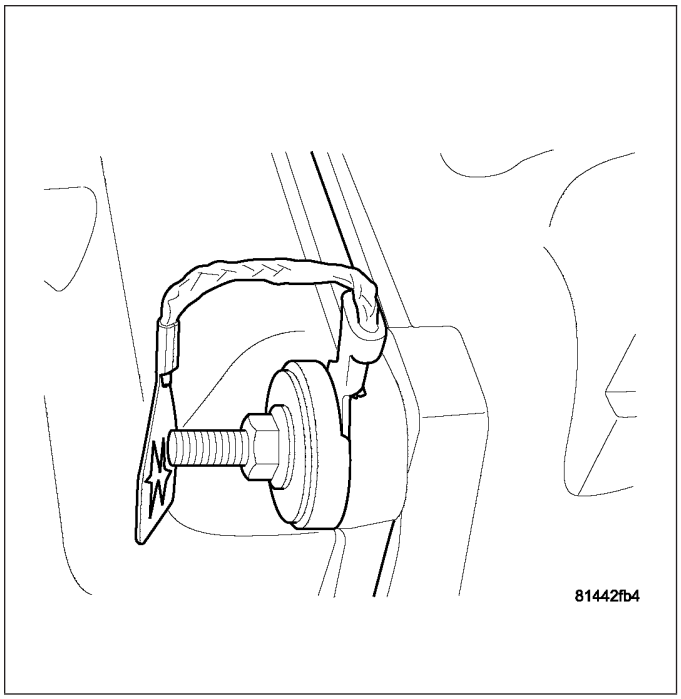
REMOVAL

1. Disconnect battery negative cable.

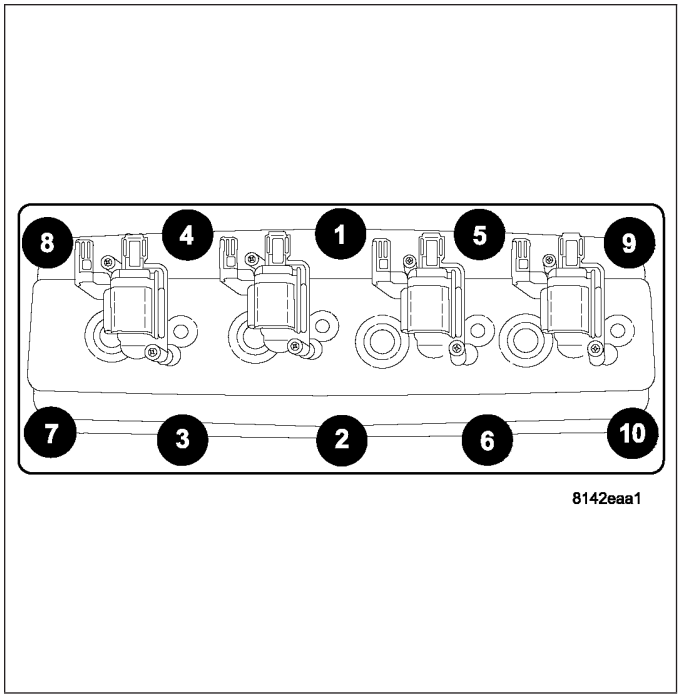
2. Disconnect coil on plug connectors (4).



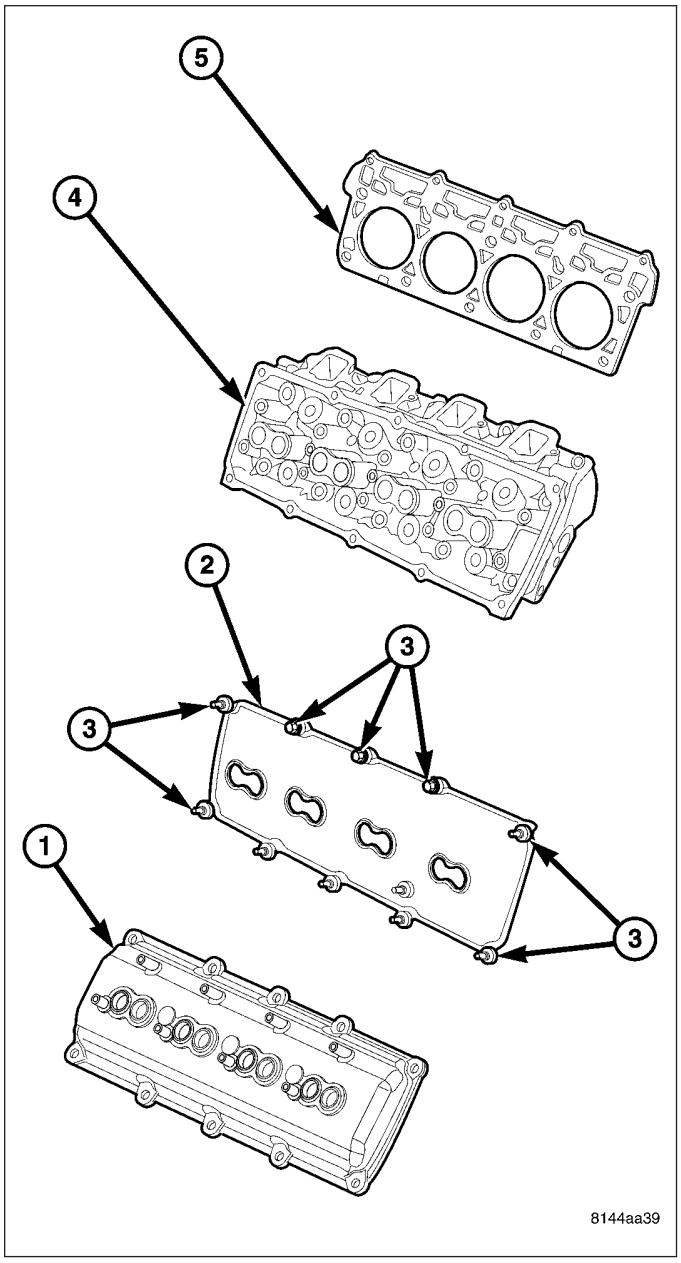
CAUTION: The ground straps must be installed in the same location as removed. The covers are machined to accept the ground straps in those locations only.



3. Remove cylinder head cover retaining bolts, and ground straps.



4. Remove cylinder head cover (1).



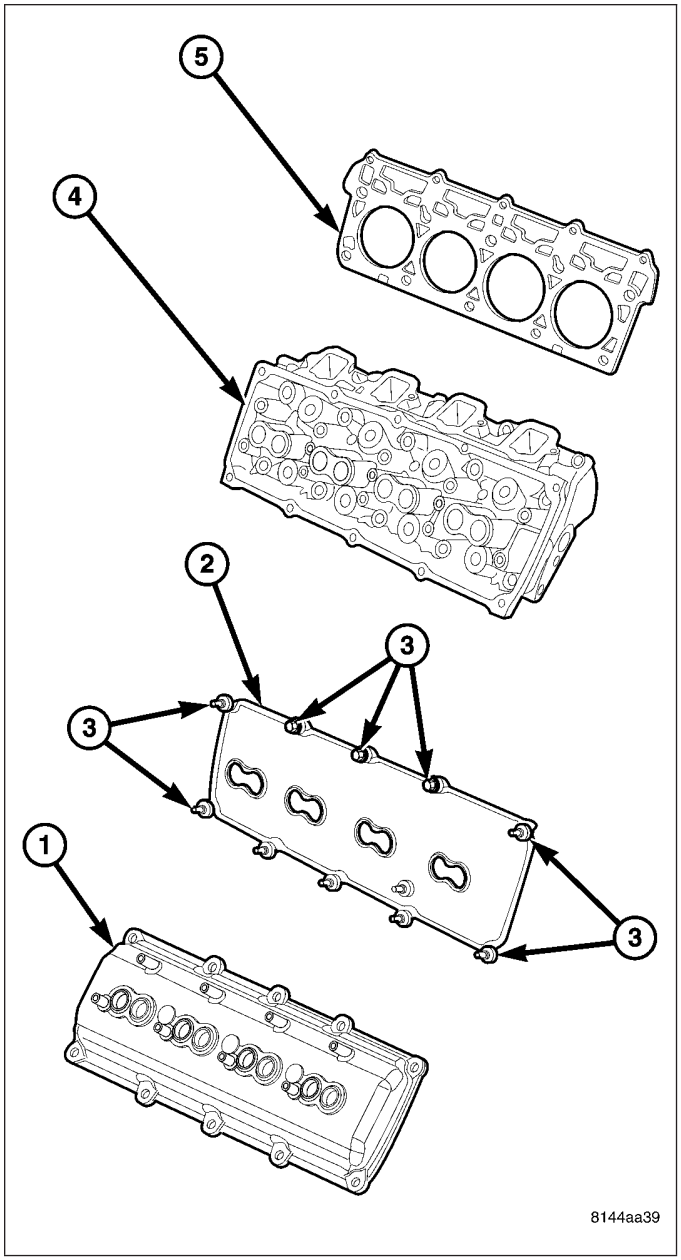
NOTE: The gasket (2) may be used again, provided no cuts, tears, or deformation has occurred.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the engine cylinder head cover. Prolonged contact with other objects may wear a hole in the cylinder head cover.

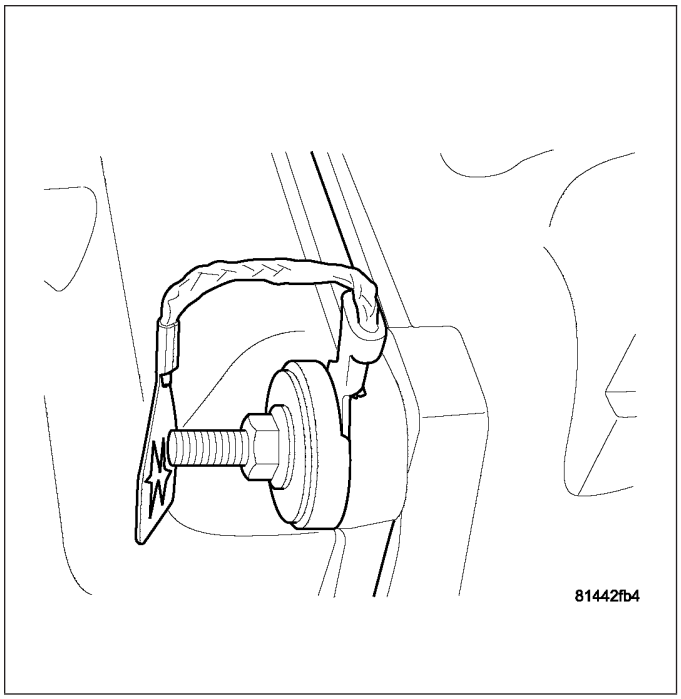
1. Clean cylinder head cover (1) and both sealing surfaces (1,4,). Inspect and replace gasket (2) as necessary.



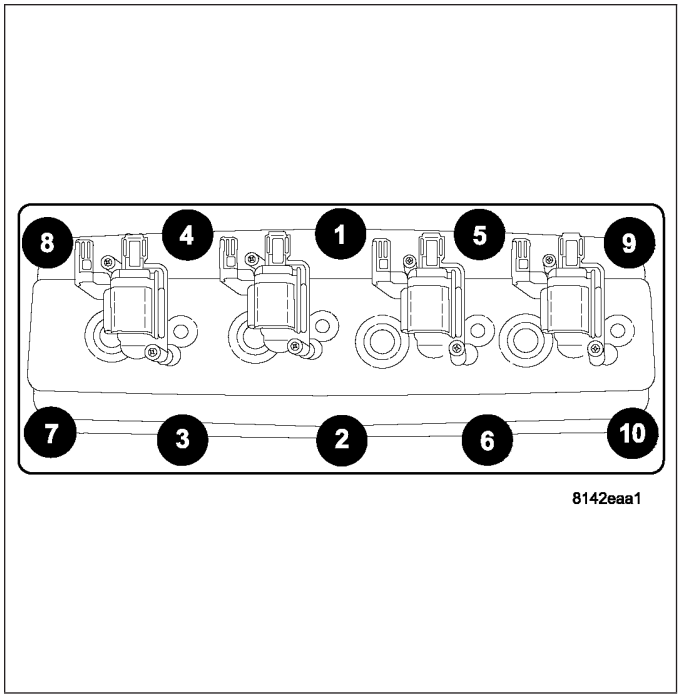
2. Install cylinder head cover and hand start all fasteners. Verify that all double ended studs are in the correct location and install left and right ground straps.

CAUTION: The ground straps must be installed in the same location as removed. The covers are machined to accept the ground straps in those locations only.

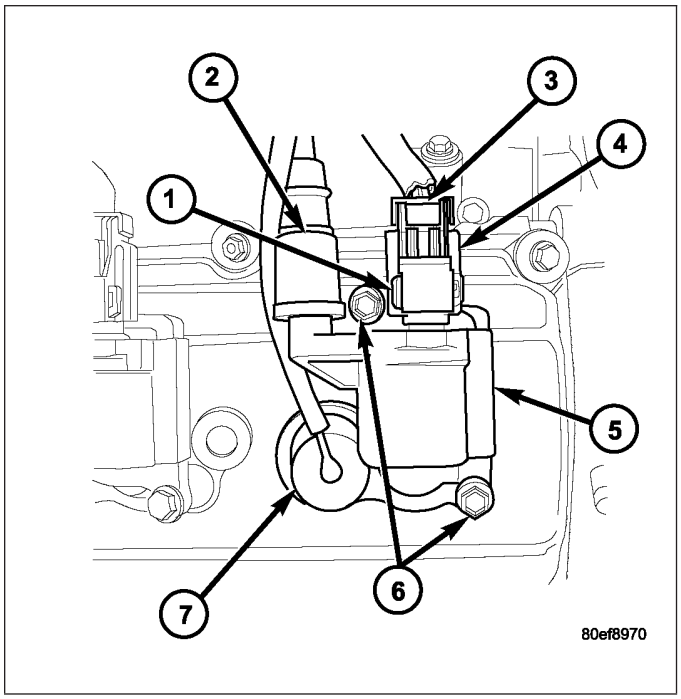
NOTE: The right hand ground strap is located on the front inboard stud. The left hand ground strap is located on the rear inboard stud.



3. Tighten cylinder head cover bolts and double ended studs to 8 N·m (70 in. lbs). Begin torque sequence in the middle of head cover and torque bolts moving outward in a crisscross pattern from top to bottom.



4. Install ignition coil on plug (5) , and torque fasteners (6) to 12 N·m (105 in. lbs)
5. Connect, ignition coil electrical connectors (4).
6. Install PCV hose.
7. Connect battery negative cable.



VALVES & SEATS - INTAKE/EXHAUST

DESCRIPTION

DESCRIPTION - VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, and valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

DESCRIPTION

Both the intake and exhaust valves are made of steel. The intake valve is 50.93 mm (2.00 inches) in diameter and the exhaust valve is 39.53 mm (1.55 inches) in diameter. All valves use three bead lock keepers to retain the springs and promote valve rotation.

STANDARD PROCEDURE - REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

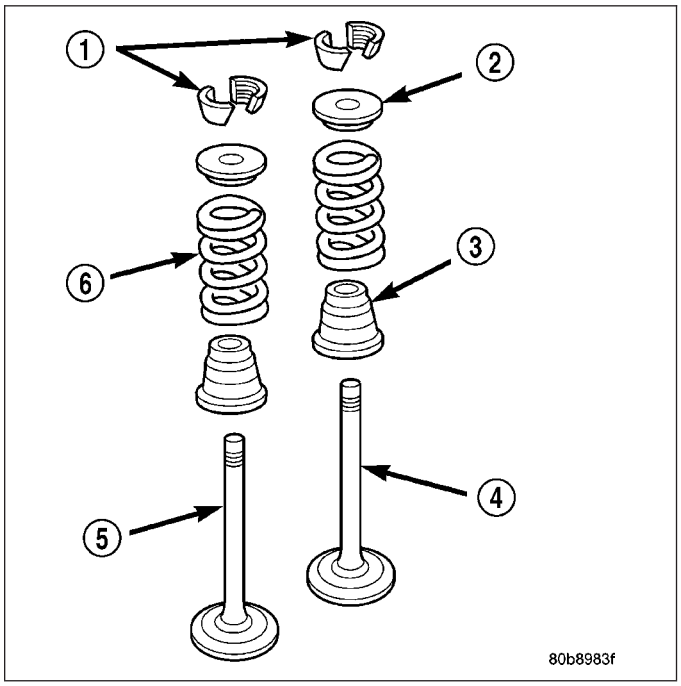
NOTE: When refacing valves and valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.

1. Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).
2. Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred below the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.
3. When the seat is properly positioned the width of the intake seat must be 1.018 - 1.62 mm (0.0464 - 0.0637 in.) and the exhaust seat must be 1.48 - 1.92 mm (0.058 - 0.075 in.).
4. Check the valve spring installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 46.0 mm (1.81 in.).

VALVE FACE AND VALVE SEAT ANGLE CHART

DESCRIPTION	SPECIFICATION
SEAT WIDTH	
INTAKE	1.018 - 1.62 mm (0.0464 - 0.0637 in.)
EXHAUST	1.48 - 1.92 mm (0.058 - 0.075 in.)
FACE ANGLE (INT. AND EXT.)	45° - 45½°
SEAT ANGLE (INT. AND EXT.)	44½° - 45°

5. The valve seat must maintain an angle of 44.5 – 45.0 degrees angle.
6. The valve face must maintain a face angle of 45.0 – 45.5 degrees angle.



REMOVAL

1. Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
2. Compress valve springs using Valve Spring Compressor Tool special tool # C-3422and adapter 8464.
3. Remove valve retaining locks, valve spring retainers, valve stem seals and valve springs.
4. Before removing valves, remove any burrs from valve stem lock grooves to prevent damage to the valve guides. Identify valves to ensure installation in original location.

INSTALLATION

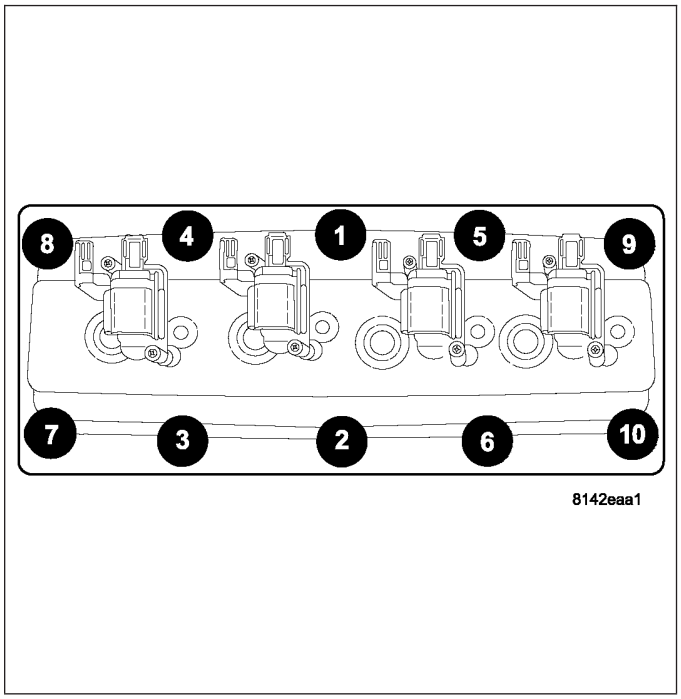
1. Clean valves thoroughly. Discard burned, warped and cracked valves.
2. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
3. Measure valve stems for wear. If wear exceeds 0.051 mm (0.002 inch), replace the valve.
4. Coat valve stems with lubrication oil and insert them in cylinder head.
5. If valves or seats are reground, check valve stem height. If valve is too long, replace cylinder head.
6. Install new seals on all valve guides. Install valve springs and valve retainers.

7. Compress valve springs with Valve Spring Compressor Tool special tool # C- 3422and adapter 8464, install locks and release tool. If valves and/or seats are ground, measure the installed height of springs. Make sure the measurement is taken from bottom of spring seat in cylinder head to the bottom surface of spring retainer.
8. Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

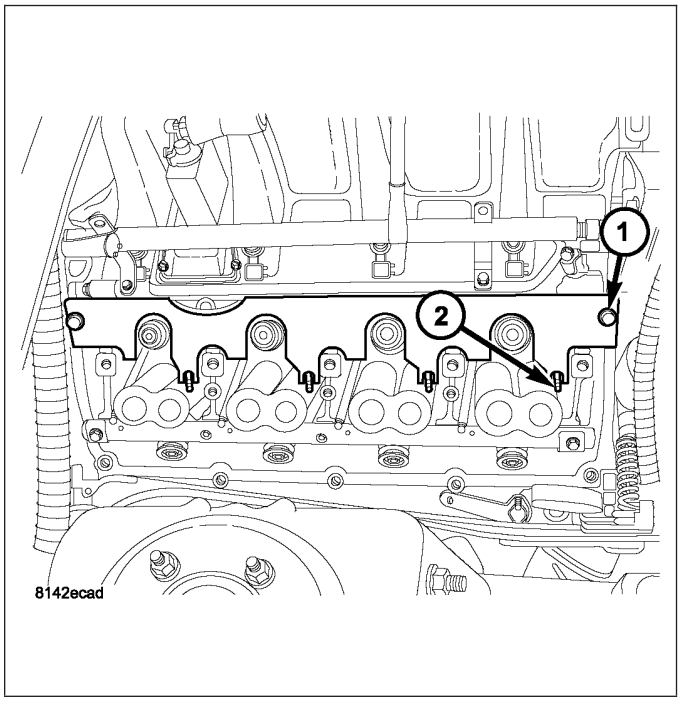
ROCKER ARM

REMOVAL

1. Remove cylinder head cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



2. Install pushrod retaining plate (1)special tool 9070.



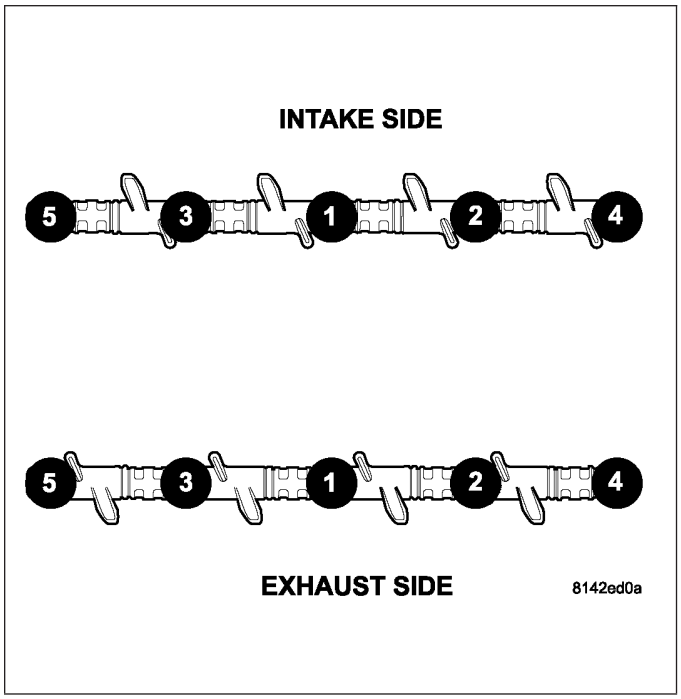
3. Loosen the rocker shafts using the sequence provided.

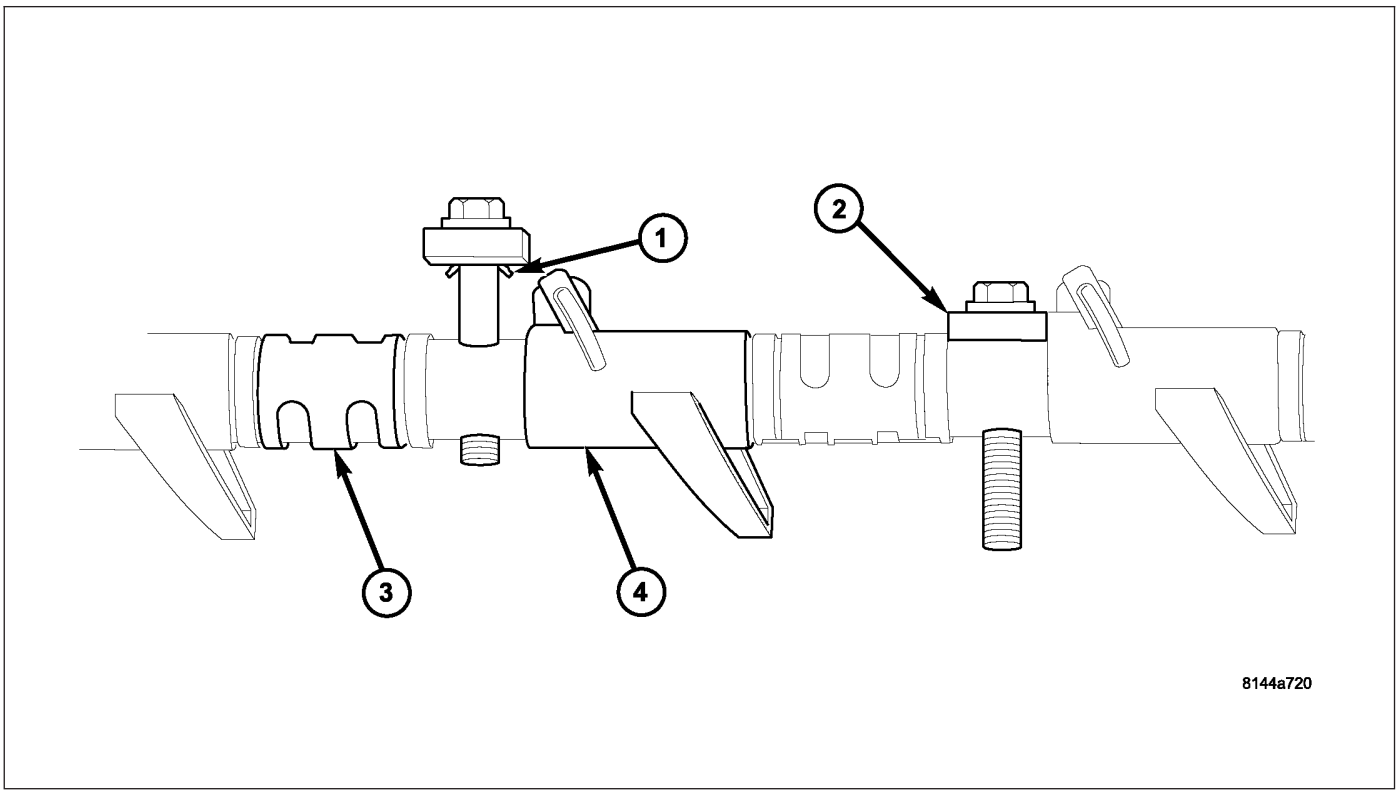
CAUTION: The rocker shaft assemblies are not interchangeable between intake and exhaust. The intake rocker arms are marked with an "I".

4. Remove the rocker shafts. Note location for reassembly.

CAUTION: The longer push rods are for the exhaust side, and the shorter push rods are for intake side.

5. Remove the pushrods. Note pushrod location for reassembly.



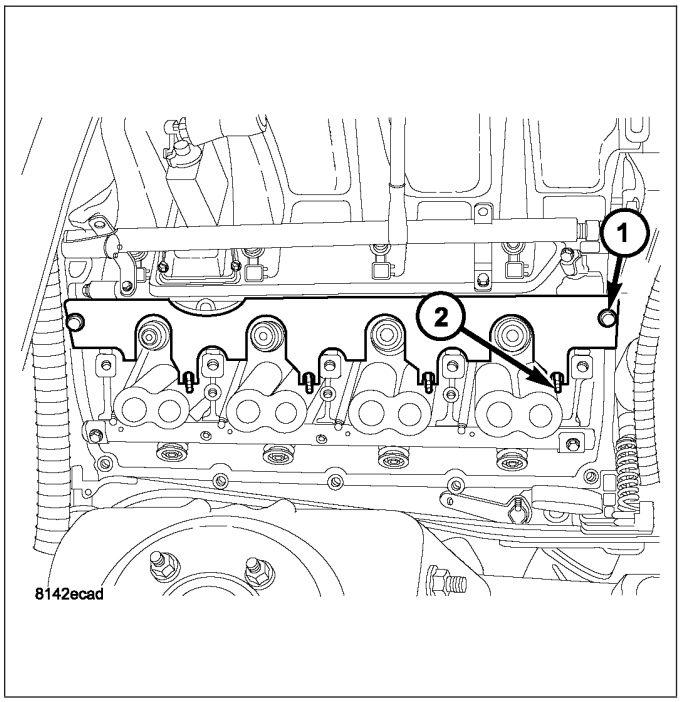


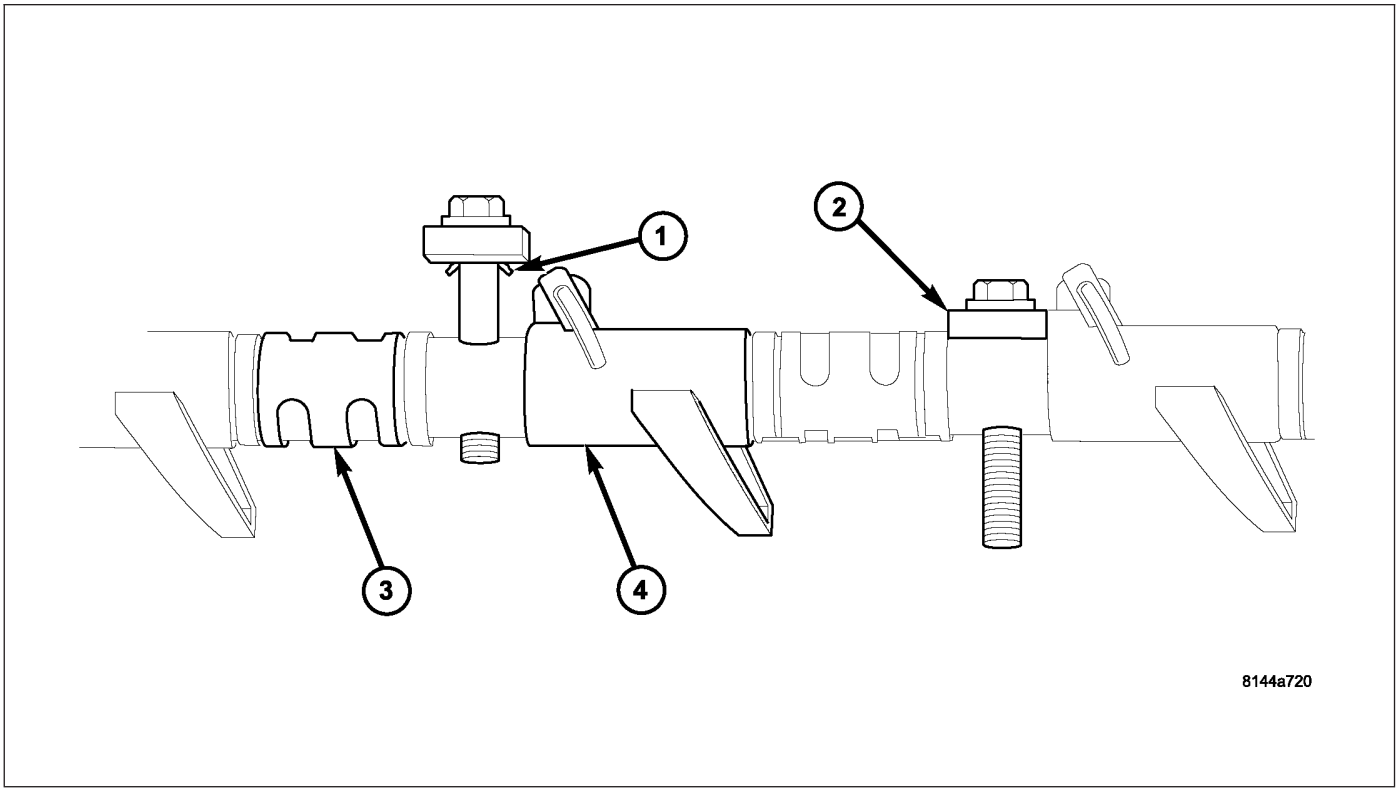
CAUTION: Do not remove the retainers from the rocker shaft. The assembly tangs (1) at the bottom of the retainers (2) can be damaged, causing the assembly tangs to break off, and get into the engine.

INSTALLATION

CAUTION: The longer push rods are for the exhaust side, and the shorter push rods are for intake side.

1. Install the push rods in the same order as removed.
2. Install the pushrod retaining plate (1) special tool 9070.





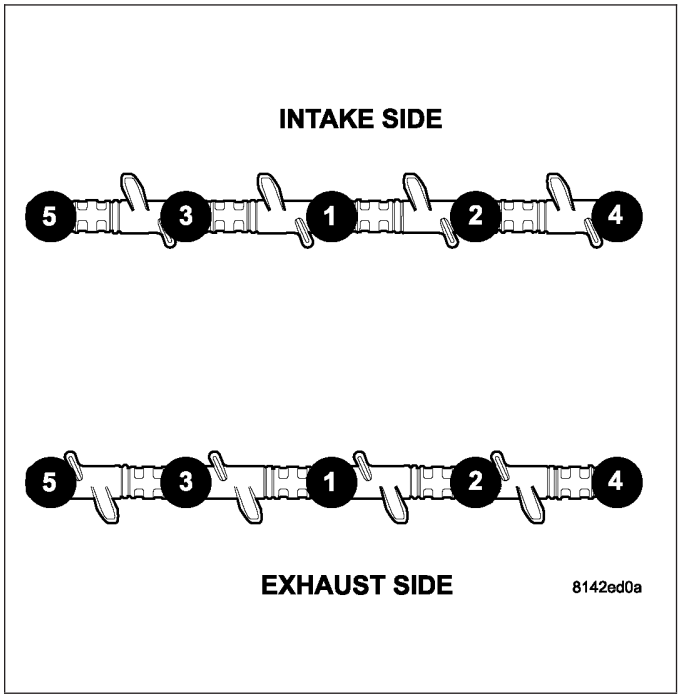
CAUTION: Ensure that retainers (2) and rocker arms (4) are not overlapped when torquing bolts.

CAUTION: Verify that pushrod is installed into rocker arm (4) and tappet correctly while installing rocker shaft assembly. Recheck after rocker shaft has been torqued to specification.

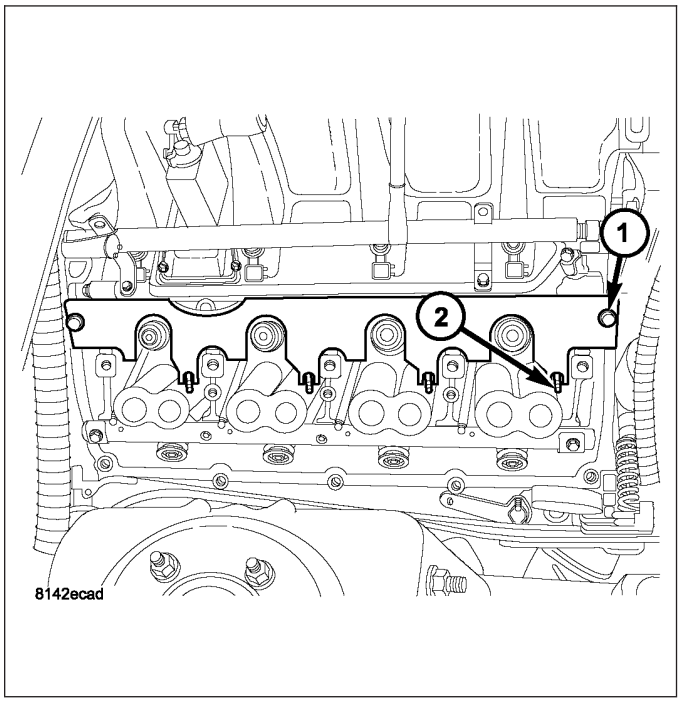
CAUTION: The rocker shaft assemblies are not interchangeable between intake and exhaust. The intake rocker arms are marked with the letter "I".

3. Install rocker shaft assemblies in the same order as removed.
4. Tighten the rocker shaft bolts to 22 N·m (195 in. lbs.) torque,using the sequence provided.

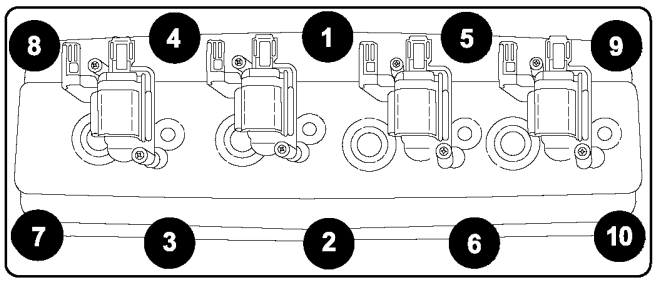
CAUTION: DO NOT rotate or crank the engine during or immediately after rocker arm installation. Allow the hydraulic roller tappets adequate time to bleed down (about 5 minutes).



5. Remove pushrod retaining plate (1) special tool 9070.



6. Install cylinder head cover (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



8142eaa1

SEALS - VALVE GUIDE

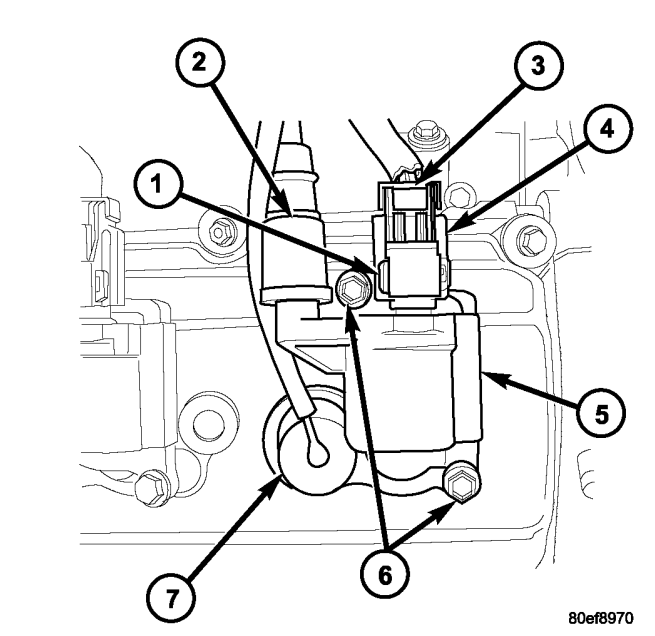
DESCRIPTION

The valve guide seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

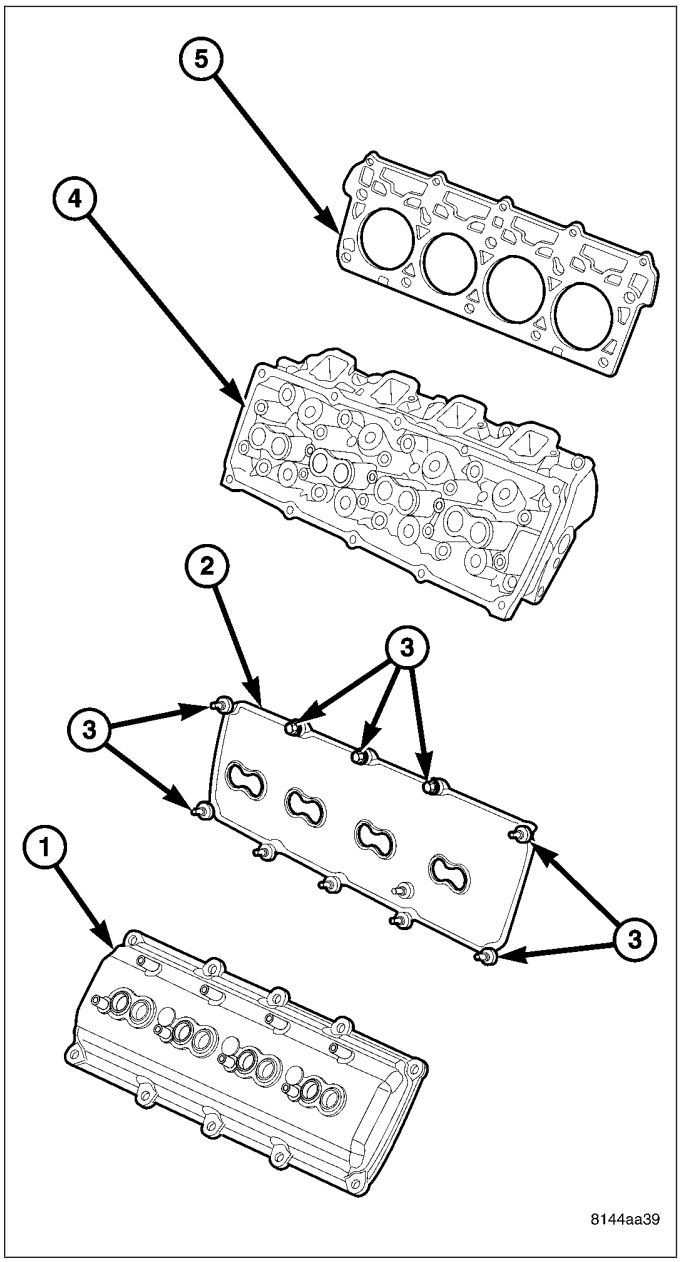
SPRINGS - VALVE

REMOVAL

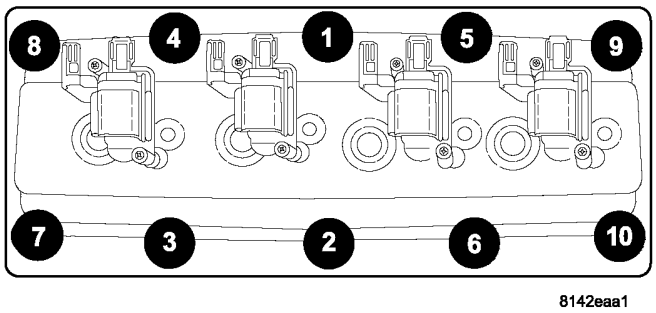
1. Disconnect negative battery cable.
2. Remove air cleaner assembly.
3. Remove air intake resonator.
4. Remove spark plug cables.
5. Remove ignition coil connectors (4).
6. Remove ignition coils (5).
7. Remove one spark plug.



80ef8970

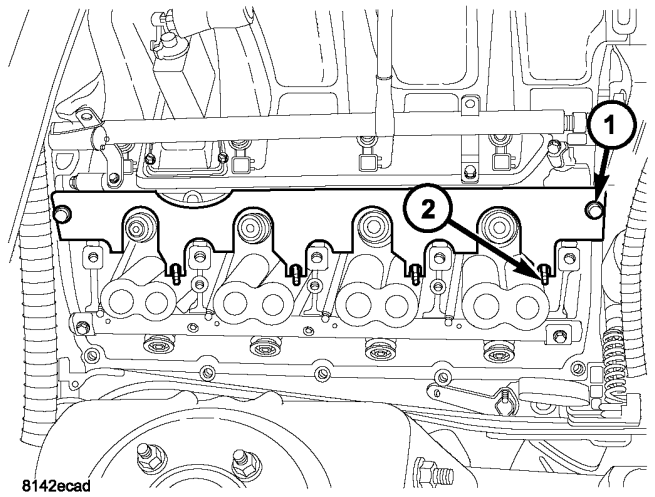

5
4
2
3
3
1
3
8144aa39

8. Remove cylinder head cover (1) using the sequence shown (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

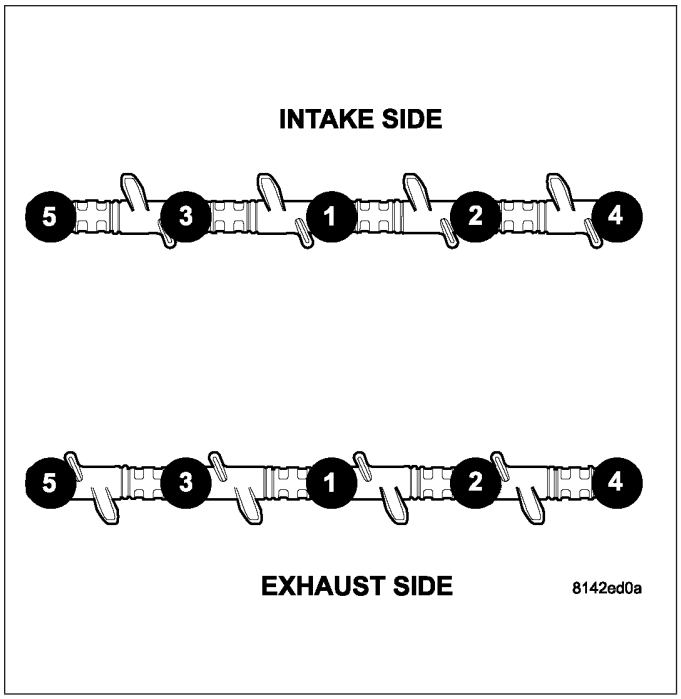


CAUTION: The piston must be at TDC, and both valves closed on the cylinder to be serviced.

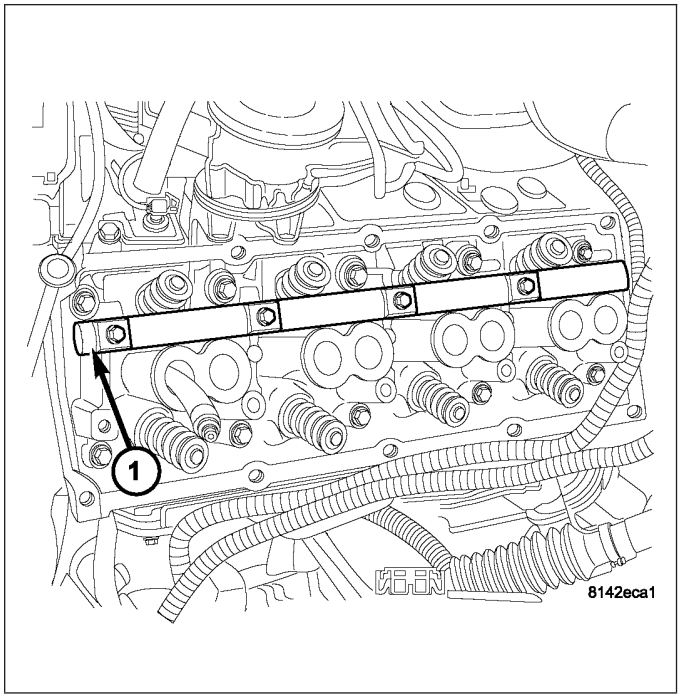
NOTE: If removing intake valve spring, install special tool# 9070, pushrod retaining plate (1), to retain the intake pushrods (2).

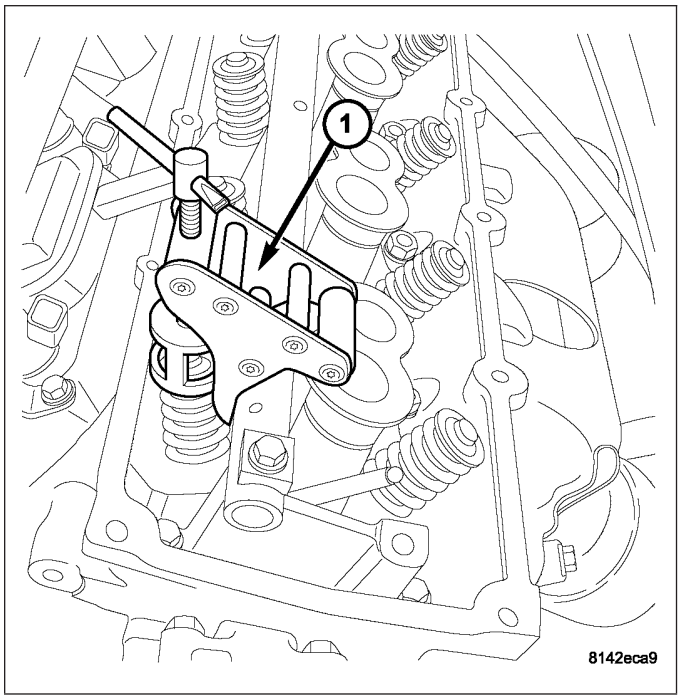


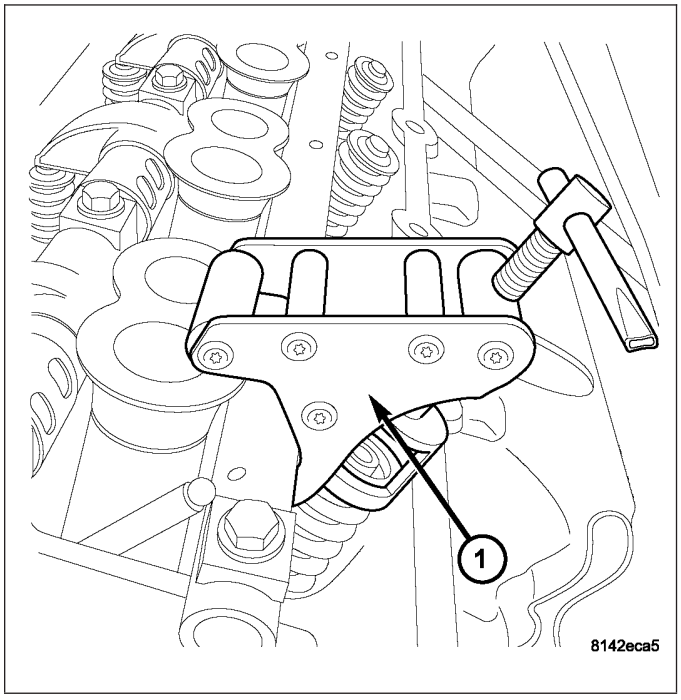
9. Remove exhaust/intake rocker arm shafts using the sequence shown.



10. Install rocker arm shaft (1) special tool# 9065.

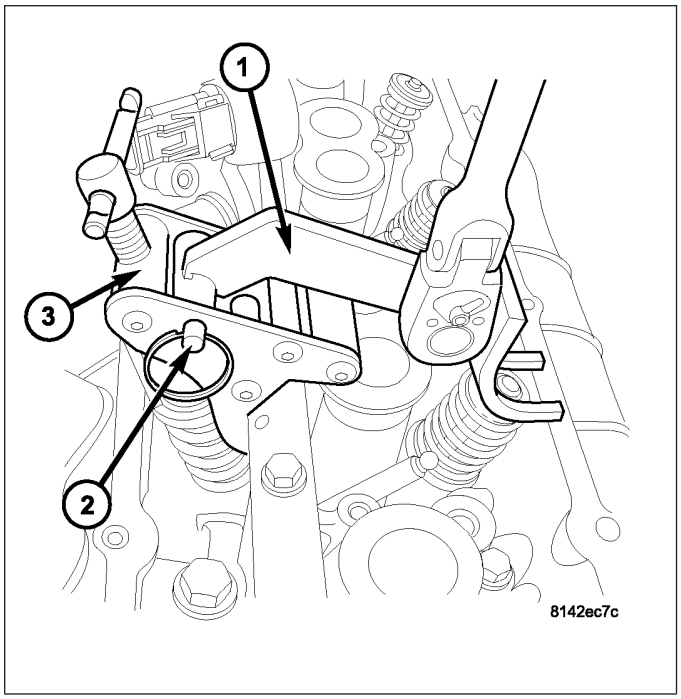


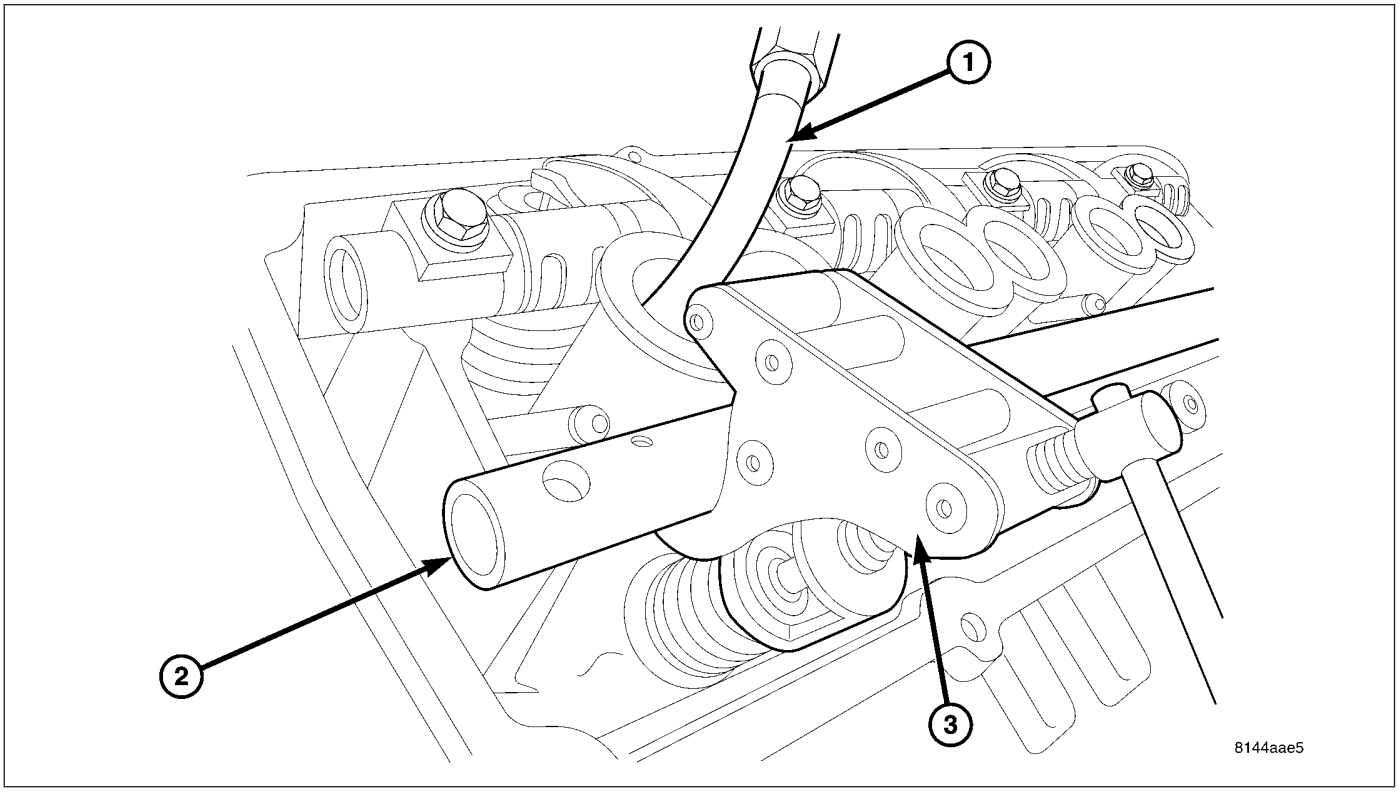

1
8142eca9


1
8142eca5

11. Install spring compressor (1,3,), special tool# 9065, and exhaust adapter arm (1) tool # 9065if needed.

NOTE: All valve springs and seals are removed in the same manner.





12. Insert air hose (1) into spark plug hole and charge cylinder with air.

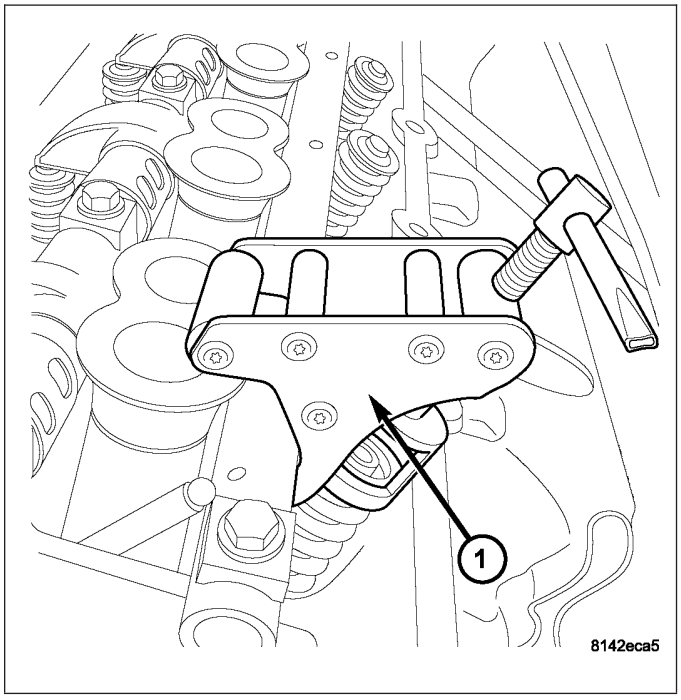
NOTE: Tap the top of the valve spring retainer to loosen the spring retainers locks.

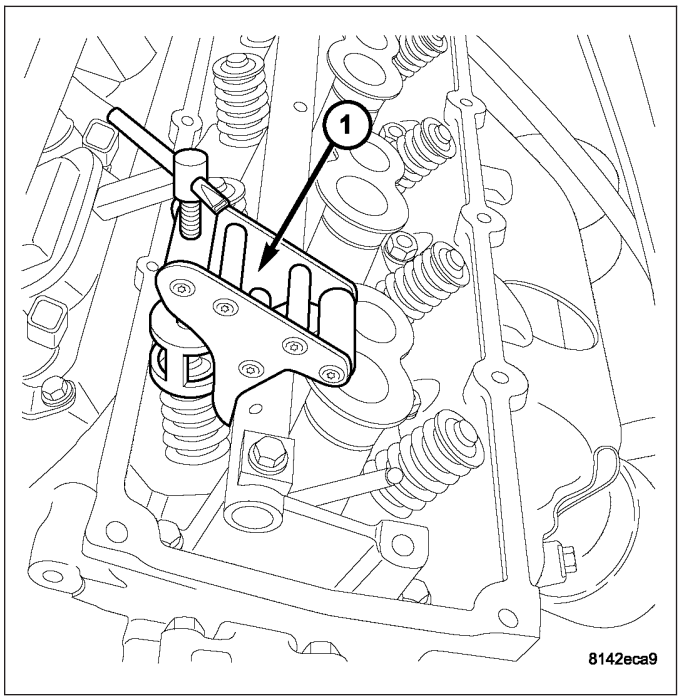
13. Compress valve spring with valve spring compessor (3) tool # 9065and remove valve retainer locks.
14. Release spring compressor (3) and remove valve spring.

NOTE: The valve springs are interchangeable between intake and exhaust.

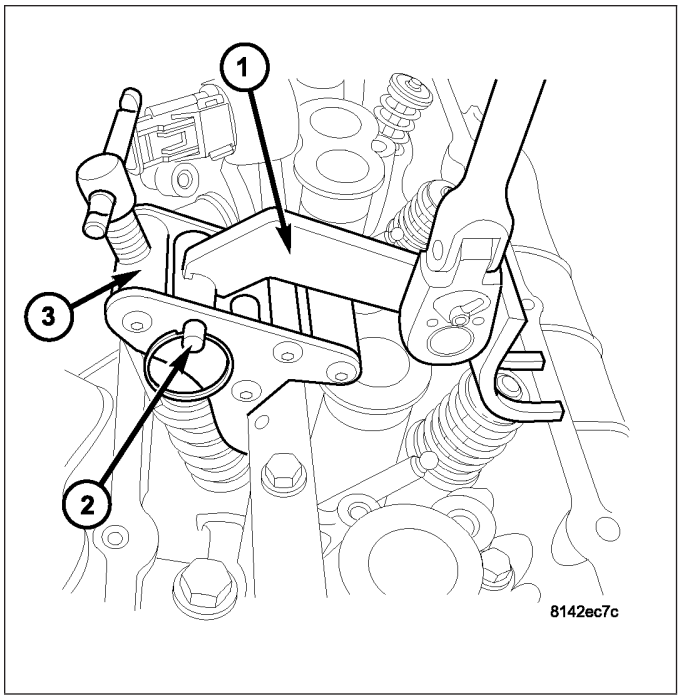
15. Remove valve seal.

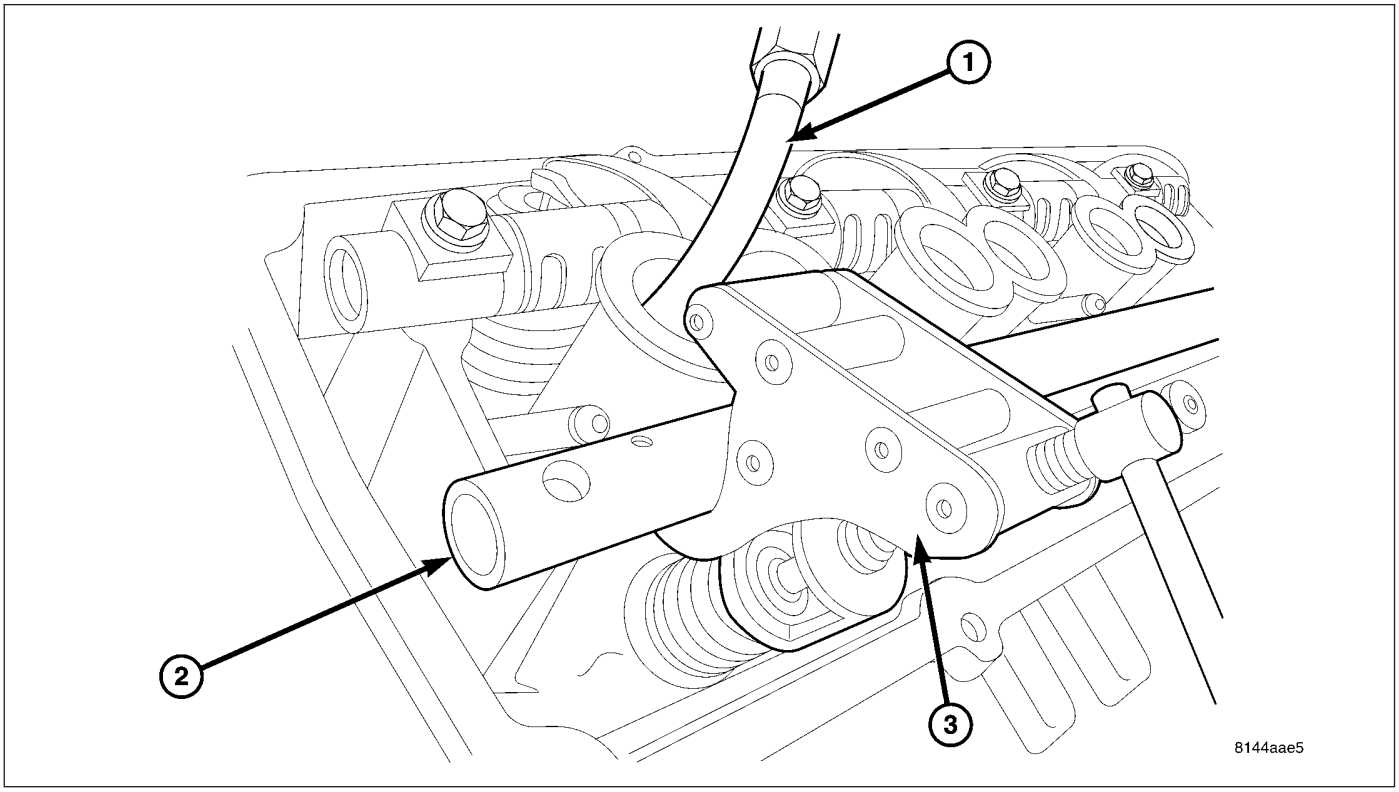
INSTALLATION





1. Install valve seal.
2. Install valve spring.
3. Using special tool# 9065 (1,3,), compress valve spring and install valve spring retainer and locks.

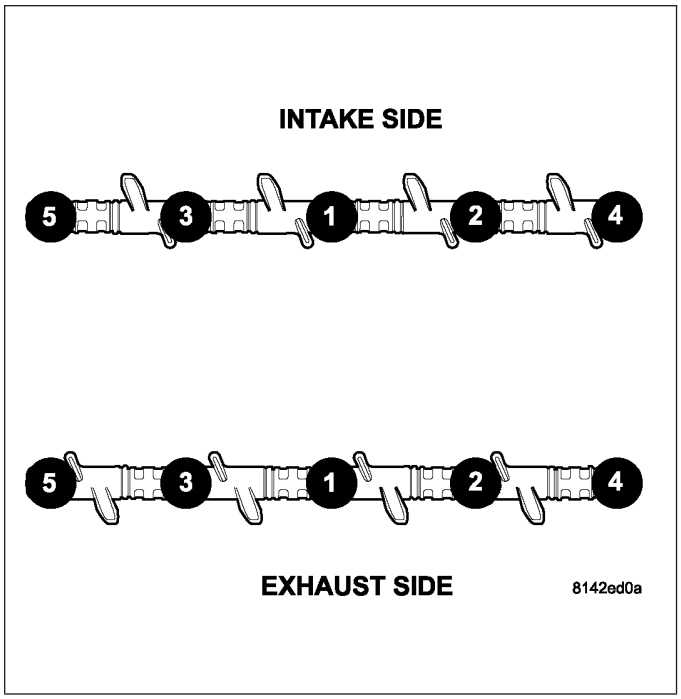




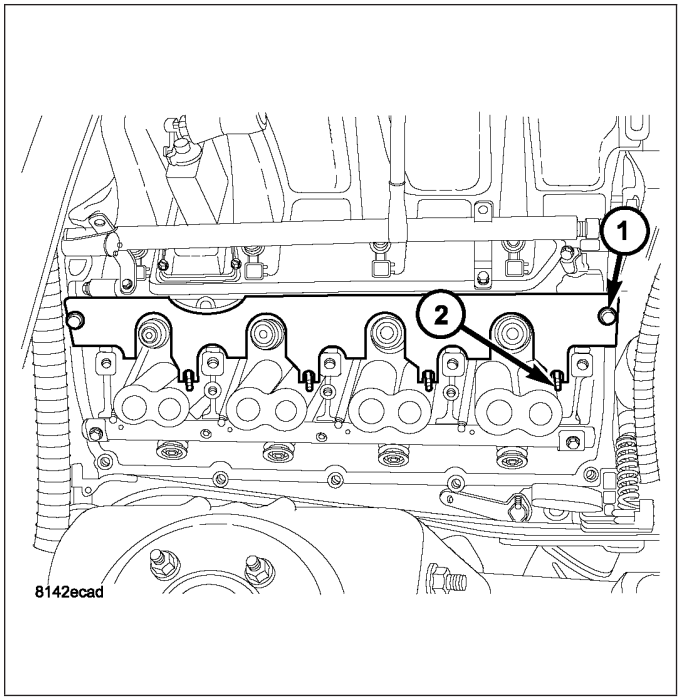
4. Release air charge in cylinder (1).
5. Remove spring compressor tool # 9065 (3).

CAUTION: Verify that the pushrods are fully seated into lifter and rocker arm. Recheck after rocker arm shaft has been torqued to specification.

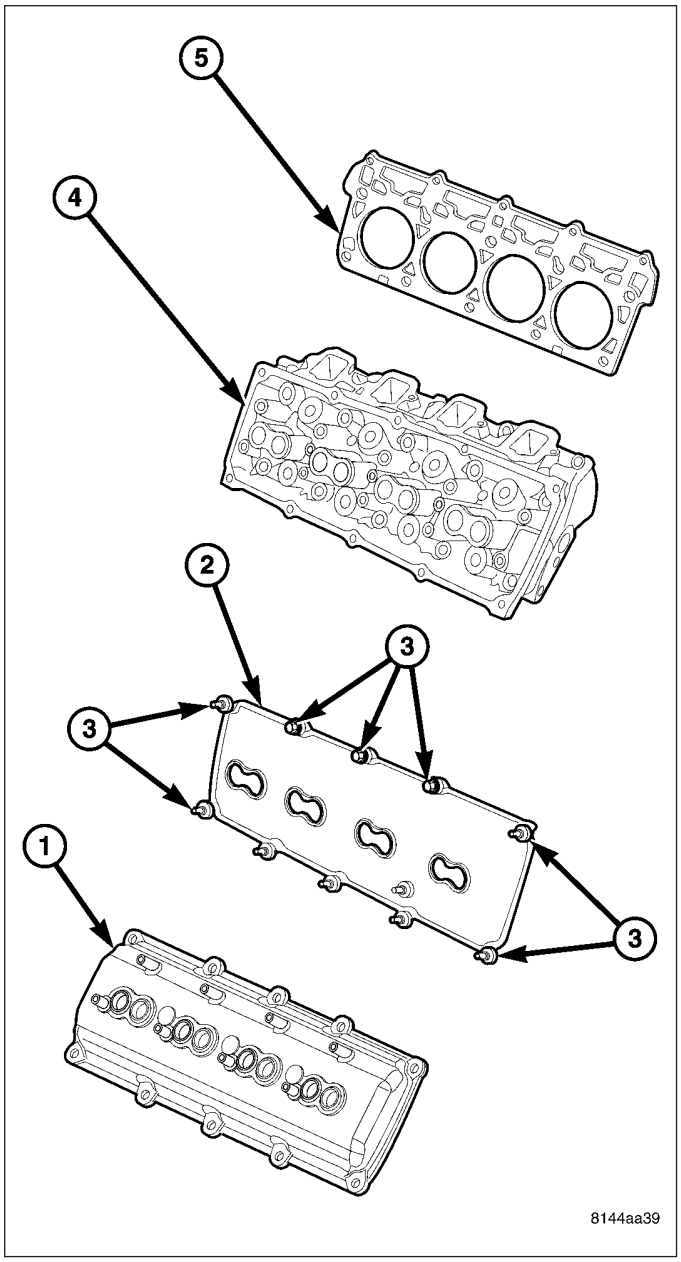
6. Install rocker arm shaft and pushrods (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).
7. Tighten the rocker shaft bolts to 22 N·m (195 in. lbs.) torque, using the rocker shaft torque sequence.



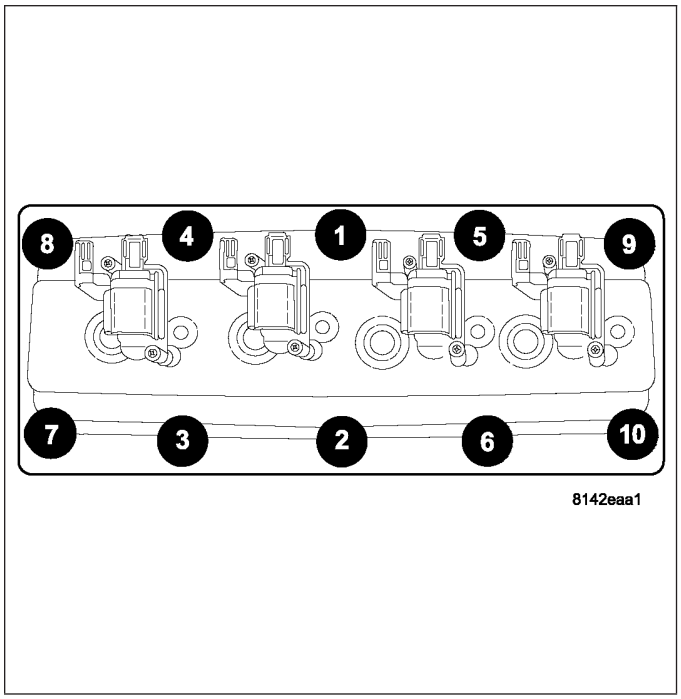
8. Remove special tool# 9070, pushrod retaining plate (1), if used.



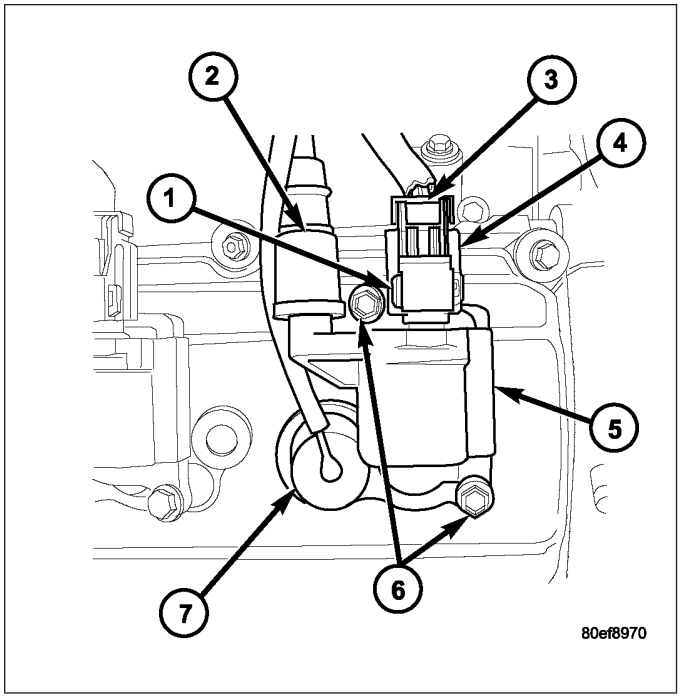
9. Install cylinder head cover (1).



10. Tighten cylinder head cover bolts and double ended studs (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION) .
11. Install spark plugs.



12. Install ignition coil on plug (5), and torque fasteners (6) to 12 N·m (105 in. lbs)
13. Install ignition coil connectors (4).
14. Install spark plug cables.
15. Install air intake resonator.
16. Install air cleaner assembly.
17. Connect negative battery cable.



ENGINE BLOCK

CLEANING

Thoroughly clean the oil pan and engine block gasket surfaces.

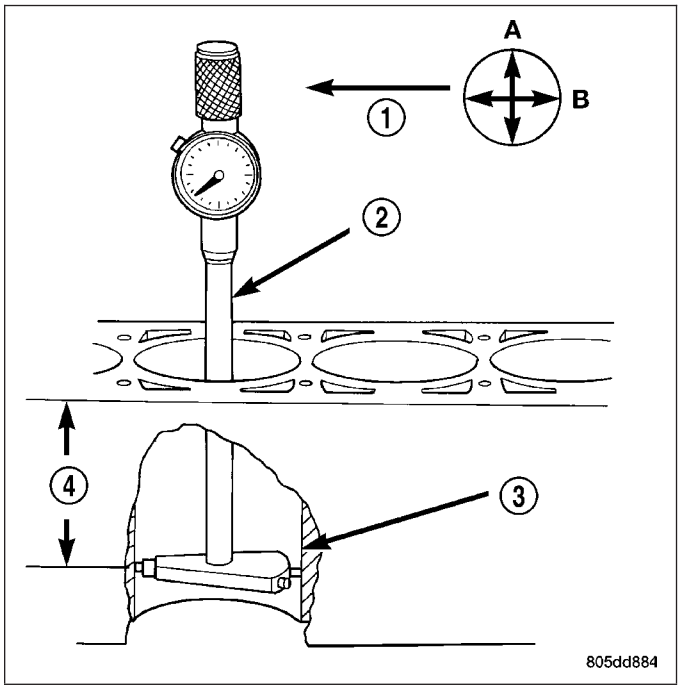
Use compressed air to clean out:

- The galley at the oil filter adaptor hole.
- The front and rear oil galley holes.
- The feed holes for the crankshaft main bearings.

Once the block has been completely cleaned, apply Loctite PST pipe sealant with Teflon 592 to the threads of the front and rear oil galley plugs. Tighten the 1/4 inch NPT plugs to 20 N·m (177 in. lbs.) torque. Tighten the 3/8 inch NPT plugs to 27 N·m (240 in. lbs.) torque.

INSPECTION

1. It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.
3. Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.
4. Determine taper by subtracting the smaller diameter from the larger diameter.
5. Rotate measuring device 90° and repeat steps above.
6. Determine out-of-roundness by comparing the difference between each measurement.



7. If cylinder bore taper does not exceed 0.025 mm (0.001 inch) and out-of-roundness does not exceed 0.025 mm (0.001 inch), the cylinder bore can be honed. If the cylinder bore taper or out- of-round condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

CAMSHAFT

REMOVAL

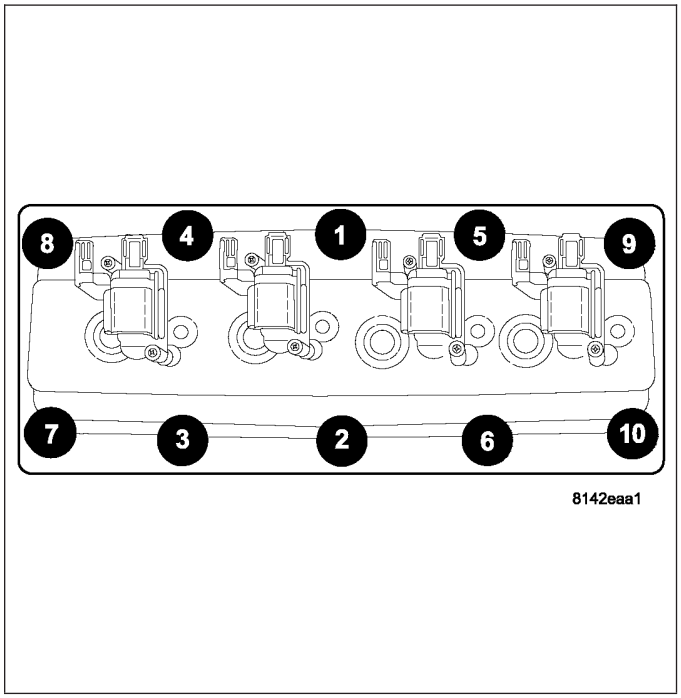
REMOVAL - CAMSHAFT CORE HOLE PLUG

CAUTION: Do not damage the rear surface of the camshaft or the core plug sealing surface, when removing the core plug.

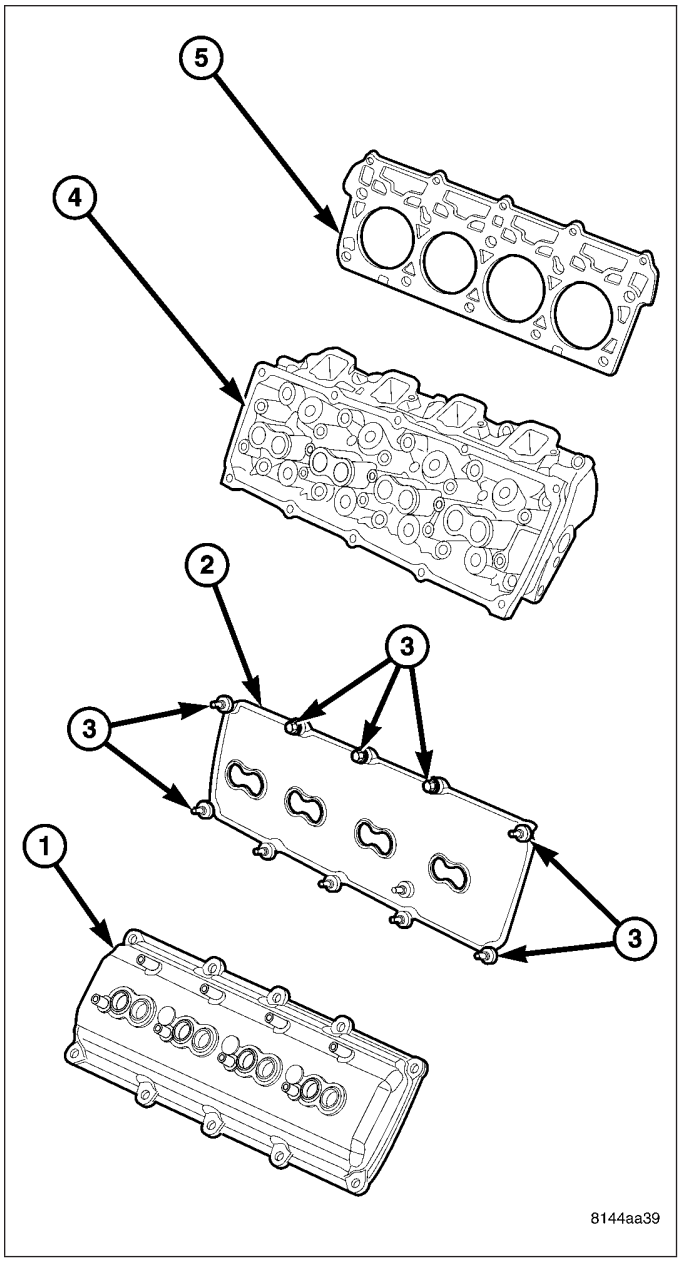
1. Remove the rear cam bearing core plug.

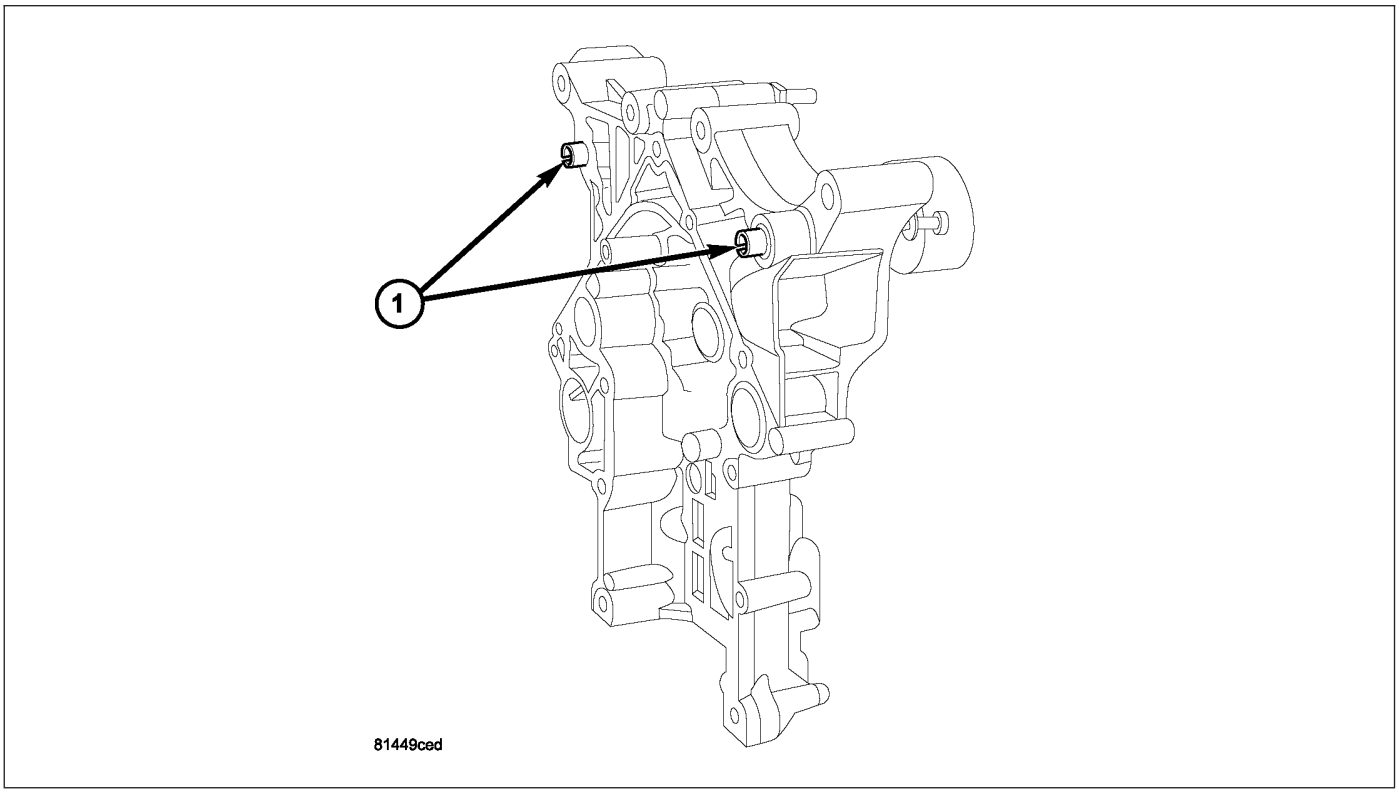
REMOVAL - CAMSHAFT

1. Remove the battery negative cable.
2. Remove the air cleaner assembly. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - REMOVAL)
3. Drain coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
4. Remove the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL)
5. Remove the generator.
6. Remove the A/C compressor, and set aside.
7. Remove the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
8. Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
9. Remove cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



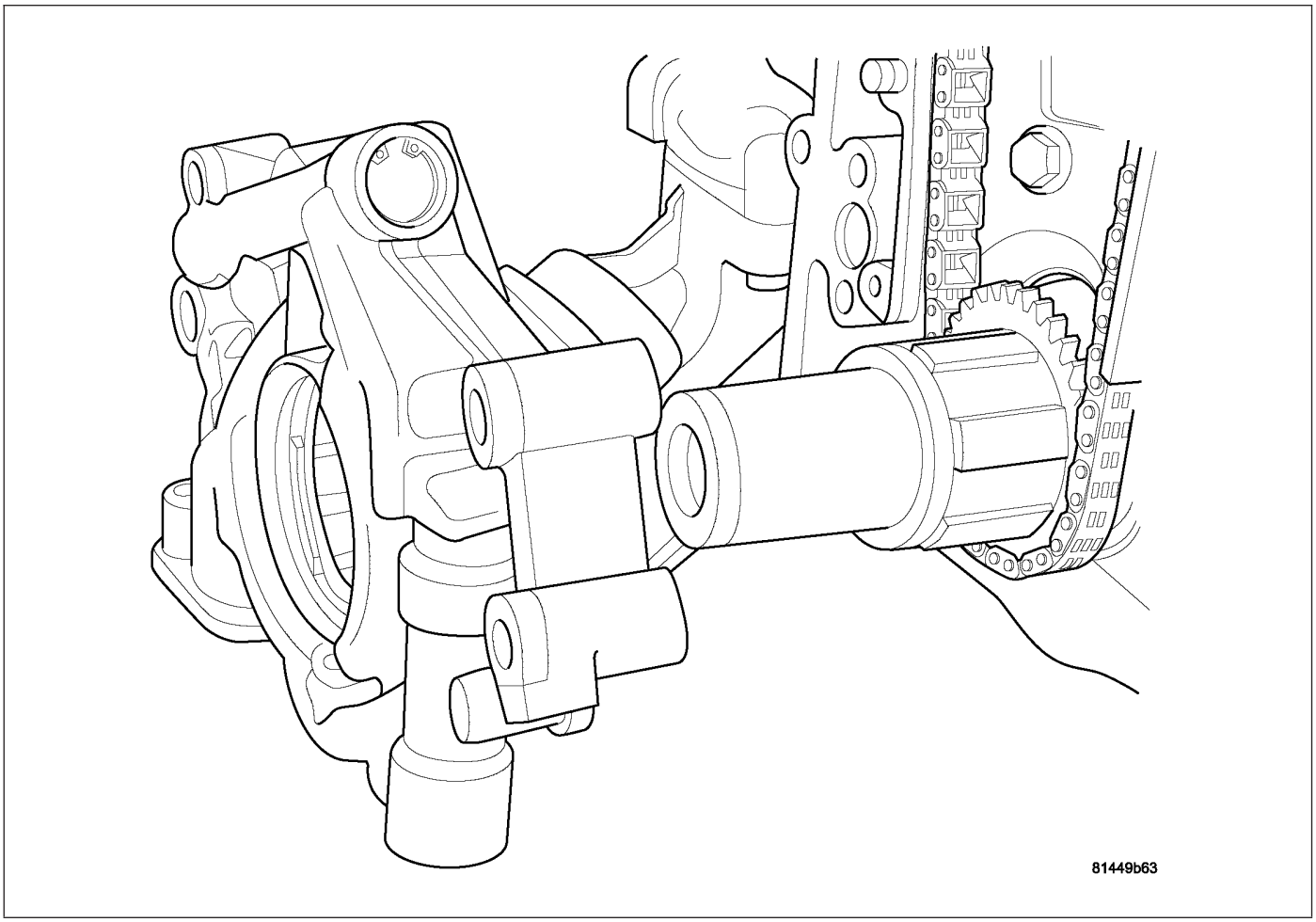
10. Remove both left and right cylinder heads (4) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
11. Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).





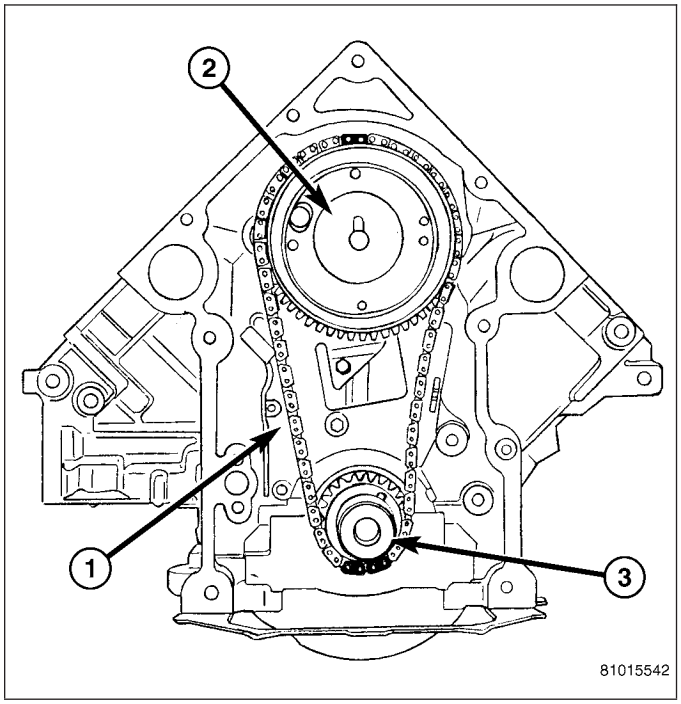
12. Remove timing case cover (1) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

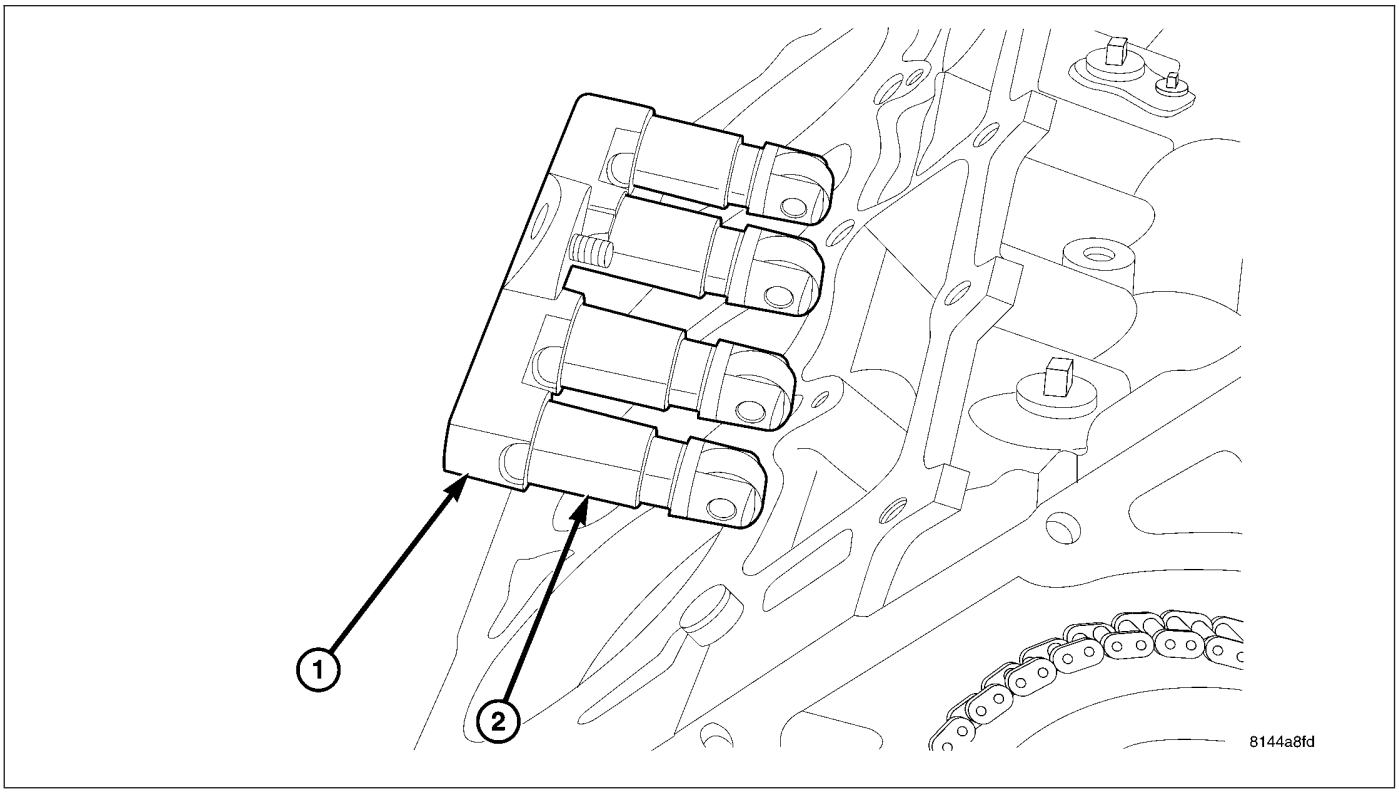
13. Remove the oil pick up tube.



14. Remove the oil pump (figure 2) (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

15. Remove timing chain (2) (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
16. Remove camshaft tensioner/thrust plate assembly.

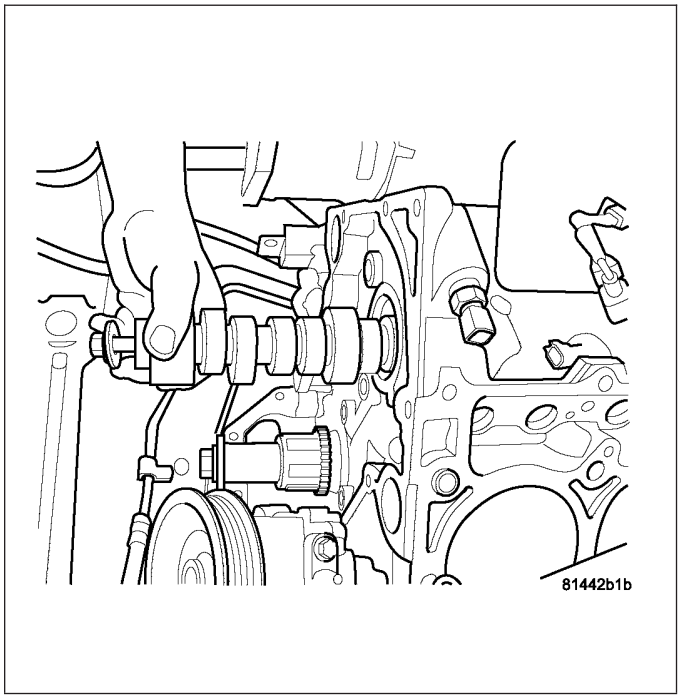




NOTE: Identify lifters to ensure installation in original location.

17. Remove the tappets (2) and retainer (1) assembly.

18. Install a long bolt into front of camshaft to aid in removal of the camshaft. Remove camshaft, being careful not to damage cam bearings with the cam lobes (figure 5).



INSPECTION

1. The cam bearings are not serviceable. Do not attempt to replace cam bearings for any reason.

INSTALLATION

INSTALLATION - CAMSHAFT CORE HOLE PLUG

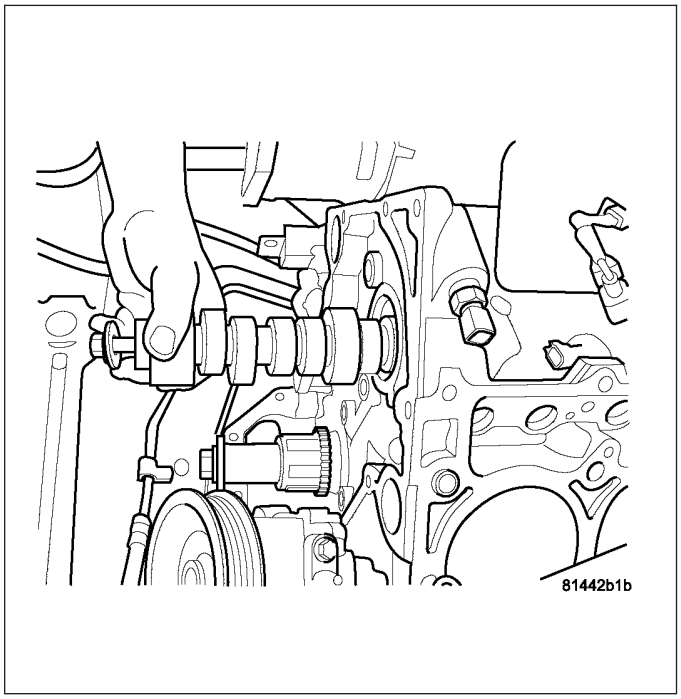
1. Clean core hole in block.

NOTE: Do not apply adhesive to the new core hole plug. A new plug will have adhesive pre-applied.

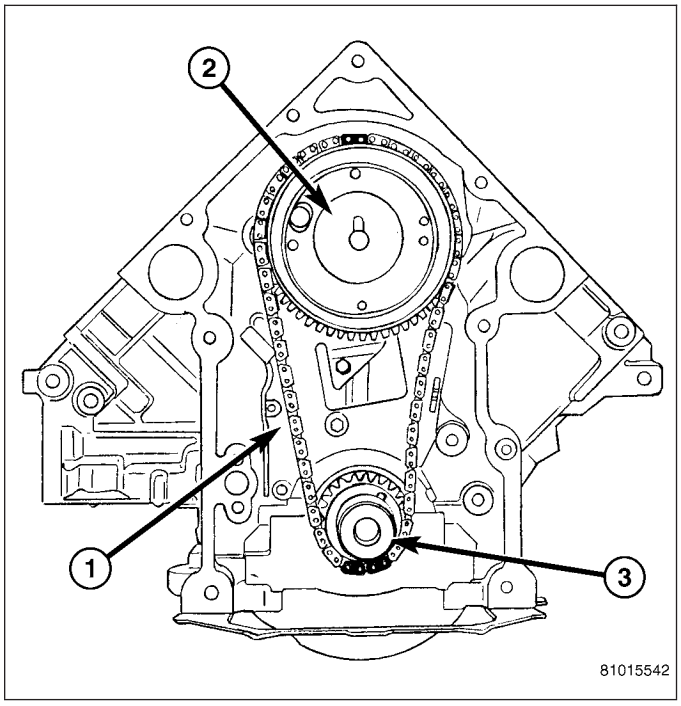
2. Install a new core hole plug at the rear of camshaft, using suitable flat faced tool. The plug must be fully seated on the cylinder block shoulder.

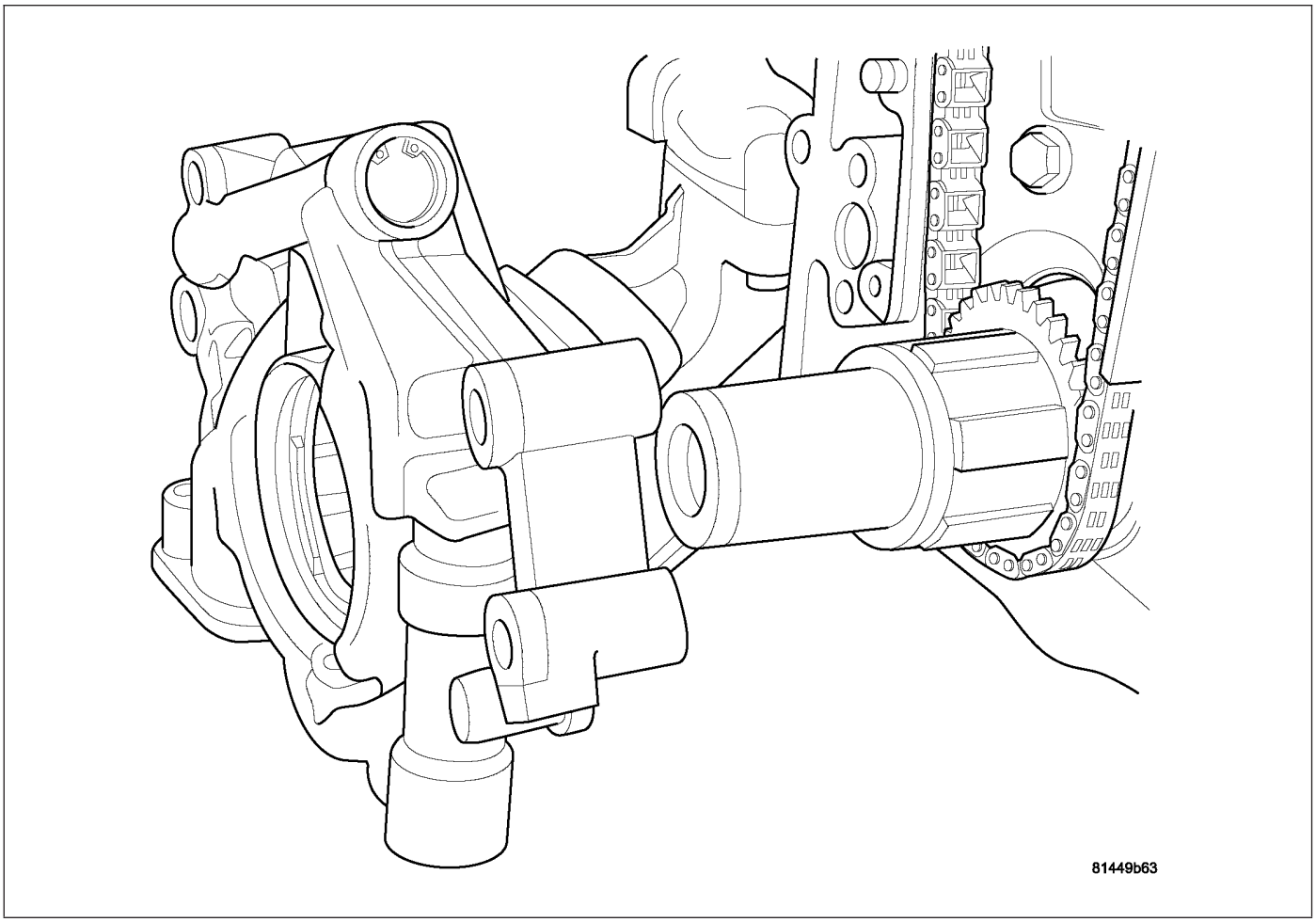
INSTALLATION - CAMSHAFT

1. Lubricate camshaft lobes and camshaft bearing journals and insert the camshaft (figure1).

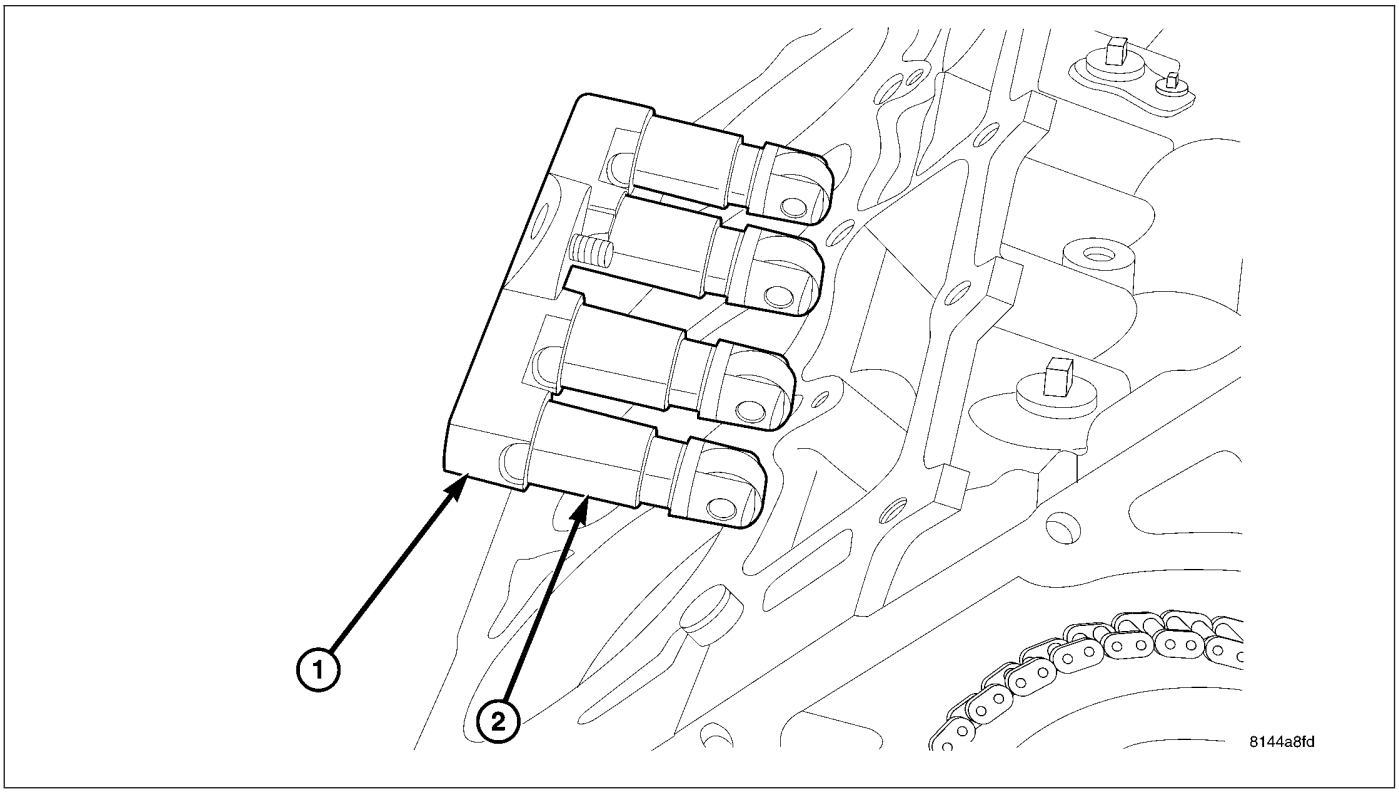


2. Install camshaft Tensioner plate assembly. Tighten bolts to 28 N·m (250 in. lbs.) torque.
3. Install timing chain and sprockets (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
4. Measure camshaft end play (Refer to 9 - ENGINE - SPECIFICATIONS). If not within limits install a new thrust plate.



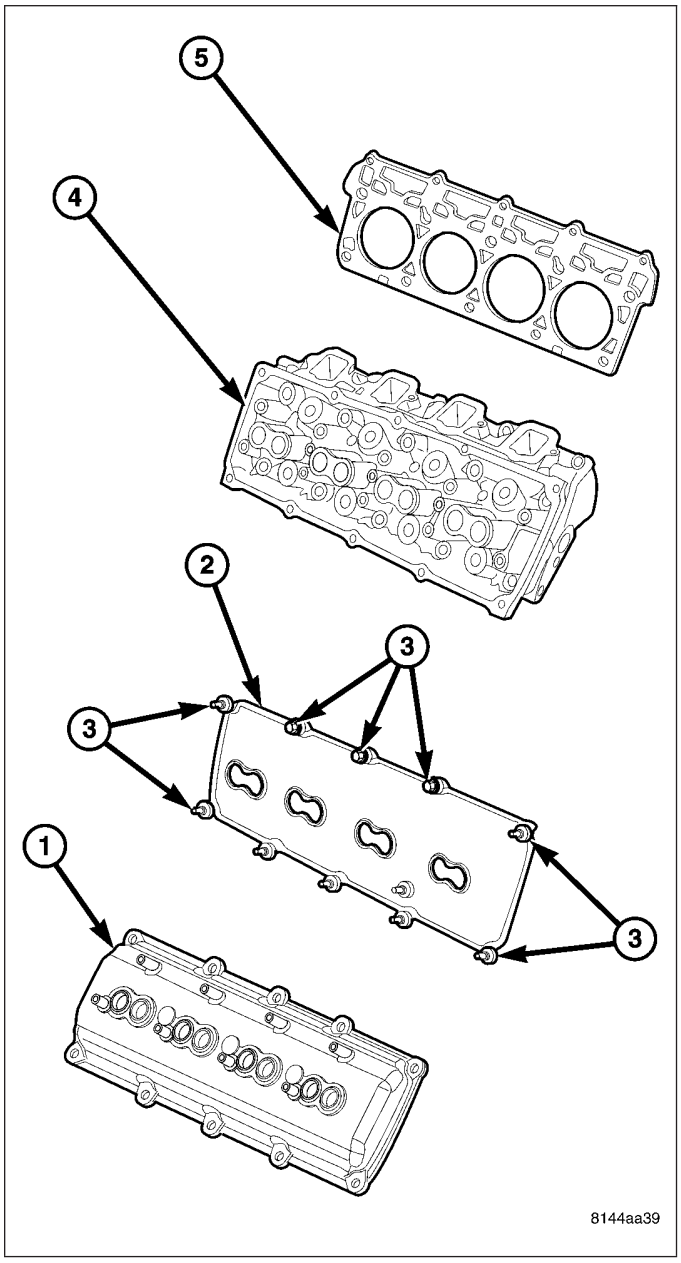


5. Install the oil pump (figure2) (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
6. Install the oil pick up tube.

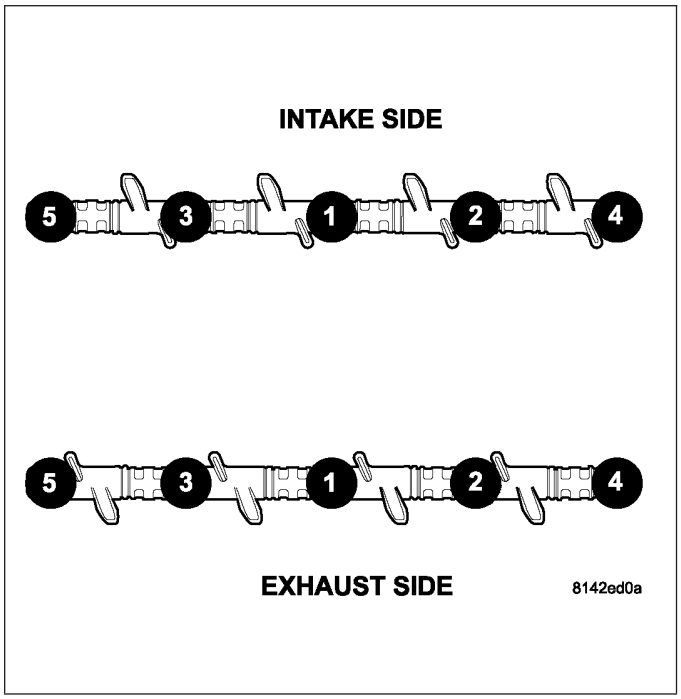


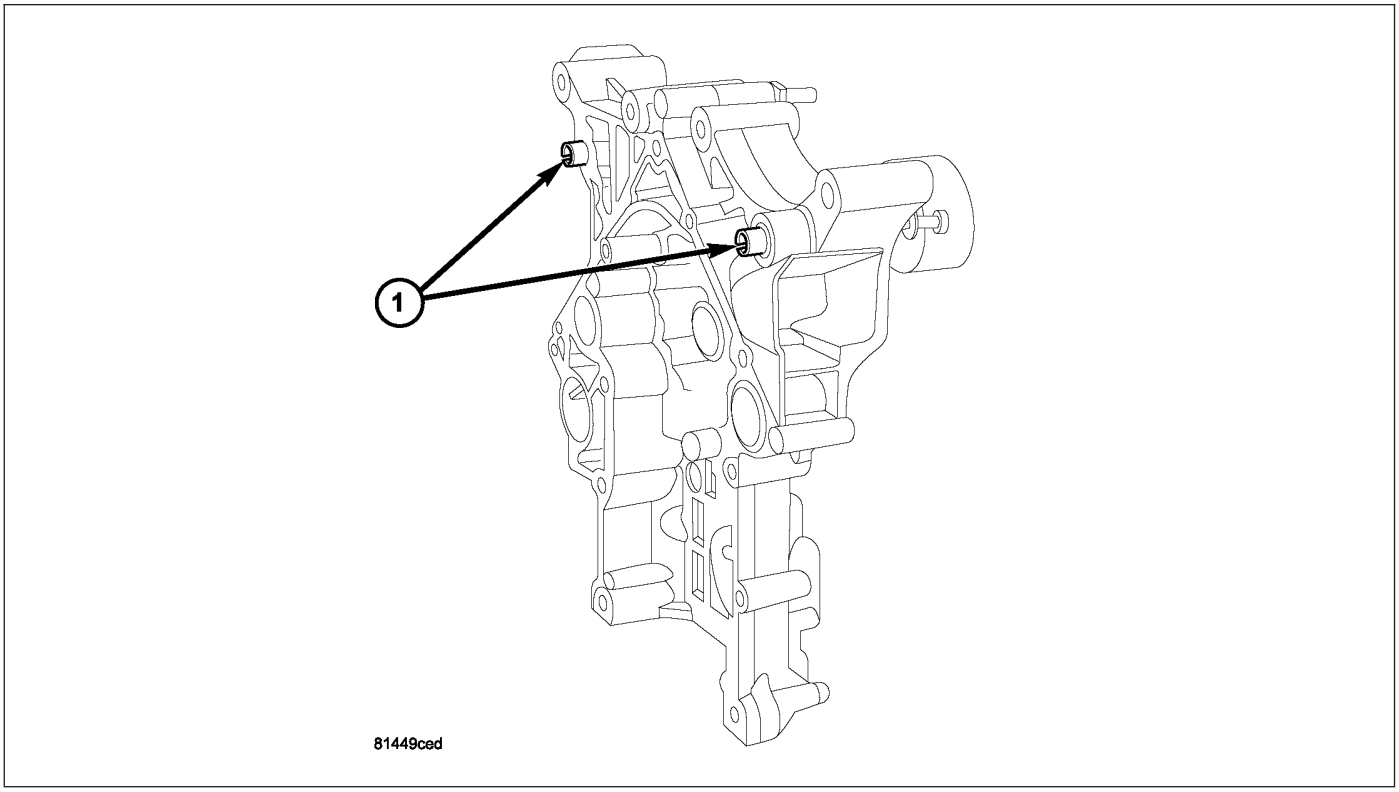
7. Each tappet reused must be installed in the same position from which it was removed. **When camshaft is replaced, all of the tappets must be replaced.**
8. Install tappets (2) and retaining yoke assembly (1). (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC LIFTERS (CAM IN BLOCK) - INSTALLATION).

9. Install both left and right cylinder heads (4) (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
10. Install pushrods.



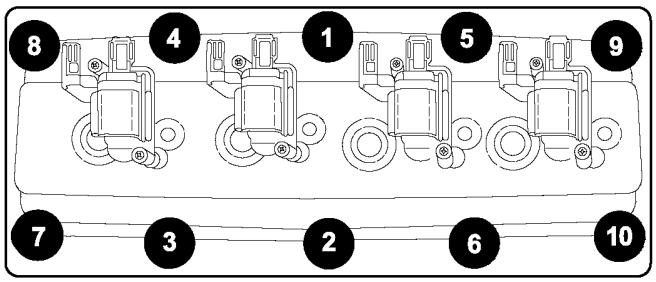
11. Install rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).





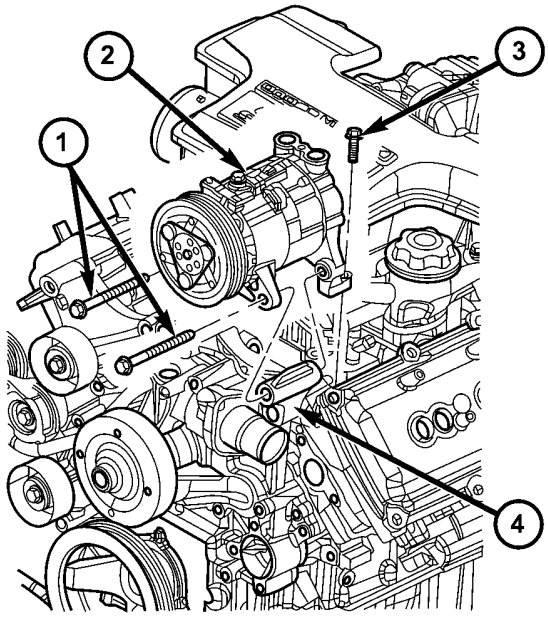
12. Install timing case cover (figure4) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
13. Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

14. Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



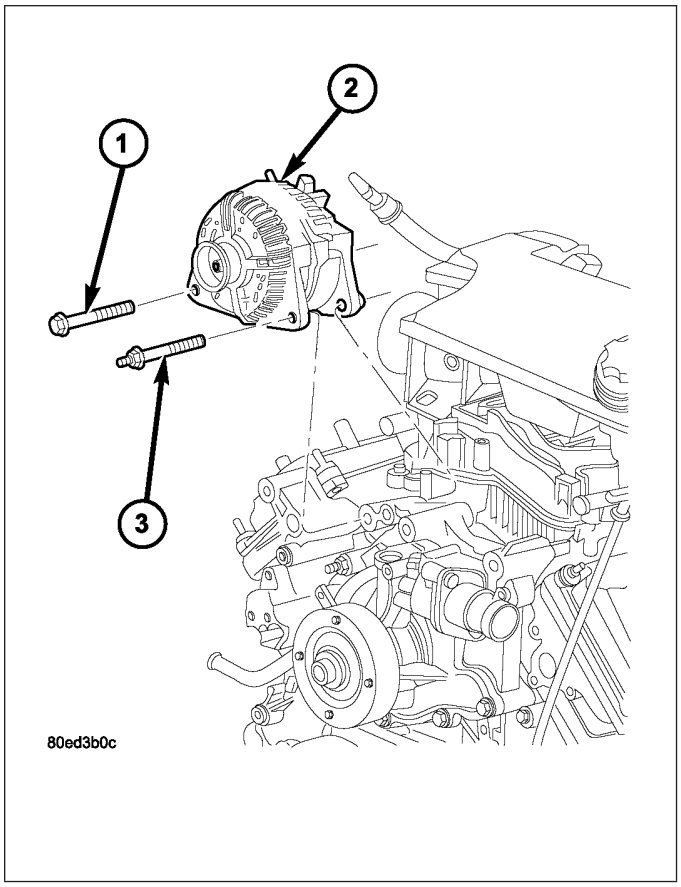
8142eaa1

15. Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
16. Install the A/C compressor (2).

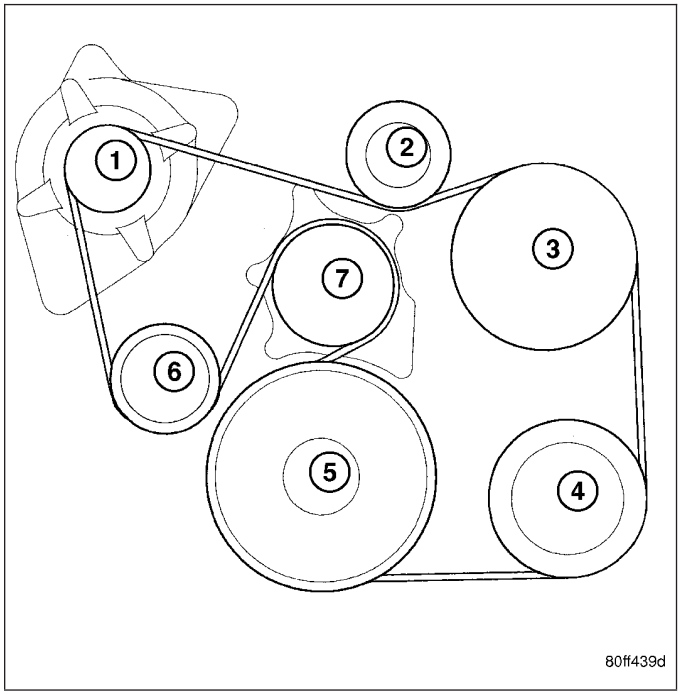


8118c508

17. Install the generator (2).



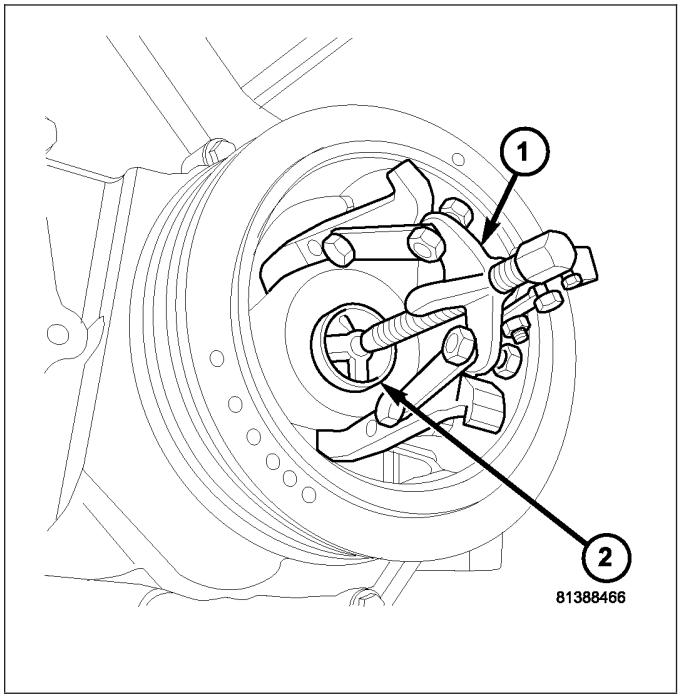
18. Install the accessory drive belt. (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
19. Install the radiator (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).
20. Install the air cleaner assembly. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - INSTALLATION)
21. Install the battery negative cable.
22. Refill coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE)
23. Refill engine oil.
24. Start engine and check for leaks.



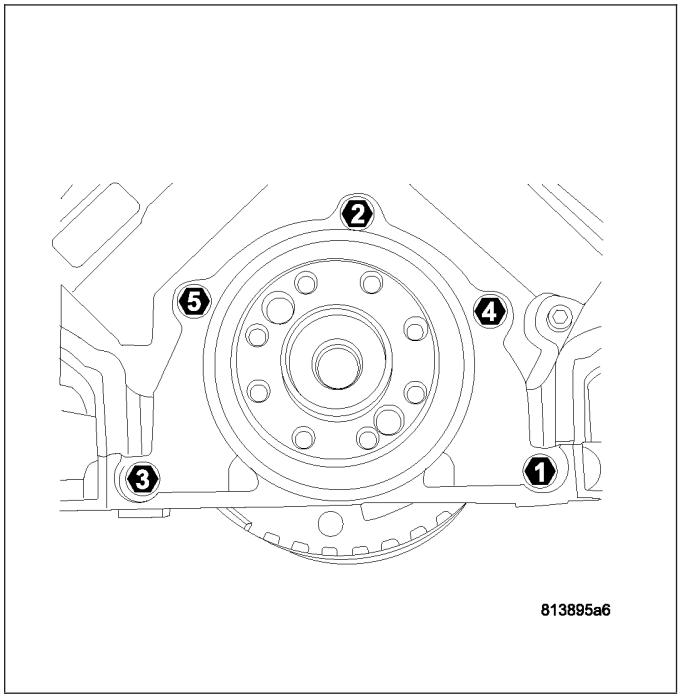
CRANKSHAFT

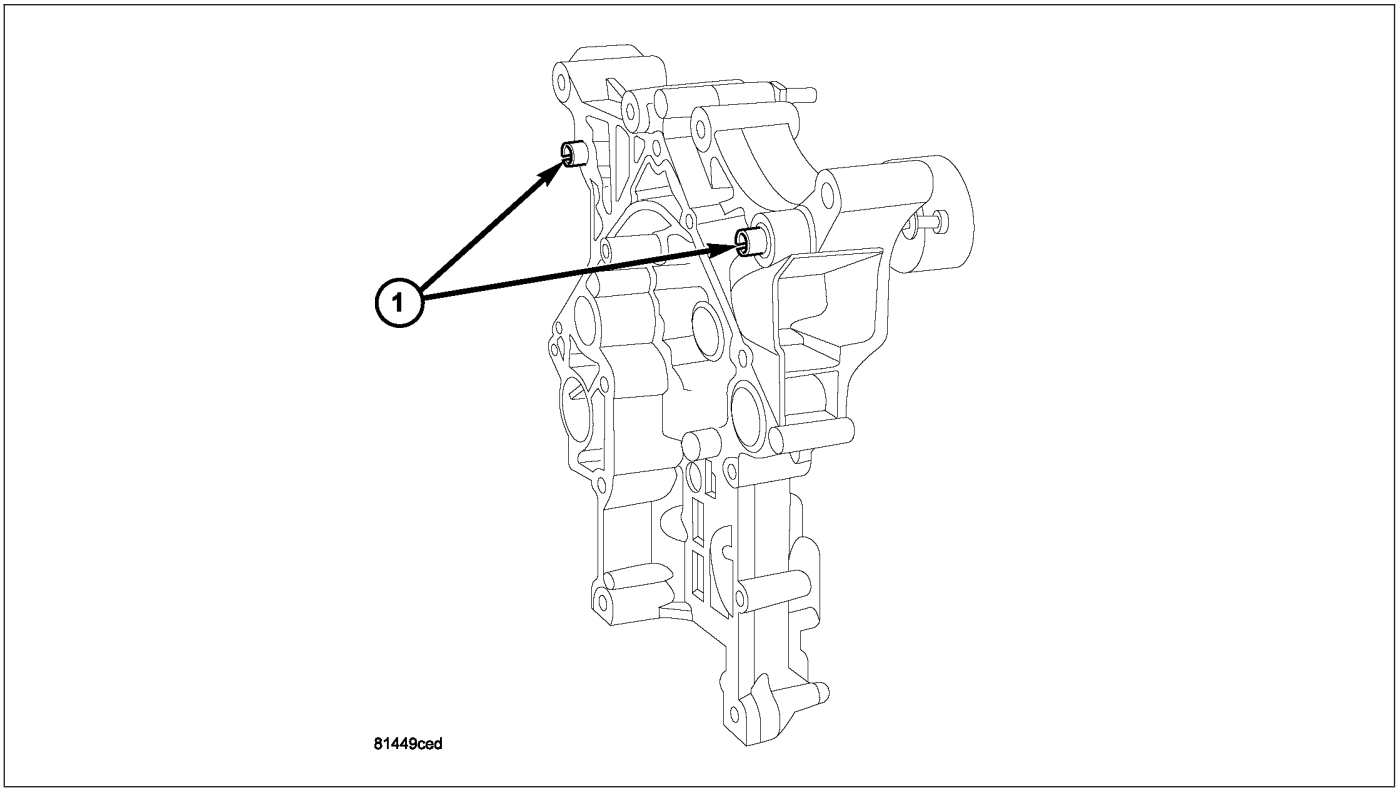
REMOVAL

1. Remove the vibration damper (1) (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

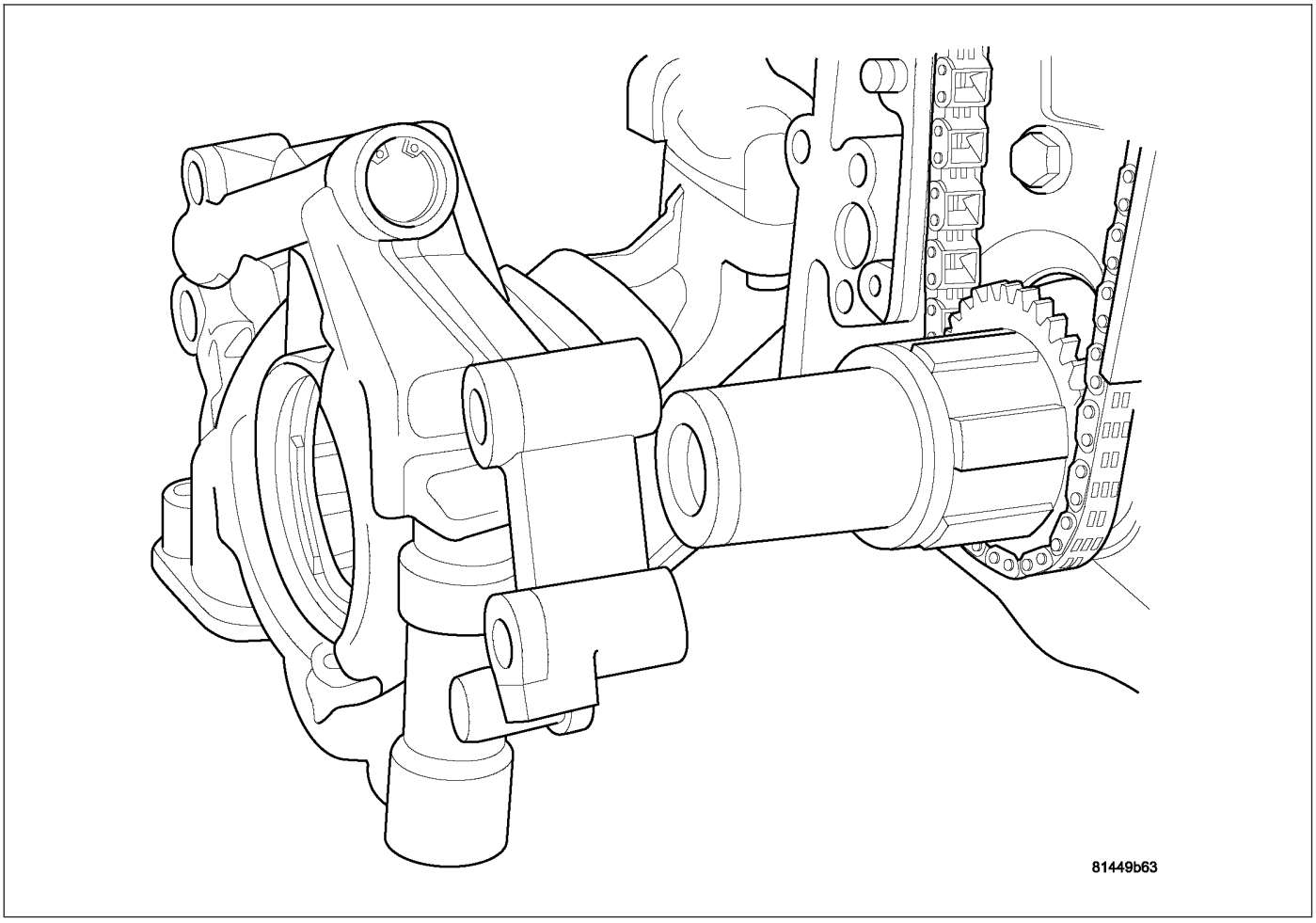


2. Remove the rear oil seal retainer (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINE - REMOVAL).
3. Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove the oil pump pickup.
5. Remove the windage tray/oil pan gasket.



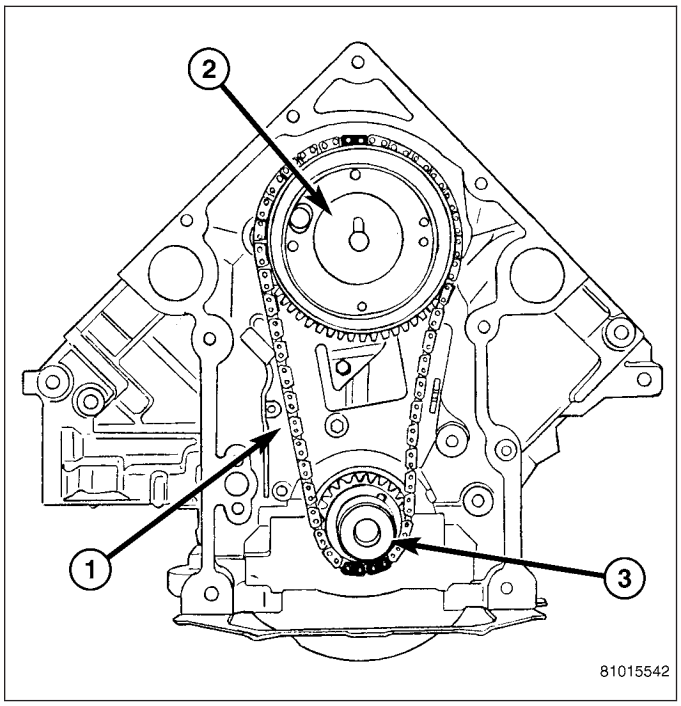


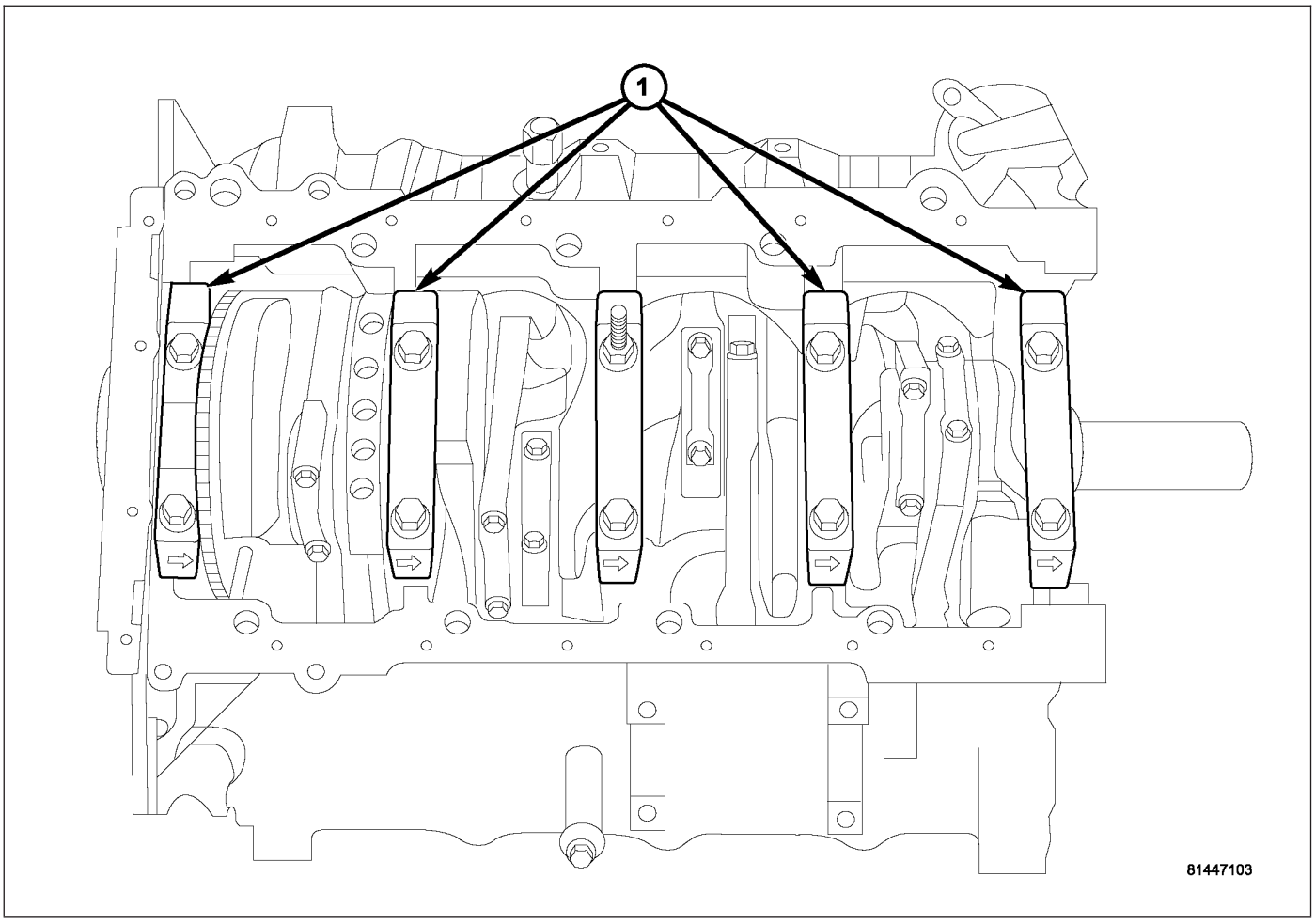
6. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).



7. Remove the oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

8. Remove the timing drive (2) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

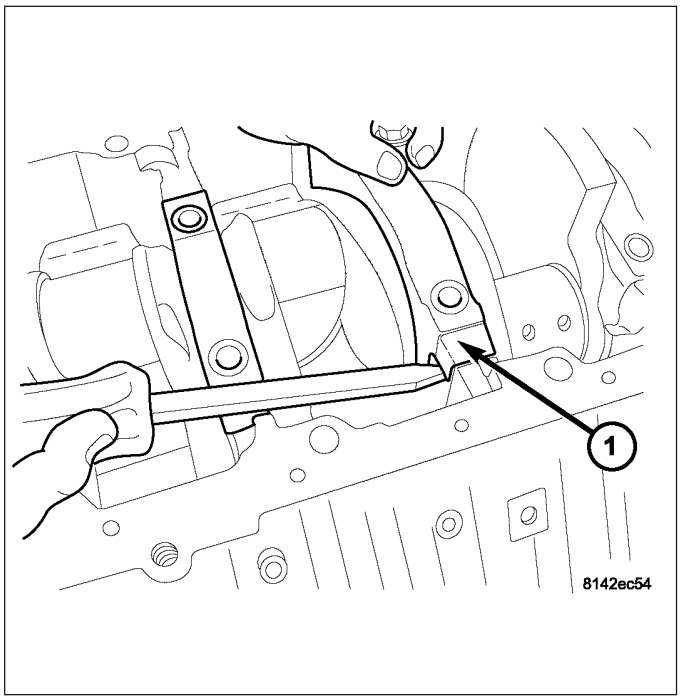


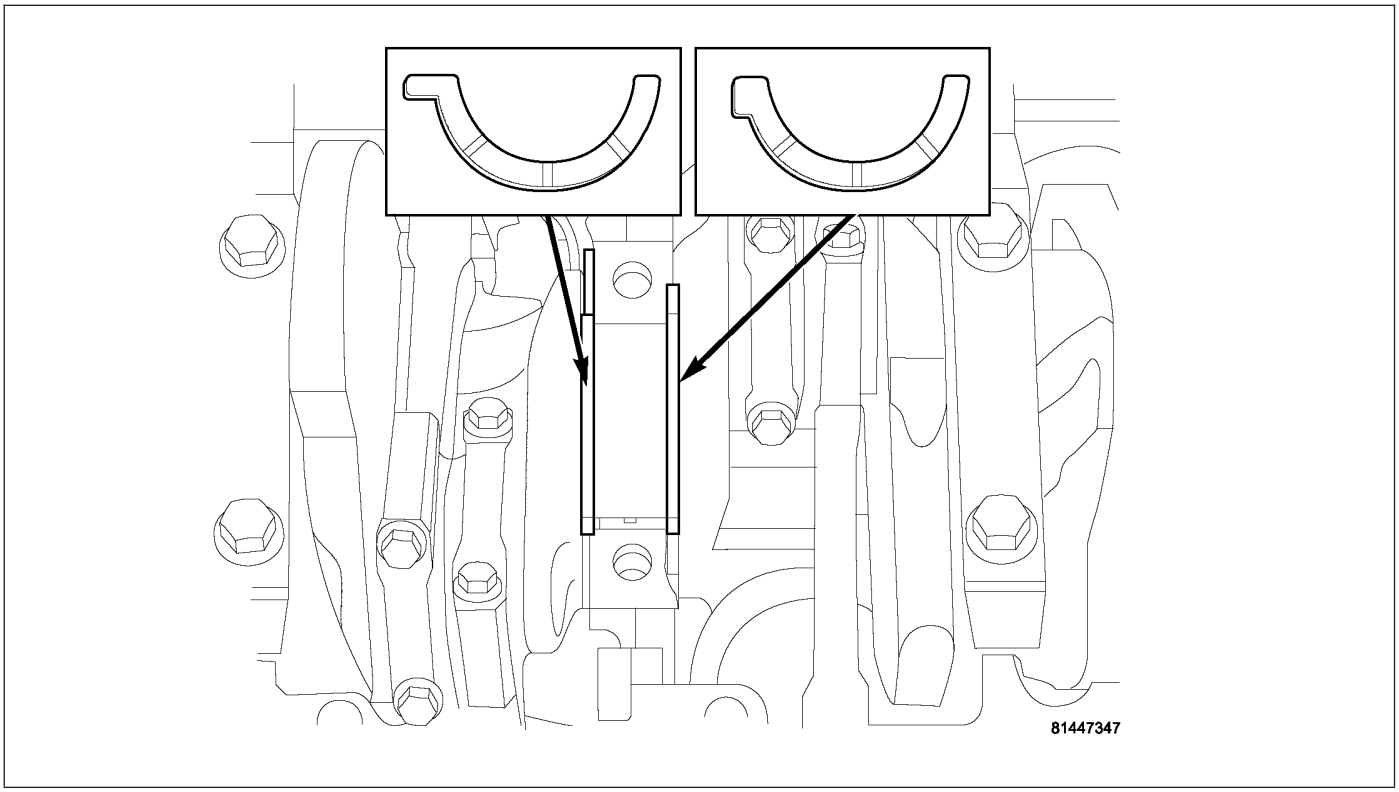


9. Identify rod bearing caps before removal. Remove rod bearing caps with bearings.

10. Identify main bearing caps (1) before removal.

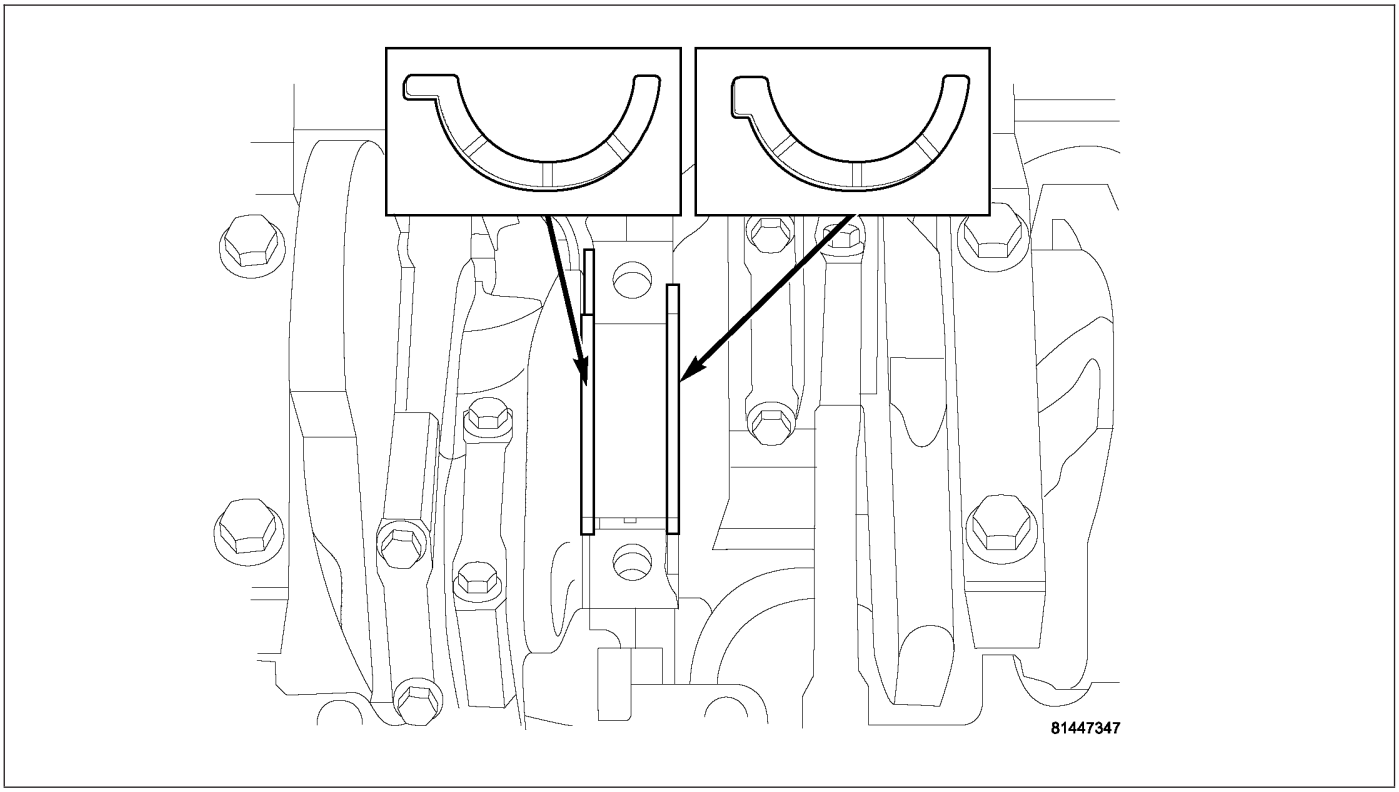
11. Remove main bearing caps (1) and bearings one at a time.



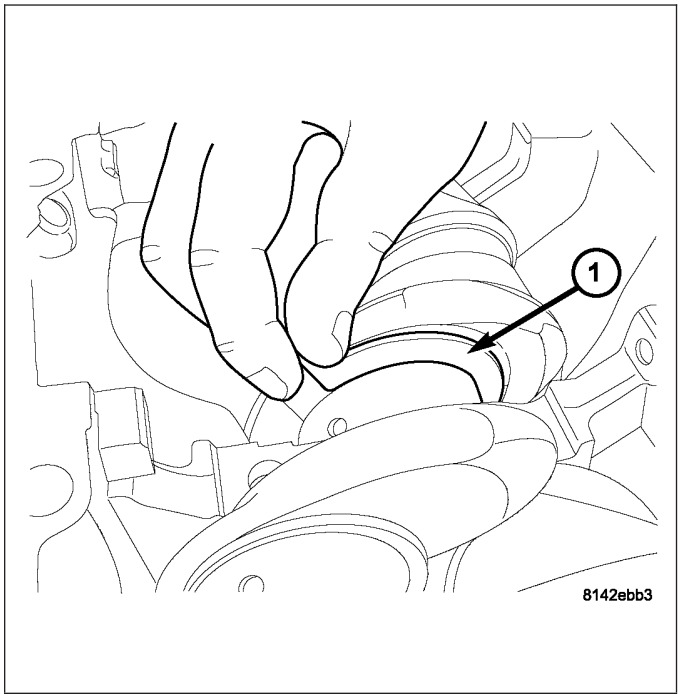


12. Remove the thrust washers.
13. Remove the crankshaft out of the block.

INSTALLATION

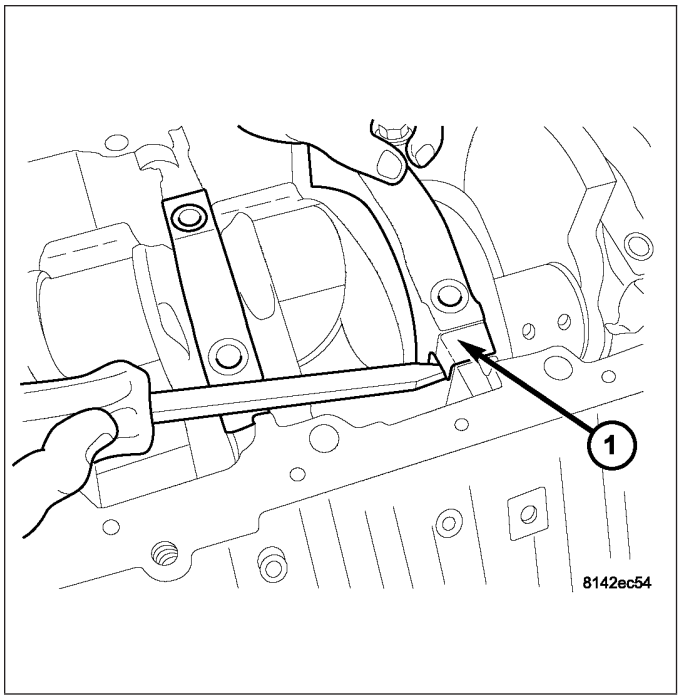


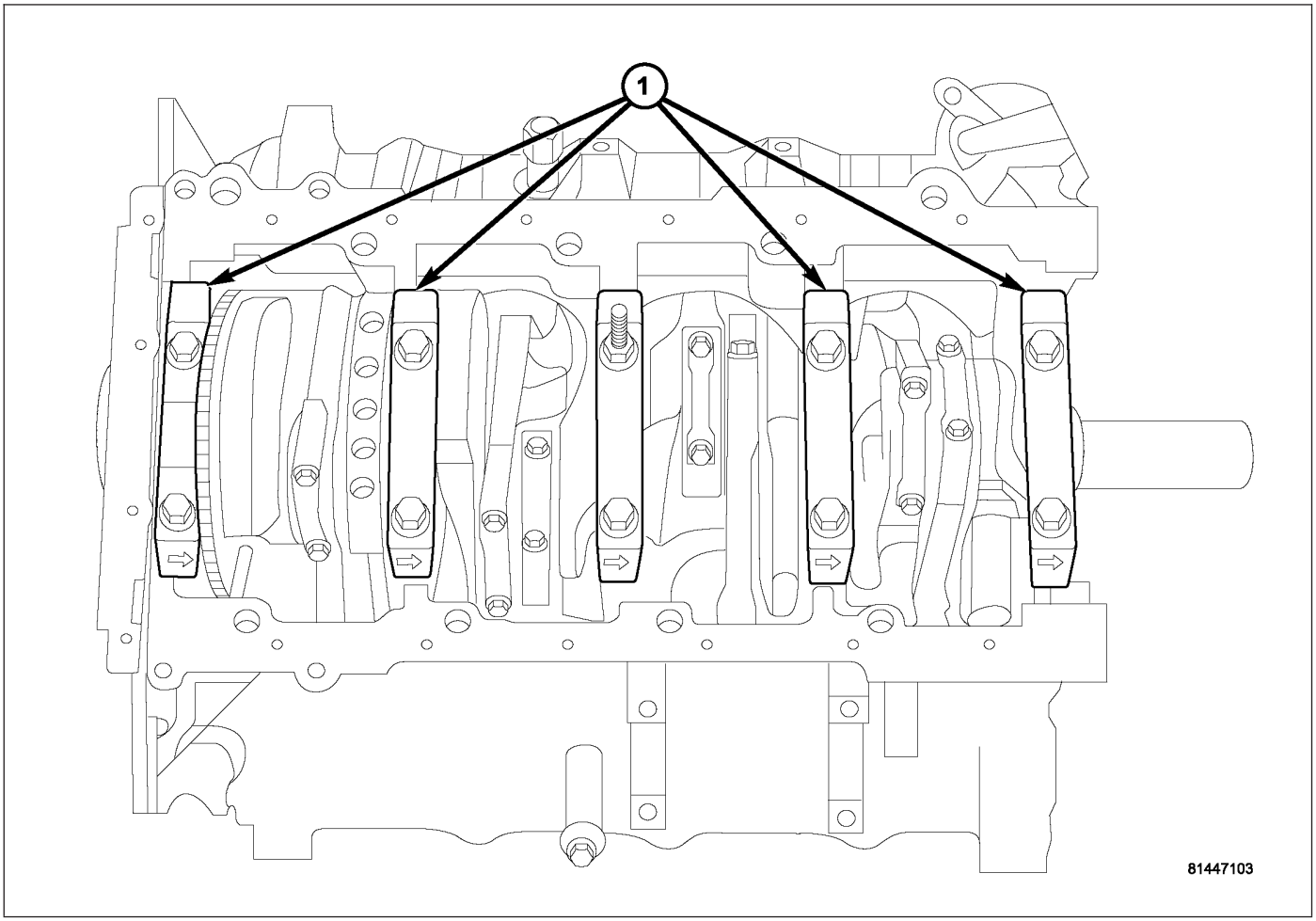
1. Select the proper main bearings (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE).
2. Install main bearings in block and caps, and lubricate bearings.
3. Position the crankshaft into the cylinder block.
4. Install the thrust washers (1).



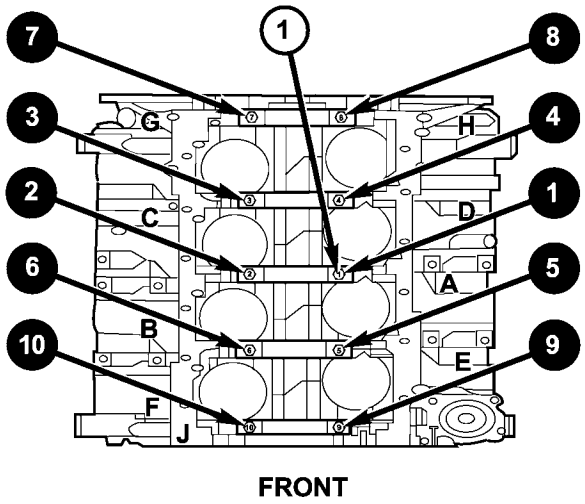
NOTE: The main cap crossbolts are torqued after final torque of the main cap bolts. Always use a new washer/seal on crossbolts.

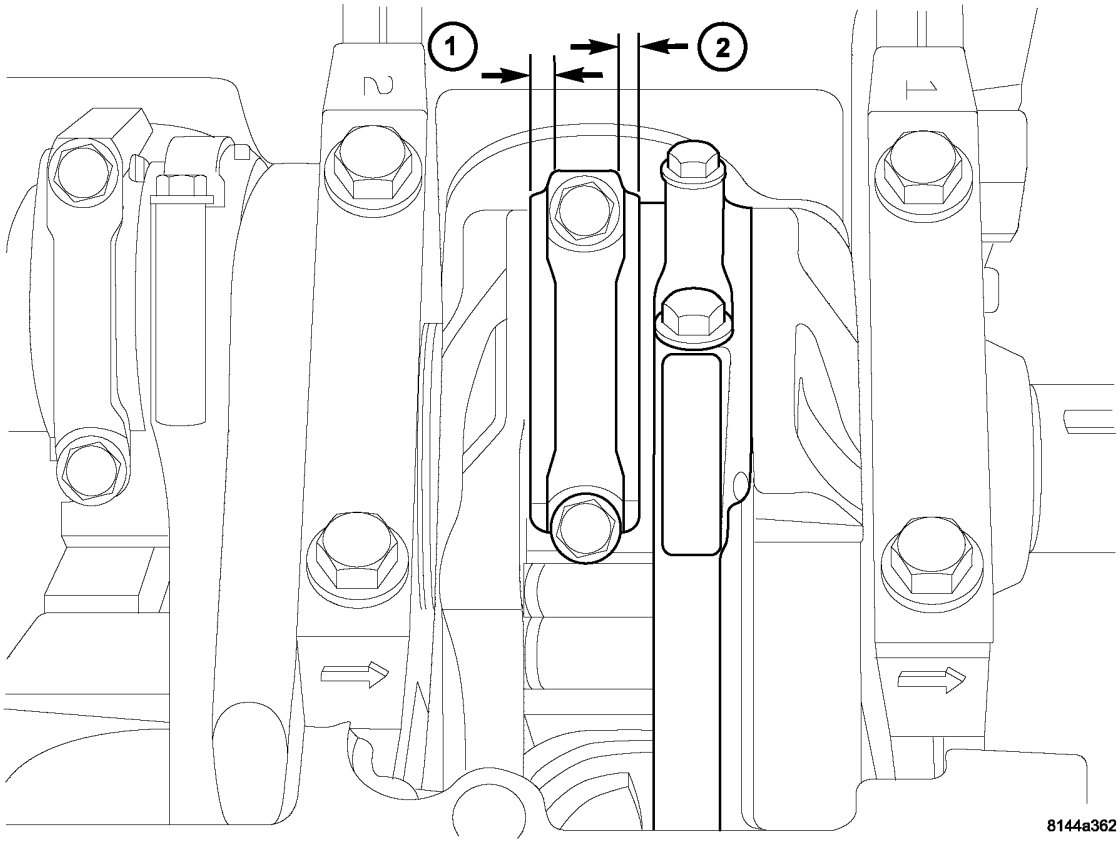
5. Clean and oil all cap bolts. Install all main bearing caps (1). Install all cap bolts and alternately tighten in two steps using the following sequence.





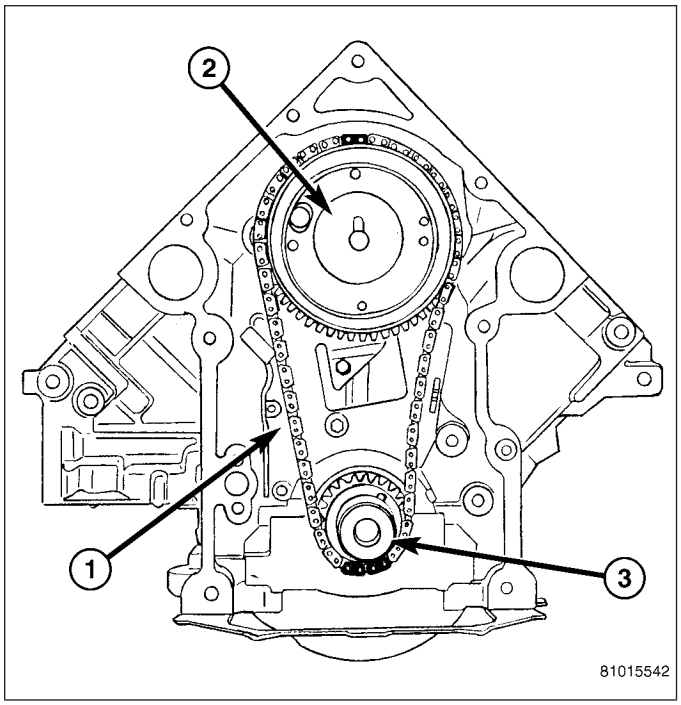
6. • Step 1 – 27 N·m (20ft. lbs.) torque.
7. • Step 2 – Turn main cap bolts an additional 90°.
8. Install the crossbolts with new washer/gasket. Starting with crossbolt A torque each crossbolt to 28 N·m (21ft. lbs.)torque.
9. Repeat crossbolt torque procedure.
10. Measure crankshaft end play (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT MAIN BEARINGS - STANDARD PROCEDURE).

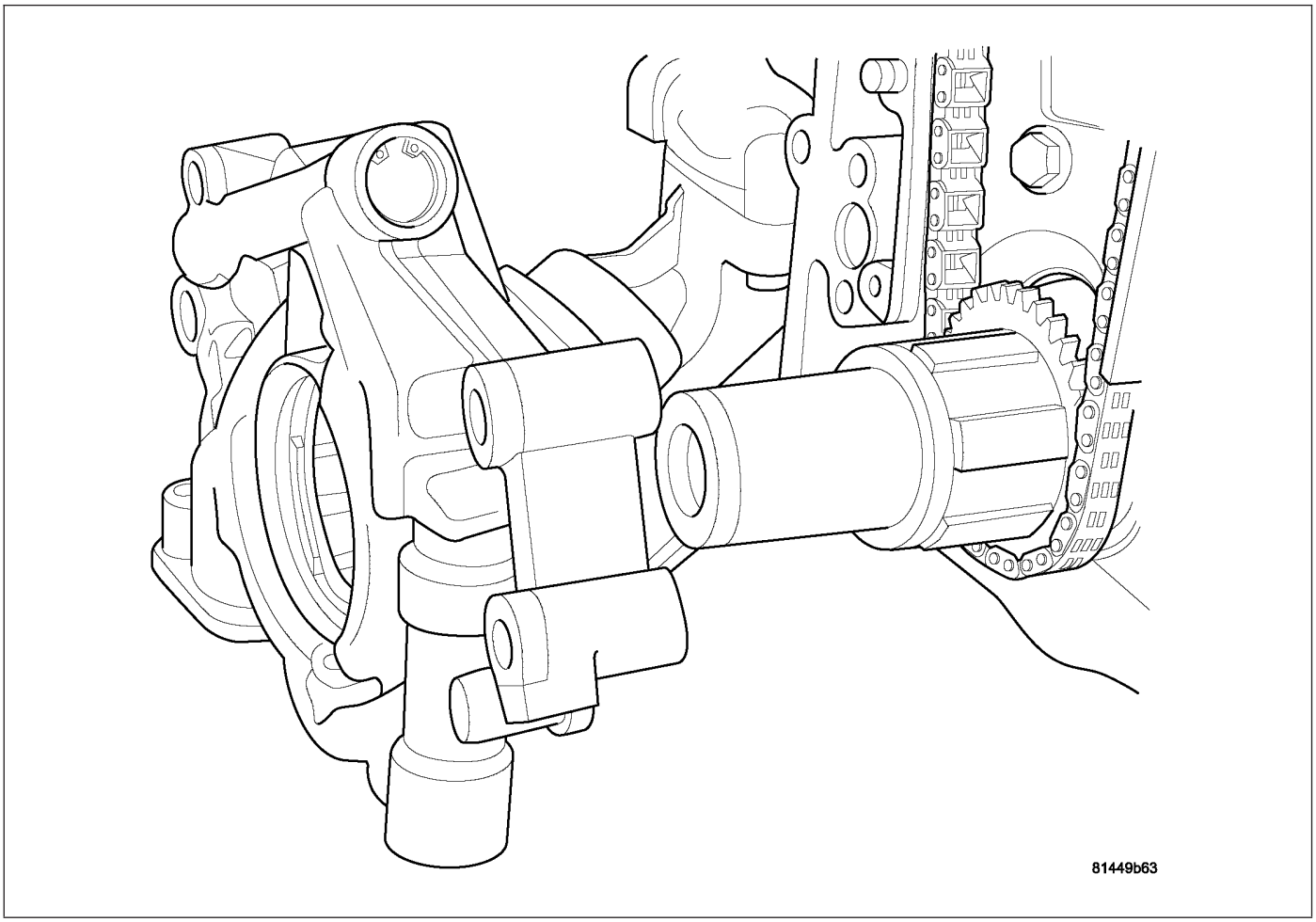




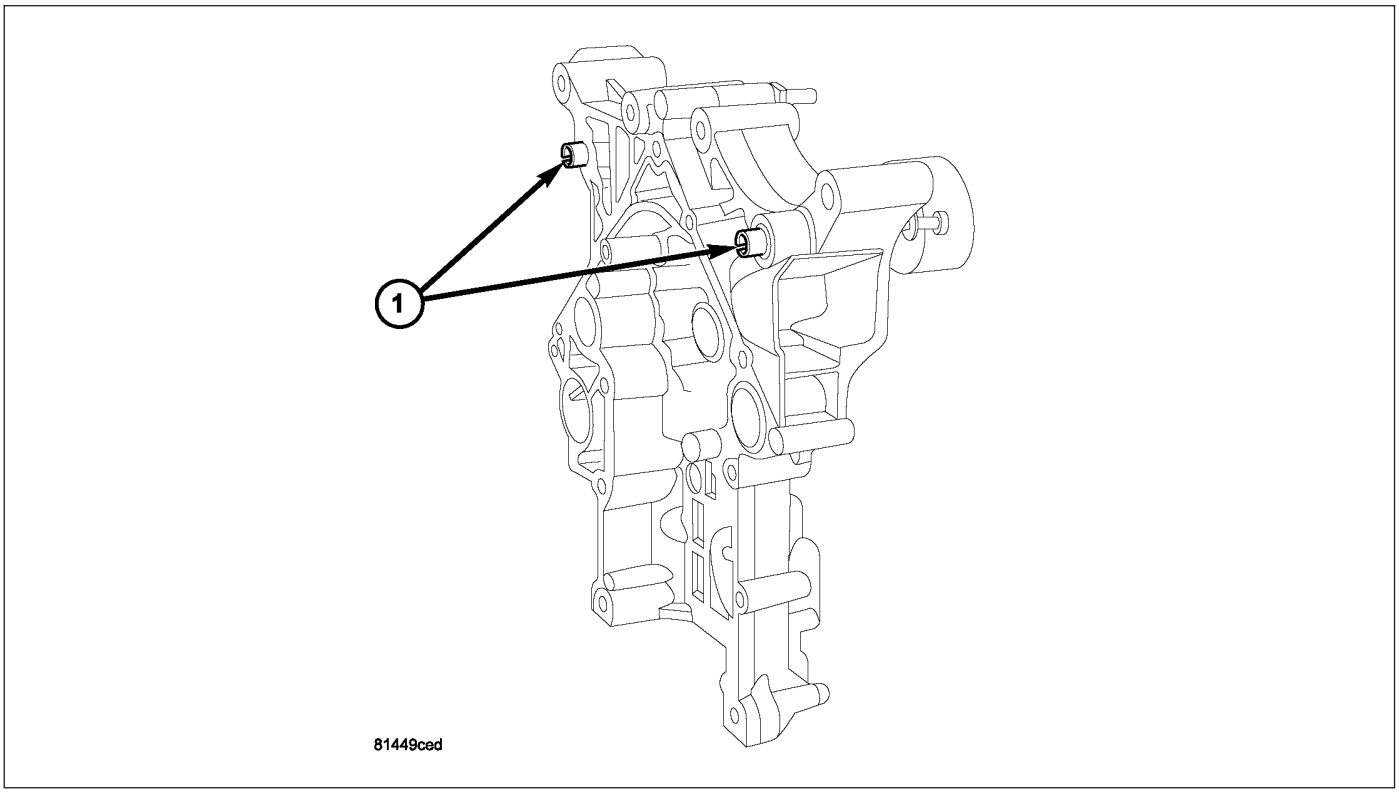
11. Position the connecting rods onto the crankshaft and install the rod bearing caps (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).

12. Install timing drive (2) (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).



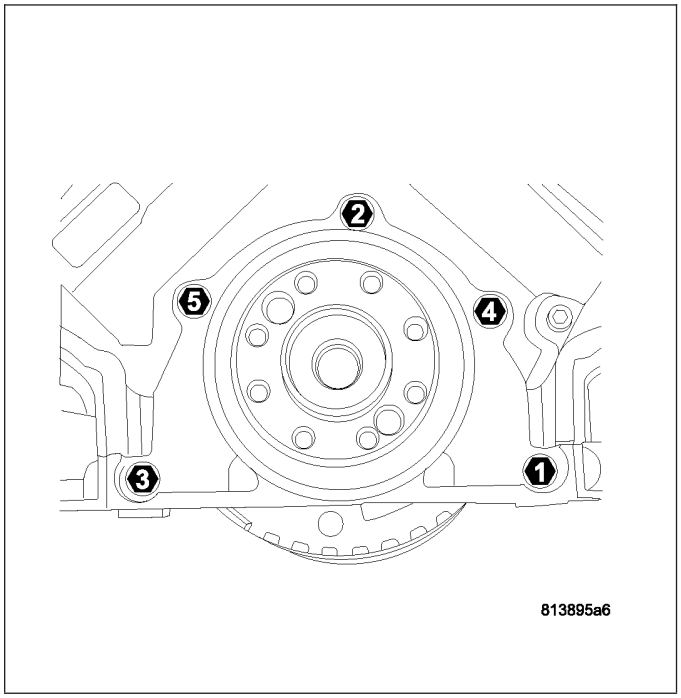


13. Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).



14. Install the timing chain cover (1) (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

15. Install the rear main seal and retainer (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINE - INSTALLATION).
16. Install the windage tray/oil pan gasket.
17. Install the oil pick up tube.
18. Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
19. Install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
20. Install the engine (Refer to 9 - ENGINE - INSTALLATION).



BEARINGS - CRANKSHAFT MAIN

STANDARD PROCEDURE - CRANKSHAFT MAIN BEARING - FITTING

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Crankshaft removed from the cylinder block.

Clean the oil off the main bearing journal.

Determine the maximum diameter of the journal with a micrometer. Measure at two locations 90° apart at each end of the journal.

The maximum allowable taper is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.0002 inch). Compare the measured diameter with the journal diameter specification (Main Bearing Fitting Chart). Select inserts required to obtain the specified bearing-to-journal clearance.

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft counterweight has grade identification marks stamped into it. These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5.

NOTE: Service main bearings are coded. These codes identify what size (grade) the bearing is.

MAIN BEARING SELECTION CHART - 5.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm U/S (0.0004 in.) U/S	64.988–64.995 mm (2.5585– 2.5588in.)
B	NOMINAL	64.996–65.004 mm (2.5588–2.5592 in.)
C	0.008 mm O/S (0.0004 in.) O/S	65.005–65.012 mm (2.5592–2.5595 in.)

INSPECTION

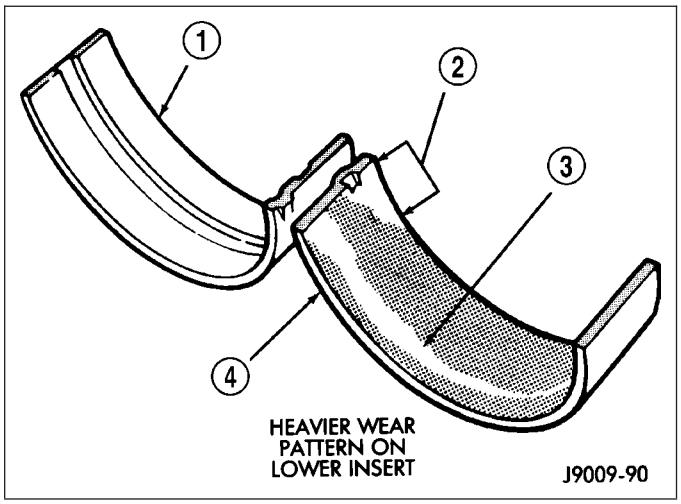
Wipe the inserts clean and inspect for abnormal wear patterns and for metal or other foreign material imbedded in the lining. Normal main bearing insert wear patterns are illustrated.

NOTE: If any of the crankshaft journals are scored, the crankshaft must be repaired or replaced.

Inspect the back of the inserts for fractures, scrapings or irregular wear patterns.

Inspect the upper insert locking tabs for damage.

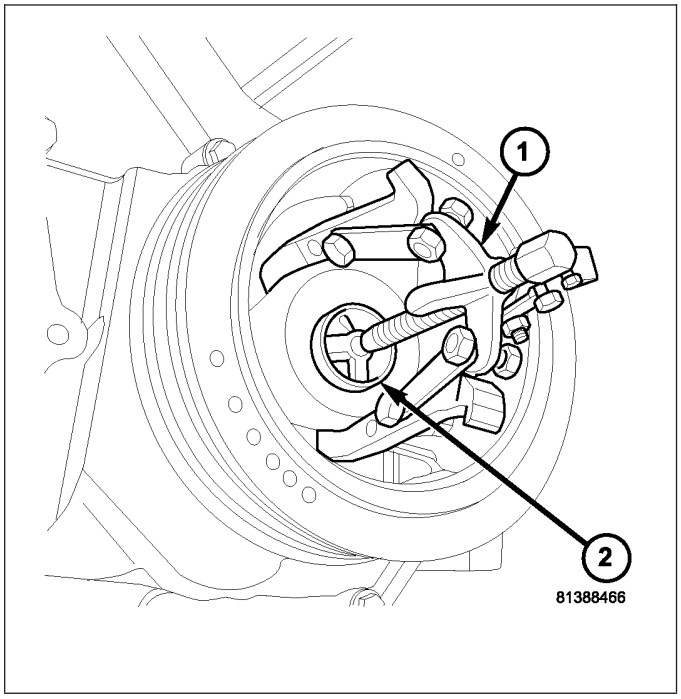
Replace all damaged or worn bearing inserts.



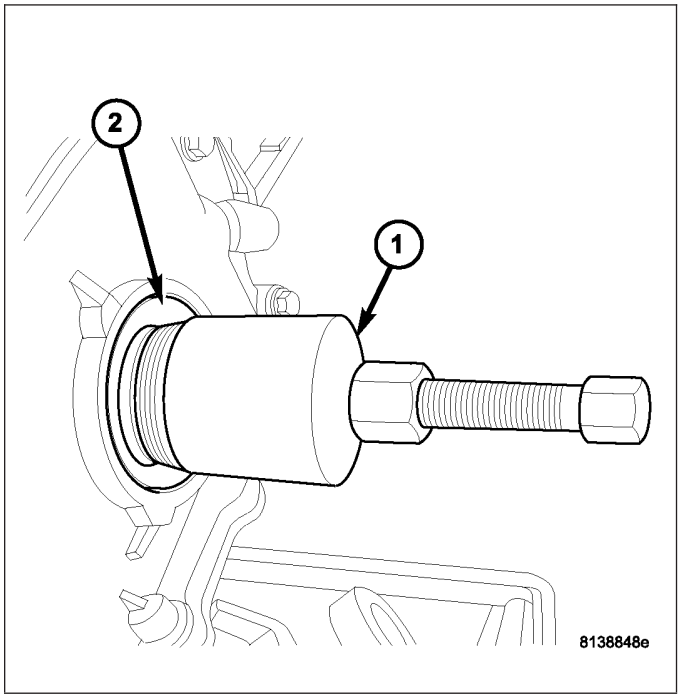
SEAL - CRANKSHAFT OIL - FRONT

REMOVAL

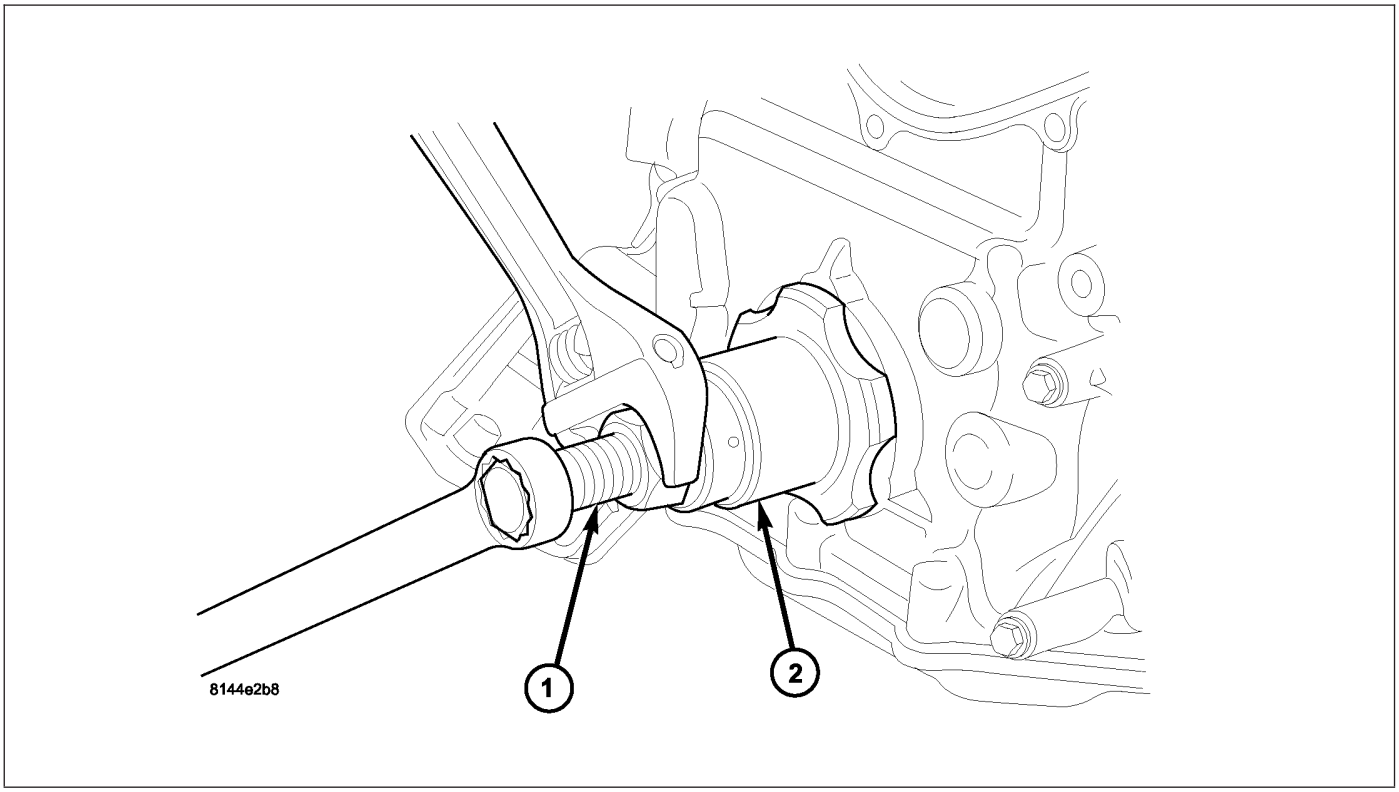
1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove upper radiator hose.
5. Remove radiator shroud attaching fasteners.
6. Remove radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
7. Remove crankshaft damper bolt.
8. Remove damper using Special Tools 8513A Insert (2) and 1023 Three Jaw Puller (1) (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).



9. Using Special Tool 9071 (1), remove crankshaft front seal (2).



INSTALLATION



CAUTION: The front crankshaft seal must be installed dry. Do not apply lubricant to sealing lip or to outer edge.

1. Using Special Tool 8348 and 8512A, install crankshaft front seal.

CAUTION: To prevent severe damage to the Crankshaft or Damper, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

2. Install vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
3. Install radiator cooling fan and shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
4. Install upper radiator hose.
5. Install accessory drive belt refer (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
6. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
7. Connect negative cable to battery.

SEAL - CRANKSHAFT OIL - REAR

DIAGNOSIS AND TESTING - REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.

b. Where leakage tends to run straight down, possible causes are a porous block, camshaft bore cup plugs, oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces. See Engine, for proper repair procedures of these items.

4. If no leaks are detected, pressurized the crankcase as outlined in the section, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks or scratches. The crankshaft seal flange is specially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING), under the Oil Leak row, for components inspections on possible causes and corrections.
7. After the oil leak root cause and appropriate corrective action have been identified, (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).

REMOVAL

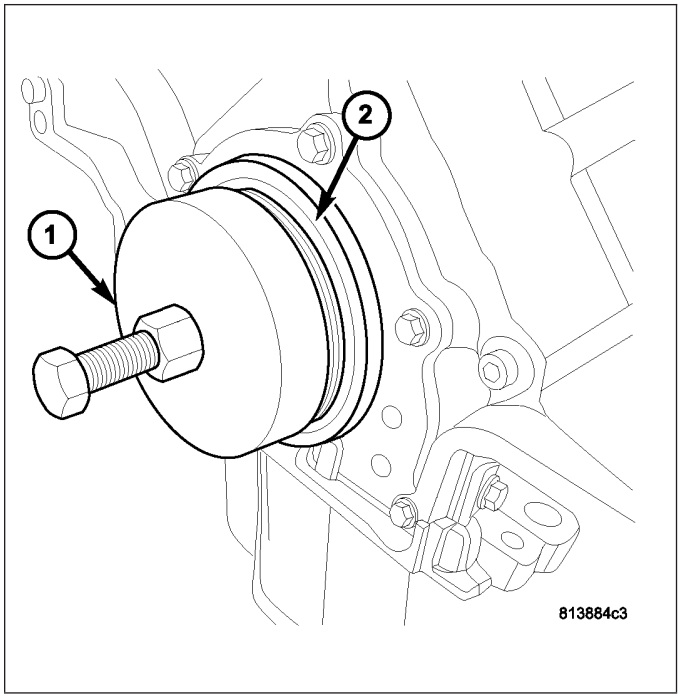
NOTE: This procedure can be performed in vehicle.

1. If being performed in vehicle, remove the transmission.
2. Remove the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

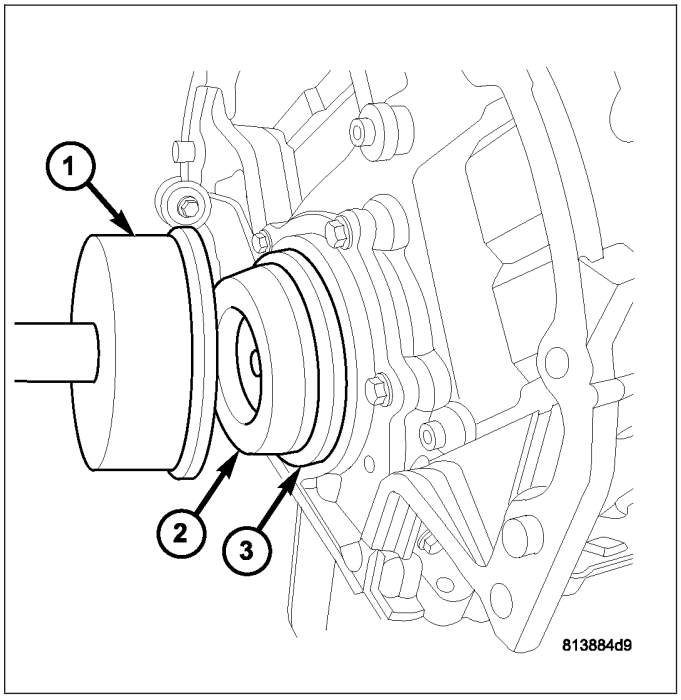
3. Using Special Tool 8506 (1), remove the crankshaft rear oil seal (2).



INSTALLATION

CAUTION: The rear seal must be installed dry for proper operation. Do not lubricate the seal lip or outer edge.

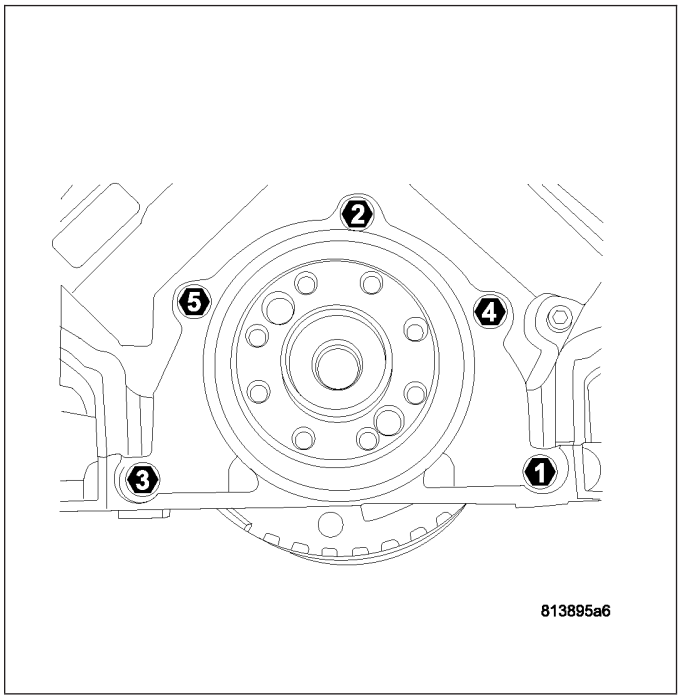
1. Position the plastic seal guide (2) onto the crankshaft rear face. Then position the crankshaft rear oil seal (3) onto the guide.
2. Using Special Tools 8349 Crankshaft Rear Oil Seal Installer (1) and C-4171 Driver Handle, with a hammer, tap the seal (3) into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.
3. Install the flexplate. (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION).
4. Install the transmission.



RETAINER - CRANK REAR OIL - SEAL

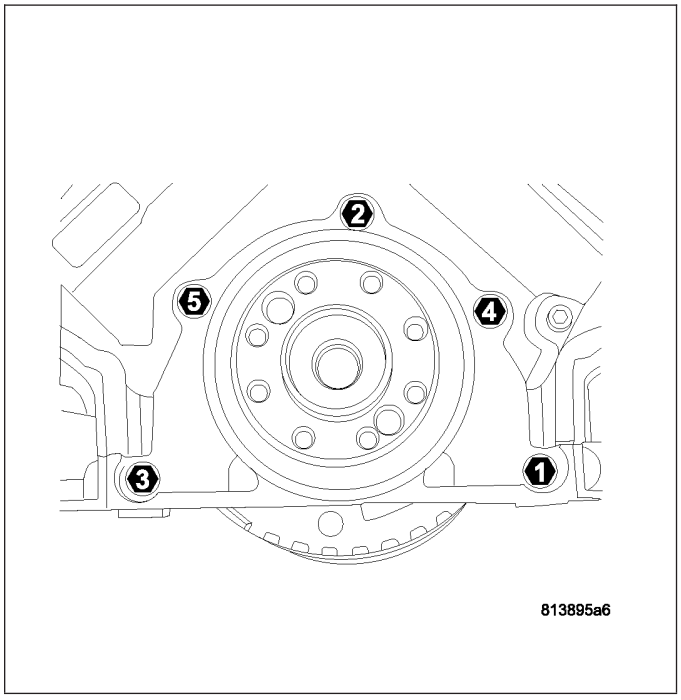
REMOVAL

1. Disconnect negative cable from battery.
2. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - REMOVAL).
3. Remove the flexplate. (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - REMOVAL).
4. Remove the oil pan. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL)
5. Remove the rear oil seal retainer mounting bolts.
6. Carefully remove the retainer from the engine block.



INSTALLATION

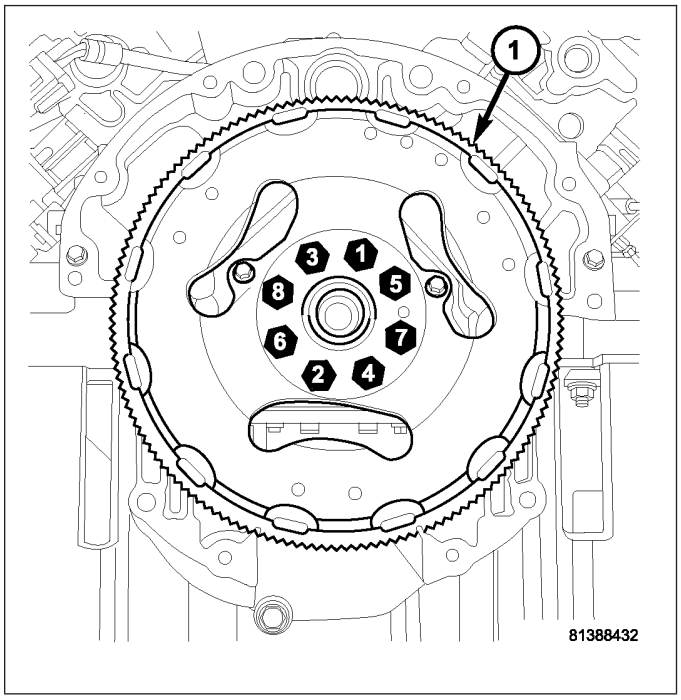
1. Throughly clean all gasket resdue from the engine block.
2. Use extream care and clean all gasket resdue from the retainer.
3. Position the gasket onto the retainer.
4. Position the retainer onto the engine block.
5. Install the retainer mounting bolts. Tighten the bolts to 15 N·m (132 in. lbs.) using the procedure shown.
6. Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
7. Install the flexplate (Refer to 9 - ENGINE/ENGINE BLOCK/FLEX PLATE - INSTALLATION).
8. Install the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION).
9. Check and verify engine oil level.
10. Start engine and check for leaks.



FLEX PLATE

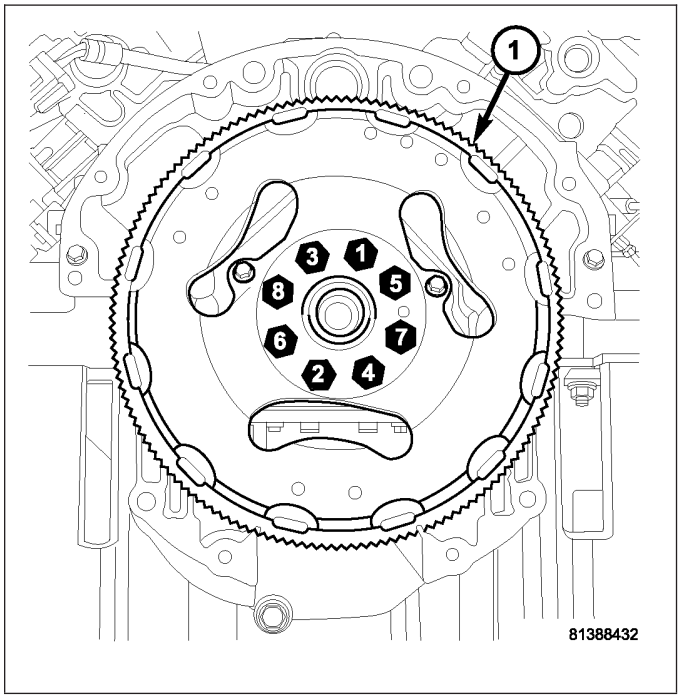
REMOVAL

1. Remove the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - REMOVAL).
2. Remove the bolts and flexplate (1).



INSTALLATION

1. Position the flexplate or flywheel onto the crankshaft and install the bolts hand tight.
2. **For automatic transmissions:** Tighten the flexplate retaining bolts to 95 N·m (70 ft. lbs.).



3. Install the transmission. (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION).

TAPPETS - HYDRAULIC ROLLER

DIAGNOSIS AND TESTING - HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check the oil pressure. If vehicle has no oil pressure gauge, install a reliable gauge at the pressure sending-unit. The pressure should be between 207-552 kPa (30-70 psi) at 3,000 RPM.

Check the oil level after the engine reaches normal operating temperature. Allow 5 minutes to stabilize oil level, check dipstick. The oil level in the pan should never be above the FULL mark or below the ADD OIL mark on dipstick. Either of these two conditions could be responsible for noisy tappets.

OIL LEVEL

HIGH

If oil level is above the FULL mark, it is possible for the connecting rods to dip into the oil. With the engine running, this condition could create foam in the oil pan. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to lose length and allow valves to seat noisily.

LOW

Low oil level may allow oil pump to take in air. When air is fed to the tappets, they lose length, which allows valves to seat noisily. Any leaks on intake side of oil pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, operate the engine at fast idle. Run engine for a sufficient time to allow all of the air inside the tappets to be bled out.

TAPPET NOISE DIAGNOSIS

1. To determine source of tappet noise, crank over engine with cylinder head covers removed.

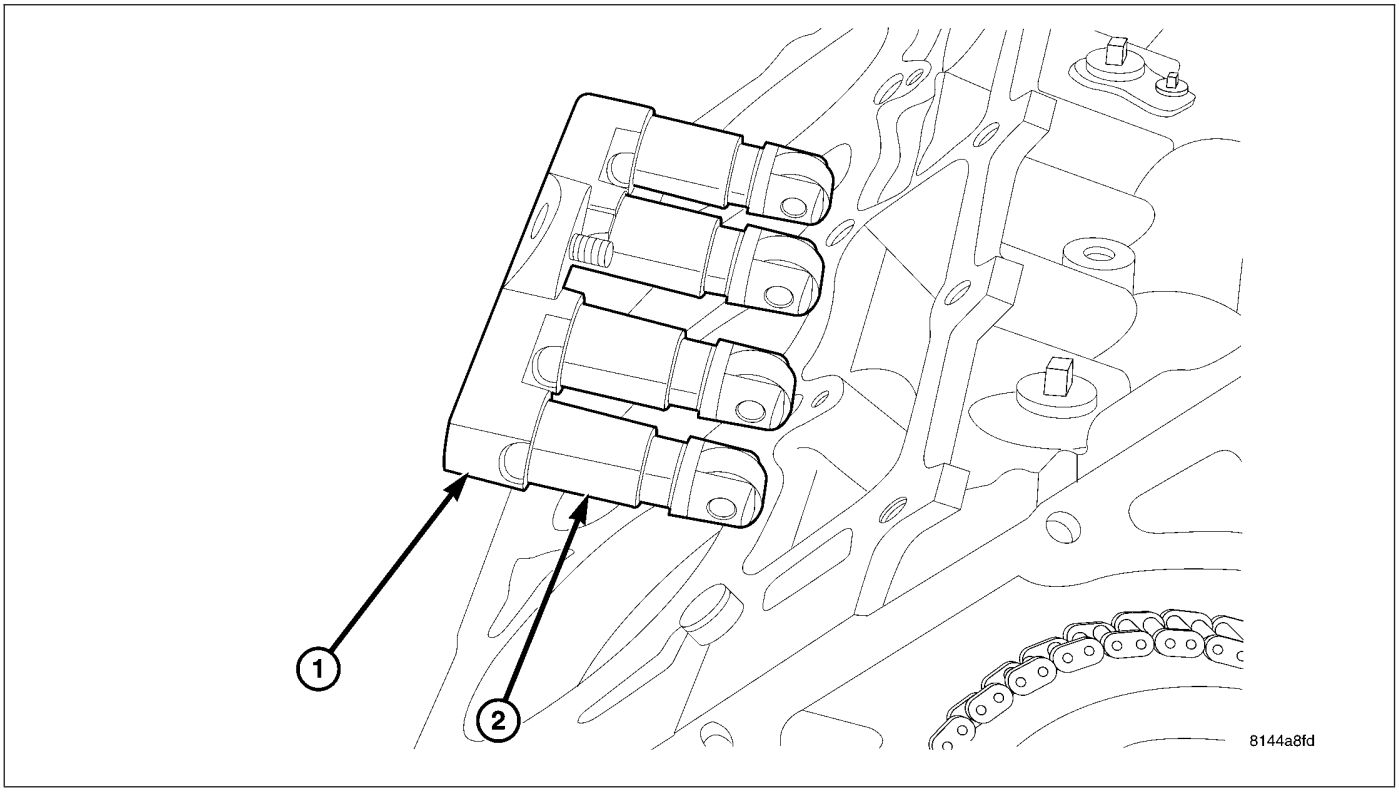
2. Feel each valve spring or rocker arm to detect noisy tappet. The noisy tappet will cause the affected spring and/or rocker arm to vibrate or feel rough in operation.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

3. Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger, or by the plunger partially sticking in the tappet body cylinder. The tappet should be replaced. A heavy click is caused by a tappet check valve not seating, or by foreign particles wedged between the plunger and the tappet body. This will cause the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed for inspection and cleaning.
4. The valve train generates a noise very much like a light tappet noise during normal operation. Care must be taken to ensure that tappets are making the noise. If more than one tappet seems to be noisy, it's probably not the tappets.

REMOVAL

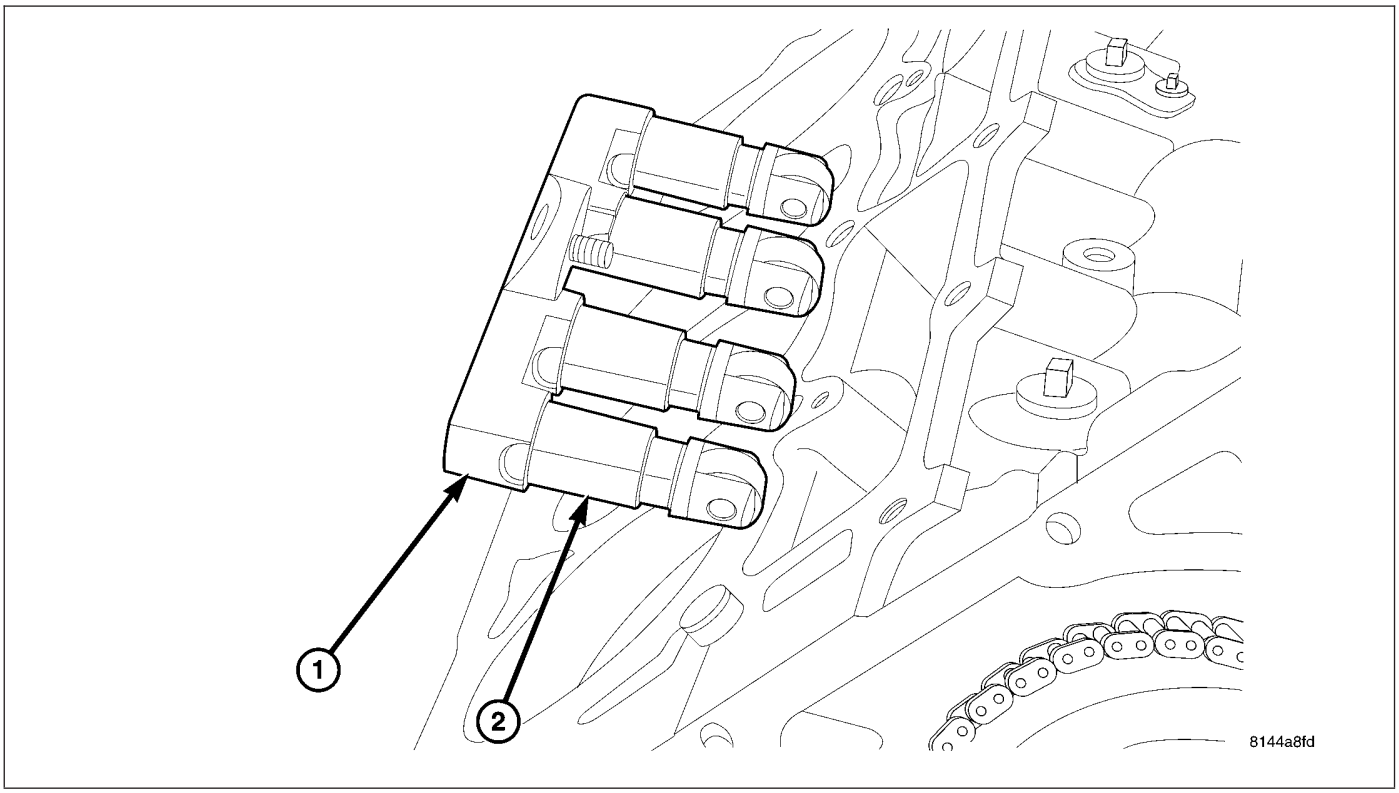
1. Disconnect the negative cable from the battery.
2. Remove the air cleaner (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - REMOVAL).
3. Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
4. Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
5. Remove rocker arm assembly and push rods (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - REMOVAL). Identify push rods to ensure installation in original location.
6. Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).



7. Remove bolt from tappet retainer (1).
8. Remove tappet retainer (1).

9. Pull tappet out of bore with a twisting motion. If all tappets are to be removed and reused, identify tappets to ensure installation in original location.
10. Check camshaft lobes for abnormal wear.

INSTALLATION



1. Lubricate tappets.
2. Install tappets in their original positions.
3. Install tappet retainer (1). Install the tappet retainer bolt and tighten to 12 N·m (106 in. lbs.) torque.
4. Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
5. Install pushrods and rocker arm assembly (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARM / ADJUSTER ASSY - INSTALLATION).
6. Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
7. Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
8. Install the air cleaner (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - INSTALLATION).
9. Connect the negative cable to the battery.

CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.

10. Road test vehicle and check for leaks.

PISTON & CONNECTING ROD

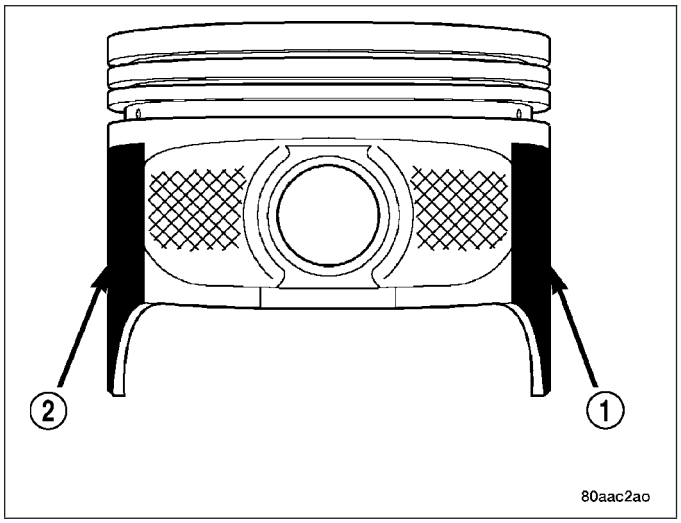
DESCRIPTION

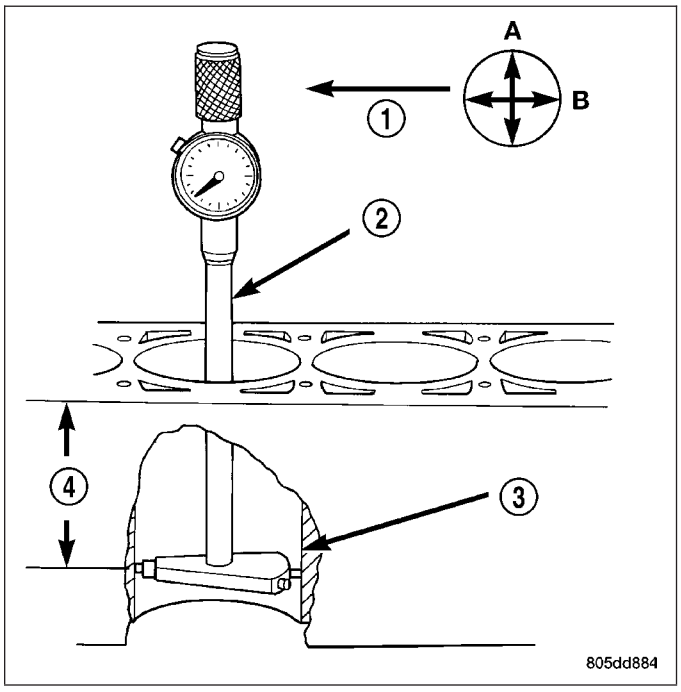
CAUTION: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

The pistons are made of a high strength aluminum alloy. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The piston top ring groove and land is anodized. The connecting rods are made of forged powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

STANDARD PROCEDURE - PISTON FITTING

1. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.
2. Measure the inside diameter of the cylinder bore at a point 38.0 mm (1.5 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B.
3. The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. The piston-rod assembly is specific for the left cylinder bank (odd numbered) and the right cylinder bank (even numbered) and must not be interchanged.
4. The coating material is applied to the piston after the final piston machining process. Measuring the outside diameter of a coated piston will not provide accurate results. Therefore measuring the inside diameter of the cylinder bore with a dial Bore Gauge is **MANDATORY**. To correctly select the proper size piston, a cylinder bore gauge capable of reading in 0.003 mm (.0001 in.) increments is required.
5. Piston installation into the cylinder bore requires slightly more pressure than that required for non-coated pistons. The bonded coating on the piston will give the appearance of a line-to-line fit with the cylinder bore.





REMOVAL

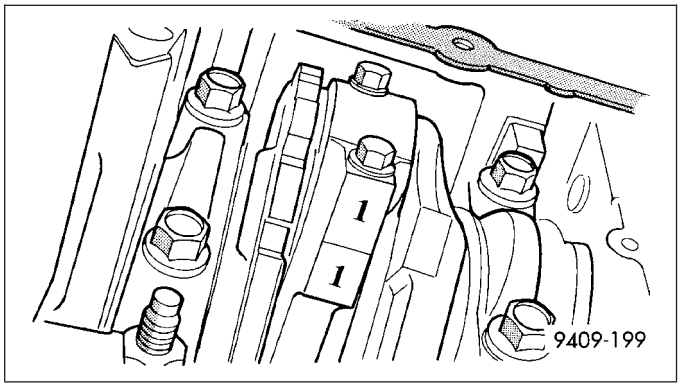
1. Disconnect negative cable from battery.
2. Remove the following components:
   - Oil pan and gasket/windage tray (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
   - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
   - Timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
   - Cylinder head(s) (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL) and (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. If necessary, remove top ridge of cylinder bores with a reliable ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

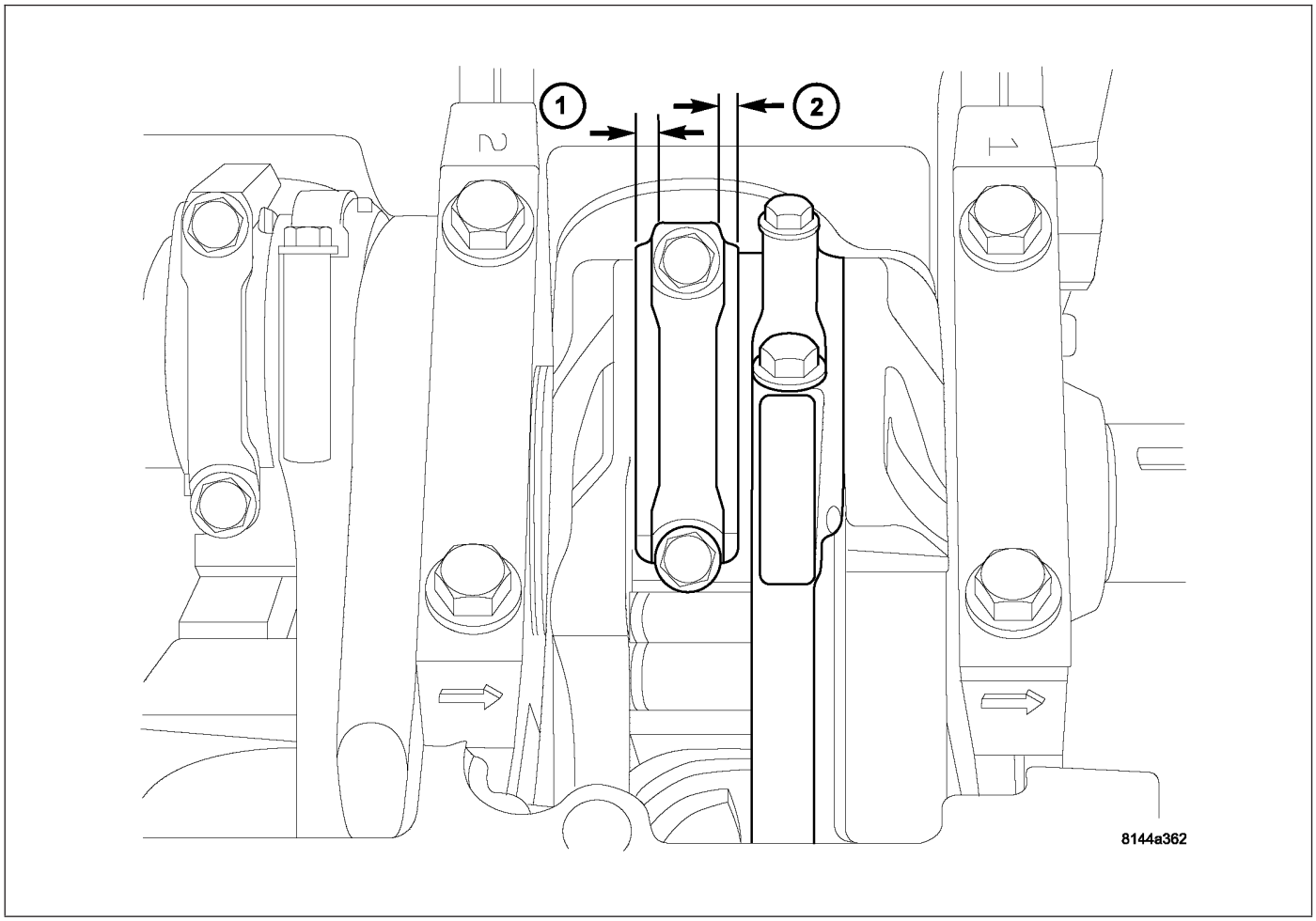
CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

4. Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool.

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.





5. Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

6. Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.

7. Carefully remove piston rings from piston(s), starting from the top ring down.

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

1. Using a suitable cleaning solvent clean the pistons in warm water and towel dry.
2. Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the connecting rod journal for excessive wear, taper and scoring (Refer to 9 - ENGINE/ENGINE BLOCK/ CONNECTING ROD BEARINGS - STANDARD PROCEDURE).

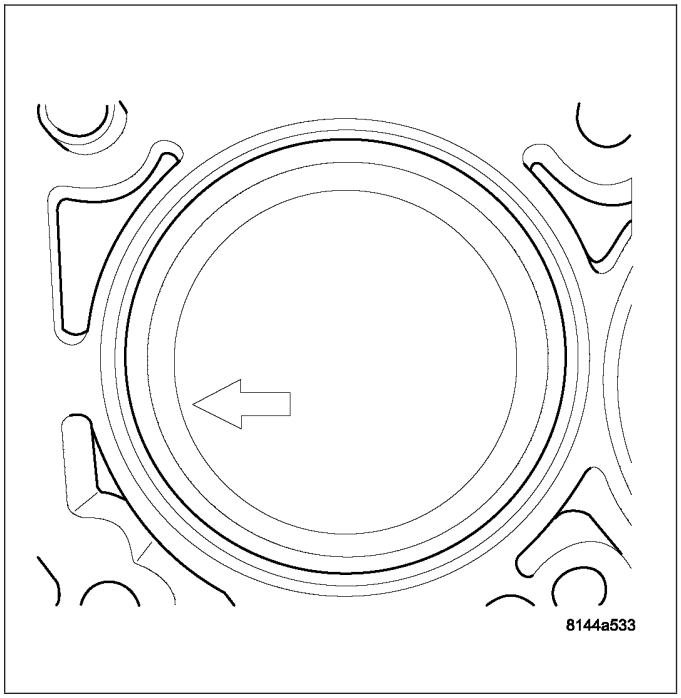
Check the connecting rod for signs of twist or bending.

Check the piston for taper and elliptical shape before it is fitted into the cylinder bore (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - STANDARD PROCEDURE).

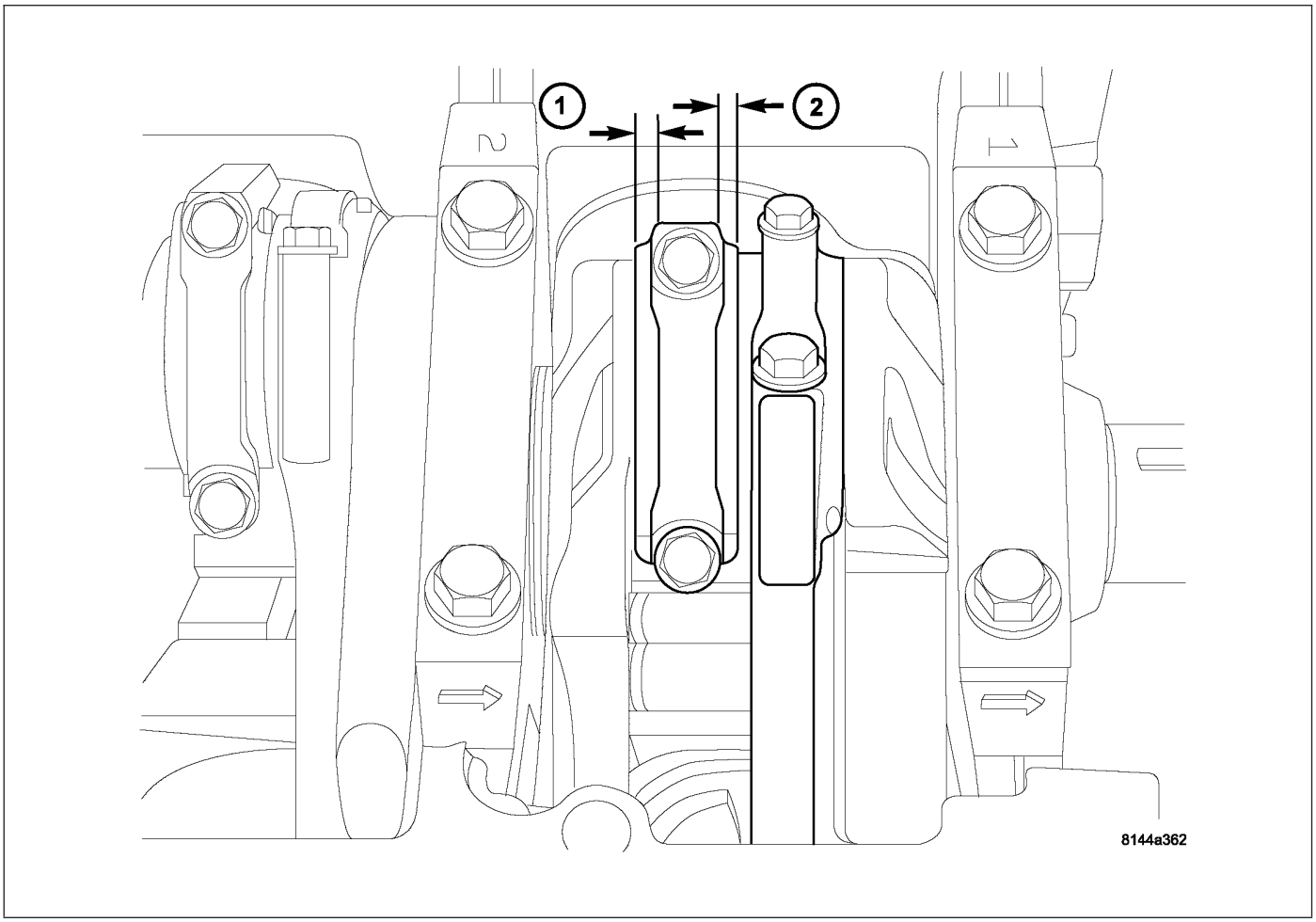
Check the piston for scoring, or scraping marks in the piston skirts. Check the ring lands for cracks and/or deterioration.

INSTALLATION

1. Before installing piston and connecting rod assemblies into the bore, install the piston rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
2. Immerse the piston head and rings in clean engine oil. Position a ring compressor over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**
3. Position bearing onto connecting rod. Lubricate bearing surface with clean engine oil.
4. Install Special Tool 8507 Connecting Rod Guides into connecting rod bolt threads.
5. The pistons are marked on the piston pin bore surface with an raised “F” or arrow on top of piston indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks.
6. Wipe cylinder bore clean and lubricate with engine oil.



7. Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.
8. Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.



CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

9. Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 21 N·m (15 ft. lbs.) plus a 90° turn.

10. Install the following components:
    - Cylinder head(s). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
    - Cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
    - Install the intake manifold.
    - Oil pan and gasket/windage tray. (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
11. Fill crankcase with proper engine oil to correct level.
12. Connect negative cable to battery.

RINGS - PISTON

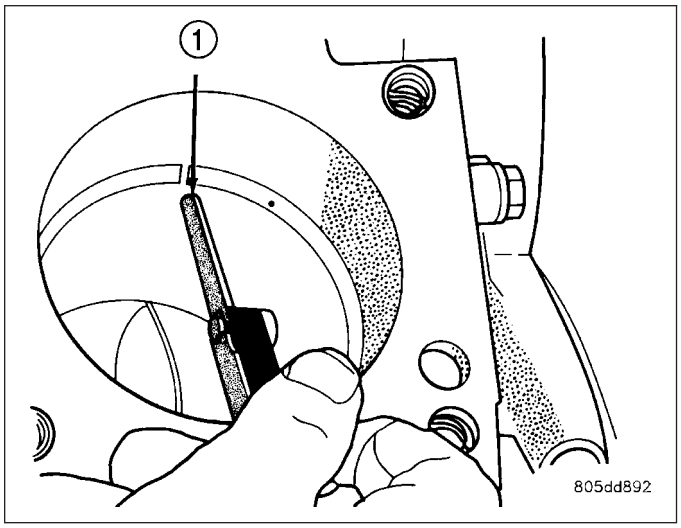
STANDARD PROCEDURE - PISTON RING FITTING

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

1. Wipe the cylinder bore clean.
2. Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

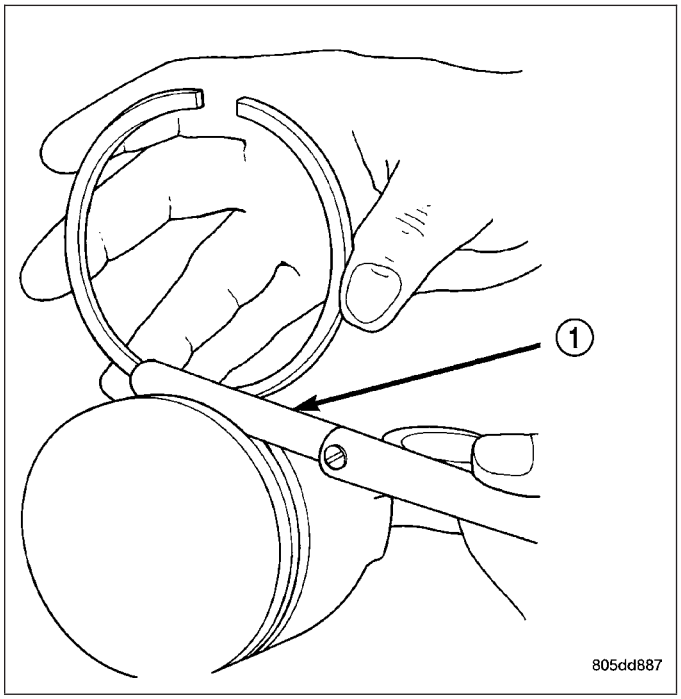
3. Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.
4. Using a feeler gauge check the ring end gap. Replace any rings not within specification.



PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

5. Measure the ring side clearance as shown make sure the feeler gauge fits snugly between the ring land and the ring. Replace any ring not within specification.
6. Rotate the ring around the piston, the ring must rotate in the groove with out binding.



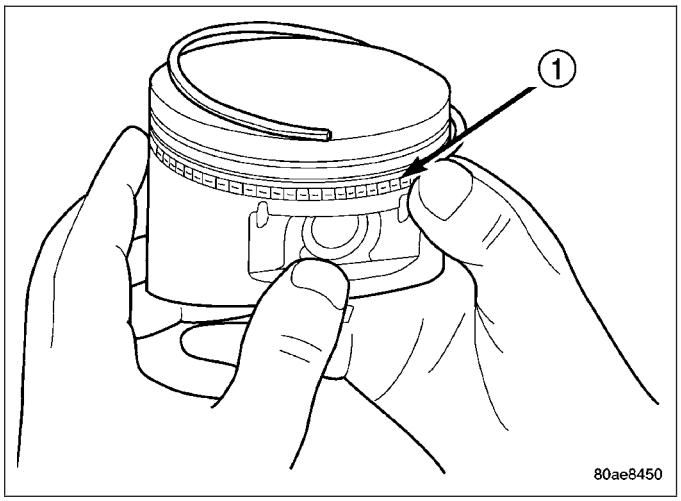
PISTON RING SPECIFICATION CHART

Ring Position	Ring/Groove Side Clearance	Maximum Clearance
Upper Ring	0.02-0.07mm (0.0008- 0.0028 in.)	0.11mm (0.004 in.)
Intermediate Ring	0.02-0.06 mm (0.0008-0.0023 in.)	0.10mm (0.004 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring	0.23-0.38mm (0.0090-0.0149 in.)	0.43mm (0.017 in.)
Intermediate Ring	0.35-0.60mm (0.0137-0.0236 in.)	0.74mm (0.029 in.)
Oil Control Ring (Steel Rail)	0.015-0.66mm (0.0059- 0.0259 in.)	0.76mm (0.030 in.)

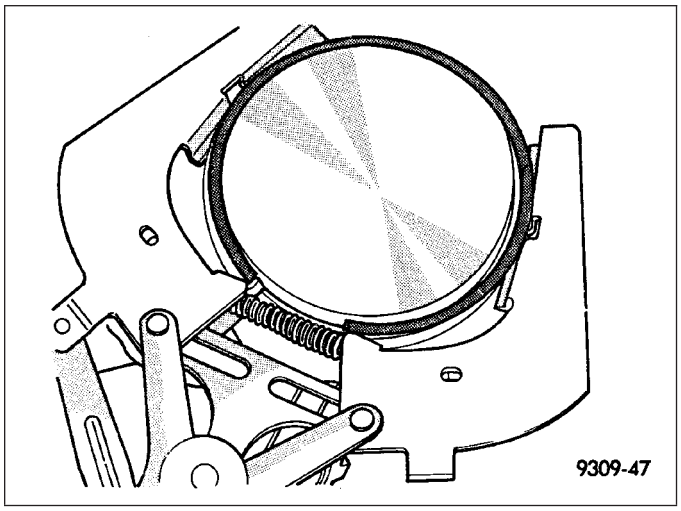
7. The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:
- **Oil ring expander.**
- **Lower oil ring side rail.**
- **Upper oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

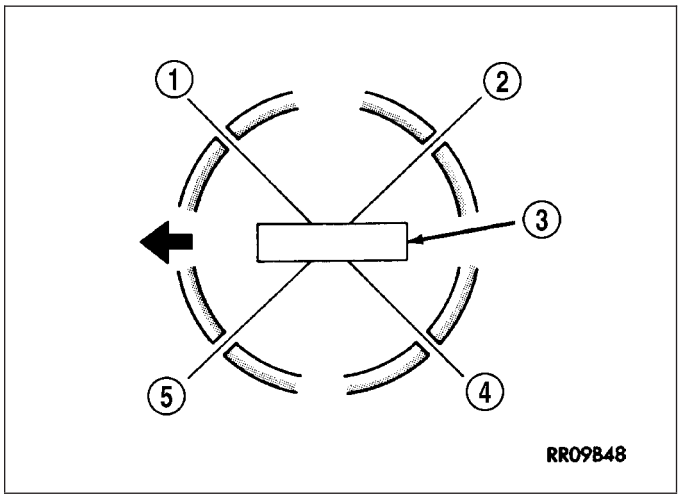
8. Install the oil ring expander.
9. Install upper side rail by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.



10. Install No. 2 intermediate piston ring using a piston ring installer.
11. Install No. 1 upper piston ring using a piston ring installer.



12. Position piston ring end gaps as shown in. It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

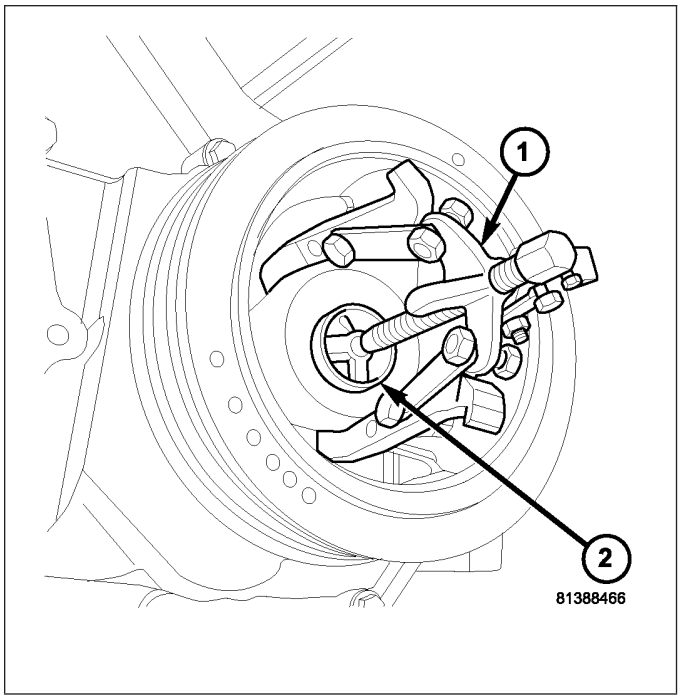


DAMPER - CRANKSHAFT

REMOVAL

1. Disconnect negative cable from battery.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Remove radiator upper hose.
5. Remove fan shroud (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
6. Remove crankshaft damper bolt.

7. Remove damper using Special Tools 8513A Insert and 1023 Three Jaw Puller.

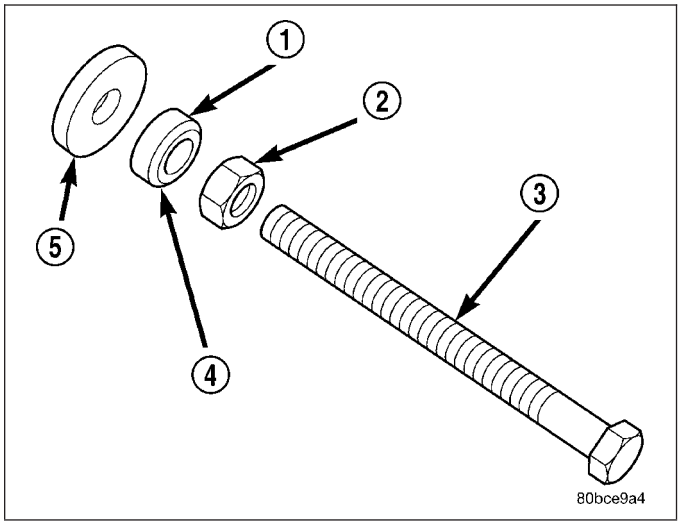


INSTALLATION

CAUTION: To prevent severe damage to the Crankshaft, Damper or Special Tool 8512–A, thoroughly clean the damper bore and the crankshaft nose before installing Damper.

1. Slide damper onto crankshaft slightly.

CAUTION: Special Tool 8512–A, is assembled in a specific sequence. Failure to assemble this tool in this sequence can result in tool failure and severe damage to either the tool or the crankshaft.



2. Assemble Special Tool 8512–A as follows, The nut is threaded onto the shaft first (2). Then the roller bearing (1) is placed onto the threaded rod (3) The hardened bearing surface of the bearing (1) **MUST** face the nut (2). Then the hardened washer (5) slides onto the threaded rod (3). Once assembled coat the threaded rod's threads with Mopar® Nickel Anti-Seize or (Loctite No. 771).
3. Using Special Tool 8512–A, press damper onto crankshaft.
4. Install then tighten crankshaft damper bolt to 176 N·m (129 ft. lbs.).
5. Install radiator upper hose.
6. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
7. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
8. Connect negative cable to battery.

COVER - STRUCTURAL

DESCRIPTION

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine.

OPERATION

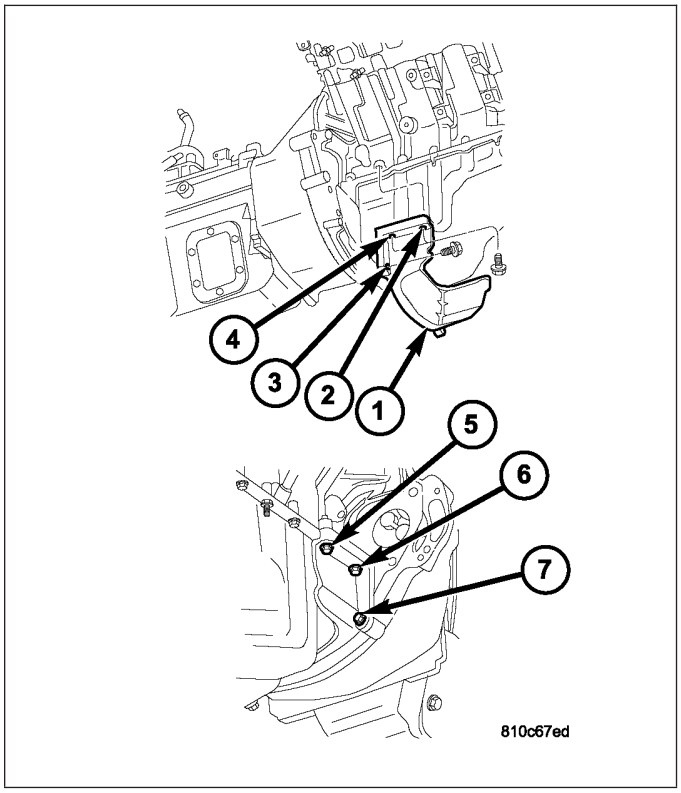
The structural cover provides additional powertrain stiffness and reduces noise and vibration.

REMOVAL

1. Raise vehicle on hoist.

CAUTION: On manual transmission vehicles, the 7/16 inch engine block to clutch housing bolts must be loosened before removal of the structural dust cover (1). Clutch housing distortion will occur if this procedure is not followed.

2. Remove the bolts retaining structural cover (1,2).
3. Remove the structural cover.

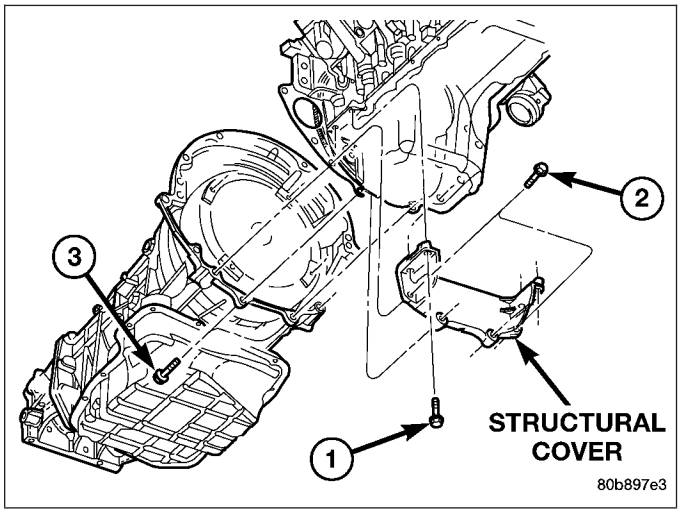


INSTALLATION

AUTOMATIC TRANSMISSION

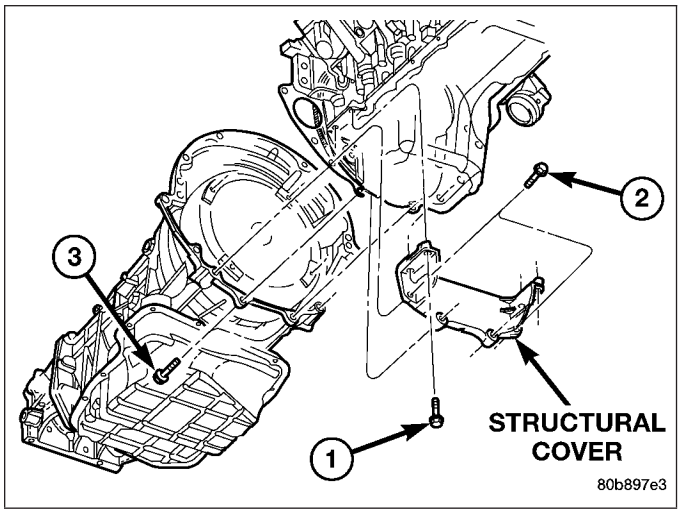
CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

1. Position the structural cover in the vehicle.
2. Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the four cover-to-transmission bolts. Do NOT tighten at this time.



CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

4. Torque the (4)structural dust cover bolts that go into the transmission to 6-11 N·m (50-100 in.lbs.).
5. Torque the (4) structural dust cover bolts that go into the engine block to 6-11 N·m (50-100 in.lbs.).
6. Starting with the two rear cover-to-engine bolts, tighten bolts (1) to 54 N·m (40 ft. lbs.), then tighten bolts (2) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.



7. Install the exhaust pipe on left hand exhaust manifold.
8. Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

MANUAL TRANSMISSION

CAUTION: The 7/16 inch engine block to clutch housing bolts must be loosened before removal/installation of the structural dust cover. Clutch housing distortion will occur if this procedure is not followed.

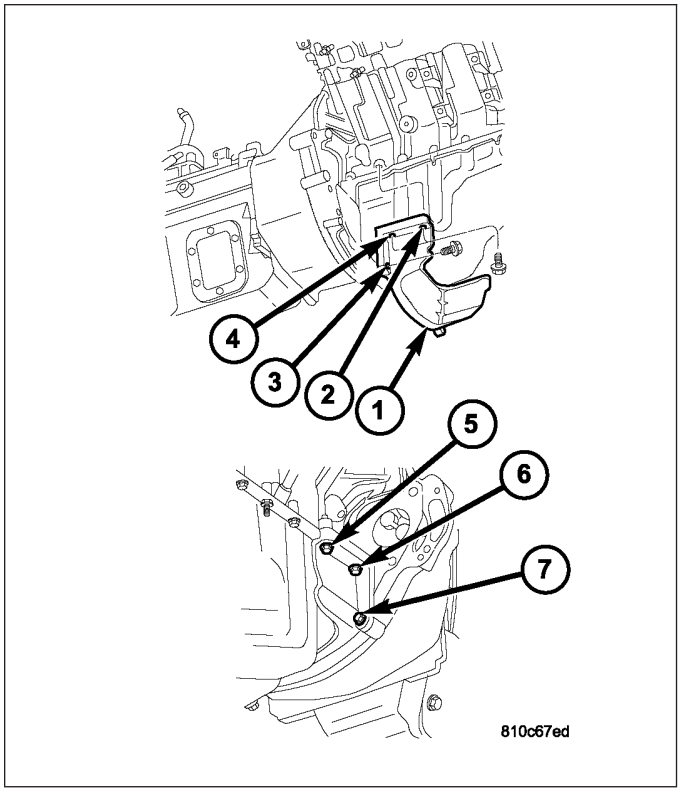
1. Position the structural cover in the vehicle.

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover, and engine noise.

2. Install all bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.
3. Install the cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against the corner formed by the engine and the transmission clutch housing during tightening sequence. Failure to do so may cause damage to the cover and engine noise.

4. Torque the (2)structural dust cover bolts that go into the clutch housing to 6-11 N·m (50-100 in.lbs.).
5. Torque the (4) structural dust cover bolts that go into the engine block to 6-11 N·m (50-100 in.lbs.).
6. Torque the structural cover bolt that is closest to the rear face of block on the passenger side of block to 54 N·m (40 ft. lbs.).
7. Torque the structural cover bolt that is closest to the front face of block on the drivers side to 54 N·m (40 ft. lbs.).
8. Torque the remaining (2) structural cover bolts that go into the **block** in an “X” pattern to 54 N·m (40 ft. lbs.).



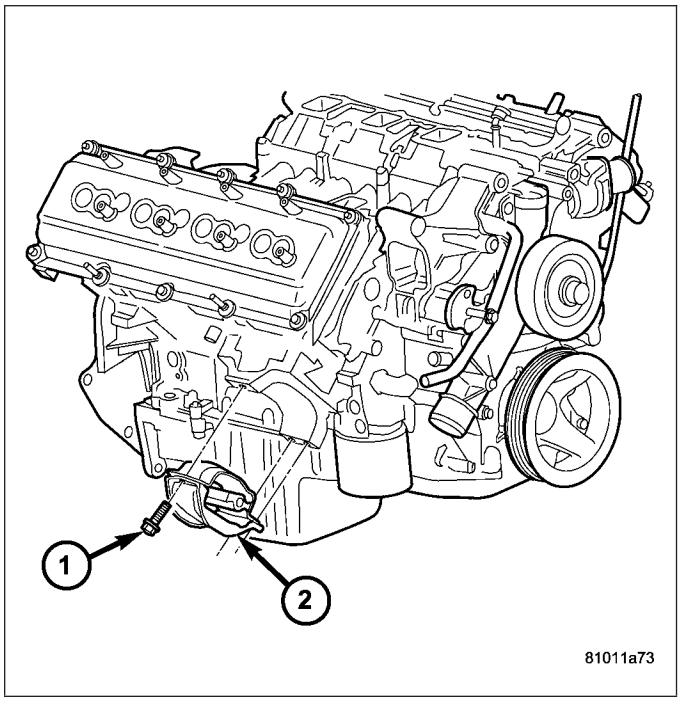
9. Torque the structural cover bolts that go into the **clutch housing** to 54 N·m (40 ft. lbs.).
10. Torque the 7/16 inch engine block to clutch housing bolts to 68 N·m (50 ft. lbs.).

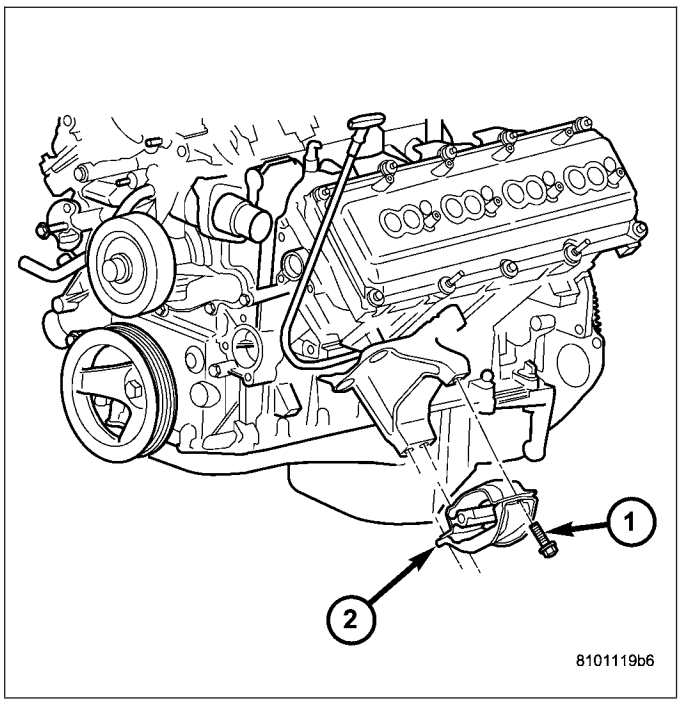
MOUNT - FRONT

REMOVAL

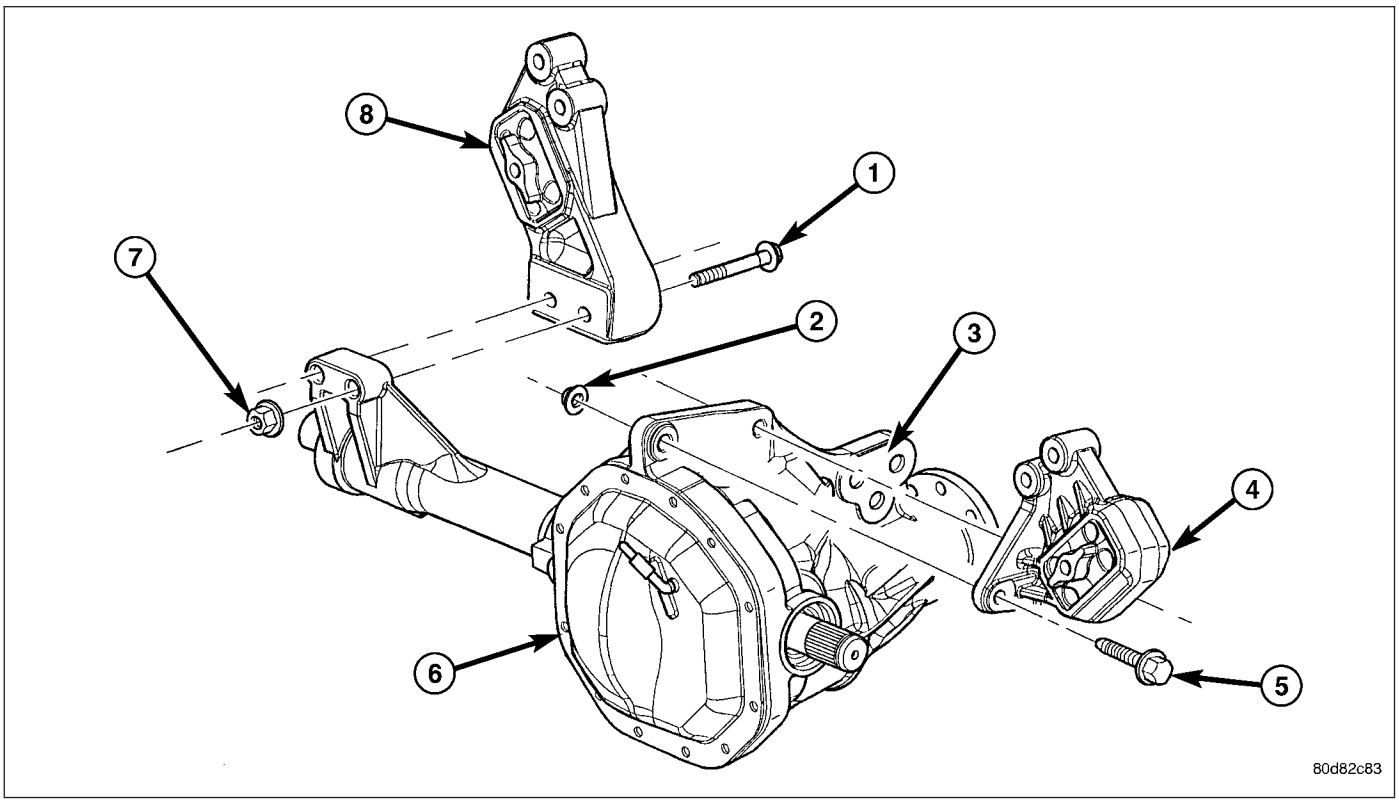
2WD

1. Disconnect negative battery cable.
2. Raise vehicle.
3. Remove engine mount through bolts.
4. Raise engine using engine support fixture special tool # 8534.
5. Remove engine mount to insulator bolts (1).
6. Remove insulator (2) from engine.





4WD



1. Disconnect the negative cable from the battery.
2. Raise the vehicle.
3. Remove the skid plate.
4. Remove the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL).
5. Remove the engine oil filter.
6. Support the engine using engine support fixture, special tool # 8534.
7. Support the front axle with a suitable jack.
8. Remove the (4) bolts that attach the engine mounts to the front axle.
9. Remove the (3) bolts that attach the front axle to the left engine bracket.
10. Lower the front axle.
11. Remove the (6) through bolts
12. Raise the engine far enough to be able to remove the left (4) and right (8) engine mounts.
13. Remove the engine mounts (4,8).

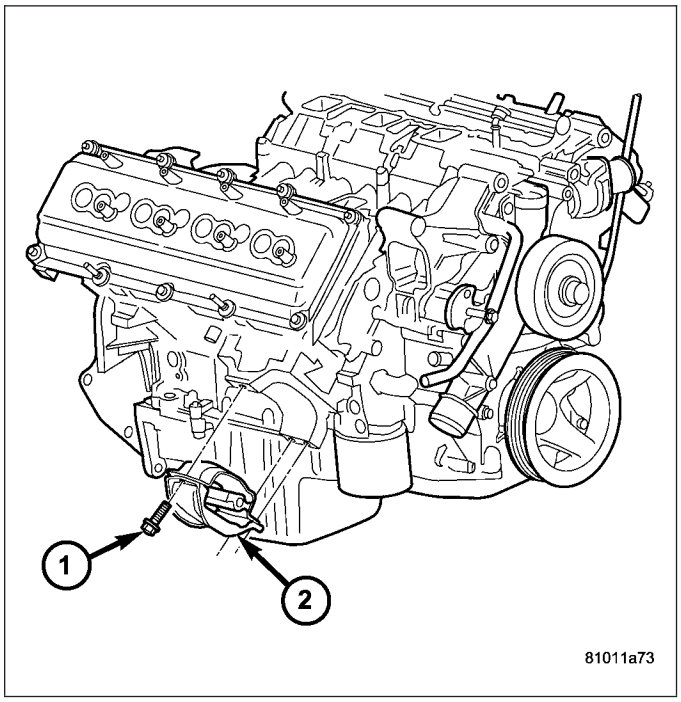
INSTALLATION

2WD

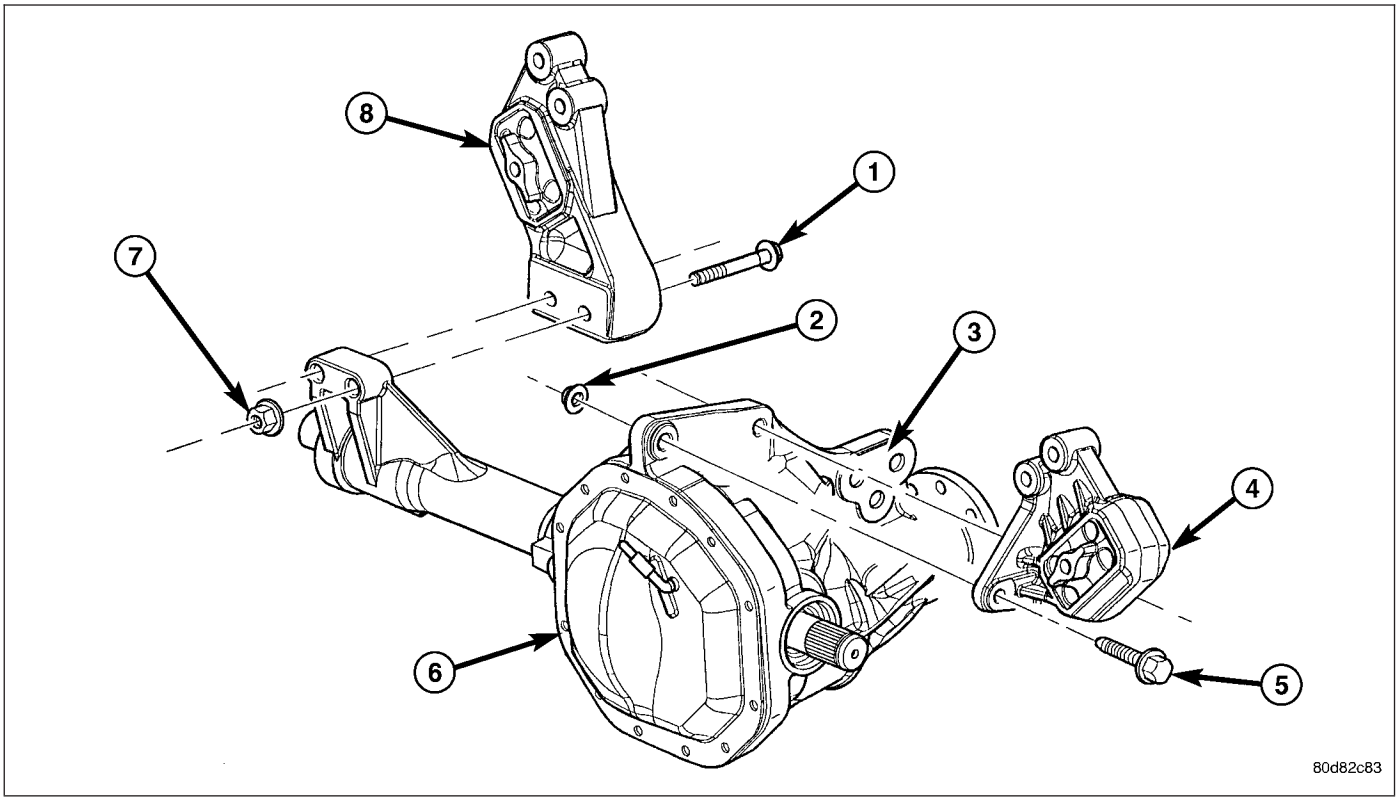
1. Install insulator (2) on the engine.

NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

2. Install upper and lower mount mounting bolts. Tighten bolts to 61 N·m (45 ft. lbs.).
3. Lower the engine using engine support fixture special tool # 8534.
4. Install mount through bolts.
5. Tighten through bolts on both sides to 61 N·m (45 ft. lbs.).
6. Lower vehicle.
7. Connect negative battery cable.



4WD



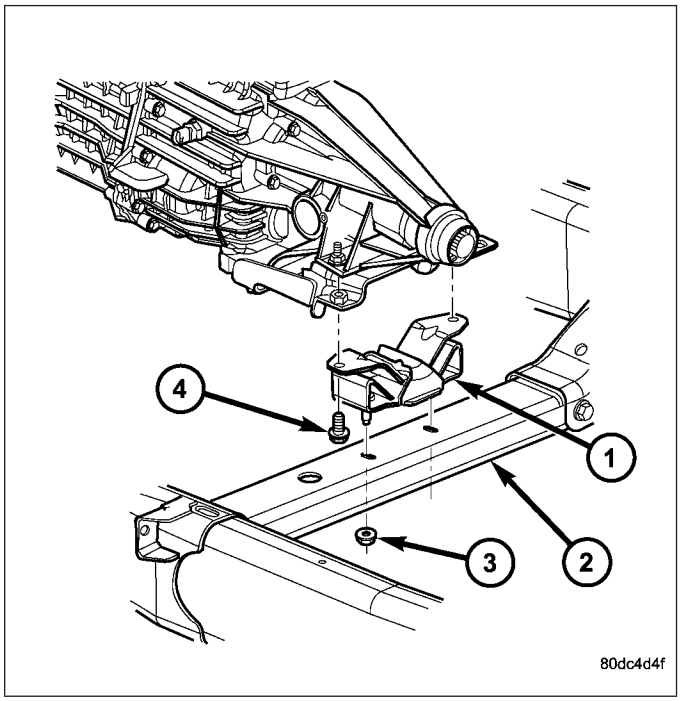
NOTE: For mount to engine block and left engine bracket to front axle bolts, apply Mopar® Lock and Seal Adhesive, Medium Strength Threadlocker.

1. Install the right (8) and left (4) side engine mounts to the front axle. Torque nuts to 94 N·m (70 ft. lbs.).
2. Raise the front axle into the frame and install the left and right side through bolts. Torque nuts to 94 N·m (70 ft. lbs.).
3. Insert the two upper through bolts into the right and left side engine mounts and loose assemble the two nuts onto the through bolts.
4. Lower the engine using engine support fixture special tool # 8534, until the left and right side engine brackets rest on the through bolts, and the lower engine bracket through holes align with the engine mounts, and the left engine bracket holes align with the front axle slots.
5. Loose assemble the 3 bolts that attach the front axle to the left engine bracket.
6. Loose assemble the lower through bolts.
7. Torque the nuts for the 4 through bolts to 101 N·m (75 ft. lbs.).
8. Torque the 3 bolts that attach the front axle to the left engine bracket to 101 N·m (75 ft. lbs.).
9. Install the engine oil filter, if removed.
10. Install the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - INSTALLATION).
11. Install the skid plate.
12. Lower the vehicle.
13. Reconnect the negative battery cable.

MOUNT - REAR

REMOVAL

1. Raise the vehicle on a hoist.
2. Using a suitable jack, support transmission.
3. Remove the nuts from the transmission mount.
4. Remove the two bolts that attach the transmission mount to the engine bracket.
5. Raise the transmission enough to remove the mount from the crossmember.
6. Remove the mount.



INSTALLATION

NOTE: Threadlocking compound must be applied to the bolts before installation.

1. Install the two bolts that attach the transmission mount to the transmission bracket.
2. Torque the bolts to 61N·m (45 ft.lbs.) torque.
3. Lower the transmission so the transmission mount rests on the crossmember, and the studs of the transmission mount are aligned in the slots in the crossmember.
4. Install the nuts onto the transmission mount studs through the crossmember access slot.
5. Torque the nuts to 54N·m (40 ft. lbs.).

LUBRICATION

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sending unit and install gauge assembly C-3292.
2. Run engine until thermostat opens.
3. Oil Pressure:
   - Curb Idle–25 kPa (4 psi) minimum
   - 3000 rpm–170 - 758 kPa (25 - 110 psi)
4. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

DIAGNOSIS AND TESTING - ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Remove the PCV valve from the IAFM. Cap or plug the PCV valve grommet.
2. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

3. Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
4. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
5. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve.
6. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

OIL

STANDARD PROCEDURE - ENGINE OIL SERVICE

The engine oil level indicator is located at the left hand of the engine on the 5.7L engines.

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about ten minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately five minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Install dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

Run engine until achieving normal operating temperature.

1. Position the vehicle on a level surface and turn engine off.
2. Hoist and support vehicle on safety stands.

3. Remove oil fill cap.
4. Place a suitable drain pan under crankcase drain.
5. Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.
6. Install drain plug in crankcase. Torque to 34 N·m (25 ft. lbs.).
7. Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
8. Install oil fill cap.
9. Start engine and inspect for leaks.
10. Stop engine and inspect oil level.

USED ENGINE OIL DISPOSAL

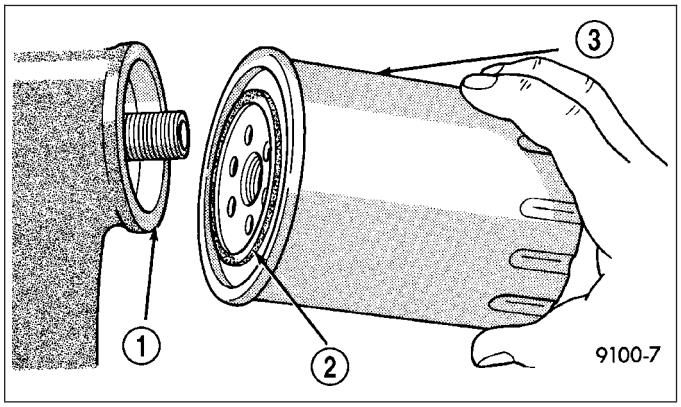
Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

FILTER - ENGINE OIL

REMOVAL

All engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

1. Position a drain pan under the oil filter.
2. Using a suitable oil filter wrench loosen filter (3).
3. Rotate the oil filter counterclockwise to remove it from the cylinder block oil filter boss.
4. When filter separates from cylinder block oil filter boss, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

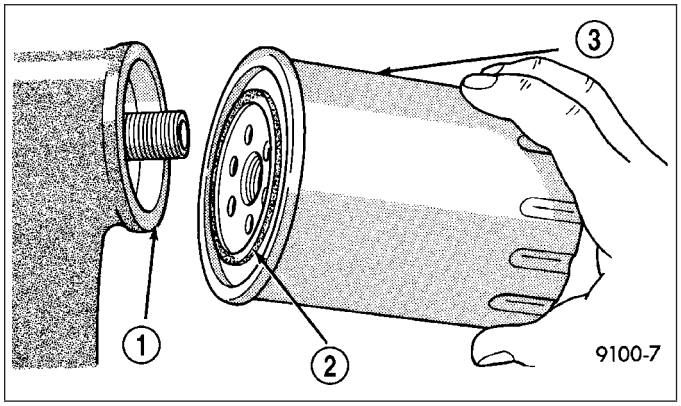


NOTE: Make sure filter gasket was removed with filter.

5. With a wiping cloth, clean the gasket sealing surface of oil and grime.

INSTALLATION

1. Lightly lubricate oil filter gasket (2) with engine oil.
2. Thread filter (3) onto adapter nipple. When gasket makes contact with sealing surface, hand tighten filter one half turn, or 180°,do not over tighten.
3. Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.



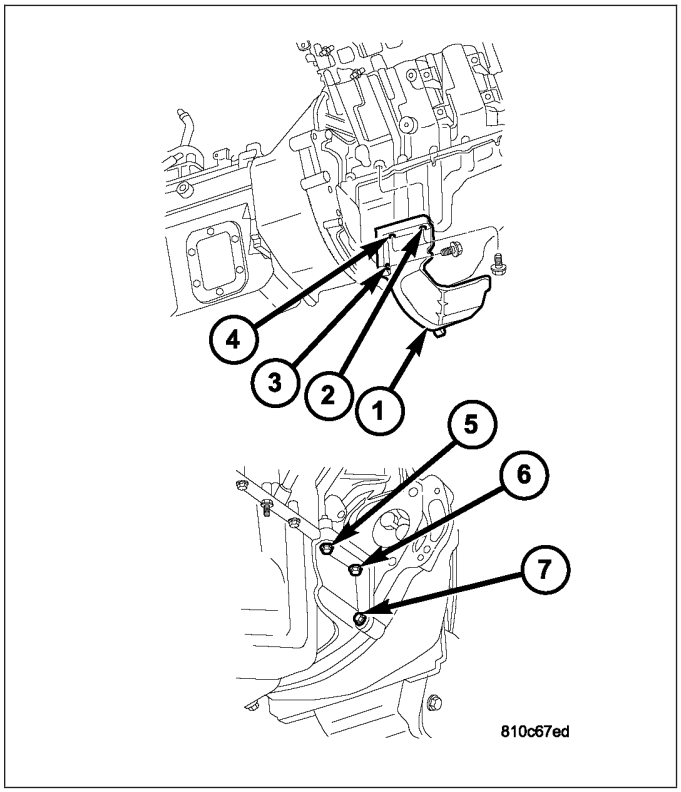
PAN - ENGINE OIL

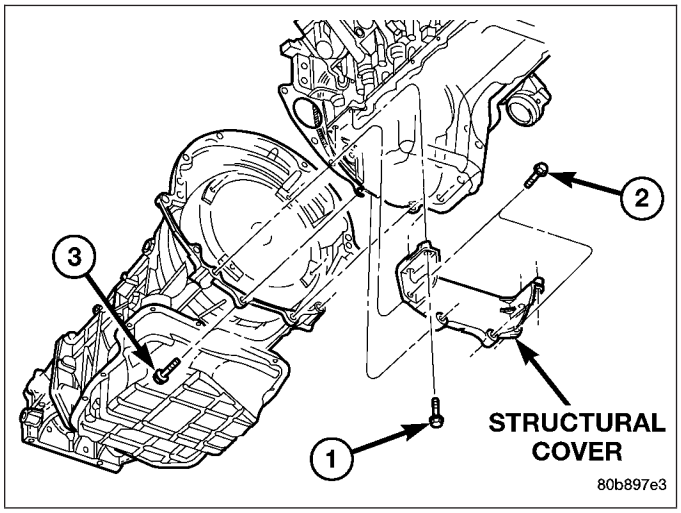
REMOVAL

1. Disconnect the negative battery cable.
2. Install engine support fixture special tool # 8534. **Do not raise engine at this time.**
3. **For 2WD vehicles,** Remove both engine mount to frame through bolts.
4. **For 4WD vehicles,** Loosen both left and right side engine mount bracket to mount bolts, and remove the lower bolt on each side. The upper hole in the engine bracket is slotted.
5. Remove the structural dust cover (1). (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - REMOVAL)
6. Drain engine oil.
7. Remove the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL).

CAUTION: Only raise the engine enough to provide clearance for oil pan removal. Check for proper clearance at fan shroud to fan and cowl to intake manifold.

8. Raise engine using special tool # 8534 to provide clearance to remove oil pan.
9. Remove the nuts from the transmission mount to crossmember.
10. Using suitable transmission jack, raise the transmission approximately 3 inches off of the crossmember.





NOTE: Do not pry on oil pan or oil pan gasket. Gasket is integral to engine windage tray and does not come out with oil pan.

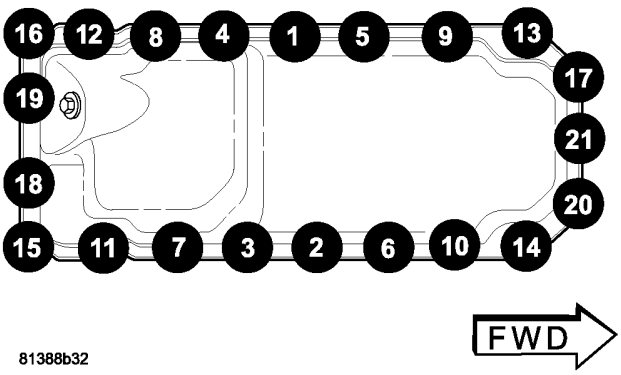
11. Remove the oil pan mounting bolts using the sequence above, and remove oil pan.

NOTE: The double ended oil pan studs must be installed in the same location that they were removed from.

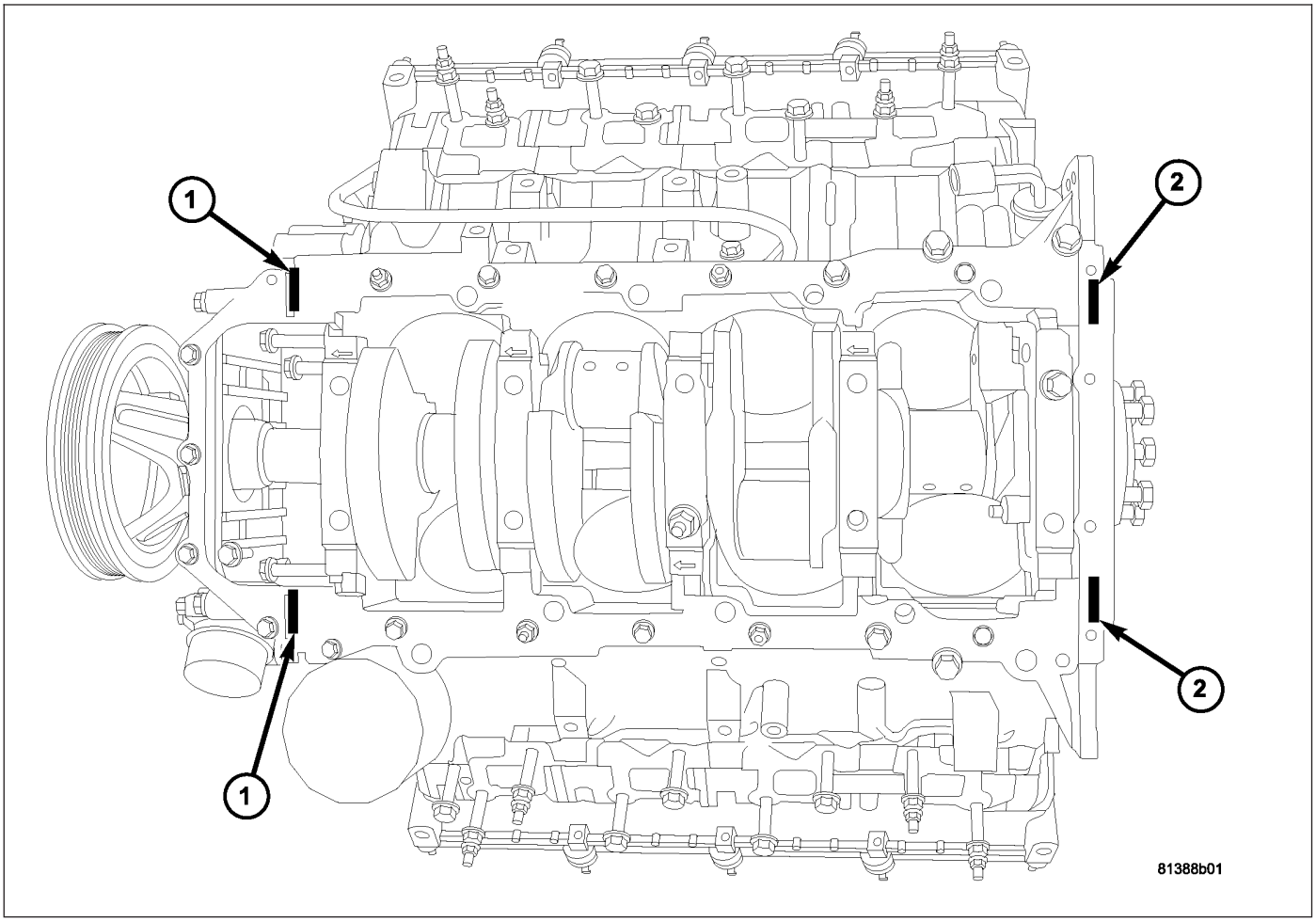
12. Unbolt oil pump pickup tube and remove tube.

NOTE: When the oil pan is removed, a new oil pan gasket/windage tray assembly must be installed. The old gasket cannot be reused.

13. Discard the integral windage tray and gasket and replace.



INSTALLATION



1. Clean the oil pan gasket mating surface of the block and oil pan.

NOTE: Mopar® Engine RTV must be applied to the 4 T-joints, (area where front cover, rear retainer, block, and oil pan gasket meet). The bead of RTV should cover the bottom of the gasket. This area is approximately 4.5 mm x 25 mm in each of the 4 T-joint locations.

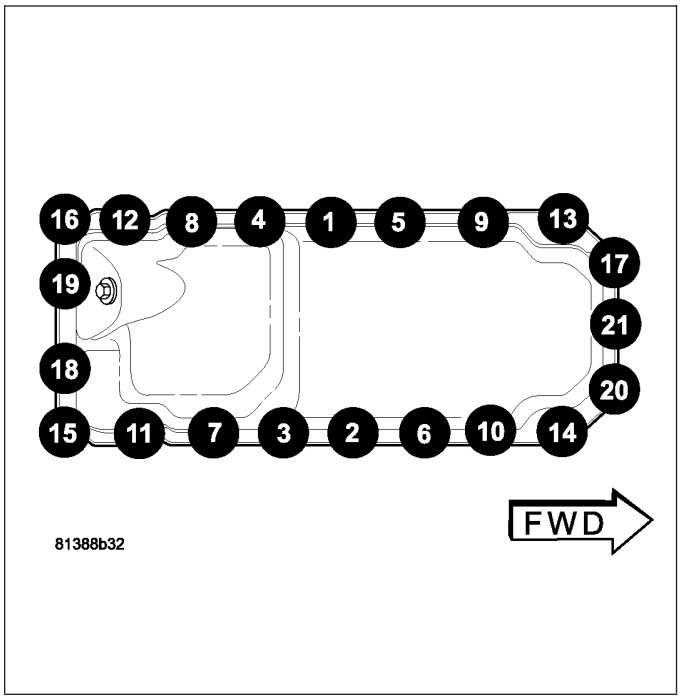
2. Apply Mopar® Engine RTV at the 4 T- joints.

NOTE: When the oil pan is removed, a new integral windage tray and gasket assembly must be installed. The old gasket cannot be reused.

3. Install a new integral windage tray and gasket.
4. Reinstall the oil pump pickup tube with new o-ring. Tighten tube to pump fasteners to 28 N·m (250 in. lbs.).

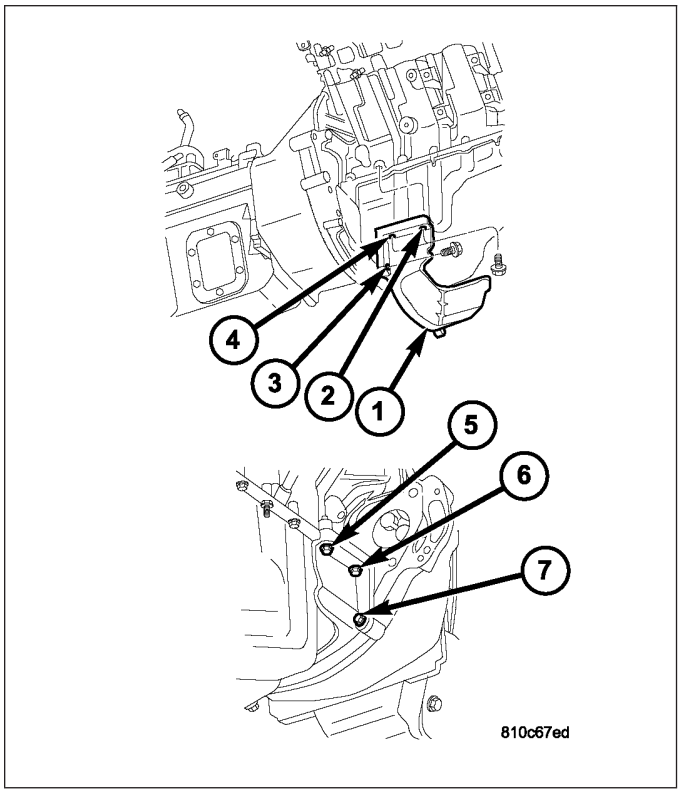
NOTE: The double ended oil pan studs must be installed in the same location that they were removed from.

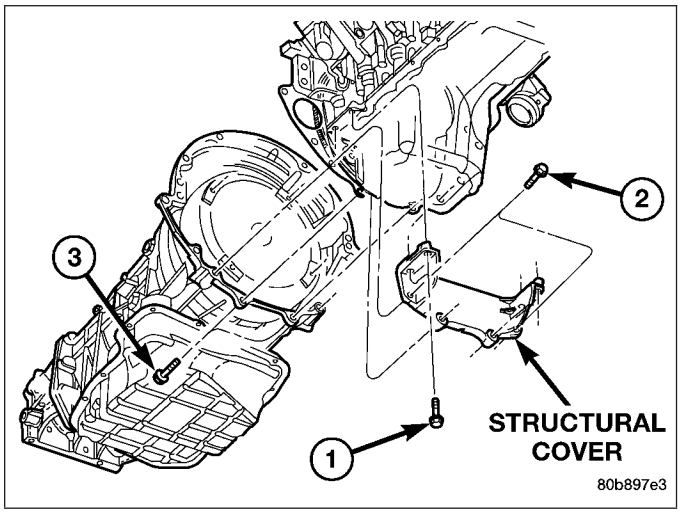
5. Position the oil pan and install the mounting bolts and studs. Tighten the mounting bolts to 12 N·m (105 in.lbs.), using the sequence above.
6. Lower the transmission onto the crossmember. Install nuts, and tighten.
7. Lower the engine into mounts using special tool # 8534.
8. **For 2WD vehicles,** Install both the left and right side engine mount through bolts. Tighten the nuts to 68 N·m (50 ft. lbs.).



9. **For 4WD vehicles,** Install both the left and right side engine mount bracket to mount bolts. Tighten the nuts to 68 N·m (50 ft. lbs.).
10. Remove special tool # 8534.

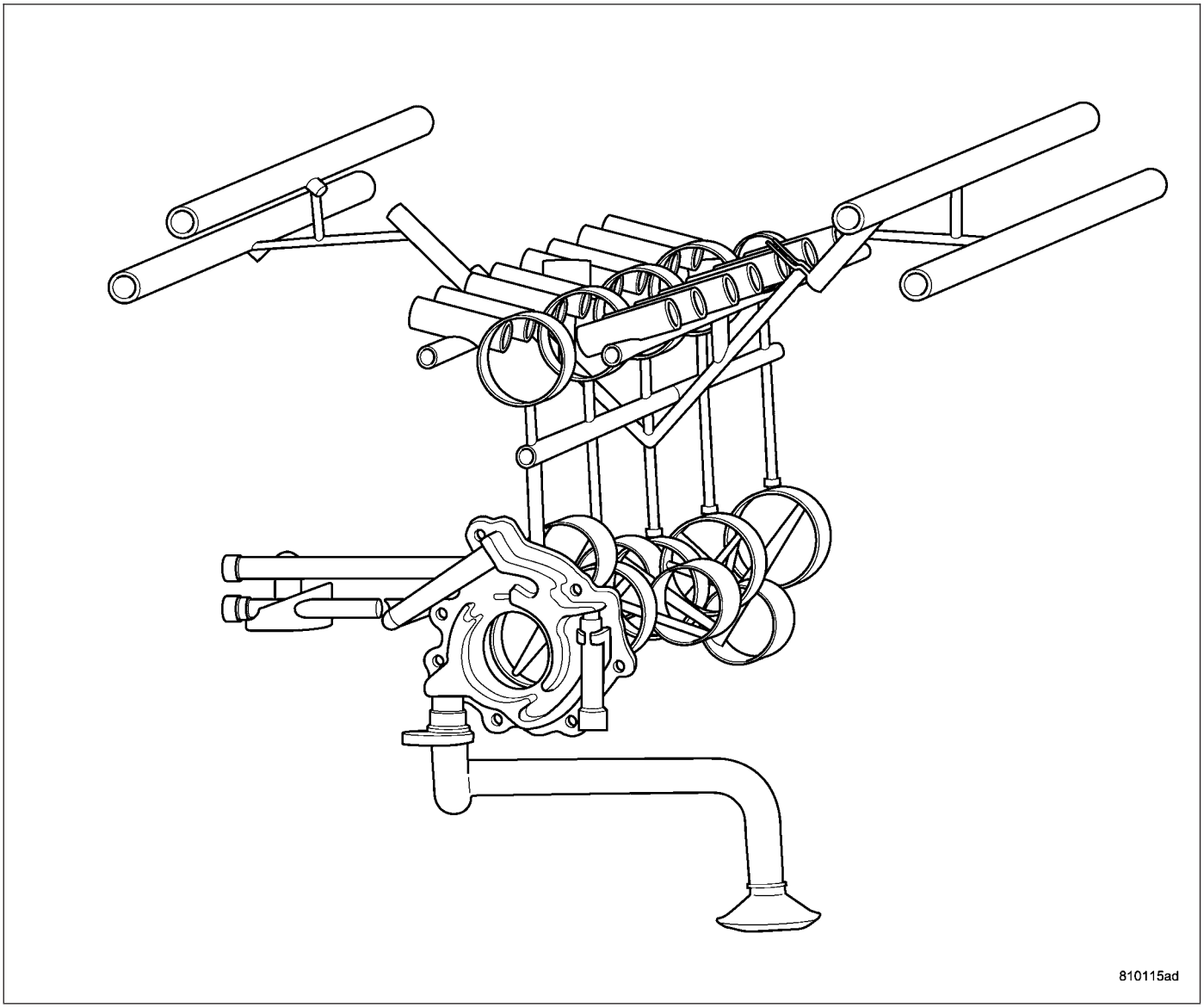
11. Install the structural dust cover (1). (Refer to 9 - ENGINE/ENGINE BLOCK/STRUCTURAL COVER - INSTALLATION).
12. Install the front crossmember (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - INSTALLATION).
13. Fill engine oil.
14. Reconnect the negative battery cable.
15. Start engine and check for leaks.





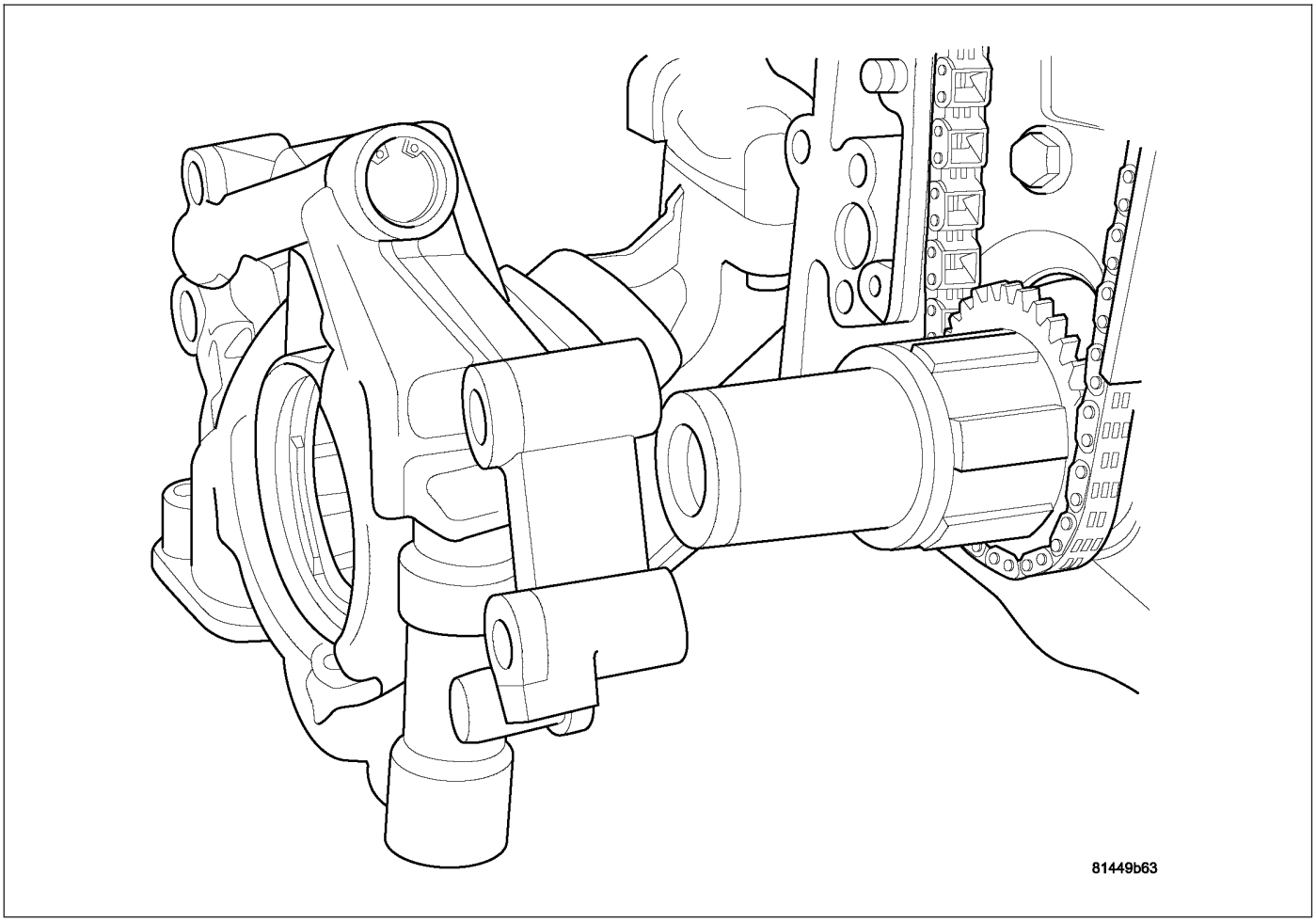
PUMP - ENGINE OIL

DESCRIPTION



The lubrication system is a full flow filtration pressure feed type.

REMOVAL



1. Remove the oil pan and pick-up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
2. Remove the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
3. Remove the four bolts, and the oil pump.

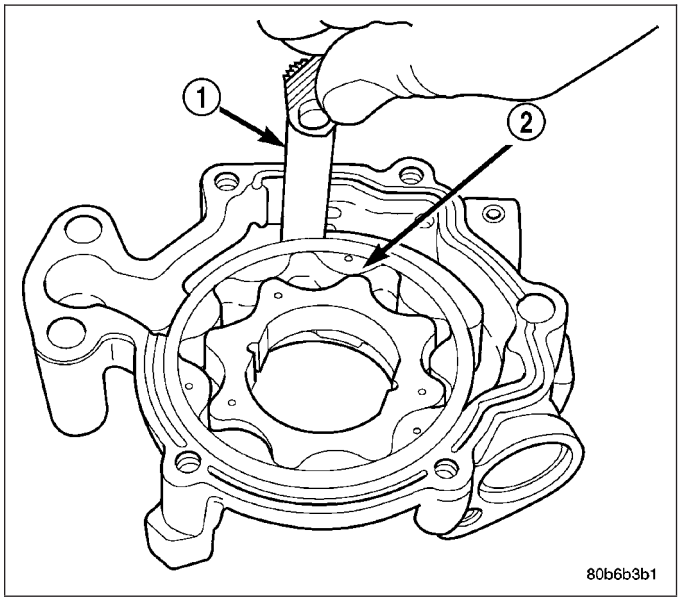
CLEANING

1. Wash all parts in a suitable solvent.

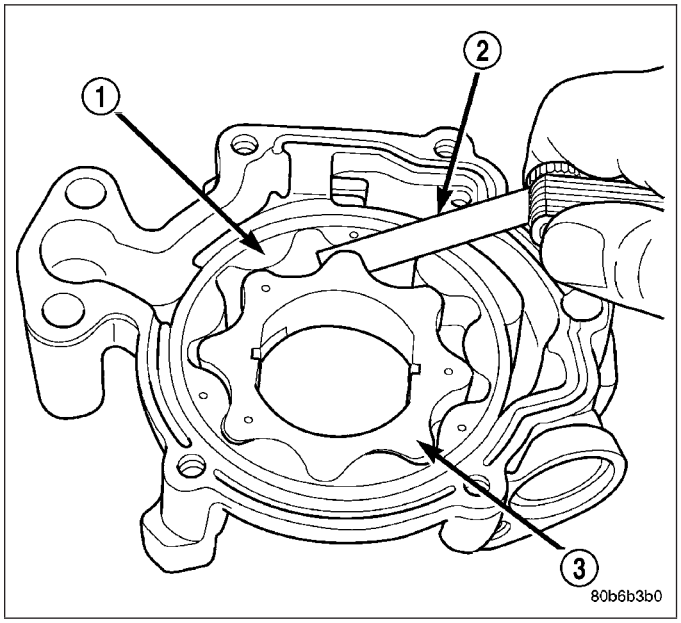
INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If these components are disassembled and or removed from the pump the entire oil pump assembly must be replaced.

1. Remove the pump cover.
2. Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.
3. Slide outer rotor into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor (2) and the body. If the measurement is 0.235mm (0.009 in.) or more the oil pump assembly must be replaced.

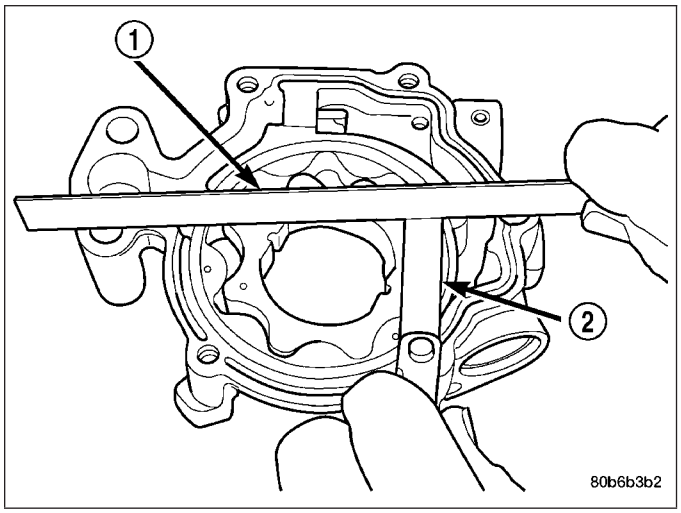


4. Install the inner rotor in the into the oil pump body. Measure the clearance between the inner (3) and outer rotors (1). If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.

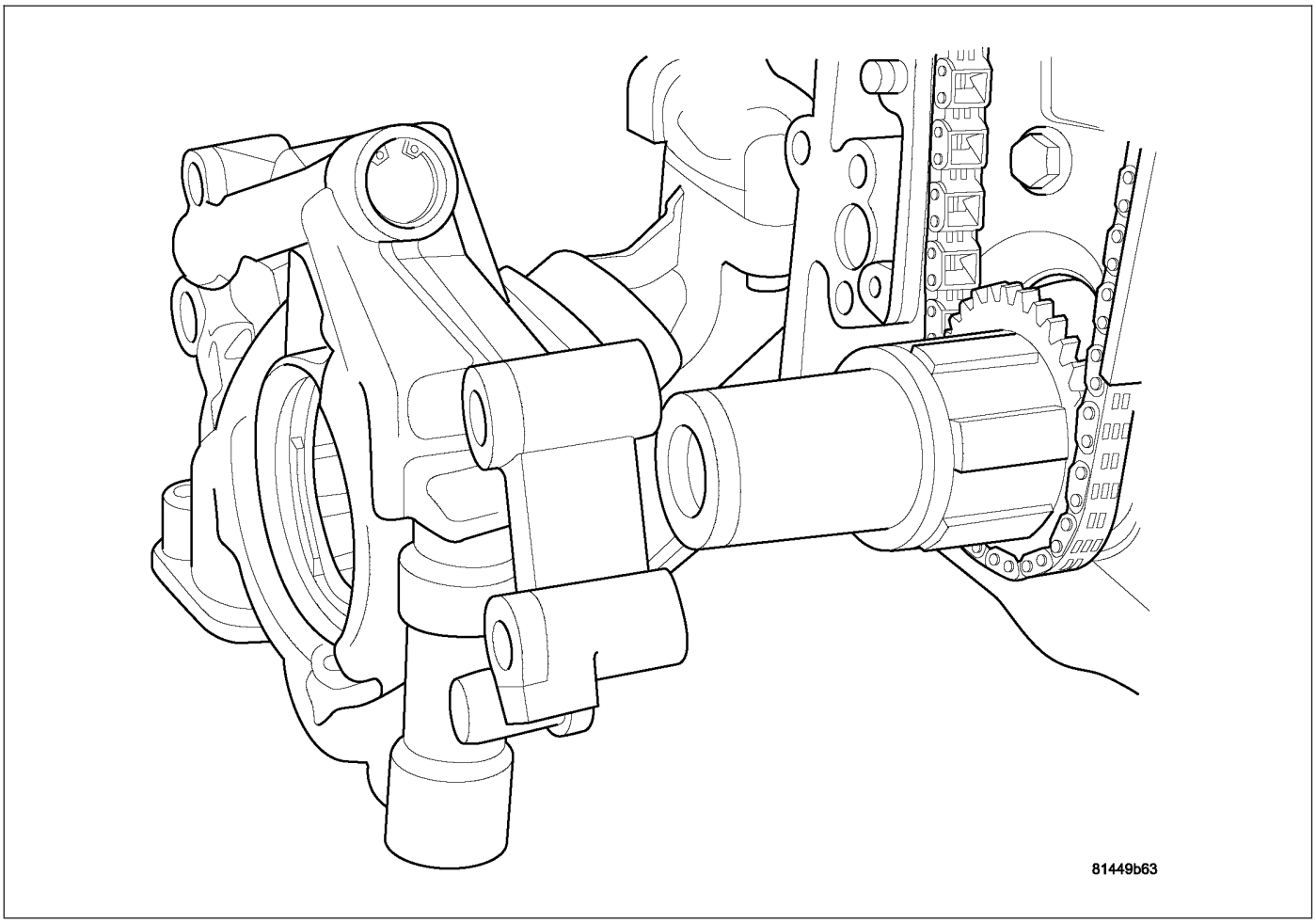


5. Place a straight edge (1) across the body of the oil pump (between the bolt holes), if a feeler gauge (2) of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced.
6. Reinstall the pump cover. Torque fasteners to 15 N·m (132 in. lbs.).

NOTE: The 5.7 Oil pump is released as an assembly. There are no DaimlerChrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.



INSTALLATION



1. Position the oil pump onto the crankshaft and install the 4 oil pump retaining bolts.
2. Tighten the oil pump retaining bolts to 28 N·m (250 in. lbs.).
3. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
4. Install the pick-up tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

MANIFOLD - INTAKE

DESCRIPTION

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks.

DIAGNOSIS AND TESTING - INTAKE MANIFOLD LEAKAGE

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

1. Start the engine.
2. Spray a small stream of water at the suspected leak area.
3. If a change in RPM is observed the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

1. Disconnect negative cable from battery.
2. Remove resonator assembly and air inlet hose.
3. Disconnect electrical connectors for the following components:
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
4. Disconnect brake booster hose and positive crankcase ventilation (PCV) hose.
5. Remove generator and set aside.

NOTE: It is not necessary to remove lines or remove freon from A/C compressor.

6. Remove air conditioning compressor and set aside..
7. Bleed fuel system (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
8. Remove intake manifold retaining fasteners in a crisscross pattern starting from the outside bolts and ending at the middle bolts.
9. Remove intake manifold and IAFM as an assembly.

CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

1. Inspect the intake sealing surface for cracks, nicks and distortion.
2. Inspect the intake manifold vacuum hose fittings for looseness or blockage.
3. Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

INSTALLATION

1. Install intake manifold seals.
2. Position intake manifold and IAFM.
3. Install intake manifold retaining bolts, and tighten in sequence from the middle bolts towards the outside in a crisscross pattern. Torque fasteners to 12 N·m (105 in. lbs.).
4. Connect electrical connectors for the following components:
   - Manifold Absolute Pressure (MAP) Sensor
   - Intake Air Temperature (IAT) Sensor
   - Throttle Position (TPS) Sensor
   - Coolant Temperature (CTS) Sensor
   - Idle Air Control (IAC) Motor
5. Install generator.
6. Install A/C compressor.
7. Connect Brake booster hose and Positive crankcase ventilation (PCV) hose.
8. Install resonator assembly and air inlet hose.
9. Connect negative cable to battery.

MANIFOLD - EXHAUST

DESCRIPTION

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

OPERATION

The exhaust manifolds collect the engine exhaust exiting the combustion chambers, then channels the exhaust gases to the exhaust pipes attached to the manifolds.

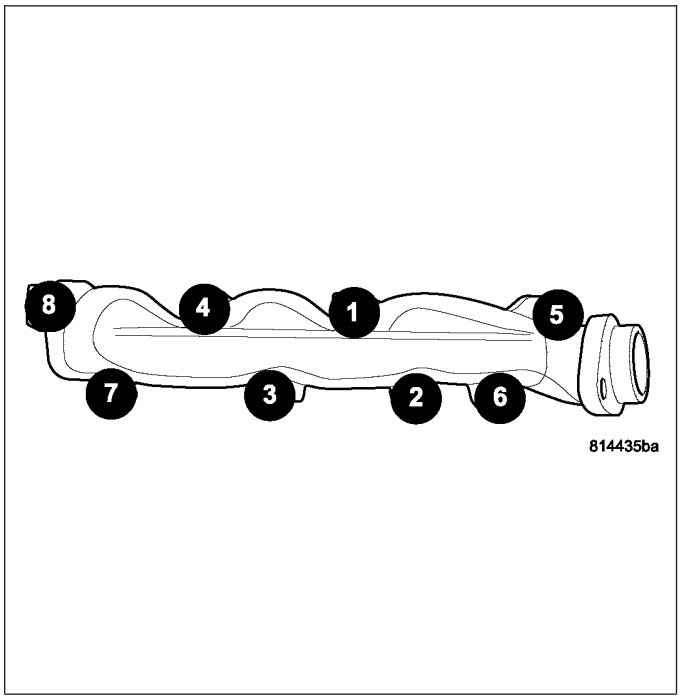
REMOVAL

EXHAUST MANIFOLD

1. Disconnect negative battery cable.
2. Raise vehicle.
3. Remove exhaust pipe to manifold bolts.
4. Lower vehicle.
5. Install engine support fixture special tool #8534.
6. Raise engine enough to remove manifolds.

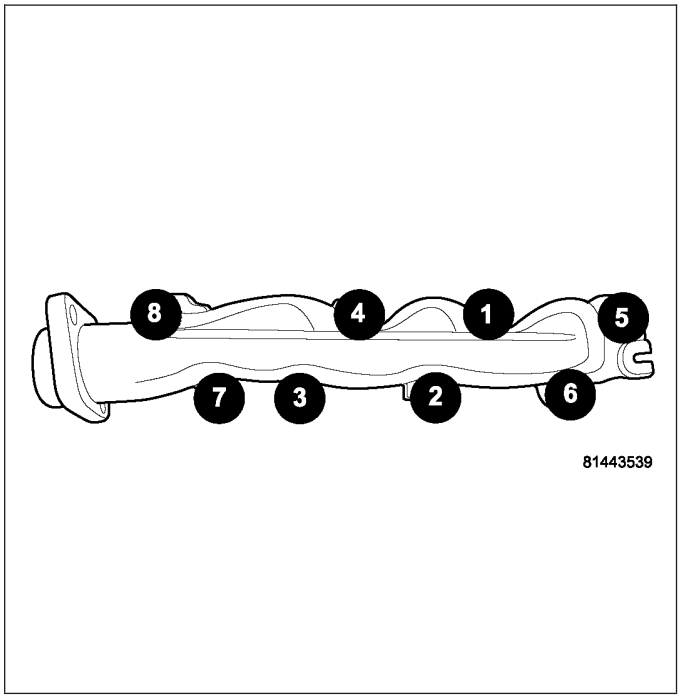
CAUTION: Do not damage engine harness while raising the engine.

7. Remove heat shield.
8. Remove manifold bolts using sequence provided.
9. Remove manifold and gasket.



CLEANING

Clean mating surfaces on cylinder head and manifold. Wash with solvent and blow dry with compressed air.



INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straight edge. Gasket surfaces must be flat within 0.2 mm per 300 mm (0.008 inch per foot).

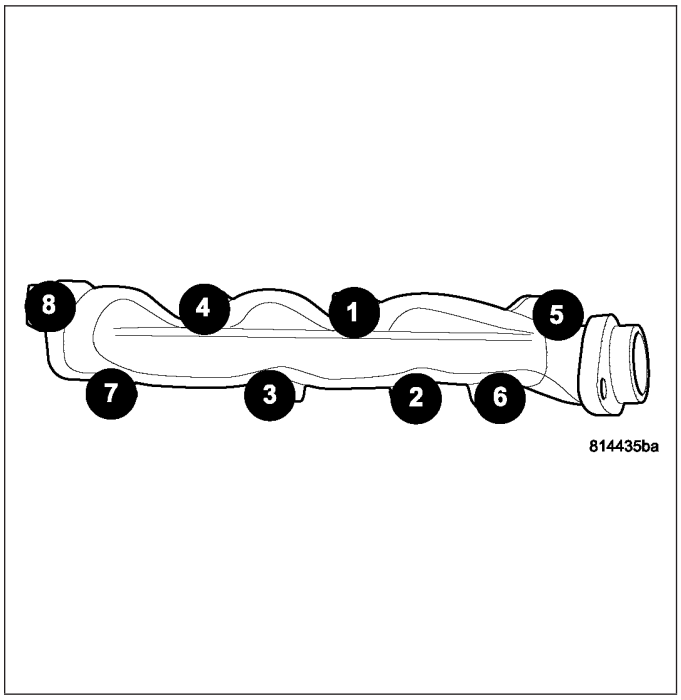
INSTALLATION

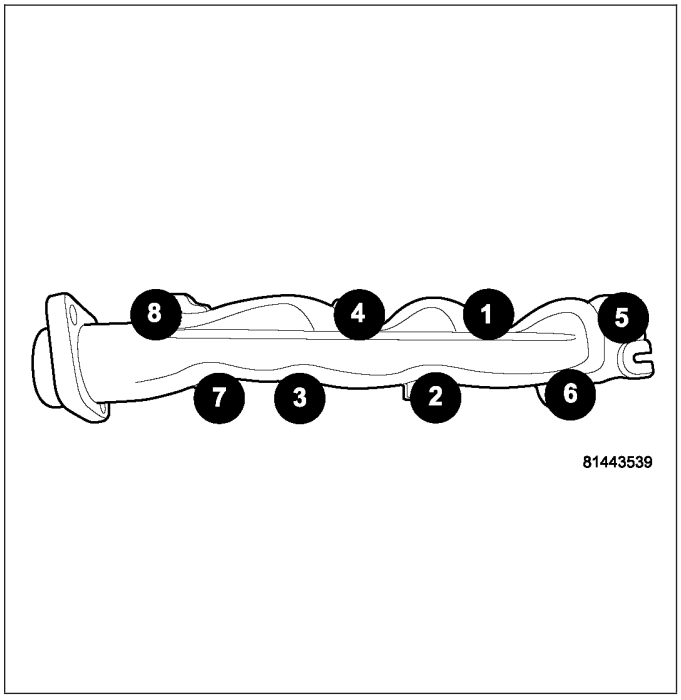
EXHAUST MANIFOLD

1. Install manifold gasket and manifold.
2. Install manifold bolts and tighten using sequence provided to 25 N·m (18 ft. lbs.).
3. Install heat shield and tighten nuts to 15 N·m (11 ft. lbs.).
4. Lower engine.

CAUTION: Do not damage engine harness while lowering the engine.

5. Remove engine support fixture from engine.
6. Raise vehicle.
7. Tighten right and left side engine mount through bolts.
8. Install exhaust flange to pipe bolts.
9. Lower vehicle.
10. Connect negative battery cable.





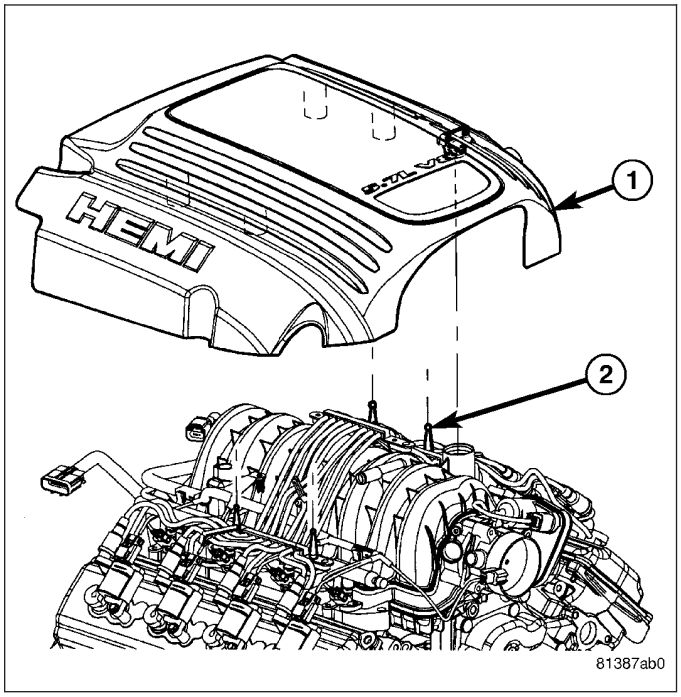
COVER - TIMING

REMOVAL

1. Disconnect the battery negative cable.
2. Remove the engine cover (1).
3. Remove air cleaner assembly.
4. Drain cooling system.
5. Remove accessory drive belt.
6. Remove fan and fan drive assembly (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).
7. Remove coolant bottle and washer bottle.
8. Remove fan shroud.

NOTE: It is not necessary to disconnect A/C lines or discharge freon.

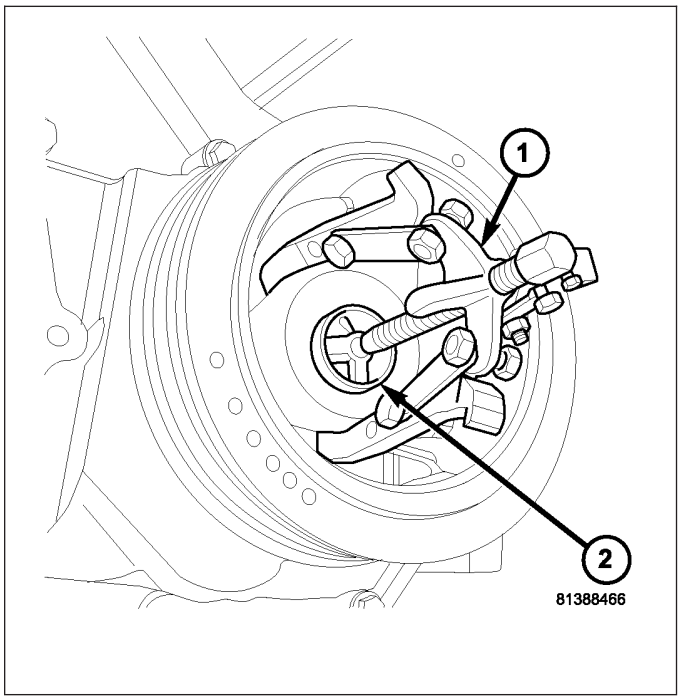
9. Remove A/C compressor and set aside.

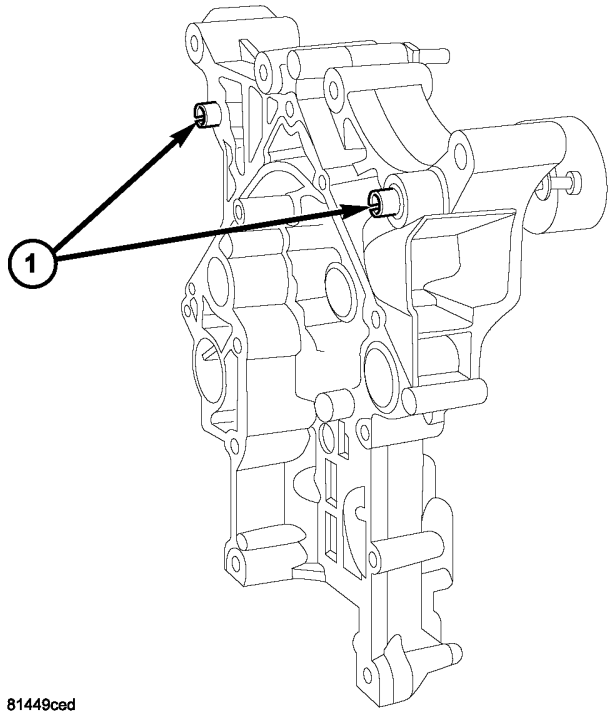


10. Remove the generator.
11. Remove upper radiator hose.
12. Disconnect both heater hoses at timing cover.
13. Disconnect lower radiator hose at engine.
14. Remove accessory drive belt tensioner and both idler pulleys.
15. Remove crankshaft damper (2) (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

NOTE: Do not remove the hoses from the power steering pump.

16. Remove power steering pump and set aside.



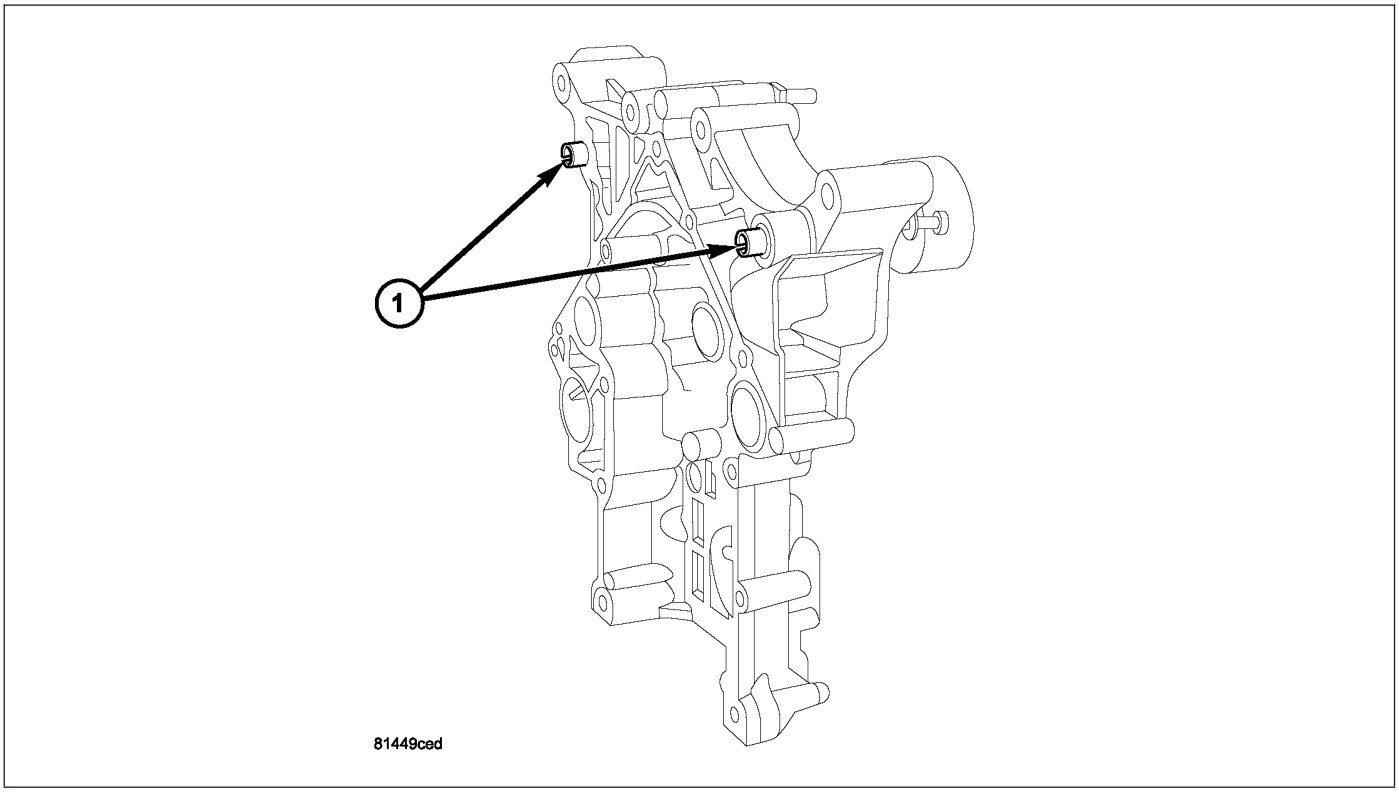


17. Remove the dipstick support bolt.
18. Drain the engine oil.
19. Remove the oil pan and pick up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

NOTE: It is not necessary to remove water pump for timing cover removal.

20. Remove timing cover bolts and remove cover.
21. Verify that timing cover slide bushings (1) are located in timing cover.

INSTALLATION



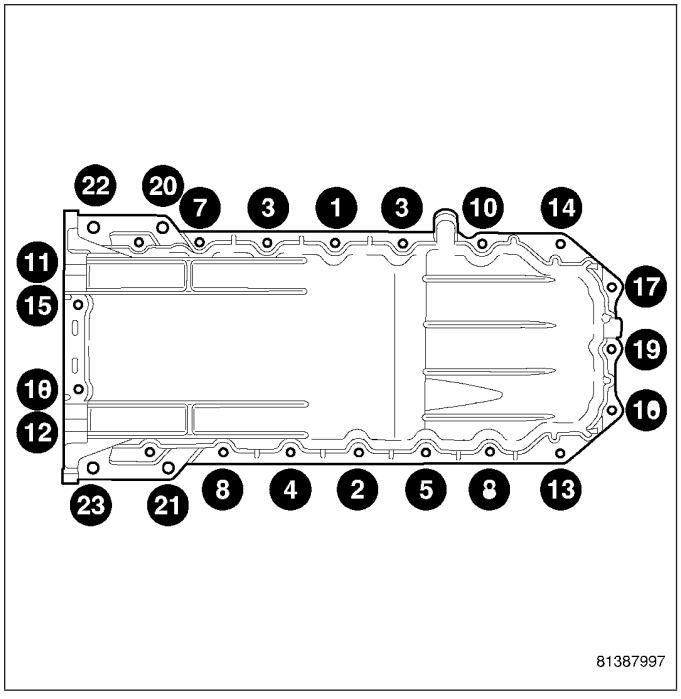
1. Clean timing chain cover and block surface.

NOTE: Always install a new gasket on timing cover.

2. Verify that the slide bushings (1) are installed in timing cover.
3. Install cover and new gasket. Tighten fasteners to 28 N·m (250 in. lbs.).

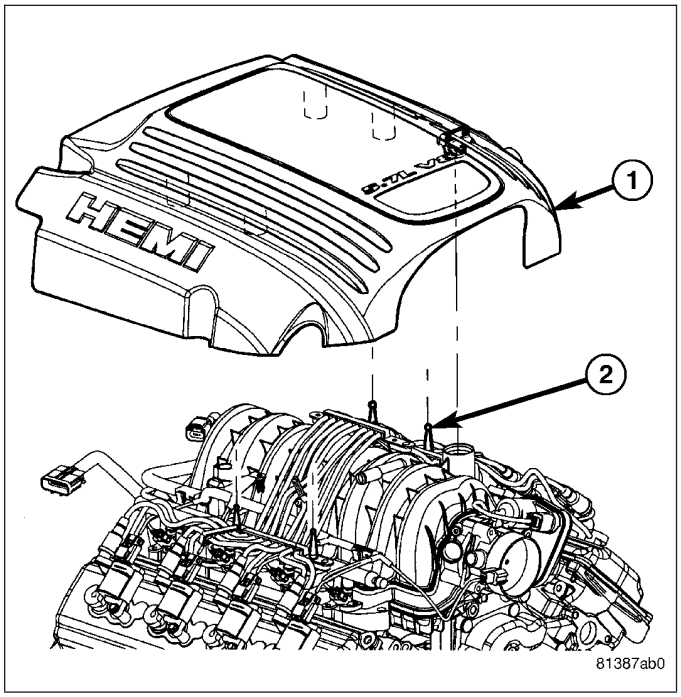
NOTE: The large lifting stud is torqued to 55 N·m (40 ft. lbs.).

4. Install the oil pan and pick up tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
5. Install the A/C compressor.
6. Install the generator.
7. Install power steering pump.
8. Install the dipstick support bolt.
9. Install the thermostat housing.
10. Install crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).



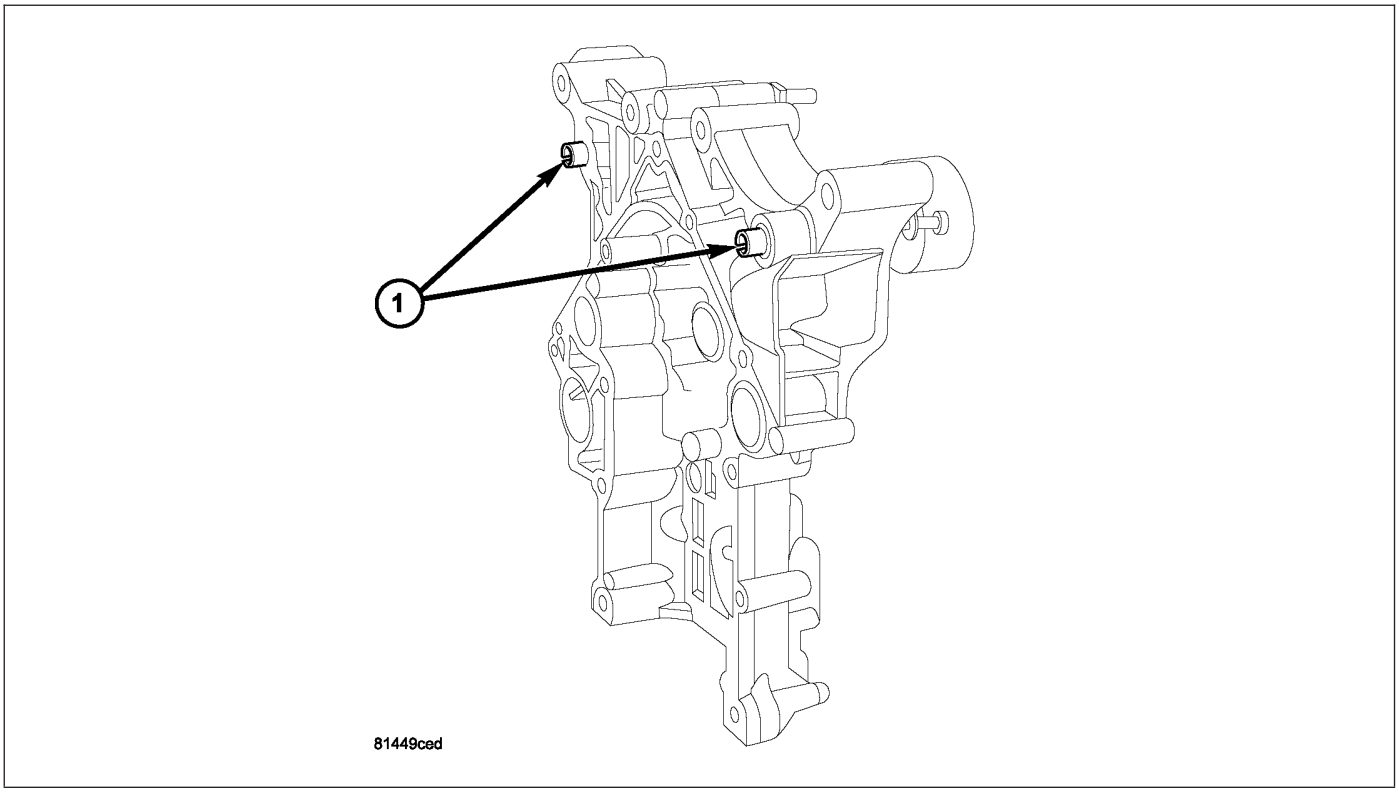
11. Install accessory drive belt tensioner assembly and both idler pulleys.

12. Install radiator lower hose.
13. Install both heater hoses.
14. Install radiator fan shroud.
15. Install the fan and fan drive assembly
16. Install the accessory drive belt.
17. Install the coolant bottle and washer bottle.
18. Install the upper radiator hose.
19. Install the air cleaner assembly.
20. Fill cooling system.
21. Refill engine oil.
22. Connect the battery negative cable.
23. Install the engine cover (1).



TIMING CHAIN & SPROCKETS

REMOVAL

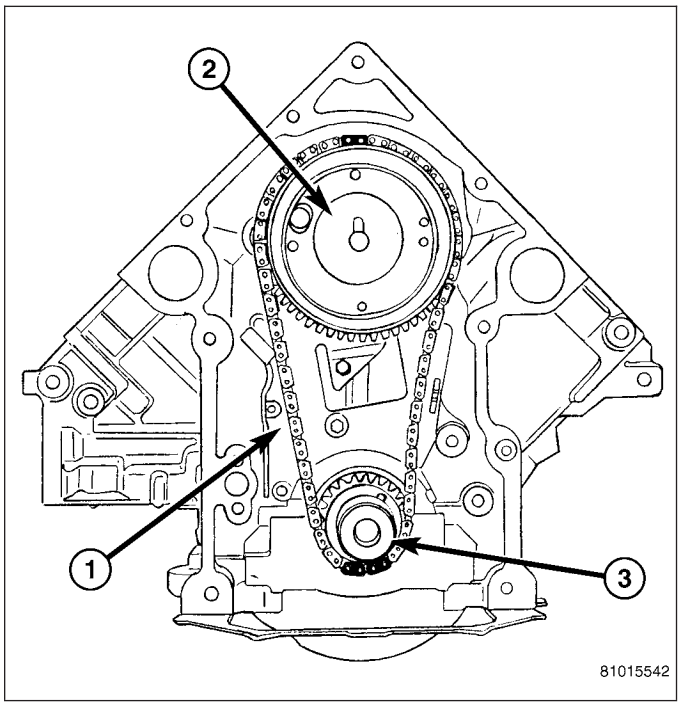


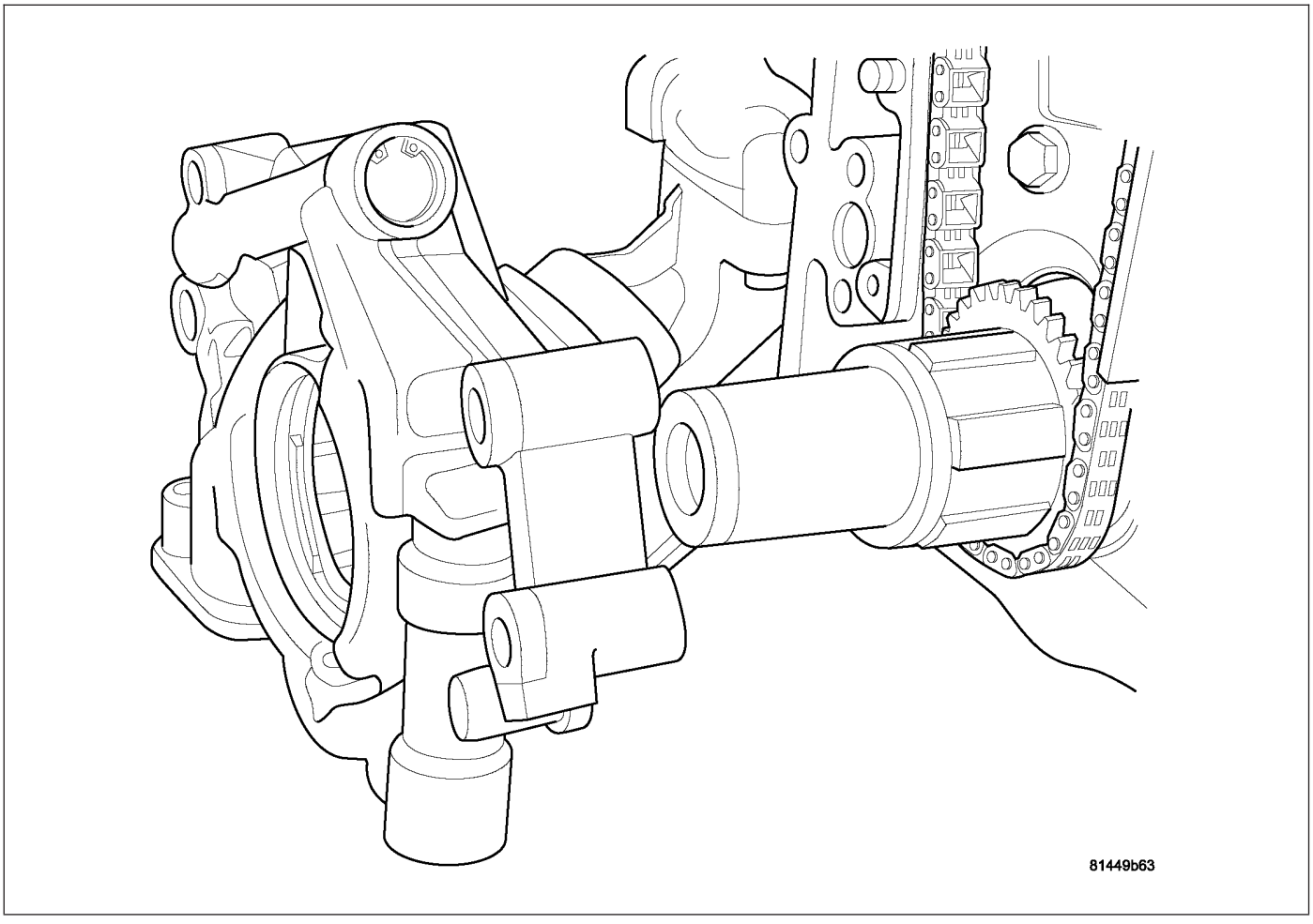
1. Disconnect battery negative cable.
2. Drain cooling system.

3. Remove Timing Chain Cover (1).

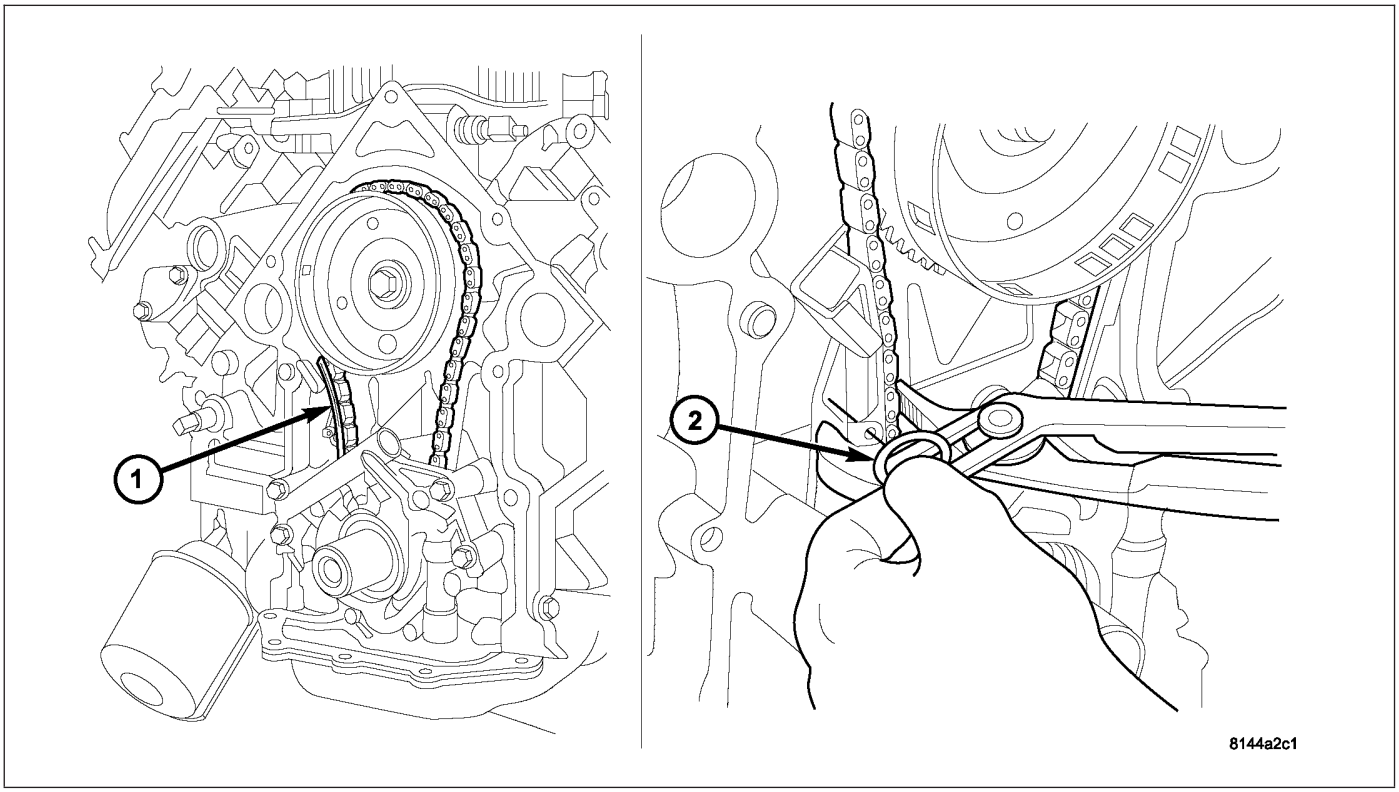
4. Re-install the vibration damper bolt finger tight. Using a suitable socket and breaker bar, rotate the crankshaft to align timing chain sprockets and keyways as shown.

CAUTION: The camshaft pin and the slot in the cam sprocket must be clocked at 12:00 (2). The crankshaft keyway must be clocked at 2:00 (3). The crankshaft sprocket must be installed so that the dots and or paint marking is at 6:00.



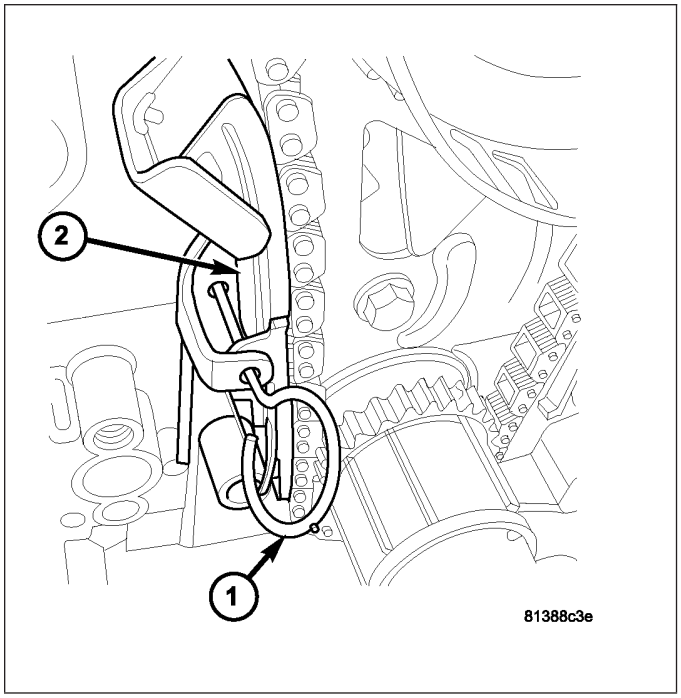


5. Remove oil pump.

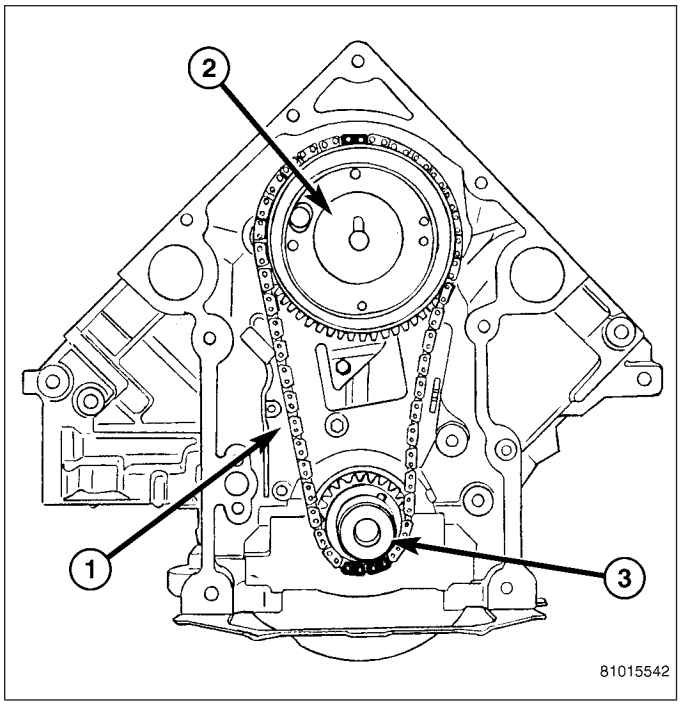


6. Retract tensioner shoe (1) until hole in shoe lines up with hole in bracket..

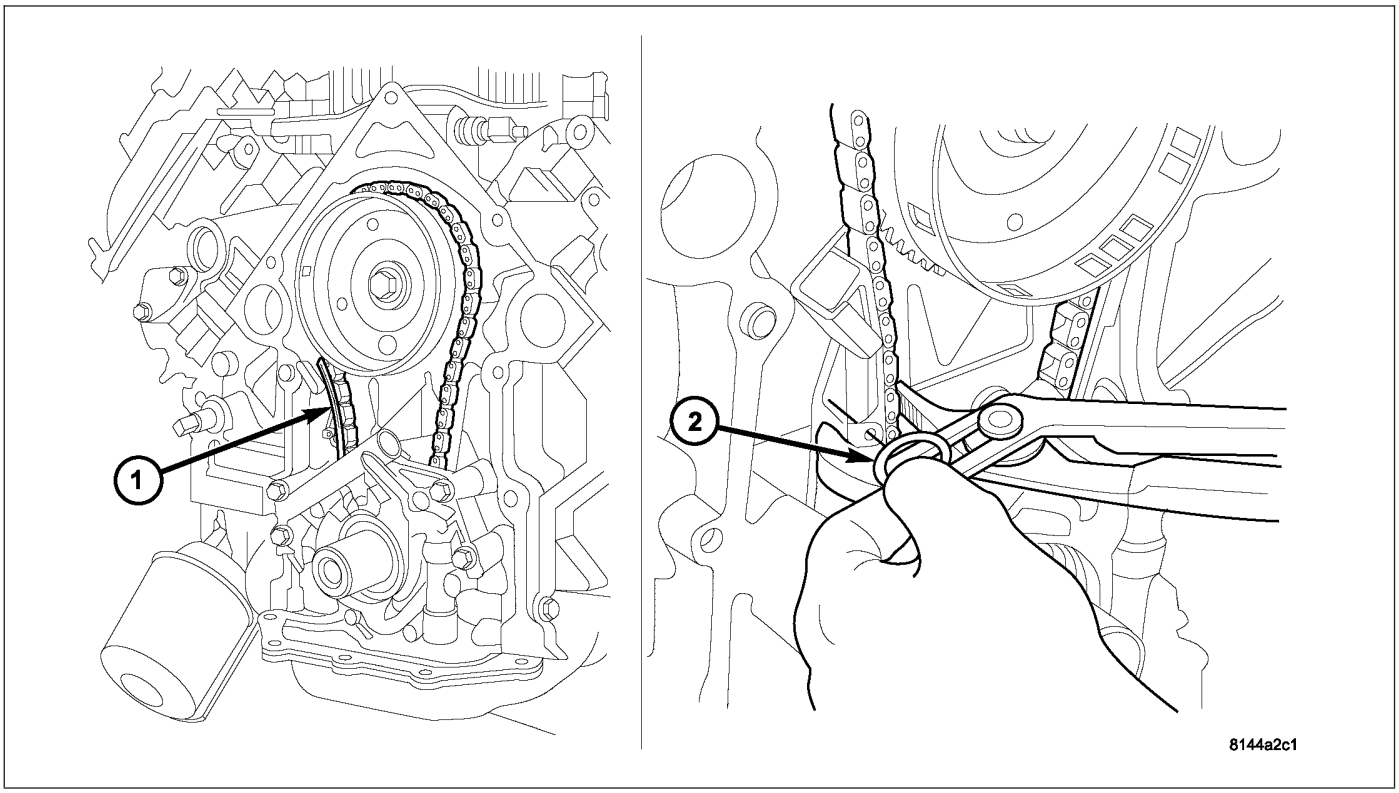
7. Slide a suitable pin (2) into the holes.



8. Remove camshaft sprocket attaching bolt and remove timing chain with crankshaft and camshaft sprockets (2).
9. If tensioner assembly is to be replaced, remove the tensioner to block bolts and remove tensioner assembly.



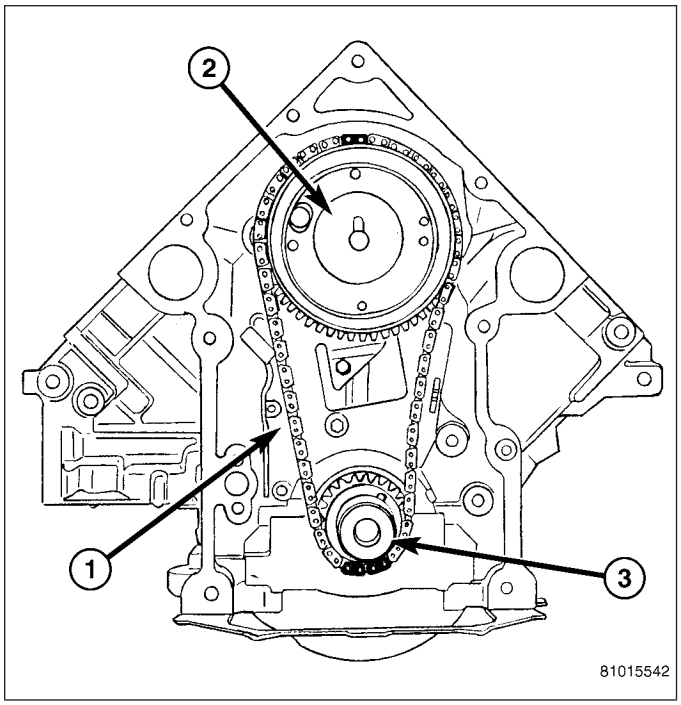
INSTALLATION



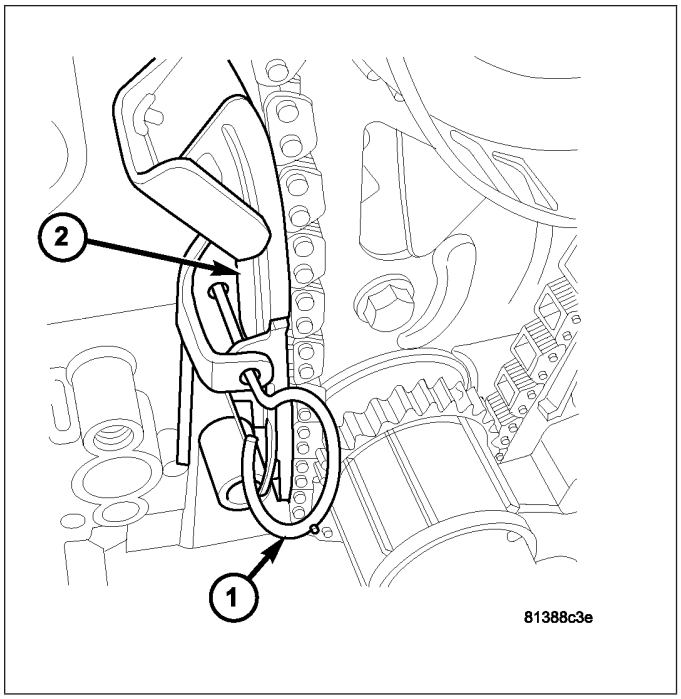
1. If tensioner (1) assembly is being replaced, install tensioner and mounting bolts. Torque bolts to 28 N·m (250 in. lbs.).
2. Retract tensioner (2) if required.

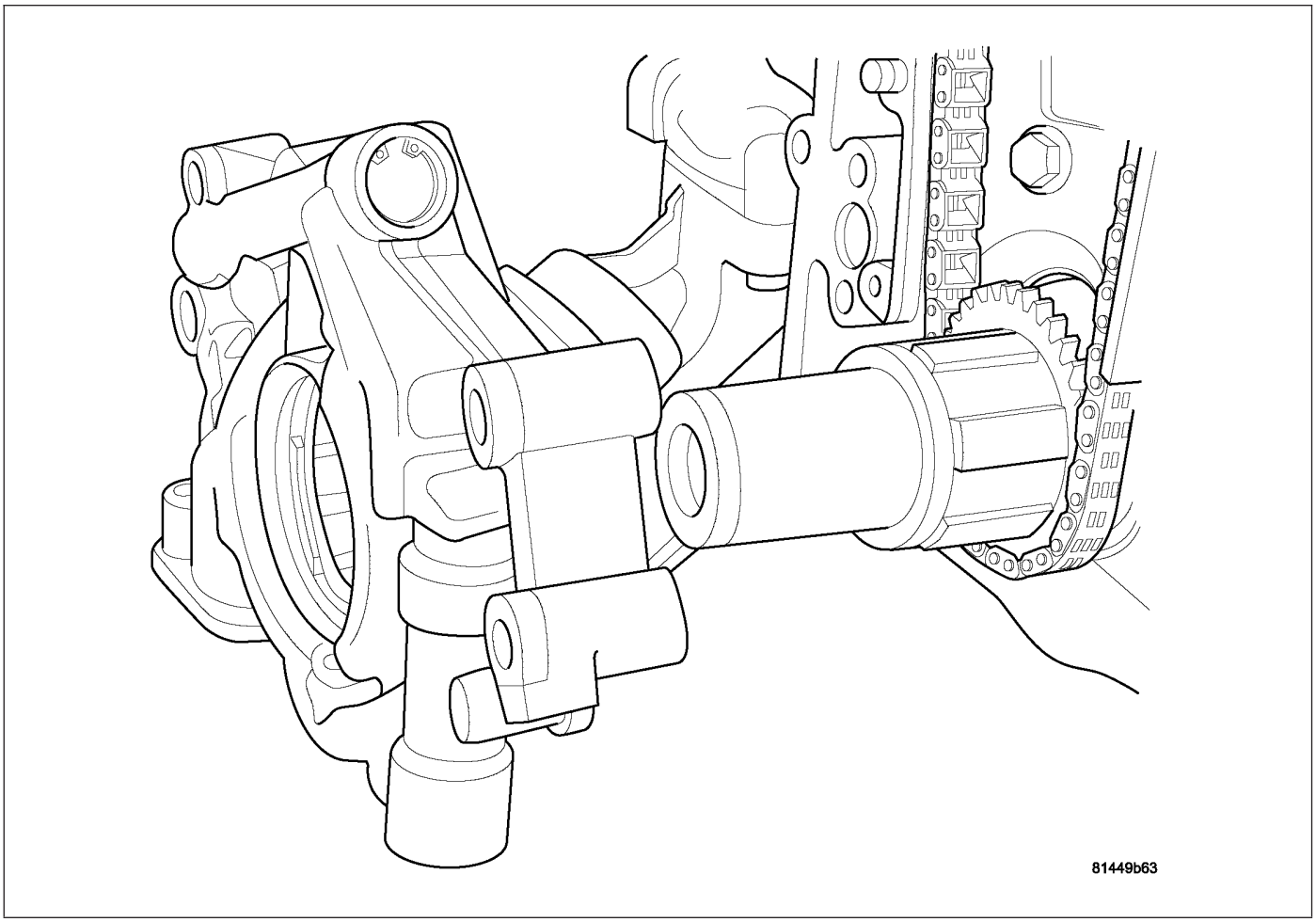
CAUTION: The timing chain must be installed with the single plated link aligned with the dot and or paint marking on the camshaft sprocket. The crankshaft sprocket is aligned with the dot and or paint marking on the sprocket between two plated timing chain links.

CAUTION: The camshaft pin and the slot in the cam sprocket must be clocked at 12:00. The crankshaft keyway must be clocked at 2:00. The crankshaft sprocket must be installed so that the dots and or paint marking is at 6:00.

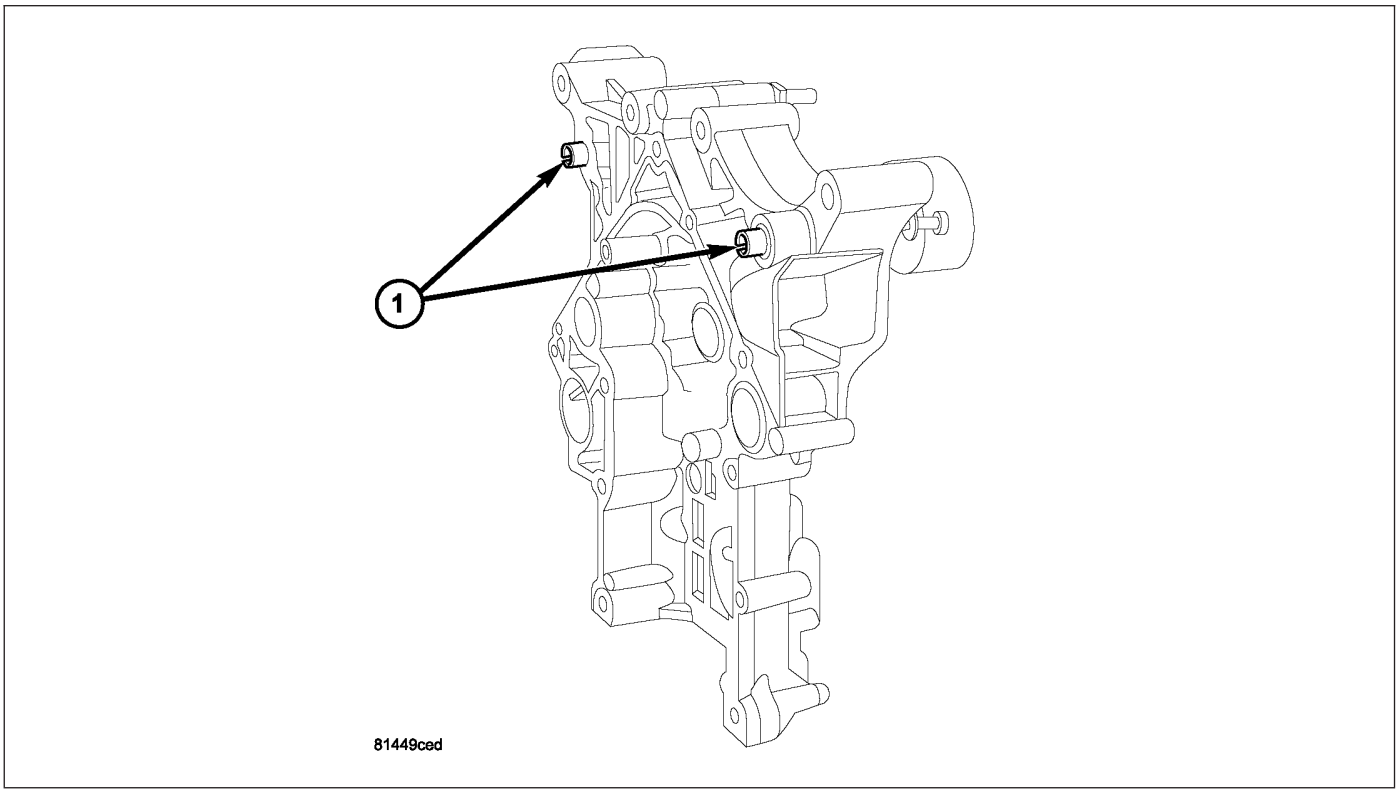


3. Place both camshaft sprocket and crankshaft sprocket on the bench with timing marks on exact imaginary center line through both camshaft and crankshaft bores.
4. Place timing chain around both sprockets.
5. Lift sprockets and chain (keep sprockets tight against the chain in position as shown).
6. Slide both sprockets (2,3) evenly over their respective shafts and check alignment of timing marks.
7. Install the camshaft bolt. Tighten the bolt to 122 N·m (90 ft. lbs.) torque.
8. **Remove tensioner pin. (1)** Again, verify alignment of timing marks.





9. Install the oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
10. Install the oil pan and pick up (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).



11. Install the timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
12. Refill engine oil.
13. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
14. Connect battery negative cable.
15. Start engine and check for oil and coolant leaks.

TENSIONER - TIMING CHAIN

DESCRIPTION

The timing chain tensioner is a stamped steel constant tension mechanical design. It is mounted to the front of the engine, behind the timing chain drive.

OPERATION

The timing chain tension is maintained by routing the timing chain through the tensioner assembly. A nylon covered spring steel arm presses on the timing chain maintaining the correct chain tension.

ENGINE - 8.3L - SERVICE INFORMATION

TABLE OF CONTENTS

page

ENGINE - 8.3L - SERVICE INFORMATION
DESCRIPTION 2422
DIAGNOSIS AND TESTING
INTRODUCTION 2423
ENGINE DIAGNOSIS - PERFORMANCE . . 2424
ENGINE DIAGNOSIS - MECHANICAL 2425
CYLINDER COMPRESSION PRESSURE TEST 2427
CYLINDER COMBUSTION PRESSURE LEAKAGE TEST 2427
CYLINDER HEAD GASKET FAILURE DIAGNOSIS 2428
HYDRAULIC TAPPET NOISE DIAGNOSIS . 2429
ENGINE OIL LEAK INSPECTION 2429
STANDARD PROCEDURE
ENGINE CORE AND OIL GALLERY PLUGS 2431
FORM-IN-PLACE GASKETS AND SEALERS 2431
ENGINE GASKET SURFACE PREPARATION 2432
HYDROSTATIC LOCKED ENGINE 2432
REMOVAL - ENGINE ASSEMBLY 2433
INSTALLATION - ENGINE ASSEMBLY 2437
SPECIFICATIONS
ENGINE 2440
TORQUE 2445
SPECIAL TOOLS
ENGINE 2447
SYSTEM-AIR INTAKE
DESCRIPTION 2450
ELEMENT-AIR CLEANER
REMOVAL 2450
INSTALLATION 2451
HOUSING-AIR CLEANER
REMOVAL 2452
INSTALLATION 2453
MOUNTS-ENGINE
REMOVAL 2454
INSTALLATION 2455
MANIFOLD-INTAKE
DIAGNOSIS AND TESTING
INTAKE MANIFOLD LEAKS 2456
REMOVAL 2457
INSPECTION 2459
INSTALLATION 2459
MANIFOLD-EXHAUST
REMOVAL 2462
INSPECTION 2463
INSTALLATION 2463

page

HEAD(S)-CYLINDER
REMOVAL - CYLINDER HEAD(S) 2464
CLEANING
CLEANING / INSPECTION 2465
INSTALLATION - CYLINDER HEAD(S) 2465
COVER(S)-CYLINDER HEAD
REMOVAL 2467
INSTALLATION 2468
ARMS-ROCKER
REMOVAL 2469
INSTALLATION 2469
SPRINGS/SEALS-VALVE
DIAGNOSIS AND TESTING
VALVE SPRING TESTING 2470
STANDARD PROCEDURE - VALVE SPRING/ SEAL SERVICE IN-CAR 2470
REMOVAL 2471
INSTALLATION 2472
INTAKE/EXHAUST - VALVES/SEATS/GUIDES
STANDARD PROCEDURE - VALVE AND VALVE SEAT - REFACING 2473
INSPECTION 2474
COVER-TIMING CHAIN
REMOVAL 2476
INSTALLATION 2478
TIMING CHAIN AND SPROCKETS
REMOVAL 2480
INSTALLATION 2482
LUBRICATION
DESCRIPTION 2483
OPERATION 2483
DIAGNOSIS AND TESTING
CHECKING ENGINE OIL PRESSURE 2483
ENGINE OIL LEAK 2483
OIL
STANDARD PROCEDURE
CHECKING ENGINE OIL LEVEL 2484
ENGINE OIL AND FILTER CHANGE 2485
COOLER & LINES-OIL
DESCRIPTION 2485
OPERATION 2485
STANDARD PROCEDURE - OIL COOLER LINE QUICK CONNECT FITTING DISASSEMBLY/ ASSEMBLY 2486
REMOVAL 2487
INSTALLATION 2488
PAN-OIL
REMOVAL 2488
INSTALLATION 2490
PUMP-OIL
REMOVAL 2492

DISASSEMBLY 2492
CLEANING 2493
INSPECTION 2493
ASSEMBLY 2495
INSTALLATION 2496
SENSOR-OIL PRESSURE
REMOVAL 2497
INSTALLATION 2497
SENSOR-OIL TEMPERATURE
REMOVAL 2498
INSTALLATION 2498
BLOCK-ENGINE
DESCRIPTION 2499
STANDARD PROCEDURE - CYLINDER BORE HONING 2499
CLEANING 2499
INSPECTION 2500
HYDRAULIC TAPPETS
DESCRIPTION 2500
REMOVAL 2501
INSTALLATION 2501
CAMSHAFT
REMOVAL 2502
INSTALLATION 2503
ROD-PISTON & CONNECTING
DESCRIPTION 2504
STANDARD PROCEDURE
PISTON FITTING 2504
MEASURING CONNECTING ROD SIDE CLEARANCE 2505
REMOVAL 2505
INSPECTION 2506
INSTALLATION 2507
RINGS-PISTON
STANDARD PROCEDURE - MEASURING PISTON RING CLEARANCES 2509
REMOVAL 2509
INSTALLATION 2510
BEARINGS-CONNECTING ROD
DESCRIPTION 2511
STANDARD PROCEDURE
CONNECTING ROD BEARING - FITTING . . 2511
MEASURING CONNECTING ROD BEARING CLEARANCE 2512
DAMPER-CRANKSHAFT
REMOVAL 2513
INSTALLATION 2514
SEAL-CRANKSHAFT OIL- FRONT
REMOVAL 2514
INSTALLATION 2515
SEAL-OIL-REAR-CRANK AND RETAINER
REMOVAL 2515
INSTALLATION 2516
BEARINGS-CRANKSHAFT MAIN
DESCRIPTION 2517
STANDARD PROCEDURE
MEASURING CRANKSHAFT MAIN BEARING CLEARANCE IN-CAR 2517
CRANKSHAFT
STANDARD PROCEDURE
MEASURING CRANKSHAFT END PLAY . . 2518
CRANKSHAFT JOURNAL MEASUREMENT 2519
REMOVAL 2519
INSPECTION 2521
INSTALLATION 2522
BEARING-CRANKSHAFT PILOT
REMOVAL 2525
INSTALLATION 2525

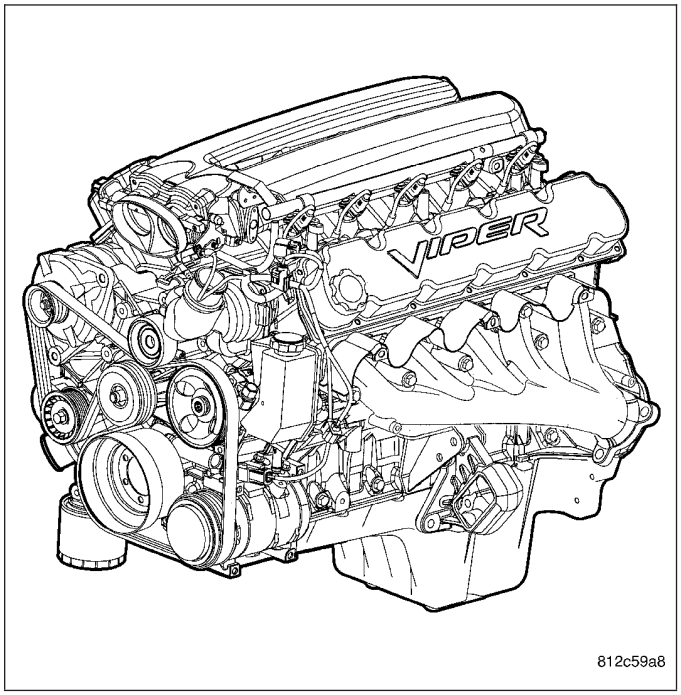
ENGINE - 8.3L - SERVICE INFORMATION

DESCRIPTION

The engine is an 8.3 Liter (505 CID), 10-cylinder, 90° V-type, lightweight, single-cam, overhead valve engine. This engine is designed for premium unleaded fuel.

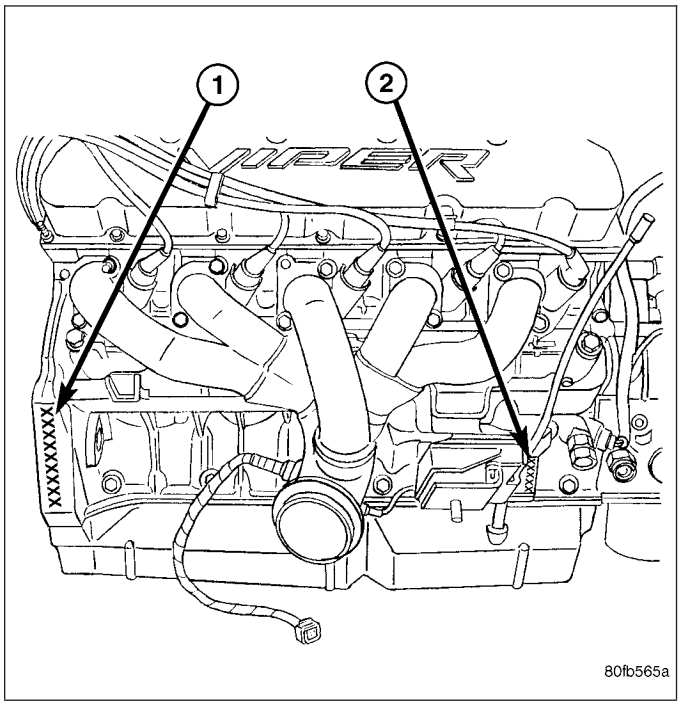
The crankshaft is forged steel. The cylinder block and cylinder heads are aluminum. The firing order is 1-10-9-4-3-6-5-8-7-2. The cylinders are numbered from front to rear as follows:

- on the left bank - 1, 3, 5, 7, 9
- on the right bank - 2, 4, 6, 8, 10



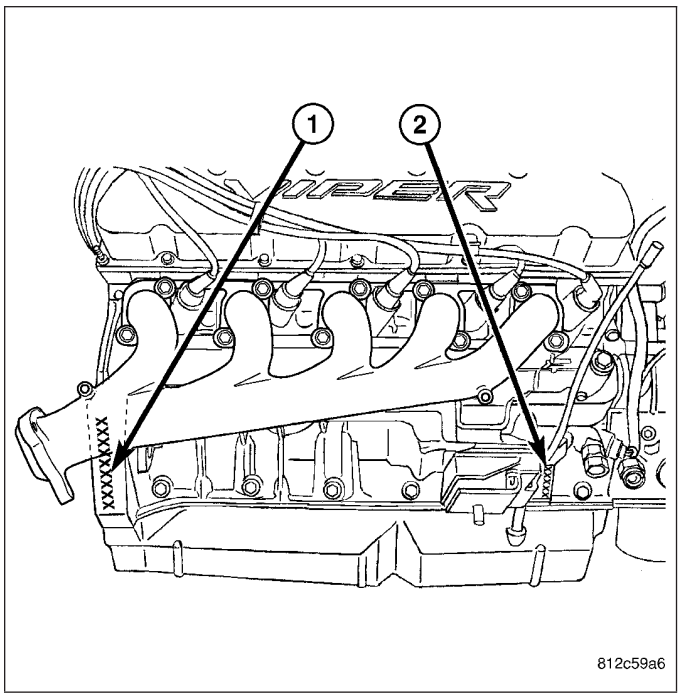
Vehicle Identification Number

This number (1) is located on the rear of the cylinder block just below the right cylinder head.



Engine Serial Number

This number (2) is located on the lower right front of the cylinder block near the oil pressure sensor.



DIAGNOSIS AND TESTING

INTRODUCTION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

(Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - MECHANICAL and (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING) - PERFORMANCE for possible causes and corrections of malfunctions. Refer to the appropriate Diagnostic Information for fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Engine Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Hydraulic Tappet Noise Diagnosis
- Engine Oil Leak Inspection

ENGINE DIAGNOSIS - PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK	1. Weak or discharged battery.	1. Charge or replace battery as necessary. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM - DIAGNOSIS AND TESTING). Check charging system. Refer to the appropriate Diagnostic Information for charging system diagnosis.
	2. Corroded or loose battery connections.	2. Clean/tighten battery/starter connections.
	3. Faulty starter or related circuits.	3. Check starting system. (Refer to 8 - ELECTRICAL/STARTING - DIAGNOSIS AND TESTING).
	4. Seized accessory drive component.	4. Remove accessory drive belt and attempt to start engine. If engine cranks, repair/replace seized component.
	5. Engine internal mechanical failure or hydrostatic lock.	5. (Refer to 9 - ENGINE - STANDARD PROCEDURE - HYDROSTATIC LOCKED ENGINE).
ENGINE CRANKS BUT WILL NOT START	1. No spark.	1. Check for spark. Refer to the appropriate Diagnostic Information for ignition system diagnosis.
	2. No fuel.	2. Perform fuel pressure test. Refer to the appropriate Diagnostic Information for fuel system diagnosis.
	3. Low or no engine compression.	3. Perform cylinder compression test. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST).
ENGINE LOSS OF POWER	1. Worn or incorrect gapped spark plugs.	1. Replace spark plugs or set gap.
	2. Dirt or water in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Replace fuel pump.
	4. Incorrect valve timing.	4. Correct valve timing.
	5. Blown cylinder head gasket(s).	5. Replace cylinder head gasket(s).
	6. Low compression.	6. Test cylinder compression. (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING - CYLINDER COMPRESSION PRESSURE TEST)
	7. Burned, warped, or pitted valves.	7. Install new or reface valves as necessary.
	8. Plugged or restricted exhaust.	8. Replace parts as necessary.
	9. Faulty ignition cables.	9. Replace ignition cables as necessary.
	10. Faulty coil(s).	10. Test and replace as necessary.

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE STALLS OR ROUGH IDLE	1. Carbon buildup on throttle plate.	1. Remove throttle body and de-carbon.
	2. Engine idle speed too low.	2. Check Idle Air Control circuit. Refer to the appropriate Diagnostic Information for IAC motor testing.
	3. Worn or incorrectly gapped spark plugs.	3. Replace spark plugs or set gap.
	4. Faulty or crossed ignition cables.	4. Check for correct firing order or replace ignition cables as necessary.
	5. Faulty coil(s).	5. Test and replace as necessary.
	6. Intake manifold vacuum leak.	6. Inspect intake manifold gasket and vacuum hoses. Replace as necessary.
ENGINE MISSES ON ACCELERATION	1. Worn or incorrectly gapped spark plugs.	1. Replace spark plugs or set gap.
	2. Faulty ignition cables.	2. Replace ignition cables as necessary.
	3. Dirt or water in fuel system.	3. Clean system and replace fuel filter.
	4. Burned, warped, or pitted valves.	4. Install new or reface valves as necessary.
	5. Faulty coil(s).	5. Test and replace as necessary.

ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	1. High or low oil level in crankcase.	1. Check for correct oil level. Adjust oil level by draining or adding as needed.
	2. Thin or diluted oil.	2. Change oil and filter.
	3. Low oil pressure.	3. Check engine oil level. If OK, perform oil pressure test. (Refer to 9 - ENGINE/ LUBRICATION - DIAGNOSIS AND TESTING).
	4. Dirt in tappets/lash adjusters.	4. Clean/replace hydraulic tappets/lash adjusters.
	5. Bent push rod(s).	5. Replace push rod(s) as necessary.
	6. Worn rocker arms.	6. Replace worn rocker arms and inspect oil supply to rocker arms.
	7. Worn tappets/lash adjusters.	7. Replace hydraulic tappets/hydraulic lash adjusters.
	8. Worn valve guides.	8. Ream and install new valves with oversize stems.
	9. Excessive runout of valve seats on valve faces.	9. Grind valve seats and valves.

CONDITION	POSSIBLE CAUSES	CORRECTION
CONNECTING ROD NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. If OK, perform oil pressure test. Inspect oil pump relief valve and spring. (Refer to 9 - ENGINE/ LUBRICATION - DIAGNOSIS AND TESTING).
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Connecting rod journal out-of-round.	5. Replace crankshaft or grind journals.
	6. Misaligned connecting rods.	6. Replace bent connecting rods.
MAIN BEARING NOISE	1. Insufficient oil supply.	1. Check engine oil level.
	2. Low oil pressure.	2. Check engine oil level. If OK, perform oil pressure test. Inspect oil pump relief valve and spring. (Refer to 9 - ENGINE/ LUBRICATION - DIAGNOSIS AND TESTING).
	3. Thin or diluted oil.	3. Change oil and filter.
	4. Excessive bearing clearance.	4. Measure bearings for correct clearance. Repair as necessary.
	5. Excessive end play.	5. Check No. 3 bearing for wear on flanges.
	6. Crankshaft journal out-of-round and/or worn.	6. Grind journals or replace crankshaft.
	7. Loose flywheel.	7. Inspect crankshaft, flywheel, and bolts for damage. Tighten bolts to correct torque.
OIL PRESSURE DROP	1. Low oil level.	1. Check oil level and fill if necessary.
	2. Faulty oil pressure sending unit.	2. Replace sending unit.
	3. Clogged oil filter.	3. Install new oil filter.
	4. Worn oil pump.	4. Replace worn gears or oil pump assembly.
	5. Thin or diluted oil.	5. Change oil to correct viscosity.
	6. Excessive bearing clearance.	6. Measure bearings for correct clearance.
	7. Oil pump relief valve stuck.	7. Remove relief valve. Inspect valve and spring. Replace as necessary.
	8. Oil pump pick up tube restricted, cracked, or damaged.	8. Remove oil pan and inspect oil pump pick up tube. Clean or replace as necessary.
	9. Oil pump cover loose, warped, or cracked.	9. Inspect/tighten cover screws or install new oil pump, if necessary.
OIL LEAKS	1. Misaligned or deteriorated gaskets.	1. Replace gaskets.
	2. Loose fastener, broken or porous component.	2. Tighten, repair or replace component.

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE OIL CONSUMPTION OR SPARK PLUGS OIL FOULED	1. PCV system malfunction.	1. Check and repair PCV system as necessary.
	2. Defective valve stem seal(s).	2. Repair or replace seal(s).
	3. Worn or broken piston rings.	3. Hone cylinder bores. Install new rings.
	4. Scuffed pistons/cylinder walls.	4. Hone cylinder bores and replace pistons as necessary.
	5. Carbon in oil control ring groove.	5. Remove rings and de-carbon piston.
	6. Worn valve guides.	6. Ream and install new valves with oversize stems.
	7. Piston rings fitted too tightly in grooves.	7. Remove piston rings. Check ring end gap and side clearance. Replace as necessary.

CYLINDER COMPRESSION PRESSURE TEST

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

1. Check engine oil level and add oil if necessary.
2. Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.
3. Remove the Auto Shut Down (ASD) relay from the Power Distribution Center (PDC).
4. Disconnect ignition cables from spark plugs.
5. Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.
6. Be sure throttle blade is fully open during the compression check.
7. Insert compression gauge adaptor Special Tool 8116 or the equivalent, into the No. 1 spark plug hole in cylinder head. Connect the 0-500 psi (Blue) pressure transducer (Special Tool CH7059) with cable adaptors to the scan tool. For Special Tool identification, (Refer to 9 - ENGINE - SPECIAL TOOLS).
8. Crank engine until maximum pressure is reached on gauge. Record this pressure as No. 1 cylinder pressure.
9. Repeat the previous step for all remaining cylinders.
10. Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.
11. If one or more cylinders have abnormally low compression pressures, repeat the compression test.
12. If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

1. Check the coolant level and fill as required. DO NOT install the pressure cap.
2. Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

3. Clean spark plug recesses with compressed air.
4. Remove the spark plugs.
5. Remove the oil fill cap.
6. Remove the air cleaner.
7. Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.
8. Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the coolant pressure bottle.

All gauge pressure indications should be equal, with no more than 25 percent leakage per cylinder.

FOR EXAMPLE: At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A cylinder head gasket leak can be located between adjacent cylinders, between a cylinder and the adjacent water jacket, or an external coolant leak may be present.

Possible indications of the cylinder head gasket leaking between adjacent cylinders are:

- Loss of engine power
- Engine misfiring
- Poor fuel economy

Possible indications of the cylinder head gasket leaking between a cylinder and an adjacent water jacket are:

- Engine overheating
- Loss of coolant
- Excessive steam (white smoke) emitting from exhaust
- Coolant foaming

CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures in Cylinder Compression Pressure Test in this section. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure. Cylinders adjacent to each other will both have low compression.

CYLINDER-TO-WATER JACKET LEAKAGE TEST

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING WITH COOLANT PRESSURE CAP REMOVED.

VISUAL TEST METHOD

With the engine cool, remove the coolant pressure cap. Start the engine and allow it to warm up until thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

COOLING SYSTEM TESTER METHOD

WARNING: WITH COOLING SYSTEM TESTER IN PLACE, PRESSURE WILL BUILD UP FAST. EXCESSIVE PRESSURE BUILT UP, BY CONTINUOUS ENGINE OPERATION, MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).

Install Cooling System Tester 7700 or equivalent to pressure cap neck. Start the engine and observe the tester's pressure gauge. If gauge pulsates with every power stroke of a cylinder a combustion pressure leak is evident.

CHEMICAL TEST METHOD

Combustion leaks into the cooling system can also be checked by using Bloc-Chek Kit C-3685-A or equivalent. Perform test following the procedures supplied with the tool kit.

HYDRAULIC TAPPET NOISE DIAGNOSIS

PRELIMINARY STEP TO CHECKING THE HYDRAULIC TAPPETS

Before disassembling any part of the engine to correct tappet noise, check engine oil level and oil pressure.

1. Check the engine oil level.
   - **Oil Level Check: stop engine after reaching normal operating temperature**
   - The oil level should never be above the FULL mark on dipstick, or below the ADD mark. Either of these two conditions could be responsible for noisy tappets. Allow 5 minutes to stabilize oil level, check dipstick.
2. Remove oil pressure sensor.
3. Install a reliable oil pressure gauge at oil pressure sensor location.

The oil pressure should be 206.8 - 551.6 kPa (30 - 80 psi) at 2000 rpm.

OIL LEVEL TOO HIGH

If oil level is above the FULL mark on dipstick, it is possible for the connecting rods to dip into the oil while engine is running and create foam. Foam in oil pan would be fed to the hydraulic tappets by the oil pump causing them to become soft and allow valves to seat noisily.

OIL LEVEL TOO LOW

Low oil level may allow pump to take in air which when fed to the tappets, causes them to become soft and allows valves to seat noisily. Any leaks on intake side of pump through which air can be drawn will create the same tappet action. Check the lubrication system from the intake strainer to the pump cover, including the relief valve retainer cap. When tappet noise is due to aeration, it may be intermittent or constant, and usually more than one tappet will be noisy. When oil level and leaks have been corrected, engine should be operated at fast idle to allow all of the air inside of the tappets to be bled out.

VALVE TRAIN NOISE DIAGNOSIS

To determine source of valve train noise, operate engine at idle with cylinder head covers removed and listen for source of the noise.

NOTE: Worn valve guides or cocked springs are sometimes mistaken for noisy tappets. If such is the case, noise may be dampened by applying side thrust on the valve spring. If noise is not appreciably reduced, it can be assumed the noise is in the tappet. Inspect the rocker arm push rod sockets and push rod ends for wear.

Valve tappet noise ranges from light noise to a heavy click. A light noise is usually caused by excessive leak-down around the unit plunger which will necessitate replacing the tappet, or by the plunger partially sticking in the tappet body cylinder. A heavy click is caused either by a tappet check valve not seating, or by foreign particles becoming wedged between the plunger and the tappet body causing the plunger to stick in the down position. This heavy click will be accompanied by excessive clearance between the valve stem and rocker arm as valve closes. In either case, tappet assembly should be removed and replaced.

ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair as necessary.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.
5. **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:
   1. Disconnect the PCV hoses at the cylinder head covers and plug or cap the outlet on the covers.
   2. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.

   3. Gradually apply air pressure from 6.89 kPa (1 psi) to 17.23 kPa (2.5 psi) maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
   4. If the leakage occurs at the crankshaft rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
6. If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Connect the PCV hoses. Proceed to next step.
7. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

NOTE: If oil leakage is observed at the dipstick tube to oil pan location; remove the tube, clean and reseal using Mopar® Stud & Bearing Mount (press fit tube applications only), and for O-ring style tubes, remove tube and replace the O-ring seal.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove clutch housing inspection cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is present in this area, remove transmission for further inspection.
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug or rear crankshaft seal retainer gasket leak. See proper repair procedures for these items.
4. If no leaks are detected, pressurize the crankcase as previously described.

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

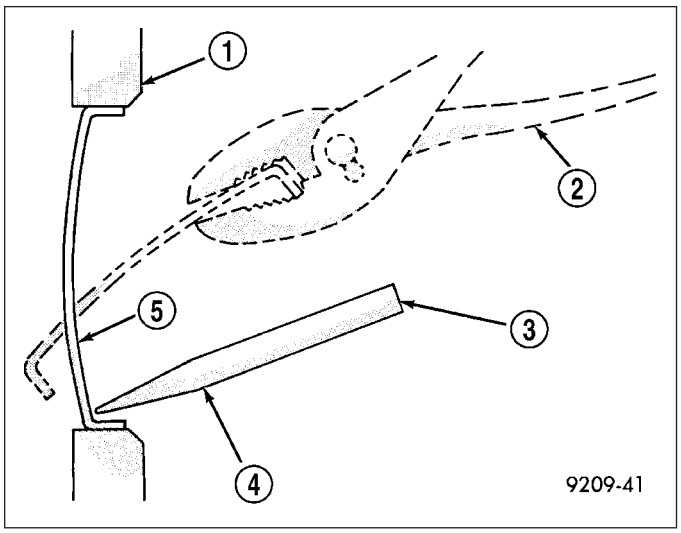
CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.
7. After the oil leak root cause and appropriate corrective action have been identified, replace component(s) as necessary.

STANDARD PROCEDURE

ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift (4) and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers (2) or other suitable tool and remove plug (5).



CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® BED PLATE SEALANT

Mopar® Bed Plate Sealant is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4 oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 mm or 6.35 mm (1/8 in. or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

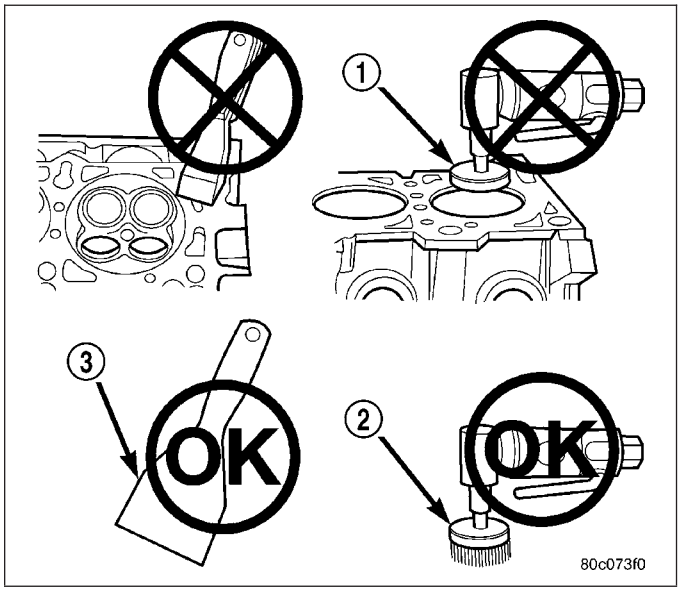
ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (1)

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.



Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (3)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (2)

CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.

HYDROSTATIC LOCKED ENGINE

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.

1. Inspect air cleaner, induction system and intake manifold to ensure system is dry and clear of foreign material.
2. Remove negative battery cable.

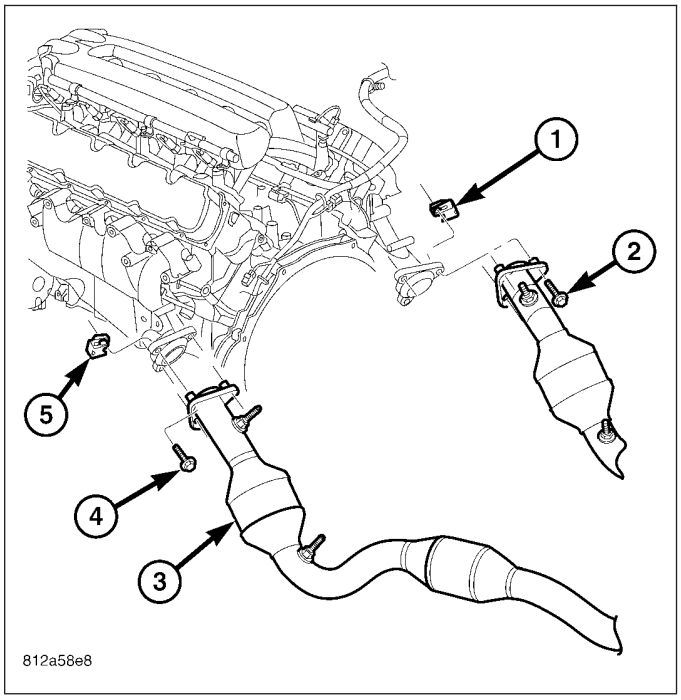
3. Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.
4. With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.
5. Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).
6. Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)
7. Repair engine or components as necessary to prevent this problem from re-occurring.

CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.

8. Install new spark plugs.
9. Drain engine oil and remove oil filter.
10. Fill engine with specified amount of approved oil and install new oil filter.
11. Connect negative battery cable.
12. Start engine and check for any leaks.

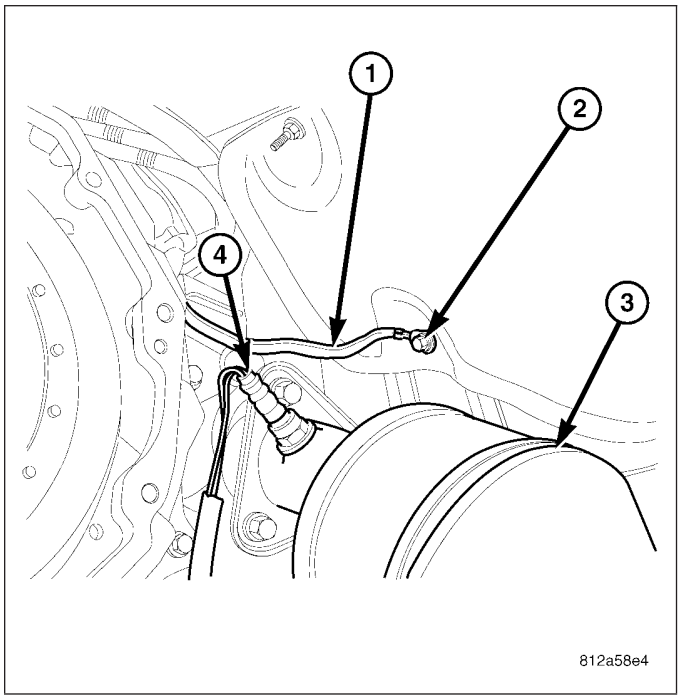
REMOVAL - ENGINE ASSEMBLY

1. Perform fuel pressure release procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
2. Disconnect negative battery cable.
3. Disconnect throttle body air inlet duct, remove air cleaner cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
4. Raise and support the vehicle.
5. Remove the lower engine shield.
6. Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE - DRAINING COOLING SYSTEM).
7. Paint mark and remove the driveshaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL).
8. Remove the transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL).
9. Remove the starter (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).
10. Disconnect the front exhaust pipe flange to exhaust manifold fasteners (1 and 2).

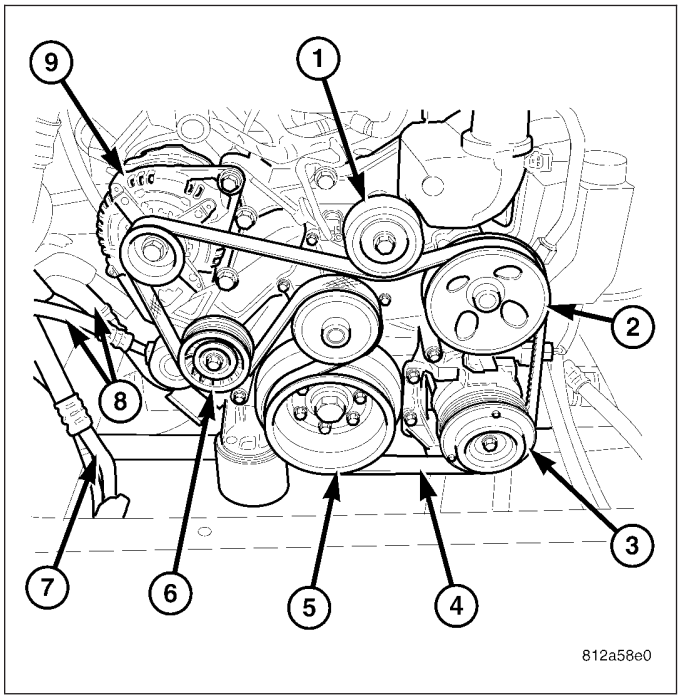


11. Disconnect the hydraulic cooling fan lines and capture any spillage (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
12. Drain engine oil and remove the oil filter.
13. Separate the air conditioning hose from the fan shroud.
14. Disconnect the lower radiator hose.
15. Disconnect the power steering line support bracket at the lower left of the radiator.
16. Loosen both engine mount through bolts.

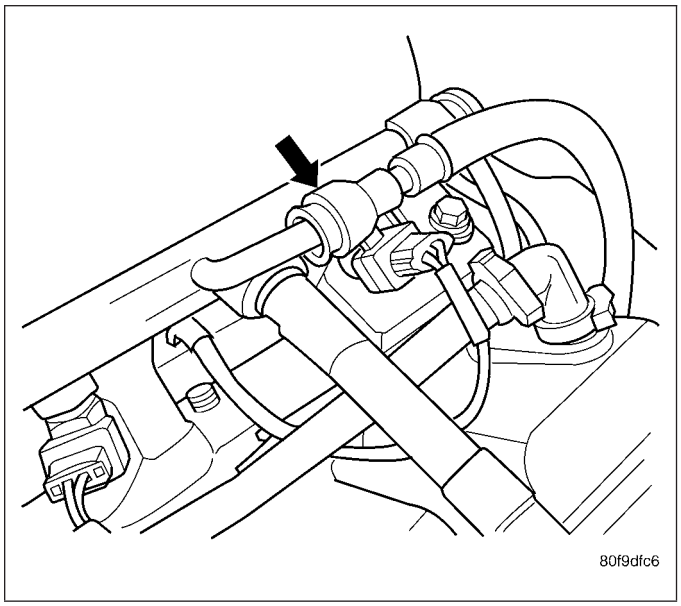
17. Separate the ground strap (1) from the floor board, above the right exhaust flange.
18. Lower the vehicle.
19. Discharge air conditioning system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).
20. Remove the upper radiator hose.
21. Disconnect windshield washer hose at the splice.
22. Remove radiator core support.
23. Disconnect the cooling fan harness connector (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
24. Remove the radiator and radiator fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
25. Remove the A/C condenser, cap and position the hoses aside.
26. Disconnect the heater hoses at the top front cover and at the lower coolant housing and position aside.



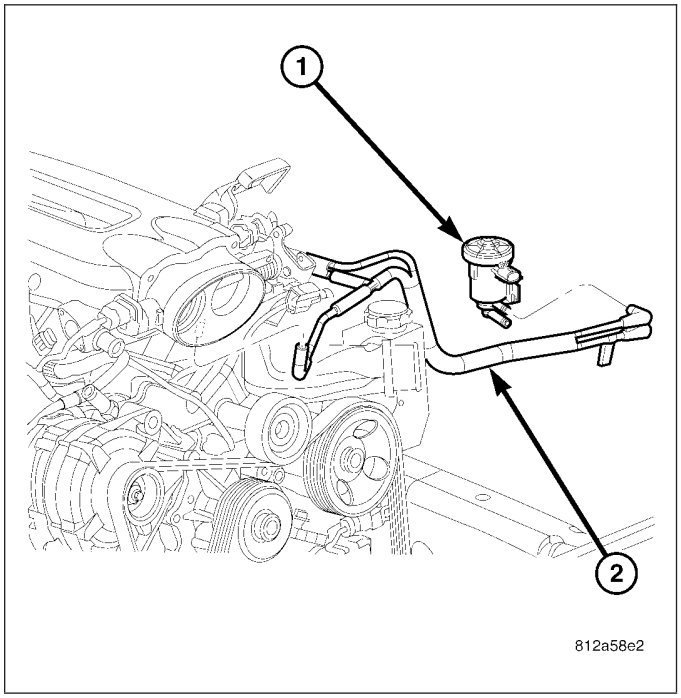
27. Disconnect the oil cooler hoses from the engine and position aside (Refer to 9 - ENGINE/LUBRICATION/OIL COOLER & LINES - STANDARD PROCEDURE).
28. Remove accessory drive belt (1).
29. Disconnect and remove generator.
30. Remove power steering pump mounting bolts and set pump aside.



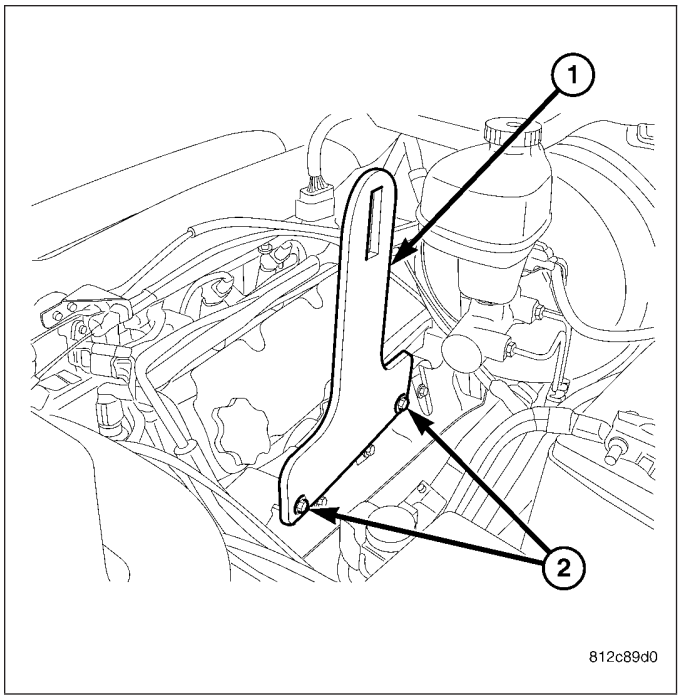
31. Disconnect A/C lines and electrical connector from A/C compressor. Plug holes in A/C compressor to prevent debris from entering A/C compressor.
32. Disconnect brake booster vacuum hose and fuel line to fuel rail.



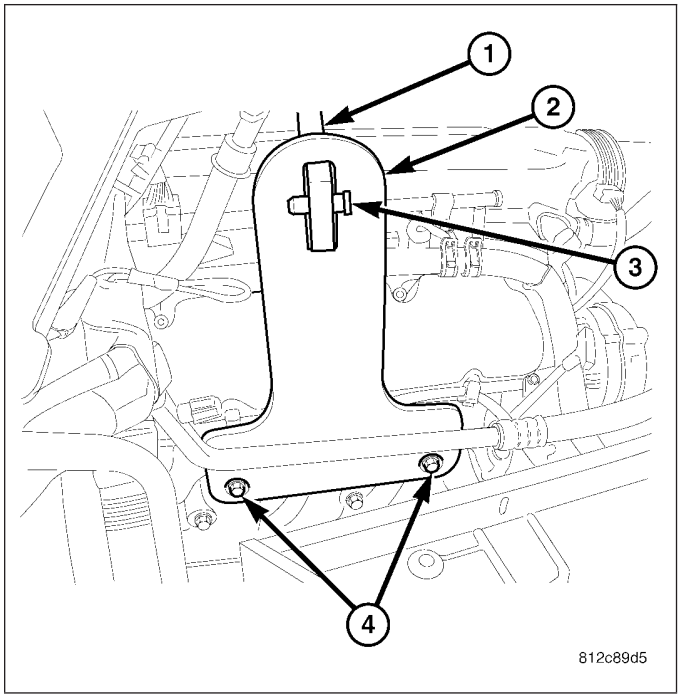
33. Disconnect the cruise control, accelerator cable and fuel vapor purge harness (2) , then set aside.
34. Disconnect the engine harness connectors on top of the intake manifold.
35. Disconnect the spark plug wires from the spark plugs and set the plug wires on top of the engine.
36. Disconnect the ground strap at the thermostat housing and pull the electrical harness underneath the intake manifold and set aside.



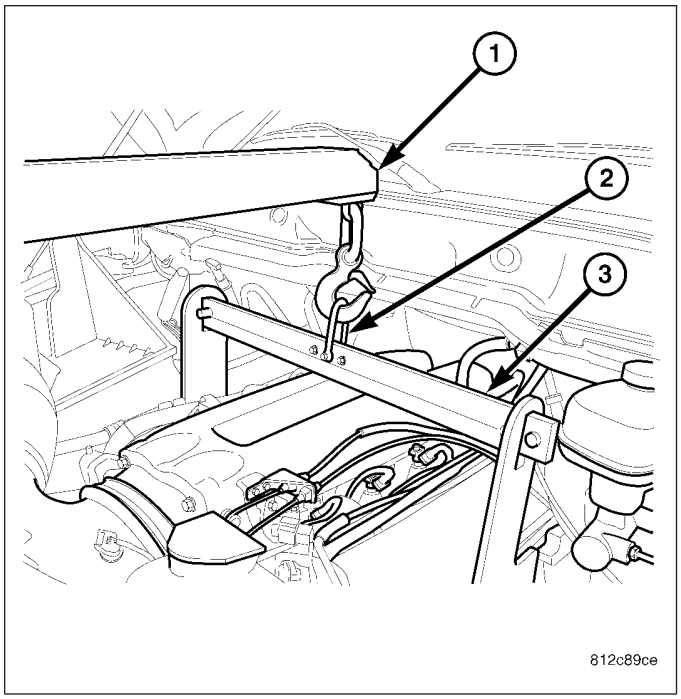
37. Install Special Tool 9363 - Engine Lifting Brackets (1) and to the exhaust manifold heat shield studs where indicated.



38. Insert engine lifting bar (1) through the access holes in the engine lifting brackets (2) and secure with the bar retaining pins (3).

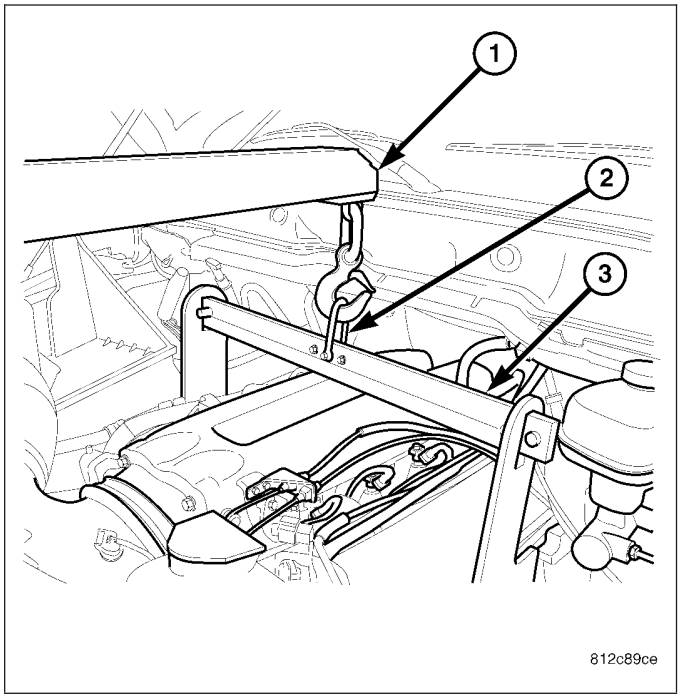


39. Remove engine with an engine hoist (1).

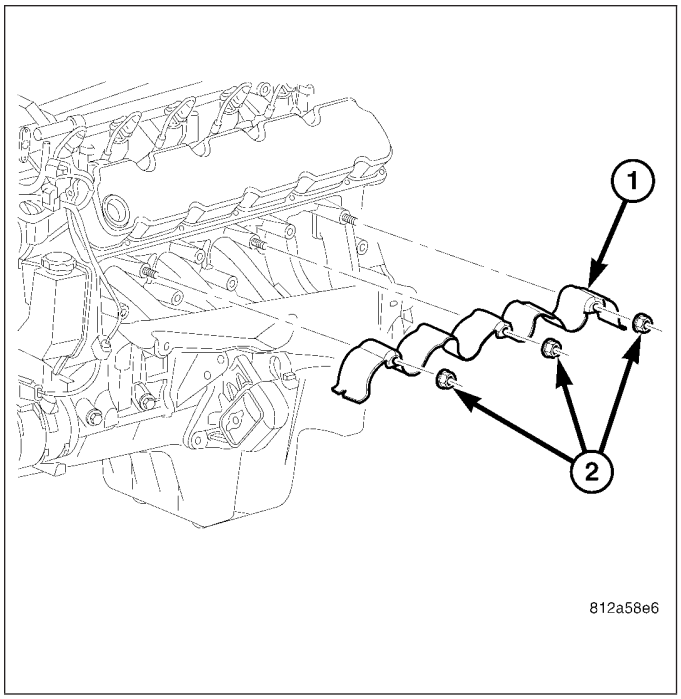


INSTALLATION - ENGINE ASSEMBLY

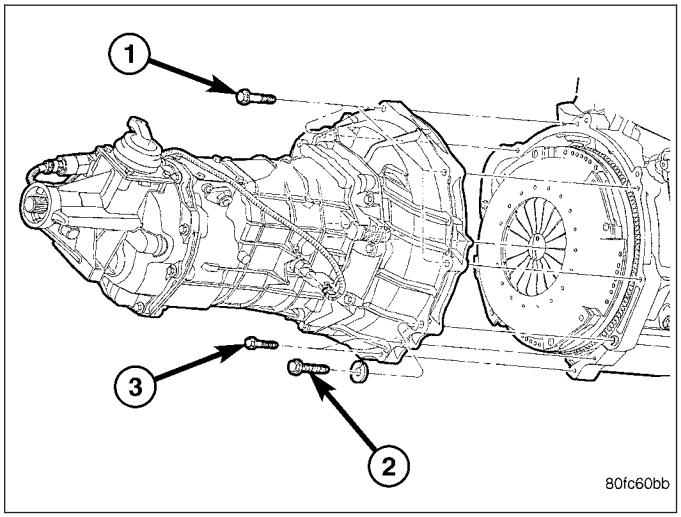
1. Attach engine hoist (1) and lower the engine into engine compartment, aligning the left and right engine mounts
2. Install left and right engine mount insulator bolts and nuts. Tighten nuts to 102 N·m (75 ft. lbs.).
3. Remove engine hoist and engine lifting bar (2) and brackets (3).



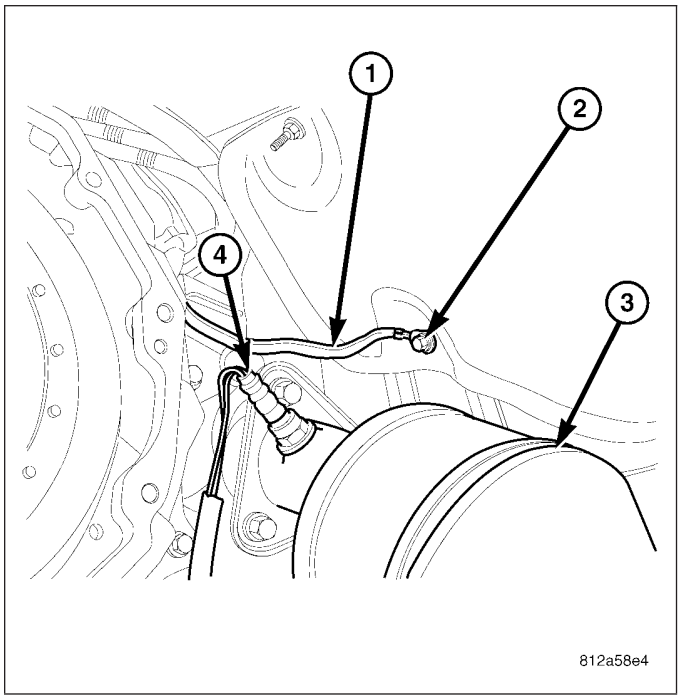
4. Install the exhaust manifold heat shield nuts (2) and tighten to 6 N·m (50 in. lbs.).
5. Connect the ground strap to the thermostat housing and route the electrical and purge harness underneath the throttle body and attach the connectors.
6. Connect the fuel vapor purge lines.
7. Properly route and connect the spark plug wires.
8. Connect the engine electrical harnesses.
9. Connect the brake booster vacuum hose, fuel line, cruise control and accelerator cables.
10. Install the A/C lines at the A/C compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).
11. Connect A/C clutch electrical connector (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL).
12. Install the power steering pump.
13. Install the generator.
14. Install the accessory drive belt.
15. Connect the heater hoses to the engine.
16. Install the radiator and cooling fan assembly.
17. Install the A/C condenser.



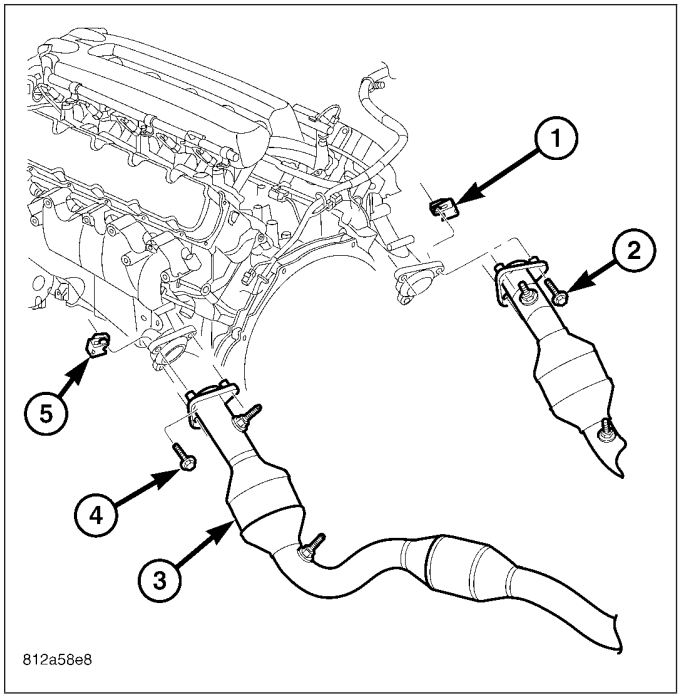
18. Connect the A/C lines to the condenser.
19. Connect the cooling fan electrical connector.
20. Connect the windshield washer hose at the splice.
21. Install the coolant recovery container.
22. Install the upper radiator hose.
23. Install the throttle body air inlet duct and the air cleaner element cover.
24. Raise and support the vehicle.
25. Install transmission.
26. Install transmission bolts and tighten bolts to:
    - 7/16 Transmission bolts and washers (2) - 68 N·m (50 ft. lbs.)
    - Transmission to top of engine - 41 N·m (30 ft. lbs.)
    - Transmission to oil pan (3) - 30 N·m (22 ft. lbs.)
27. Install drive shaft.

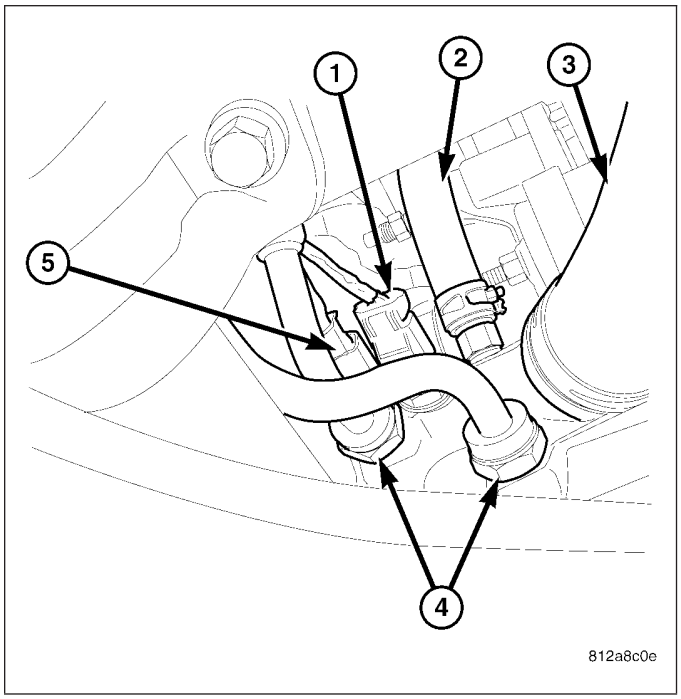


28. Install the ground strap (1) to the floor pan above the right exhaust manifold flange.



29. Connect the front exhaust pipes to the exhaust manifolds and tighten the fasteners (1 and 2) to 34 N·m (25 ft. lbs.).





30. Connect oil cooler lines (4) and connect the oil pressure sensor (1) and oil temperature sensor (5).
31. Install the power steering line support bracket at the radiator.
32. Install lower radiator hose.
33. Connect the cooling fan hydraulic lines (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
34. Connect the A/C line to the fan shroud.
35. Install under body shield.
36. Lower vehicle.
37. Fill engine crankcase with the proper oil to the correct level (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
38. Evacuate and recharge the air conditioning (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
39. Fill the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
40. Fill power steering to proper level and purge the system (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
41. Connect the negative battery cable.
42. Start the engine and run until operating temperature is obtained.
43. Turn engine off and inspect for leaks.
44. Recheck all fluid levels, fill as required.

SPECIFICATIONS

ENGINE

GENERAL SPECIFICATIONS

DESCRIPTION	SPECIFICATION	
Type	90° V-10	
Number of Cylinders	10	
Firing Order	1-10-9-4-3-6-5-8-7-2	
Compression Ratio	9.6:1	
Brake Horsepower	501@5600 RPM	
Torque	525 ft. lbs. @4100 RPM	
Crankshaft	Forged Steel	
Cylinder Block	Aluminum Alloy with Interference Fit Cast Iron Liners	
Connecting Rods	Cracked Cap Powdered Metal	
Pistons	Cast Aluminum Alloy	
	Metric	**Standard**
Displacement	8.3L	505 cu. in.
Bore	102.4 mm	4.03 in.
Stroke	100.6 mm	3.96 in.
Compression Pressure	1069-1172 kPa	155-170 psi
Engine Weight (Approx.)	284 Kilograms	625 Lbs.

CYLINDER BLOCK

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Cylinder Bore Diameter	102.356-102.368 mm	4.02975-4.03025 in.
Out of Round (Max.)	0.051 mm	0.002 in.
Taper (Max.)	0.038 mm	0.0015 in.
Tappet Bore Diameter	22.974-22.992 mm	0.9045-0.9052 in.
Block Length	693.7 mm	27.310 in.
Block Height	240.8 mm	9.48 in.

CRANKSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Connecting Rod Journal Diameter	53.990-54.008 mm	2.1256-2.1263 in.
Out-of-Round (Max.)	0.013 mm	0.0005 in.
Taper (Max.)	0.013 mm	0.0005 in
End Play	0.051-0.178 mm	0.002-0.007 in.
Desired	0.13 mm	0.005 in.
Wear Limit	0.254 mm	0.010 in.
Main Bearing Clearance 1-6	0.025-0.051 mm	0.001-0.002 in.
Wear Limit	0.076 mm	0.003 in.

MAIN BEARING JOURNALS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Diameter-High	76.233-76.246 mm	3.0013-3.0018 in.
Diameter-Low	76.220-76.223 mm	3.0008-3.0013 in.
Out of Round (Max.)	0.013 mm	0.0005 in

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Bearing Clearance	0.005-0.074 mm.	0.0002-0.0029 in.
Desired	0.0381 mm	0.0015 in.
Wear Limit	0.0889 mm	0.0035 in.
Piston Pin Boar Diameter	23.940-23.978 mm	0.9425-0.9440 in.
Side Clearance (Two Rods)	0.25-0.46 mm	0.010-0.018 in.
Wear Limit	0.51 mm	0.020 in.
Total Weight (Less Bearing)	598.4 grams	21.11 oz.

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Size	102.314-102.332 mm.	4.0281-4.0288 in.
Clearance at Top of Skirt (12 mm from bottom)	0.025-0.055 mm.	0.0010-0.0022 in.
Land Clearance (Diametrical)	0.771-0.808 mm	-0.036–0.042 in.
Weight	429-439 grams	15.13-15.49 oz.
Piston Length	57.0 mm	2.24 in.
Piston Pin Boar Diameter	23.940-23.978 mm	0.9425-0.9440 in.
Piston Pin Boar Offset	0.800 mm	0.031 in.
Piston Ring Groove Depth No.1	91.55-91.88 mm	3.604-3.614 in.
Piston Ring Groove Depth No.2	90.75-91.00 mm	3.573-3.583 in.
Piston Ring Groove Depth No.3	92.53-92.79 mm	3.643-3.653 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance in Piston	0.009-0.022 mm	0.0004-0.0009 in.
Clearance in Connecting Rod	0.017-0.061 mm	0.0007-0.0024 in.
Diameter	23.995-24.000 mm	0.9447-0.9449 in.
Length	73.35 mm	2.888 in.
End Play	None	

PISTON RING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Piston Ring End Gap		
Top Compression Ring	0.20-0.36 mm	0.008-0.014 in.
Second Compression Ring	0.56-0.79 mm	0.022-0.031 in.
Oil Control (Steel Rails)	0.25-0.76 mm	0.010-0.030 in.
Wear Limit-Top Compression Ring	0.63 mm	0.025 in.
Wear Limit-2nd Compression Ring	1.40 mm	0.055 in.
Wear Limit-Oil Control Steel Rails	1.64 mm	0.065 in.
Piston Ring Side Clearance		
Top and 2nd Compression Ring	0.040-0.085 mm	0.0016-0.0033 in.
Oil Ring (Steel Ring)	0.046-0.201 mm	0.0018-0.0079 in.
Wear Limit- Top and 2nd Ring	0.10 mm	0.004 in.
Wear Limit Oil Ring Pack	0.216 mm	0.0085 in.
Piston Ring Width		
Compression Rings	1.407-1.490 mm	0.0579-0.0586 in.
Oil Ring (Steel Rails)	0.447-0.473 mm	0.0176-0.0186 in.

CAMSHAFT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Lift	8.13 mm	0.320 in.
Journal Diameter 1-6	53.09-53.11 mm	2.090-2.091 in.
Boar Diameter No.1-6	53.16-53.19 mm	2.093-2.094 in.
Diametrical Clearance	0.051-0.102 mm	0.002-0.004 in.
Max. Allowable	0.127 mm	0.005 in.
End Play	0.127-0.381 mm	0.005-0.015 in.
Valve Timing-Exhaust Valve		
Closes (ATC)	36.5°	
Opens (BBC)	88.5°	
Duration	305.0°	
Valve Timing-Intake Valve		
Closes (BTDC)	86.5°	
Opens	23.5°	
Duration	297.0°	
Valve Overlap	60.0°	

HYDRAULIC TAPPETS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Body Diameter	22.949-22.962 mm	0.9035-0.9040 in.
Clearance in Block	0.013-0.043 mm	0.0005-0.0017 in.
Plunger Travel (Dry)	4.24 mm	0.167 in.
Push Rod Length (Overall)	193.22-193.73 mm	7.607-7.627 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Gasket Thickness (Compressed)	1.35 mm	0.053 in.

CYLINDER HEAD VALVE SEAT

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Seat Angle	44°-44.5°	
Runout (Max.)	0.038 mm	0.002 in.
Width (Finish) Intake and Exhaust	1.02-1.52 mm	0.040-0.060 in.
Guide Bore Diameter (Std.)	7.95-7.98 mm	0.313-0.314 in.

VALVES

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Face Angle	45-45.5°	
Back Cut Angle	25°-29°	
Stem Diameter-Intake and Exhaust	7.90-7.92 mm	0.331-0.312 in.
Head Diameter-Intake	50.67-50.93 mm	1.995-2.005 in.
Head Diameter-Exhaust	40.01-40.26 mm	1.575-1.585 in.
Length-Intake (Over All)	145.69-146.33 mm	5.736-5.761 in.
Length-Exhaust (Over All)	146.23-146.86 mm	5.757-5.782 in.
Valve Margin-Intake	1.30 mm	0.051 in.
Valve Margin-Exhaust	2.03 mm	0.080 in.
Lift-Intake (Zero Lash	14.06 mm	0.554 in.
Lift-Exhaust (Zero Lash)	14.06 mm	0.554 in.
Valve Stem Tip Height	52.96 mm	2.085 in.
Stem-to-Guide Clearance-Intake and Exhaust	0.025-0.076 mm	0.001-0.003 in.
Max. Allowable-Intake (Rocking Method)	0.50 mm	0.020 in.
Max. Allowable-Exhaust (Rocking Method)	0.70 mm	0.027 in.

VALVE SPRING

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Free Length - Spring	55.0 mm	2.165 in.
Free Length - Spring Damper	47 mm	1.850 in.
Spring Tension (Valve Closed)	534 ± 20 N @ 44.5 mm	120 ± 4.5 lbs. @ 1.750 in.
Spring Tension (Valve Open)	1245 ± 40 N @ 30.6 mm	280 ± 9.0 lbs. @ 1.207 in.
Number of Coils - Spring	7.25 Right Hand Twist	
Number of Coils - Spring Damper	3.6 to 4.0 Left Hand Twist	
Wire Diameter (Ovate)	4.2 x 5.3 mm	0.166 x 0.208 in.
Installed Height (Spring Seat to Bottom of Retainer)	44.5 mm	1.750 in.

LUBRICATION

DESCRIPTION	SPECIFICATION	
	Metric	Standard
At Curb Idle Speed* (Minimum with engine at operating temperature)	68.9 kPa	10 psi
At 3000 RPM	310-517 kPa	45-75 psi
CAUTION: *If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.		

OIL PUMP

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Clearance Over Rotors (Max.)	0.077 mm	0.003 in.
Cover Out-Of-Flat (Max.)	0.076 mm	0.003 in.
Inner Rotor Thickness (Min.)	18.92 mm	0.744 in.
Clearance (Max.)	0.19 mm	0.007 in.
Diameter (Min.)	82.45 mm	3.246 in.
Thickness (Min.)	18.92 mm	0.744 in.
Tip Clearance Between Rotors (Max)	0.150 mm	0.0068 in.

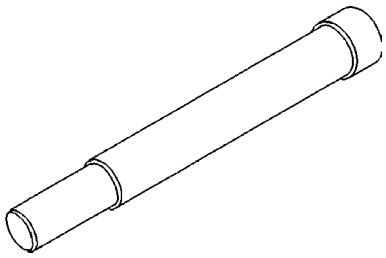
TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolts-A/C Compressor Mounting	23	-	200
Bolts-A/C Compressor Bracket	23	-	200
Bolt-Camshaft Position Sensor	11	-	95
Bolts-Camshaft Sprocket	23	-	200
Bolts-Camshaft Thrust Plate	24	-	210
Bolts-Connecting Rod Cap	68	50	-
Bolts-Crankshaft Main Bearing Cap	(Refer to CRANKSHAFT - INSTALLATION)		
Nuts-Crankshaft Oil Scraper	23	-	200
Bolts-Crankshaft Pulley	23	-	200
Bolt-Crankshaft Vibration Damper	176	130	-
Bolts-Cylinder Head	(Refer to CYLINDER HEAD - INSTALLATION)		
Bolts/Studs-Cylinder Head Cover	11	-	95
Exhaust Manifold	23	-	200
Exhaust Pipe to Exhaust Manifold	34	25	-
Bolts-Engine Mount Bracket-to-Block	41	30	-
Nuts-Engine Mount Insulator	102	75	-
Bolts-Flywheel to Crankshaft	75	55	-
Bolts-Generator Mounting	41	30	-
Bolts-Intake Manifold	11	-	95
Bolts-Oil Cooler	5	-	40
Oil Cooler Line Fitting	68	50	-
Bolts-Oil Pan			
1/4–20	11	-	95
5/16–18	23	-	200
Plug-Oil Pan Drain	34	25	-
Plug-Oil Pressure Relief Valve	34	25	-
Bolts-Oil Pump Cover	23	-	200
Oil Pump Pick-up Tube			
Bolt 1/4–20	11	-	95

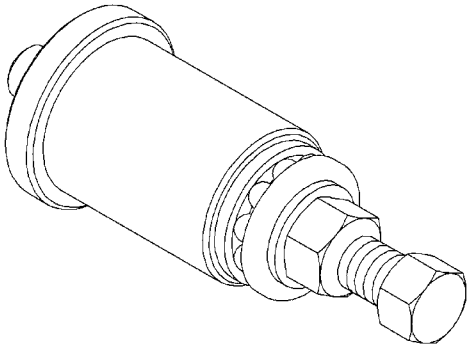
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Nut 5/16–18	23	-	200
Oil Filter	18	-	160
Oil Pressure Sensor	8.5	-	75
Oil Temperature Sensor	8.5	-	75
Bolts-Power Steering Pump Mounting	23	-	200
Bolts-Rear Crankshaft Seal Retainer	11	-	95
Bolts-Rocker Arm	35	26	-
Spark Plugs	27	20	-
Bolts-Starter Mounting	41	30	-
Bolts-Throttle Body	11	-	95
Bolts-Timing Chain Cover	23	-	200
Bolts-Water Pump Mounting	11	-	95

SPECIAL TOOLS

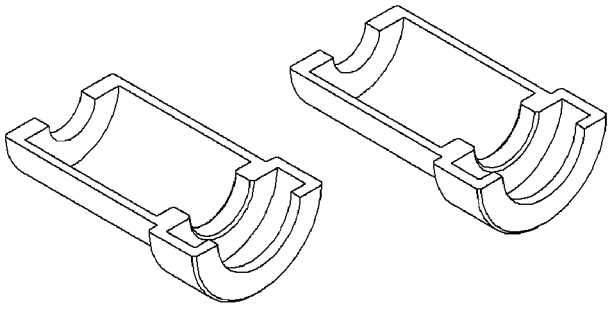
ENGINE



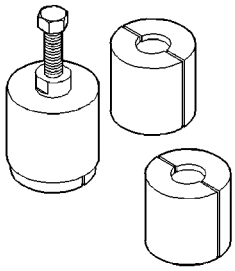
Crankshaft Insert 8194



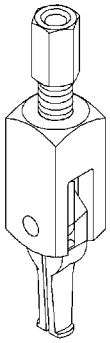
Crankshaft Damper/Sprocket Installer 9055



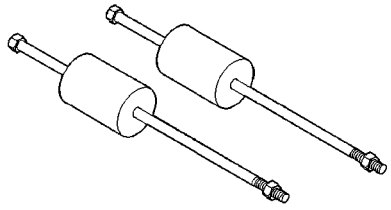
Crankshaft Sprocket Remover 9056



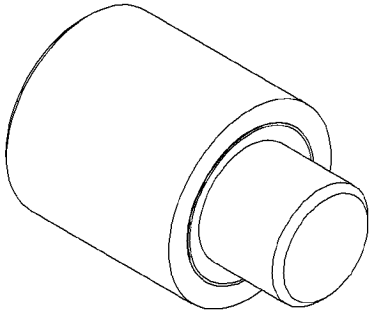
Puller 5048



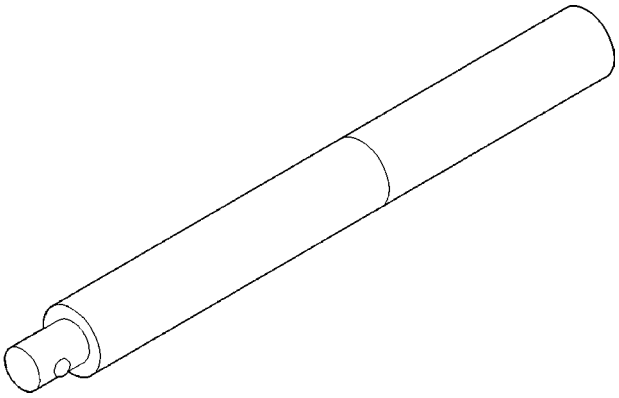
Bearing/Seal Remover Adapter - 8990



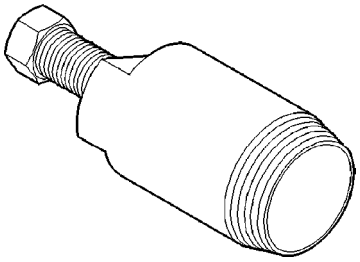
Puller, Slide Hammer C-3752



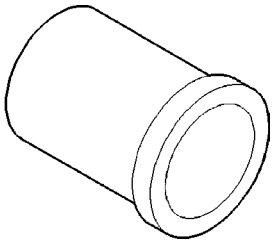
Crankshaft Pilot Bearing Installer 9058



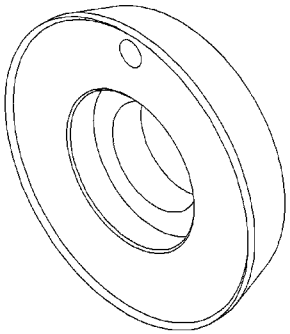
Driver Handle C-4171



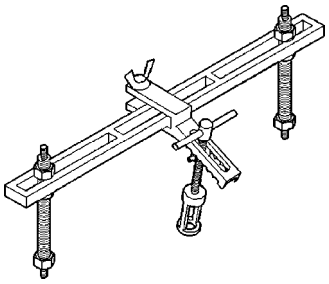
Front Crankshaft Seal Remover C-4679A



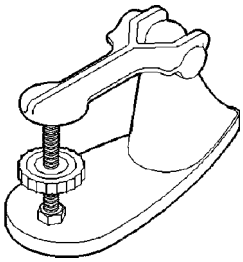
Front Crankshaft Seal Installer MD-998306



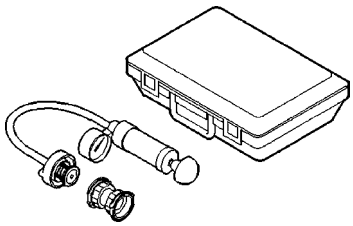
Rear Crankshaft Seal Installation Guide 9060



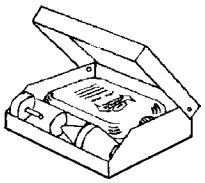
Valve Spring Compressor MD998772A



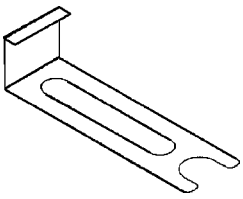
Valve Spring Tester C-647



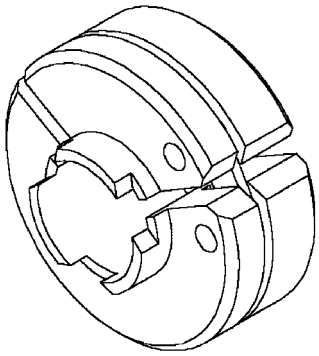
Pressure Tester Kit 7700



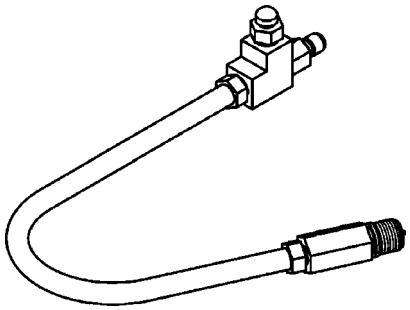
Bloc–Chek–Kit C-3685–A



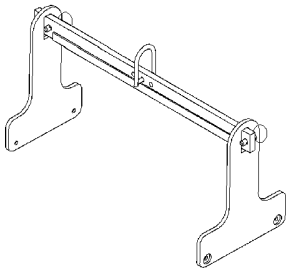
Clutch Hydraulic Line Disconnect Tool 6638A



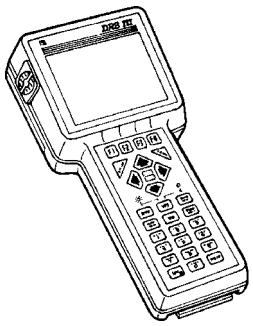
Disconnect Tool 9005



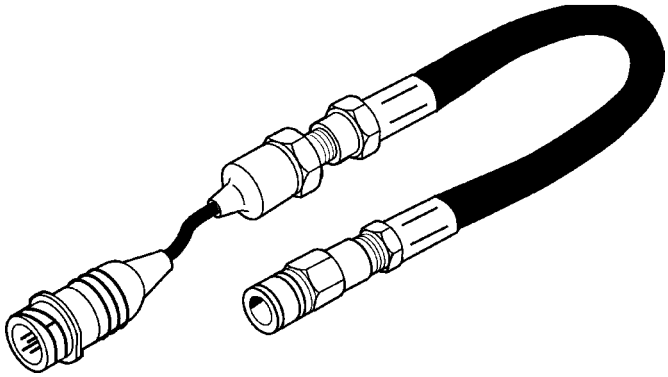
Adaptor 8116



ENGINE LIFTING FIXTURE 9363



DRB III® with PEP Module – OT-CH6010A

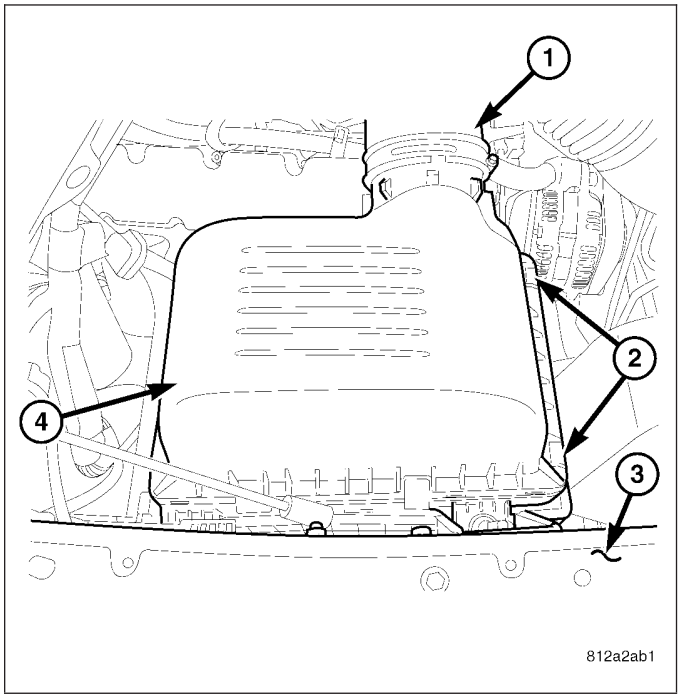


Pressure Transducer OT-CH7059

SYSTEM-AIR INTAKE

DESCRIPTION

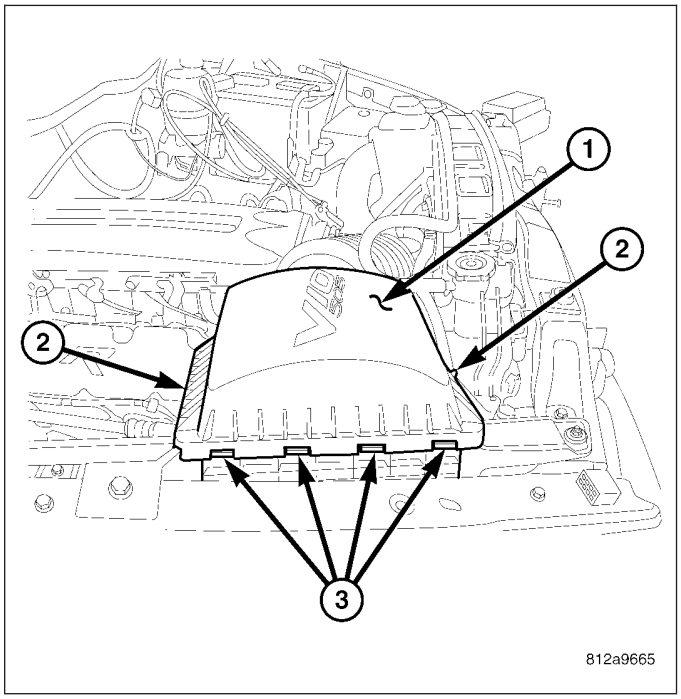
Air deflectors mounted to the hood and front grill route the cool incoming air into the right inner fender (3) where the inlet for the air cleaner housing (4) resides. Air passes through a filter element inside the housing, through a air inlet duct (1), and into the throttle body.



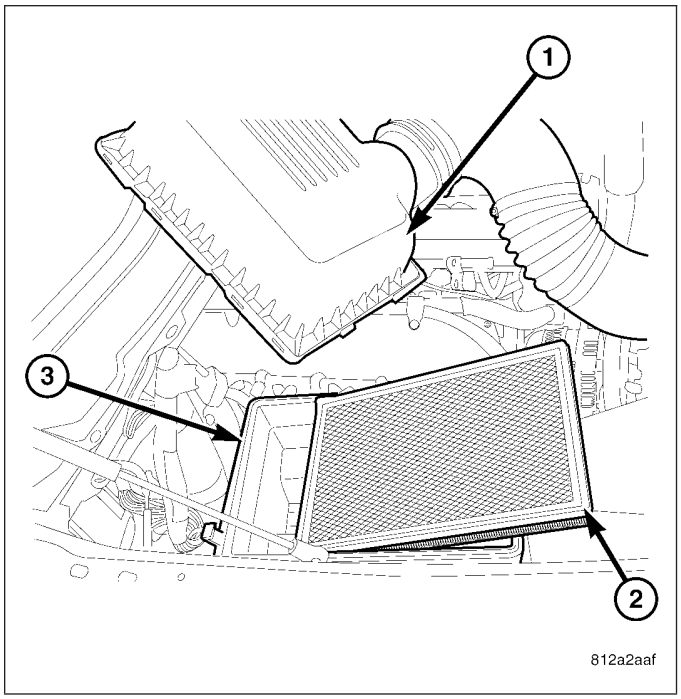
ELEMENT-AIR CLEANER

REMOVAL

1. Unclip the air cleaner cove (1) and release the top of the air cleaner housing assembly.

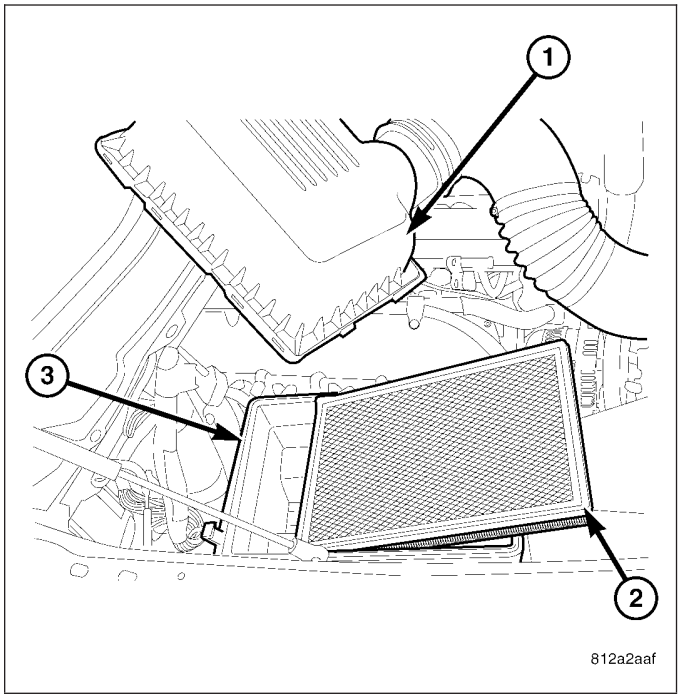


2. Pull the air filter element up and out of the air cleaner housing assembly.

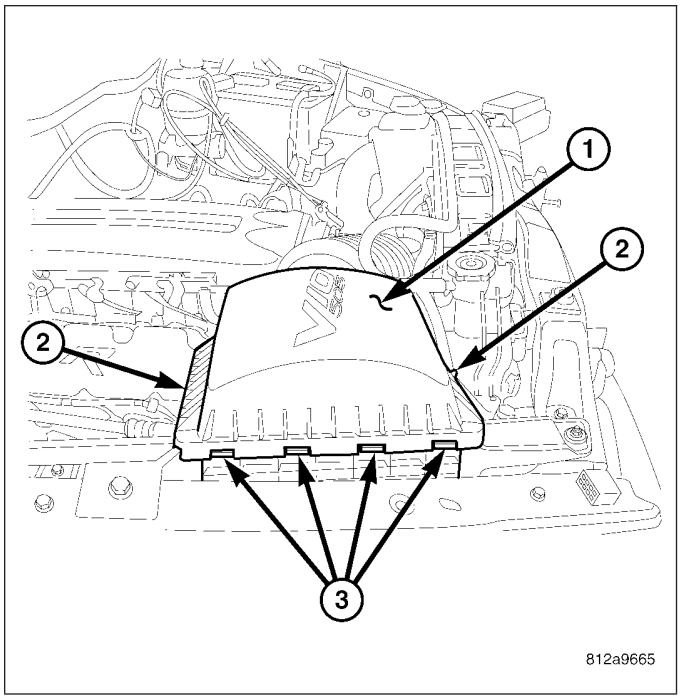


INSTALLATION

1. Install the air filter element (2) into the housing assembly (3).



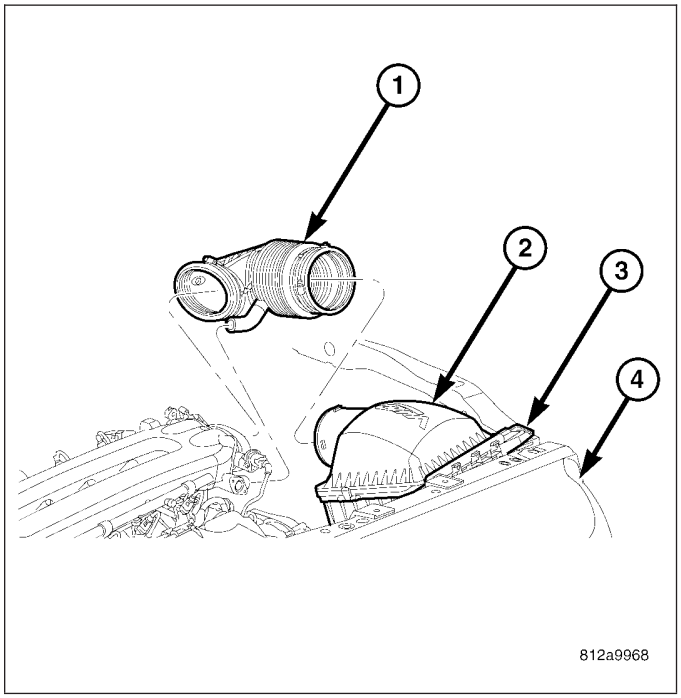
2. Position the alignment tabs (3) of the housing cover (1) into the lower housing assuring the position of the interlocking tabs.
3. Clip and snap the air cleaner housing cover retainers (2).



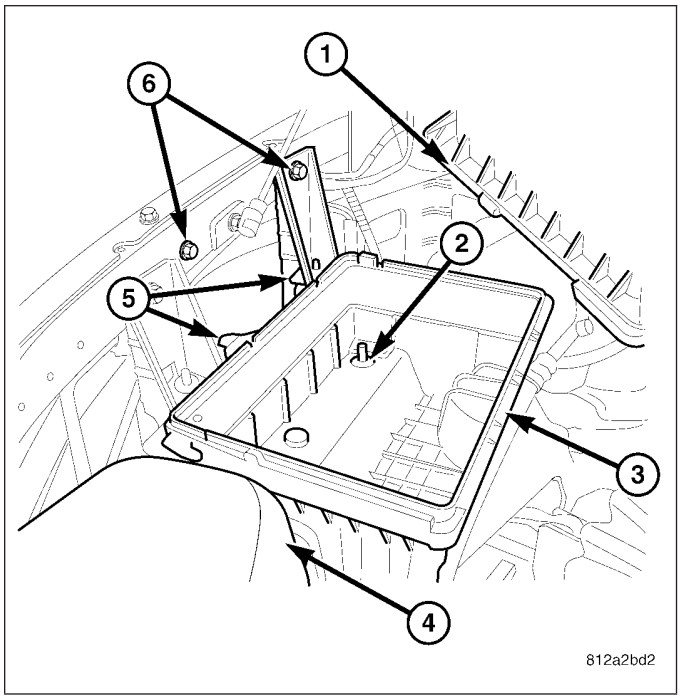
HOUSING-AIR CLEANER

REMOVAL

1. Disconnect the air inlet duct (1) and crankcase ventilation hose from the air cleaner housing (2).

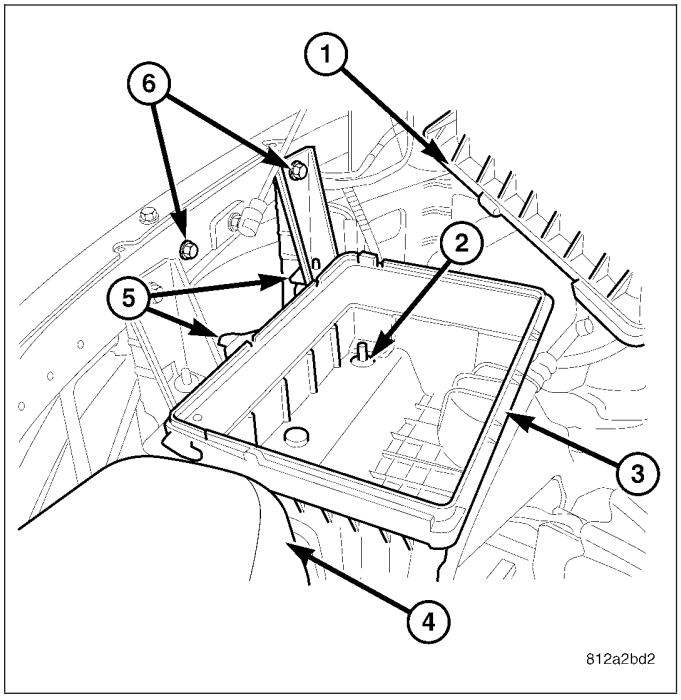


2. Remove the air cleaner housing fastener (6) on the front core support.
3. Lift up and remove the housing off of the guide pins (2) and grommets.

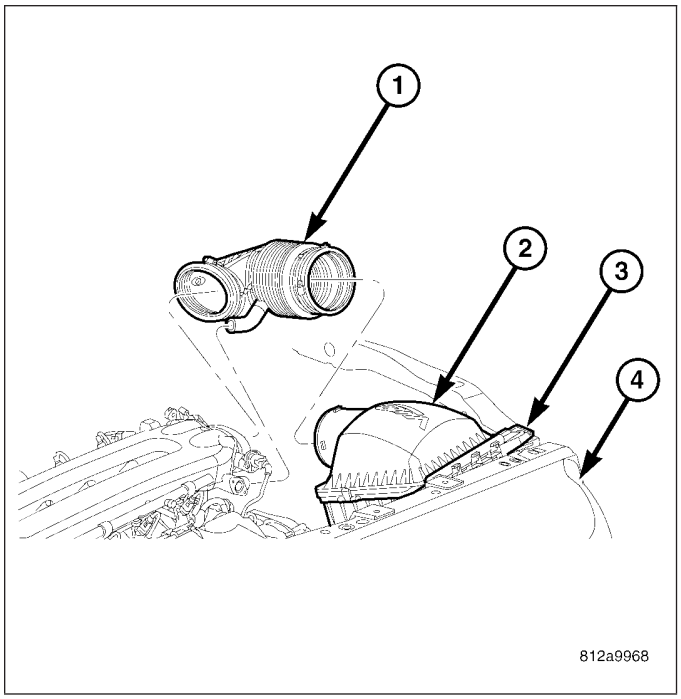


INSTALLATION

1. Position the housing (3) over the guide pins (2) and push down to seat.
2. Install and tighten the housing fasteners (6).



3. Connect the throttle body air inlet duct (1) and crank case ventilation hose to the air cleaner housing cover (2).

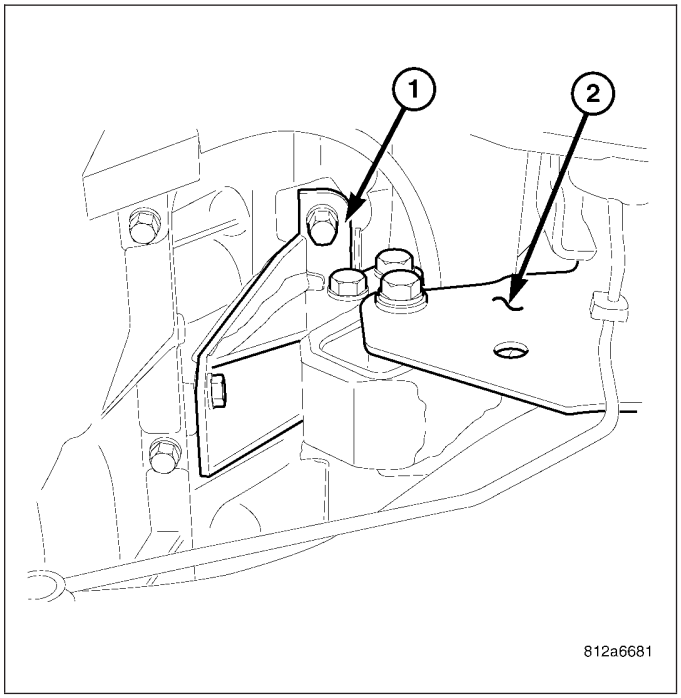


MOUNTS-ENGINE

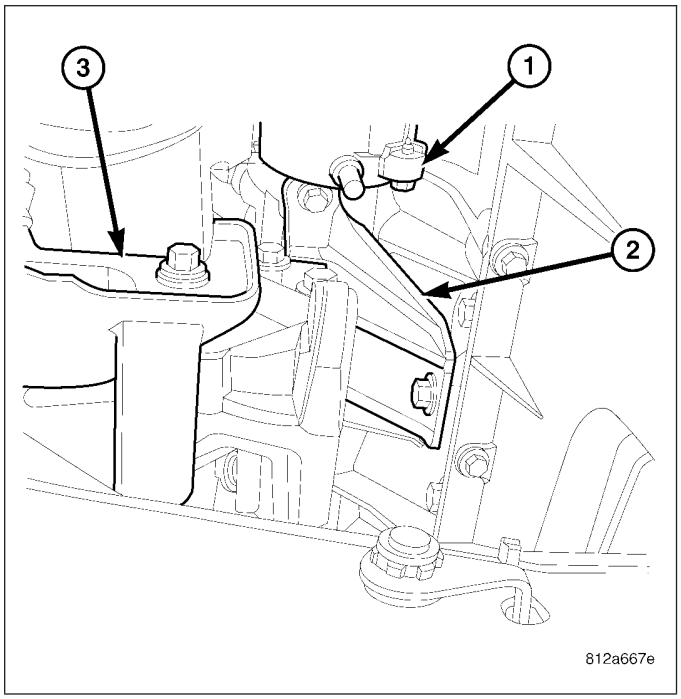
REMOVAL

NOTE: This procedure covers either the left or right engine mount.

1. Raise vehicle on hoist.
2. Support oil pan with suitable jack.
3. Loosen engine mount (1) to block bolts or.



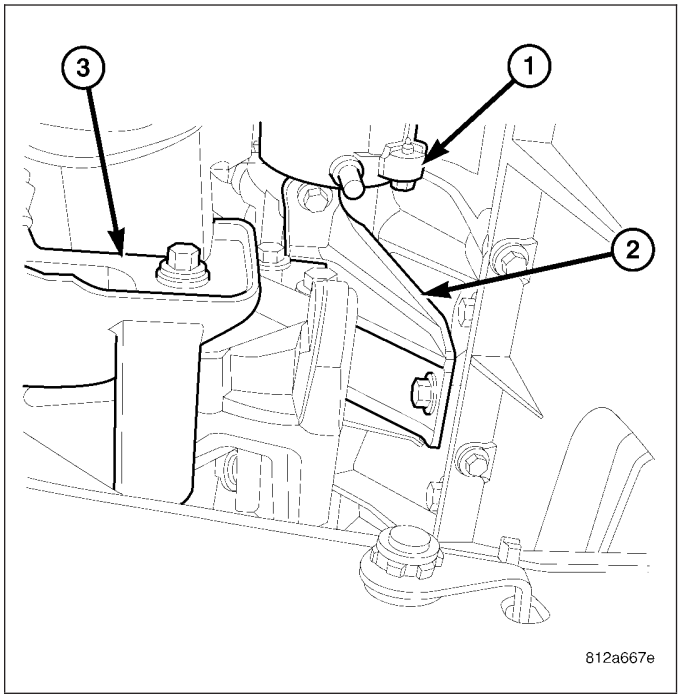
4. Loosen engine mount (2) to frame nut
5. Raise engine with jack. Remove engine mount to block bolts.
6. Remove engine mount or.



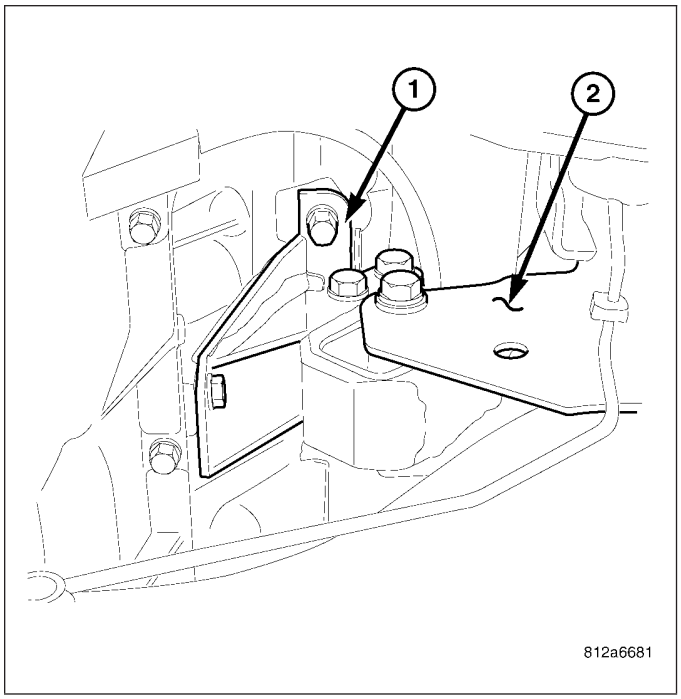
INSTALLATION

NOTE: This procedure covers either the left or right engine mount.

1. With engine raised, position engine mount (2) onto engine and install bolts. Tighten bolts to 41 N·m (30 ft. lbs.) or.



2. Lower engine with jack while guiding engine mount (1) studs into frame slots.
3. Install engine mount to frame nut. Tighten nut to 102 N·m (75 ft. lbs.) or.
4. Remove jack.
5. Lower vehicle.



MANIFOLD-INTAKE

DIAGNOSIS AND TESTING

INTAKE MANIFOLD LEAKS

An intake manifold air leak is characterized by lower than normal manifold vacuum, rough idle, or engine misfire.

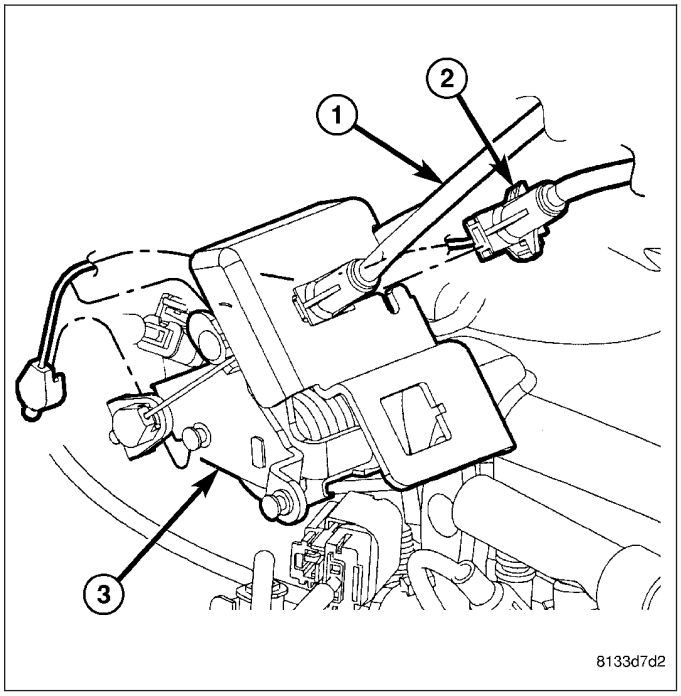
WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELT OR THE FAN. DO NOT WEAR LOOSE CLOTHING.

1. Start the engine.
2. Spray a small stream of water (Spray Bottle) at the suspected leak area.
3. If engine RPM'S change, the area of the suspected leak has been found.
4. Repair as required.

REMOVAL

NOTE: Care must be taken to protect the intake manifold powder coating from scrapes and abrasions.

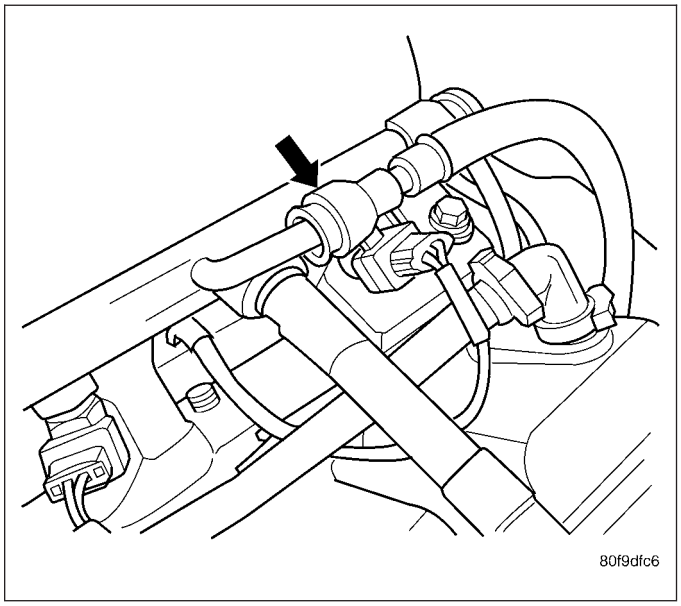
1. Perform the fuel system pressure release procedure, **before attempting any repairs.** (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE - FUEL SYSTEM PRESSURE RELEASE PROCEDURE).
2. Disconnect negative battery cable.
3. Disconnect throttle body air inlet duct, IAT sensor, CCV hose and remove air cleaner cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - REMOVAL).
4. Disconnect throttle cable (2) from throttle cam. Remove throttle cable from bracket and set aside.
5. Disconnect speed control cable from throttle cam and set aside.



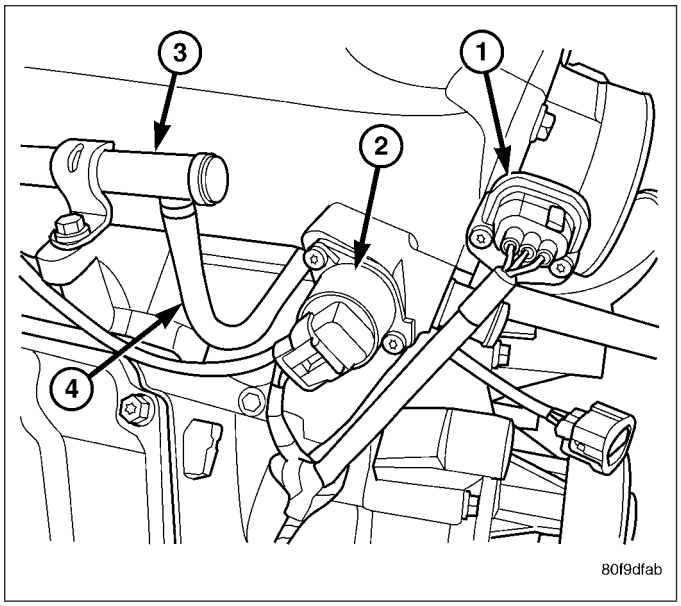
6. Disconnect brake booster vacuum hose from the intake manifold and set aside.

WARNING: WRAP A SHOP TOWEL AROUND FUEL LINE TO CATCH ANY GASOLINE SPILLAGE.

7. Disconnect fuel line quick connect fitting from fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/QUICK CONNECT FITTING - STANDARD PROCEDURE).

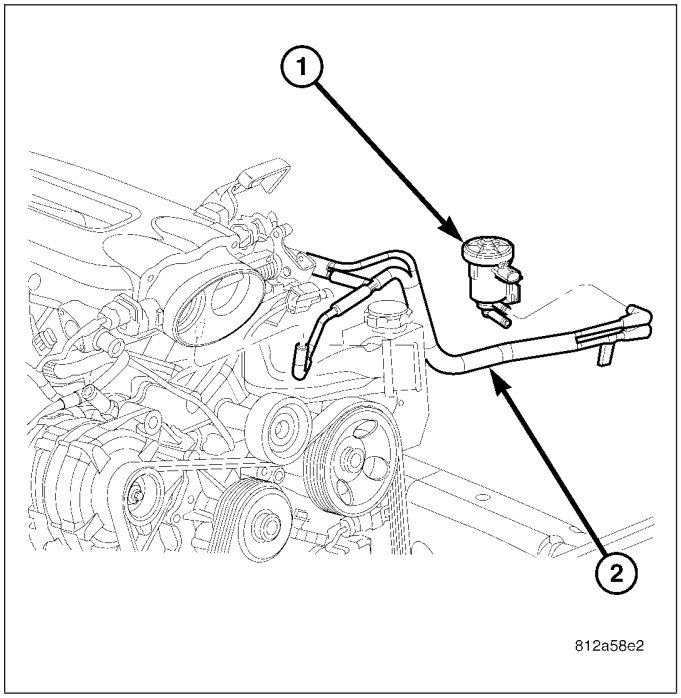


8. Disconnect the following electrical connectors:
   - Left cylinder head fuel injectors
   - MAP sensor
   - Engine Coolant Temperature (ECT) Sensor
   - Idle Speed Control Sensor (ISC)
   - Throttle Position Sensor (TPS) (1)
   - Right cylinder head fuel injectors
9. Carefully separate the fuel injector harness push pins from the intake manifold.

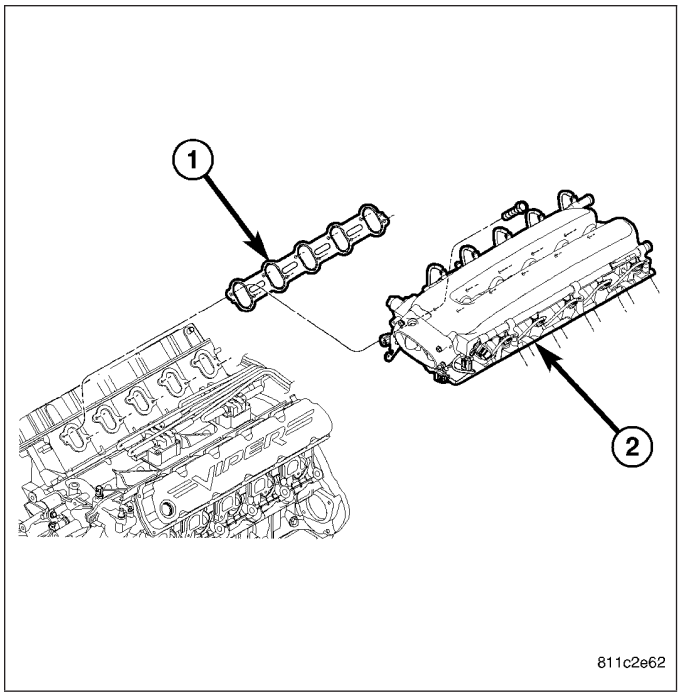


10. Disconnect the purge solenoid hose from beneath the throttle body.
11. Disconnect CCV hoses from left and right cylinder head covers.

CAUTION: Care must be taken when removing the No. nine cylinder inside intake manifold bolt. Failure to do so may result in personal injury or possible damage.



12. Remove the intake manifold bolts and intake manifold (2).
13. Cover the intake manifold openings with a suitable cover when servicing to prevent any debris from entering cylinder heads.



INSPECTION

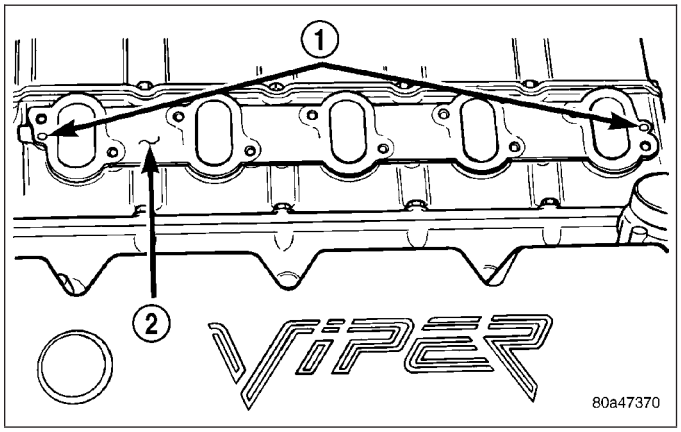
1. Inspect manifold for cracks or other damage.
2. Inspect manifold sealing surfaces for damage.

INSTALLATION

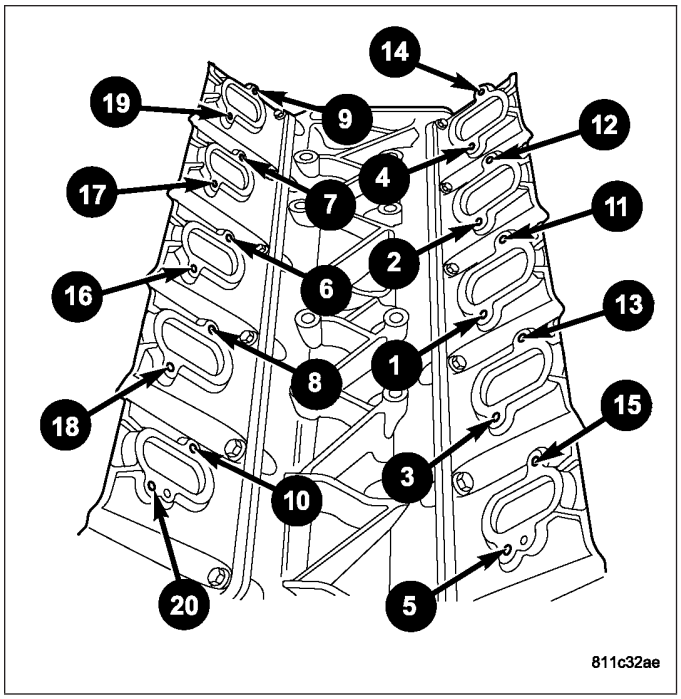
CAUTION: When cleaning the intake manifold and cylinder head mating surfaces, do not use a metal scraper because the surfaces could be cut or ground. Instead, use a wooden or plastic scraper.

NOTE: Care must be taken to protect the intake manifold powder coat from possible scrapes and abrasions.

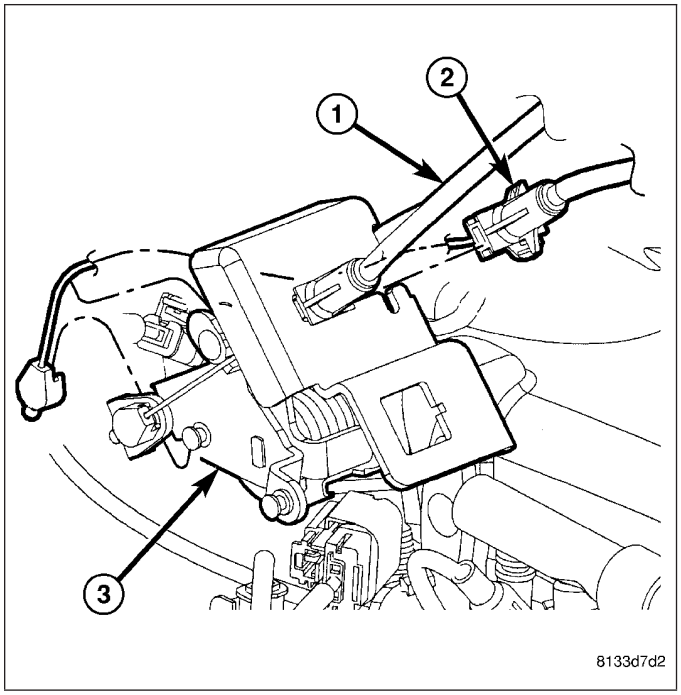
1. Clean gasket surfaces and remove covering from intake manifold openings.
2. Carefully install the intake manifold gaskets (2) and alignment pins (1).



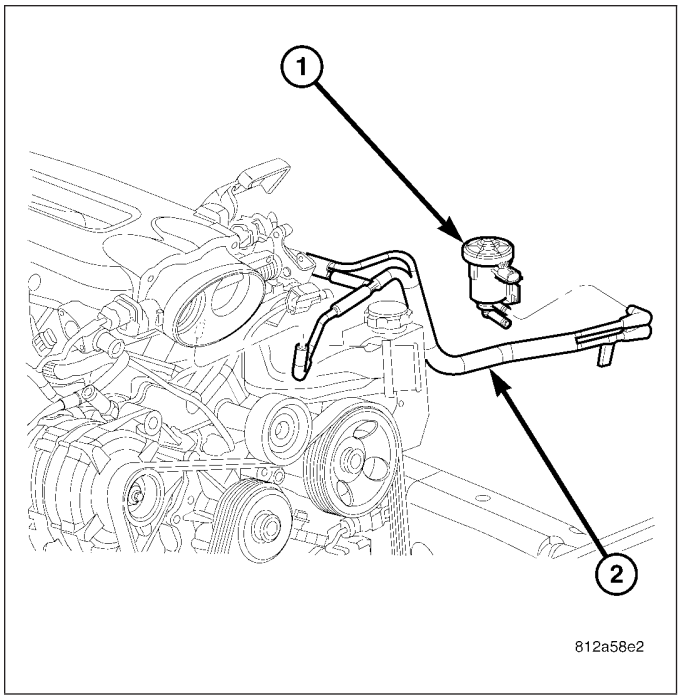
3. Set the intake manifold in position on the engine. Install intake manifold bolts and tighten initially to 1 N·m (10 in. lbs.). Tighten bolts starting at the center and working outward to 11 N·m (95 in. lbs.).
4. Connect CCV hoses to left and right cylinder head covers.
5. Connect fuel line to fuel rail. Pull backward on the quick connect fitting to ensure complete insertion.
6. Connect the brake booster vacuum hose.



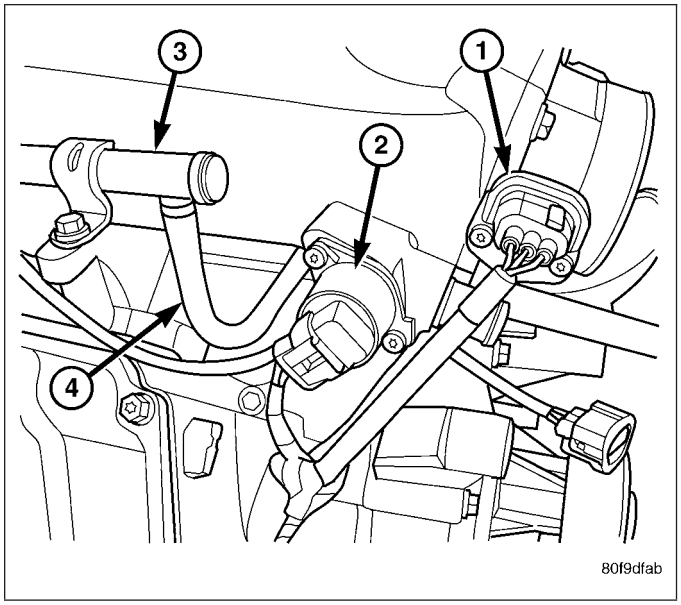
7. Connect speed control cable to throttle linkage.
8. Connect the throttle cable housing to the bracket and then attach the cable to the throttle linkage



9. Attach the purge solenoid hose to the underside of the throttle body housing.



10. Reconnect the following electrical connectors:
    - Left cylinder head fuel injectors
    - Engine Coolant Temperature (ECT) Sensor
    - MAP sensor
    - Idle Speed Control
    - Throttle Position Sensor
    - Right cylinder head fuel injectors
11. Install air cleaner cover assembly, connect throttle body air inlet hose, CCV hose and connect the Intake Air Temperature Sensor (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - INSTALLATION).
12. Connect negative battery cable.
13. With the Scan Tool, use the ASD Fuel System Test to pressurize fuel system to check for leaks.



CAUTION: When using the ASD Fuel System Test, the Auto Shutdown (ASD) relay will remain energized for 7 minutes or until the ignition switch is turned to the OFF position, or Stop All Test is selected.

MANIFOLD-EXHAUST

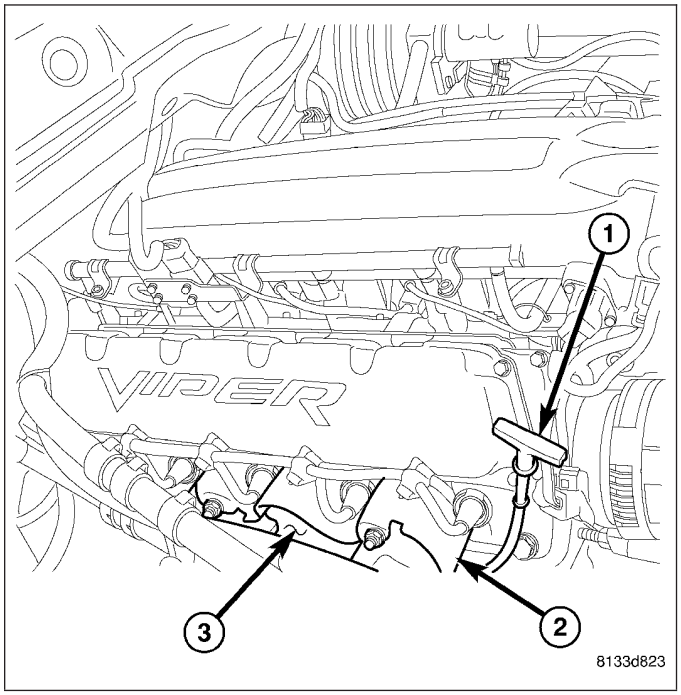
REMOVAL

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions. This procedure covers either the left or right exhaust manifold.

1. Disconnect negative battery cable.

NOTE: When servicing the right exhaust manifold it is necessary to remove the upper oil dip stick tube fastener and position the tube aside.

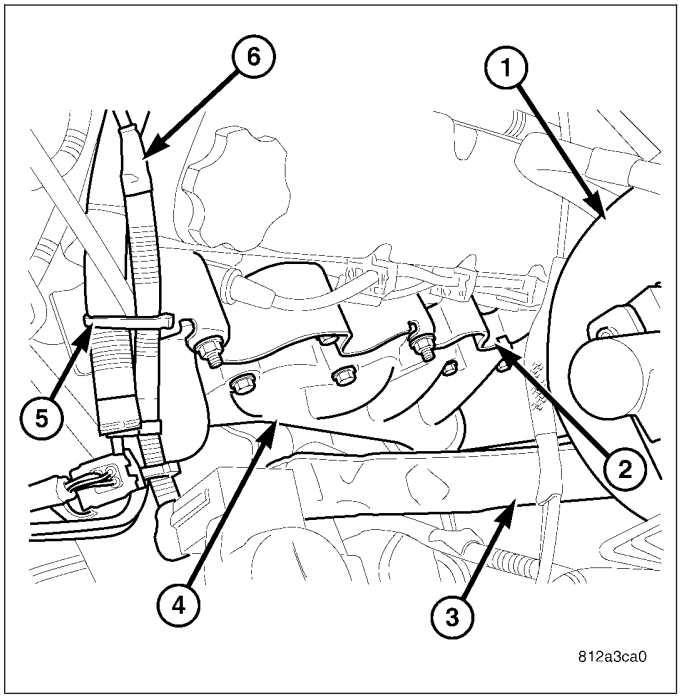
2. Raise vehicle on hoist.



3. Loosen and remove the fasteners from the exhaust pipe to exhaust manifold.
4. Separate exhaust pipe from the exhaust manifold.
5. Lower the vehicle.
6. Disconnect the spark plug wires from the spark plugs and set aside.
7. Remove manifold heat shield from exhaust manifold ,.

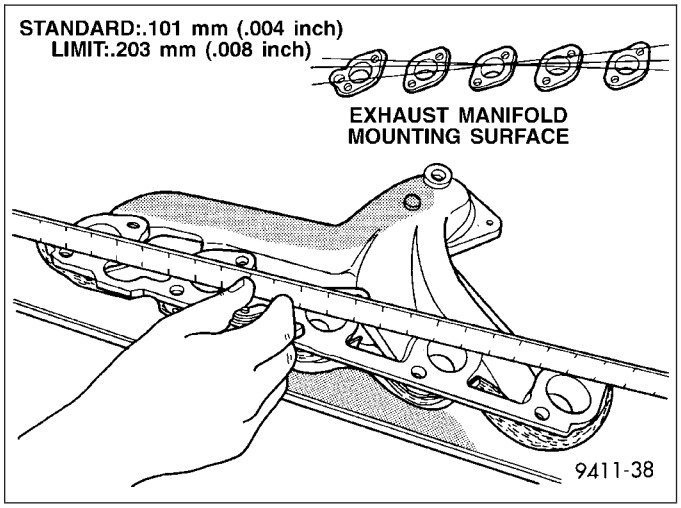
NOTE: Note the location of exhaust manifold studs and bolts for proper installation.

8. Remove studs and bolts attaching manifold to cylinder head and remove manifold ,.



INSPECTION

Inspect exhaust manifolds for damage or cracks. Check for distortion of the cylinder head mounting surfaces with a straightedge and feeler gauge.



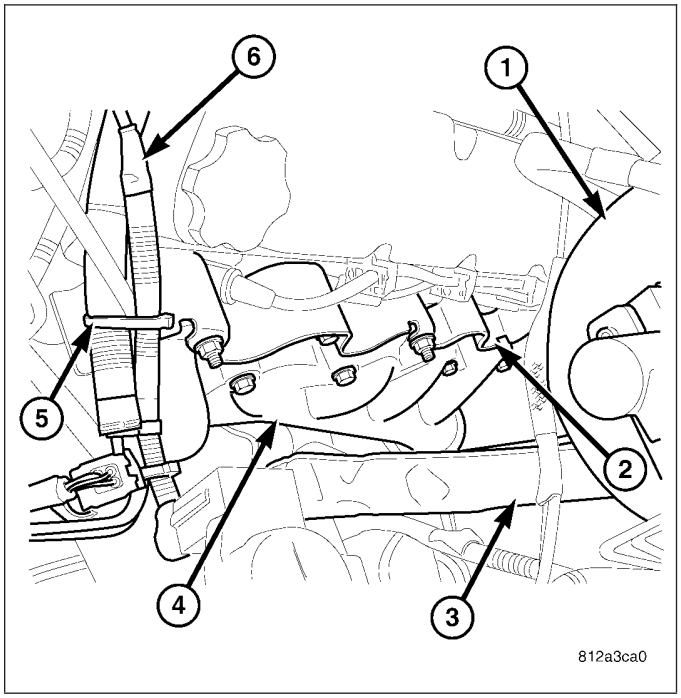
INSTALLATION

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions. This procedure covers either the left or right exhaust manifold.

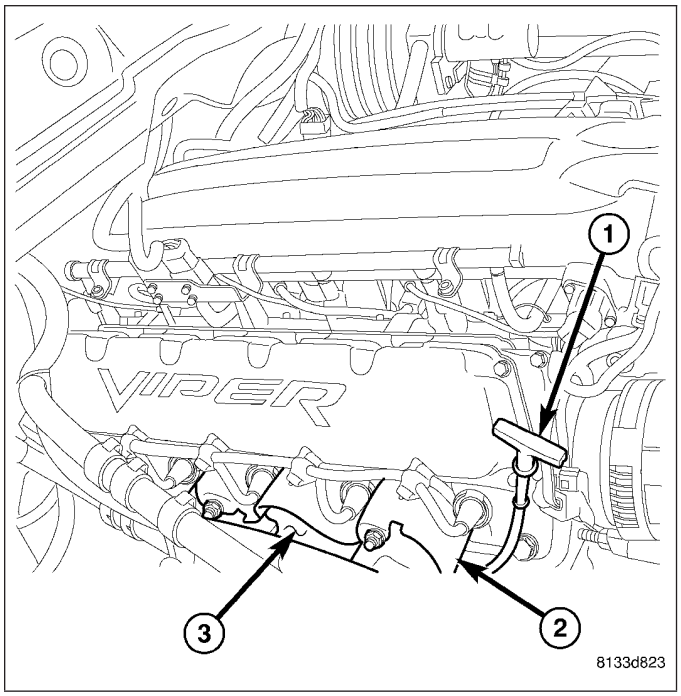
1. Install new gasket and install exhaust manifold Tighten attaching fasteners to 23 N·m (200 in. lbs.) ,.

NOTE: When installing right exhaust manifold, properly position the oil level indicator tube, install fastener and tighten to the cylinder head cover specification.

2. Install manifold heat shield and tighten attaching fasteners to 6 N·m (50 in. lbs.) ,.



3. Install the spark plug wires.
4. Raise vehicle on hoist.
5. Connect exhaust pipe to exhaust manifold. Tighten fasteners to 34 N·m (25 ft.lbs.).
6. Lower vehicle.
7. Connect negative battery cable.



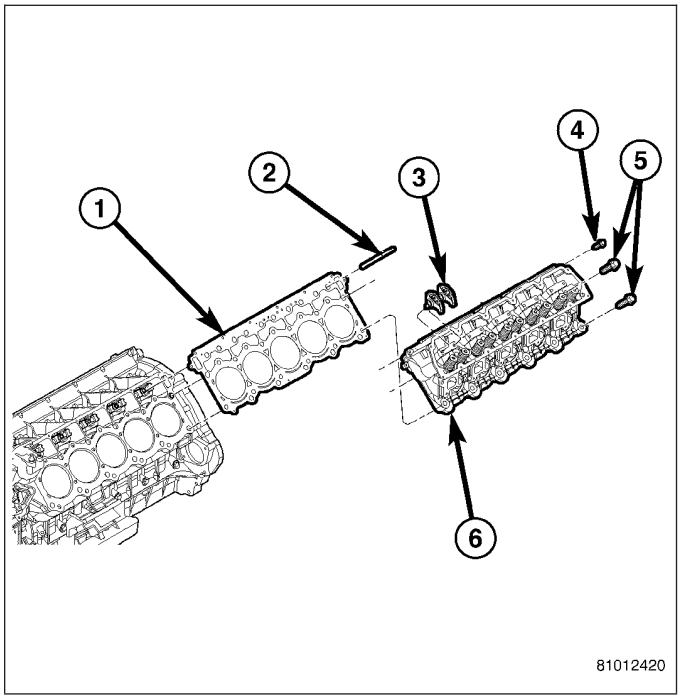
HEAD(S)-CYLINDER

REMOVAL - CYLINDER HEAD(S)

NOTE: Care must be taken to protect the intake manifold and cylinder head covers powder coating from scrapes and abrasions. This procedure covers either the left or right cylinder head.

The aluminum alloy cylinder head shown in is held in place by 12, ½ inch bolts (5) and 8, ¼ inch bolts (4).

1. Release the fuel pressure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
2. Disconnect negative battery cable.
3. Disconnect the throttle body air inlet duct, IAT sensor, CCV hose and remove the air cleaner cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
4. Drain the cooling system (Refer to 7 - COOLING/ ENGINE - STANDARD PROCEDURE - DRAINING COOLING SYSTEM).
5. Raise and support the vehicle.
6. Disconnect the front exhaust pipe to exhaust manifold connection.



7. Lower the vehicle.
8. Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
9. Disconnect the spark plug wires by pulling on the boot straight out in line with the spark plug. Dislodge spark plug retainers from the cylinder head cover studs and position the spark plug wires aside.
10. Disconnect the oil level indicator tube and set aside.
11. Disconnect CCV hoses from cylinder head covers.
12. Remove the cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL).

13. Remove exhaust manifold heat shields.
14. Remove exhaust manifold(s) and gasket(s) (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - REMOVAL).

NOTE: If rocker arms and push rods are to be reused, identify each component to ensure installation in original locations.

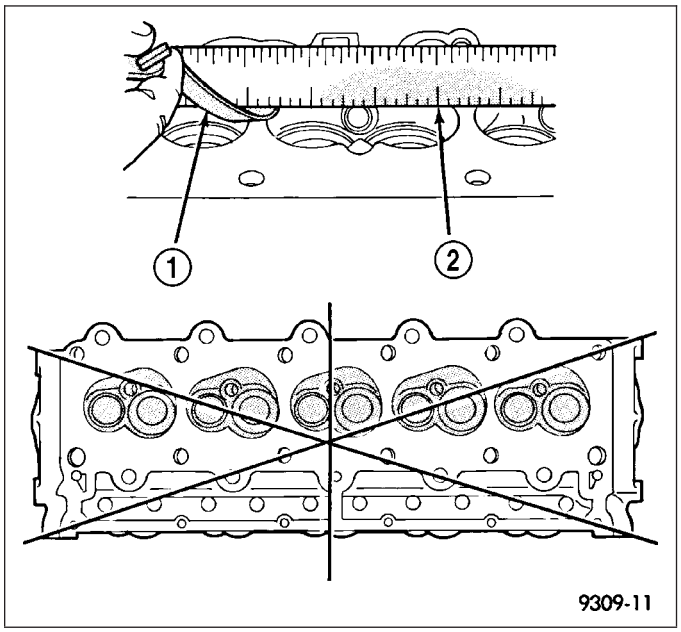
15. Remove the rocker arm and pedestal assemblies (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - REMOVAL).
16. Remove push rods.
17. Remove the 12 head bolts and 8 cylinder head tappet gallery bolts from cylinder head(s).
18. Remove cylinder head(s) and gasket(s).

CLEANING

CLEANING / INSPECTION

1. Before cleaning, check for leaks, damage and cracks.
2. Clean cylinder head and oil passages.
3. Check cylinder head for flatness.
4. Inspect all surfaces with a straightedge (2) if there is any reason to suspect leakage. If out-of-flatness exceeds 0.019 mm (0.00075 in.) times the span length in inches in any direction, either replace head or lightly machine the head surface. As an example, if a 12.0 inch span is 1.0 mm (0.004 in.) out-of-flat, allowable is 12 x 0.019 mm (0.00075 in.) equals 0.22 mm (0.009 in.). This amount of out-of-flat is acceptable. *Maximum of 0.2 mm (0.008 in.) for grinding is permitted.

CAUTION: This is a combined total dimension of stock removal from cylinder head surface.

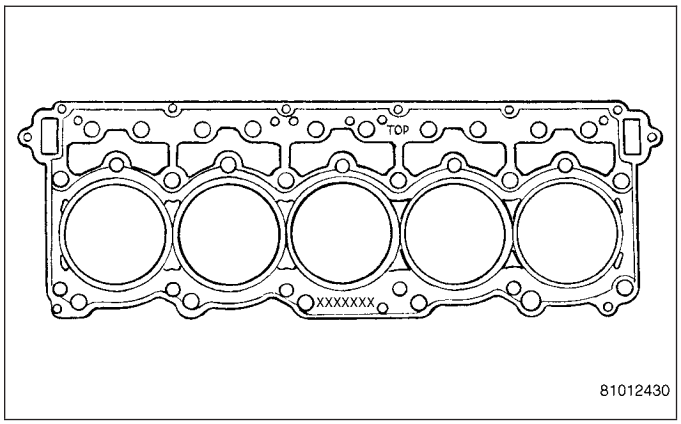


INSTALLATION - CYLINDER HEAD(S)

NOTE: This procedure covers either the left or right cylinder head.

1. Clean all surfaces of engine block and cylinder heads (Refer to 9 - ENGINE - STANDARD PROCEDURE - ENGINE GASKET SURFACE PREPARATION).

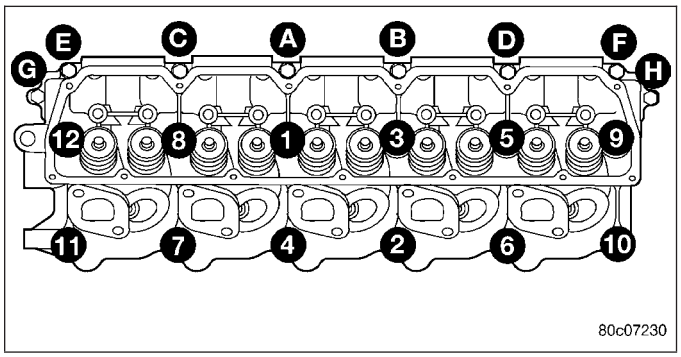
CAUTION: Remove all gasket material from cylinder head and block using a plastic scraper only. DO NOT use a metal scraper, as damage to sealing surface may occur.



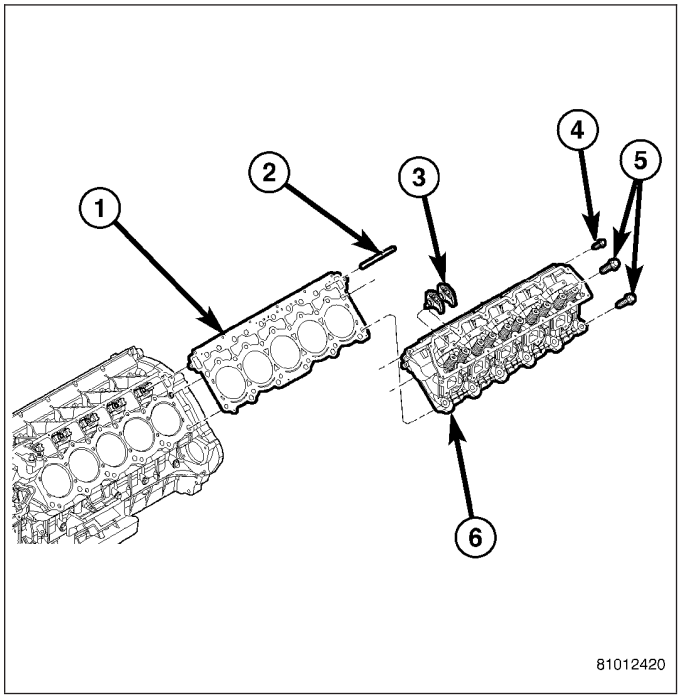
NOTE: A multi-layer steel head gasket is used.

2. Install new gasket(s) on the engine block. Assure all coolant passages and bolt holes align properly..

CAUTION: Cylinder head bolts are coated, DO NOT oil.



3. Install cylinder head(s) over dowel pins. Install cylinder head bolts 1–12. Tighten cylinder head bolts 1–12 in the sequence shown in using a two step torque sequence:
   a. First to 47 N·m (35 ft. lbs.).
   b. Second to 122 N·m (90 ft. lbs.).
4. After cylinder head bolts 1-12 have been tightened to specifications, install and tighten cylinder head tappet gallery bolts A-H in sequence shown to 11 N·m (95 in. lbs.).



5. Inspect the push rods. Replace worn or bent push rods as necessary.
6. Install push rods. Install rocker arms and pedestal assemblies into their original positions. Ensure push rods are seated properly under each rocker arm. Tighten rocker arm bolts to 35 N·m (26 ft. lbs.).
7. Install exhaust manifold(s) and gasket(s) (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - INSTALLATION).
8. Install exhaust manifold heat shields.
9. Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
10. Position and install the oil level indicator tube. Tighten fastener to 11 N·m (95 in. lbs.).
11. Connect CCV hoses to cylinder head covers.
12. Install the spark plug wires and plug wire retainers.
13. Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).
14. Raise and support the vehicle.
15. Connect the exhaust system to the exhaust manifolds.
16. Drain the engine oil (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE).
17. Lower the vehicle.
18. Fill engine oil to the proper level (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION), (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
19. Fill the cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE - FILLING COOLING SYSTEM).
20. Connect negative battery cable.
21. Install the air cleaner cover, throttle inlet duct and connect the IAT sensor and CCV hose.
22. Start engine and inspect for leaks.

COVER(S)-CYLINDER HEAD

REMOVAL

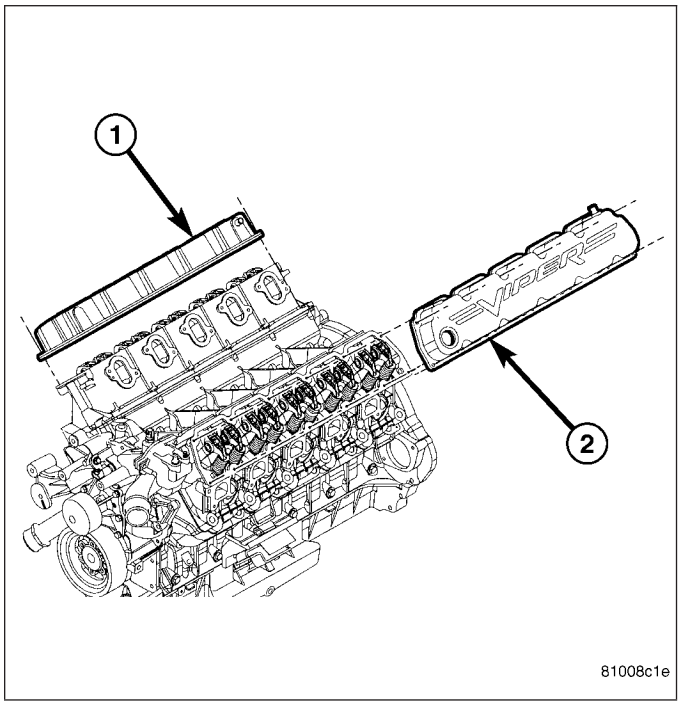
LEFT CYLINDER HEAD COVER

NOTE: Care must be taken to protect the cylinder head cover powder coating from scrapes and abrasions.

1. Disconnect CCV hose from cylinder head cover.
2. Disconnect left side spark plug wires by pulling on the boot straight out in line with plug. Dislodge spark plug wire retainers from cylinder head cover studs. Reposition spark plug wires aside.
3. Disconnect the power brake booster vacuum hose at the intake manifold and set aside.

NOTE: For reassembly purposes, identify location of cylinder head cover attaching studs and bolts.

4. Remove cylinder head cover fasteners. Remove cylinder head cover (2) from engine.



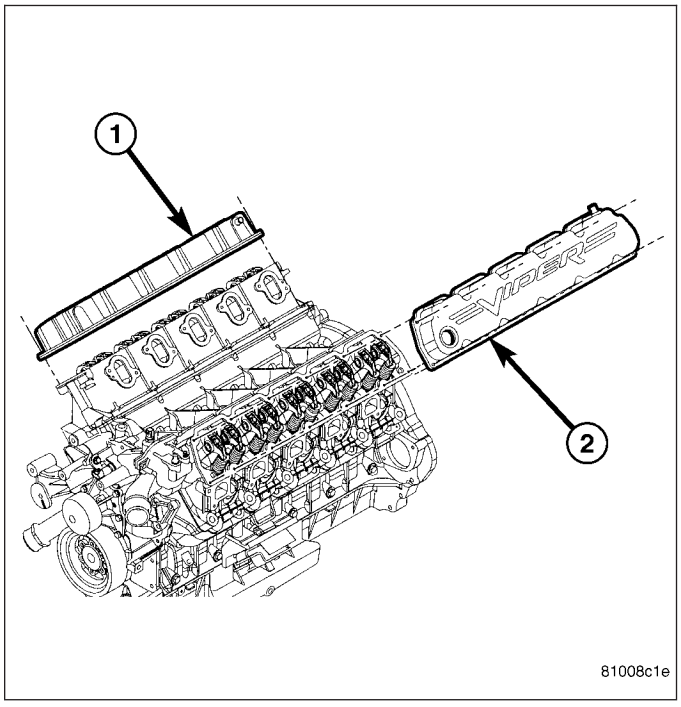
RIGHT CYLINDER HEAD COVER

NOTE: Care must be taken to protect the cylinder head cover powder coating from scrapes and abrasions.

1. Disconnect CCV hose from cylinder head cover.
2. Disconnect right side spark plug wires by pulling on the boot straight out in line with plug. Dislodge spark plug wire retainers from cylinder head cover studs. Reposition spark plug wires aside.
3. Remove the oil level indicator tube fastener and position tube aside.

NOTE: For reassembly purposes, identify location of cylinder head cover attaching studs and bolts.

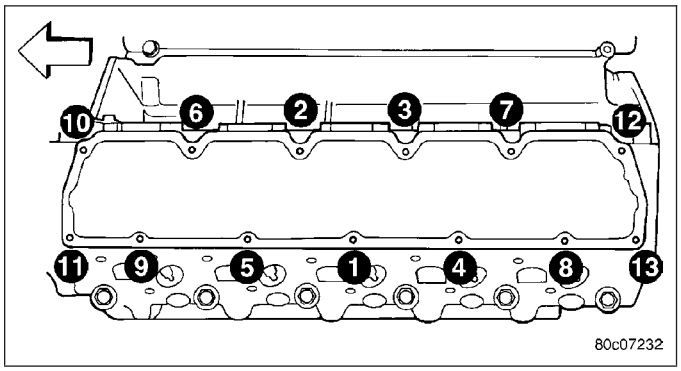
4. Remove cylinder head cover fasteners.
5. Remove cylinder head cover (1) from engine.



INSTALLATION

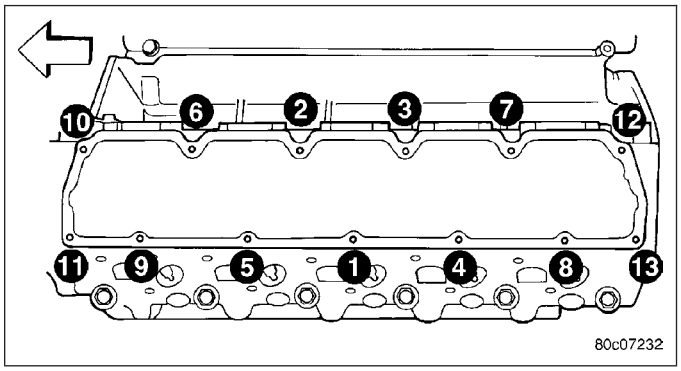
LEFT CYLINDER HEAD COVER

NOTE: Care must be taken to protect the cylinder head covers powder coating from scrapes and abrasions.



1. Inspect cylinder head cover gasket. Replace as necessary.
2. Place cylinder head cover onto cylinder head. Install and tighten cylinder head cover fasteners to 11 N·m (95 in. lbs.) in sequence shown in.
3. Connect spark plug wires. Position spark plug wire retainers onto cylinder head cover studs.
4. Connect CCV hose to cylinder head cover.
5. Connect the power brake booster vacuum hose to the intake manifold port.

RIGHT CYLINDER HEAD COVER



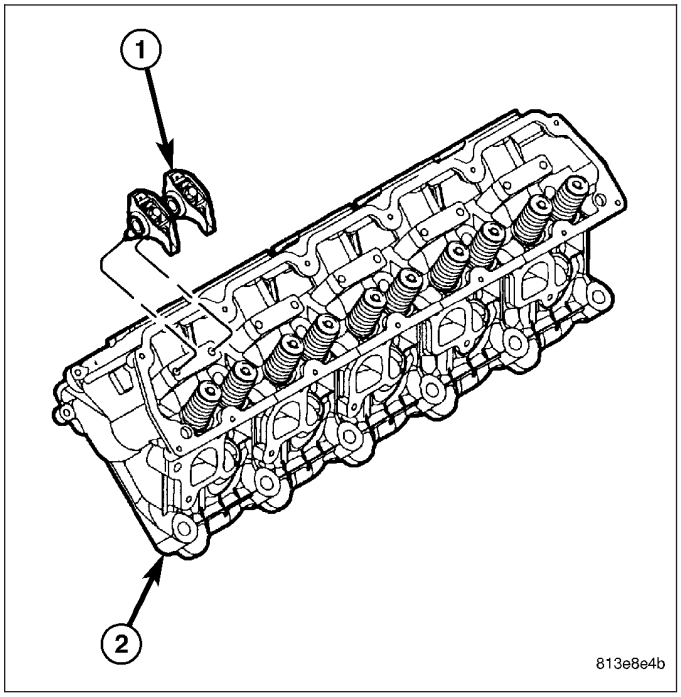
1. Inspect cylinder head cover gasket. Replace as necessary.
2. Place cylinder head cover onto cylinder head. Install and tighten cylinder head cover fasteners to 11 N·m (95 in. lbs.) in sequence shown in.
3. Position the oil level indicator tube into position. Tighten fastener to 11 N·m (95 in. lbs.).
4. Connect spark plug wires. Position spark plug wire retainers onto cylinder head cover studs.
5. Connect CCV hose to cylinder head cover.

ARMS-ROCKER

REMOVAL

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

1. Remove cylinder head cover(s) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Remove two rocker pedestal bolts per each cylinder.
3. Remove rocker arm assemblies as a pair.
4. If rocker arm assemblies are disassembled for cleaning or replacement, reassemble rocker arms in their original position.



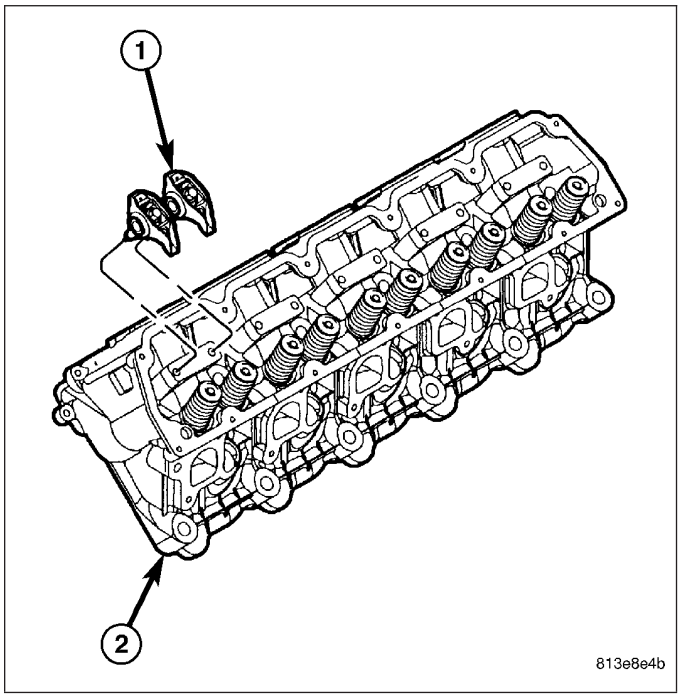
INSTALLATION

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

1. Install rocker arm and pedestal assemblies into position. Ensure push rods are seated properly under each rocker arm. Tighten rocker arm bolts to 35 N·m (26 ft. lbs.).

CAUTION: THE ROCKER ARM PEDESTAL BOLTS SHOULD BE TORQUED DOWN SLOWLY. ALLOW 20 MINUTES TAPPET BLEED DOWN TIME AFTER INSTALLATION OF THE ROCKER BOLTS BEFORE ENGINE OPERATION.

2. Install cylinder head cover(s) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).



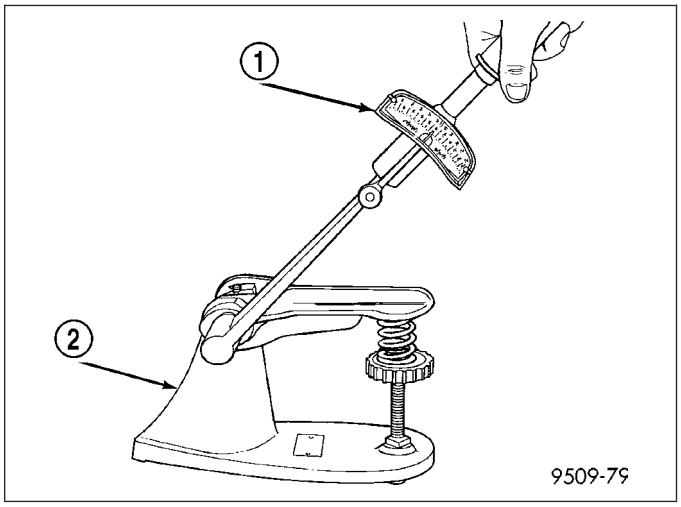
SPRINGS/SEALS-VALVE

DIAGNOSIS AND TESTING

VALVE SPRING TESTING

The valve springs should be tested whenever removed for inspection, reconditioning, or replacement.

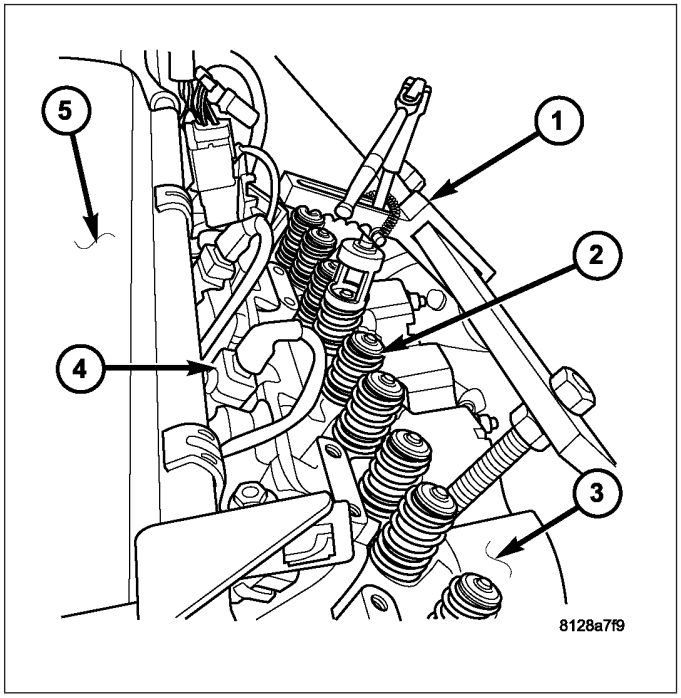
1. Obtain specifications for spring tension at specified spring length (Refer to 9 - ENGINE - SPECIFICATIONS).
2. Turn table of Special Tool C-647 (2) until the surface is in line with the spring length specification mark on the threaded stud and the zero mark is on the front.
3. Place spring over stud on the table and lift compressing lever to set tone device.
4. Pull on torque wrench (beam or dial type) until ping is heard. Take reading on torque wrench at this instant. Multiply this reading by two. This will give the spring load at test length.



5. Compare reading to the specification. Discard the springs that do not meet specifications.

STANDARD PROCEDURE - VALVE SPRING/SEAL SERVICE IN-CAR

1. Disconnect negative battery cable.
2. Disconnect secondary ignition wires and remove spark plugs.
3. Remove cylinder head cover(s) (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
4. Rotate crankshaft until No. 1 piston is at TDC on compression stroke.
5. Remove rocker arms with pivots. The rocker arms should not be disturbed and remain on pivot block.
6. With air hose attached to spark plug adapter installed in No. 1 spark plug hole, apply 620.5 - 689 kPa (90 - 100 psi) air pressure. This is to hold valves into place while servicing components.



CAUTION: Place a suitable shop towel around the valve spring being serviced to prevent the valve retaining locks from entering the engine once the valve spring is compressed.

7. Using valve spring compressor MD998772-A with insert 6716-A (1), compress valve spring (2) and remove valve retaining locks.
8. Release valve spring compressor (1).
9. Remove valve spring and retainer.
10. Remove valve seal.

NOTE: Black valve seals are intake. Brown valve seals are exhaust.

11. The intake and exhaust valve stem seals should be pushed firmly and squarely over the valve guide using the valve stem as guide. Push seal against top of guide. When installing the valve retainer locks, compress the spring **only enough** to install the locks.

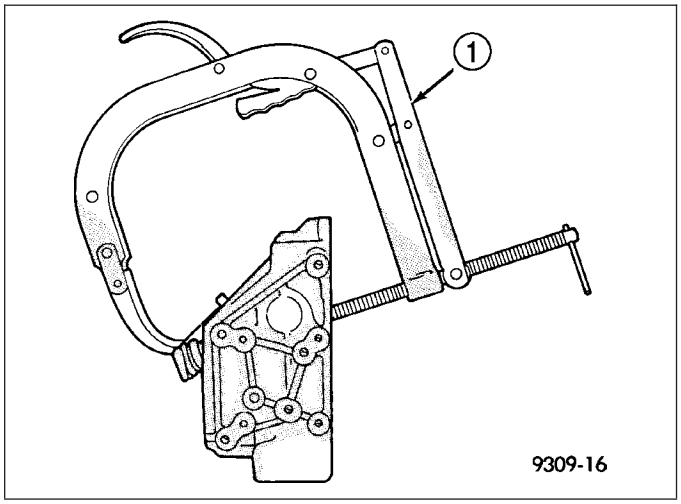
CAUTION: Do not pinch seal between retainer and top of valve guide.

12. Follow the same procedure on the remaining 9 cylinders. **Make sure piston is at TDC on the cylinder the valve spring is being removed.**
13. Remove spark plug adapter tool.
14. Install rocker arm and pedestal assemblies. Ensure push rods are seated properly under each rocker arm. Tighten rocker arm bolts to 35 N·m (26 ft. lbs.).
15. Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
16. Install spark plugs and connect secondary ignition wires.
17. Connect negative battery cable.

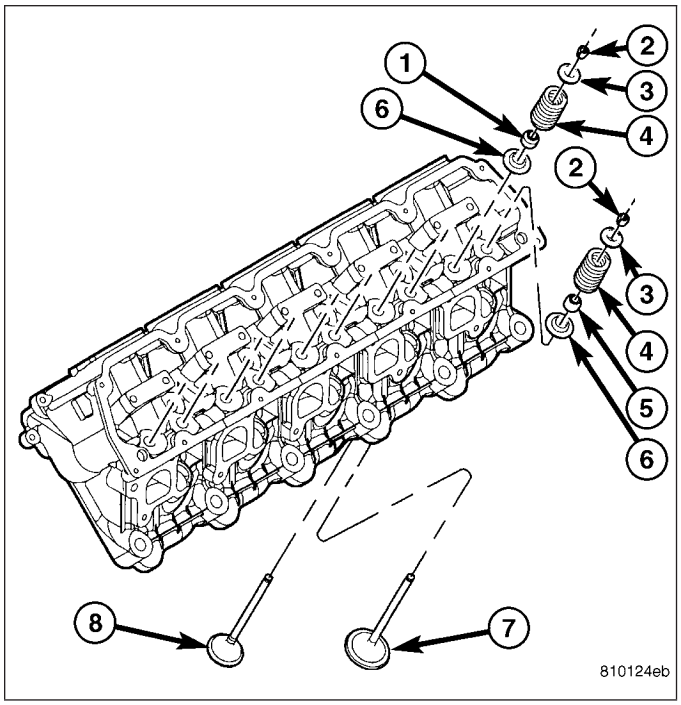
REMOVAL

NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

1. With the cylinder head removed, compress valve springs using a valve spring compressor (1).



2. Remove valve retaining locks.
3. Slowly release valve spring compressor.
4. Remove valve spring retainer and valve spring.
5. Before removing the valves, **remove any burrs from valve stem lock grooves to prevent damage to the valve guides.** Identify the valves to ensure installation in original location.
6. Remove valve seal.
7. Repeat procedure for remaining valves.

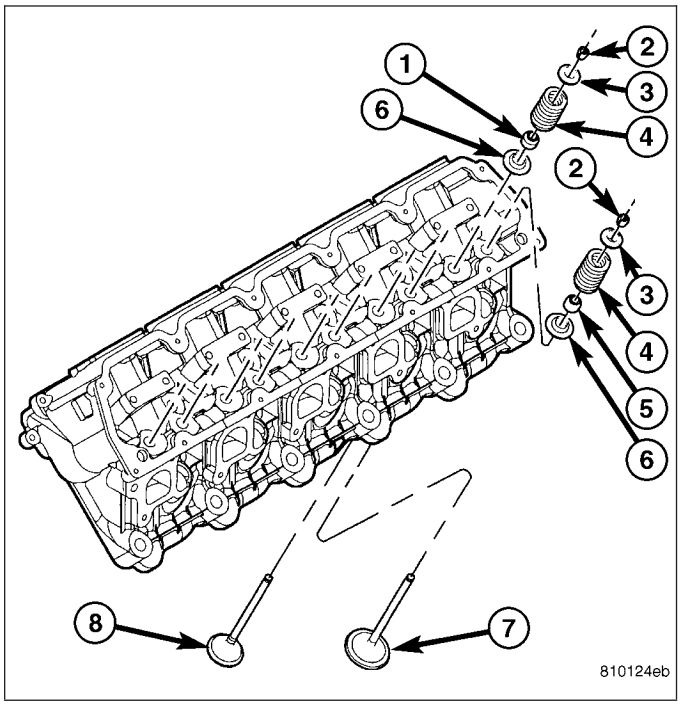


INSTALLATION

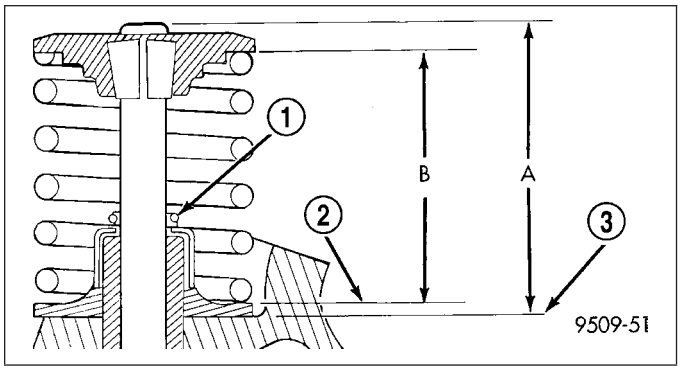
NOTE: Before replacing parts, inspect all related valvetrain components for damage to prevent engine misfire.

NOTE: Black valve seals are intake. Brown valve seals are exhaust.

1. Install valve seals (1).
2. Coat the valve stems with clean engine oil and insert them in the cylinder head.
3. Install valve spring seats (6).
4. Install valve springs and valve retainers (2).



5. Compress valve springs with a valve spring compressor. Install retaining locks and release tool.
6. **If valves and/or seats have been reground, measure valve tip height (A). Make sure measurements are taken from cylinder head surface to the top of valve stem.** If valve tip height is greater than 52.96 mm (2.085 in.), grind the valve tip until within specifications.
7. **If valves and/or seats have been reground, measure installed height of springs (B). Make sure measurements are taken from top of spring seat to the bottom surface of valve spring retainer.** If height is greater than 44.45 mm (1.75 in.), install a 0.794 mm (.031 in.) spacer in head counter-bore under the valve spring seat to bring spring height back to 43.69 - 44.45 mm (1.72 - 1.75 in.).

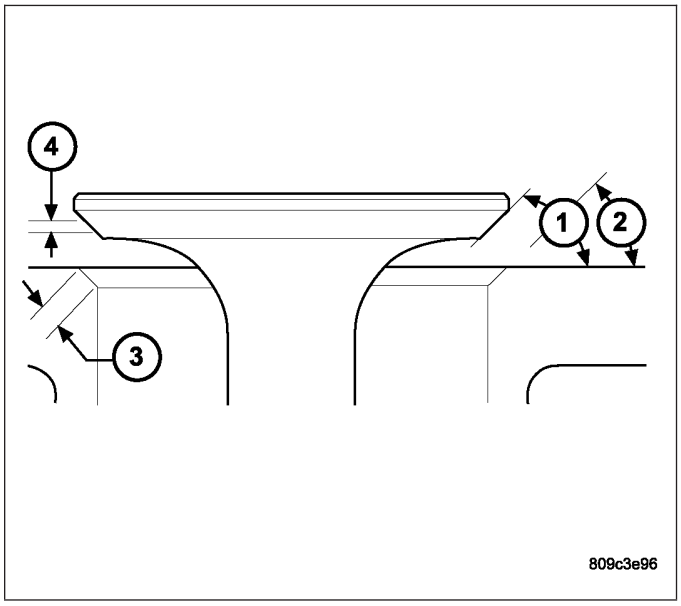


INTAKE/EXHAUST - VALVES/SEATS/GUIDES

STANDARD PROCEDURE - VALVE AND VALVE SEAT - REFACING

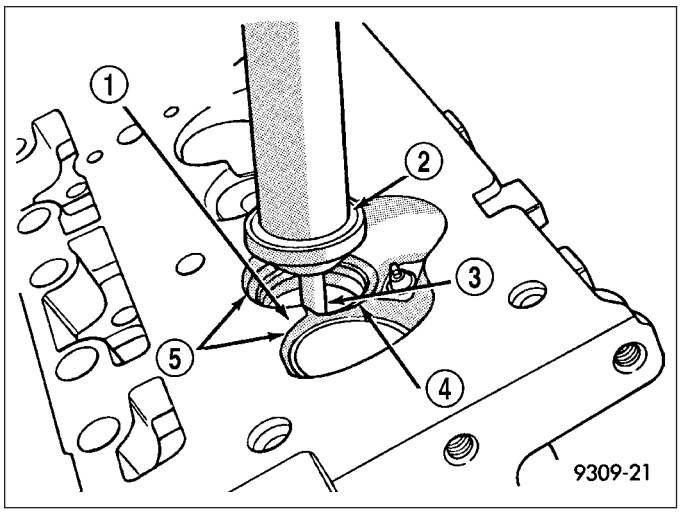
The intake and exhaust valves have a 44.5° - 45° face angle (1). The valve seats (2) have a 44.5° - 45° face angle.

Inspect the remaining margin after the valves are refaced. (Refer to 9 - ENGINE - SPECIFICATIONS).



VALVE SEATS

CAUTION: Do not un-shroud valves during valve seat refacing.



1. When refacing valve seats, it is important that the correct size valve guide pilot be used for reseating stones. A true and complete surface must be obtained.
2. Measure the concentricity of valve seat using a dial indicator. Total runout should not exceed 0.051 mm (0.002 in.) total indicator reading.
3. Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY**with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of valve face, lower valve seat with a 30° stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 75° stone.

NOTE: Valve seats which are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise cylinder head must be replaced.

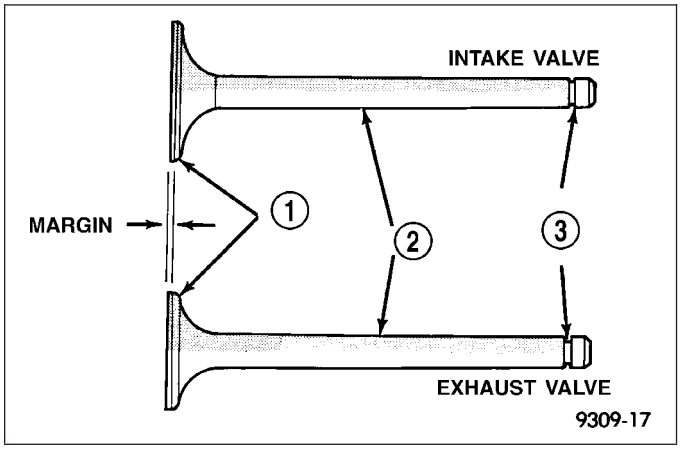
4. When seat is properly positioned the width of both seats should be 1.02 - 1.52 mm (0.040 - 0.060 in.).

INSPECTION

Valve

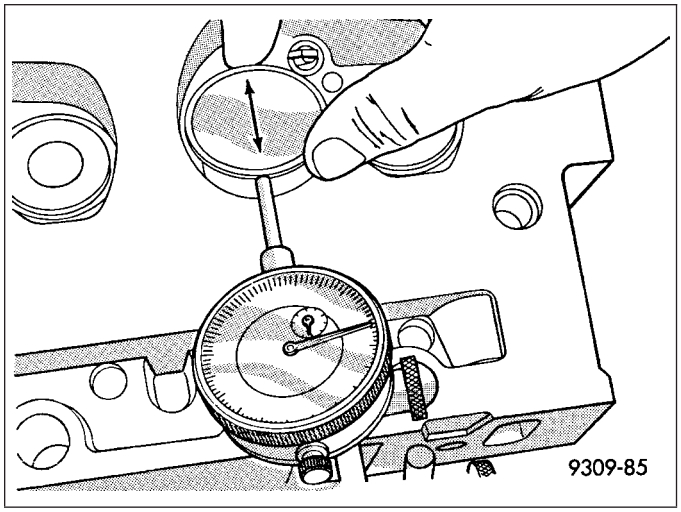
1. Clean valves thoroughly and discard any burned, bent, warped, and cracked valves.
2. Measure valve stems for wear (Refer to 9 - ENGINE - SPECIFICATIONS).

NOTE: Valve stems are chrome plated and should not be polished.



Valve Guide

1. Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.
2. Measure valve stem guide clearance as follows:
   1. Install valve into cylinder head so it is 14 mm (0.551 in.) off the valve seat. A small piece of hose may be used to hold valve in place.
   2. Attach Special Tool C-3339, dial indicator to cylinder head and set it at right angle of valve stem being measured.
   3. Move valve to and from the indicator. (Refer to 9 - ENGINE - SPECIFICATIONS) for valve guide specifications. If guides are out of specifications, ream to next oversize.
3. Ream the guides for valves with oversized stems if dial indicator reading is excessive or if the stems are scuffed or scored.



4. Service valves with oversize stems and over size seals are available in 0.15 mm (0.005 in.) and 0.40 mm (0.015 in.) oversize.

NOTE: Oversize seals must be used with oversize valves.

5. Select the correct size reamer to accommodate the oversize valve stem. Refer to Valve Guide Oversize Chart.
6. Slowly turn reamer by hand and clean guide thoroughly before installing new valve. **Do not attempt to ream the valve guides from standard directly to 0.40 mm (0.015 in.). Use a step procedure of 0.15 mm (0.005 in.) to 0.40 mm (0.015 in.), so the valve guides may be reamed true in relation to the valve seat. After reaming guides, the seat runout should be measured and resurfaced if necessary. See Refacing Valves and Valve Seats (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).**

NOTE: Replace cylinder head if guide does not clean up with 0.40 mm (0.015 inch) oversize reamer, or if guide is loose in cylinder head.

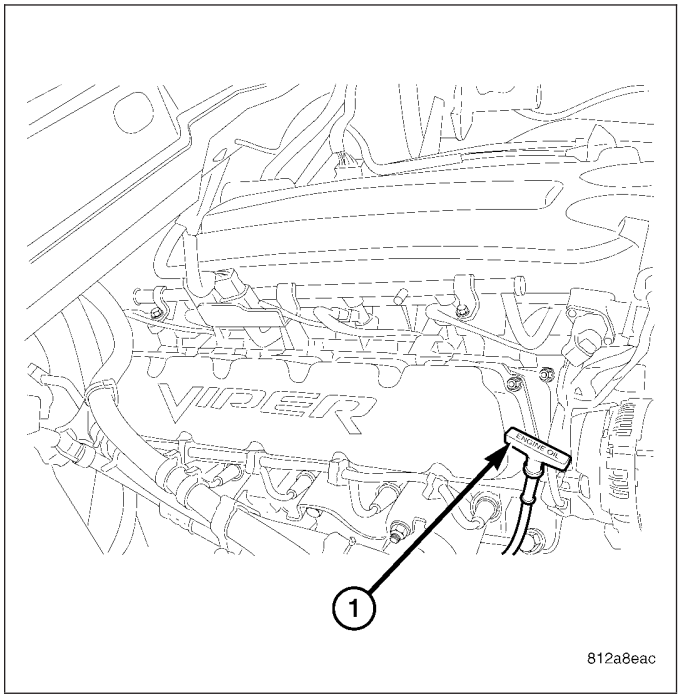
VALVE GUIDE OVERSIZE CHART

Valve Guide Reamer Oversize	Valve Guide Size
0.15 mm (0.005 in.)	8.077 - 8.103 mm (0.318 - 0.319 in.)
0.40 mm (0.015 in.)	8.331 - 8.357 mm (0.328 - 0.329 in.)

COVER-TIMING CHAIN

REMOVAL

1. Disconnect negative battery cable.
2. Disconnect throttle body air inlet duct at the throttle body, CCV hose, disconnect the IAT sensor and remove air cleaner housing cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - REMOVAL).
3. Remove the oil indicator tube (1) fastener at the right cylinder head cover.
4. Raise and support the vehicle.
5. Remove the lower engine shield.
6. Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE - DRAINING COOLING SYSTEM).
7. Drain engine oil and remove oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE).
8. Drain power steering.
9. Disconnect the cooling fan return hose at radiator fan.
10. Disconnect the radiator fan pressure hose to power steering rack.



11. Disconnect the power steering hose to power steering pump.
12. Separate the A/C hose from the radiator fan module.
13. Remove the lower radiator hoses.
14. Remove the front frame cross member (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL).
15. Remove the flywheel inspection cover.

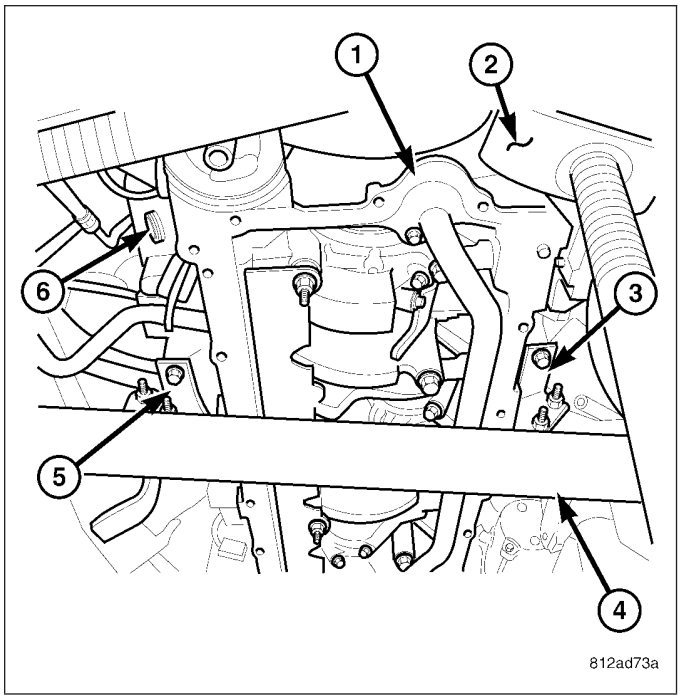
NOTE: Capture and properly dispose of any fuel spillage.

16. Disconnect oil cooler line at the timing cover using Special Tool 9005 (Refer to 9 - ENGINE/LUBRICATION/OIL COOLER & LINES - STANDARD PROCEDURE).
17. Separate the oil cooler coolant hose from the timing cover.

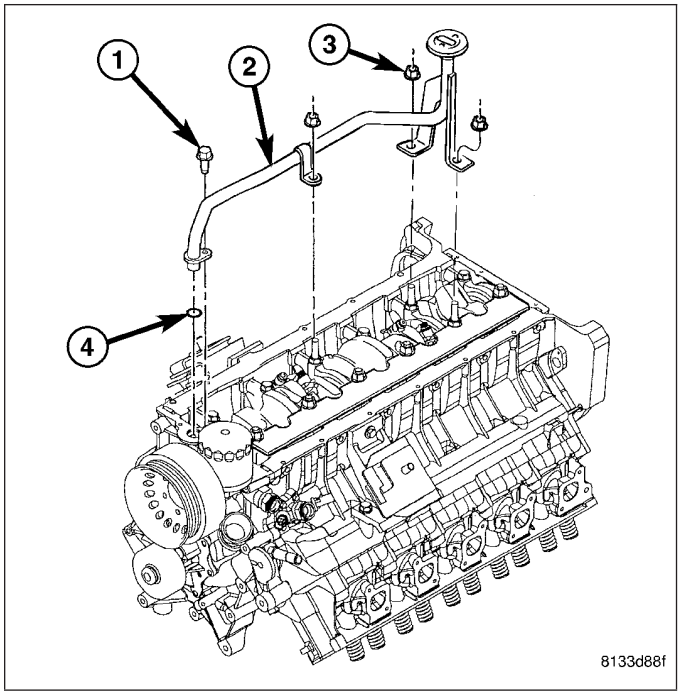
18. Wiggle oil indicator tube free of oil pan.
19. Loosen engine mounts (3 and 5).

NOTE: Care must be taken not to damage the A/C compressor when placing the jack stand and raising the engine

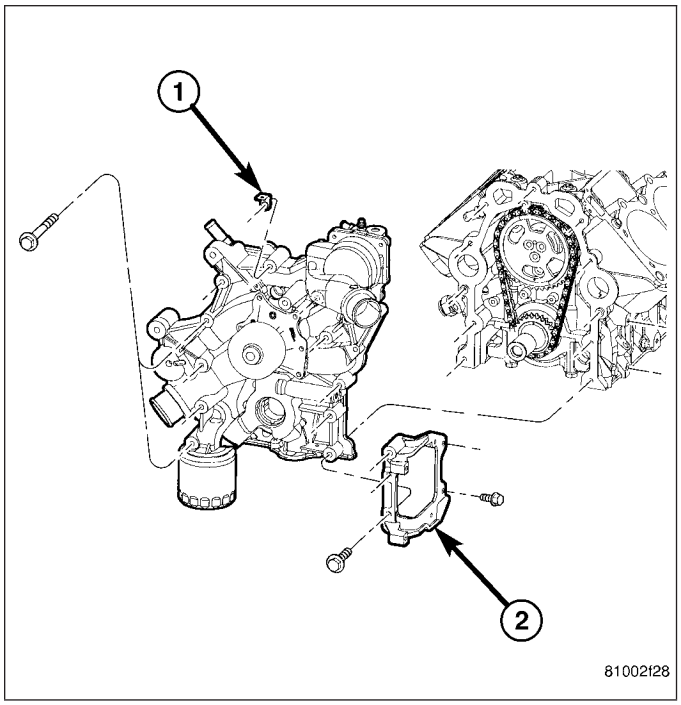
20. Raise and support the engine with a jack stand at the A/C bracket.
21. Remove the engine oil pan.
22. Lower the engine and remove the jack stand.



23. Remove the oil pump pick up tube (2).
24. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).



25. Remove A/C compressor mounting bolts. Reposition A/C compressor. **Do not** disconnect A/C lines.
26. Disconnect the power steering line support bracket at the radiator.
27. Lower the vehicle.
28. Remove the upper radiator hose and coolant recovery container.
29. Remove the cooling fan module (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
30. Remove the upper idler pulley.
31. Remove power steering pump mounting bolts. Reposition power steering pump aside. **Do not** disconnect power steering lines.
32. Remove the generator (Refer to 8 - ELECTRICAL/CHARGING/GENERATOR - REMOVAL).
33. Disconnect the heater hose at the timing cover.
34. Disconnect the ground wire at the thermostat housing.



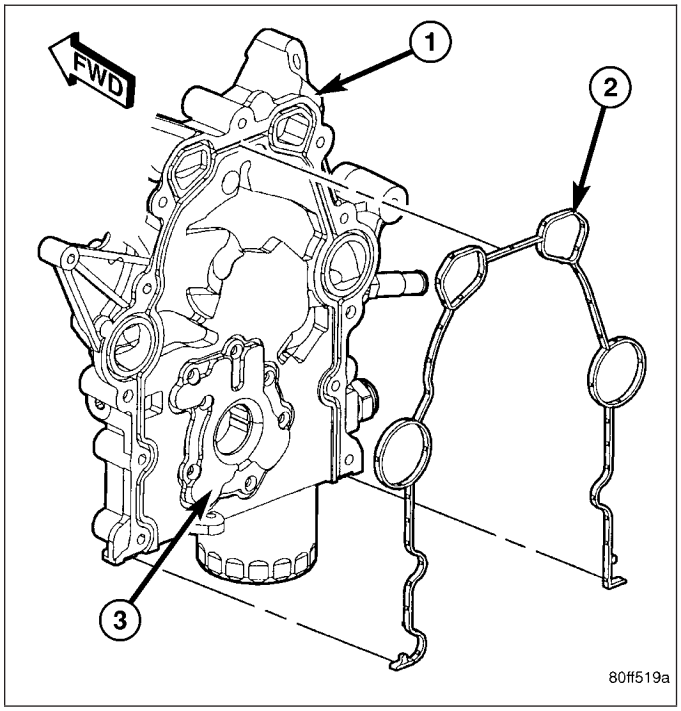
NOTE: Do Not remove the camshaft position sensor from the timing cover.

35. Disconnect the camshaft sensor wiring harness connector.
36. Disconnect engine coolant temperature (ECT) sensor connector.
37. Remove crankshaft pulley and damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
38. Remove the timing cover.

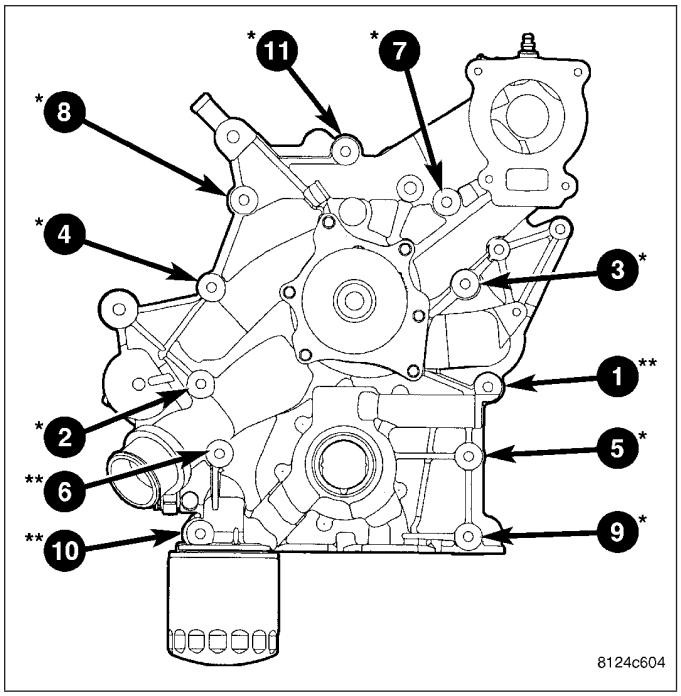
INSTALLATION

CAUTION: Do not use a metal scraper to clean aluminum sealing surfaces, as damage to surfaces may occur. Use only a plastic scraper and Mopar® Brake Parts Cleaner or the equivalent.

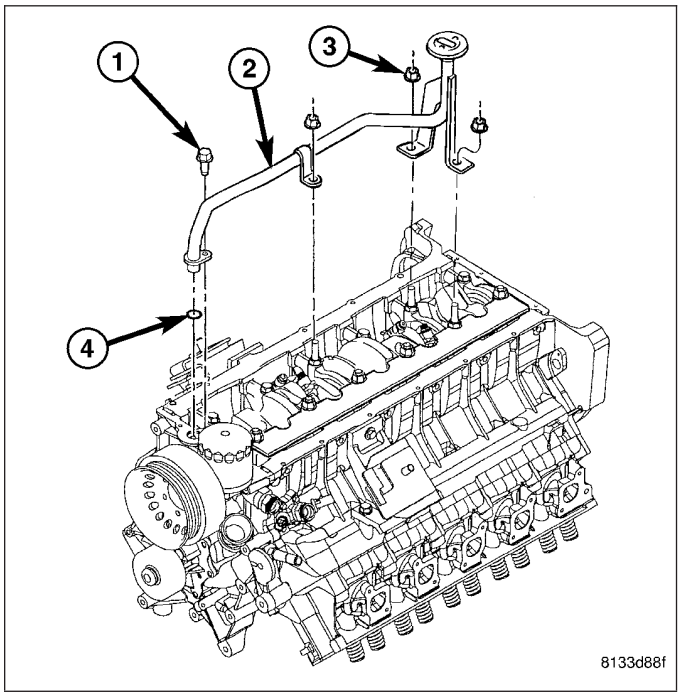
1. Be sure mating surfaces of chain case cover and cylinder block are clean and free from burrs. Crankshaft oil seal must be removed to insure correct oil pump engagement.
2. Install the timing chain cover gasket.
3. Position the oil pump inner rotor mating flats in the same position as the crankshaft drive flats.
4. Install the timing chain cover onto crankshaft. Ensure the oil pump is engaged on the crankshaft correctly or severe damage may result (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).



5. Hand start bolts No.1 and No.2.
6. Loosely install A/C compressor mounting bracket.
7. Hand start remaining timing chain cover bolts.
8. Torque timing chain cover bolts in the sequence shown in to 23 N·m (200 in. lbs.).
9. Torque A/C compressor mounting bracket bolts to 23 N·m (200 in. lbs.).
10. Install crankshaft oil seal (Refer to 9 - ENGINE/ ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION).
11. Raise vehicle on hoist.



12. Install oil pump pick up tube using a **new** o-ring. Torque 1/4–20 bolt to 11 N·m (95 in. lbs.). Torque 5/16–18 nuts to 23 N·m (200 in. lbs.).
13. Support the engine with a jack stand.
14. Install oil pan and drain plug (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
15. Remove the jackstand.
16. Tighten the engine mount to frame nuts to 102 N·m (75 ft.lbs.).
17. Connect the oil cooler coolant hose to the timing cover.
18. Connect the oil cooler line (Refer to 9 - ENGINE/ LUBRICATION/OIL COOLER & LINES - STANDARD PROCEDURE).
19. Install the lower radiator hose.
20. Install the flywheel inspection cover.
21. Install the front frame cross member (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - INSTALLATION).



22. Lower vehicle.
23. Position the compressor and install A/C compressor mounting bolts. Torque bolts to 23 N·m (200 in. lbs.).
24. Connect heater hose at timing cover.
25. Install crankshaft damper and pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
26. Install generator. Connect electrical connectors.
27. Install the idler pulley.
28. Connect the camshaft position sensor wiring harness connector.
29. Connect engine coolant temperature (ECT) sensor wiring harness connector.
30. Install power steering pump mounting bolts.

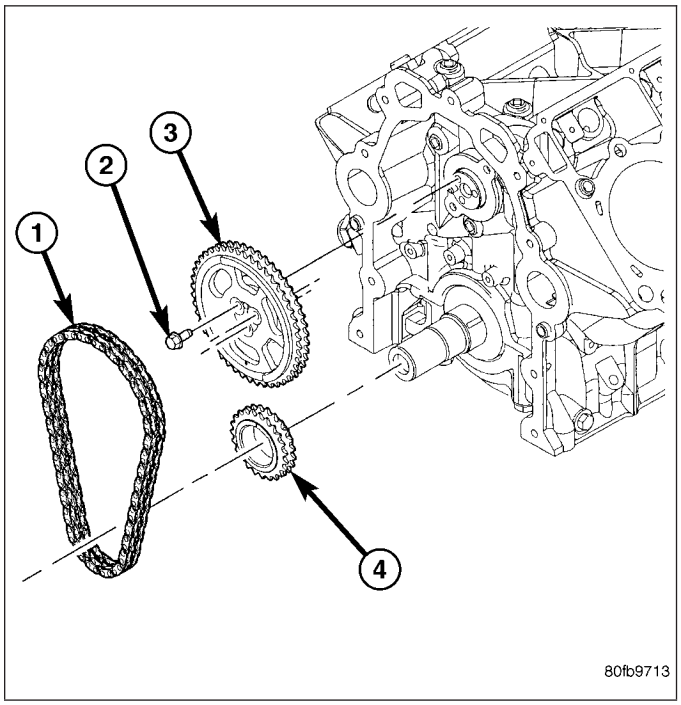
31. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
32. Install the radiator fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
33. Raise and support the vehicle.
34. Connect the hydraulic lines to the fan assembly and steering rack then connect the A/C hose to the fan shroud.
35. Install a **New** oil filter.
36. Lower the vehicle.
37. Install upper radiator hose and connect the ground wire at the thermostat housing.
38. Install air cleaner housing cover assembly, connect throttle body air inlet duct, IAT sensor and CCV hose. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM - INSTALLATION).
39. Fill and purge air from the power steering system.
40. Fill engine crankcase with proper oil to correct level.
41. Fill and purge air from the cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE - FILLING COOLING SYSTEM).
42. Connect negative battery cable.
43. Start the vehicle and inspect for leaks.
44. Install the lower engine shield.

TIMING CHAIN AND SPROCKETS

REMOVAL

TIMING CHAIN AND CAMSHAFT SPROCKET REMOVAL

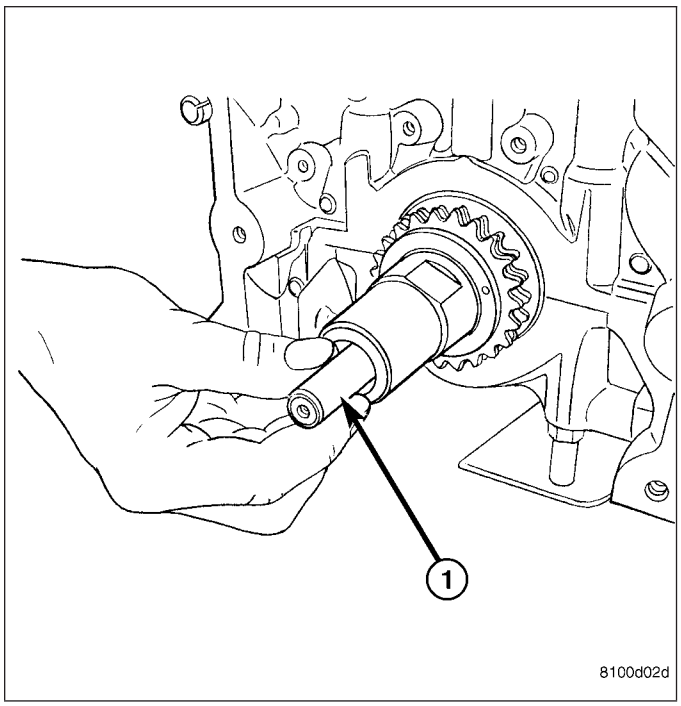
1. Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - REMOVAL).
2. Rotate crankshaft until timing marks are aligned.
3. Remove the camshaft sprocket attaching bolts (2).
4. Remove the timing chain (1) with camshaft sprocket (2).



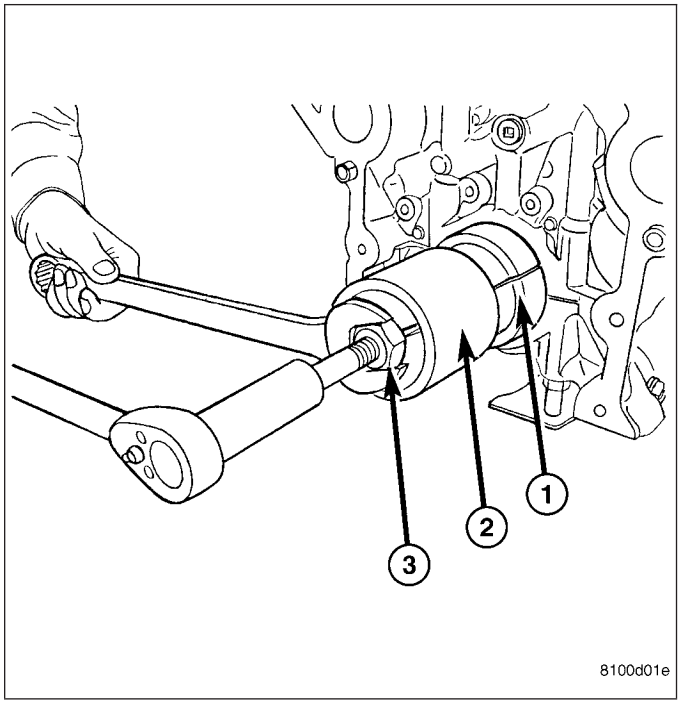
CRANKSHAFT SPROCKET REMOVAL

1. Install Special Tool 8194 into end of crankshaft. Lubricate the end of Special Tool 8194 with wheel bearing grease or equivalent.

NOTE: Lubricate the threads of Special Tool 5048 using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft sprocket removal.



2. Using Special Tools 9056 (1) and 5048 (2 and 3), remove crankshaft sprocket.



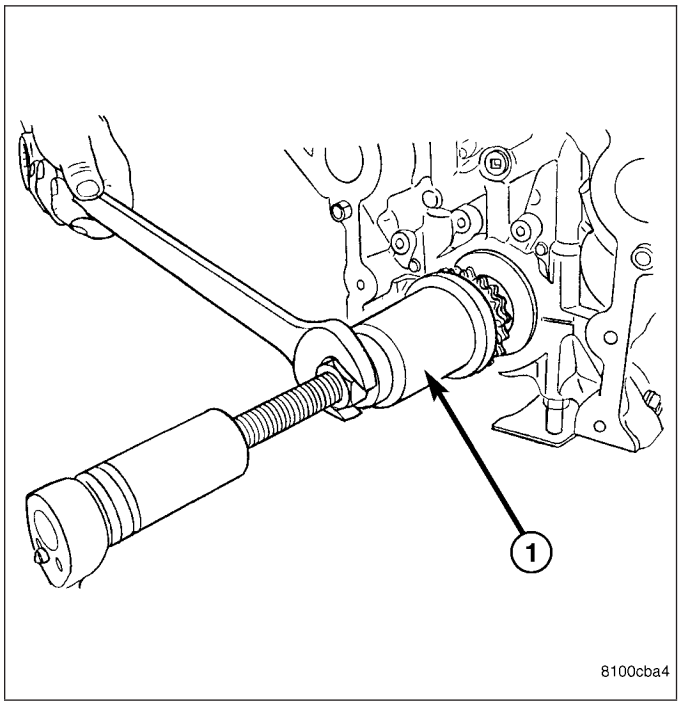
INSTALLATION

CRANKSHAFT SPROCKET INSTALLATION

1. Position a new crankshaft sprocket on the crankshaft with timing mark facing out. Align crankshaft keyway with slot in crankshaft sprocket.

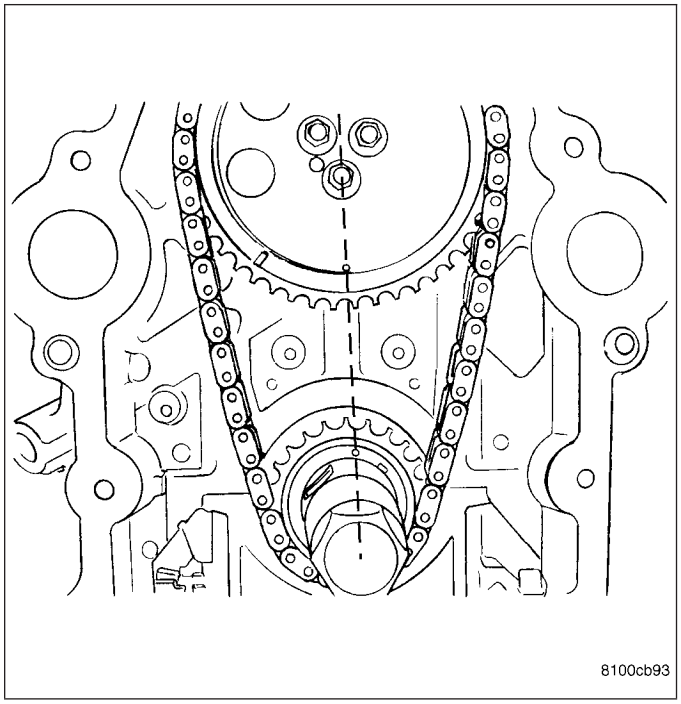
NOTE: Lubricate the threads of Special Tool 9055 (1) using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft sprocket installation.

2. Install the crankshaft sprocket using Special Tool 9055 (1).



TIMING CHAIN AND CAMSHAFT SPROCKET INSTALLATION

1. Rotate the crankshaft sprocket so the timing mark is at the 12 O'clock position.
2. Place the timing chain around the camshaft sprocket and place the timing mark to the 6 O'clock position.
3. Place the timing chain around crankshaft sprocket and install the camshaft sprocket into position.
4. Using straight edge, check alignment of timing marks.
5. Install the camshaft sprocket bolts. Tighten the bolts to 23 N·m (200 in. lbs.).
6. Rotate crankshaft 2 revolutions. Timing marks should line up. If timing marks do not line up, remove cam sprocket and realign.
7. Measure camshaft end play. (Refer to 9 - ENGINE - SPECIFICATIONS). If not within specifications, install new thrust plate.
8. Install timing chain cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING CHAIN COVER - INSTALLATION).



LUBRICATION

DESCRIPTION

The engine lubrication system is a full-flow filtration pressure feed type.

OPERATION

Engine oil stored in the oil pan is taken in and discharged by an internal gear type oil pump, which is driven by the crankshaft. A pressure relief valve is located in the timing chain case cover; it regulates oil pressure. The oil is pumped through an oil filter and feeds a main oil gallery. Also, oil is routed to an external oil cooler. The main oil gallery feeds oil under pressure to the main bearings, connecting rod bearings, and camshaft bearings. Passages in the cylinder block feed oil to the hydraulic lifters. The oil then flows through hollow pushrods, which feed the rocker arm pivots.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

1. Remove oil pressure sensor (Refer to 9 - ENGINE/LUBRICATION/OIL PRESSURE SENSOR - REMOVAL).
2. Install oil pressure gauge.
3. Warm engine at high idle until thermostat opens.

CAUTION: If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

4. Oil pressure should be 68.9 kPa (10 psi) at idle or 310 - 517 kPa (45 - 75 psi) at 3000 RPM.
5. If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

ENGINE OIL LEAK

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

1. Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
2. Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.
3. Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.
4. If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.**If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method.

Air Leak Detection Test Method

1. Remove the PCV valve from the IAFM. Cap or plug the PCV valve grommet.
2. Attach an air hose with pressure gauge and regulator to the dipstick tube.

CAUTION: Do not subject the engine assembly to more than 20.6 kPa (3 PSI) of test pressure.

3. Gradually apply air pressure from 6.89 - 17.23 kPa (1 - 2.5 psi) maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provide the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.
4. If the leakage occurs at the rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.
5. If no leaks are detected, turn off the air supply and remove the air hose and all plugs and caps. Install the PCV valve.
6. Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

1. Disconnect the battery.
2. Raise the vehicle.
3. Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak:
   a. Circular spray pattern generally indicates seal leakage or crankshaft damage.
   b. Where leakage tends to run straight down, possible causes are a porous block, distributor seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.
4. If no leaks are detected, pressurize the crankcase as outlined in the, Inspection (Engine oil Leaks in general)

CAUTION: Do not exceed 20.6 kPa (3 psi).

5. If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

CAUTION: Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

6. For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

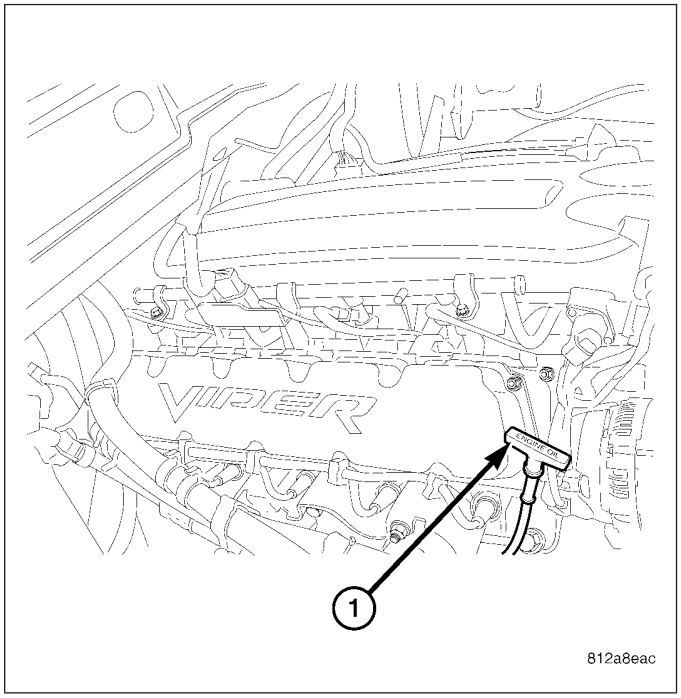
OIL

STANDARD PROCEDURE

CHECKING ENGINE OIL LEVEL

The best time to check engine oil level is after the vehicle has sat overnight. If the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove the engine oil indicator. The indicator is calibrated for 1 quart within the SAFE zone.



ENGINE OIL AND FILTER CHANGE

WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.

Change engine oil and filter at mileage and time intervals described in LUBRICATION AND MAINTENANCE (Refer to LUBRICATION & MAINTENANCE/MAINTENANCE SCHEDULES - DESCRIPTION).

ENGINE OIL AND FILTER CHANGE

1. Run engine until achieving normal operating temperature.
2. Position the vehicle on a level surface and turn engine off.
3. Open hood, remove oil fill cap.
4. Raise vehicle on hoist.
5. Remove underbody front shield
6. Place a suitable drain pan under oil pan drain plug.
7. Remove drain plug from oil pan and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug and gasket if damaged.
8. Install drain plug in crankcase.
9. Remove oil filter and replace with new.
10. Install under body shield.
11. Lower vehicle and fill crankcase with specified type (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION) and amount of engine oil (Refer to LUBRICATION & MAINTENANCE - SPECIFICATIONS).
12. Install oil fill cap.
13. Start engine and inspect for leaks.
14. Stop engine and inspect oil level. Adjust oil level as necessary.

OIL SPECIFICATION

DaimlerChrysler Corporation recommends a fully synthetic API certified engine oil of the proper viscosity grade for refill. Viper engine factory fill is Mobil 1® 10W-30 Synthetic.

OIL FILTER SPECIFICATION

All DaimlerChrysler Corporation engines are equipped with a high quality full-flow, disposable type oil filter. DaimlerChrysler Corporation recommends a Mopar® or equivalent oil filter be used.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine.

COOLER & LINES-OIL

DESCRIPTION

An engine oil cooler is used on all models. The cooler is a coolant-to-oil type and mounted on the right front inner fender.

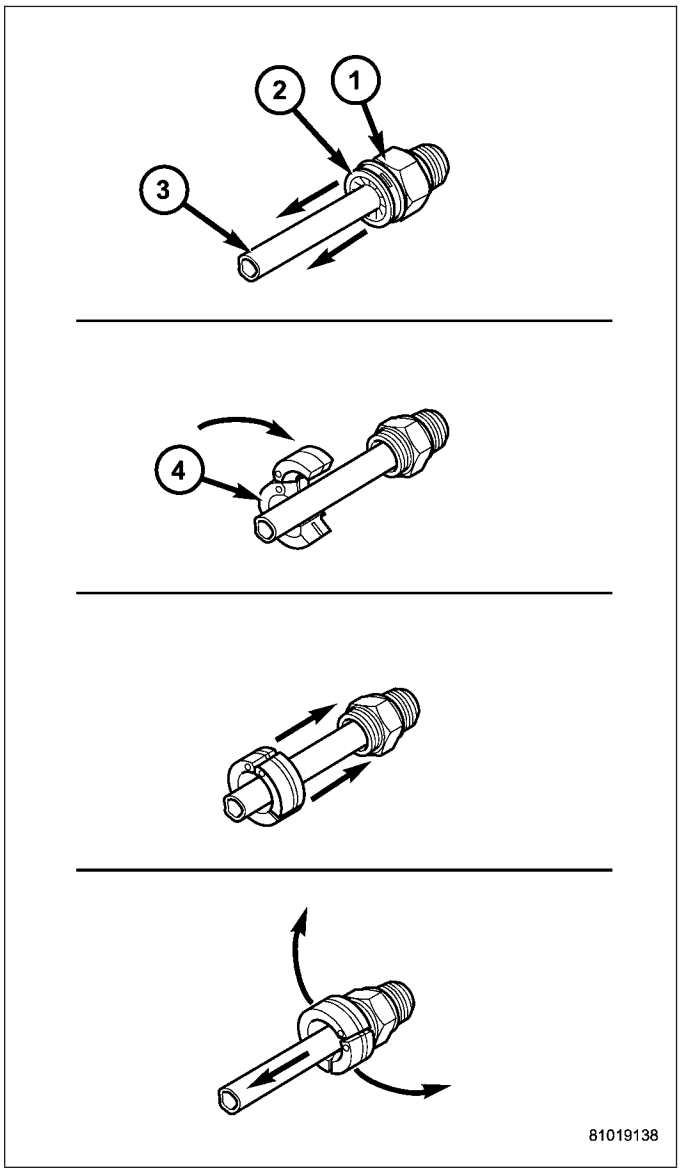
OPERATION

Engine oil travels from the oil pump and filter to the oil cooler via an oil supply line. The oil is cooled and returned to the engine via an oil return line. Engine oil is then pumped into the main oil gallery. Engine coolant flows into the cooler from the heater return hose and exits into the water pump inlet nipple.

STANDARD PROCEDURE - OIL COOLER LINE QUICK CONNECT FITTING DISASSEMBLY/ASSEMBLY

DISASSEMBLY

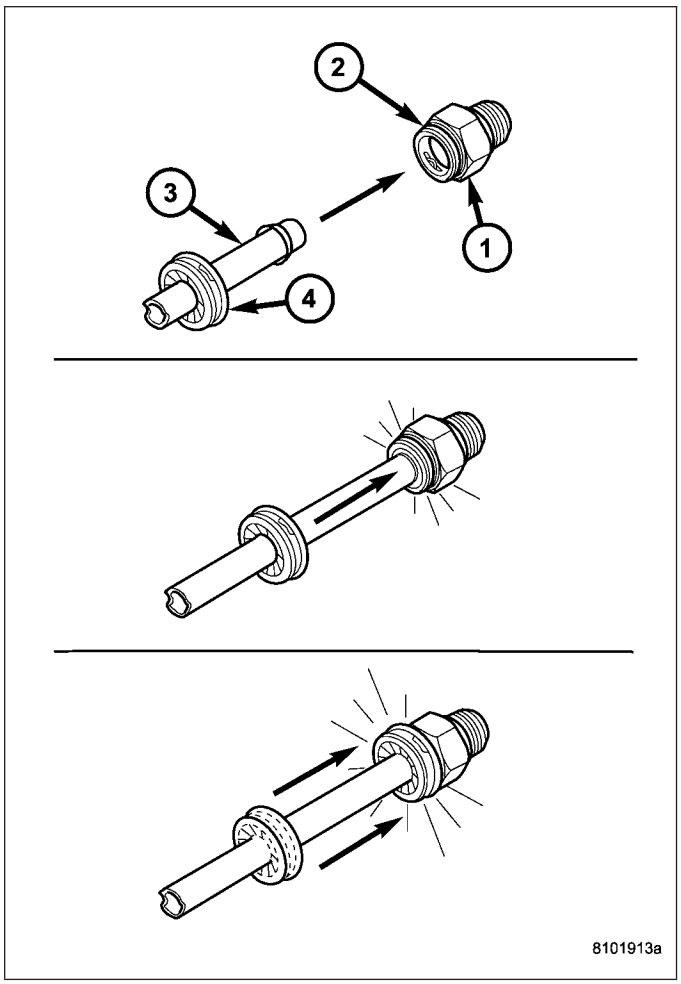
1. Remove dust cap by pulling it straight back off of quick connect fitting (1).
2. Place disconnect tool (4) onto oil cooler line with the fingers of the tool facing the quick connect fitting (1).
3. Slide disconnect tool down the line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the disconnect tool 60° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the oil cooler line to remove.



ASSEMBLY

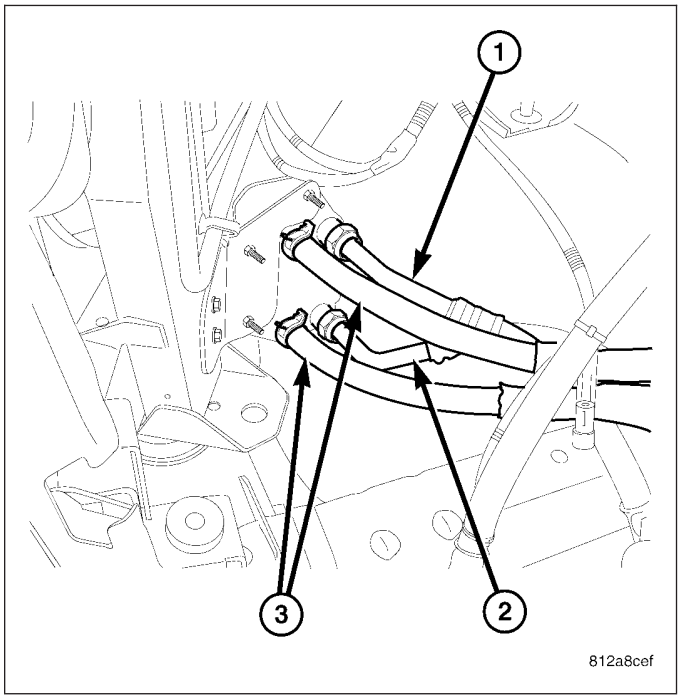
1. Align oil cooler line (3) with quick connect fitting (1) while pushing straight into the fitting.
2. Push in on oil cooler line (3) until a “click” is heard or felt.
3. Slide dust cap (4) down the oil cooler line (3) and snap it over the quick connect fitting (1) until it is fully seated and rotates freely. Dust cap (4) will only snap over quick connect fitting (1) when the cooler line (3) is properly installed.

NOTE: If dust cap will not snap into place, repeat assembly step #2.



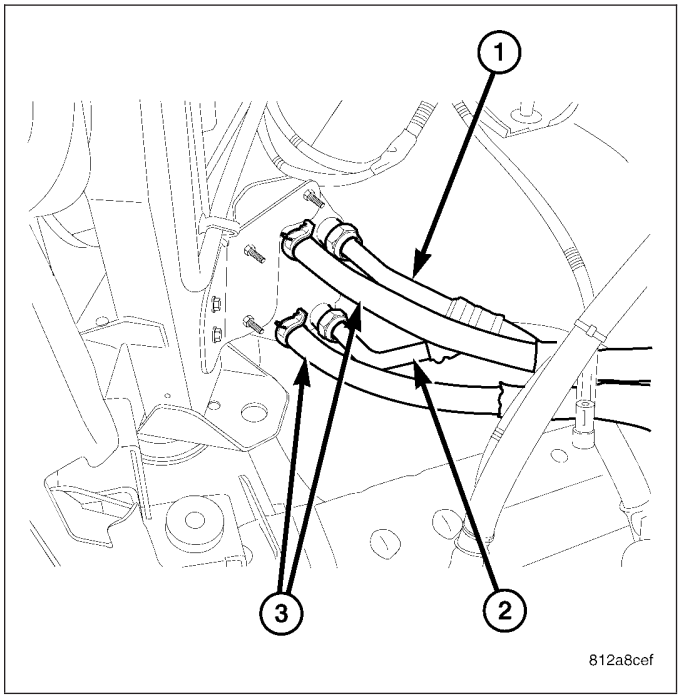
REMOVAL

1. Disconnect oil cooler coolant hoses (3).
2. Disconnect throttle body air inlet hose, remove air cleaner housing assembly (Refer to 9 - ENGINE/ AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
3. Drain cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
4. Using Special Tool 9005, disconnect oil supply (1) and return lines (2) at oil cooler (Refer to 9 - ENGINE/LUBRICATION/OIL COOLER & LINES - STANDARD PROCEDURE).
5. Remove fasteners securing oil cooler to inner fender and remove oil cooler.



INSTALLATION

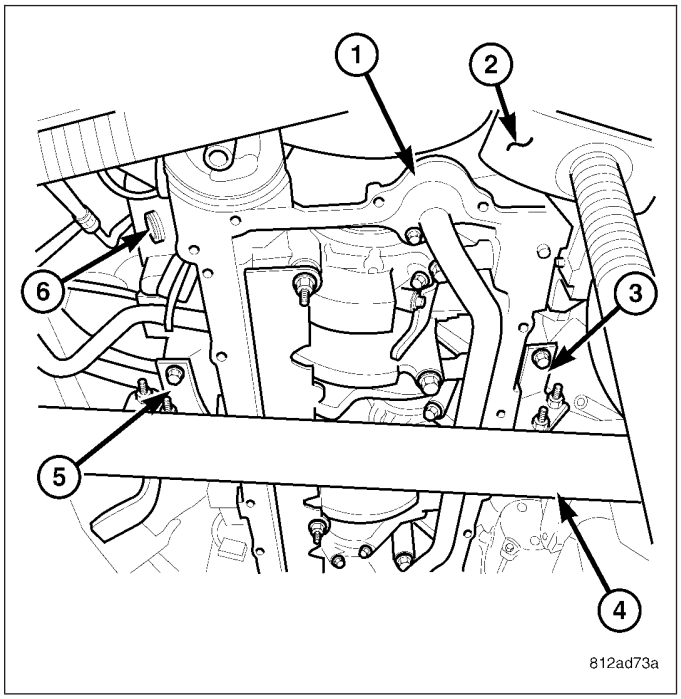
1. Position oil cooler to mounting position.
2. Install oil cooler fasteners. Tighten to 12 N·m (105 in. lbs.).
3. Connect oil supply (1) and return lines (2) to oil cooler and.
4. Connect oil cooler coolant hoses (3).
5. Install air cleaner housing assembly, connect throttle body air inlet hose (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).
6. Fill cooling system (Refer to 7 - COOLING/ENGINE - STANDARD PROCEDURE).
7. Start the engine to circulate and fill the oil cooler. Shut off the engine and check the oil level. Add oil as needed.
8. Inspect the oil cooler connections for leaks.



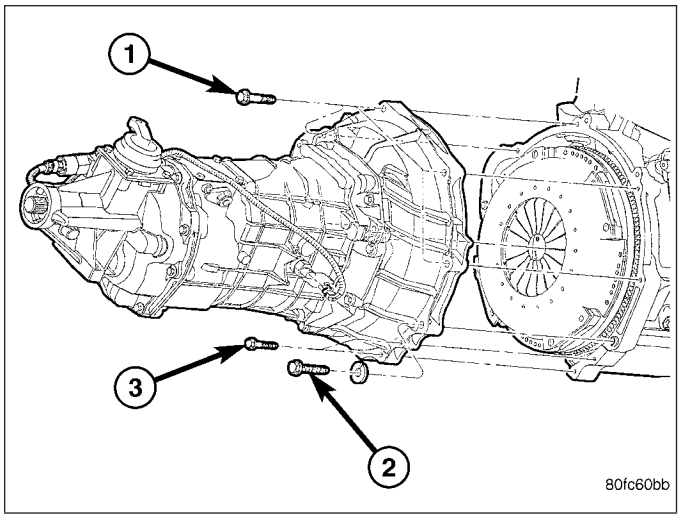
PAN-OIL

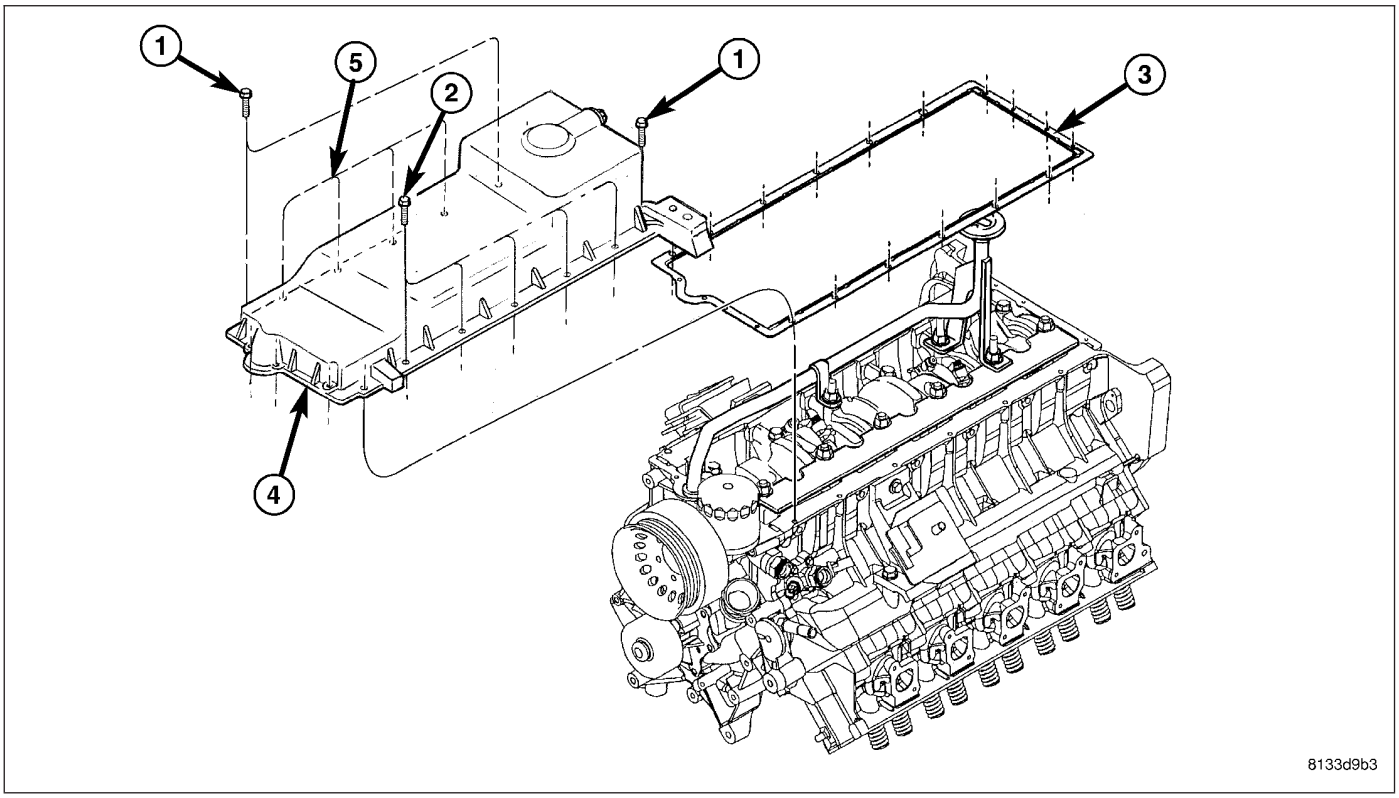
REMOVAL

1. Disconnect the negative battery cable.
2. Disconnect engine oil indicator tube fastener from the right cylinder head cover.
3. Install engine lifting fixture TOOL 9363 and support TOOL.
4. Raise vehicle on hoist.
5. Remove the lower engine shield.
6. Drain engine oil.
7. Remove the front cross member (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSSMEMBER - REMOVAL)
8. Remove flywheel inspection cover.
9. Loosen engine mount through bolts.
10. Wiggle and separate the oil level indicator tube from the oil pan.



NOTE: Careful positioning of the jack stand is necessary to prevent damage to other components

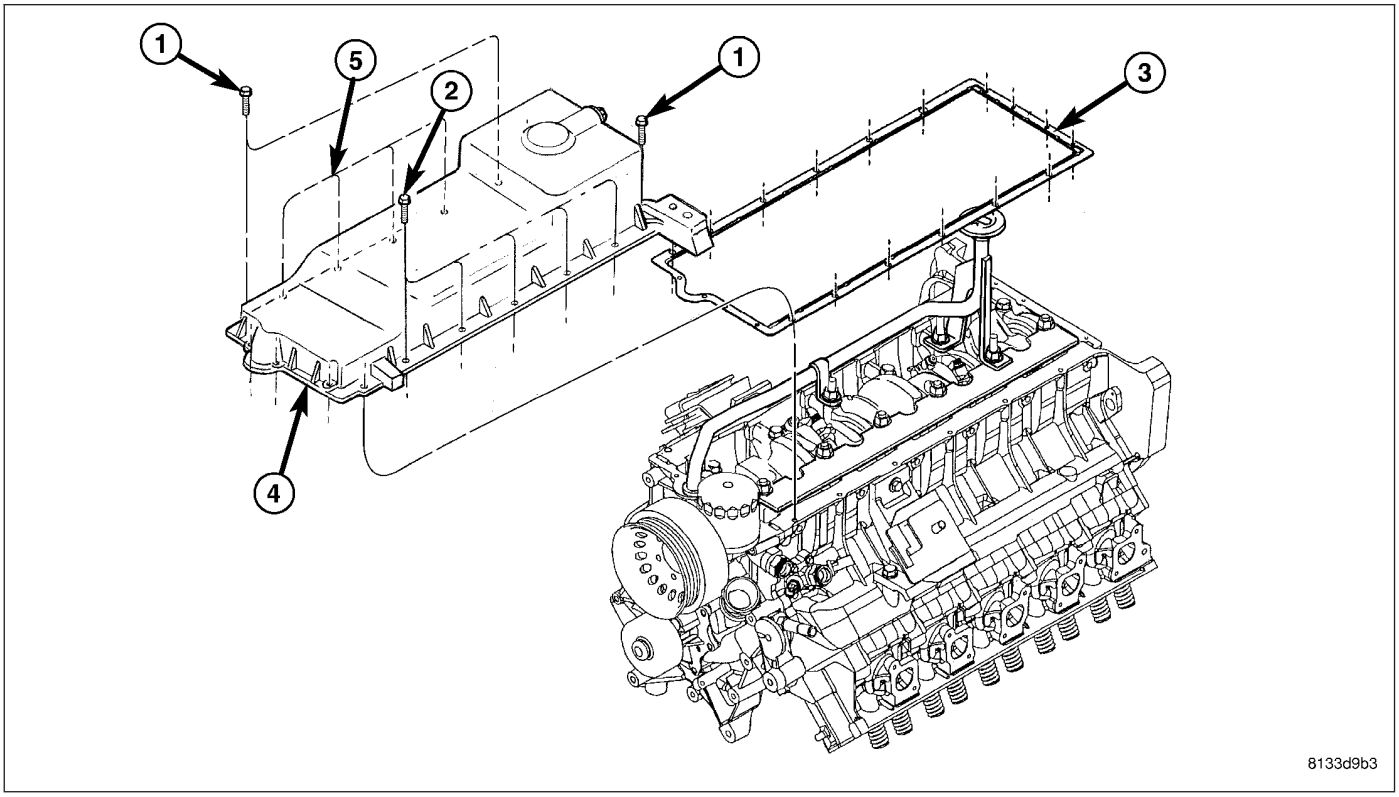




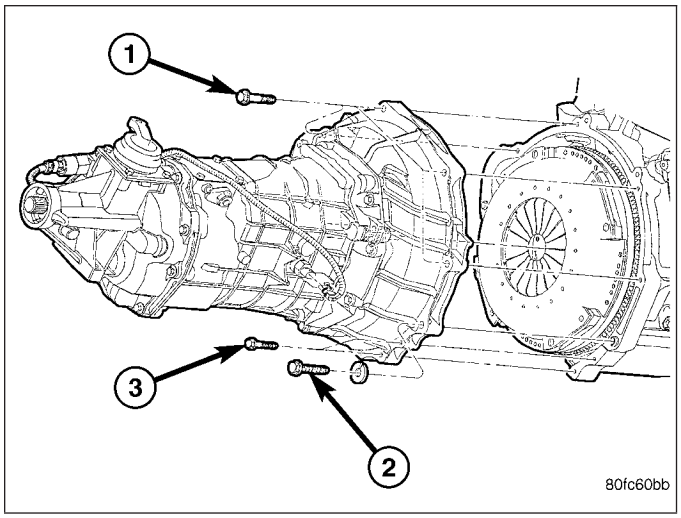
11. Using lifting fixture TOOL 9363 and support TOOL , raise the front of the engine
12. Remove transmission to oil pan fasteners.
13. Remove oil pan bolts and remove oil pan.

NOTE: Clean and inspect oil pan gasket. The pan gasket can be used again if in good condition.

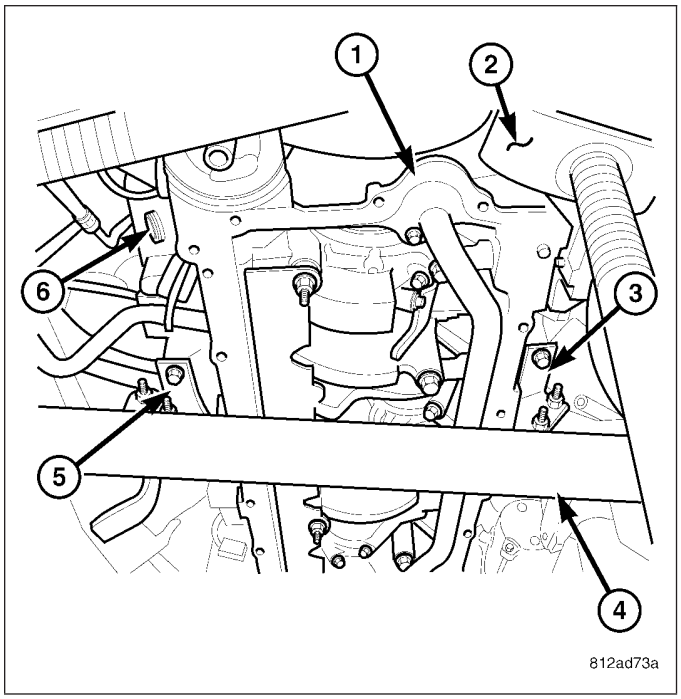
INSTALLATION



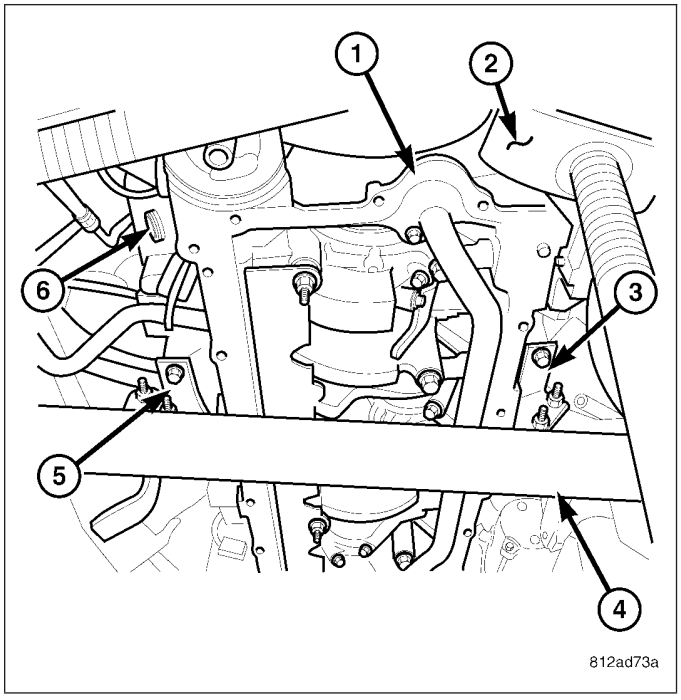
1. Clean gasket surfaces. Inspect oil pan gasket. Replace as necessary.
2. Apply an 1/8 in. bead of Mopar Engine RTV at the two joints between the cylinder block to timing chain case cover and the two joints between the rear main seal retainer and engine block.
3. Position oil pan and gasket to engine block, seat the oil level indicator tube in the oil pan and hand start all fasteners.
4. Tighten the transmission to oil pan bolts in finger tight.
5. Torque 5/16-18 oil pan bolts to 23 N·m (200 in. lbs.). Torque 1/4-20 oil pan bolts to 11 N·m (95 in lbs.).
6. Torque transmission to oil pan bolts to 23 N·m (200 in. lbs.).



7. Lower the engine.
8. Install and tighten engine mount through bolts to 102 N·m (75 ft. lbs.).
9. Install flywheel inspection cover.



10. Install frame front cross member (Refer to 13 - FRAME & BUMPERS/FRAME/FRONT CROSS-MEMBER - INSTALLATION).
11. Lower vehicle.
12. Install the oil level indicator tube fastener.
13. Fill the crankcase with the correct oil to proper level.
14. Start the engine and inspect for leaks.

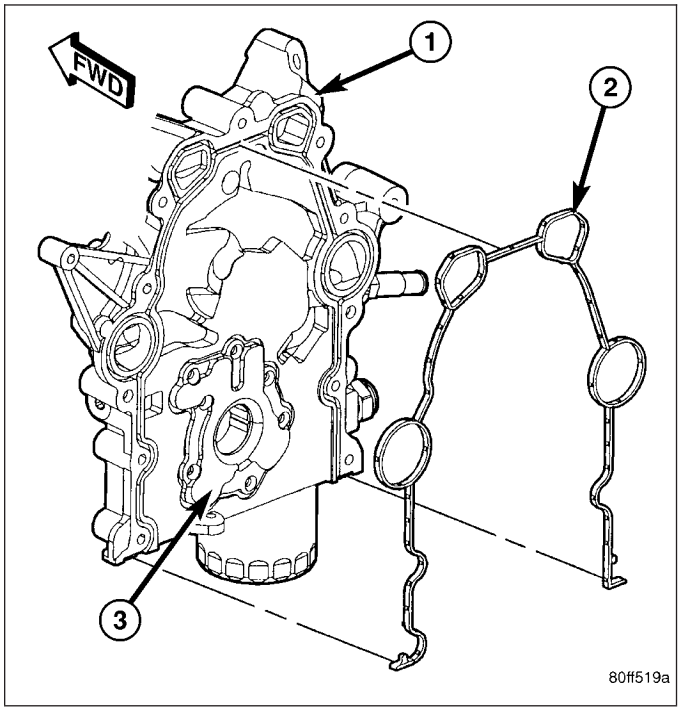


PUMP-OIL

REMOVAL

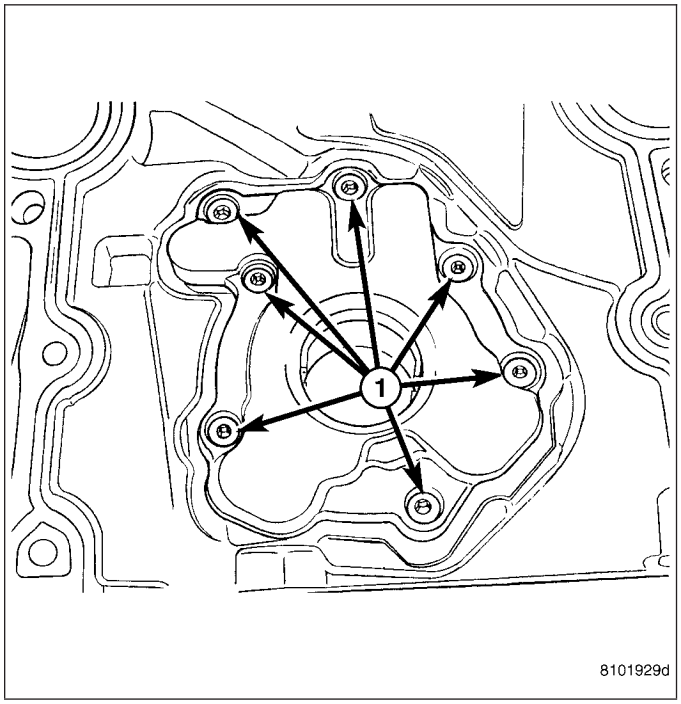
NOTE: The oil pump is serviced with the timing chain cover.

1. Remove timing chain cover (1) (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - REMOVAL).
2. Disassemble oil pump (3) (Refer to 9 - ENGINE/ LUBRICATION/OIL PUMP - DISASSEMBLY).
3. Inspect oil pump parts (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSPECTION).

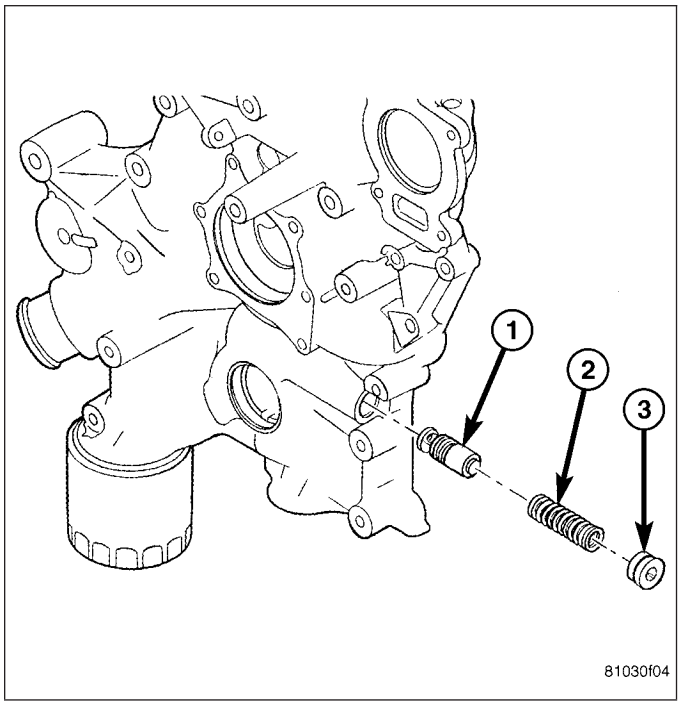


DISASSEMBLY

1. Remove oil pump cover screws (1) and lift off cover.
2. Remove pump rotors.



3. Remove oil pressure relief valve (1) and spring (2).
4. Wash all parts in a suitable solvent and inspect carefully for damage or wear.

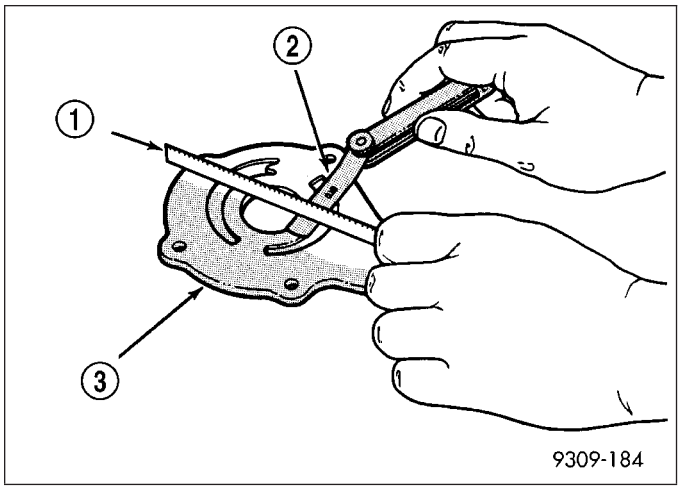


CLEANING

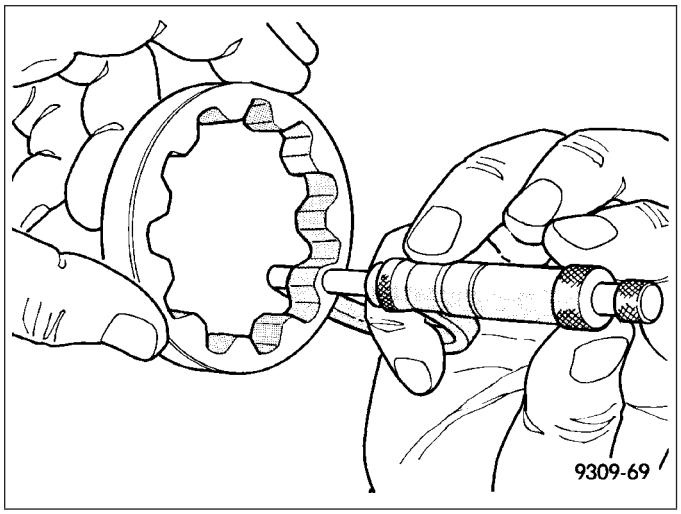
Clean all parts thoroughly. Mating surface of the chain case cover should be smooth. Replace pump cover if scratched or grooved.

INSPECTION

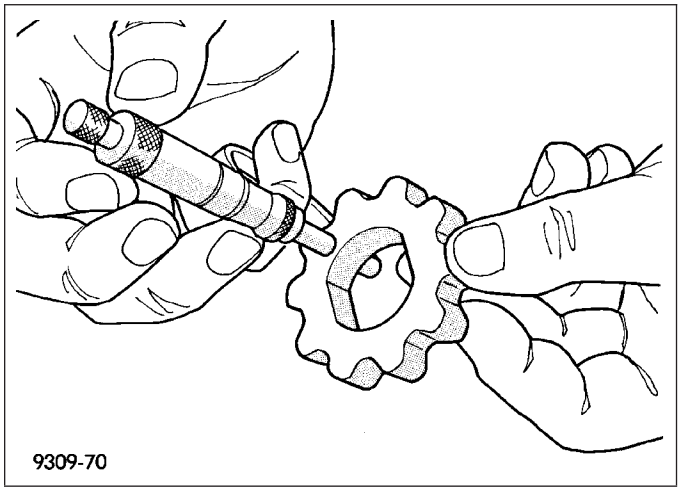
1. Lay a straightedge (1) across the pump cover surface. If a 0.076 mm (0.003 in.) feeler gauge (2) can be inserted between cover and straight edge, cover should be replaced.



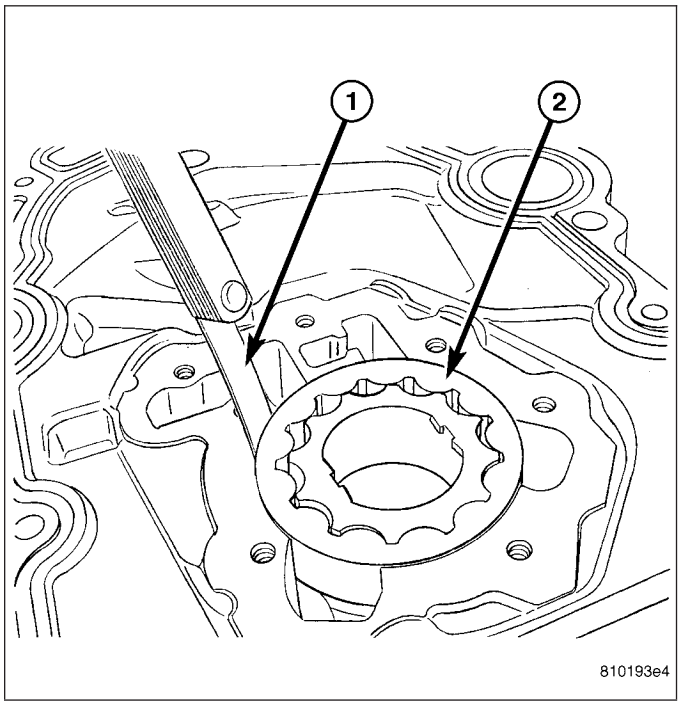
2. Measure thickness and diameter of rotors. if the outer rotor diameter is 82.45 mm (3.246 in.) or less, replace rotor set and.



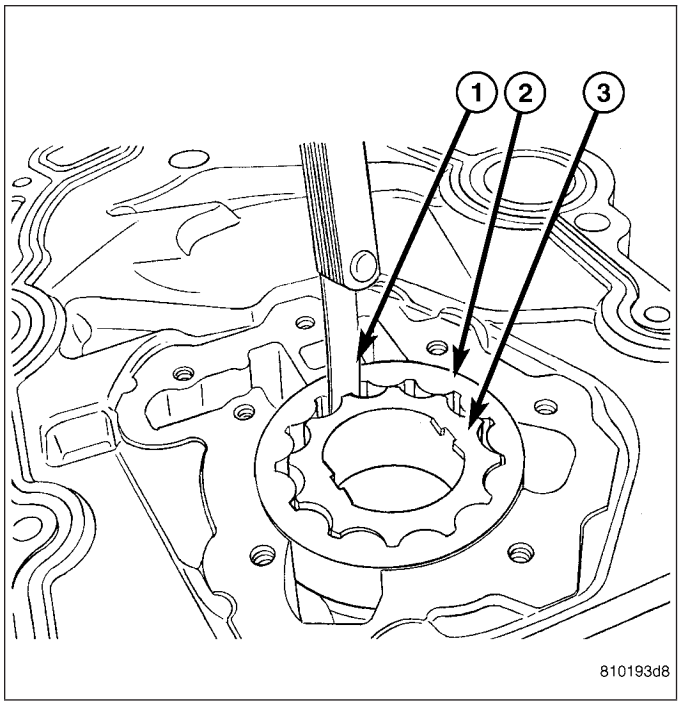
3. If either rotor thickness measures 18.92 mm (0.744 in.) or less, replace rotor set



4. Measure clearance between outer rotor (2) and case. If measurement is 0.19 mm (0.007 in.) or more, and outer rotor (2) is within specification, replace chain case cover.

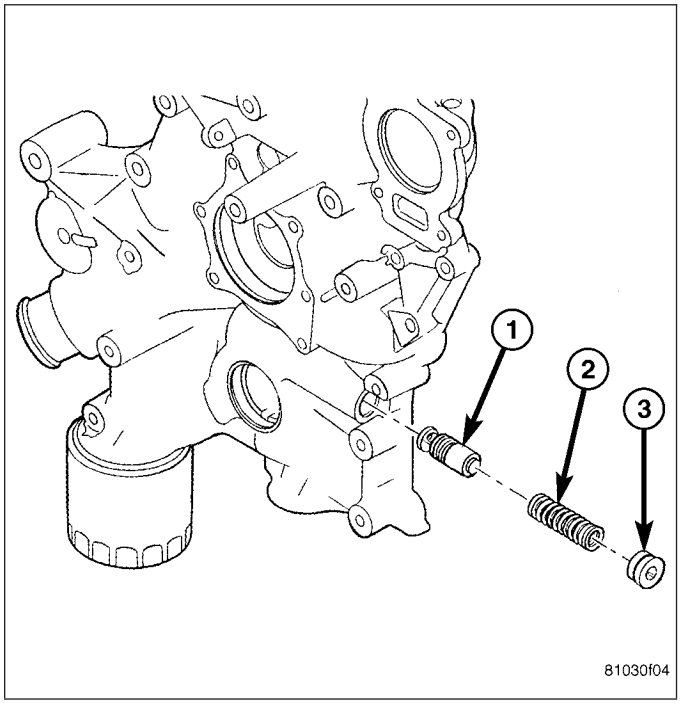


5. Measure clearance between the outer rotor (2) and inner rotor (3). If clearance between inner (3) and outer rotors (2) is 0.150 mm (0.006 in.) or more, replace rotor set.
6. Place a straightedge across the face of the chain case cover, in between the bolt holes. If a feeler gauge of 0.077 mm (0.003 in.) or more can be inserted between rotors and the straightedge, and the rotors are within specification, replace the case cover.
7. Inspect oil pressure relief valve for scoring and free operation in its bore. Small marks may be removed with 400 grit wet or dry sandpaper.
8. The relief valve spring has a free length of approximately 68.7 mm (2.70 in.) and should test between 10.2 kg and 12.4 kg (22.5 and 27.5 lbs.) when compressed to 57 mm (2.24 in.). Replace spring that fails to meet specifications.
9. If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other reasons for oil pressure loss.

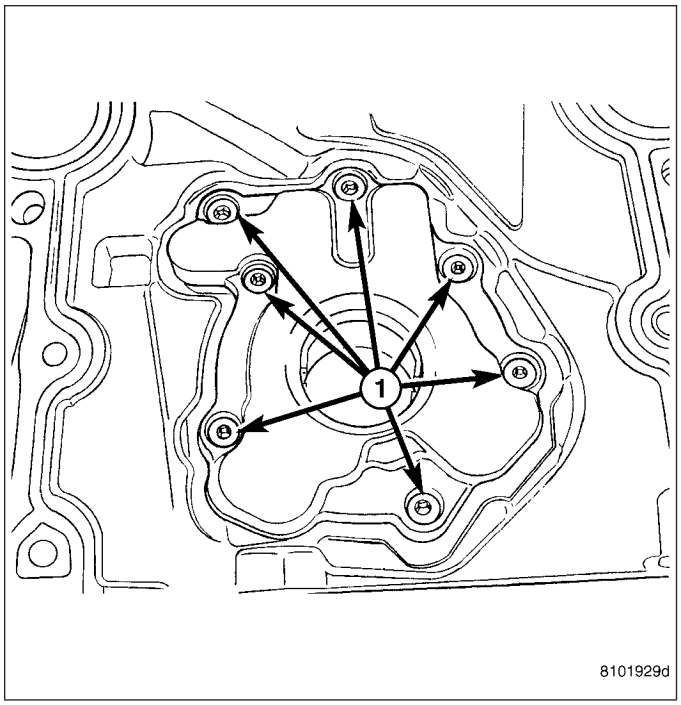


ASSEMBLY

1. Assemble pump using new parts as required.
2. Install spring (2) onto oil pressure relief valve (1).
3. Lubricate oil pressure relief valve and spring with clean engine oil.
4. Install oil pressure relief valve (1) and spring (2).
5. Inspect relief valve plug o-ring (3). Replace as necessary. Torque plug to 34 N·m (25 ft. lbs.)

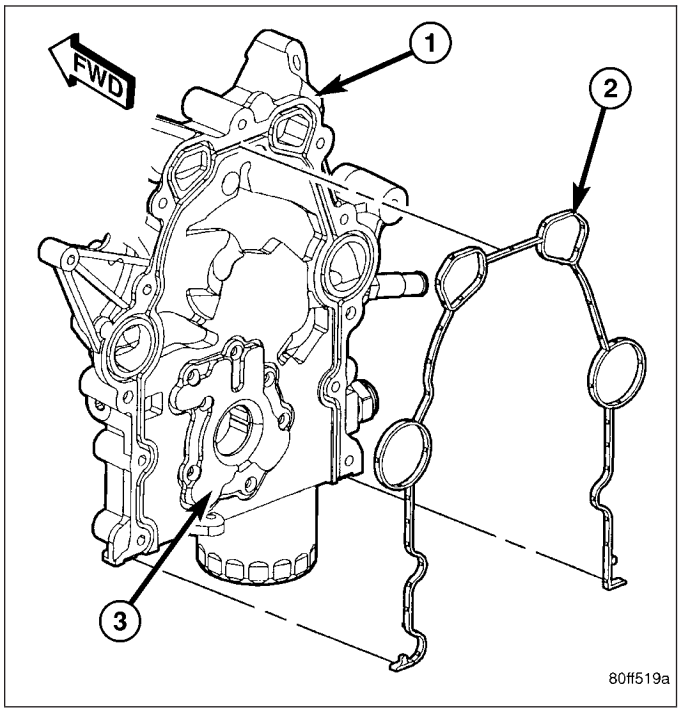


6. Install pump rotors with chamfer side to the inside of chain case cover.
7. Install oil pump cover and screws (1). Tighten cover screws to 23 N·m (200 in. lbs.).
8. Prime oil pump before installation by filling rotor cavity with engine oil.



INSTALLATION

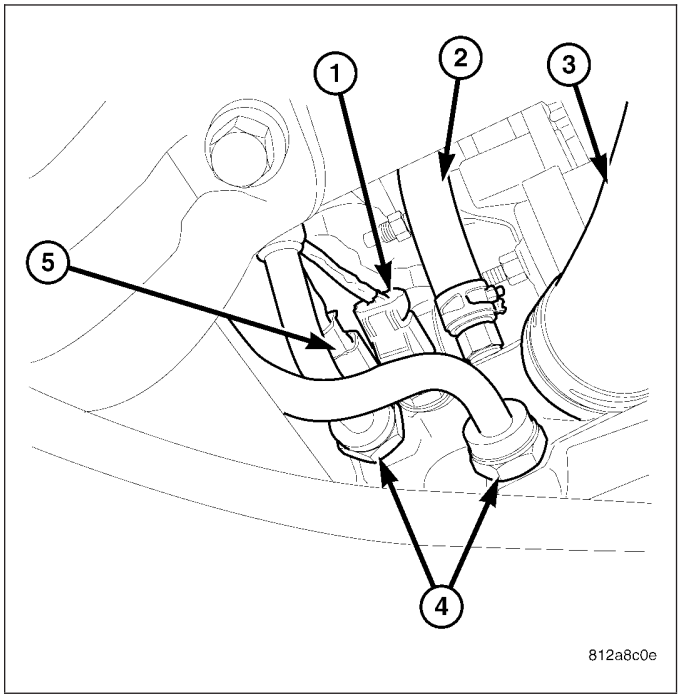
1. Assemble oil pump (3) (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - ASSEMBLY).
2. Prime oil pump before installation by filling rotor cavity with the correct engine oil.
3. Install timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - INSTALLATION).
4. Install **NEW** oil filter.
5. Fill the crankcase with the correct engine oil to the proper level.



SENSOR-OIL PRESSURE

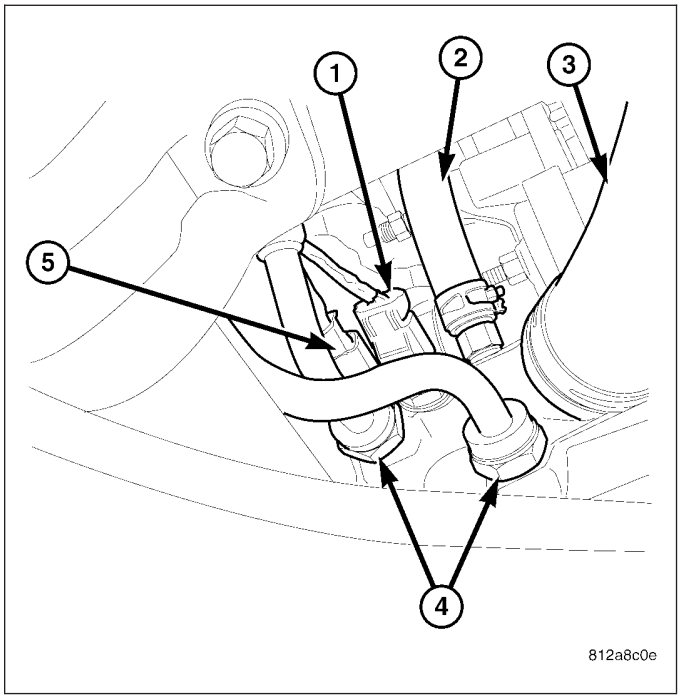
REMOVAL

1. Disconnect oil pressure sensor electrical connector.
2. Remove oil pressure sensor (1).



INSTALLATION

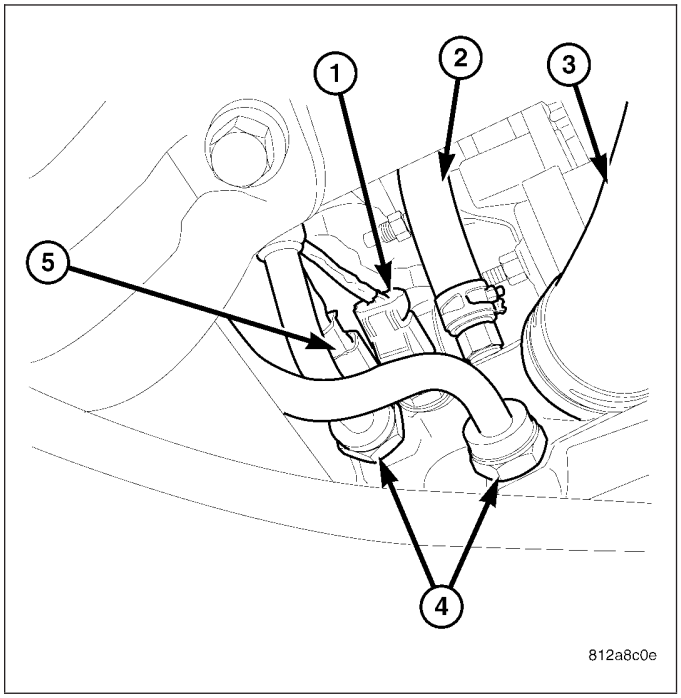
1. Apply thread sealer to oil pressure sensor threads.
2. Install oil pressure sensor (1).
3. Connect electrical connector.



SENSOR-OIL TEMPERATURE

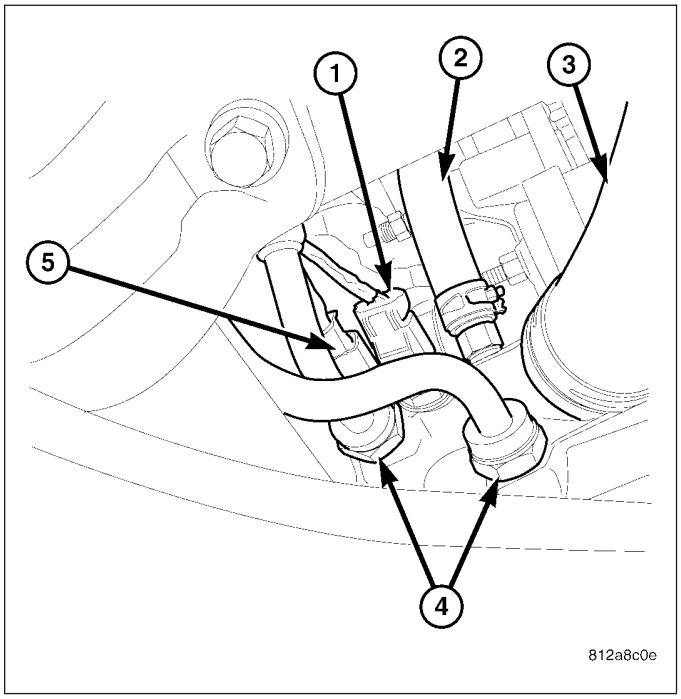
REMOVAL

1. Disconnect oil temperature sensor electrical connector.
2. Remove oil temperature sensor (5).



INSTALLATION

1. Apply thread sealer to oil temperature sensor threads.
2. Install oil temperature sensor (5).
3. Connect electrical connector.



BLOCK-ENGINE

DESCRIPTION

The cylinder block is made of a sand-cast aluminum alloy. The cylinder block has interference-fit cast iron cylinder liners. The cylinder liners are thermally installed during block manufacturing; they are not serviceable items.

Six iron main bearing caps use four bolts per cap; two vertical and two horizontal. A crankshaft oil scraper is attached to the main bearing caps via extended main bearing cap bolts and nuts.

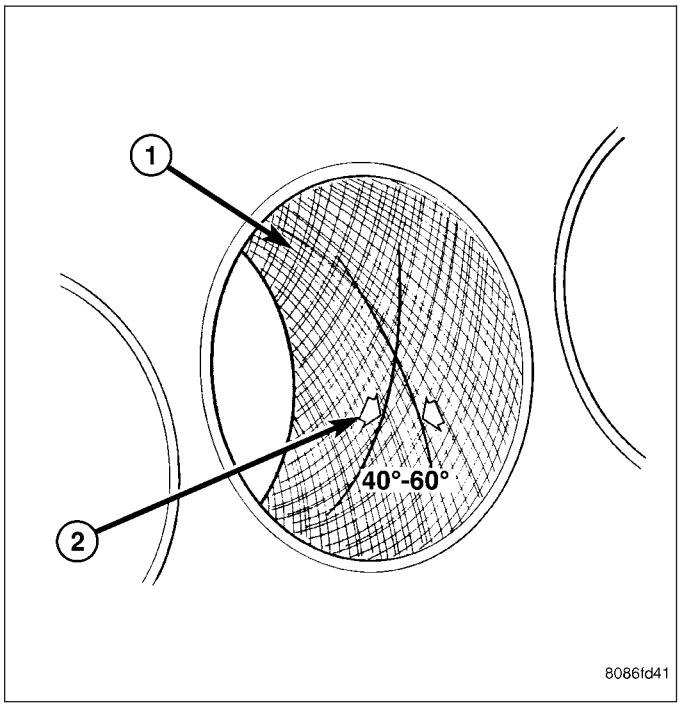
STANDARD PROCEDURE - CYLINDER BORE HONING

Before honing, stuff plenty of clean shop towels under the bores and over the crankshaft to keep abrasive materials from entering the crankshaft area.

1. Used carefully, the Cylinder Bore Sizing Hone C-823, equipped with 220 grit stones, is the best tool for this job. In addition to deglazing, it will reduce taper and out-of-round, as well as removing light scuffing, scoring and scratches. Usually, a few strokes will clean up a bore and maintain the required limits.

CAUTION: DO NOT use rigid type hones to remove cylinder wall glaze.

2. Deglazing of the cylinder walls may be done if the cylinder bore is straight and round. Use a cylinder surfacing hone, Honing Tool C-3501, equipped with 280 grit stones (C-3501-3810). about 20-60 strokes, depending on the bore condition, will be sufficient to provide a satisfactory surface. Using honing oil C-3501-3880, or a light honing oil, available from major oil distributors.



CAUTION: DO NOT use engine or transmission oil, mineral spirits, or kerosene.

3. Honing should be done by moving the hone up and down fast enough to get a crosshatch pattern. The hone marks should INTERSECT at 50° to 60° for proper seating of rings.
4. A controlled hone motor speed between 200 and 300 RPM is necessary to obtain the proper crosshatch angle. The number of up and down strokes per minute can be regulated to get the desired 50° to 60° angle. Faster up and down strokes increase the crosshatch angle.
5. After honing, it is necessary that the block be cleaned to remove all traces of abrasive. Use a brush to wash parts with a solution of hot water and detergent. Dry parts thoroughly. Use a clean, white, lint-free cloth to check that the bore is clean. Oil the bores after cleaning to prevent rusting.

CLEANING

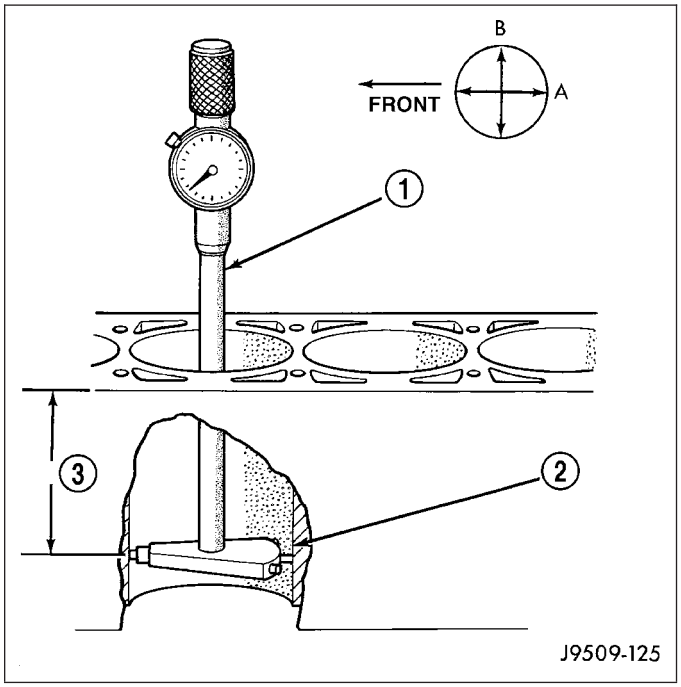
CAUTION: Remove all gasket material from cylinder block using a plastic gasket scraper and Mopar® Brake Parts Cleaner or the equivalent, this will prevent damage to the cylinder block.

1. When cleaning the cylinder block, remove the oil gallery plugs at the front and rear of the block.
2. Spray compressed air into all oil gallery passages to ensure they are clear of blockage.
3. Use a wooden or plastic scraper and Mopar® Brake Parts Cleaner or the equivalent to remove the old gasket.
4. Clean the oil passages in the crankshaft with a brush.

INSPECTION

The cylinder walls should be checked for out-of-round and taper with Special Tool C-119 (1). If the cylinder walls are badly scuffed or scored, the cylinder bore can be machined oversize. Oversize piston and rings are available.

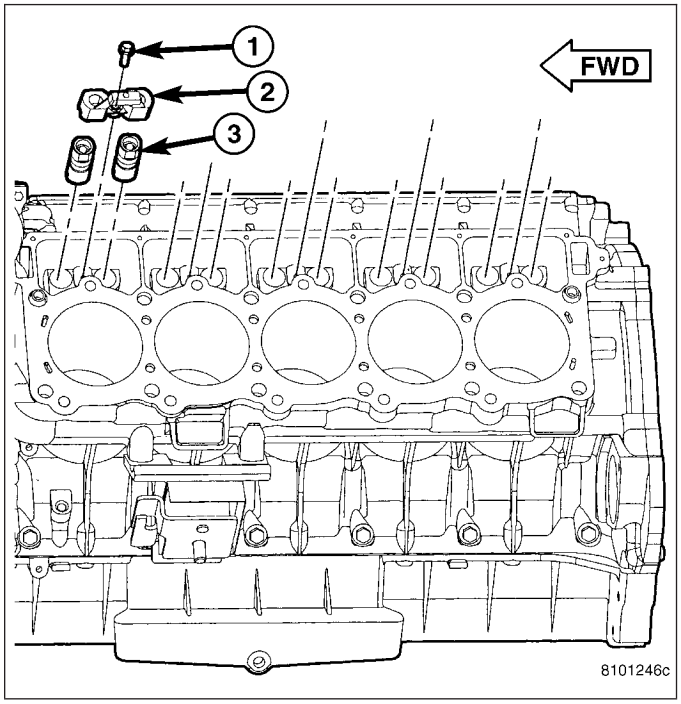
Measure the cylinder bore at three levels in directions A and B. Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 12 mm (0.50 in.) up from bottom of bore. (Refer to 9 - ENGINE - SPECIFICATIONS) for cylinder bore and piston specifications.



HYDRAULIC TAPPETS

DESCRIPTION

The roller type design hydraulic tappets (3) are positioned in the cylinder block. Roller tappet alignment is maintained by machined flats on tappet body being fitted in pairs into ten aligning yokes (2).



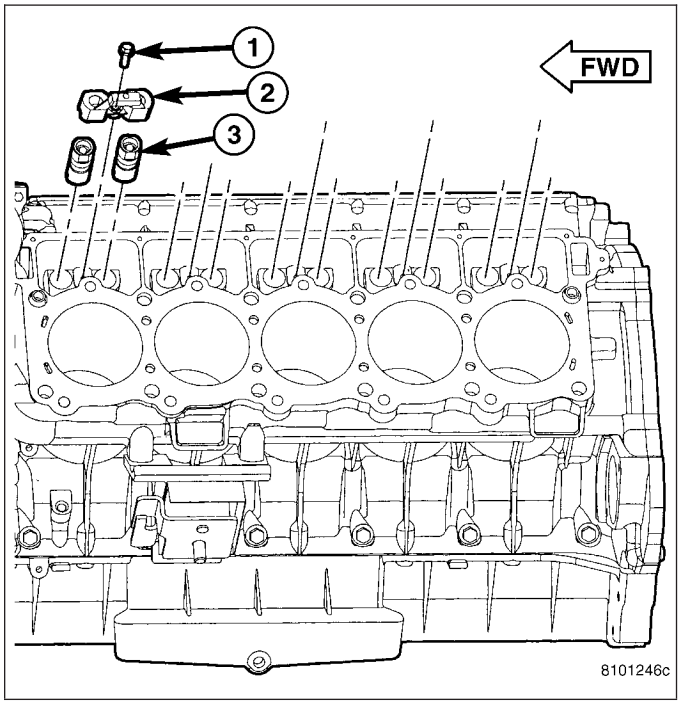
REMOVAL

1. Remove cylinder head(s) (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

NOTE: If tappets (3) are to be reused, identify tappet location to ensure installation in original location.

2. Remove tappet aligning yoke bolt (1).
3. Remove tappets (3) from bores.

CAUTION: Do not disassemble tappets.



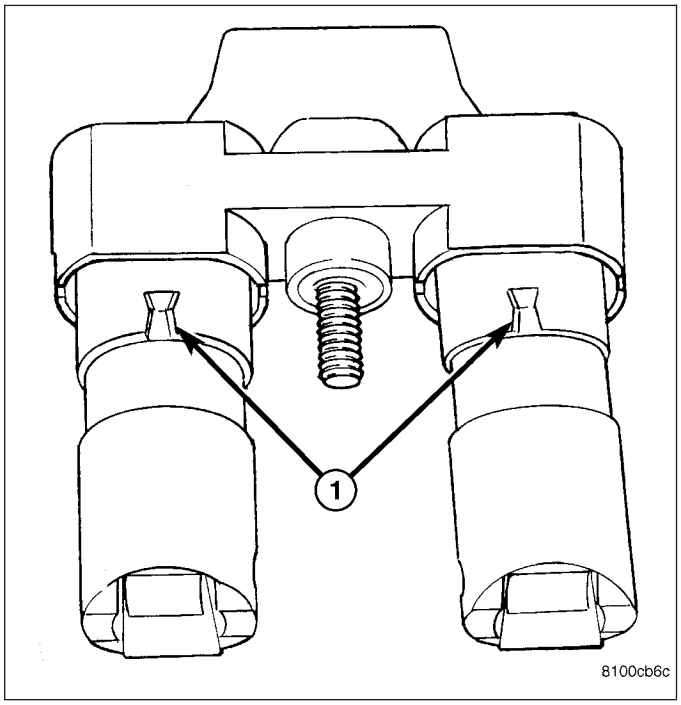
INSTALLATION

1. Lubricate tappets.
2. Install tappets in their original positions with oil holes (1) facing up.

CAUTION: The "handle" on the tappet aligning yoke must be installed in the outboard position; i.e. toward the cylinders.

3. With roller tappets in proper position, install aligning yoke assemblies. Apply Mopar® Lock & Seal Adhesive (Medium Strength Threadlocker) to the screws and tighten to 11 N·m (95 in. lbs.).
4. Install cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
5. Start and operate engine. Warm up to normal operating temperature.

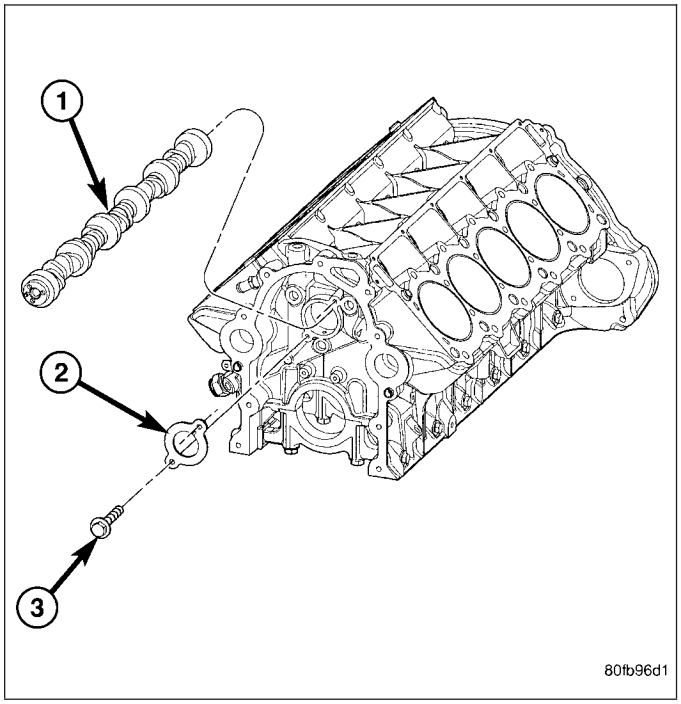
CAUTION: To prevent damage to valve mechanism, engine must not be run above fast idle until all hydraulic tappets have filled with oil and have become quiet.



CAMSHAFT

REMOVAL

1. Perform the fuel pressure relief procedure (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - STANDARD PROCEDURE).
2. Disconnect the negative battery cable.
3. Raise and support the vehicle.
4. Remove the front engine shield.
5. Drain the cooling system
6. Drain the power steering fluid.
7. Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
8. Lower the vehicle.
9. Remove the radiator and radiator fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
10. Remove intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - REMOVAL).
11. Remove cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
12. Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - REMOVAL).
13. Remove rocker arm assemblies.

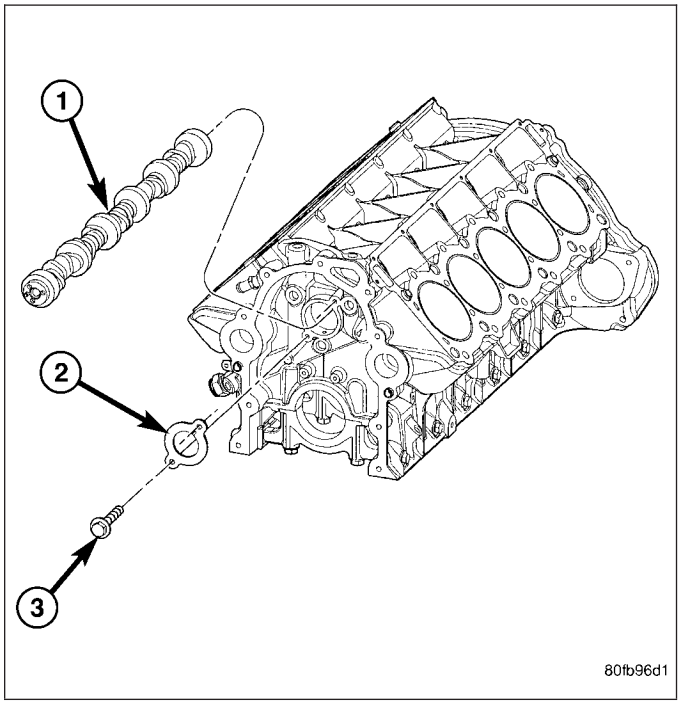


NOTE: Identify each push rod to be replaced in its original location.

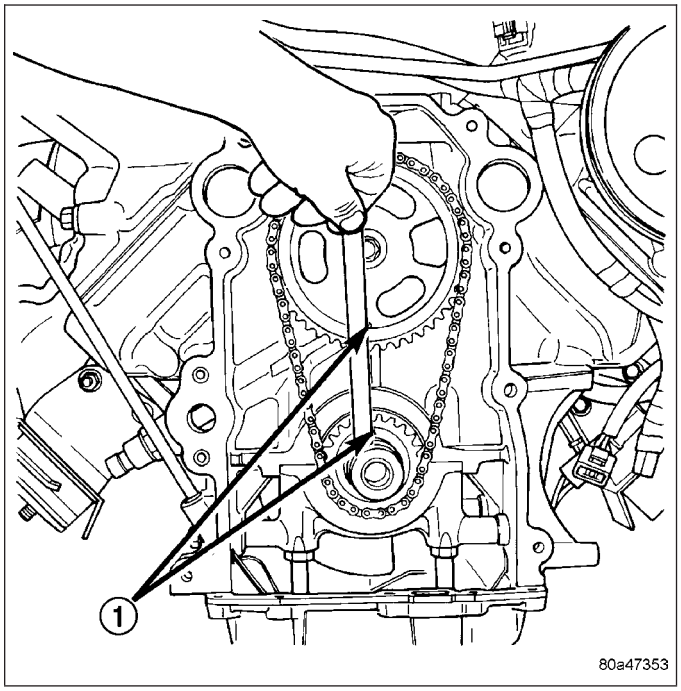
14. Remove push rods.
15. Remove cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
16. Remove hydraulic tappets (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC TAPPETS - REMOVAL).
17. Remove timing chain and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - REMOVAL).
18. Remove camshaft thrust plate (2).
19. Slowly remove camshaft (1). Use care not to damage camshaft bearing surfaces with the cam lobes.

INSTALLATION

1. Lubricate camshaft lobes and camshaft bearing journals.
2. Slowly install camshaft (1). Use care not to damage camshaft bearing surfaces with the cam lobes.
3. Install camshaft thrust plate bolts (3).. Tighten to 24 N·m (210 in. lbs.).



4. Install timing chain and camshaft sprocket (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - INSTALLATION).
5. Measure camshaft end play. End Play should measure 0.0127 - 0.381 mm (0.005 - 0.015 in.) 0.381 mm (0.015 in. Max.). If not within limits, install a new thrust plate.
6. **When camshaft is replaced, all of the tappets must be replaced.** Each hydraulic tappet must be installed with oil hole facing up (Refer to 9 - ENGINE/ENGINE BLOCK/HYDRAULIC TAPPETS - INSTALLATION).
7. Install timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - INSTALLATION).
8. Install cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
9. Install push rods in their original location.
10. Install rocker arms (Refer to 9 - ENGINE/CYLINDER HEAD/ROCKER ARMS - INSTALLATION).
11. Install intake manifold (Refer to 9 - ENGINE/MANIFOLDS/INTAKE MANIFOLD - INSTALLATION).



12. Install cylinder head covers (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
13. Install the radiator and fan assembly (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).
14. Raise and support the vehicle.
15. Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
16. Install the front engine shield.

17. Lower the vehicle.
18. Fill and purge air from the power steering (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).
19. Fill and purge air from the cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
20. Fill engine crankcase with the proper oil to the correct level (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE).
21. Connect the negative battery cable.
22. Start the vehicle and inspect for leaks.

ROD-PISTON & CONNECTING

DESCRIPTION

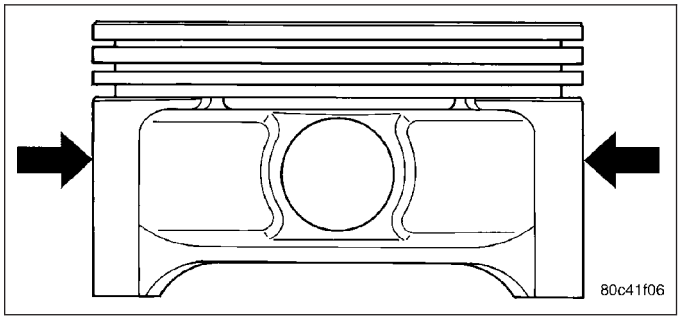
The pistons are made of cast aluminum with an added anodized coating on both sides of the skirt and the top piston ring groove for reduced wear and it's low friction properties. Three piston rings are used; two compression and one three-piece oil control ring. The piston pin (press-fit into the rods) joins the piston to a forged steel, fractured cap, designed connecting rod, with a custom twelve point nine millimeter threaded bolt. The piston and connecting rod is serviced as an assembly and is not interchangeable with previous model years.

STANDARD PROCEDURE

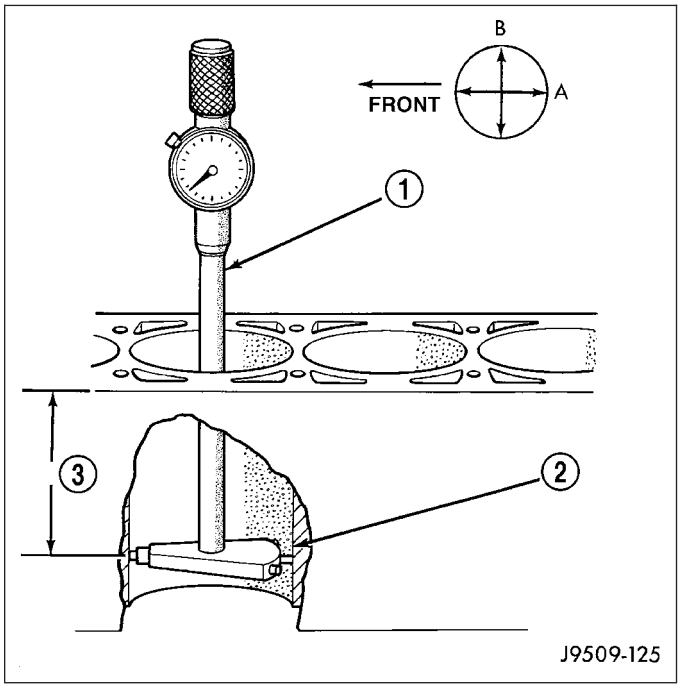
PISTON FITTING

All pistons are machined to the same weight in grams, to maintain piston balance.

Piston and cylinder wall must be clean and dry. Piston diameter should be measured 90 degrees to piston pin axis at size location shown in. Cylinder bores should be measured halfway down the cylinder bore and transverse to the engine crankshaft center line shown in. (Refer to 9 - ENGINE - SPECIFICATIONS) for cylinder bore and piston specifications.

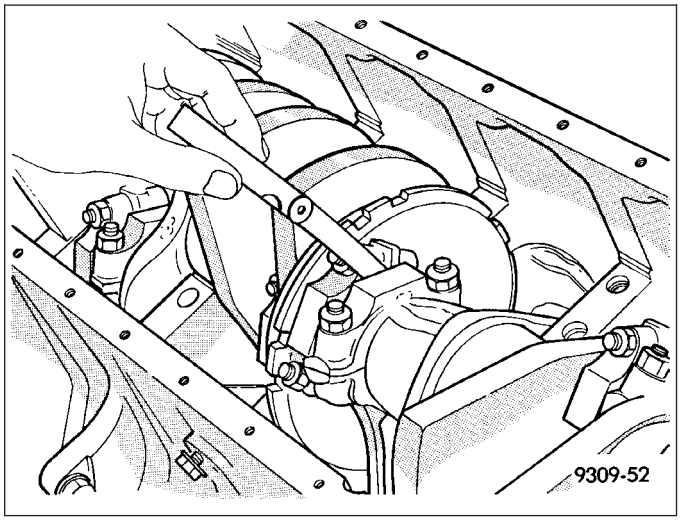


NOTE: Pistons and cylinder bores should be measured at normal room temperature, 70°F (21°C).



MEASURING CONNECTING ROD SIDE CLEARANCE

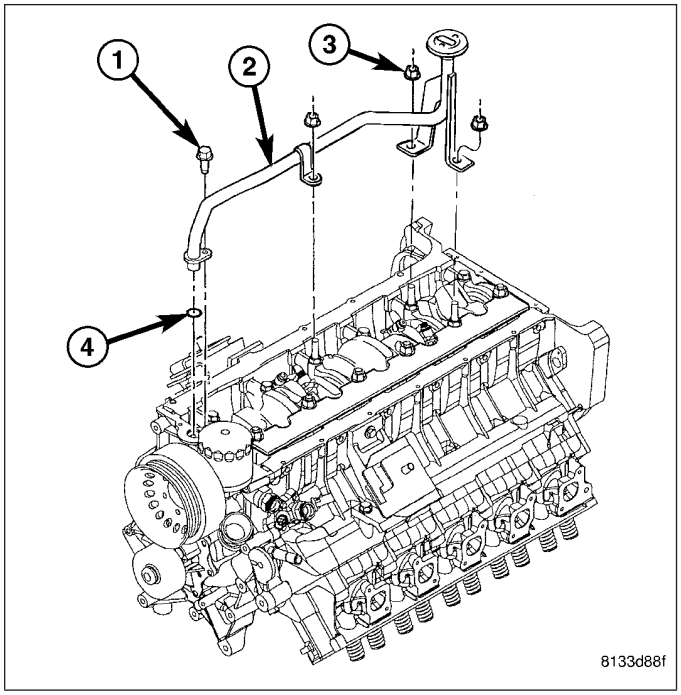
1. Using a feeler gauge, check connecting rod side clearance. (Refer to 9 - ENGINE - SPECIFICATIONS) for connecting rod side clearance specifications.



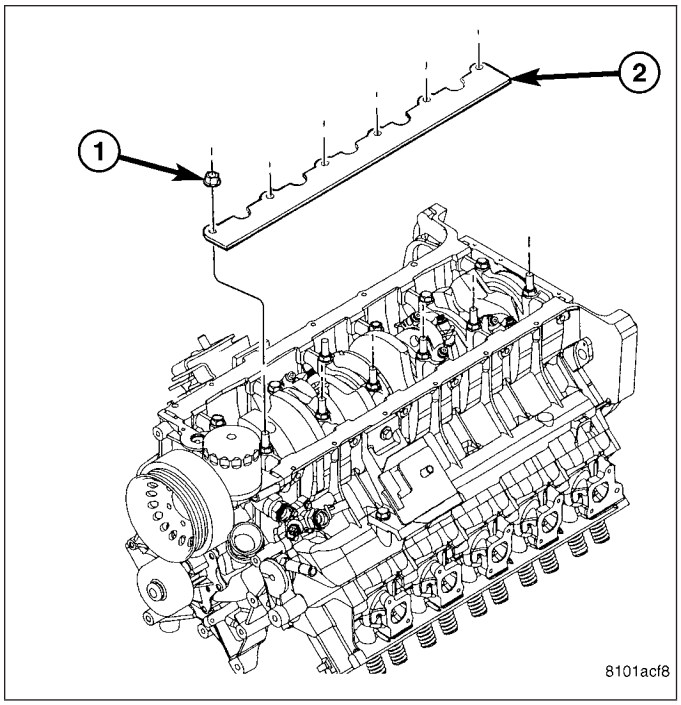
REMOVAL

NOTE: Pistons and connecting rods are to be removed as an assembly from top of cylinder block.

1. Remove engine (Refer to 9 - ENGINE - REMOVAL) and place in a suitable engine stand.
2. Remove cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove the oil pump pick up tube (2)



5. Remove the crankshaft oil scraper nuts (1) and oil scraper (2).



CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

6. Inspect connecting rods and connecting rod caps for cylinder identification (1). Identify them if necessary using a permanent ink or paint marker.

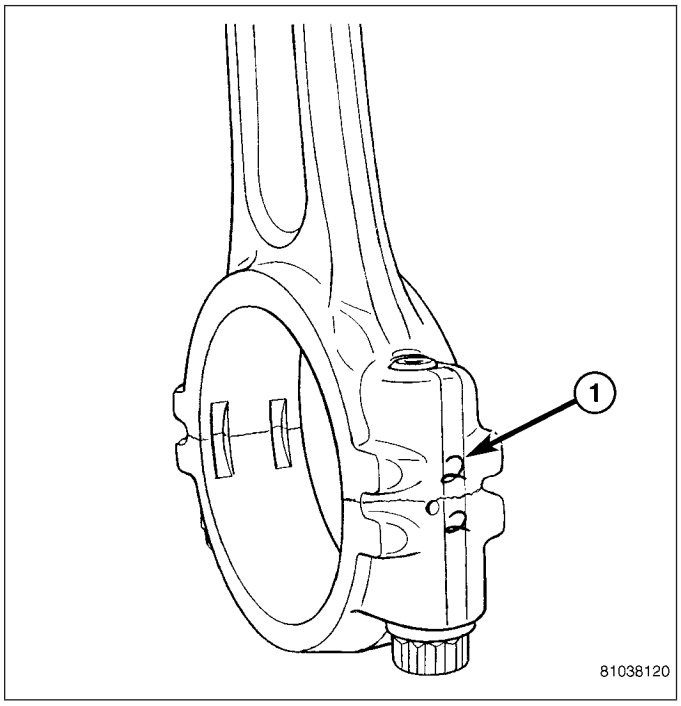
CAUTION: Care must be taken not to damage the fractured rod and cap joint surfaces, as engine damage may occur.

NOTE: Do not reuse connecting rod bolts.

7. Remove connecting rod bolts and cap. Push each piston and rod assembly out the block.

NOTE: Be careful not to nick crankshaft journals.

8. After removal, install bearing cap on the mating rod.



INSPECTION

CONNECTING ROD

1. Check the connecting rods for twist or bend.
2. Check the condition of the large end. Use an oil stone to remove any nicks and burrs.
3. Check the condition of the pin bore in the small end of the connecting rod. Use an oil stone to remove all nicks and burrs.

PISTON PIN

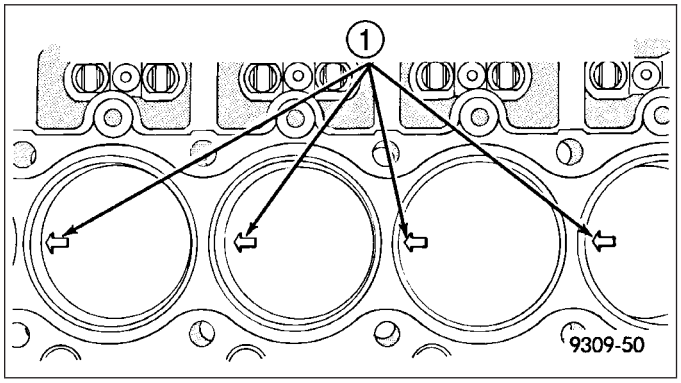
1. Inspect for free rotation of the piston pin in the piston.

PISTON

1. Inspect all piston surfaces for nicks and scuffs.
2. Inspect piston and ring grooves for wear.

INSTALLATION

NOTE: Pistons and connecting rods are serviced as an assembly. Left bank pistons are labeled "ODD". Right bank pistons are labeled "EVEN".

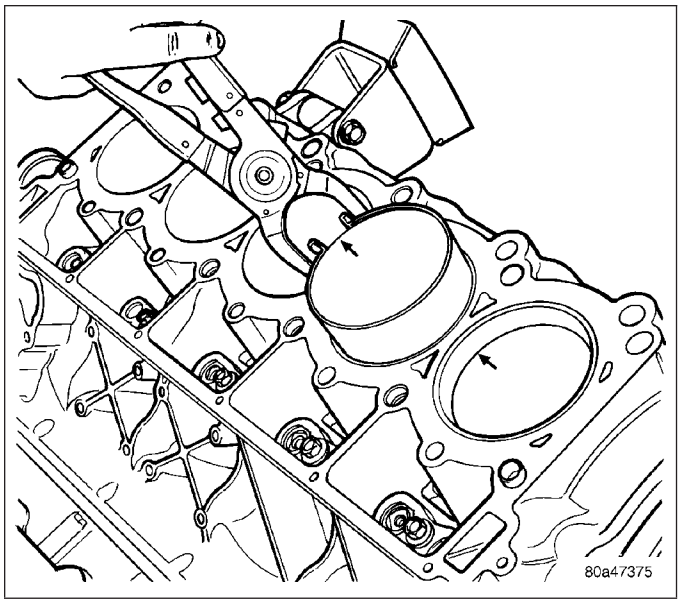


1. Install piston rings (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - INSTALLATION).

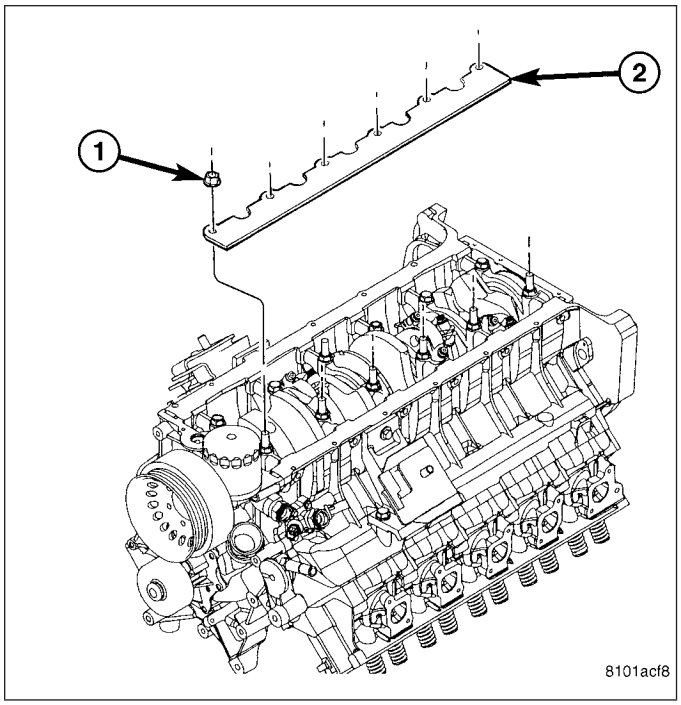
NOTE: Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap. Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in.

2. Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston. **Be sure position of rings does not change during this operation.**
3. Rotate crankshaft so that the connecting rod journal is at the bottom of it's stroke and in the center of the cylinder bore.
4. The arrow on top of piston (1) must be pointing toward front of engine.
5. Install new connecting rod bearing in connecting rod and rod cap.

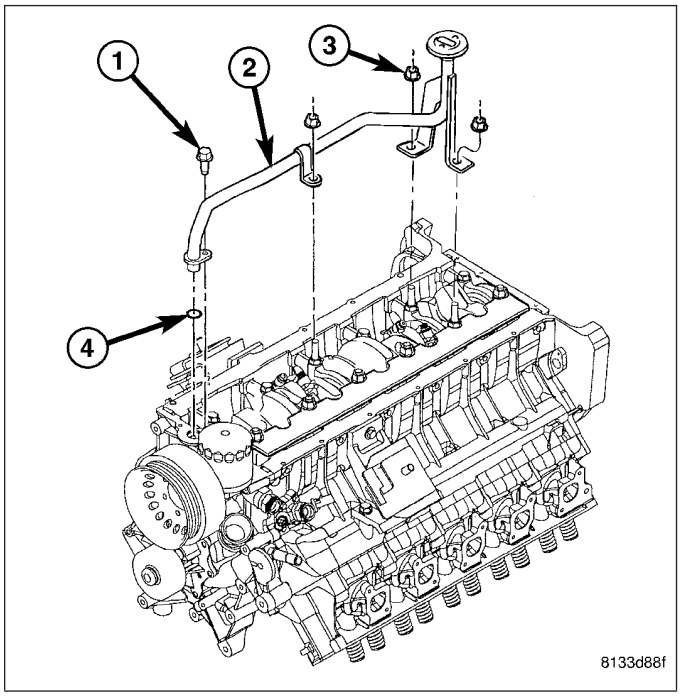
6. Install piston assembly from the top of the block. Tap the piston down in cylinder bore, using a hammer handle. Guide the rod over the crankshaft journal.
7. Install rod cap. Install **NEW** connecting rod bolts. Bolt threads should be oiled with engine oil. Torque connecting rod bolts to 68 N·m (50 ft. lbs.).



8. Install the crankshaft oil scraper (2) and nuts (1). Torque nuts (1) to 23 N·m (200 in. lbs.).



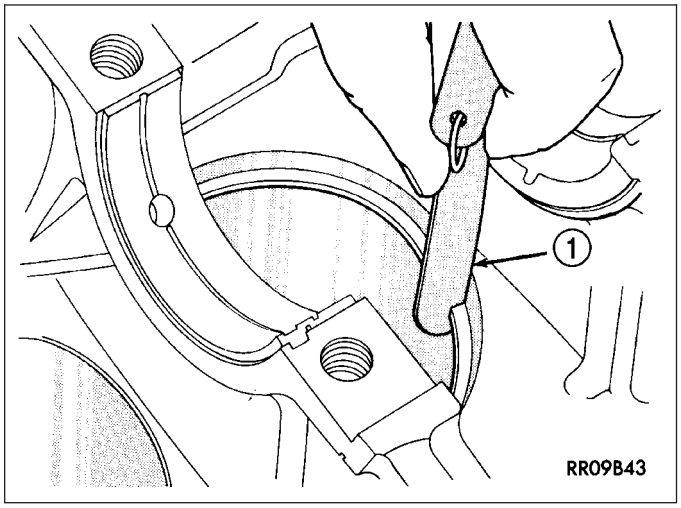
9. Install oil pump pick up tube (2) using a **new** o-ring (4). Torque 1/4-20 bolt to 11 N·m (95 in. lbs.). Torque 5/16-18 nuts to 23 N·m (200 in. lbs.).
10. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
11. Install cylinder heads (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
12. Install engine, (Refer to 9 - ENGINE - INSTALLATION).



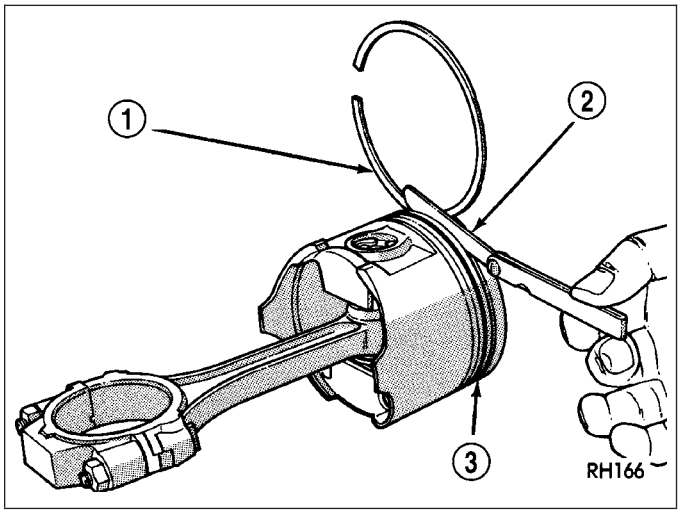
RINGS-PISTON

STANDARD PROCEDURE - MEASURING PISTON RING CLEARANCES

1. Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge (1). (Refer to 9 - ENGINE - SPECIFICATIONS) for piston ring specifications.

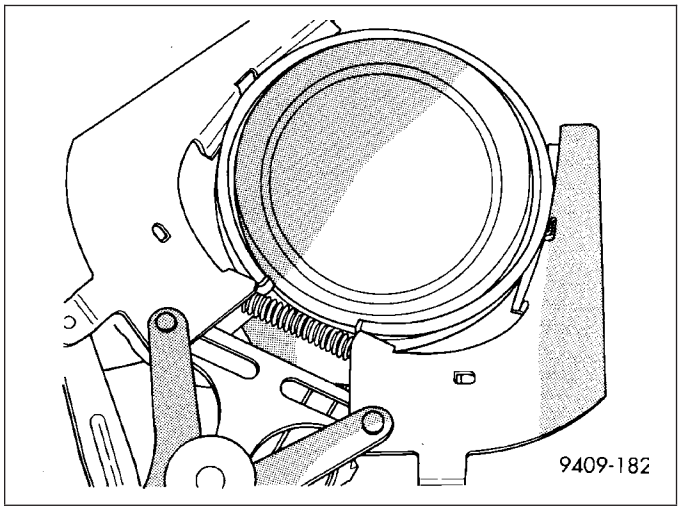


2. Check piston ring side clearance. (Refer to 9 - ENGINE - SPECIFICATIONS) for piston ring specifications.



REMOVAL

1. Using a suitable ring expander, remove upper and intermediate piston rings.
2. Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.
3. Clean ring grooves of any carbon deposits.



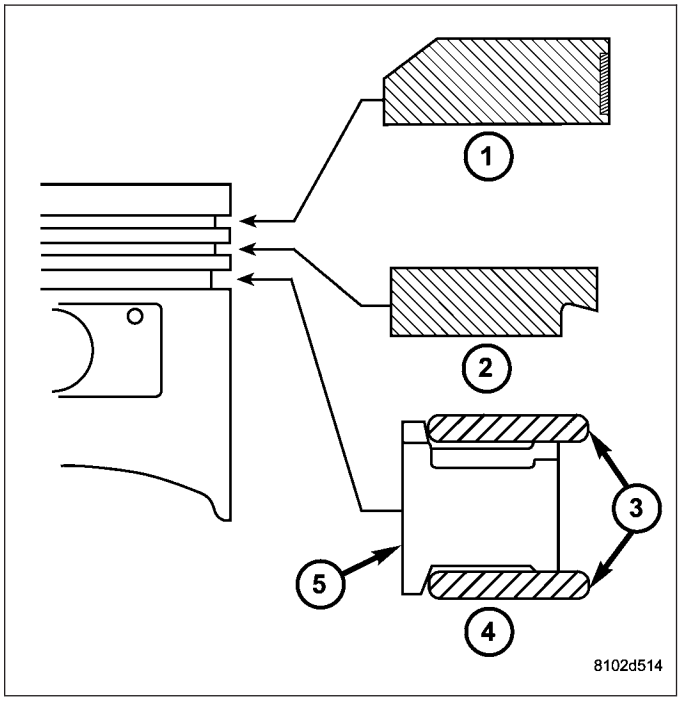
INSTALLATION

The No. 1 (1) and No. 2 (2) piston rings have a different cross section. Install rings with manufacturers I.D. mark facing up, to the top of the piston.

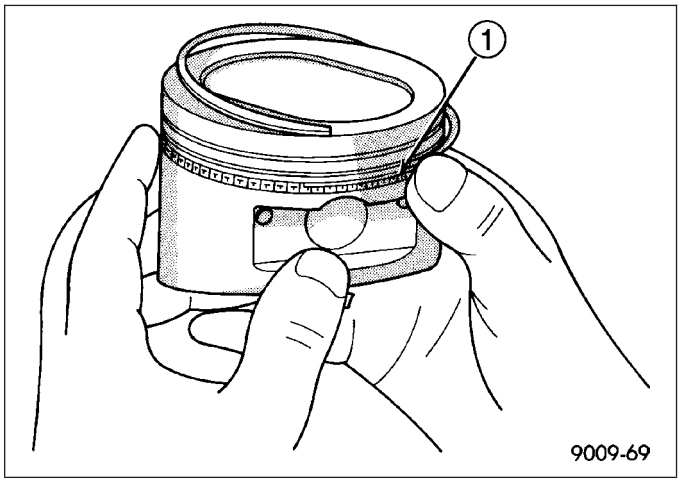
CAUTION: Install piston rings in the following order:

- Oil ring expander
- Lower oil ring side rail
- Upper oil ring side rail
- No. 2 intermediate piston ring
- No. 1 upper piston ring

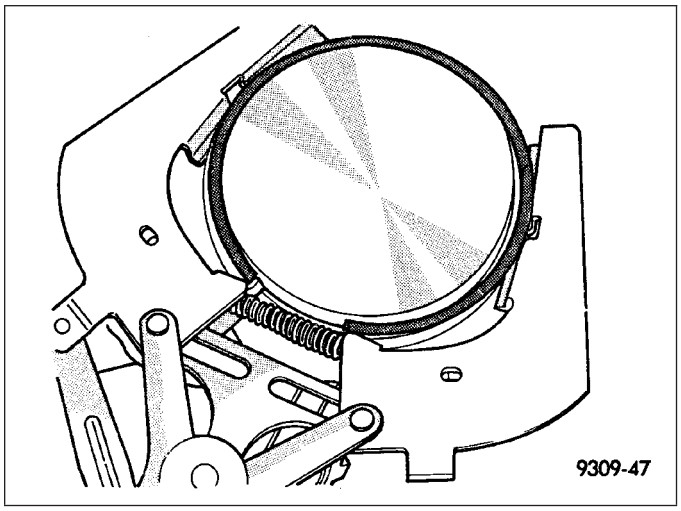
1. Install oil ring expander.



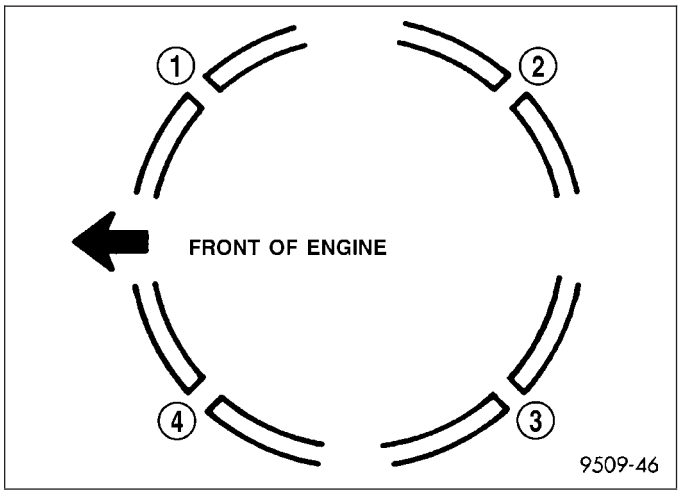
2. Install the lower oil ring side rail by placing one end between the piston ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail (1) is in position. **Do not use a piston ring expander.**.



3. Install upper oil ring side rail.
4. Install No. 2 piston ring and then No. 1 piston ring.



5. Position piston ring end gaps as shown.
6. Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction. Staggering ring gap is important for oil control.



BEARINGS-CONNECTING ROD

DESCRIPTION

The bearing caps are not interchangeable and should be paint marked or scribed at removal to insure correct assembly.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

Limits of taper or out-of-round on any crankshaft journals should be held to 0.013 mm (0.0005 in.). Bearings are available in 0.025 mm (0.001 in.), 0.051 mm (0.002 in.), 0.076 mm (0.003 in.), 0.254 mm (0.010 in.) and 0.305 mm (0.012 in.) undersize. **Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.**

STANDARD PROCEDURE

CONNECTING ROD BEARING - FITTING

Fit all rods on one bank until complete. Do not alternate from one bank to another, because when the rods are assembled to pistons correctly, they are not interchangeable from one bank to another.

The bearing caps are not interchangeable and should be marked at removal to insure correct assembly.

The bearing shells must be installed so that the tangs are in the machined grooves in the rods and caps.

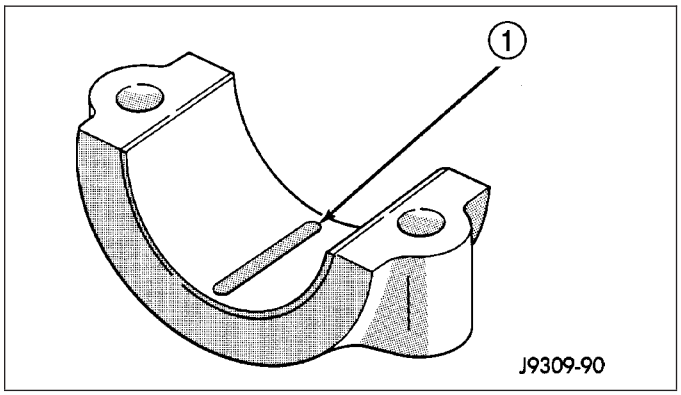
Limits of taper or out-of-round on any crankshaft journals should be held to 0.013 mm (0.0005 in.). Bearings are available in 0.025 mm (0.001 in.), 0.051 mm (0.002 in.), 0.076 mm (0.003 in.), 0.254 mm (0.010 in.) and 0.305 mm

(0.012 in.) undersize. **Install the bearings in pairs. Do not use a new bearing half with an old bearing half. Do not file the rods or bearing caps.**

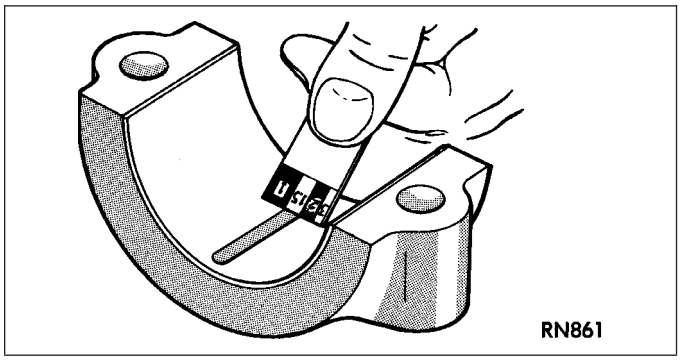
1. (Refer to 9 - ENGINE/ENGINE BLOCK/CONNECTING ROD BEARINGS - STANDARD PROCEDURE) - Measuring Connecting Rod Bearing Clearance to determine bearing clearance.
2. Before installing the connecting rod cap bolts, the bolt threads should be oiled with engine oil.
3. Install bolts finger tight, then alternately torque each bolt to assemble the cap properly.
4. Tighten the connecting rod bolts to 68 N·m (50 ft. lbs.).

MEASURING CONNECTING ROD BEARING CLEARANCE

Engine crankshaft bearing clearances can be determined by use of Plastigage (1) or equivalent. The following is the recommended procedure for the use of Plastigage:



1. Rotate the crankshaft until the connecting rod to be checked is at the bottom of its stroke.
2. Remove oil film from surface to be checked. Plastigage is soluble in oil.
3. Place a piece of Plastigage (1) across the entire width of the bearing shell in the bearing cap approximately 6.35 mm (1/4 inch.) off center and away from the oil hole. In addition, suspect areas can be checked by placing plastigage in the suspect area.
4. Before assembling the rod cap with Plastigage in place, the crankshaft must be rotated until the connecting rod being checked starts moving toward the top of the engine. Only then should the cap be assembled and torqued to specifications. **Do not rotate the crankshaft while assembling the cap or the Plastigage may be smeared, giving inaccurate results.**

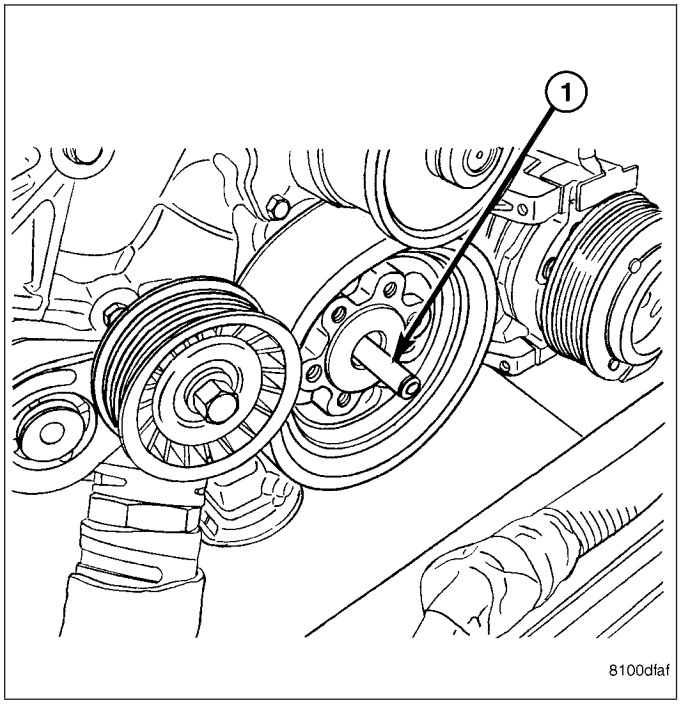


5. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. (Refer to 9 - ENGINE - SPECIFICATIONS). **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**
6. Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

DAMPER-CRANKSHAFT

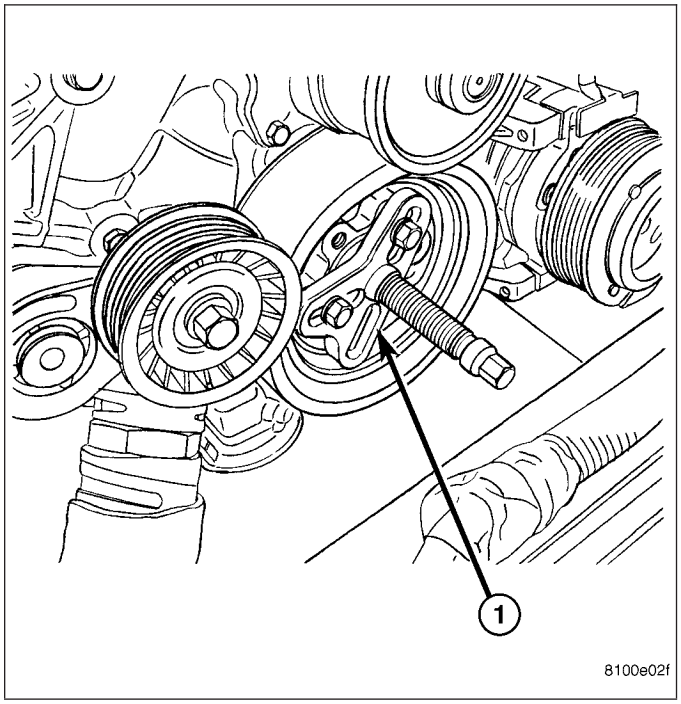
REMOVAL

1. Raise and support the vehicle.
2. Remove the engine front shield.
3. Disconnect the radiator fan hydraulic lines (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
4. Lower vehicle.
5. Disconnect the air inlet duct, IAT sensor, CCV hose at the throttle body, and remove the air cleaner housing cover.
6. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
7. Remove the radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
8. Raise and support the vehicle.
9. Remove crankshaft pulley.
10. Remove crankshaft damper bolt.
11. Install crankshaft insert, Special Tool 8194 (1). Lubricate the end of Special Tool 8194 (1) with wheel bearing grease or equivalent.



NOTE: Lubricate the threads of the puller using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft damper removal.

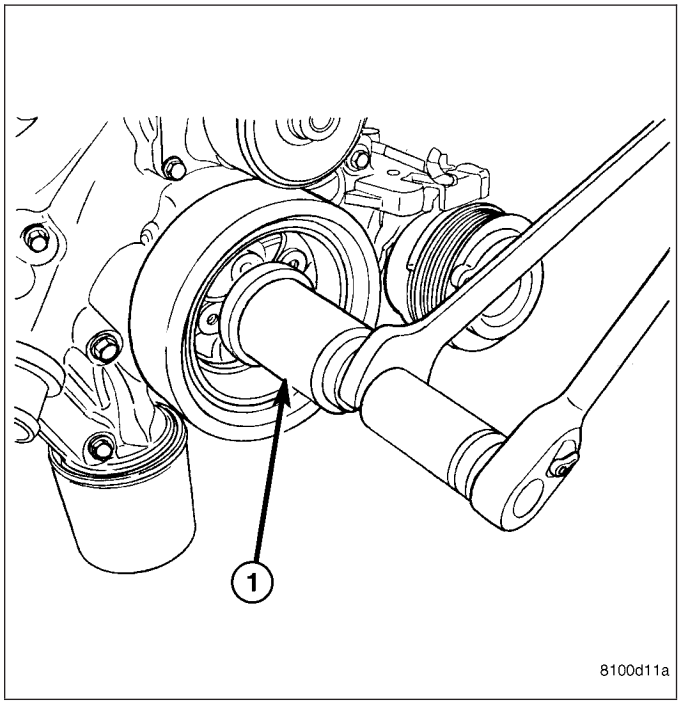
12. Using a bolt-grip type universal puller (1), remove the crankshaft damper.



INSTALLATION

NOTE: Lubricate the threads of Special Tool 9055 (1) using Mopar® Nickel Anti-seize Compound or equivalent, before beginning crankshaft damper installation.

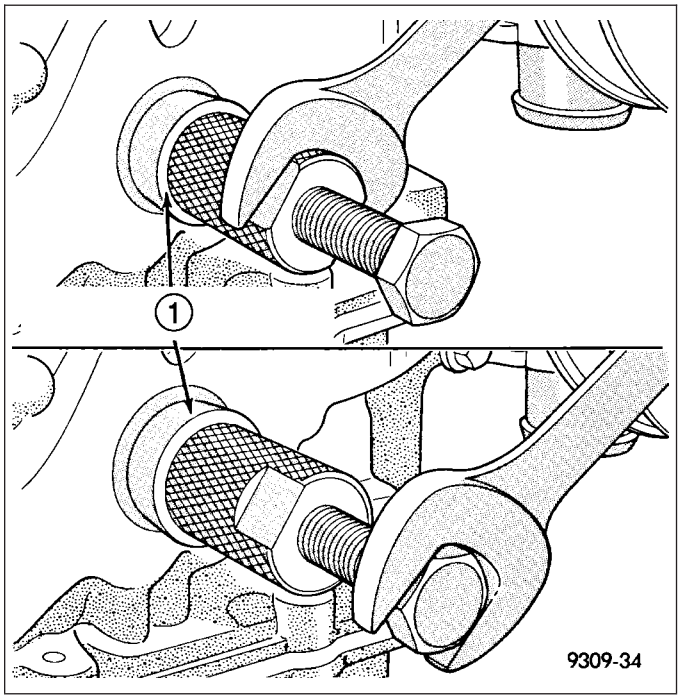
1. Raise and support the vehicle.
2. Install crankshaft damper using Special Tool 9055 (1).
3. Install and tighten damper bolt to 176 N·m (130 ft. lbs.).
4. Install the crankshaft pulley. Tighten crankshaft pulley bolts to 23 N·m (200 in. lbs.).
5. Install the front engine shield.
6. Lower the vehicle.
7. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
8. Install the radiator fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
9. Install air cleaner cover connecting the CVV hose, IAT, and air duct to the throttle body housing.
10. Lower vehicle.



SEAL-CRANKSHAFT OIL- FRONT

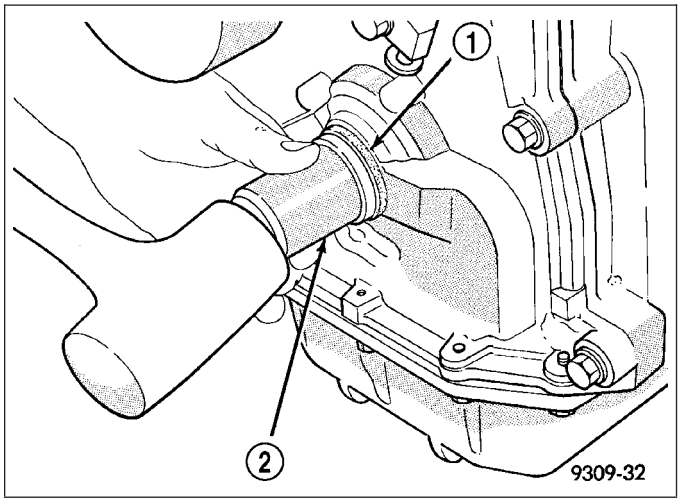
REMOVAL

1. Disconnect the air inlet duct, IAT sensor, CCV hose at the throttle body, and remove the air cleaner housing cover.
2. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
3. Remove crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/CRANKSHAFT DAMPER - REMOVAL).
4. Use Special Tool C-4679A (1) to remove crankshaft oil seal. Be careful not to damage the crankshaft seal surface of cover.



INSTALLATION

1. Install the new seal by using Special Tool MD 998306 (2).
2. Place seal into opening with seal spring towards the inside of engine. Install seal until it bottoms out in timing chain cover.
3. Install crankshaft damper (Refer to 9 - ENGINE/ ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
4. Install accessory drive belt (Refer to 7 - COOLING/ ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
5. Install air cleaner cover connecting the CVV hose, IAT sensor, and air duct to the throttle body housing.



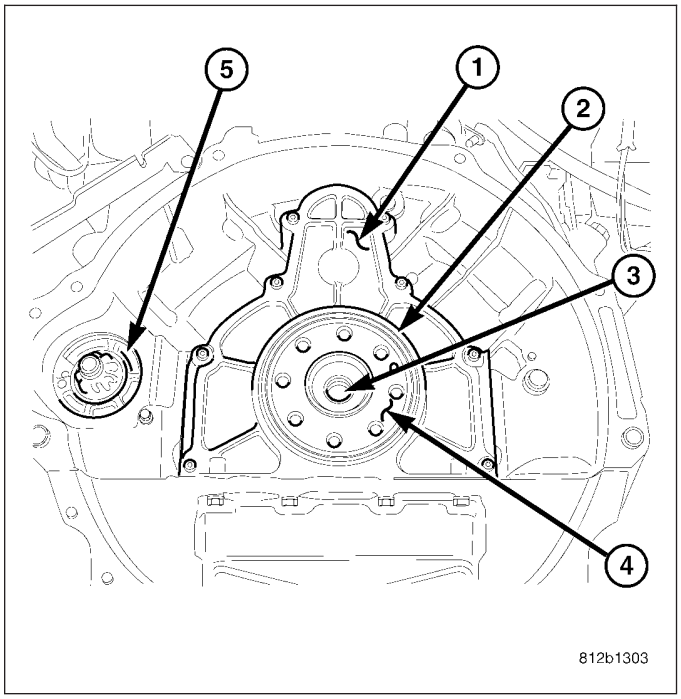
SEAL-OIL-REAR-CRANK AND RETAINER

REMOVAL

1. Remove transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL).
2. Remove clutch and flywheel (Refer to 6 - CLUTCH/ CLUTCH DISC - REMOVAL).

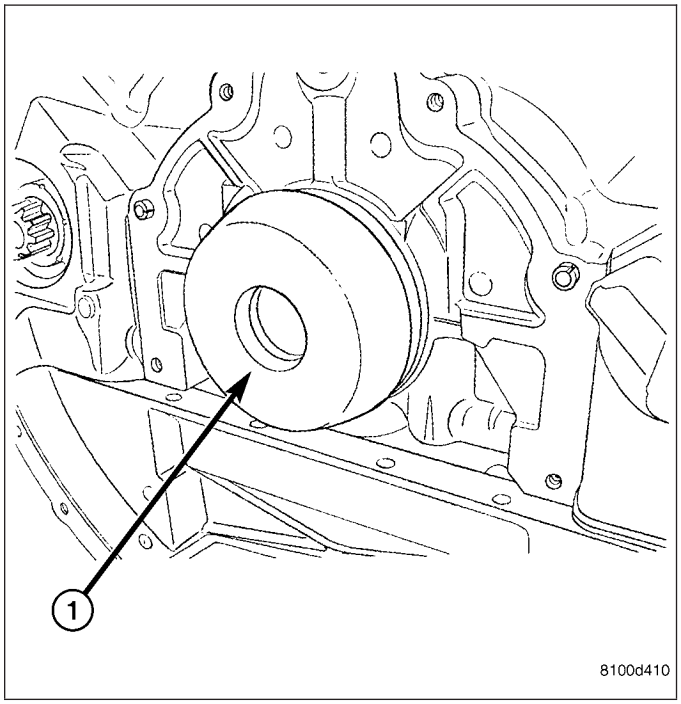
NOTE: The oil seal and retainer are serviced as an assembly.

3. Remove the seal retainer bolts from cylinder block and oil pan.
4. Remove the oil seal and retainer (1) assembly.

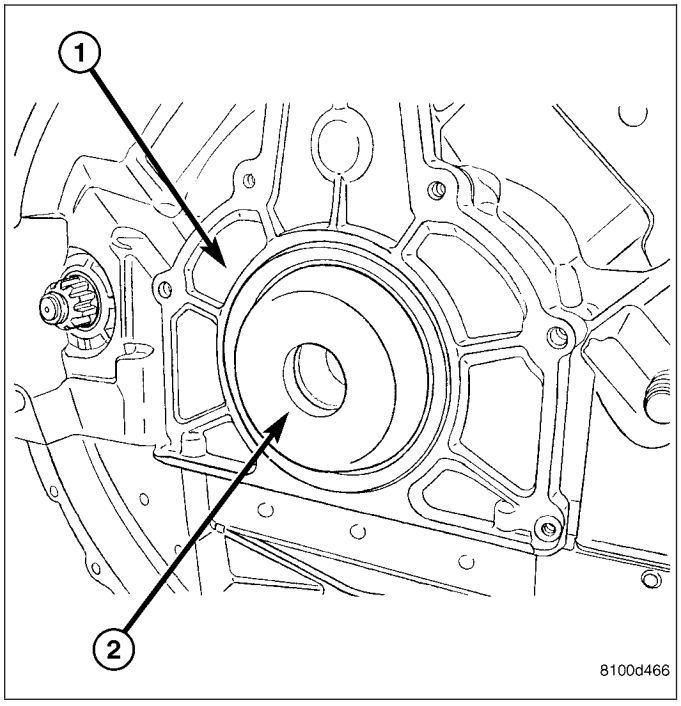


INSTALLATION

1. Clean the engine block and retainer. Make sure surfaces are clean and free of oil.
2. Install Special Tool 9060 (1) (seal guide) onto end of crankshaft. Align hole in tool with dowel pin on crankshaft.



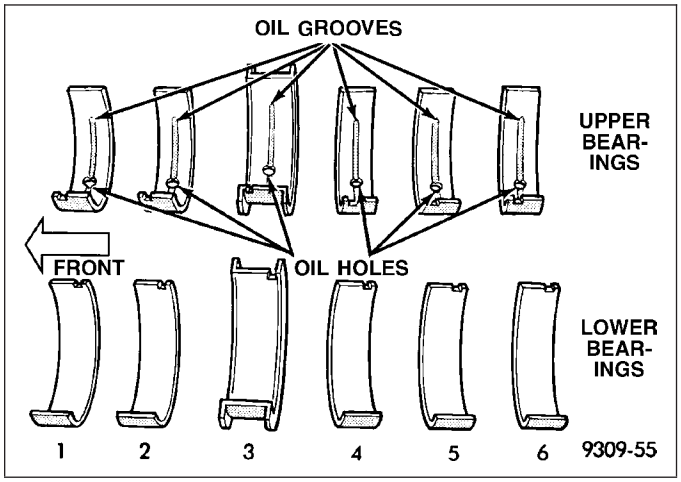
3. Carefully position retainer/oil seal (1) to block. Tighten the retainer bolts to 11 N·m (95 in. lbs.).
4. Install flywheel and clutch (Refer to 6 - CLUTCH/ CLUTCH DISC - INSTALLATION).
5. Install transmission (Refer to 21 - TRANSMISSION/ TRANSAXLE/MANUAL - INSTALLATION).



BEARINGS-CRANKSHAFT MAIN

DESCRIPTION

The main bearing caps are not interchangeable and should be marked at removal to insure correct assembly. Upper and lower main bearing halves are NOT interchangeable. Lower main bearing halves of No. 1, No. 2, No. 4, No. 5 and No. 6 are interchangeable. Upper main bearing halves of No. 1, No. 2, No. 4, No. 5 and No. 6 are interchangeable.



Upper and lower No. 3 bearing halves are flanged to carry the crankshaft thrust loads and are NOT interchangeable with any other bearing halves in the engine. All bearing cap bolts removed during service procedures are to be cleaned and oiled before installation. Bearing shells are available in standard and the following undersizes: 0.025 mm (0.001 in.), 0.051 mm (0.002 in.), 0.076 mm (0.003 in.), 0.254 mm (0.010 in.), 0.305 mm (0.012 in.) and 0.508 mm (0.020 in.). Never install an undersize bearing that will reduce clearance below specifications.

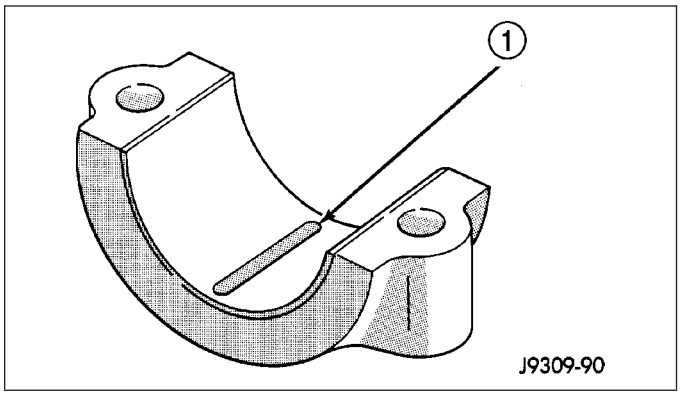
STANDARD PROCEDURE

MEASURING CRANKSHAFT MAIN BEARING CLEARANCE IN-CAR

PLASTIGAGE METHOD

Engine crankshaft bearing clearances can be determined by use of Plastigage or equivalent. The following is the recommended procedure for the use of Plastigage:

1. Remove oil film from surface to be checked. Plastigage is soluble in oil.
2. The total clearance of the **main bearings** can only be determined by removing the weight of the crankshaft. This can be accomplished by either of two methods:

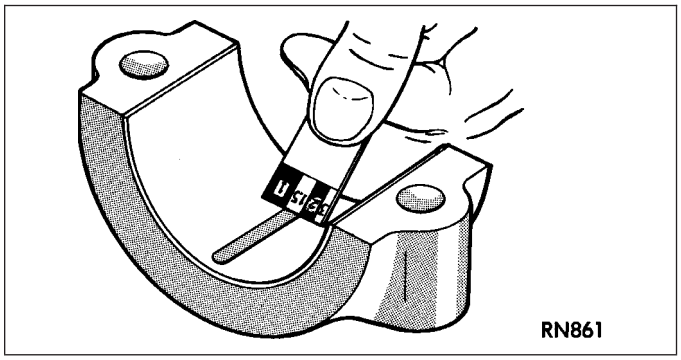


PREFERRED METHOD

1. Shimming the bearings adjacent to the bearing to be checked in order to remove the clearance between upper bearing shell and the crankshaft. This can be accomplished by placing a minimum of 0.254 mm (.010 inch) shim (e. g. cardboard, matchbook cover, etc.) between the bearing shell and the bearing cap on the adjacent bearings and tighten bolts to 14-20 N·m (10-15 ft.lb.)
   - When checking No. 1 main bearing. Shim No. 2 main bearing.
   - When checking No. 2 main bearing. Shim No.1 and No. 3 main bearing.
   - When checking No.3 main bearing. Shim No. 2 and No. 4 main bearing.
   - When checking No. 4 main bearing. Shim No. 3 and No. 5 main bearing.
   - When checking No. 5 main bearing. Shim No. 4 and No. 6 main bearing.
   - When checking No. 6 main bearing. Shim No. 5 main bearing.

NOTE: REMOVE ALL SHIMS BEFORE REASSEMBLING ENGINE

ALTERNATIVE METHOD

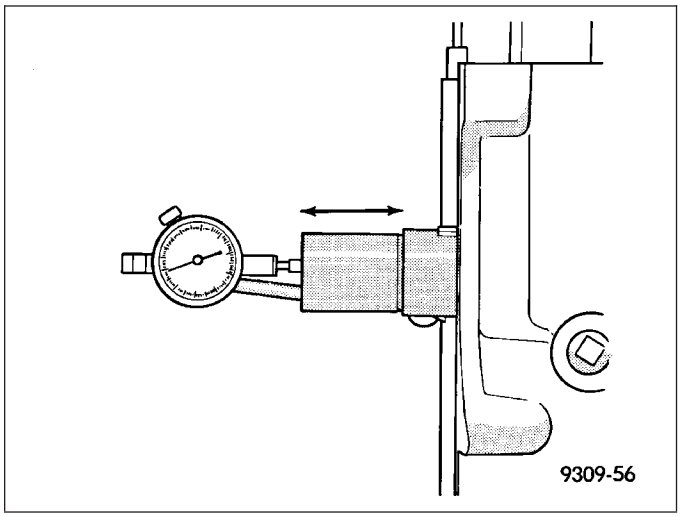


1. With the weight of the crankshaft being supported by a jack under the counterweight adjacent to the bearing being checked.
2. Place a piece of Plastigage across the entire width of the bearing shell in the cap approximately 6.35 mm (1/4 inch) off center and away from the oil holes. (In addition, suspect areas can be checked by placing the Plastigage in the suspect area). Torque the bearing cap bolts of the bearing being checked to the proper specifications.
3. Remove the bearing cap and compare the width of the flattened Plastigage with the metric scale provided on the package. Locate the band closest to the same width. This band shows the amount of clearance in thousandths of a millimeter. Differences in readings between the ends indicate the amount of taper present. Record all readings taken. Refer to Engine Specifications. **Plastigage generally is accompanied by two scales. One scale is in inches, the other is a metric scale.**
4. Plastigage is available in a variety of clearance ranges. The 0.025-0.076 mm (.001-.003 inch) is usually the most appropriate for checking engine bearing proper specifications.

CRANKSHAFT

STANDARD PROCEDURE

MEASURING CRANKSHAFT END PLAY



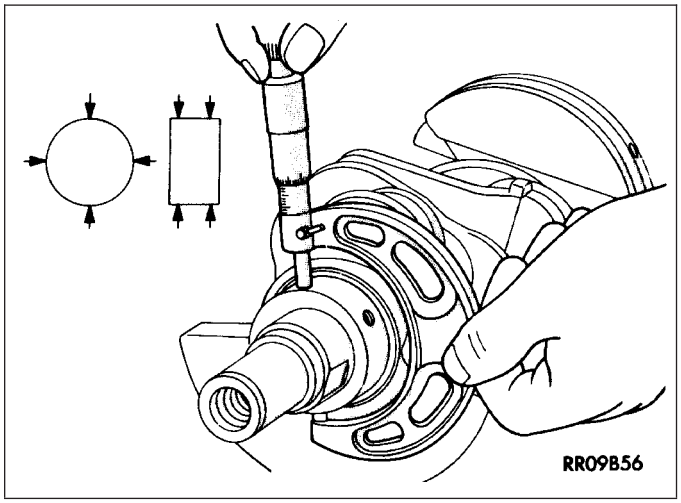
1. Mount a dial indicator to front of engine, locating probe on nose of crankshaft.
2. Move crankshaft all the way to the rear of its travel.
3. Zero the dial indicator.
4. Move crankshaft all the way to the front and read the dial indicator. (Refer to 9 - ENGINE - SPECIFICATIONS) for crankshaft end-play specifications.

CRANKSHAFT END PLAY CHECK - OPTIONAL

1. Move crankshaft all the way to the rear of its travel using a lever inserted between a main bearing cap and a crankshaft cheek using care not to damage any bearing surface. **Do not** loosen main bearing cap.
2. Use a feeler gauge between number 3 thrust bearing and machined crankshaft surface to determine end play. (Refer to 9 - ENGINE - SPECIFICATIONS) for crankshaft end-play specifications.

CRANKSHAFT JOURNAL MEASUREMENT

The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to 0.013 mm (0.0005 in.). Journal grinding should not exceed 0.508 mm (0.020 in.) under the standard journal diameter. DO NOT grind thrust faces of No. 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

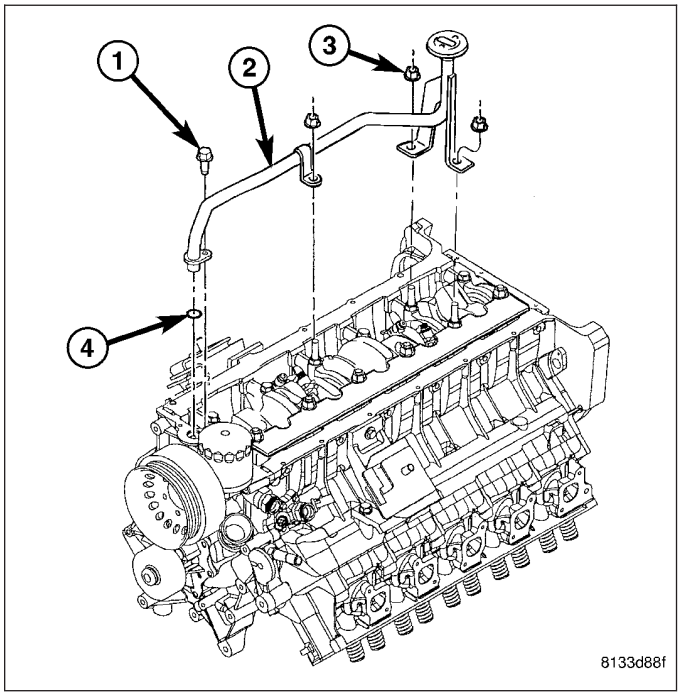


CAUTION: With the forged crankshafts it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

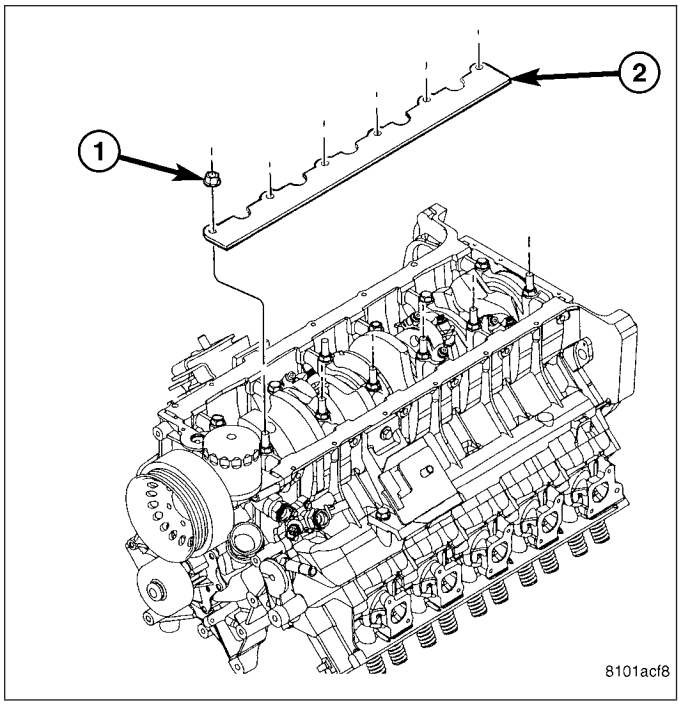
1. Measure the journal outside diameter as illustrated. (Refer to 9 - ENGINE - SPECIFICATIONS) for crankshaft specifications.

REMOVAL

1. Remove engine assembly from vehicle (Refer to 9 - ENGINE - REMOVAL).
2. Mount engine on a suitable repair stand.
3. Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove crankshaft rear oil seal retainer (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINER - REMOVAL).
5. Remove crankshaft pulley and damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
6. Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER - REMOVAL).
7. Remove timing chain and crankshaft sprocket. (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - REMOVAL).
8. Remove oil pump pick up tube (2).



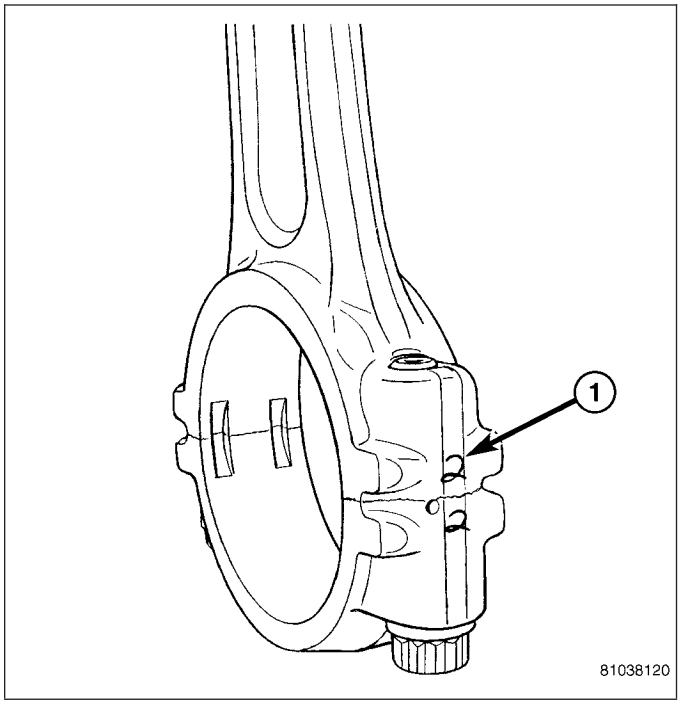
9. Remove crankshaft oil scraper (2).

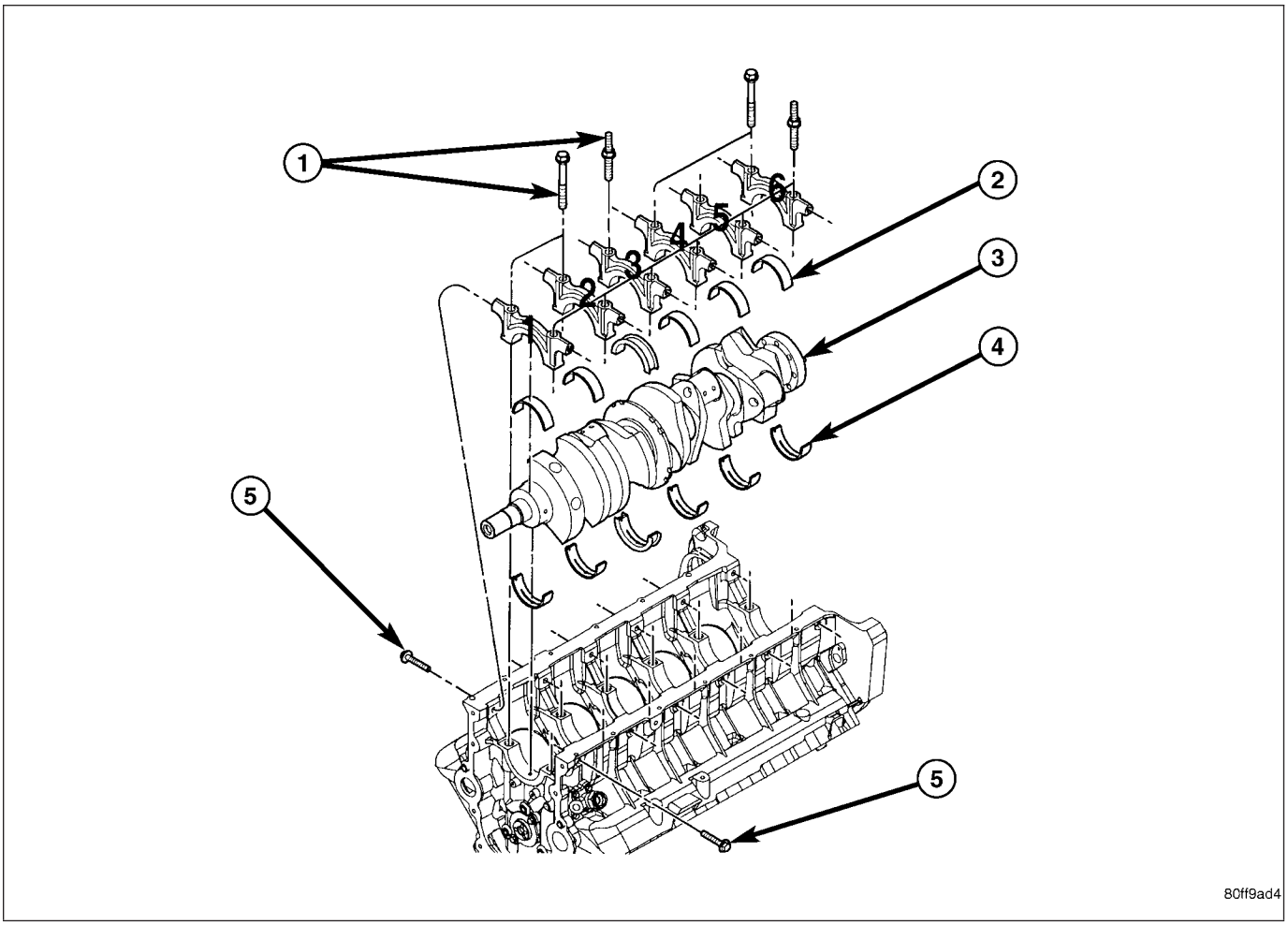


CAUTION: DO NOT use a number stamp or a punch to mark connecting rods. Damage to connecting rod could occur.

10. Inspect connecting rods and connecting rod caps for cylinder identification (1). Identify them if necessary using a permanent ink or paint marker.

CAUTION: Care must be taken not to damage the fractured rod and cap joint surfaces, as engine damage many occur.





NOTE: Do not reuse connecting rod bolts.

11. Remove connecting rod bolts (1) and caps.
12. Main bearing caps are not interchangeable and should be marked before removal to ensure correct reassembly.
13. Remove the side main bearing cap bolts and main bearing cap bolts.
14. Remove the main bearing caps.
15. When removing the crankshaft, it should be lifted straight out of the engine block. This will prevent any damage to the engine and crankshaft.

INSPECTION

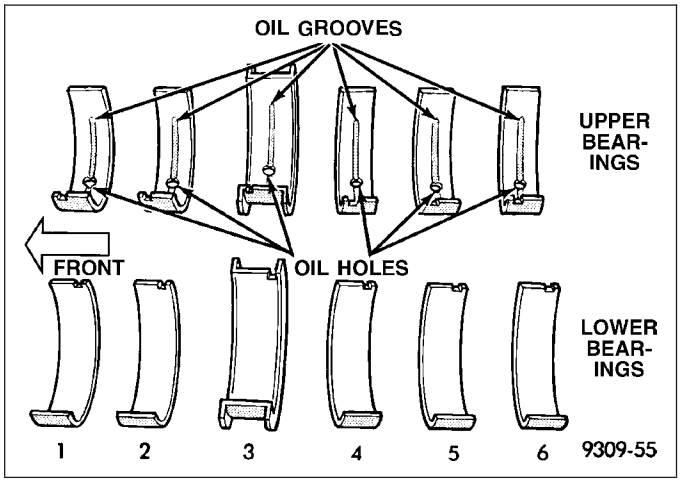
1. The crankshaft journals should be checked for excessive wear, taper and scoring. Limits of taper or out-of-round on any crankshaft journals should be held to 0.025 mm (0.001 in.). Journal grinding should not exceed 0.508 mm (0.020 inch) under the standard journal diameter. DO NOT grind thrust faces of No. 3 main bearing. DO NOT nick crank pin or bearing fillets. After grinding, remove rough edges from crankshaft oil holes and clean out all passages.

CAUTION: With the forged crankshafts it is important that the final paper or cloth polish after any journal regrind be in the same direction as normal rotation in the engine.

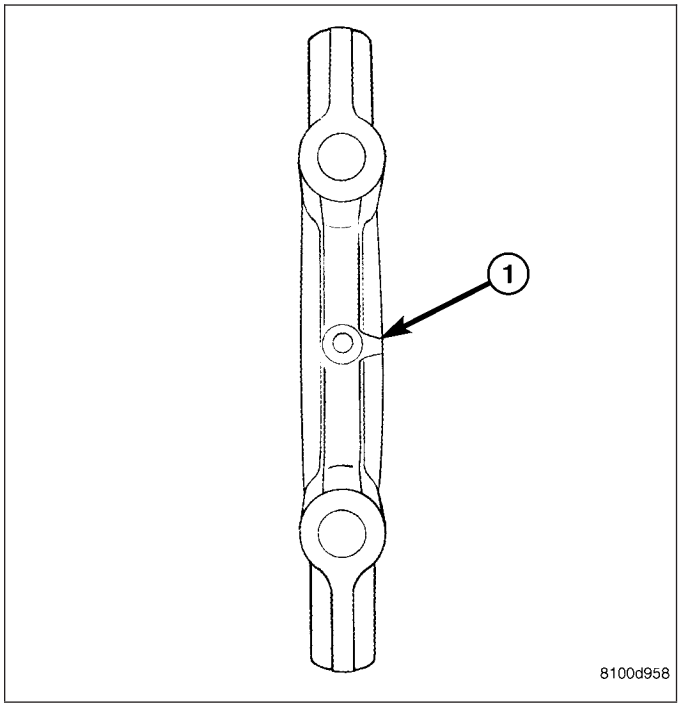
2. Check and clean all oil holes for blockage and debris.

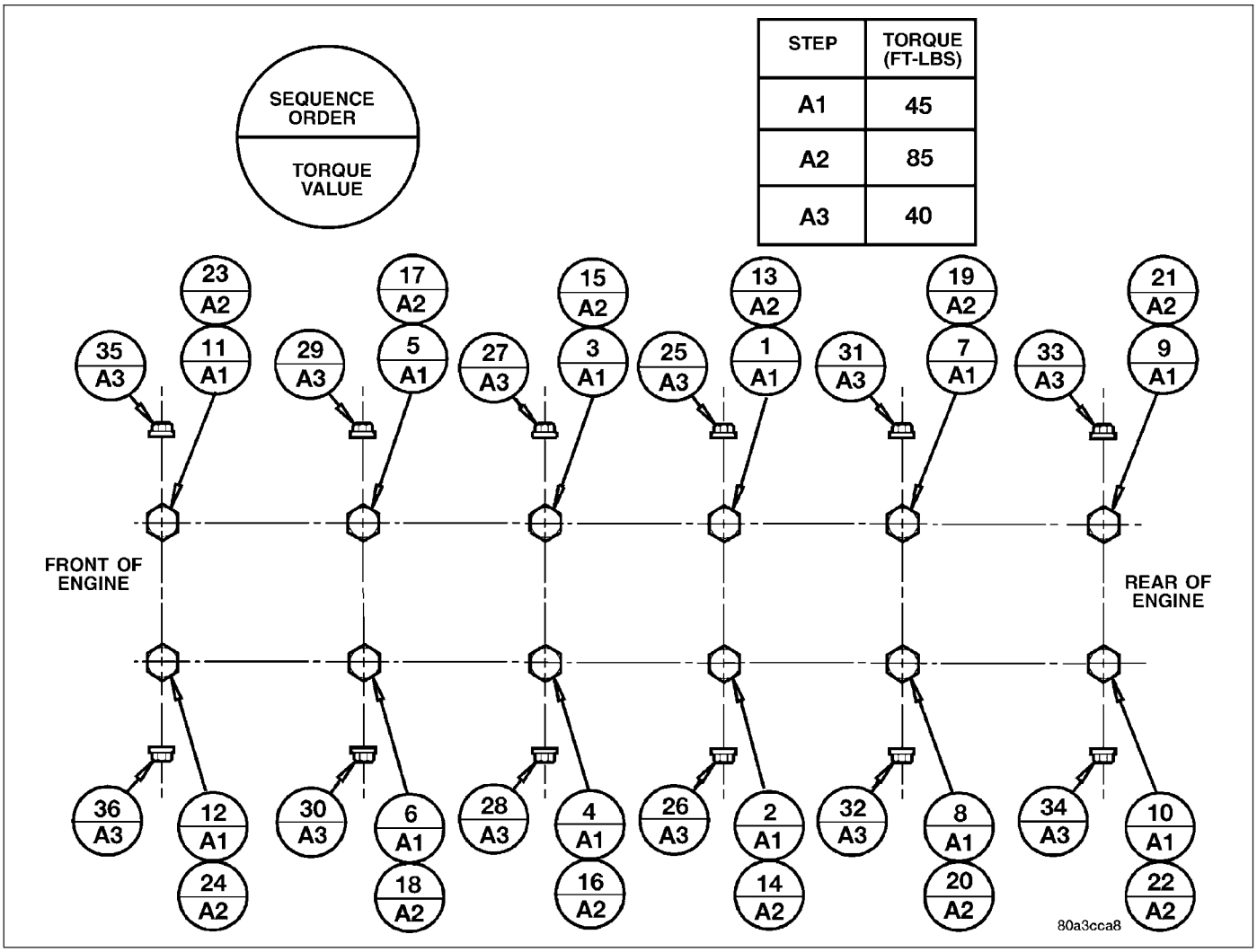
INSTALLATION

1. Install upper main bearing shells into engine block.
2. Lubricate upper main bearing shells with clean engine oil.
3. Install the crankshaft.
4. Install lower main bearing shells into main bearing caps.



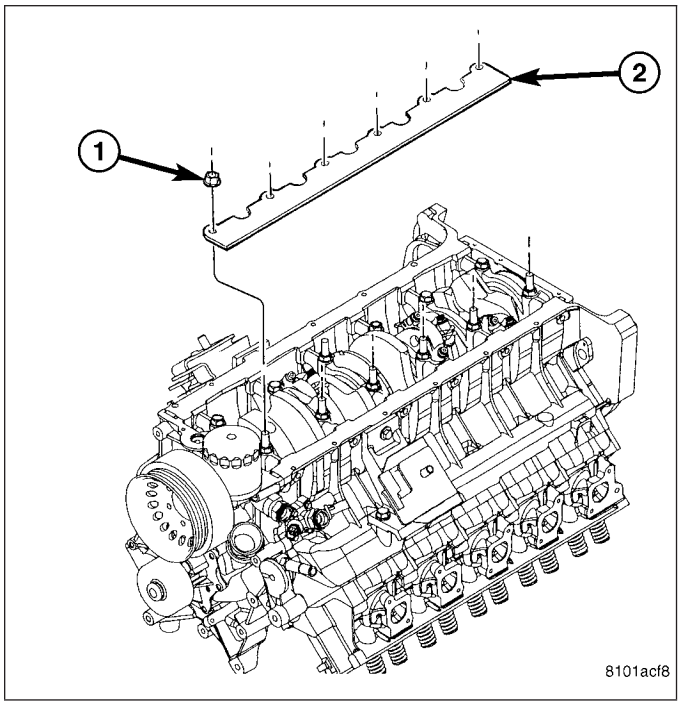
5. Install each main bearing cap in proper sequence and direction (1). Tighten all bolts finger tight.



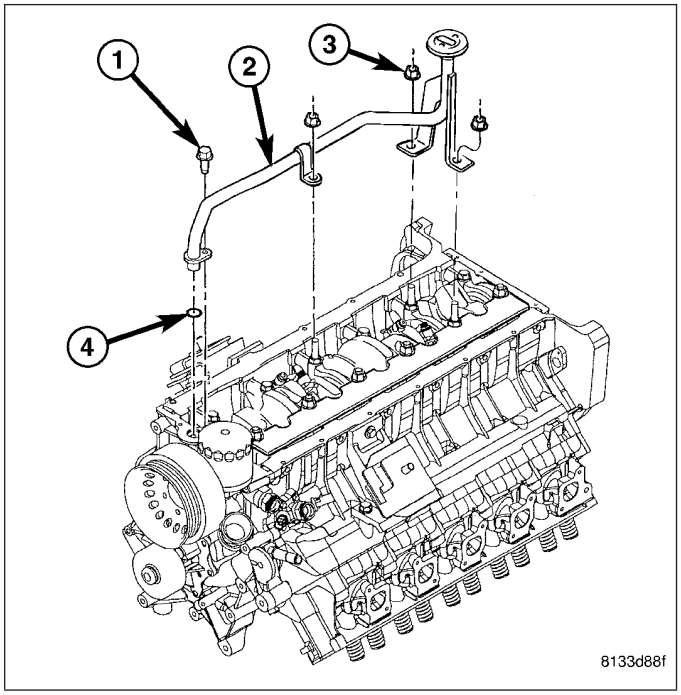


6. Tighten the main cap bolts following the illustrated tightening sequence:
   - **Step 1** Tighten main bearing cap bolts 1-12 in the illustrated sequence to 20 N·m (15 ft. lbs.). This will seat the bearing caps onto the engine block.
   - **Step 2** To ensure correct thrust bearing alignment the following procedure must be follwed:
     a. Move crankshaft all the way to the rear of its travel.
     b. Then, move crankshaft all the way to the front of its travel.
     c. Wedge an appropriate tool between the rear of the cylinder block and rear crankshaft counterweight. This will hold the crankshaft in it's most forward position.
   - **Step A1**–tighten the A1 bolts to 61 N·m (45 ft. lbs.) in the illustrated sequence.
   - **Step A2**–tighten the A2 bolts to 115 N·m (85 ft. lbs.) in the illustrated sequence.
   - **Step A3**–tighten the A3 Bolts to 54 N·m (40 ft. lbs.) in the illustrated sequence.
7. Remove the holding tool.
8. Install new connecting rod bearings.
9. Install rod caps. Install **NEW** connecting rod bolts. Bolt threads should be oiled with engine oil. Torque connecting rod bolts to 68 N·m (50 ft. lbs.).

10. Install the crankshaft oil scraper and tighten nuts to 23 N·m (200 in. lbs.).



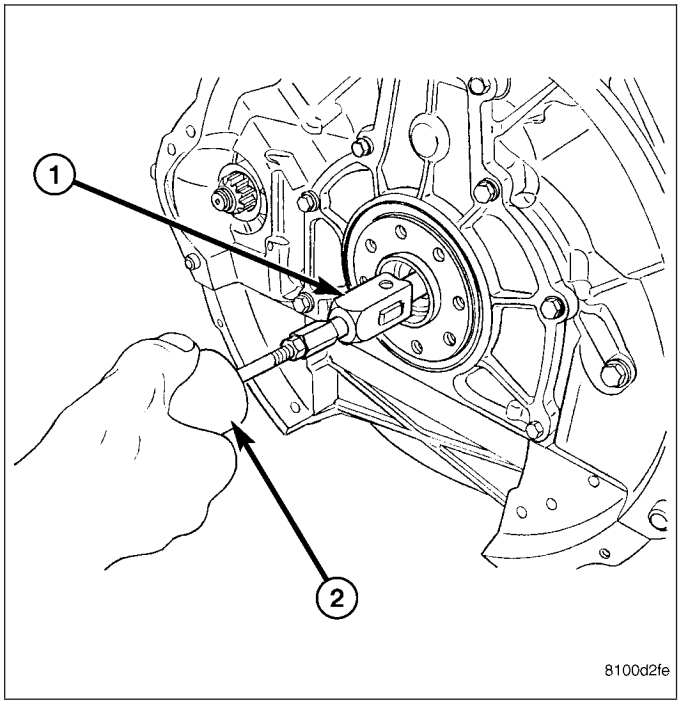
11. Install oil pump pick up tube (2) using a **new** o-ring (4). Torque 1/4-20 bolt to 11 N·m (95 in. lbs.). Torque 5/16-18 nuts to 23 N·m (200 in. lbs.).
12. Install the crankshaft rear oil seal and retainer (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT REAR OIL SEAL RETAINER - INSTALLATION).
13. Install lower crankshaft gear along with the timing chain (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN AND SPROCKETS - INSTALLATION).
14. Install timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING CHAIN COVER(S) - INSTALLATION).
15. Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
16. Install crankshaft damper and pulley (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
17. Install engine assembly (Refer to 9 - ENGINE - INSTALLATION).



BEARING-CRANKSHAFT PILOT

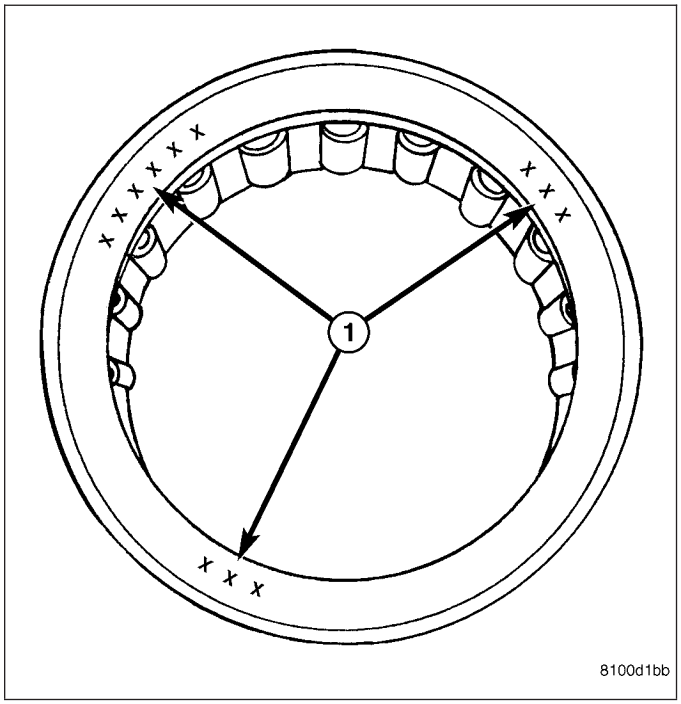
REMOVAL

1. Remove transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/MANUAL - REMOVAL).
2. Remove clutch and flywheel (Refer to 6 - CLUTCH/CLUTCH DISC - REMOVAL).
3. Using Special Tools 8990 (1) and C-3752 (2), remove pilot bearing from crankshaft.

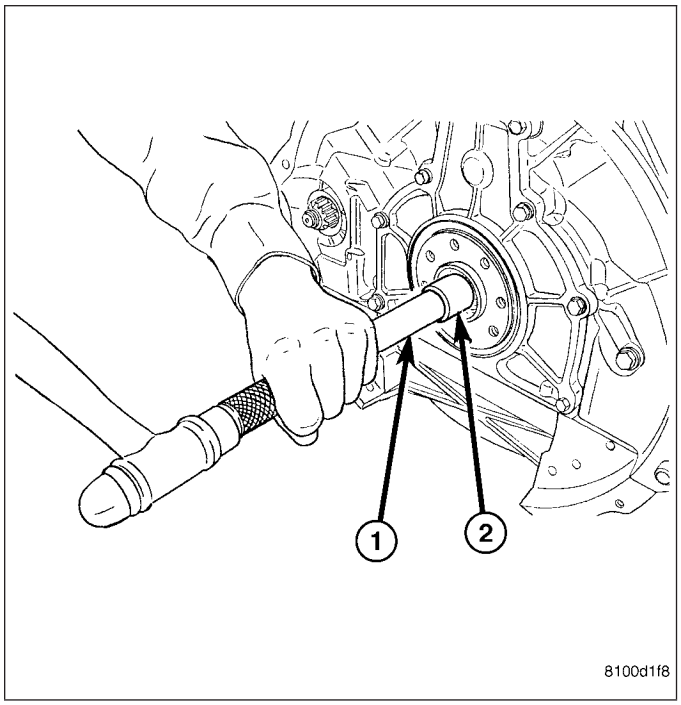


INSTALLATION

NOTE: New pilot bearing has special grease packed into bearing. Do not wash grease from bearing. Install bearing with part number markings (1) facing out.



1. Install pilot bearing with Special Tools 9058 (1) and C-4171 (2).
2. Install flywheel and clutch (Refer to 6 - CLUTCH/ CLUTCH DISC - INSTALLATION).
3. Install transmission (Refer to 21 - TRANSMISSION/ TRANSAXLE/MANUAL - INSTALLATION).



ENGINE - 5.9L DIESEL - SERVICE INFORMATION

TABLE OF CONTENTS

page

ENGINE - 5.9L DIESEL - SERVICE INFORMATION
DESCRIPTION
DESCRIPTION 2529
DESCRIPTION - CRANKCASE BREATHER - LATE BUILDS 2530
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL 2531
DIAGNOSIS AND TESTING - SMOKE DIAGNOSIS CHARTS 2533
DIAGNOSIS AND TESTING - CYLINDER COMPRESSION/LEAKAGE TESTS 2535
STANDARD PROCEDURE
STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS 2537
STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS 2538
STANDARD PROCEDURE—HYDROSTATIC LOCK 2538
REMOVAL
REMOVAL - ENGINE 2539
REMOVAL - CRANKCASE BREATHER - EARLY BUILD 2544
INSTALLATION
INSTALLATION - ENGINE 2544
INSTALLATION - CRANKCASE BREATHER - EARLY BUILD 2550
SPECIFICATIONS
SPECIFICATIONS - 5.9L DIESEL 2551
TORQUE 2553
SPECIAL TOOLS
5.9L DIESEL ENGINE 2554
ENGINE DATA PLATE
DESCRIPTION 2557
AIR CLEANER ELEMENT
REMOVAL 2557
INSTALLATION 2558
CYLINDER HEAD
DESCRIPTION 2559
REMOVAL 2559
CLEANING
CLEANING—CYLINDER HEAD 2561
CLEANING—CROSSHEADS 2561
CLEANING—PUSHRODS 2561
INSPECTION
INSPECTION - CYLINDER HEAD 2562
INSPECTION - CROSSHEADS 2563
INSPECTION—PUSHRODS 2563
INSTALLATION 2564

page

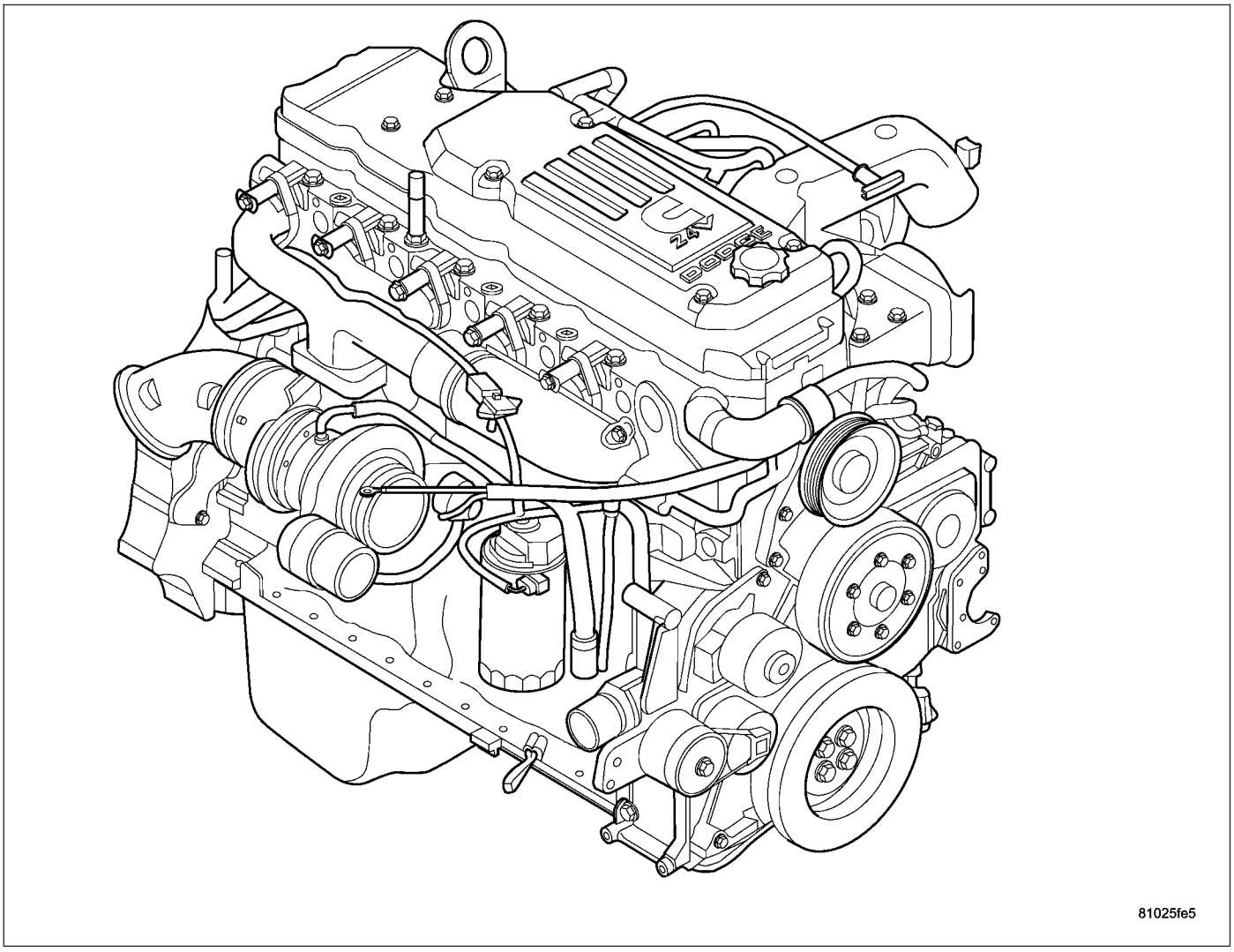
COVER - CYLINDER HEAD
REMOVAL
REMOVAL - CYL HEAD COVER - EARLY . . 2567
REMOVAL - ROCKER HOUSING 2567
REMOVAL - CYL HEAD COVER - LATE . . . 2568
REMOVAL - CYL HEAD COVER GASKET . 2569
CLEANING 2569
INSPECTION 2569
INSTALLATION
INSTALLATION - CYL HEAD COVER - EARLY 2570
INSTALLATION - ROCKER HOUSING 2570
INSTALLATION - CYL HEAD COVER - LATE 2571
INSTALLATION 2572
VALVES & SEATS - INTAKE/EXHAUST
DESCRIPTION 2573
STANDARD PROCEDURE
STANDARD PROCEDURE - VALVES, GUIDES AND SPRINGS 2573
STANDARD PROCEDURE - VALVE LASH ADJUSTMENT AND VERIFICATION 2578
REMOVAL - VALVE SPRINGS AND SEALS . . 2579
INSTALLATION 2581
ROCKER ARM
DESCRIPTION 2581
REMOVAL 2582
CLEANING 2582
INSPECTION 2583
INSTALLATION 2584
ENGINE BLOCK
STANDARD PROCEDURE
STANDARD PROCEDURE - CYLINDER BLOCK REFACING 2585
STANDARD PROCEDURE - CYLINDER BORE - DE-GLAZE 2585
STANDARD PROCEDURE—CYLINDER BORE REPAIR 2586
STANDARD PROCEDURE - CAM BORE REPAIR 2589
INSPECTION 2589
CAMSHAFT & BEARINGS (IN BLOCK)
REMOVAL
CAMSHAFT BEARINGS 2590
CAMSHAFT 2591
INSPECTION 2593
INSTALLATION
CAMSHAFT BEARINGS 2595
CAMSHAFT 2595

BEARINGS - CONNECTING ROD
STANDARD PROCEDURE - CONNECTING ROD BEARING AND CRANKSHAFT JOURNAL CLEARANCE 2596
CRANKSHAFT & GEAR
DESCRIPTION 2597
REMOVAL - GEAR 2597
INSTALLATION - GEAR 2598
BEARINGS - CRANKSHAFT MAIN
STANDARD PROCEDURE - MAIN BEARING CLEARANCE 2598
SEAL - CRANKSHAFT OIL - FRONT
REMOVAL 2599
INSTALLATION 2600
SEAL - CRANKSHAFT OIL - REAR
REMOVAL 2601
INSTALLATION 2601
RETAINER - CRANK REAR OIL SEAL
REMOVAL 2602
INSTALLATION 2602
TAPPETS - VALVE
REMOVAL 2604
CLEANING 2605
INSPECTION 2605
INSTALLATION 2606
PISTON & CONNECTING ROD
DESCRIPTION 2608
STANDARD PROCEDURE - HEAD GASKET SELECTION 2608
REMOVAL 2609
CLEANING—PISTON AND CONNECTING ROD 2609
INSPECTION
INSPECTION - PISTONS 2609
INSPECTION - CONNECTING ROD 2611
INSTALLATION 2611
RINGS - PISTON
STANDARD PROCEDURE - PISTON RING FITTING 2612
DAMPER - CRANKSHAFT
REMOVAL 2614
INSPECTION 2614
INSTALLATION 2614
MOUNT - FRONT
REMOVAL 2615
INSTALLATION 2616
MOUNT - REAR
REMOVAL 2617
INSTALLATION 2617
LUBRICATION
DESCRIPTION 2618
OPERATION 2618
DIAGNOSIS AND TESTING—ENGINE OIL PRESSURE 2622
OIL
STANDARD PROCEDURE
STANDARD PROCEDURE - ENGINE OIL LEVEL 2622
STANDARD PROCEDURE - ENGINE OIL SERVICE 2622
COOLER - ENGINE OIL & LINES
CLEANING
CLEANING AND INSPECTION 2623
FILTER - ENGINE OIL
REMOVAL 2623
INSTALLATION 2623
PAN - ENGINE OIL
REMOVAL 2623
CLEANING 2624
INSPECTION 2624
INSTALLATION 2624
VALVE - OIL PRESSURE RELIEF
REMOVAL 2625
CLEANING 2625
INSPECTION 2625
INSTALLATION 2625
SWITCH - OIL PRESSURE
REMOVAL 2625
INSTALLATION 2626
PUMP - ENGINE OIL
REMOVAL 2626
CLEANING 2626
INSPECTION 2626
INSTALLATION 2628
MANIFOLD - INTAKE
REMOVAL 2629
CLEANING 2630
INSPECTION 2630
INSTALLATION 2630
MANIFOLD - EXHAUST
REMOVAL 2631
CLEANING 2631
INSPECTION 2631
INSTALLATION 2631
VALVE TIMING
STANDARD PROCEDURE - TIMING VERIFICATION 2632
CASE - FRONT
REMOVAL 2632
INSTALLATION 2633
COVER - TIMING
REMOVAL 2635
INSTALLATION 2635

ENGINE - 5.9L DIESEL - SERVICE INFORMATION

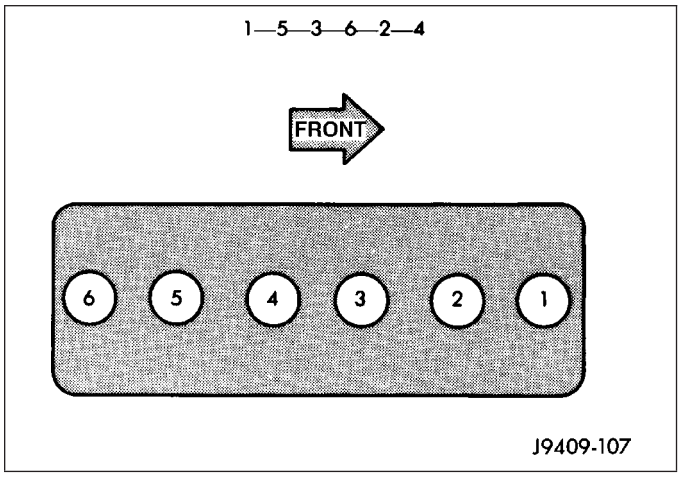
DESCRIPTION

DESCRIPTION



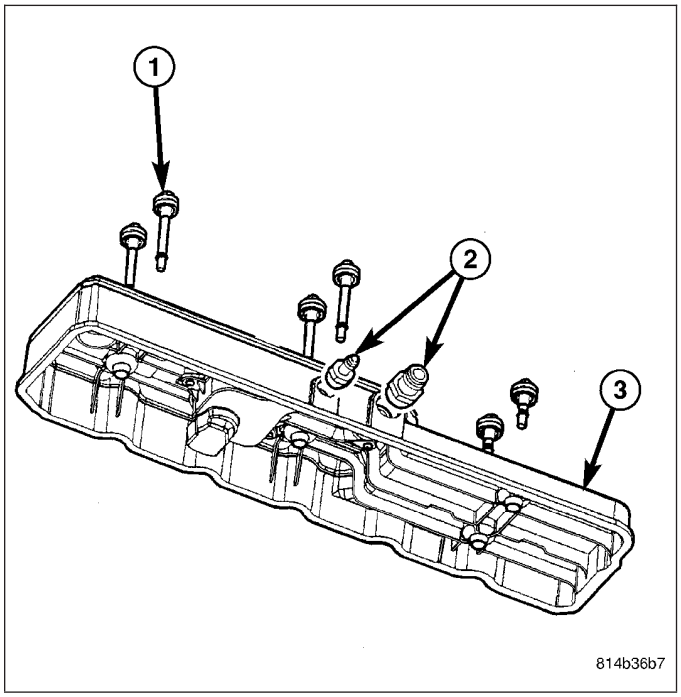
The cylinder block is constructed of cast iron. The casting is a skirted design which incorporates longitudal ribs for superior strength and noise reduction. The block incorporates metric straight thread o-ring fittings at lubrication oil access points. The engine is manufactured with the cylinders being a non-sleeved type cylinder. However, one approved service method is to bore out the cylinders and add cylinder sleeves to the cylinder block.

The cylinders are numbered front to rear ; 1 to 6. The firing order is 1–5–3–6–2–4.



DESCRIPTION - CRANKCASE BREATHER - LATE BUILDS

The crankcase breather assembly is integrated into the cylinder head cover (3) and is not serviced seperately. The external fittings (2) to the breather tube and breather drain tube are serviceable.



DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE DIAGNOSIS - MECHANICAL

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL PRESSURE LOW	1. Low oil level.	1. (a) Check and fill with clean engine oil. (b) Check for a severe external oil leak that could reduce the pressure.
	2. Oil viscosity thin, diluted or wrong specification.	2. (a) Verify the correct engine oil is being used. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION). (b) Look for reduced viscosity from fuel dilution.
	3. Improperly operating pressure switch/gauge.	3. Verify the pressure switch is functioning correctly. If not, replace switch/gauge.
	4. Relief valve stuck open.	4. Check/replace valve.
	6. If cooler was replaced, shipping plugs may have been left in cooler	6. Check/remove shipping plugs.
	7. Worn oil pump.	7. Check and replace oil pump.
	8. Suction tube loose or seal leaking.	8. Check and replace seal.
	9. Loose main bearing cap.	9. Check and install new bearing. Tighten cap to proper torque.
	10. Worn bearings or wrong bearings installed.	10. Inspect and replace connecting rod or main bearings. Check and replace directed piston cooling nozzles.
	11. Directed piston cooling nozzles under piston, bad fit into main carrier.	11. Check directed piston cooling nozzles position.
	12. Loose oil rifle plug with saddle-jet style nozzles	12.Tighten oil rifle plug.
	13. Loose directed piston cooling nozzle.	13. Tighten directed piston cooling nozzle.
	14. Both J-jet and saddle jet style cooling nozzle installed.	14. Install correct style jet.
LUBRICATING OIL PRESSURE TOO HIGH ENGINE BREATHER RESTRICTED	1. Pressure switch/gauge not operating properly.	1. Verify pressure switch is functioning correctly. If not, replace switch/gauge.
	2. Engine running too cold.	2. Refer to Coolant Temperature Below Normal (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	3. Oil viscosity too thick.	3. Make sure the correct oil is being used. (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
	4. Oil pressure relief valve stuck closed or binding	4. Check and replace valve.
LUBRICATING OIL LOSS	1. External leaks.	1. Visually inspect for oil leaks. Repair as required.
	2. Crankcase being overfilled.	2. Verify that the correct dipstick is being used.
	3. Incorrect oil specification or viscosity.	3. (a) Make sure the correct oil is being used (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).

CONDITION	POSSIBLE CAUSES	CORRECTION
		(b) Look for reduced viscosity from dilution with fuel. (c) Review/reduce oil change intervals.
	4. Oil cooler leak	4. Check and replace the oil cooler.
	5. High blow-by forcing oil out the breather.	5. Check the breather tube area for signs of oil loss. Perform the required repairs.
	6. Turbocharger leaking oil to the air intake.	6. Inspect the air ducts for evidence of oil transfer. Repair as required.
COMPRESSION KNOCKS	1. Air in the fuel system.	1. Identify location of air leak and repair. Do not bleed high pressure fuel system.
	2. Poor quality fuel or water/gasoline contaminated fuel.	2. Verify by operating from a temporary tank with good fuel. Clean and flush the fuel tank. Replace fuel/water separator filter.
	3. Engine overloaded.	3. Verify the engine load rating is not being exceeded.
	4. Improperly operating injectors.	5. Check and replace misfiring/inoperative injectors.
EXCESSIVE VIBRATION	1. Loose or broken engine mounts.	1. Replace engine mounts.
	2. Damaged fan or improperly operating accessories.	2. Check and replace the vibrating components.
	3. Improperly operating vibration damper	3. Inspect/replace vibration damper.
	4. Improperly operating electronically controlled viscous fan drive.	4. Inspect/replace fan drive.
	5. Worn or damaged generator bearing.	5. Check/replace generator.
	6. Flywheel housing misaligned.	6. Check/correct flywheel alignment.
	7. Loose or broken power component.	7. Inspect the crankshaft and rods for damage that causes an unbalance condition. Repair/replace as required.
	8. Worn or unbalanced driveline components.	8. Check/repair driveline components.
EXCESSIVE ENGINE NOISES	1. Drive belt squeal, insufficient tension or abnormally high loading.	1. Check the automatic tensioner and inspect the drive belt. Make sure water pump, tensioner pulley, fan hub, generator and power steering pump turn freely.
	2. Intake air or exhaust leaks.	2. Refer to Excessive Exhaust Smoke (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).
	3. Excessive valve lash.	3. Adjust valves. Make sure the push rods are not bent and rocker arms, adjusting screws, crossheads, are not severely worn. Replace bent or severely worn components.
	4. Turbocharger noise.	4. Check turbocharger impeller and turbine wheel for housing contact. Repair/replace as required.
	5. Gear train noise.	5. Visually inspect and measure gear backlash. Replace gears as required.
	6. Power function knock.	6. Check/replace rod and main bearings.

DIAGNOSIS AND TESTING - SMOKE DIAGNOSIS CHARTS

The following charts include possible causes and corrections for **excess or abnormal** exhaust smoke. Small amounts of exhaust smoke (at certain times) are to be considered normal for a diesel powered engine.

EXCESSIVE BLACK SMOKE	
POSSIBLE CAUSE	**CORRECTION**
Air filter dirty or plugged.	Check Filter Minder® at air filter (Refer to 9 - ENGINE/ AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
Air intake system restricted.	Check entire air intake system including all hoses and tubes for restrictions, collapsed parts or damage. Repair/replace as necessary.
Air Leak in Intake System.	Check entire air intake system (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/CHARGE AIR COOLER AND PLUMBING - DIAGNOSIS AND TESTING) including all hoses and tubes for cracks, loose clamps and/or holes in rubber ducts. Also check intake manifold for loose mounting hardware.
Diagnostic Trouble Codes (DTC's) active or multiple, intermittent DTC's.	Refer to Powertrain Diagnostic Procedures Information.
Engine Control Module (ECM) not calibrated or ECM has incorrect calibration.	Refer to Powertrain Diagnostic Procedures Information.
Exhaust system restriction is above specifications.	Check exhaust pipes for damage/restrictions. Repair as necessary.
Fuel grade is not correct or fuel quality is poor.	Temporarily change fuel brands and note condition. Change brand if necessary.
Fuel injection pump malfunctioning.	A DTC may have been set. If so, refer to Powertrain Diagnostic Procedures Information.
Fuel injector malfunctioning.	A DTC may have been set. Perform "Cylinder Performance Test" or "Cylinder Cutout Test" using DRB scan tool to isolate individual cylinders. Also refer to Powertrain Diagnostic Procedures Information and, to (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - DIAGNOSIS AND TESTING).
Fuel return system restricted.	Check fuel return lines for restriction (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY - DIAGNOSIS AND TESTING).
Intake manifold restricted.	Remove restriction.
Manifold Air Pressure (Boost) Sensor or sensor circuit malfunctioning.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information.
Raw fuel in intake manifold.	Fuel injectors leaking on engine shutdown. Do Fuel Injector Test (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - DIAGNOSIS AND TESTING).
Turbocharger air intake restriction.	Remove restriction.
Turbocharger damaged.	(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSPECTION).
Turbocharger has excess build up on compressor wheel and/or diffuser vanes.	(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - CLEANING).
Turbocharger wheel clearance out of specification.	(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSPECTION).

EXCESSIVE WHITE SMOKE	
POSSIBLE CAUSE	**CORRECTION**
Air in fuel supply: Possible leak in fuel supply side.	(Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL TRANSFER PUMP - DIAGNOSIS AND TESTING).
Coolant leaking into combustion chamber.	Do pressure test of cooling system (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
Diagnostic Trouble Codes (DTC's) active or multiple, intermittent DTC's.	Refer to Powertrain Diagnostic Procedures Information.
In very cold ambient temperatures, engine block heater is malfunctioning (if equipped).	(Refer to 7 - COOLING/ENGINE/ENGINE BLOCK HEATER - REMOVAL).
Engine coolant temperature sensor malfunctioning.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information. Also check thermostat operation (Refer to 7 - COOLING/ENGINE/ ENGINE COOLANT THERMOSTAT - DIAGNOSIS AND TESTING).
Engine Control Module (ECM) not calibrated or has incorrect calibration.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information.
Fuel filter plugged.	Refer to Powertrain Diagnostic Manual for fuel system testing.
Fuel grade not correct or fuel quality is poor.	Temporarily change fuel brands and note condition. Change brand if necessary.
Fuel heater element or fuel heater temperature sensor malfunctioning. This will cause wax type build-up in fuel filter.	Refer to Fuel Heater Testing (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL HEATER - DIAGNOSIS AND TESTING).
Fuel injector malfunctioning.	A DTC should have been set. Perform "Cylinder Performance Test" or "Cylinder cutout Test" using DRB scan tool to isolate individual cylinders. Also refer to Powertrain Diagnostic Procedures Information and, (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - DIAGNOSIS AND TESTING).
Fuel injector hold-downs loose.	Torque to specifications.
Fuel injector protrusion not correct.	Check washer (shim) at bottom of fuel injector for correct thickness. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION)
Fuel injection pump malfunctioning.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information.
Fuel supply side restriction.	Refer to Powertrain Diagnostic Manual for fuel system testing.
Fuel transfer (lift) pump malfunctioning.	A DTC may have been set. Refer to Powertrain Diagnostic Procedures Information.
Intake/Exhaust valve adjustments not correct (too tight).	(Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/ EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
Intake manifold air temperature sensor malfunctioning.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information.
Intake manifold heater circuit not functioning correctly in cold weather.	A DTC should have been set. Refer to Powertrain Diagnostic Procedures Information. Also check heater elements for correct operation.
Intake manifold heater elements not functioning correctly in cold weather.	A DTC should have been set if heater elements are malfunctioning. Refer to Powertrain Diagnostic Procedures Information.

EXCESSIVE WHITE SMOKE	
POSSIBLE CAUSE	**CORRECTION**
Internal engine damage (scuffed cylinder).	Analyze engine oil and inspect oil filter to locate area of probable damage.
Restriction in fuel supply side of fuel system.	Refer to Powertrain Diagnostic Manual for fuel system testing.

EXCESSIVE BLUE SMOKE	
POSSIBLE CAUSE	**CORRECTION**
Dirty air cleaner or restricted turbocharger intake duct.	Check Filter Minder® at air filter housing. (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).
Air leak in boost system between turbocharger compressor outlet and intake manifold.	Service air charge system..
Obstruction in exhaust manifold.	Remove exhaust manifold and inspect for blockage (Refer to 9 - ENGINE/MANIFOLDS/EXHAUST MANIFOLD - REMOVAL).
Restricted turbocharger drain tube.	Remove turbocharger drain tube and remove obstruction.
Crankcase ventilation system plugged.	Inspect crankcase ventilation system for function
Valve seals are worn, brittle, or improperly installed.	Replace valve stem oil seals (Refer to 9 - ENGINE/ CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - REMOVAL).
Valve stems and/or guides are worn.	Remove valves and inspect valves and guides. (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).
Broken or Improperly installed piston rings.	Tear down engine and inspect piston rings.
Excessive piston ring end gap.	Remove pistons and measure piston ring end gap (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
Excessive cylinder bore wear and taper.	Remove pistons and measure cylinder bore wear and taper (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE).
Cylinder damage.	Remove pistons and inspect cylinder bore for cracks or porosity. Repair with cylinder liner if necessary. (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE).
Piston damage.	Remove pistons and inspect for cracks, holes. Measure piston for out-of-round and taper (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSPECTION).
Turbocharger failure.	(Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSPECTION).

DIAGNOSIS AND TESTING - CYLINDER COMPRESSION/LEAKAGE TESTS

CYLINDER COMPRESSION PRESSURE

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure batteries are completely charged and the engine starter motor is in good operating condition. Otherwise, the indicated compression pressures may not be valid for diagnostic purposes.

1. Disconnect the fuel inlet line to the fuel filter housing. Plug the fuel line from the fuel tank.

NOTE: Failure to plug fuel line will result in fuel leak.

2. Remove fuel transfer pump relay from PDC.
3. Start the engine and idle until the engine stalls (runs out of fuel).
4. **FOR EARLY BUILDS** Disconnect all three injector wire harness connectors at the rocker housing.**FOR LATE BUILDS** Remove the cylinder head cover.
5. **FOR LATE BUILDS** Remove the cylinder head cover carrier gasket.
6. **FOR EARLY BUILDS** Remove the breather cover and cylinder head cover.
7. Remove the high pressure fuel line between the cylinder head and fuel rail for the cylinder to be tested. Use tool# 9011 to cap this fuel rail on the cylinder being tested.
8. Remove the fuel connector tube nut and fuel connector tube.
9. Remove the exhaust rocker lever.
10. Use Tool 9010 to remove the injector and copper sealing washer.
11. Install the exhaust rocker lever and torque to 36 N·m (27 ft. lbs.).
12. Cover the remaining rocker levers with clean shop towels to prevent any oil splatter under the hood.
13. Place a rag over the compression test tool fitting. Crank the engine for 2–3 seconds to purge any fuel that may have drained into the cylinder when the injector was removed.
14. Connect the compression test gauge.
15. Crank the engine for 5 seconds and record the pressure reading. Repeat this step three times and calculate the average of the three readings.

NOTE: The minimum cylinder pressure is 350 psi. Cylinder pressure should be within 20% from cylinder to cylinder.

16. Combustion pressure leakage can be checked if cylinder pressure is below the specification. Perform the leakage test procedure on each cylinder according to the tester manufacturer instructions.
17. Upon completion of the test check and erase any engine related fault codes.

CYLINDER COMBUSTION PRESSURE LEAKAGE

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss

1. Start and operate the engine until it attains normal operating temperature.
2. **FOR EARLY BUILDS** Remove the breather cover and cylinder head cover.
3. **FOR EARLY BUILDS** Disconnect all three injector wire harness connectors at the rocker housing.
4. **FOR LATE BUILDS** Disconnect injector harness connectors.
5. **FOR LATE BUILDS** Disconnect breather tube and breather drain tube from valve cover.
6. **FOR LATE BUILDS** Remove the cylinder head cover.
7. **FOR LATE BUILDS** Disconnect harness from injectors.
8. **FOR LATE BUILDS** Remove the cylinder head cover carrier gasket.
9. Bring the cylinder to be tested to TDC.
10. Remove the high pressure fuel line between the cylinder head and the fuel rail for the cylinder to be tested.
11. Install capping Tool 9011 onto the rail.
12. Remove the high pressure connector nut and high pressure connector with Tool 9015.
13. Remove the exhaust and intake rocker lever.
14. Use Tool 9010 to remove the injector and copper sealing washer.
15. Install compression test Tool 9007 into the injector bore.
16. Connect the leakage tester and perform the leakage test procedure on each cylinder according to the tester manufacturer's instructions.

17. Upon completion of the test check and erase any engine related fault codes.

STANDARD PROCEDURE

STANDARD PROCEDURE - FORM-IN-PLACE GASKETS AND SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and sealing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier than using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

STANDARD PROCEDURE - REPAIR DAMAGED OR WORN THREADS

CAUTION: Be sure that the tapped holes maintain the original center line.

Damaged or worn threads can be repaired. Essentially, this repair consists of:

- Drilling out worn or damaged threads.
- Tapping the hole with a special Heli-Coil Tap, or equivalent.
- Installing an insert into the tapped hole to bring the hole back to its original thread size.

STANDARD PROCEDURE—HYDROSTATIC LOCK

CAUTION: DO NOT use the starter motor to rotate the crankshaft. Severe damage could occur.

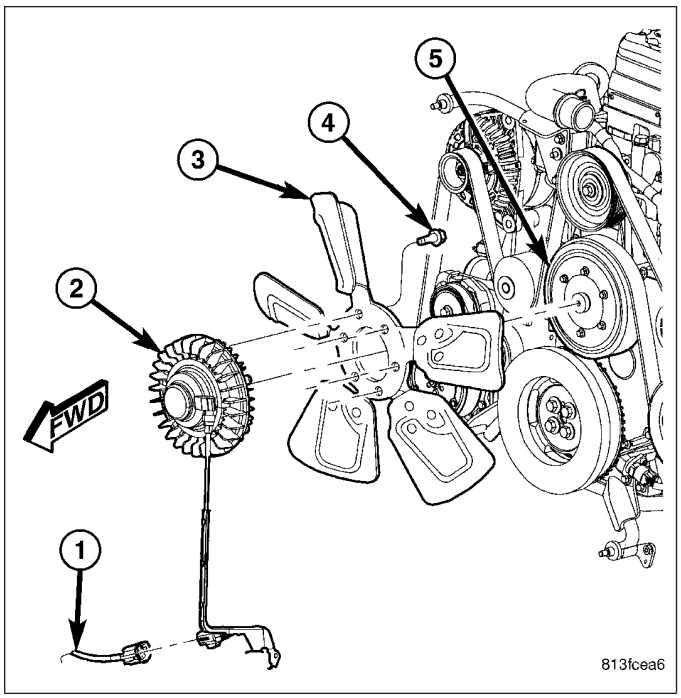
When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

1. Disconnect the negative cable(s) from the battery.
2. Inspect air cleaner, induction system, and intake manifold to ensure system is dry and clear of foreign material.
3. Place a shop towel around the fuel injectors to catch any fluid that may possibly be under pressure in the cylinder head. Remove the fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
4. With all injectors removed, rotate the crankshaft using the crankshaft barring tool (PN 7471–B).
5. Identify the fluid in the cylinders (coolant, fuel, oil, etc.).
6. Be sure all fluid has been removed from the cylinders.
7. Repair engine or components as necessary to prevent this problem from occurring again.
8. Squirt a small amount of engine oil into the cylinders to lubricate the walls. This will prevent damage on restart.
9. Install fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
10. Drain engine oil. Remove and discard the oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
11. Install the drain plug. Tighten the plug to 50 N·m (37 ft. lbs.) torque.
12. Install a new oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).
13. Fill engine crankcase with the specified amount and grade of oil (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - SPECIFICATIONS).
14. Connect the negative cable(s) to the battery.
15. Start the engine and check for any leaks.

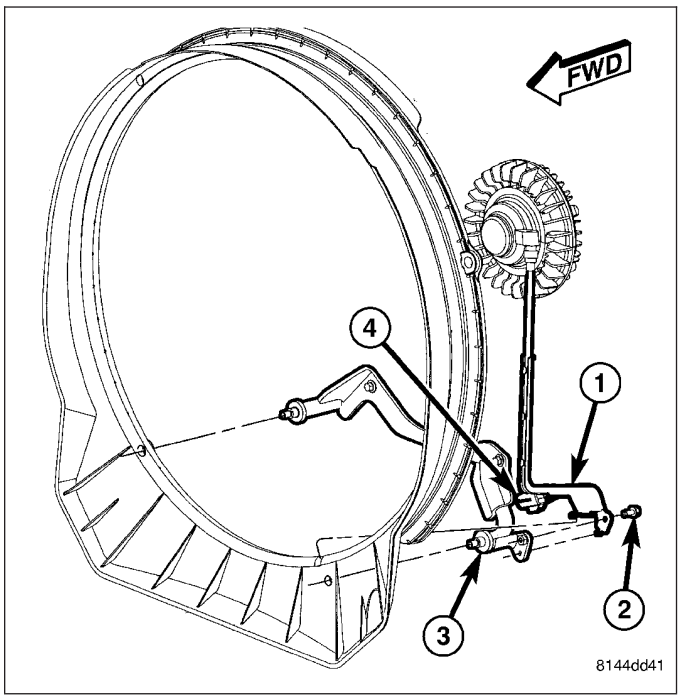
REMOVAL

REMOVAL - ENGINE

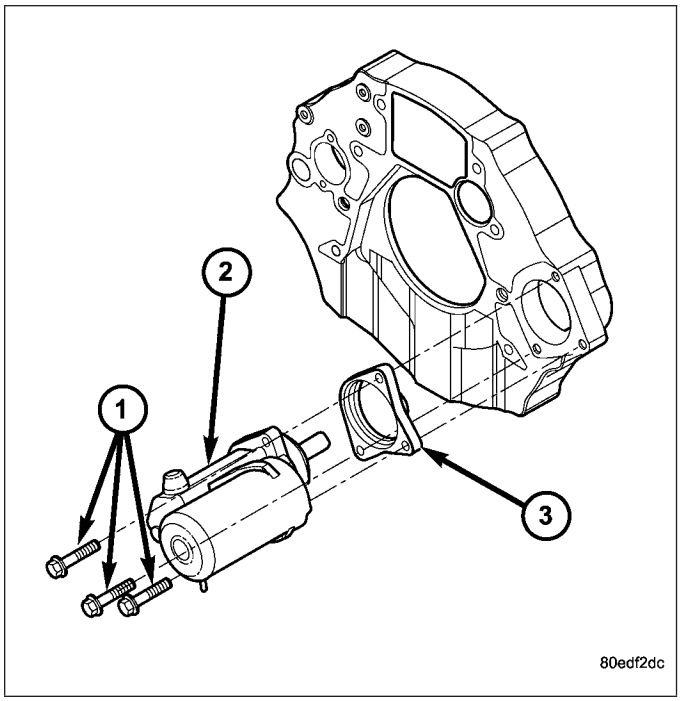
1. Disconnect both battery negative cables.
2. Disconnect engine grid heater harness at grid heater relays.
3. Disconnect electrical connections from rear of alternator.
4. Recover A/C refrigerant. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
5. Raise vehicle on a hoist.
6. Drain engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
7. Remove engine oil drain plug and drain engine oil.
8. Reinstall drain plug. Tighten to 50N·m (37 ft. lbs.) torque.
9. Lower the vehicle.
10. Remove fan (3) and fan drive (2). Refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).



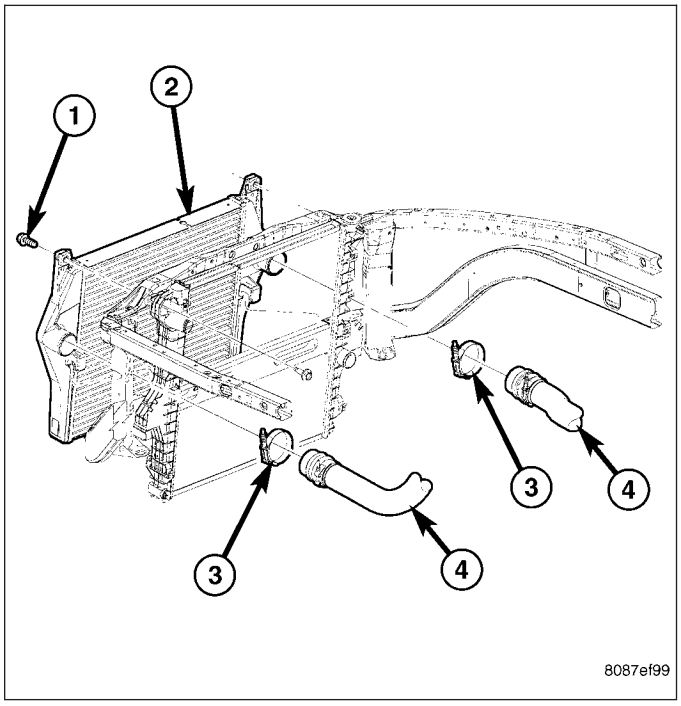
11. Remove fan shroud mounting bracket (3) and shroud. Refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
12. Remove radiator upper hose.
13. Disconnect the coolant recovery bottle hose from the radiator fill neck.
14. Disconnect heater core supply and return hoses from the cylinder head fitting and coolant pipe.
15. Raise vehicle on a hoist.
16. Remove transmission and transfer case (if equipped).
17. Disconnect exhaust pipe from turbocharger extension pipe.
18. Disconnect engine harness to vehicle harness connectors.



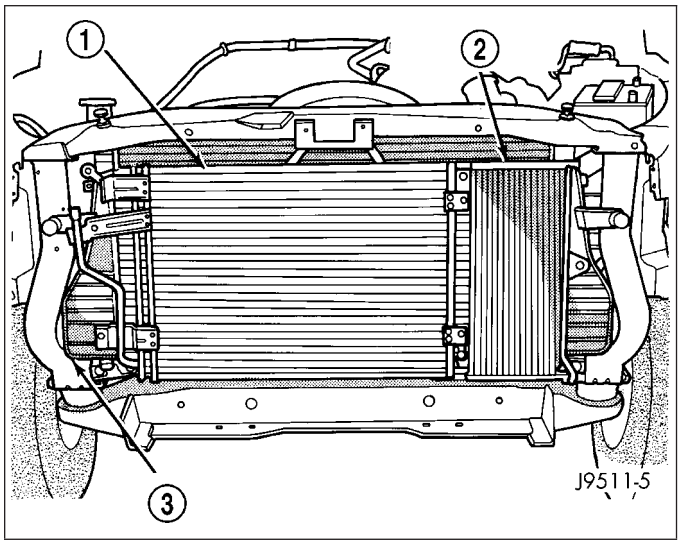
19. Remove starter motor (2) (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL).
20. Remove flywheel/flexplate.
21. Remove transmission adapter.



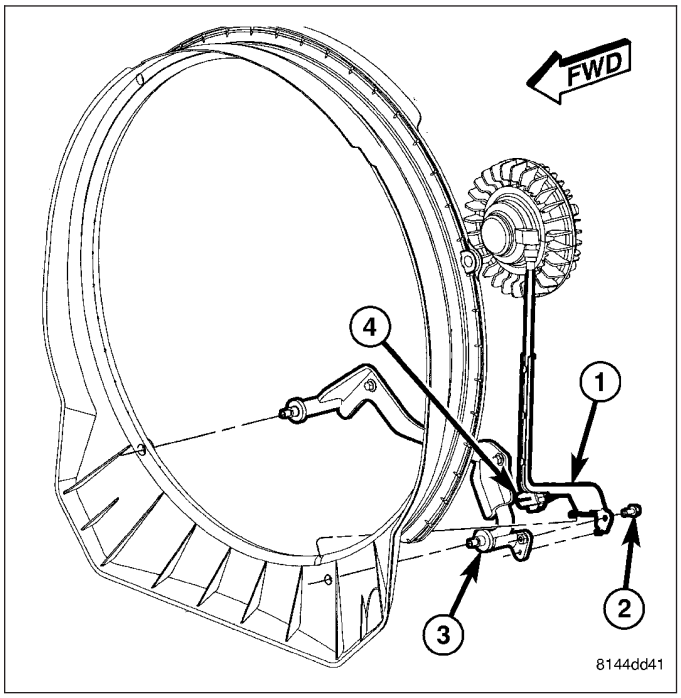
22. Disconnect A/C suction/discharge hose from the rear of the A/C compressor.
23. Lower vehicle.
24. Disconnect lower radiator hose from radiator outlet.
25. **Automatic transmission models:**
26. Disconnect transmission oil cooler lines from in front of radiator using special tool #6931
27. Remove radiator. (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).
28. If A/C equipped, disconnect A/C condenser refrigerant lines.
29. Disconnect charge air cooler piping.
30. Remove charge air cooler mounting bolts (1).
31. Remove charge air cooler (2) from vehicle.



32. Remove the A/C condenser (1).
33. Remove damper and speed indicator ring from front of engine.

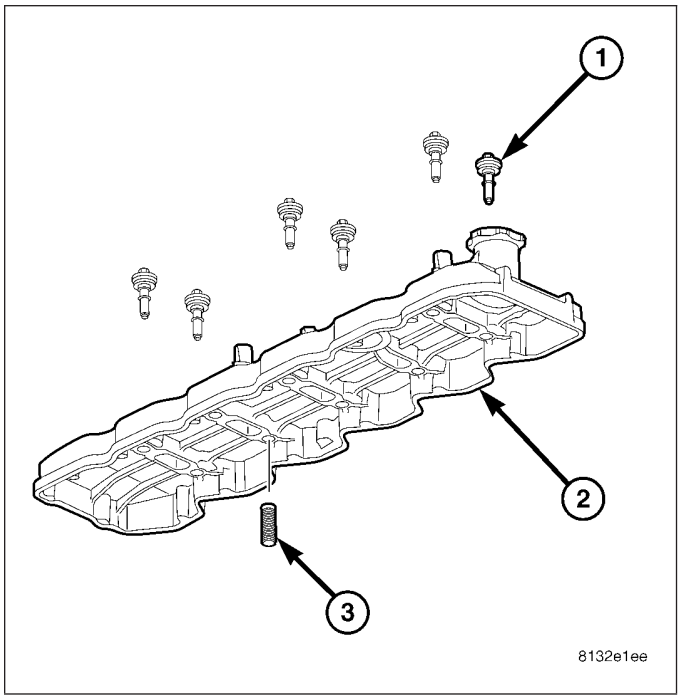


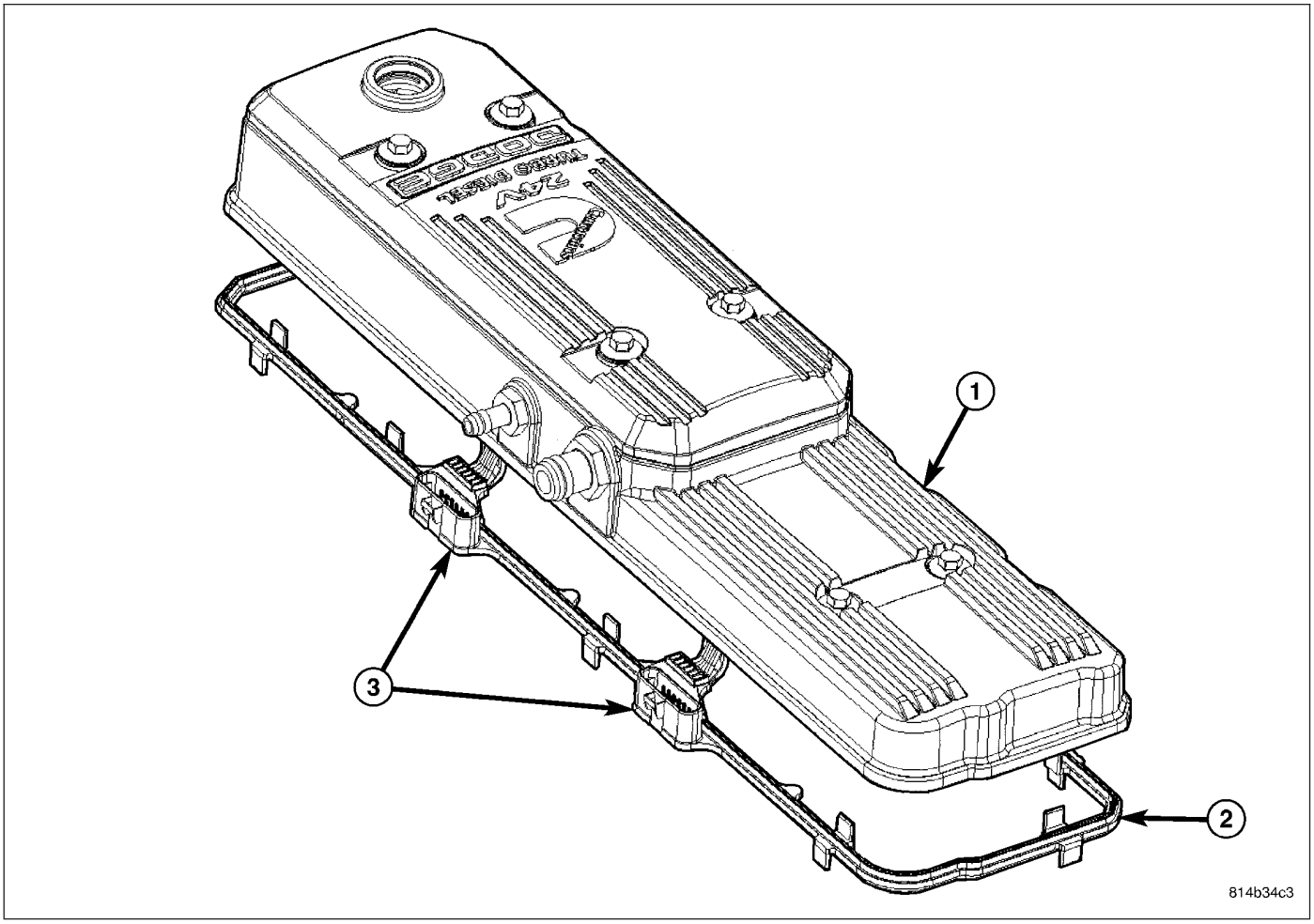
34. Remove lower fan shroud bracket (3) from engine.
35. Remove upper fan shroud brackets from engine.
36. Disconnect engine block heater connector.
37. Disconnect A/C compressor and pressure sensor electrical connectors.
38. Remove the passenger battery ground cable from the engine block. Remove the driver side battery ground cable from the engine block.
39. Remove power steering pump from engine by removing 3 bolts.
40. Disconnect the ECM power connector.
41. Disconnect the ECM ground wire from the hydro-form screw.
42. Disconnect the fuel supply and return hoses.



NOTE: For early builds, Ensure that grounding spring (3) remains intact with cylinder head cover (2).

43. **FOR EARLY BUILDS** Remove the cylinder head cover (2)and grounding spring (3). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
44. **FOR EARLY BUILDS** Disconnect the 3 injector harness connectors at the rocker housing. Disconnect the wire harnesses from the injectors.

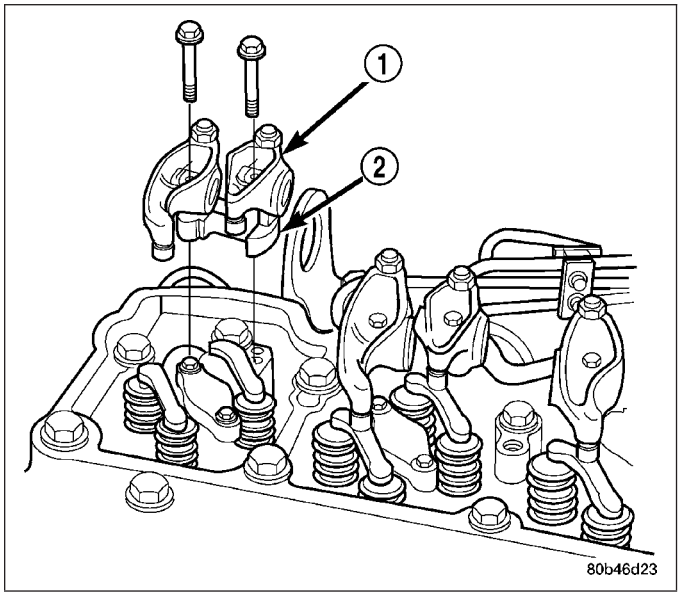




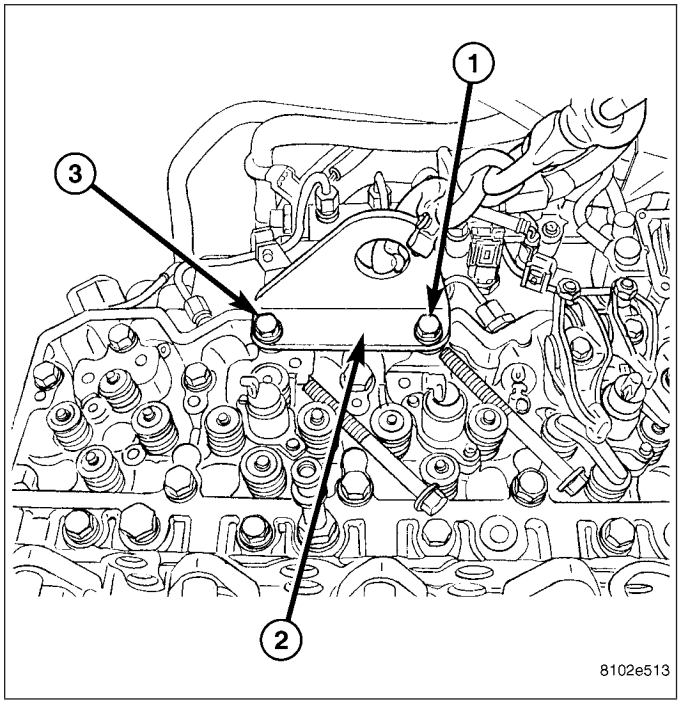
45. **FOR LATE BUILDS** Remove the cylinder head cover (1). (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
46. **FOR LATE BUILDS** Disconnect the wire harnesses from the injectors (3).

47. **FOR LATE BUILDS** Remove the cylinder head cover carrier gasket (2).
48. Loosen #6 fuel line shield bolts and rotate shield out of the way.
49. Remove cylinder #5 and #6 high pressure fuel lines.
50. Remove the rear engine lift bracket.

51. Remove cylinder #4, #5, and #6 intake and exhaust rocker arms (1), pedestals (2), and push tubes. Note the original location for re-assembly.
52. Remove the fuel connector tube nut and fuel connector tube. Remove cylinder #5 and #6 fuel injector.
53. Remove rocker housing.

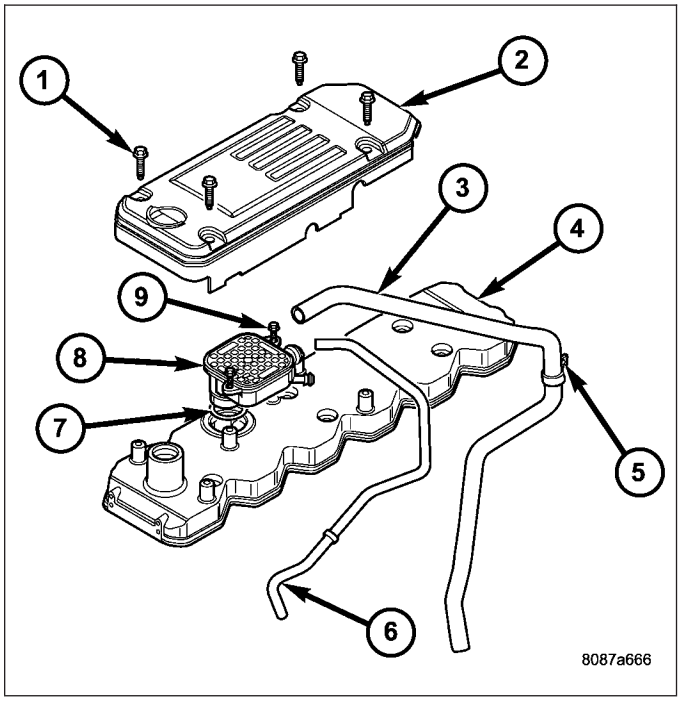


54. Remove two cylinder head bolts (1) according to the diagram and install Tool # 9009 (2). Torque bolts to 105N·m (77ft. lbs.).
55. Loosen but do not remove engine mount through bolts and nuts.
56. Disconnect hood support struts and position hood out of the way.
57. Attach a chain with two hooks to the engine lift brackets.
58. While keeping engine level, lift straight up out of the mounts.
59. Rotate nose of engine upward and pull out of chassis.



REMOVAL - CRANKCASE BREATHER - EARLY BUILD

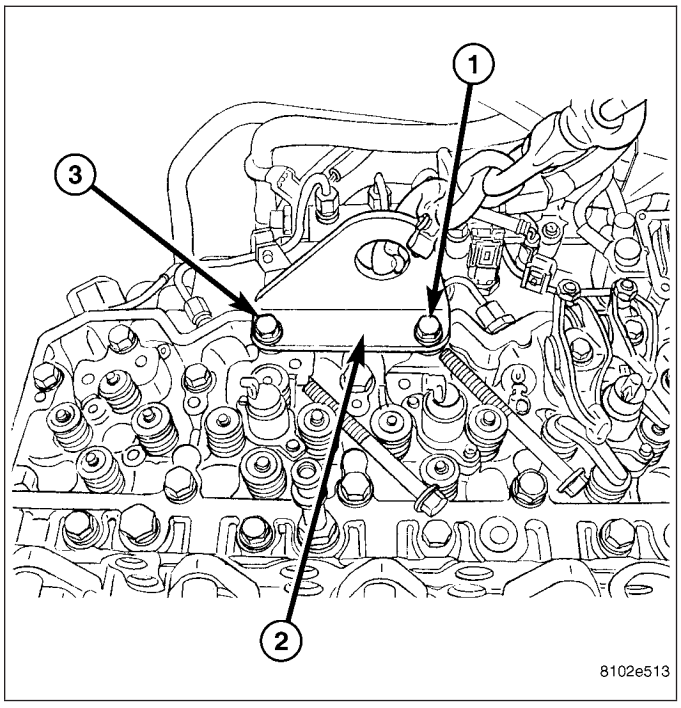
1. Remove the oil fill cap.
2. Remove the breather cover bolts (1).
3. Remove breather cover (2).
4. Disconnect breather tube and lube oil drain tube from breather.
5. Remove breather mounting bolts (9).
6. Remove breather from cylinder head cover.



INSTALLATION

INSTALLATION - ENGINE

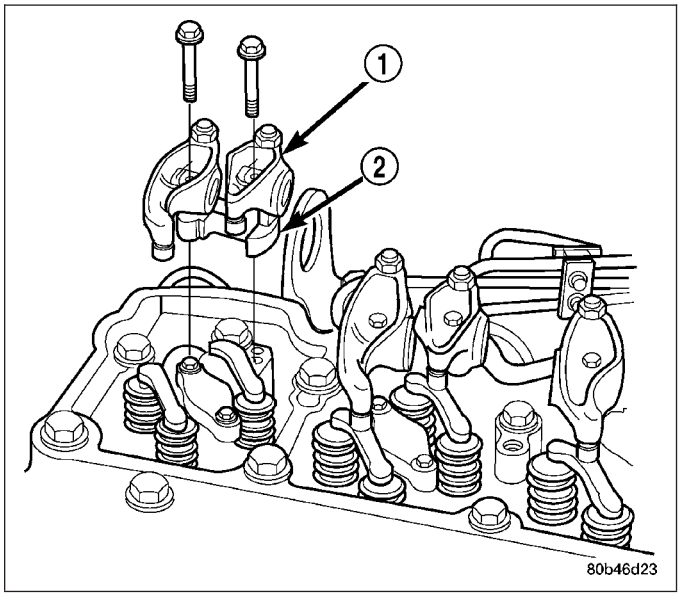
1. Remove cylinder head bolts (1,3) according to the diagram. Install special Tool 9009 (2). Torque bolts to 105N·m (77ft. lbs.)
2. Lower engine into the engine compartment and install the engine mount through bolts and nuts.
3. Tighten the mount through bolts and nuts to 88 N-m (65 ft-lbs) torque.
4. Remove the engine lifting device (Tool 9009).
5. Check cylinder head capscrew length and install into cylinder head.
6. Torque in 4 steps to:
   - Step 1—Tighten to 70 N·m (52 ft. lbs.) torque.
   - Step 2—Back off 360°.
   - Step 3—Tighten to 105 N·m (77 ft. lbs.) torque.
   - Step 4—Rotate 90°.



7. Install rocker housing. Torque to 24 N-m (18 ft-lbs). Refer to (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
8. Replace injector o-ring and sealing washer on injectors #5 and #6. Install injectors and torque using the following steps:

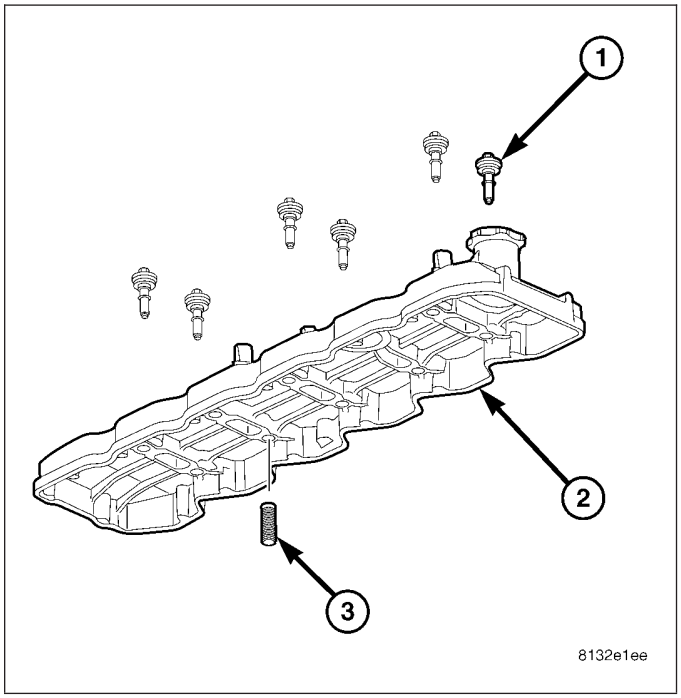
- Step 1—Install injector hold-down capscrews and torque to 5 N·m (44 in. lbs.) torque.
- Step 2—Loosen injector hold-down capscrews.
- Step 3—Install HPC connector tube and nut. Torque nut to 15 N·m (11 ft. lbs.) torque.
- Step 4—Torque injector hold-down capscrews to 10 N·m (89 in. lbs.) torque.
- Step 5—Torque HPC connector tube nut to 50 N·m (37 ft. lbs.) torque.

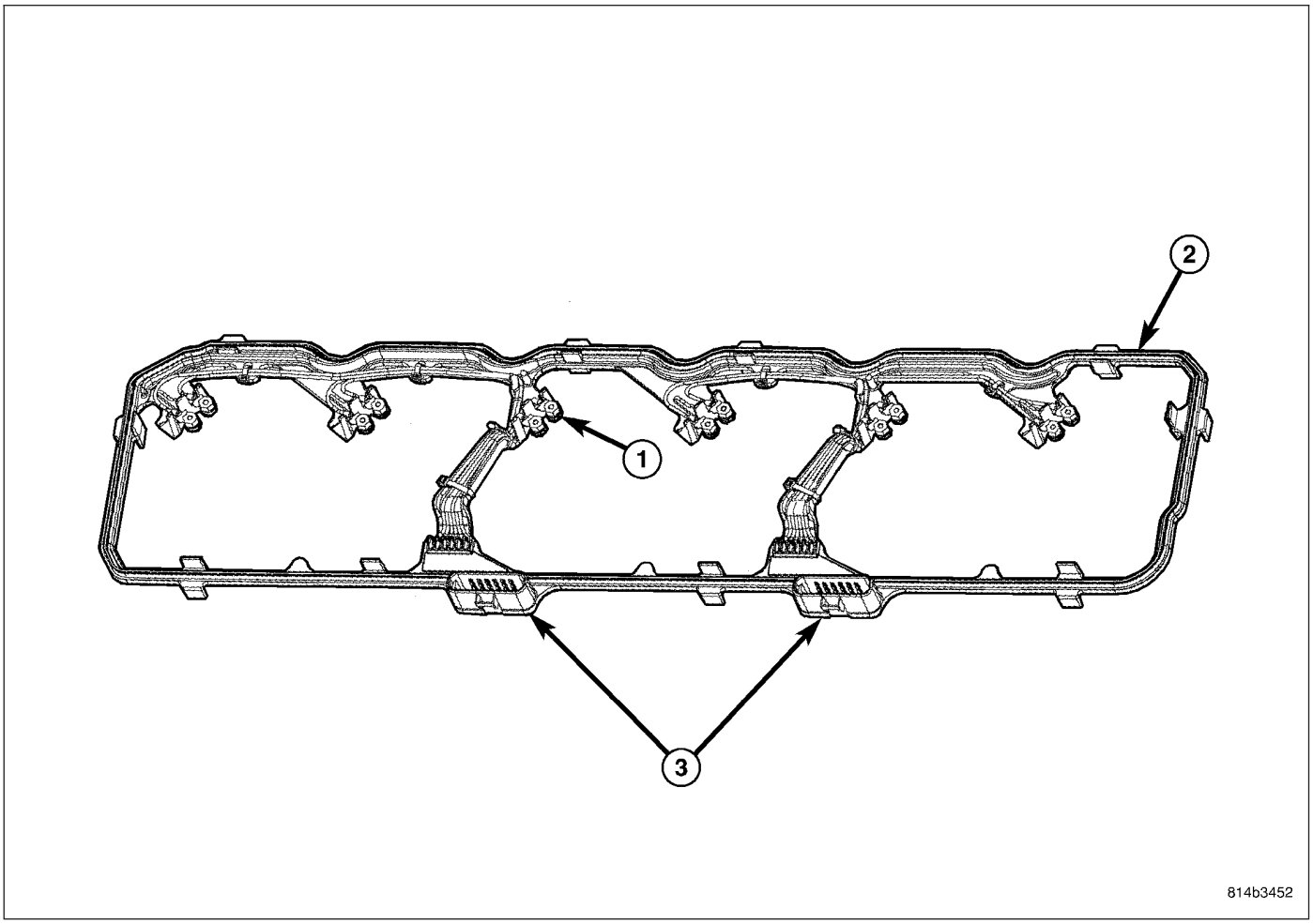
9. Install rear engine lift bracket. Torque to 77 N-m (57 ft-lb).
10. Install #5 and #6 high pressure fuel lines. Follow correct torque sequence per section 14. Torque fuel line fittings to 30 N-m (22 ft-lb). Torque brace capscrew and nut to 24 N-m (18 ft-lb).
11. Install push tubes, rocker arms (1), and pedestals (2) for cylinders #4, #5, and #6. Torque the mounting bolts to 36 N-m (27 ft-lbs).
12. Reset valve lash on cylinders #4, #5, and #6. Torque adjusting nuts to 24 N-m (18 ft-lbs).



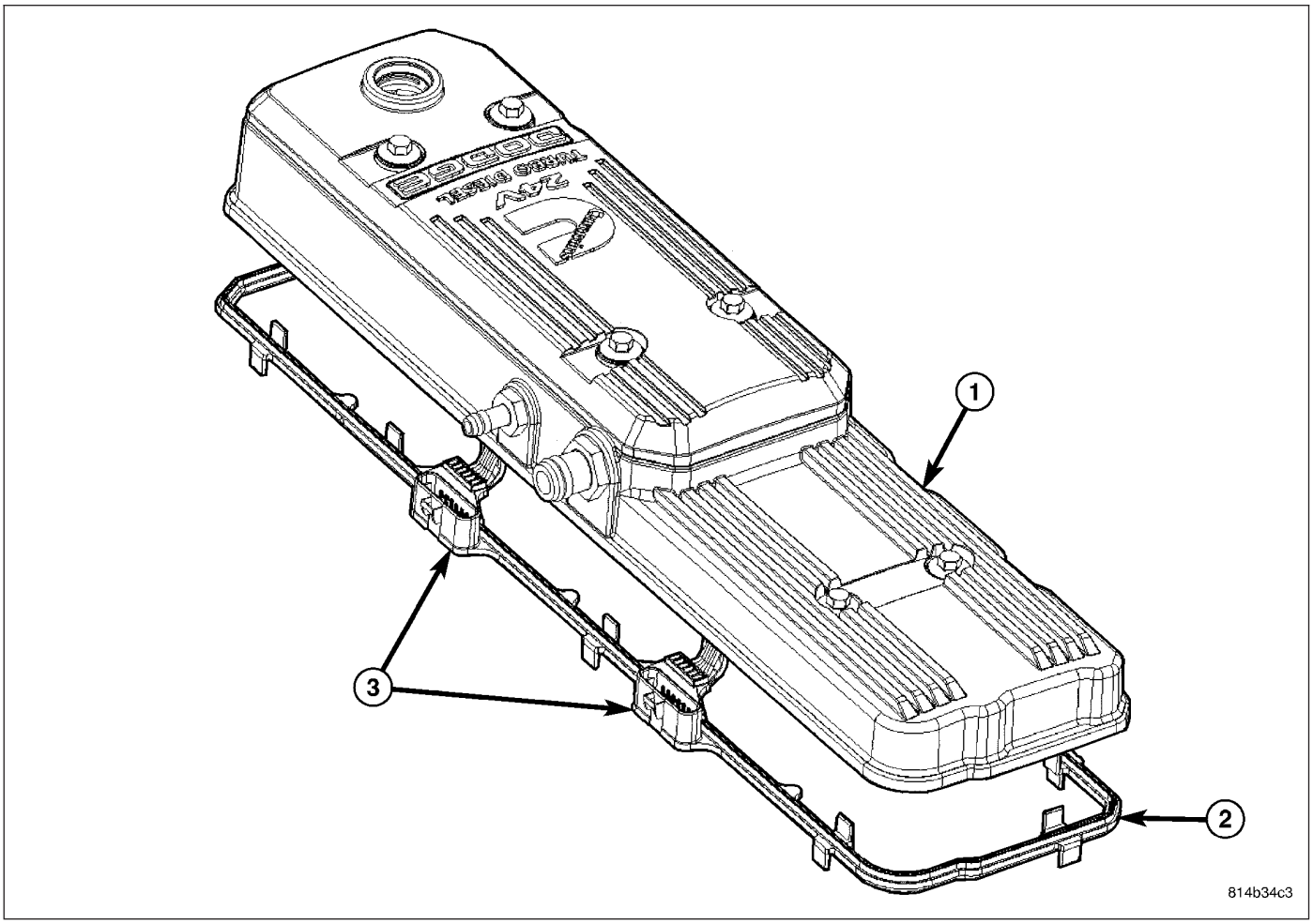
NOTE: For early builds, Verify proper installation of cylinder head cover ground spring (3) into cylinder head cover (2).

13. Install cylinder head cover (2). Torque to 24 N-m (18 ft-lbs). (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
14. **FOR EARLY BUILDS** Connect breather tube and lube oil drain tube to breather housing cover. Install breather cover. Torque capscrews to 24 N-m (18 ft-lbs)



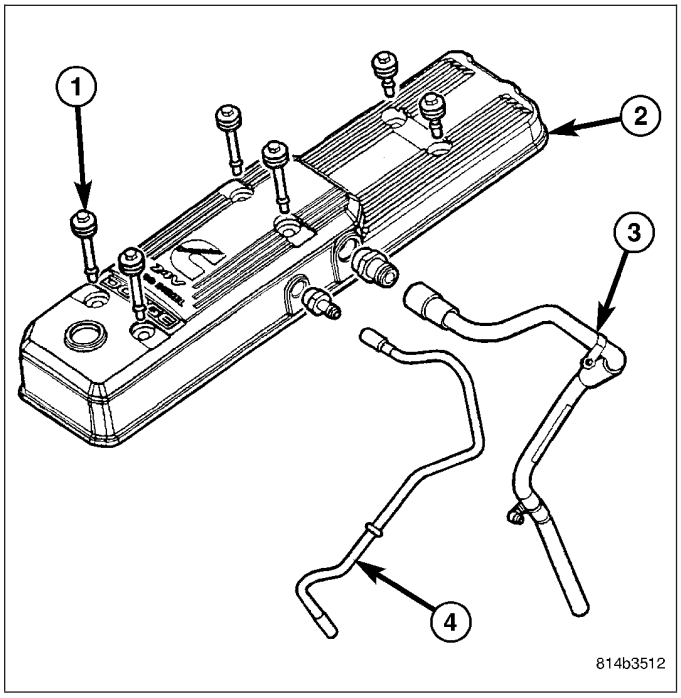


15. **FOR LATE BUILDS** Install cylinder head cover carrier gasket (2).
16. **FOR LATE BUILDS** Connect injector harness nuts to injectors (1). Torque to 1.25 N.m (11 in. lbs.)
17. **FOR LATE BUILDS** Connect injector wiring harness connectors to injector connections on cylinder head cover carrier gasket (3).

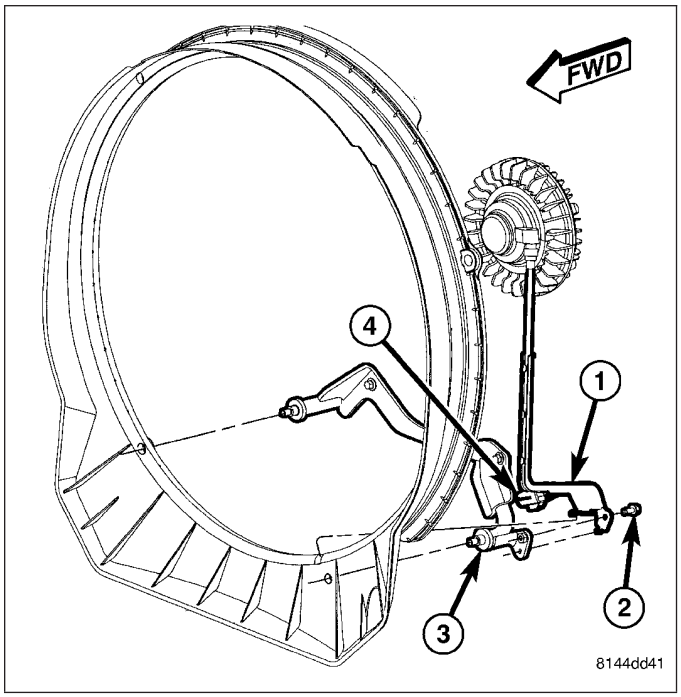


18. **FOR LATE BUILDS** Install cylinder head cover (1).

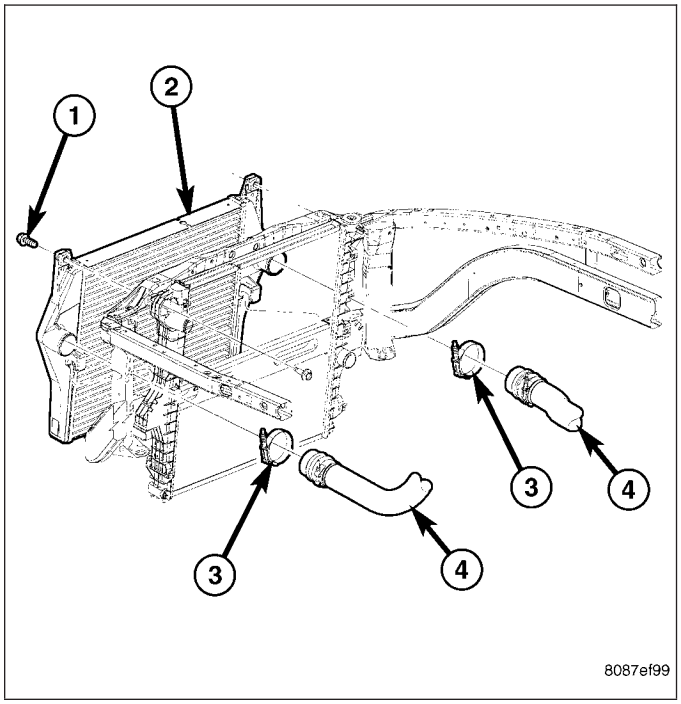
19. **FOR LATE BUILDS** Connect breather tube (3) and lube oil drain tube (4) to cylinder head cover (2).



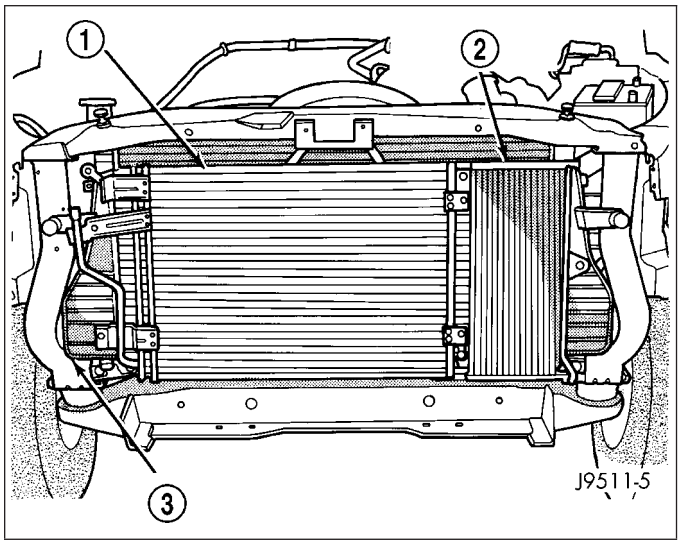
20. Connect fuel supply and return hoses.
21. Connect ECM ground to hydroform screw. Connect ECM power connector.
22. Install the power steering pump.
23. Install the damper and speed indicator ring. Torque to 40 N-m (30 ft-lb) plus 60 degrees.
24. Install lower fan shroud bracket (3). Torque to 24 N-m (18 ft·lb).



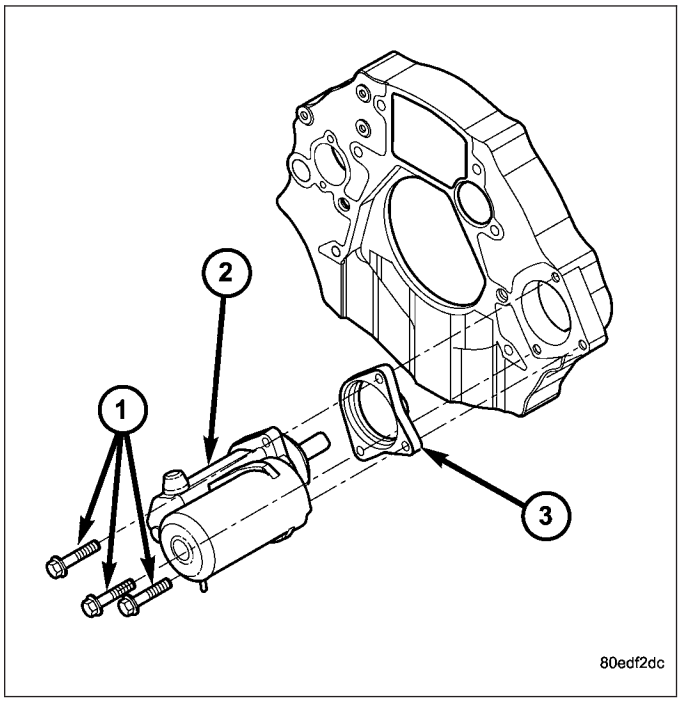
25. Install upper fan shroud brackets, but do not tighten fasteners at this time.
26. Connect the engine block heater connection.
27. Connect the A/C compressor and pressure sensor connectors
28. Install the charge air cooler (2). Install and tighten the charge air cooler mounting bolts(1) to 2 N-m (17 in-lbs).
29. Connect the charge air cooler tubes(4). Torque all clamps to 8 N-m (72 in-lbs).



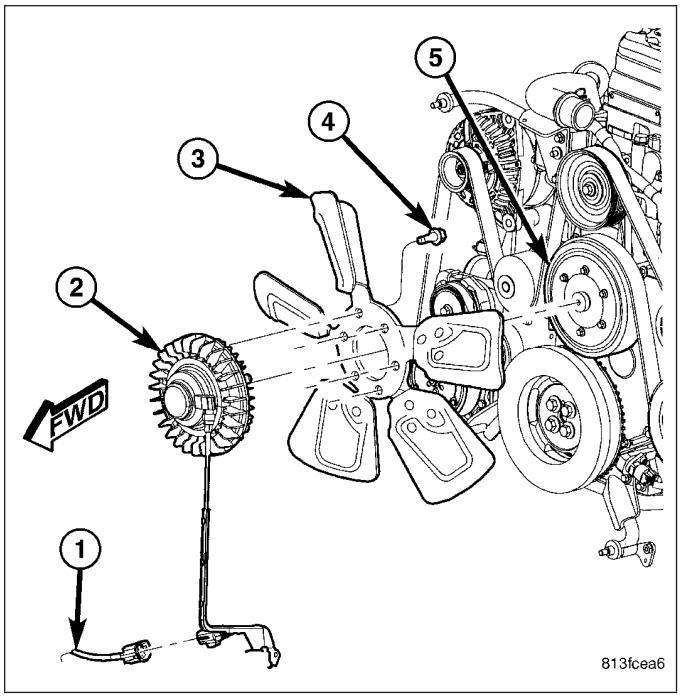
30. Install the a/c condenser (1).
31. Connect the a/c refrigerant lines to the a/c condenser.
32. Install the radiator upper support panel.
33. Install radiator.
34. Connect the transmission quick-connect oil cooler lines.
35. Raise vehicle.
36. Connect a/c compressor suction/discharge hose (if equipped).
37. Install the radiator lower hose and clamps.
38. Install the battery negative cables to the engine block on the driver and passenger side.



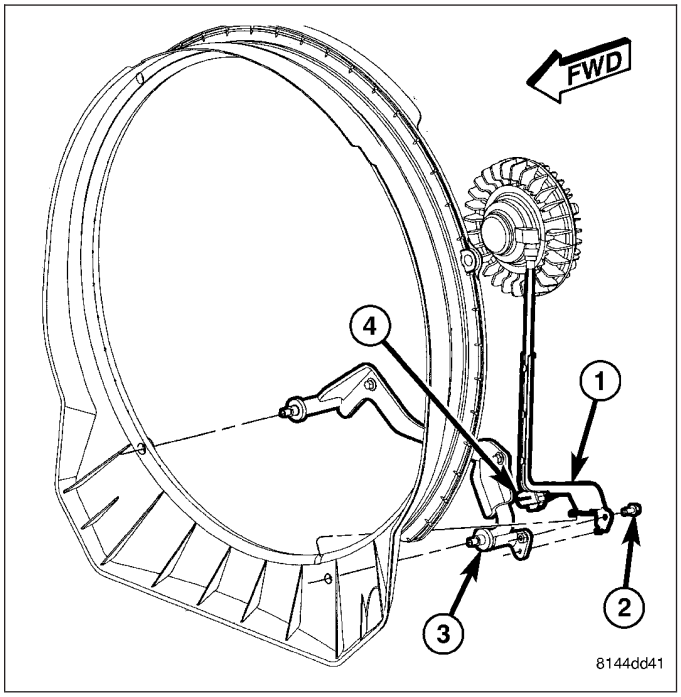
39. Install the transmission adapter with a new camshaft rectangular ring seal. Torque to 77 N-m (57 ft-lb).
40. **FOR EARLY BUILDS** Install the flywheel/flexplate. Torque to 137 N-m (101 ft-lb).
41. **FOR LATE BUILDS** Install the flywheel and adapter or flexplate. Torque to 137 N-m (101 ft-lb).
42. Install the starter motor (2). Torque to 43 N-m (32 ft-lb). (Refer to 8 - ELECTRICAL/STARTING/ STARTER MOTOR - INSTALLATION).
43. Connect engine to vehicle harness connectors.
44. Install transmission and transfer case (if equipped).
45. Connect the exhaust pipe to the turbocharger elbow.
46. Connect the transmission auxiliary oil cooler lines (if equipped).
47. Lower the vehicle.
48. Connect the heater core supply and return hoses.



49. Install the cooling fan (3) and fan drive (2). (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).



50. Install the fan shroud mounting bracket (3) and shroud. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
51. Install the windshield washer bottle.
52. Install the upper radiator hose and clamps.
53. Raise vehicle.
54. Change oil filter and install new engine oil.
55. Fill the cooling system with coolant. (Refer to 7 - COOLING - STANDARD PROCEDURE).
56. Connect grid heater harness at grid heater relays.
57. Connect electrical connections to rear of alternator.
58. Start the engine and inspect for engine oil, coolant, and fuel leaks.



INSTALLATION - CRANKCASE BREATHER - EARLY BUILD

1. Install a new o-ring onto the breather element.
2. Lubricate o-ring and install into cylinder head cover. Torque capscrews to 10 N·m (89 in. lbs.).
3. Connect breather tube and lube oil drain tube.
4. Install breather cover. Torque to 24 N·m (18 ft. lbs.)
5. Install oil fill cap.

SPECIFICATIONS

SPECIFICATIONS - 5.9L DIESEL

GENERAL DESCRIPTION

DESCRIPTION	SPECIFICATION
Engine Type	In-Line 6 Cyl. Turbo Diesel
Displacement	5.9 Liters 359 (Cubic Inches)
Bore	102.0 mm (4.02 in.)
Stroke	120.0 mm (4.72 in.)
Compression Ratio 325 H.P	17.2:1
Cylinder Pressure (Minimum)	350 psi.
Horsepower High Output 48 RE A/T and NV 5600 or G 56 M/T	325 HP @ 2900 RPM
Torque Rating High Output (48RE A/T and NV 5600 or G 56 M/T)	600 LB-FT @ 1400 RPM
Lubrication System	Pressure Feed-Full Flow With Bypass Valve
Firing Order	1-5-3-6-2-4
Cylinder Block	Cast Iron
Crankshaft	Induction Hardened Forged Steel
Cylinder Head	Cast Iron With Valve Seat Inserts
Combustion Chambers	High Swirl Bowl
Camshaft	Chilled Ductile Iron
Pistons	Cast Aluminum
Connnecting Rods	Cross Rolled Micro Alloy

PISTONS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Skirt Diameter	101.775 - 101.793 mm	4.007 - 4.008 in.
Ring Groove Clearance		
Intermediate (Min)	0.045 mm	.0018 in
(Max)	0.095 mm	0.0037 in.
Oil Control (Min)	0.040 mm	.0016 in.
(Max)	0.085 mm	.0033 in.

PISTON PINS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Pin Diameter (Min)	39.990 mm	1.5744 in.
(Max)	40.003 mm	1.5749 in.
Bore Diameter (Min)	40.006 mm	1.5750 in.
(Max)	40.012	1.5753 in.

PISTON RINGS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Ring Gap		
Top Ring	0.26 - 0.36mm	0.010 - 0.014 in.
Intermediate	0.85 - 1.15 mm	0.033 - 0.045in.
Oil Control	0.25 - 0.55 mm	0.010 - 0.21 in.

CONNECTING RODS

DESCRIPTION	SPECIFICATION	
	Metric	Standard
Pin Bore Diameter (Min. w/ bushing installed)	40.019 mm	1.5764 in.
Pin Bore Diameter (Max. w/ bushing installed)	40.042 mm	1.5765 in.
Side Clearance (Min)	0.100 mm	0.004 in.
Side Clearance (Max)	0.330 mm	0.013 in.

CYLINDER HEAD

DESCRIPTION	SPECIFICATION
Overall Flatness End To End (max)	0.305 mm (0.012 in.)
Overall Flatness Side To Side (Max)	0.076 mm (0.003 in.)
Intake Valve Seat Angle	30°
Exhaust Valve Seat Angle	45°
Valve Stem Diameter	
(Min)	6.96 mm (0.2740 in.)
(Max)	7.01 mm (0.2760 in.)
Valve Rim Thickness (Min.)	0.79 mm (0.031 in.)

OIL PRESSURE

SPECIFICATION	SPECIFICATION
At Idle	69 kPa (10 psi)
@ 2500 rpm	207 kPa (30 psi)
Regulating Valve Opening Pressure	517 kPa (75 psi)
Oil Filter Bypass Pressure Setting	344.75 kPa (50 psi)

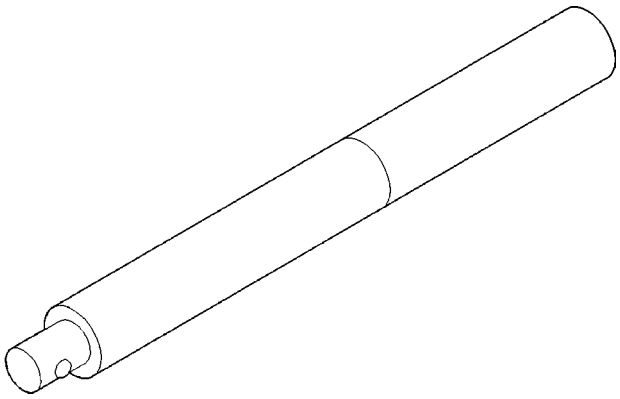
TORQUE

TORQUE CHART 5.9L DIESEL ENGINE

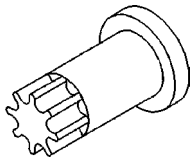
DESCRIPTION	N·m	In. Lbs.	Ft. Lbs.
Connecting Rod—Bolts			
Step 1	30	—	22
Step 2	60	—	44
Step 3	Rotate 60 degrees		
Crankshaft Main Cap—Bolts			
Step 1	50		37
Step 2	80		59
Step 3	Rotate 90°		
Cylinder Head—Bolts			
Step 1	70	—	52
Step 2	Back off 360 degrees		
Step 3	105	—	77
Step 4 Verify	105	—	77
Step 5	Rotate All Bolts 1/4 Turn		
Cylinder Head Cover Bolts	24	—	18
Breather Cover Bolts	24	—	18
HPC Nut	50	—	37
Flexplate to Engine	137	—	101
Flywheel to Engine (NV 5600)	137	—	101
Flywheel/Crankshaft Adapter G 56 Dual Mass Flywheel	137	—	101
Fuel Delivery Lines—Banjo	24	—	18
Fuel Drain Line—Banjo	24	—	18
Fuel line—rail to cylinder head	30	—	22
Fuel line—pump to fuel rail	37	—	27
Injector fuel line brace	24	—	18
#6 Fuel Line Brace Nut at Lift Bracket Stud	24	—	18
Fuel rail holddown bolt	24	—	18
Oil Pan—Bolts	28	—	21
Oil Pan—Drain Plug	50	—	37
Oil Pressure Regulator—Plug	80	—	59
Oil Pressure Switch	18	—	13
Oil Pump—Bolts			
Step1	8	—	6
Step2	24	—	18
Oil Suction Tube (Flange)—Bolts	24	—	18
Oil Suction Tube (Brace)—Bolt	43	—	32
Rocker Arm/Pedestal—Bolts	36	—	27

SPECIAL TOOLS

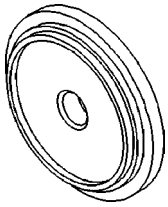
5.9L DIESEL ENGINE



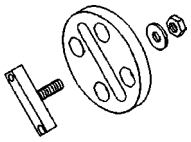
Universal Driver Handle - C4171



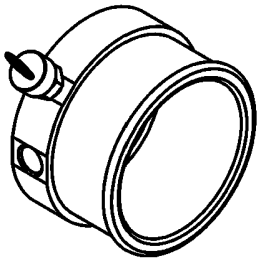
Crankshaft Barring Tool - 7471 - B



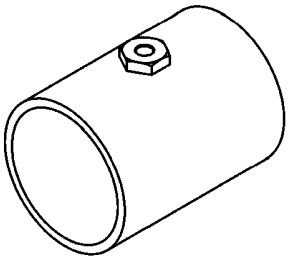
Crankshaft Front Oil Seal Installer - 8281



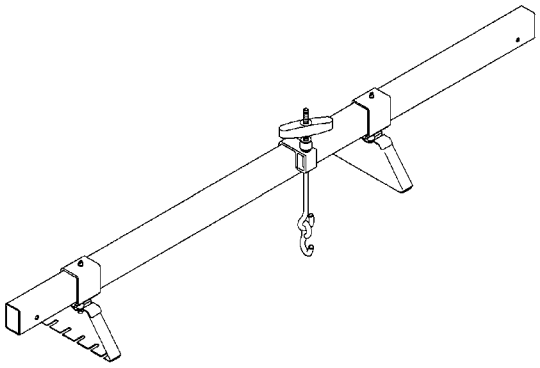
Valve Spring Compressor - 8319A



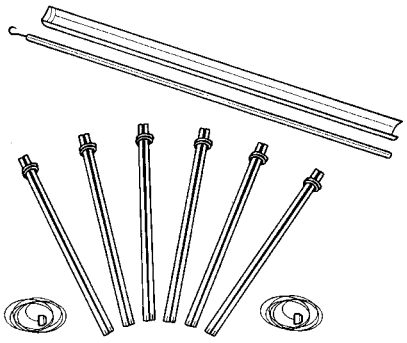
Test Plug - 8442



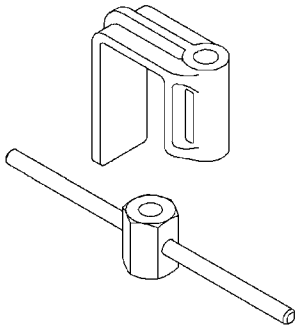
Adapter - 8462



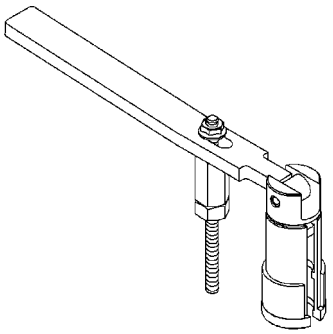
Engine Support Fixture - 8534



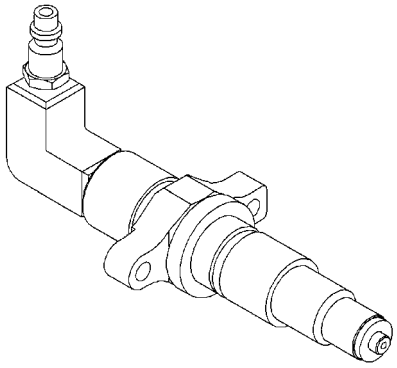
TAPPET INSTALLATION TOOL - 8502



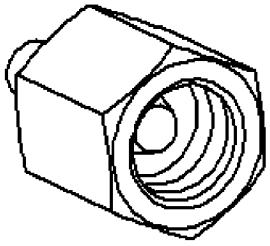
STEEL BRACKET - 8534-A



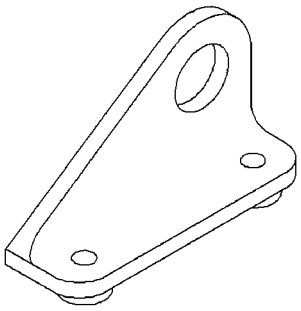
Fuel Injector Remover - 9010



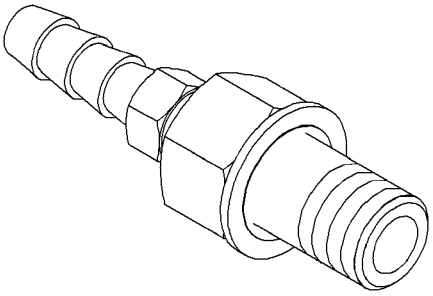
Compression Test Adapter - 9007



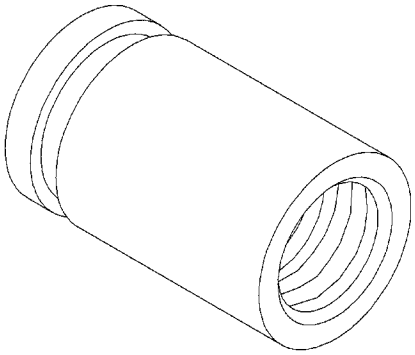
FUEL BLOCKOFF PLUG - 9011



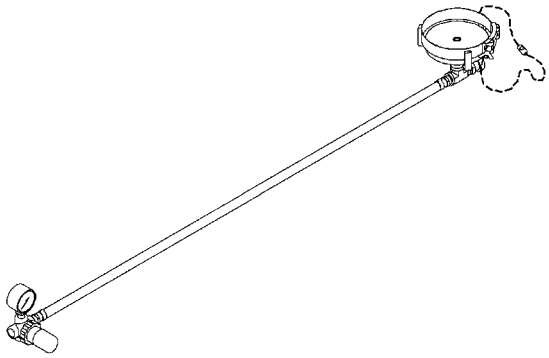
Engine Lift Bracket - 9009



FUEL TEST FITTING - 9013



Fuel Injector Tube (Connector) Remover - 9015

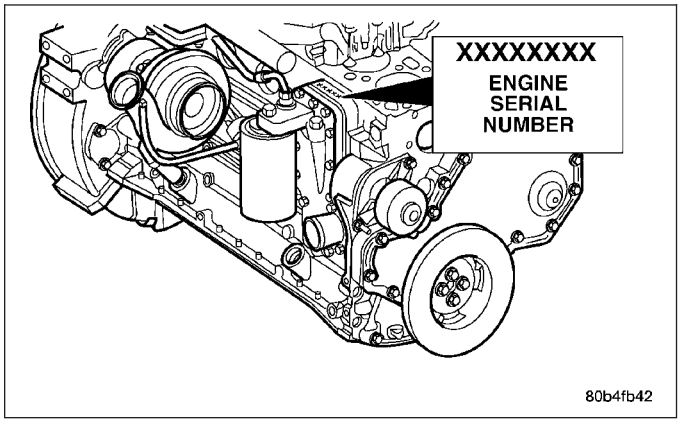


TURBO TEST ADAPTER - 9022

ENGINE DATA PLATE

DESCRIPTION

The engine data plate contains specific information that is helpful to servicing and obtaining parts for the engine. For early model year builds, the data plate can be found affixed to the breather cover on the left side of the engine. For late model year builds, the data plate is on the cylinder head cover. Information that can be found on the data plate includes:



- Engine Part Number
- Date of Engine Manufacture
- Engine Serial Number
- Control Parts List (CPL)
- Engine Rated Horsepower
- Engine Firing Order
- Engine Displacement
- Valve Lash Reset Specifications

If the engine data plate is missing or not legible, the engine serial number is used for engine identification. The engine serial number is stamped on the right side of the block, on top of the oil cooler cavity.

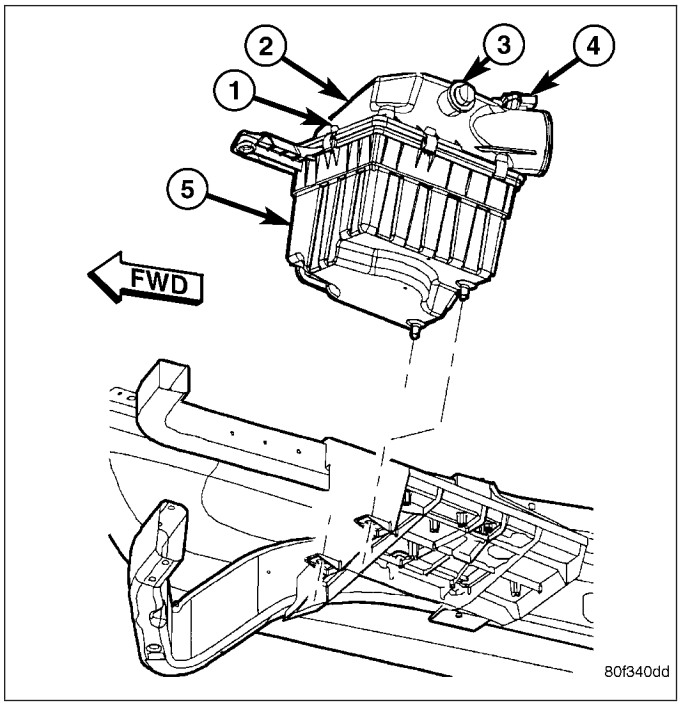
AIR CLEANER ELEMENT

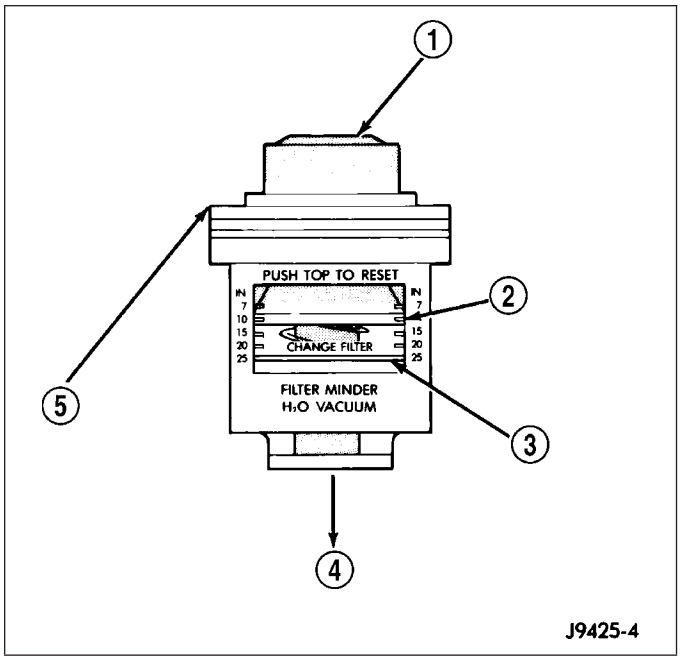
REMOVAL

Testing Air Cleaner Element using Filter Minder™

Do not attempt to unnecessarily remove top of air cleaner housing for air cleaner element inspection on diesel engines.

The air cleaner (filter) housing (5) is equipped with an air Filter Minder™ gauge (3). This air flow restriction gauge will determine when air cleaner element is restricted and should be replaced.





The Filter Minder™ (5) consists of a diaphragm and calibrated spring sealed inside of a plastic housing. A yellow colored disc (2) attached to diaphragm moves along a graduated scale on side of Filter Minder. After the engine has been shut off, a ratcheting device located within Filter Minder will hold yellow disc at highest restriction that air cleaner element has experienced. A drop in air pressure due to an air cleaner element restriction moves diaphragm and yellow disc will indicate size of air drop.

CAUTION: Certain engine degreasers or cleaners may discolor or damage plastic housing of Filter Minder. Cover and tape Filter Minder if any engine degreasers or cleaners are to be used.

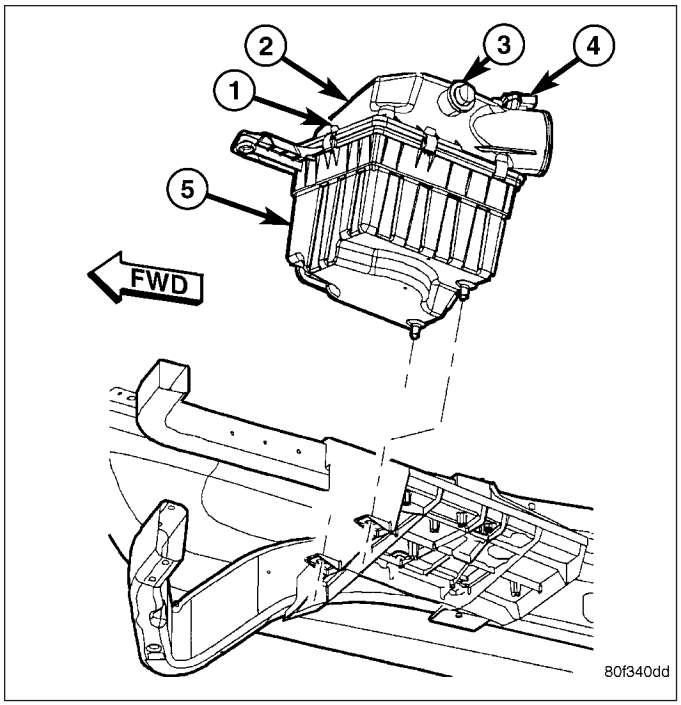
To test, turn engine off. If yellow disc (2) has reached red colored zone (3) on graduated scale, air cleaner element should be replaced. Refer to Removal / Installation.

Resetting Filter Minder: After air cleaner (filter) element has been replaced, press rubber button on top of Filter Minder. This will allow yellow colored disc to reset. After button has been pressed, yellow disc should spring back to UP position.

If Filter Minder gauge has reached red colored zone, and after an examination of air cleaner (filter) element, element appears to be clean, high reading may be due to a temporary condition such as snow build-up at air intake. Temporary high restrictions may also occur if air cleaner (filter) element has gotten wet such as during a heavy rain or snow. If this occurs, allow element to dry out during normal engine operation. Reset rubber button on top of Filter Minder and retest after element has dried.

Filter Removal

1. The housing cover is equipped with spring clips and is hinged with plastic tabs. Unlatch clips from top of air cleaner housing and tilt housing cover up for cover removal.
2. Remove air cleaner element from air cleaner housing (5).



INSTALLATION

1. Before installing new air cleaner element (filter), clean inside of air cleaner housing.
2. Position air cleaner cover to tabs on front of air cleaner housing. Latch spring clips to seal cover to housing.

CYLINDER HEAD

DESCRIPTION

The cylinder head is constructed of cast iron and is a one piece cross flow design with four valves per cylinder. The arrangement of two intake and two exhaust valves per cylinder allows for a centrally located injector. The cylinder head also includes an integral intake manifold, an integral thermostat housing, and a longitudal fuel return rifle, which exits at the rear of the head. The 24 valve design also includes integrally cast valve guides and hardened intake and exhaust valve seat inserts.

REMOVAL

1. Disconnect battery negative cables.
2. Raise vehicle on hoist.
3. Drain engine coolant.
4. Disconnect exhaust pipe from turbocharger elbow.
5. Remove turbocharger drain tube bolts at turbocharger. Cap off ports to prevent dirt or foreign material from entering.
6. Lower vehicle.
7. Disconnect air inlet temperature/pressure sensor.
8. Remove air cleaner housing and snorkel from the vehicle. Cap off turbocharger air inlet to prevent intrusion of dirt or foreign material.
9. Disconnect cab heater core supply and return hoses from the cylinder head and heater pipe.
10. Disconnect turbocharger oil supply line at the turbocharger end. Cap off open ports to prevent intrusion of dirt or foreign material.
11. Remove exhaust manifold-to-cylinder head bolts, spacers, heat shield, retention straps, and cab heater plumbing. Remove exhaust manifold and turbocharger from the vehicle as an assembly.
12. Remove cooling fan/drive/shroud assembly. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL)
13. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
14. Remove cooling fan support from cylinder block.
15. Remove upper generator bolt, loosen lower generator bolt, and rotate generator away from cylinder head.
16. Disconnect radiator upper hose from the thermostat housing.
17. Disconnect the Intake Air Temperature/Manifold Air Pressure, and Coolant Temperature sensor connectors.
18. Remove the engine harness to cylinder head attaching bolts and P-clips at front of head.
19. Remove the throttle linkage cover.
20. Remove the intake air grid heater wires from the grid heater.
21. Remove engine oil level indicator tube attaching bolt at fuel filter housing bracket and inlet air connection..
22. Remove the charge air cooler-to-air inlet housing pipe.
23. Remove the engine wire harness attaching bolt and wire harness push-in fastener from air inlet housing.
24. Remove the air inlet housing and intake grid heater from the intake manifold cover.
25. Remove the two grid heater harness-to-cylinder head attaching bolts at front of cylinder head.
26. **Remove the high pressure pump to fuel rail fuel line as follows:**
    a. Loosen fuel line nuts at fuel pump and at fuel rail.
    b. Use a back-up wrench on the fitting at the fuel pump to keep it from loosening.
27. Remove the fuel rail to cylinder head fuel lines as follows:
    a. Loosen No. 6 high pressure fuel line shield and position out of way.
    b. Loosen the fuel line nuts at the fuel rail and at the cylinder head. Use a back-up wrench on HPC nut.
    c. Remove the fuel line bracket bolts at the intake manifold cover.
28. Remove the engine lift bracket from the rear of the cylinder head.
29. Remove the fuel rail as follows:

a. Remove fuel rail pressure sensor connector.

b. Remove banjo fitting at pressure limiting valve.

c. Remove fuel rail bolts and fuel rail.

30. Remove the low pressure lines as follows:

a. Remove the fuel drain banjo fitting on the front side of fuel filter housing.

b. Remove the fuel drain banjo fitting on rear side of fuel filter housing.

c. Remove the fuel drain line support bracket on rear side of filter housing.

d. Disconnect fuel drain hose.

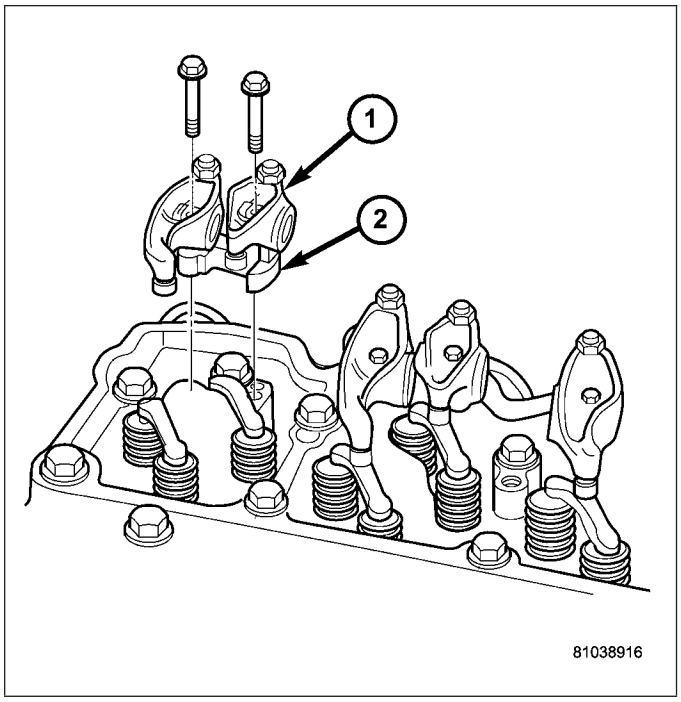
e. Remove banjo fitting at bottom of fuel filter housing.

f. Disconnect fuel supply hose at fuel filter.

31. Disconnect fuel heater, and water in fuel sensor.
32. Remove the fuel filter assembly-to-cylinder head bolts and remove filter assembly from vehicle.
33. Remove wire harness P-clip from cylinder head (located behind filter housing).

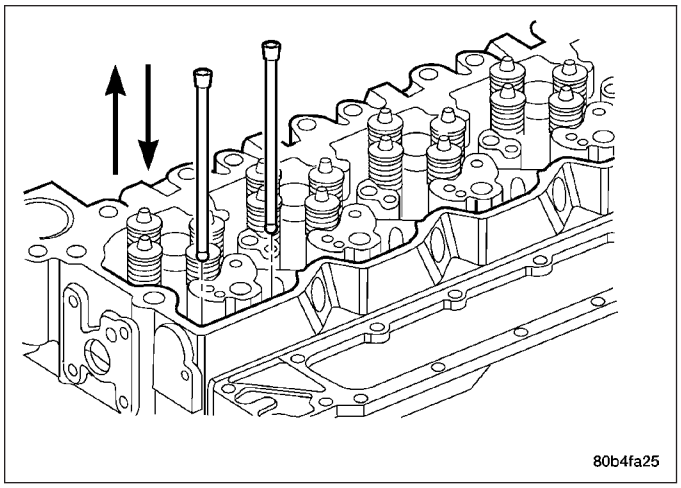
NOTE: Verify that the cylinder head cover ground spring is retained in the cylinder head cover.

34. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
35. Disconnect rocker housing injector harness connectors.
36. Remove injector harness nuts from injectors.



37. Remove the rocker levers (1), cross heads and push rods. Mark each component so they can be installed in their original positions.

NOTE: The #5 cylinder exhaust and the #6 cylinder intake and exhaust push rods are removed by lifting them up and through the provided cowl panel access holes. Remove the rubber plugs to expose these relief holes.



38. Remove the fuel return line and banjo bolt at the rear of the cylinder head. Be careful not to drop the two (2) sealing washers.
39. Remove the fuel injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
40. Remove rocker housing bolts and rocker housing and gasket.
41. Reinstall the engine lift bracket at the rear of cylinder head. Torque to 77 N·m (57 ft. lbs.).
42. Remove twenty six (26) cylinder head-to-block bolts.
43. Attach an engine lift crane to engine lift brackets and lift cylinder head off engine and out of vehicle.
44. Remove the head gasket and inspect for failure.

CLEANING

CLEANING—CYLINDER HEAD

CAUTION: Do not wire brush head surface while fuel injectors are still installed. Fuel injector damage can result.

Remove fuel injectors before cleaning (if not already removed during cylinder head removal).

Clean the carbon from the injector nozzle seat with a nylon or brass brush.

Scrape the gasket residue from all gasket surfaces.

Wash the cylinder head in hot soapy water solution (88°C or 140°F).

After rinsing, use compressed air to dry the cylinder head.

Polish the gasket surface with 400 grit paper. Use an orbital sander or sanding block to maintain a flat surface.

CLEANING—CROSSHEADS

Clean all crossheads in a suitable solvent. If necessary, use a wire brush or wheel to remove stubborn deposits. Rinse in hot water and blow dry with compressed air.

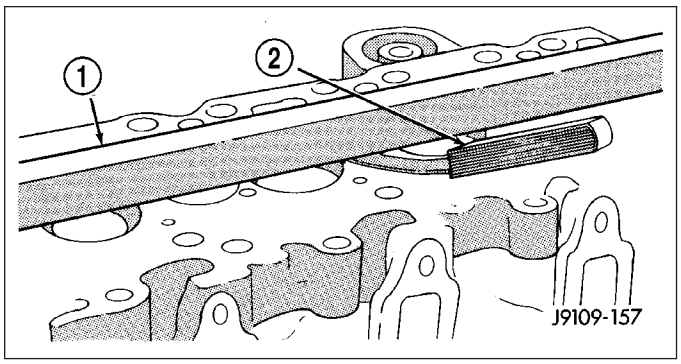
CLEANING—PUSHRODS

Clean the pushrods in a suitable solvent. Rinse in hot water and blow dry with compressed air. If necessary, use a wire brush or wheel to remove stubborn deposits.

INSPECTION

INSPECTION - CYLINDER HEAD

Inspect the cylinder head for cracks in the combustion surface. Pressure test any cylinder head that is visibly cracked. A cylinder head that is cracked between the injector bore and valve seat can be pressure tested and reused if OK; however, if the crack extends **into** the valve seat insert bore, the cylinder head **must** be replaced.



Visually inspect the cylinder block and head combustion surfaces for localized dips or imperfections. Check the cylinder head and block combustion surfaces for overall out-of-flatness. If either the visual or manual inspection exceeds the limits, then the head or block must be surfaced.

Check the top surface for damage caused by the cylinder head gasket leaking between cylinders.

Inspect the block and head surface for nicks, erosion, etc.

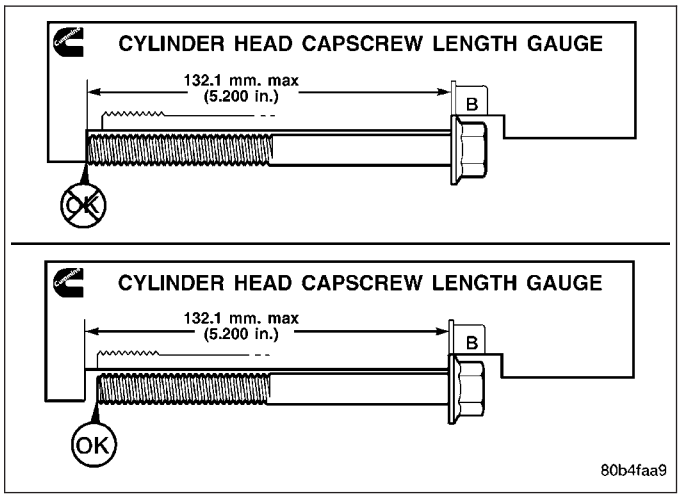
Check the head distortion. Maximum overall variation end to end is 0.305 mm (0.012 inch), and maximum overall variation side to side 0.076 mm (.003 in.).

DO NOT proceed with the in-chassis overhaul if the cylinder head or block surface is damaged or not flat (within specifications).

Check block surface for distortion. Maximum variation end-to-end is 0.076 mm (.003 in.), side-to-side 0.051 mm (.002).

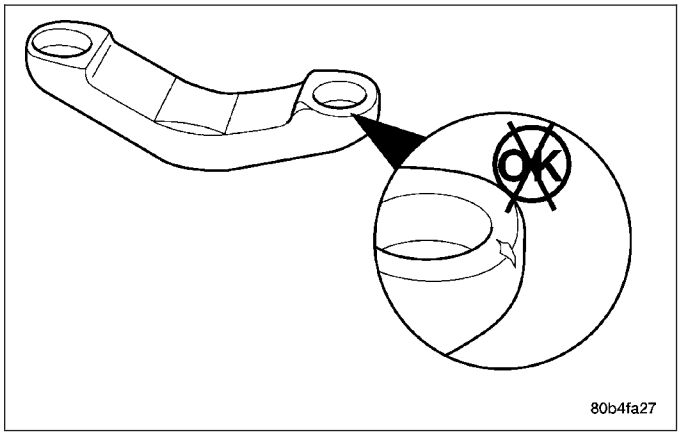
Visually inspect the cylinder head bolts for damaged threads, corroded/pitted surfaces, or a reduced diameter due to bolt stretching.

If the bolts are not damaged, their “free length” should be measured using the cap screw stretch gauge provided with the replacement head gasket. Place the head of the bolt against the base of the slot and align the bolt with the straight edge of gauge . If the end of the bolt touches the foot of the gauge, the bolt **must** be discarded. **The maximum bolt free length is 132.1 mm (5.200 in.).**



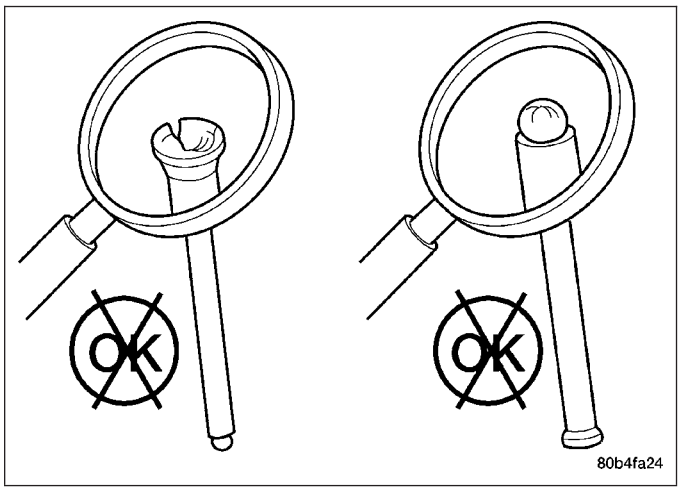
INSPECTION - CROSSHEADS

Inspect the crossheads for cracks and/or excessive wear on rocker lever and valve tip mating surfaces. Replace any crossheads that exhibit abnormal wear or cracks.

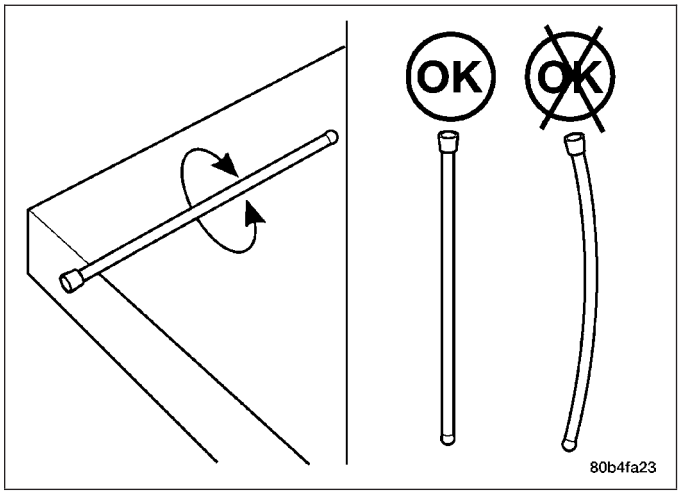


INSPECTION—PUSHRODS

Inspect the push rod ball and socket for signs of scoring. Check for cracks where the ball and the socket are pressed into the tube
.



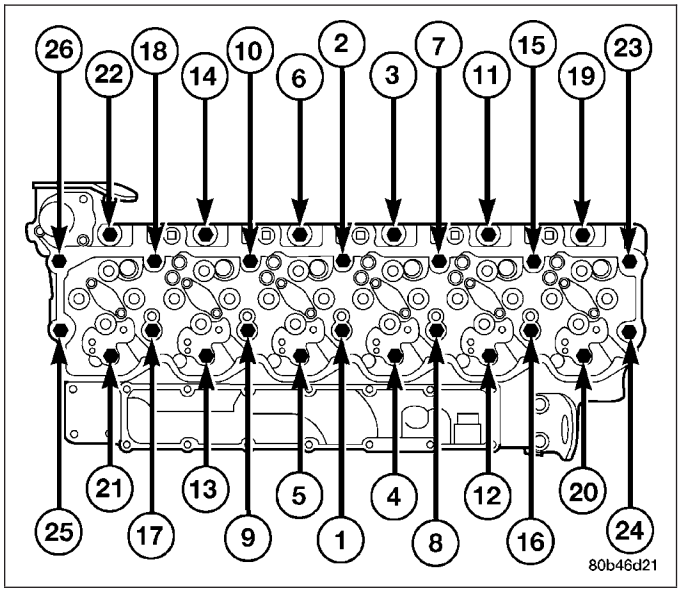
Roll the push rod on a flat work surface with the socket end hanging off the edge. Replace any push rod that appears to be bent.



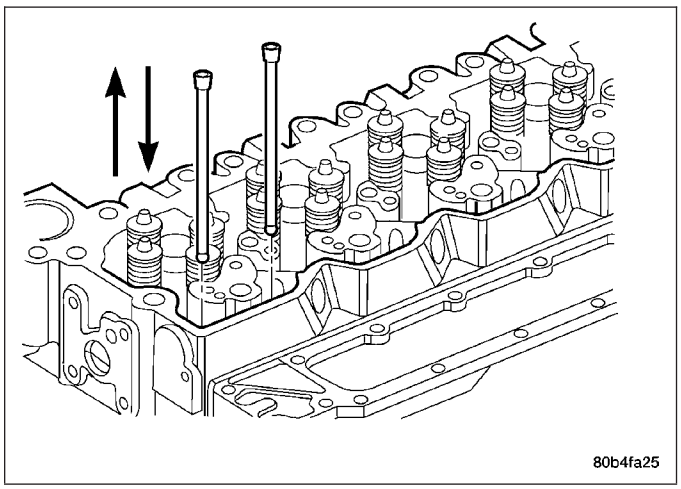
INSTALLATION

WARNING: THE OUTSIDE EDGE OF THE HEAD GASKET IS VERY SHARP. WHEN HANDLING THE NEW HEAD GASKET, USE CARE NOT TO INJURE YOURSELF.

1. Install a new gasket with the part number side up, and locate the gasket over the dowel sleeves.
2. Using an engine lifting crane, lower the cylinder head onto the engine.
3. Lightly lubricate head bolts with engine oil and install. Using the sequence shown in , tighten bolts in the following steps:
   a. Torque bolts to 70 N·m (52 ft. lbs.)
   b. Back off 360 degrees in sequence
   c. Torque bolts to 105 N·m (77 ft. lbs.)
   d. Re-check all bolts to 105 N·m (77 ft. lbs.)
   e. Tighten all bolts an additional ¼ turn (90°)

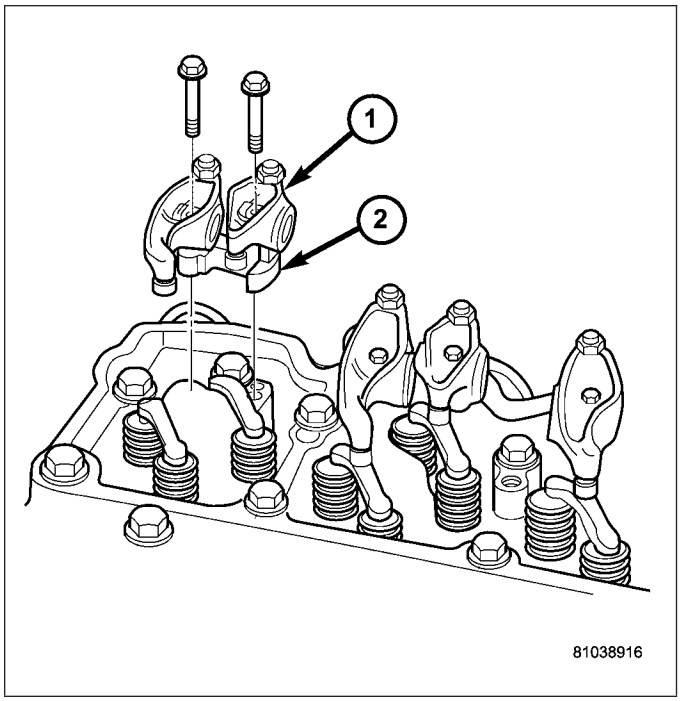


4. Install push rods into their original locations. **Verify that they are seated in the tappets**.



5. Inspect rocker housing gasket for cuts and proper installation into groove. Replace if damaged.
6. Install rocker housing and bolts. Tighten to 24 Nm (18 lb. ft.).
7. Install fuel injector (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
8. **FOR EARLY BUILDS** Install injector harness nuts. Tighten to 1.25 Nm (11 lb. in.).
9. **FOR EARLY BUILDS** Reconnect injector harness connectors at rocker housing.

10. Lubricate valve stem tips and install the cross-heads in their original locations.
11. Lubricate the rocker arms (1) and pedestals (2) and install them in their original locations. Install the bolts and torque them to 36 N·m (27 ft. lbs.).
12. Verify that the valve lash settings are maintained (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).



NOTE: For early builds, Verify that cylinder head ground spring is properly installed and retained in the cylinder head cover, before installation.

13. **FOR EARLY BUILDS** Install cylinder head cover and ground spring (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
14. **FOR LATE BUILDS** Install cylinder head cover gasket onto rocker housing.
15. **FOR LATE BUILDS** Install injector harness nuts. Tighten to 1.25 Nm (11 lb. in.).
16. **FOR LATE BUILDS** Connect injector harness connectors at cylinder head cover gasket.
17. Install wire harness P-clip to cylinder head behind filter housing 24 N·m (18 ft. lbs.).
18. Connect the IAT/MAP sensor connector.
19. Install the fuel filter housing assembly and torque mounting bolts to 24 N·m (18 ft. lbs.).
20. Connect WIF sensor, and fuel heater.

CAUTION: Failure to follow procedure will result in fuel leaks and/or fuel system failure.

21. **Install the fuel rail and high pressure fuel lines as follows:**
    a. Hand tighten fuel rail bolts.
    b. Hand tighten fuel drain line to pressure limiting valve. Hand tighten banjo bolt at fuel filter housing.
    c. Hand tighten fuel rail-to-cylinder head high pressure fuel lines.
    d. Install fuel line brace bolts-to-intake manifold finger tight for fuel lines #2 thru #5.
    e. Install fuel line brace nut to rear lift bracket stud, finger tight, for fuel line #6.
    f. Hand tighten fuel pump to fuel rail line.
    g. Torque fuel line nuts at cylinder head to 30 Nm (22 ft. lbs.).
    h. Torque fuel line nuts at fuel rail to 30 Nm (22 ft. lbs.)
    i. Using a back up wrench, torque fuel pump to fuel rail line to 37 Nm (27 ft. lbs.). At injection pump.
    j. Torque fuel pump to fuel rail line to 37 Nm (27 ft. lbs.) at fuel rail.
    k. Torque fuel drain banjo bolt at pressure limiting valve and front of fuel filter housing to 24 Nm (18 ft. lbs.).
    l. Torque fuel line brace bolts to 24 N·m (18 ft. lbs.).

m. Torque fuel line brace nut to 24 N·m (18 ft. lbs.).

n. Torque rail bolts to 24 Nm (18 ft. lbs.).

o. Connect fuel pressure sensor.

22. Reposition number 6 fuel line shield and torque to 43 N·m (32 ft. lbs.).
23. Install the fuel filter to injection pump low pressure line. Inspect and replace sealing washers if necessary. Torque banjo bolts to 24 N·m (18 ft. lbs.).
24. Connect fuel return line at back of cylinder head hand tight.
25. Connect fuel return line at filter housing hand tight.
26. Torque banjo connections at cylinder head and fuel filter housing to 24 Nm (18 ft. lbs.)
27. Install bracket to rear of filter housing. Torque to 24 Nm (18 ft. lbs.).
28. Using new gaskets, install the intake grid heater and air inlet housing. Torque bolts to 24 N·m (18 ft. lbs.).
29. Install wire harness P-clip and push on clip to air inlet housing.
30. Connect engine oil level indicator tube at fuel filter housing and at air inlet housing.
31. Install the charge air cooler-to-air inlet housing duct assembly. Torque all clamps to 11 N·m (100 in. lbs.).
32. Connect intake grid heater wires.
33. Secure engine harness to front of cylinder head with bolt at four locations.
34. Connect engine coolant temperature sensor connector.
35. Connect radiator upper hose to thermostat housing.
36. Rotate generator into position. Install upper bolt and torque upper and lower bolts.
37. Install wire harness push-on clip below bracket.
38. Install wire harness P-clip to top of bracket.
39. Install fan support and torque to 32 N·m (24 ft. lbs.).
40. Install cooling fan/drive refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
41. Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
42. Install exhaust manifold/turbocharger assembly, using new gaskets. Start all bolts/spacers by hand. Torque bolts to 43 N·m (32 ft. lbs.).
43. Install exhaust manifold heat shield to exhaust manifold studs. Install retaining nuts.Torque to 24 N·m (18 ft. lbs.).
44. Install exhaust bolt retention straps across cylinders 5 & 6.
45. Using a new gasket, connect the turbocharger oil drain tube. Torque to 24 N·m (18 ft. lbs.).
46. Perform the turbocharger pre-lube procedure. Refer to Group 11, Exhaust System and Turbocharger for the correct procedure.
47. Connect the turbocharger oil supply line. Torque to 24 N·m (18 ft. lbs.).
48. Install air cleaner housing and duct.
49. Connect air inlet temperature/pressure sensor.
50. Raise vehicle on hoist.
51. Install exhaust pipe to turbocharger elbow. Torque bolts to 11 N·m (100 in. lbs.).
52. Lower vehicle.
53. Fill engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
54. Start engine and check for leaks.

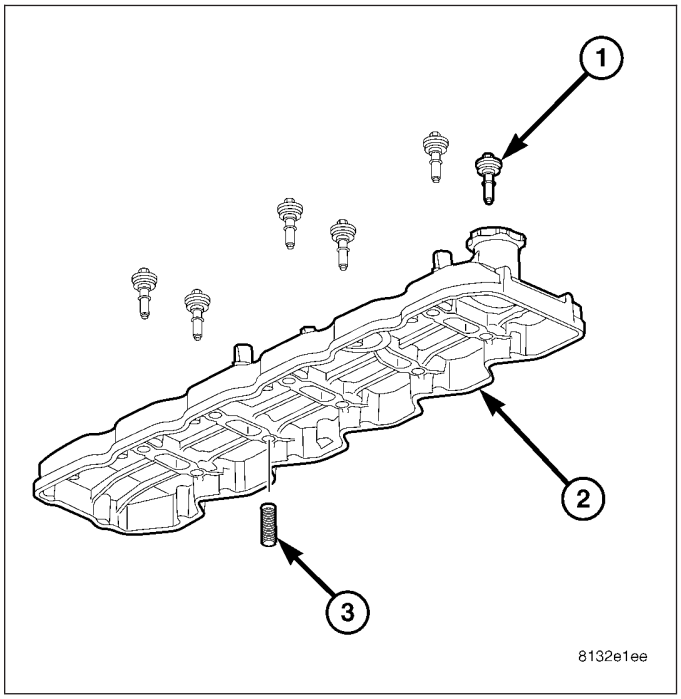
COVER - CYLINDER HEAD

REMOVAL

REMOVAL - CYL HEAD COVER - EARLY

1. Disconnect both battery negative cables.
2. Remove oil fill cap.
3. Remove the breather cover.
4. Disconnect the breather hose and breather drain tube from the breather housing.
5. Remove cylinder head cover bolts (1).
6. Remove the cylinder head cover (2).

NOTE: Verify cylinder head ground spring is still properly retained in cylinder head cover.

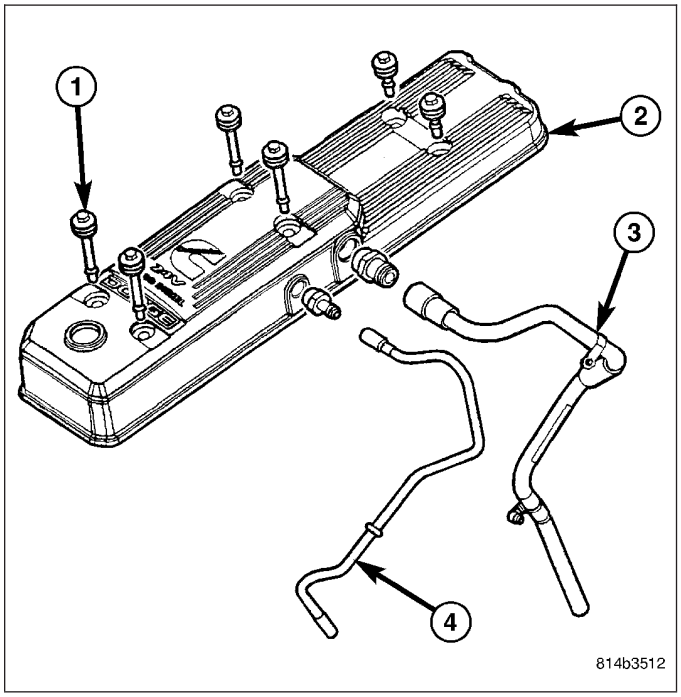


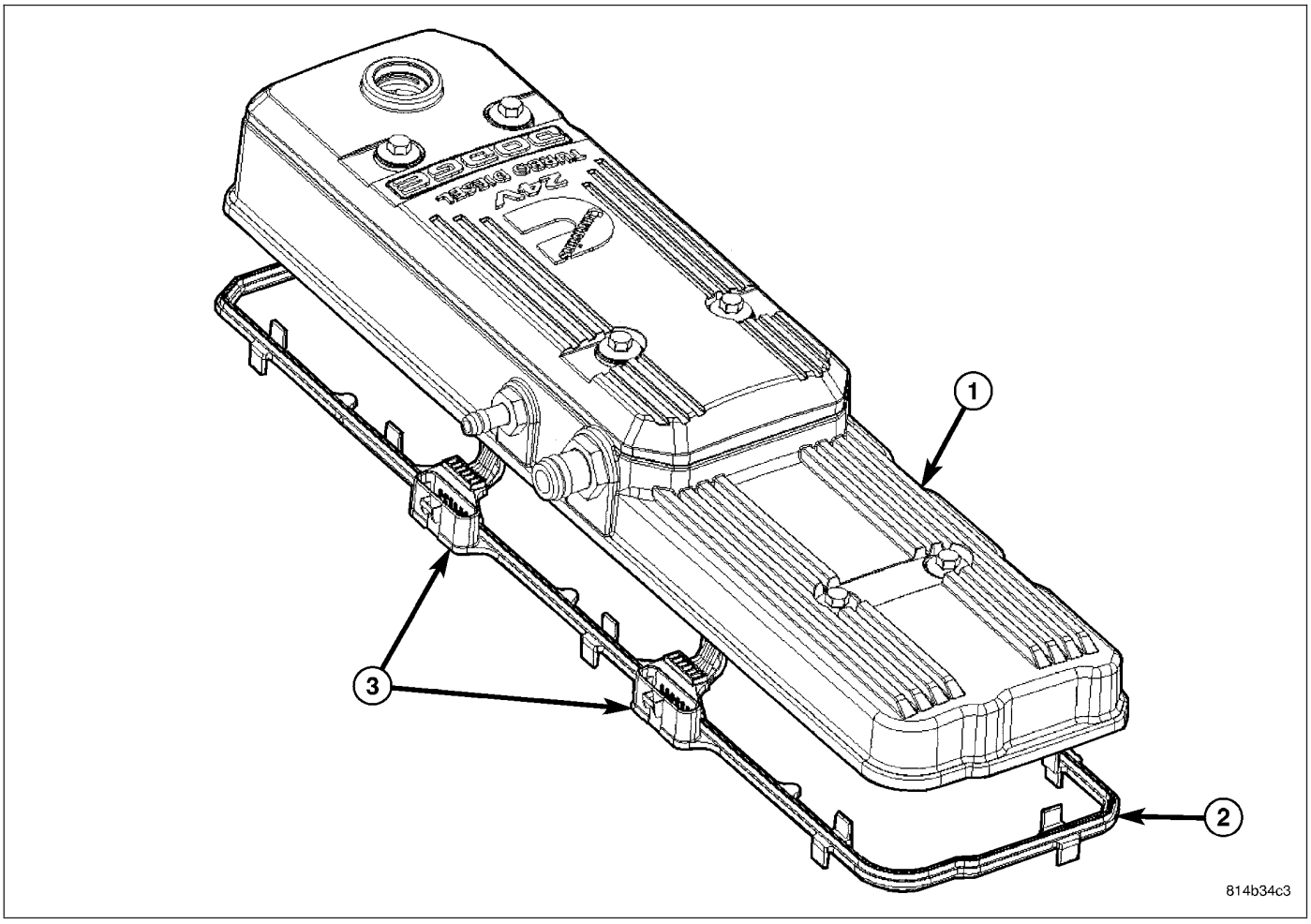
REMOVAL - ROCKER HOUSING

1. Remove cylinder head cover as outlined in this section.
2. **FOR EARLY BUILDS** Disconnect rocker housing injector harness connectors.
3. **FOR EARLY BUILDS** Remove injector harness nuts from injectors.
4. **FOR LATE BUILDS** Remove cylinder head cover gasket.
5. Remove rocker housing bolts.
6. Remove rocker housing and gasket.

REMOVAL - CYL HEAD COVER - LATE

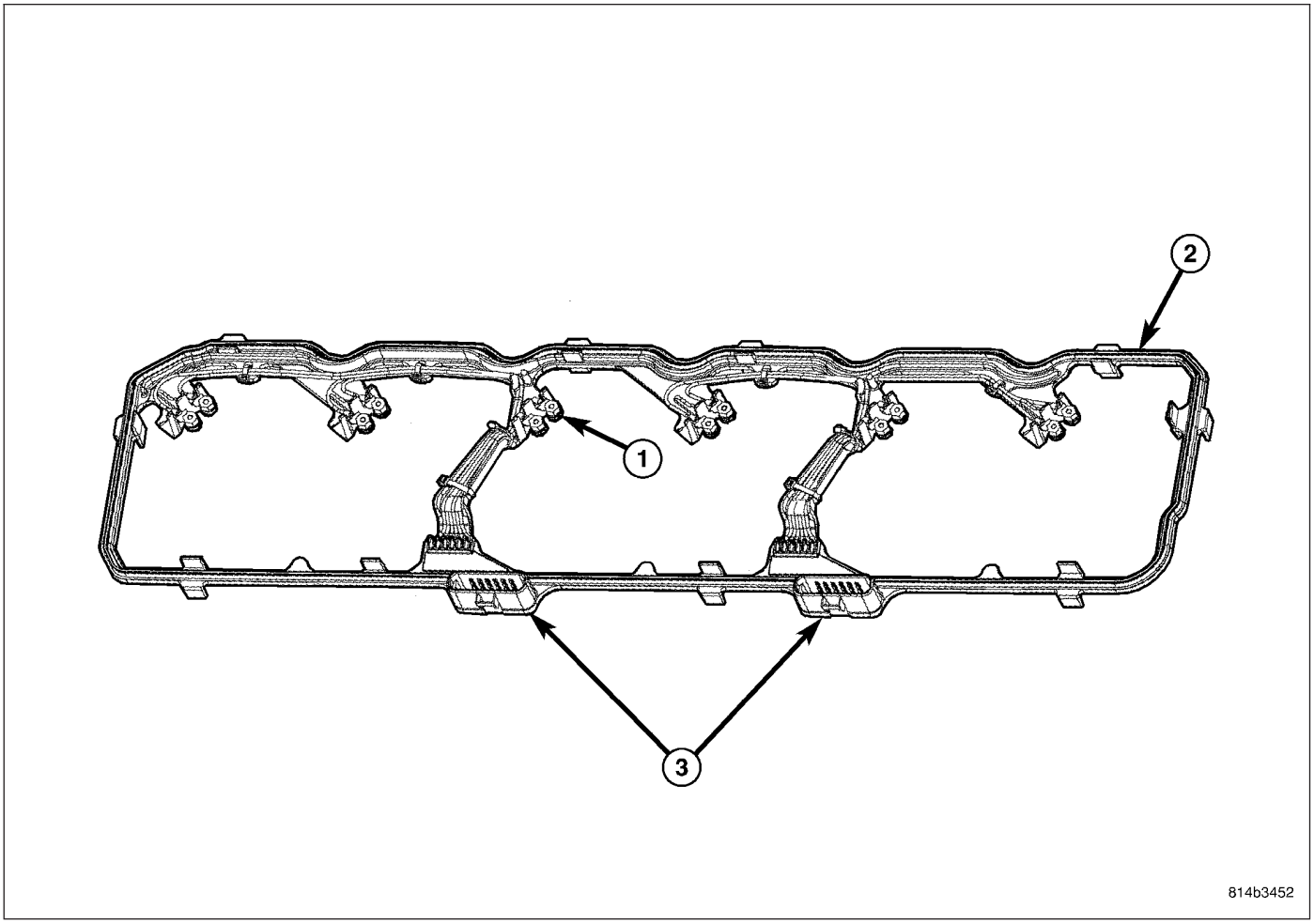
1. Disconnect both negative battery cables.
2. Disconnect the breather tube (3) and breather drain tube (4) from the cylinder head cover.
3. Remove the cylinder head cover bolts.





4. Remove the cylinder head cover (1).

REMOVAL - CYL HEAD COVER GASKET



1. Remove cylinder head cover.
2. Disconnect injector harness connectors (3) at cylinder head cover gasket.
3. Remove injector solenoid nuts (1) at injectors.
4. Remove cylinder head cover gasket (2).

CLEANING

Using a suitable solvent, Clean and dry gasket mating surfaces on cylinder head and rocker housing. Wipe gasket dry and inspect for re-use.

INSPECTION

The cylinder head cover gasket and rocker housing gasket, are reusable. However, should cracks, nicks, or tears be present in the rubber/silicone construction, the defective components should be replaced. Also replace gasket if it is no longer flexible. Inspect cylinder head cover rubber isolated capscrews for cracks, nicks, or tears.**Do not reuse gasket if it has been removed from the groove in the rocker housing or cylinder head cover.**

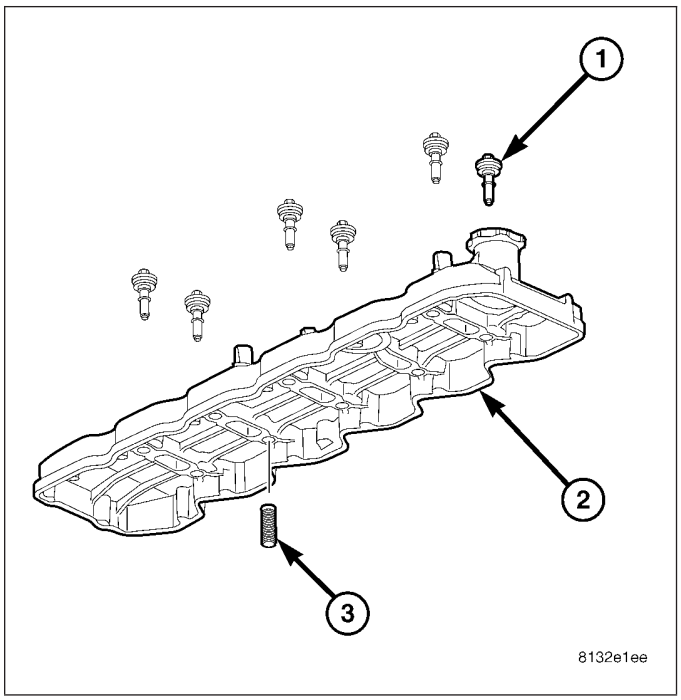
INSTALLATION

INSTALLATION - CYL HEAD COVER - EARLY

1. Inspect cylinder head cover gasket for cuts and proper installation in groove. Replace if damaged.
2. Position cylinder cover on top of rocker housing.

NOTE: Inspect rubber isolators and replace if damaged.

3. Install bolts (1).
4. Starting with the center bolt, torque to 24 N·m (18 ft. lbs.).
5. Install breather hose to breather.
6. Install breather drain hose to breather.
7. Install breather cover and wire harness clip. Torque to 24 N·m (18 ft. lbs.).



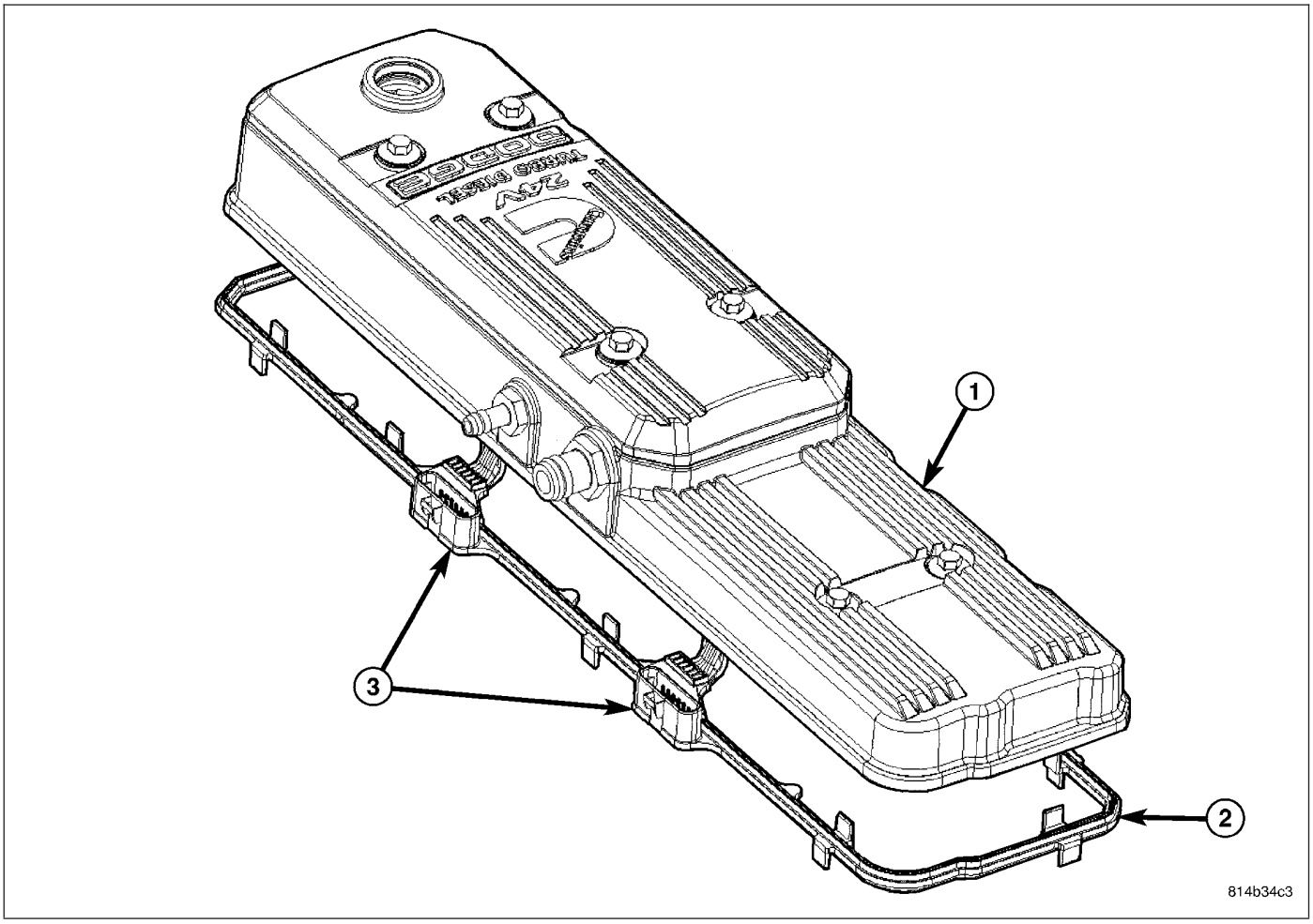
INSTALLATION - ROCKER HOUSING

1. Inspect rocker housing gasket for cuts, nicks, or tears. Replace if damaged or if gasket has come out of groove.
2. Inspect rocker housing gasket for proper installation in groove. Gasket bead must be centered in groove. A gasket bead that is tilted to the side will cause an oil leak.

CAUTION: When installing rocker housing onto cylinder head, do not slide housing from side to side, The gasket could fall out or be damaged.

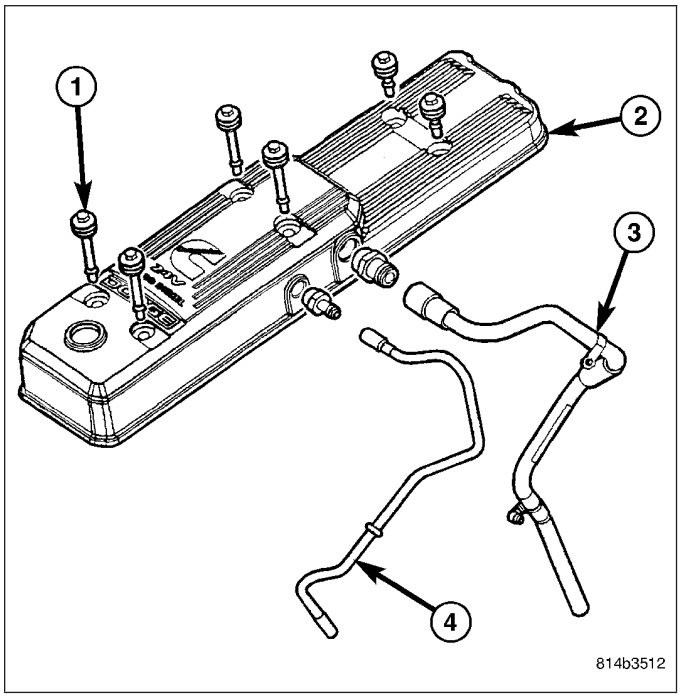
3. Install the rocker housing. Carefully guide the rocker housing evenly down onto the cylinder head.
4. Install rocker housing bolts and tighten finger tight.
5. Torque bolts, working from center out, to 24 Nm (18ft. lbs.).
6. **FOR EARLY BUILDS** Install injector harness nuts to injector solenoid. Torque to 1.25 Nm (11 in. lbs.).
7. **FOR EARLY BUILDS** Connect rocker housing injector harness connections.

INSTALLATION - CYL HEAD COVER - LATE

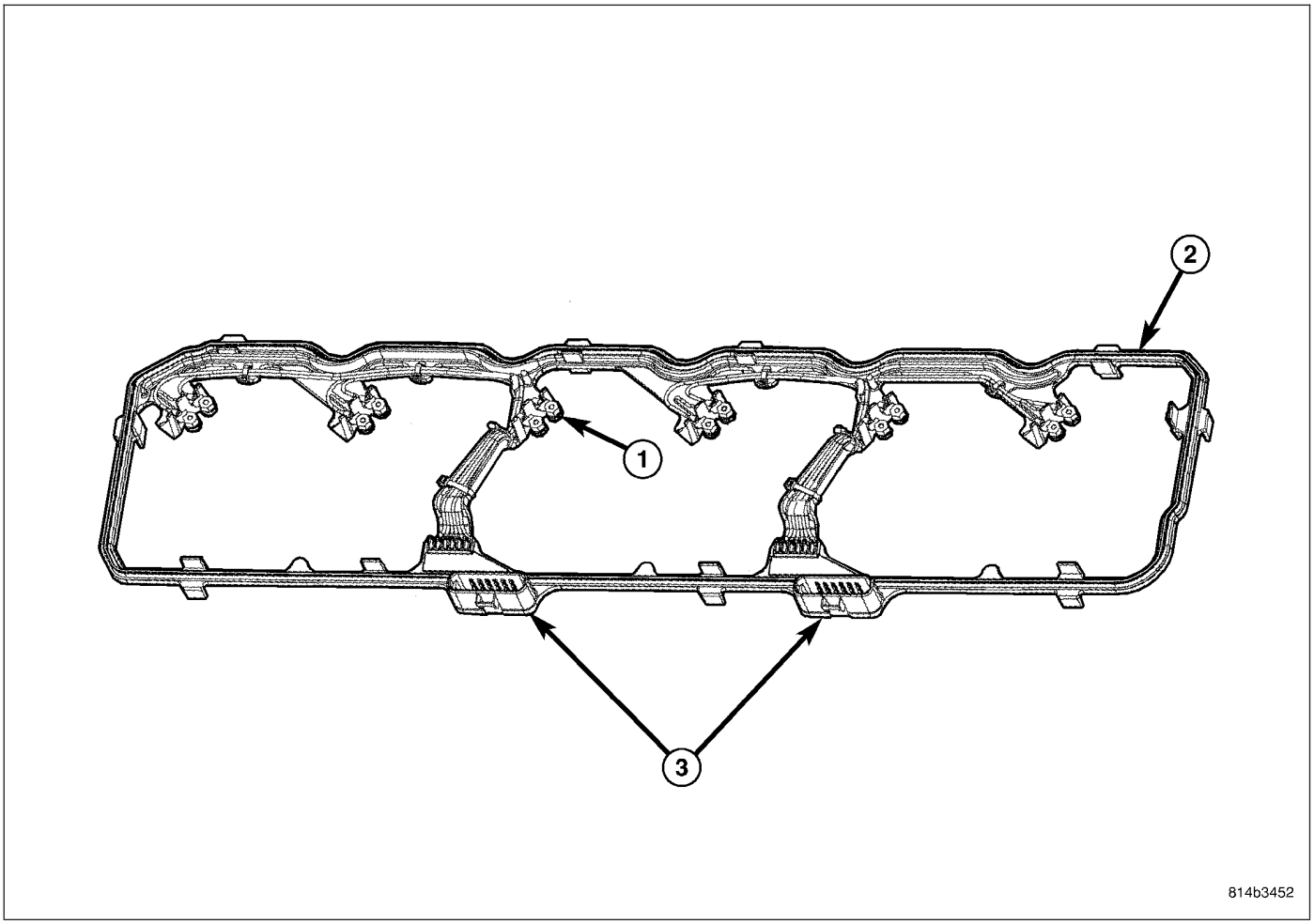


1. Position cylinder head cover (1) on top of cylinder head cover gasket (2).
2. Install bolts finger tight.

3. Starting with the center bolt, torque bolts (1) to 24 N·m (18 ft. lbs.).
4. Install breather tube (3) to cylinder head cover (2).
5. Install breather drain tube (4) to cylinder head cover (2).



INSTALLATION



1. Clean oil from cylinder head cover gasket
2. Inspect cylinder head cover gasket for cuts or damage. Replace if damaged.

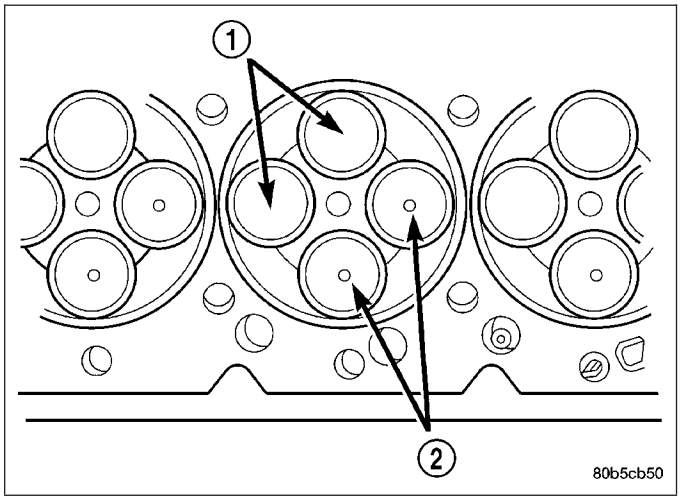
3. Place cylinder head cover gasket on top of rocker housing (2).
4. Install injector solenoid nuts (1) at injectors. Torque to 1.25 N·m (11 in. lbs.).
5. Connect injector harness connectors (3) at cylinder head cover gasket.

VALVES & SEATS - INTAKE/EXHAUST

DESCRIPTION

The valves (1,2) are made of heat resistant steel, and have chrome plated stems to prevent scuffing. The intake and exhaust valves are both similar in head diameter and overall length, but they have unique face angles which makes them non-interchangeable. The valves are distinguished by unique dimples on the exhaust valve head (2).

The exhaust valve springs are made from high strength, chrome silicon steel. The exhaust valve springs are also exhaust brake compatible.

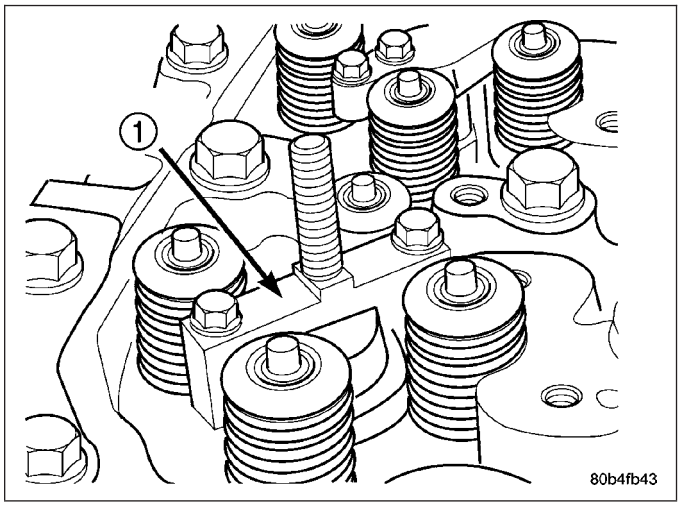


STANDARD PROCEDURE

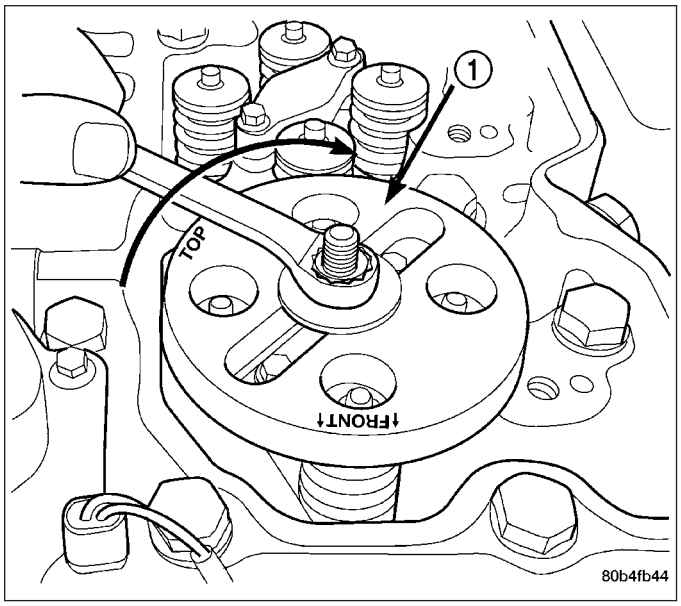
STANDARD PROCEDURE - VALVES, GUIDES AND SPRINGS

REMOVAL

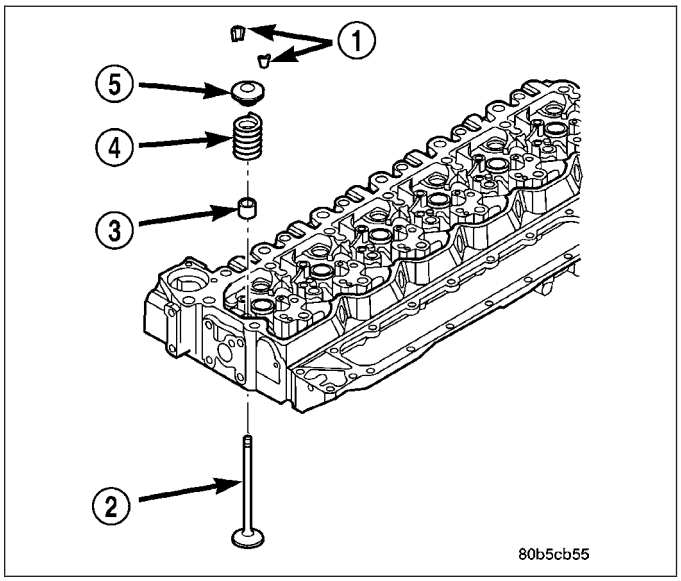
1. Remove cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
2. Support cylinder head on stands, or install head bolts upside down (through combustion surface side) to protect injector tips from damage from work bench.
3. Install the valve spring compressor mounting base (1) as shown.



4. Install the compressor top plate, washer, and nut. Using a suitable wrench, tighten the nut (clockwise) to compress the valve springs and remove the locks.
5. Rotate the compressor nut counter-clockwise to relieve tension on the springs. Remove the spring compressor (1).



6. Remove the retainers (5), springs (4), valve seals (3) (if necessary), and valves (2). Arrange or number all components so they can be installed in their original locations.
7. Repeat the procedure on all cylinders to be serviced.

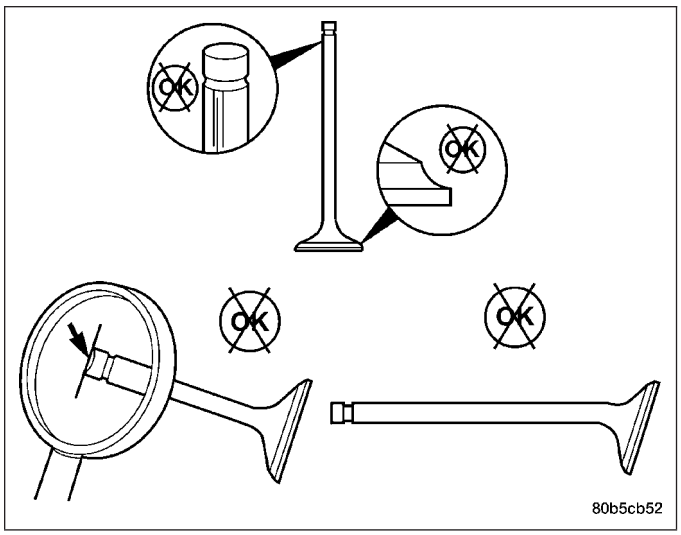


CLEANING

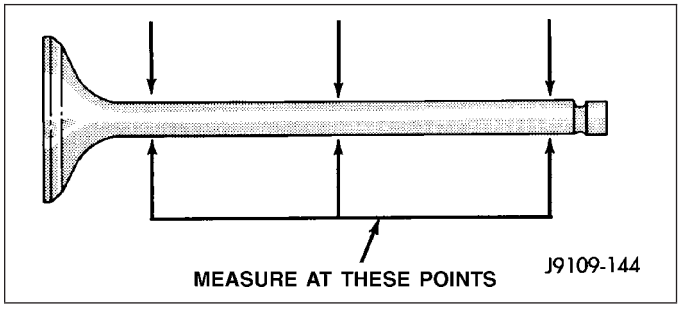
Clean the valve stems with crocus cloth or a Scotch-Brite™ pad. Remove carbon with a soft wire brush. Clean valves, springs, retainers, and valve retaining locks in a suitable solvent. Rinse in hot water and blow dry with compressed air.

INSPECTION

Visually inspect the valves for abnormal wear on the heads, stems, and tips. Replace any valve that is worn out or bent.



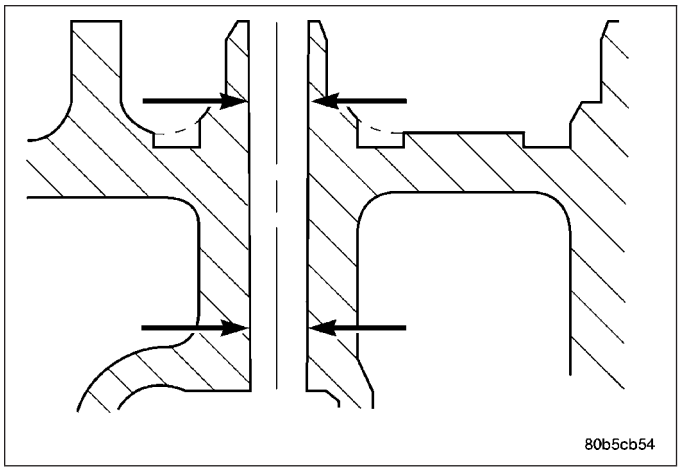
Measure the valve stem diameter in three places as shown.



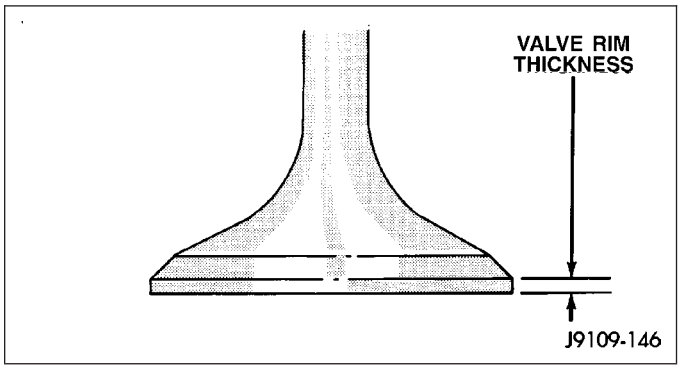
VALVE GUIDE BORE SPECIFICATIONS

VALVE GUIDE BORE SPECIFICATIONS	
Valve guide bore diameter	
Min.	7.027 mm (0.2767 in.)
Max.	7.077 mm (0.2786 in.)
Installed valve guide depth	
Intake	
Min.	0.584 mm (0.023 in.)
Max.	1.092 mm (0.043 in.)
Exhaust	
Min.	0.965 mm (0.028 in.)
Max.	1.473 mm (0.058 in.)

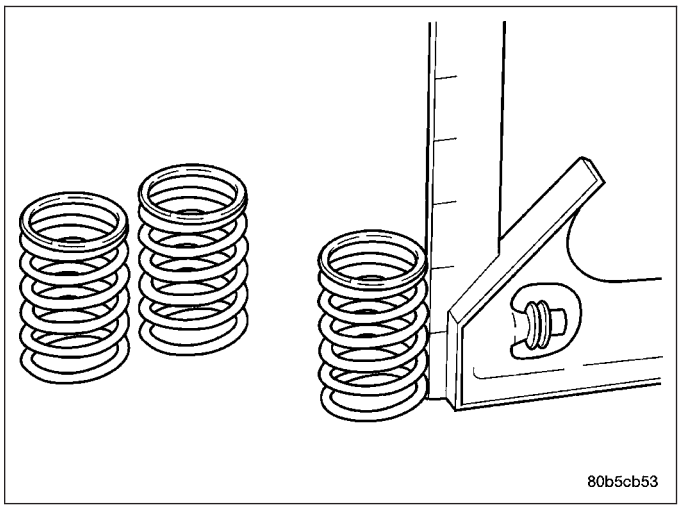
Measure the cylinder head valve guide bore.



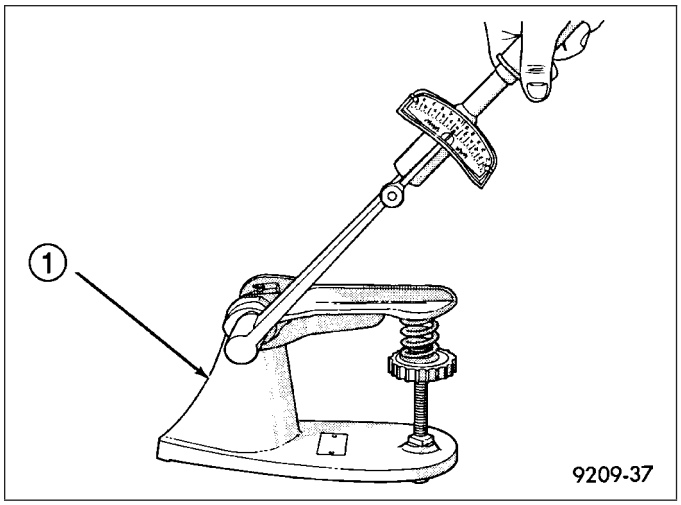
Measure valve margin (rim thickness).



Measure the valve spring free length and maximum inclination.

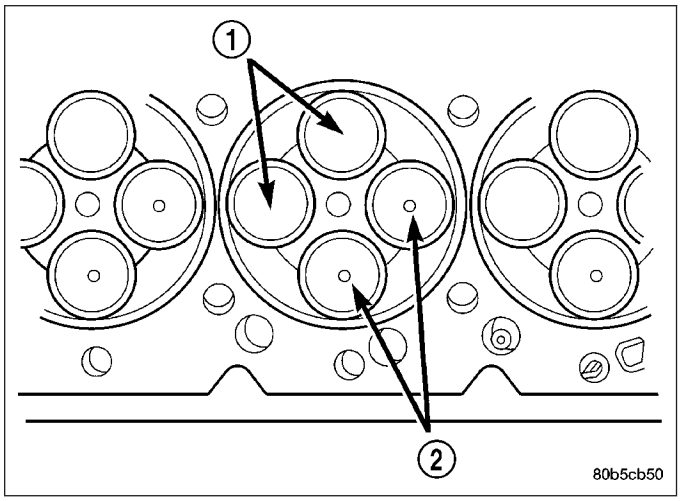


Test valve spring force with tool C-647 (1). Specification 72.0 — 80.7 lbs. when compressed to 35.33 mm (1.39 in.).

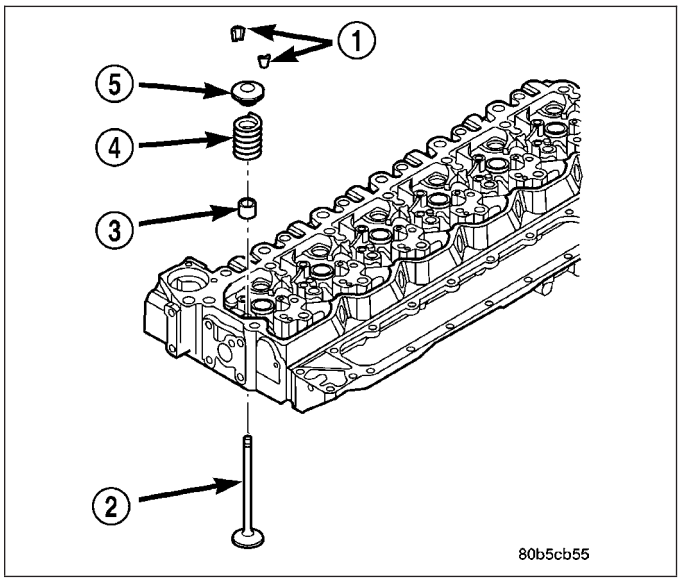


INSTALLATION

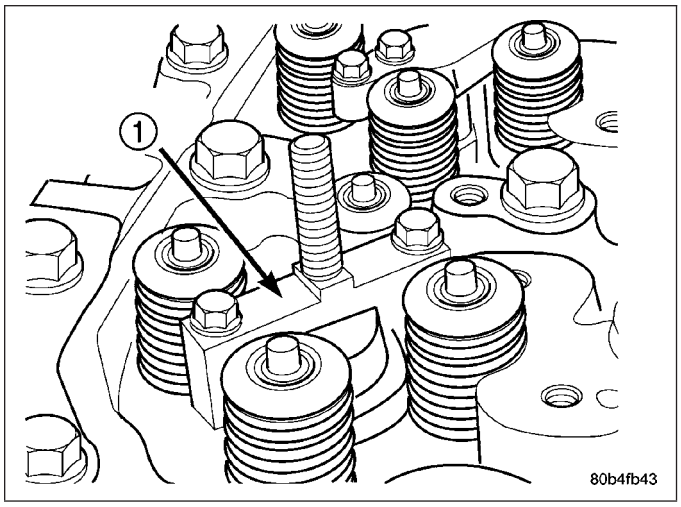
1. Install new valve seals. The yellow seals are for the intake valves and the green seals are for the exhaust valves.
2. Install the valves in their original postion. The exhaust valves are identified by a dimple on the valve head.

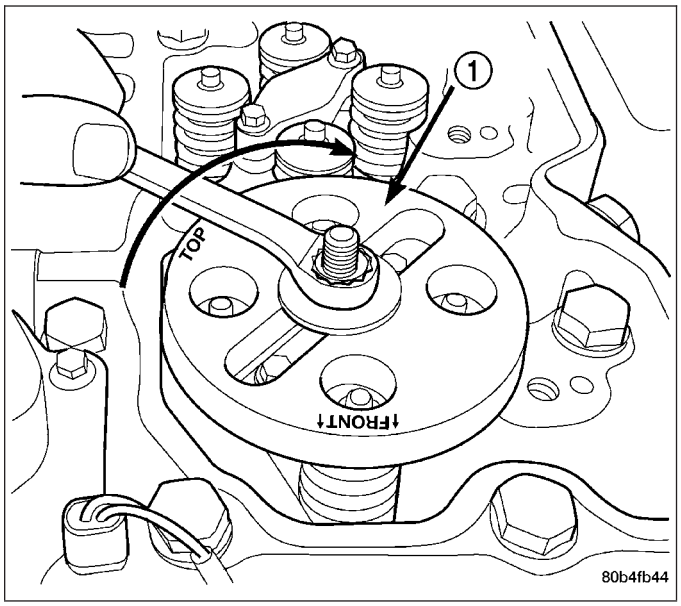


3. Install the valve (2), springs (4), and retainer (5).



4. Install the valve spring compressor tool 8319–A (1)as shown.
5. Compress the valve springs and install the valve retaining locks.
6. Remove the compressor and repeat the procedure on the remaining cylinders.
7. Install new o-ring and sealing washer on injector.
8. Lubricate o-ring and injector bore.
9. Verify sealing washer (shim) was removed with old injector.
10. Install injector Refer to (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
11. Install the cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION).



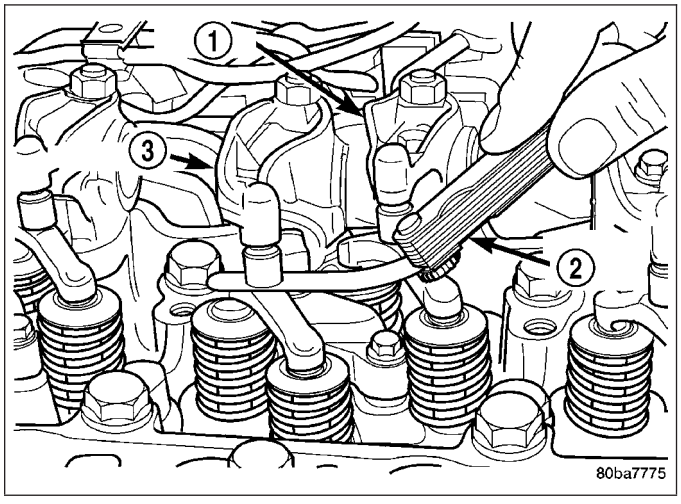


STANDARD PROCEDURE - VALVE LASH ADJUSTMENT AND VERIFICATION

NOTE: To obtain accurate readings, valve lash measurements AND adjustments should only be performed when the engine coolant temperature is less than 60° C (140° F).

The 24–valve overhead system is a “low-maintenance” design. Routine adjustments are no longer necessary, however, measurement should still take place when trouble-shooting performance problems, or upon completion of a repair that includes removal and installation of the valve train components or injectors.

1. Disconnect battery negative cables.
2. Remove cylinder head cover (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).



3. Using the crankshaft barring tool #7471–B, rotate crankshaft to align damper TDC mark to 12:00 o’clock position.
   a. If both number one cylinder rocker levers are loose, continue to next step.
   b. If both number one clylinder rocker levers are not loose, rotate crankshaft 360 degrees.

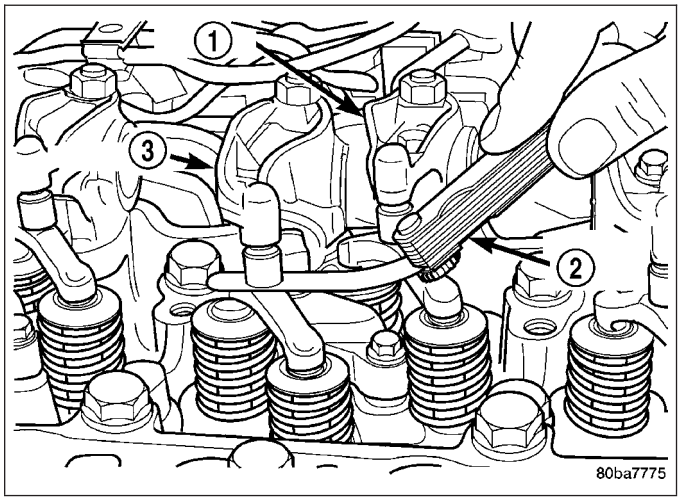
4. With the engine in this position, valve lash can be measured at the following rocker arms: **INTAKE 1–2–4 / EXHAUST 1–3–5**. Measure the valve lash by inserting a feeler gauge between the rocker arm socket and crosshead. Refer to VALVE LASH LIMIT CHART for the correct specifications. If the measurement falls **within** the limits, adjustment/resetting **is not** necessary. If measurement finds the lash **outside** of the limits, adjustment/resetting **is** required.

VALVE LASH LIMIT CHART

INTAKE	EXHAUST
0.152 mm (0.006 in.) MIN.	0.381 mm (0.015 in.) MIN.
0.381 mm (0.015 in.) MAX.	0.762 mm (0.030 in.) MAX.

NOTE:
If measured valve lash falls within these specifications, no adjustment/reset is necessary. Engine operation within these ranges has no adverse affect on performance, emissions, fuel economy or level of engine noise.

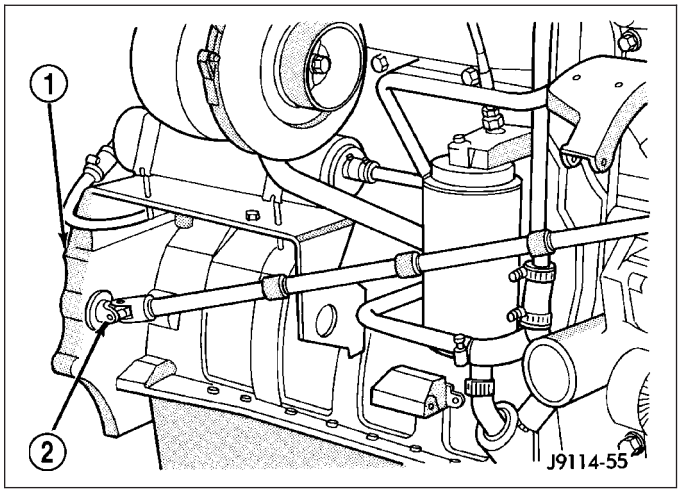
5. If adjustment/resetting is required, loosen the lock nut on rocker arms and turn the adjusting screw until the desired lash is obtained:
   - **INTAKE** 0.254 mm (0.010 in.)
   - **EXHAUST** 0.508 mm (0.020 in.) Tighten the lock nut to 24 Nm (18 ft. lbs.) and re-check the valve lash.
6. Using the crankshaft barring tool, rotate the **crankshaft** one revolution (360°) to align the damper TDC mark to the 12 o'clock position.
7. With the engine in this position, valve lash can be measured at the remaining rocker arms: **INTAKE 3–5–6 / EXHAUST 2–4–6**. Use the same method as above for determining whether adjustment is necessary, and adjust those that are found to be outside of the limits.



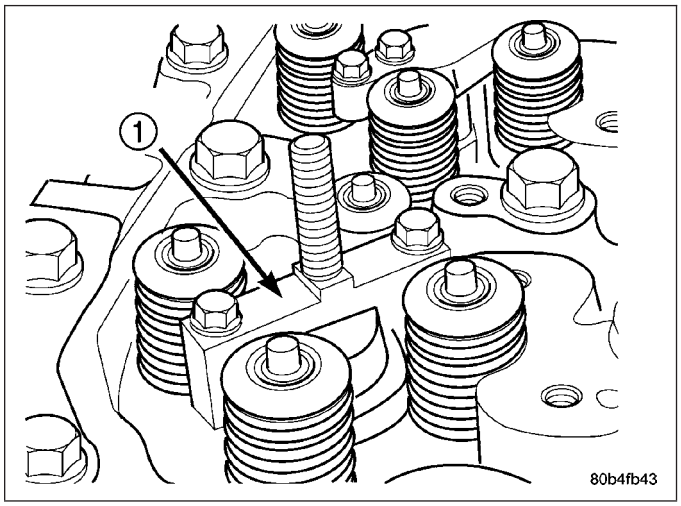
8. Install the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
9. Connect the battery negative cables.

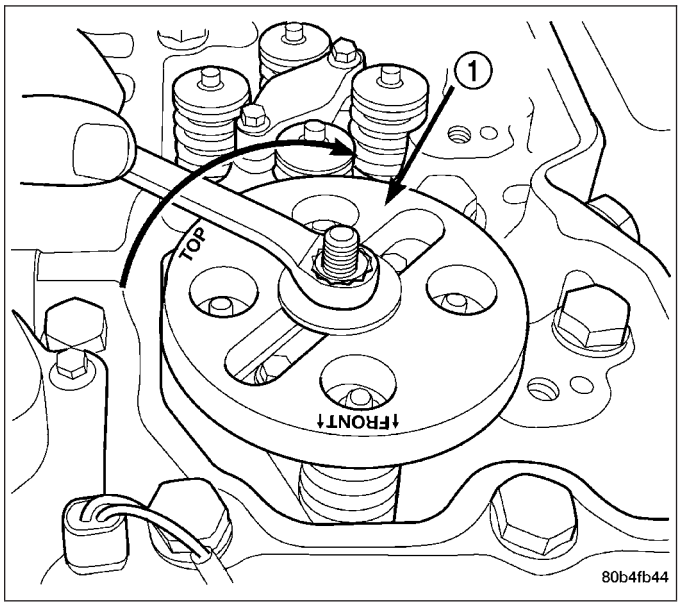
REMOVAL - VALVE SPRINGS AND SEALS

1. Disconnect the battery negative cables.
2. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
3. **FOR EARLY BUILD ENGINES** Disconnect rocker housing injector harness connector. Remove all injector harness solenoid nuts.
4. **FOR LATE BUILD ENGINES** Disconnect the injector harness connectors at cylinder head cover gasket. Remove all injector solenoid nuts. Remove cylinder head cover gasket.
5. Remove injector(s) for cylinder(s) to be serviced. (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL) or (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
6. Remove the rocker housing.

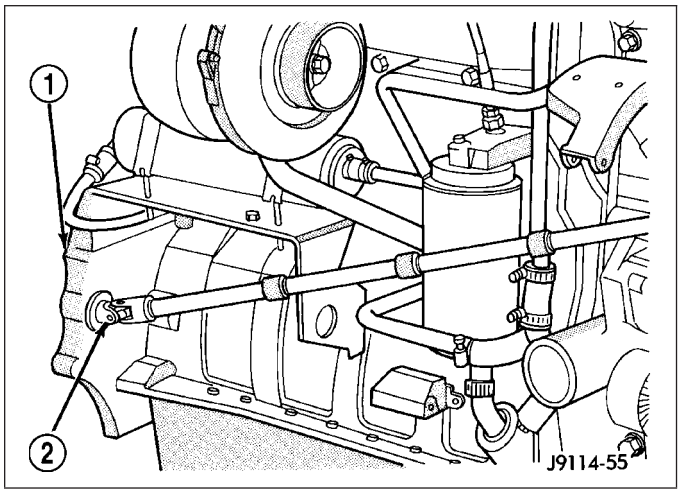


7. Remove the rocker arms and crossheads from the cylinder(s) to be serviced. Mark each component so they can be installed in their original position.
8. Using the crankshaft barring tool #7471–B (2), rotate the engine to position the damper mark in the 12 o'clock position. **At this engine position, cylinders #1 and #6 can be serviced.**
9. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
10. With the damper TDC mark in the 12 o'clock position, add a paint mark anywhere on the gear housing cover next to the crankshaft damper. Place another mark on the vibration damper in alignment with the mark you just made on the cover.
11. Divide the crankshaft damper into three equally sized segments as follows:
    a. Using a tape measure, measure the circumference of the crankshaft damper and divide the measurement by three (3).
    b. Measure that distance in a counter-clockwise direction from the first balancer mark and place another mark on the balancer.
    c. From the second damper mark, again measure in a counter-clockwise direction and place a mark on the damper at the same distance you measured when placing the second damper mark. The damper should now be marked in three equally spaced locations and the damper TDC mark should be in the 12 o'clock position.
    d. Remove injectors, fuel lines, and high pressure connectors for every cylinder that requires repair.
12. Compress the valve springs at cyls. #1 and #6 as follows:
    a. Install the valve spring compressor mounting base as shown in.
    b. Install the top plate, washer, and nut. Using a suitable wrench tighten the nut (clock-wise) to compress the valve springs and remove the collets.
    c. Rotate the compressor nut counter-clockwise to relieve tension on springs. Remove spring compressor.
    d. Remove and replace retainers, springs, and seals as necessary.
    e. **Do not rotate the engine until the springs and retainers are re-installed.**
    f. Install seals, springs and retainers. Install spring compressor, compress valve springs and install the collets.
    g. Release the spring tension and remove the compressor. Verify that the collets are seated by tapping on the valve stem with a plastic hammer.





13. Using the crankshaft barring tool (2), rotate the engine until the next crankshaft damper paint mark aligns with the mark you placed on the cover. **In this position, cylinders #2 and #5 can be serviced.**
14. Repeat the valve spring compressing procedure previously performed and service the retainers, springs, and seals as necessary.
15. Using the crankshaft barring tool, rotate the engine until the next crankshaft damper paint mark aligns with the mark you placed on the cover. **In this position, cylinders #3 and #4 can be serviced.**
16. Repeat the spring compressing procedure previously performed and service the retainers, springs, and seals as necessary.



INSTALLATION

1. Install rocker housing.
2. Install fuel injectors and high pressure fuel lines.
3. Lubricate the valve tips and install the crossheads in their original locations.
4. Lubricate the crossheads and push rod sockets and install the rocker arms and pedestals in their original locations. Tighten bolts to 36 N·m (27 ft. lbs.) torque.
5. **Verify valve lash adjustment (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).**
6. **FOR EARLY BUILDS** Install cylinder head cover and reusable gasket (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
7. **FOR LATE BUILDS** Install cylinder head cover gasket onto rocker housing.
8. Install injector solenoid nuts.
9. Connect injector harness connectors.
10. Install cylinder head cover.
11. Connect battery negative cables.

ROCKER ARM

DESCRIPTION

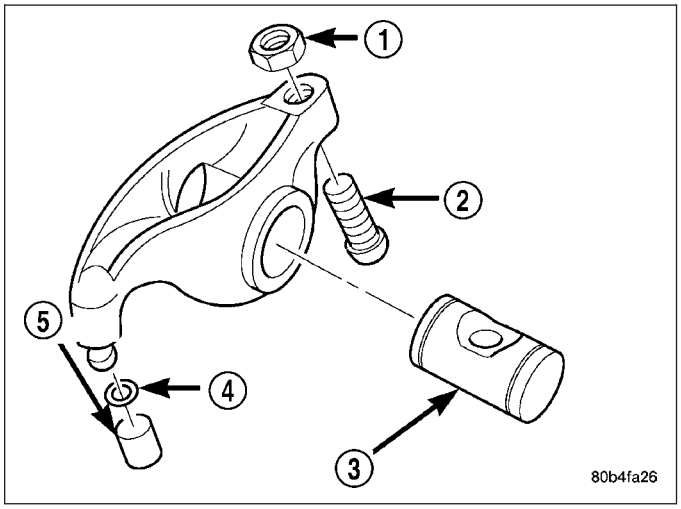
The unique intake and exhaust rocker arms have their own rocker shafts and are lubricated by passages intersecting the cylinder block main oil rifle. Crossheads are used, which allow each rocker arm to operate two valves.

The solid push rods are hardened at the rocker arm and tappet contact areas for superior strength and durability.

REMOVAL

1. Disconnect the battery negative cables.
2. Remove cylinder head cover (Refer to 9 - ENGINE/ CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
3. Remove the rocker arm/pedestal fasteners and remove rocker arm (1) and pedestal (2) from cylinder head. Mark the arms and pedestals so they can be installed in their original position.

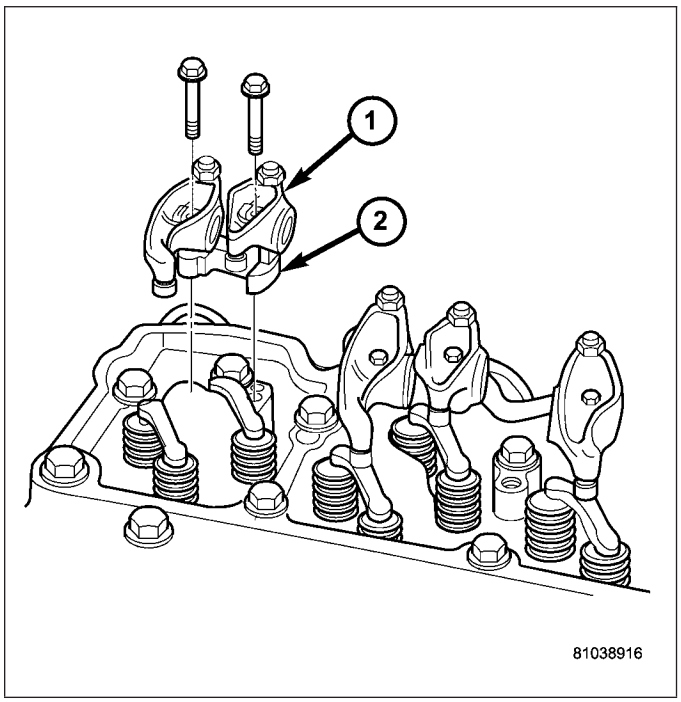
CAUTION: When removing the rocker arms, the sockets may come loose and fall into the engine. Make sure they stay with the arm upon removal/installation.



4. Lift the push rod(s) up and out of the engine. Mark them so they can be installed in their original position.

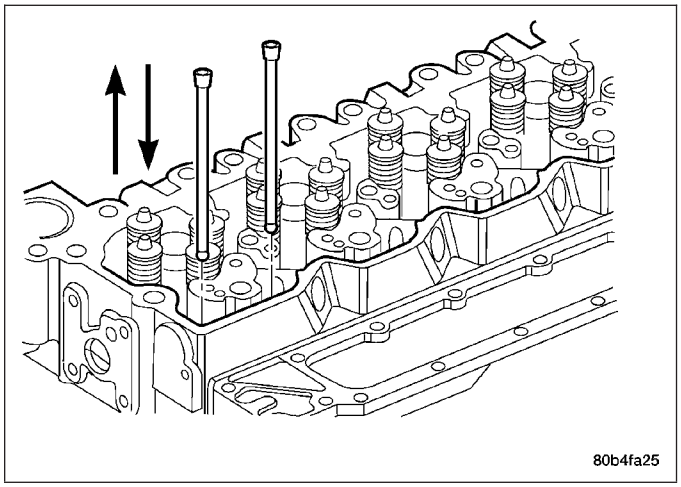
NOTE: The #5 cyl. intake and exhaust and #6 cyl. intake and exhaust push rods must be raised through the provided cowl panel access holes.

5. Lift the crosshead(s) off of the valve stems. Mark them so they can be installed in their original position.



CLEANING

Clean all components in a suitable solvent. If necessary, use a wire brush or wheel to remove stubborn deposits. Rinse in hot water and blow dry with compressed air. Inspect oil passages in rocker arms and pedestals. Apply compressed air to lubrication orifices to purge contaminants.

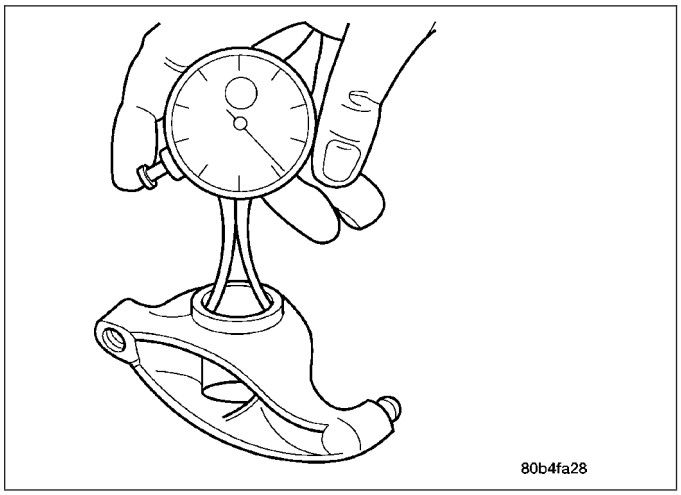


INSPECTION

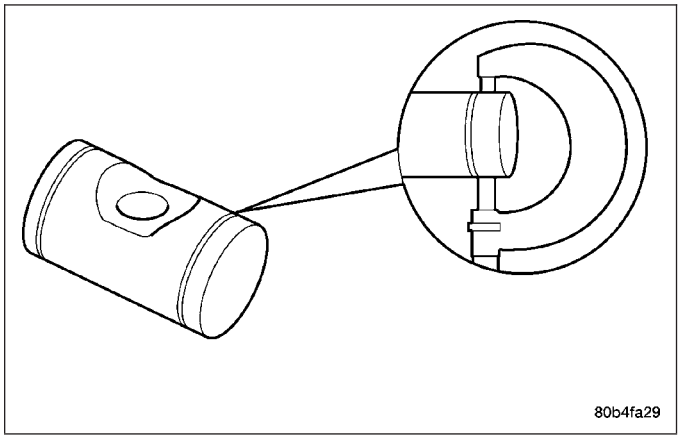
Rocker Arms

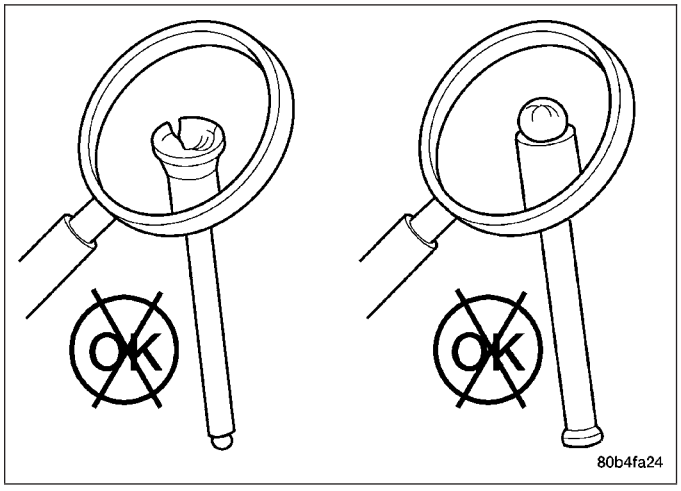
1. Remove rocker shaft and inspect for cracks and excessive wear in the bore or shaft. Remove socket and inspect ball insert and socket for signs of wear. Replace retainer if necessary.

Measure the rocker arm bore and shaft.



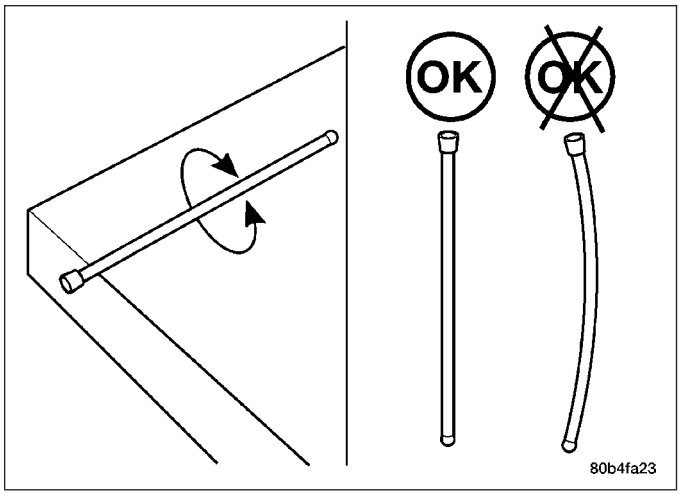
Push Rods





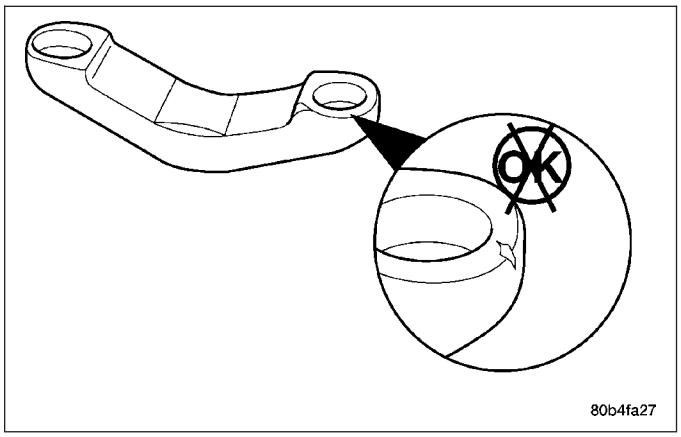
Inspect the push rod ball and socket for signs of scoring. Check for cracks where the ball and the socket are pressed into the tube.

Roll the push rod on a flat work surface with the socket end hanging off the edge. Replace any push rod that appears to be bent.



Crossheads

Inspect the crossheads for cracks and/or excessive wear on rocker lever and valve tip mating surfaces.



INSTALLATION

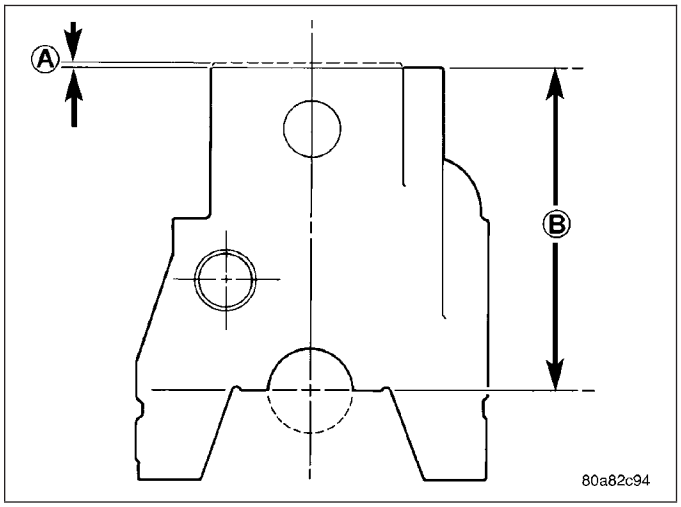
1. If previously removed, install the push rods in their original location. **Verify that they are seated in the tappets.**
2. Lubricate the valve tips and install the crossheads in their original locations.
3. Lubricate the crossheads and push rod sockets and install the rocker arms and pedestals in their original locations. Tighten bolts to 36 N·m (27 ft. lbs.) torque.
4. **Verify valve lash adjustment (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).**
5. **FOR EARLY BUILDS** Install cylinder head cover and reusable gasket (Refer to 9 - ENGINE/CYLINDER HEAD/ CYLINDER HEAD COVER(S) - INSTALLATION).
6. **FOR LATE BUILDS** Install cylinder head cover.
7. Connect battery negative cables.

ENGINE BLOCK

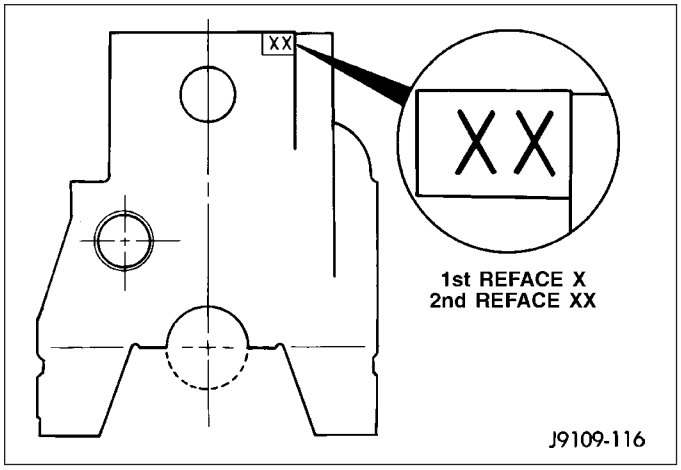
STANDARD PROCEDURE

STANDARD PROCEDURE - CYLINDER BLOCK REFACING

1. The combustion deck can be refaced twice. The first reface should be 0.25 mm (0.0098 inch). If additional refacing is required, an additional 0.25 mm (0.0098 inch) can be removed. Total allowed refacing is 0.50 mm (0.0197 inch).

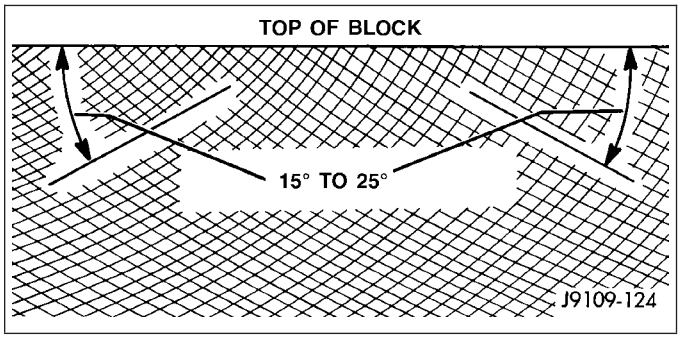


2. The upper right corner of the rear face of the block must be stamped with a X when the block is refaced to 0.25 mm (0.0098 inch). A second X must be stamped beside the first when the block is refaced to 0.50 mm (0.0197 inch).
3. Consult the parts catalog for the proper head gaskets which must be used with refaced blocks to ensure proper piston-to-valve clearance.

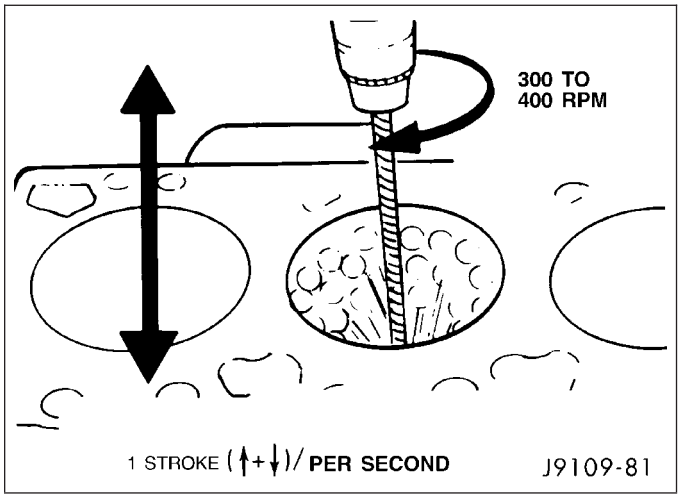


STANDARD PROCEDURE - CYLINDER BORE - DE-GLAZE

1. New piston rings may not seat in glazed cylinder bores.
2. De-glazing gives the bore the correct surface finish required to seat the rings. The size of the bore is not changed by proper de-glazing.
3. Cover the lube and tappet holes in the top of the block with waterproof tape.
4. It crankshaft is installed, wrap connecting rod journals with clean cloth. Cover cloth with waterproof tape.



5. A correctly honed surface will have a crosshatch appearance with the lines at 15° to 25° angles. For the rough hone, use 80 grit honing stones. To finish hone, use 280 grit honing stones.



6. Use a drill, a fine grit Flex-hone and a mixture of equal parts of mineral spirits and SAE 30W engine oil to de-glaze the bores.
7. The crosshatch angle is a function of drill speed and how fast the hone is moved vertically.
8. Vertical strokes MUST be smooth continuous passes along the full length of the bore.
9. Inspect the bore after 10 strokes.
10. Use a strong solution of hot water and laundry detergent to clean the bores. Clean the cylinder bores immediately after de-glazing.
11. Rinse the bores until the detergent is removed and blow the block dry with compressed air.
12. Check the bore cleanliness by wiping with a white, lint free, lightly oiled cloth. If grit residue is still present, repeat the cleaning process until all residue is removed. Wash the bores and the complete block assembly with solvent and dry with compressed air. Place a clean shop towel around the top main bearing saddle to deflect water and residue from piston cooling nozzels. Remove directed piston cooling nozzles if installed.
13. Be sure to remove the tape covering the lube holes, rod journals, and piston cooling nozzles after the cleaning process is complete.

STANDARD PROCEDURE—CYLINDER BORE REPAIR

Cylinder bore(s) can be repaired by one of two methods:

- Method 1:—Over boring and using oversize pistons and rings.
- Method 2:—Boring and installing a repair sleeve to return the bore to standard dimensions.

METHOD 1—OVERSIZE BORE

Cylinder bore(s) can be repaired by one of two methods:

Oversize pistons and rings are available in two sizes - 0.50 mm (0.0197 inch) and 1.00 mm (0.0393 inch).

Any combination of standard, 0.50 mm (0.0197 inch) or 1.00 mm (0.0393 inch) overbore may be used in the same engine.

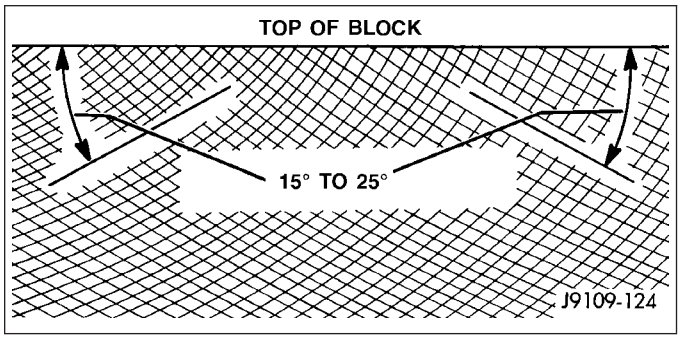
If more than 1.00 mm (0.0393 inch) overbore is needed, a repair sleeve can be installed (refer to Method 2—Repair Sleeve).

Cylinder block bores may be bored twice before use of a repair sleeve is required. The first bore is 0.50 mm (0.0197 inch) oversize. The second bore is 1.00 mm (0.0393 inch) oversize.

After boring to size, use a honing stone to chamfer the edge of the bore.

CYLINDER BORE DIMENSION CHART

DESCRIPTION	MEASUREMENT
BORING DIAMETER DIMENSION	1st. REBORE - 102.469 mm (4.0342 in.)
	2nd. REBORE - 102.969 mm (4.0539 in.)
HONING DIAMETER DIMENSIONS	STANDARD - 102.020 ± 0.020 mm (4.0165 ± 0.0008 in.)
	1st. REBORE - 102.520 ± 0.020 mm (4.0362 ± 0.0008 in.)
	2nd. REBORE - 103.020 ± 0.020 mm 4.0559 ± 0.0008 in.)
CHAMFER DIMENSIONS	Approx. 1.25 mm (0.049 in.) by 30°



A correctly honed surface will have a crosshatch appearance with the lines at 15° to 25° angles with the top of the cylinder block. For the rough hone, use 80 grit honing stones. To finish hone, use 280 grit honing stones.

A maximum of 1.2 micrometer (48 microinch) surface finish must be obtained.

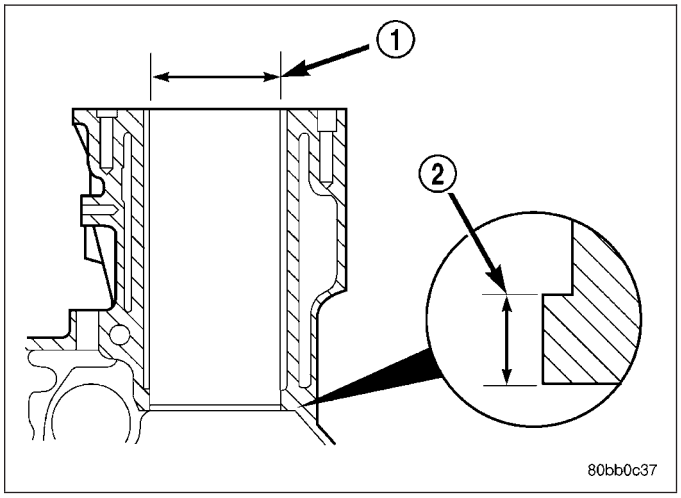
After finish honing is complete, immediately clean the cylinder bores with a strong solution of laundry detergent and hot water.

After rinsing, blow the block dry.

Check the bore cleanliness by wiping with a white, lint-free, lightly- oiled cloth. There should be no grit residue present.

If the block is not to be used right away, coat it with a rust- preventing compound.

METHOD 2—REPAIR SLEEVE



REPAIR SLEEVE BLOCK REBORE DIMENSIONS CHART

BORE DIAMETER	STEP DIMENSION
104.500 + 0.015 mm (4.1142 + 0.0006 in.)	6.35 mm (0.25 in.)

If more than a 1.00 mm (0.03937 inch) diameter oversize bore is required, the block must be bored and a repair sleeve installed.

Bore the block cylinder bore to 104.500-104.515 mm (4.1142-4.1148 inch).

Repair sleeves can be replaced by using a boring bar to bore out the old sleeve. DO NOT cut the cylinder bore beyond the oversize limit.

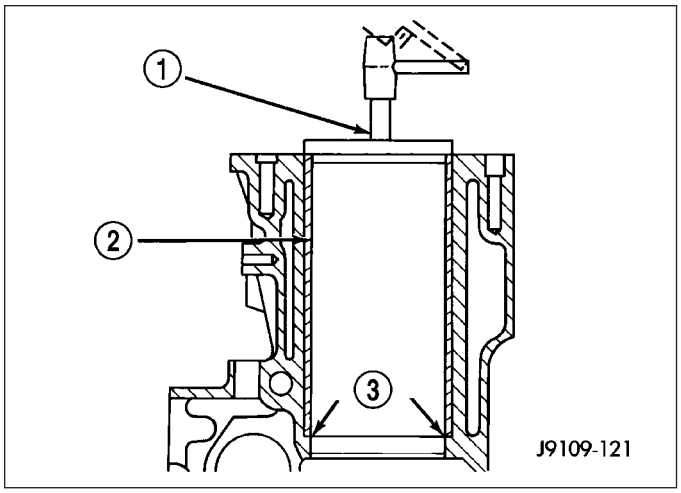
After machining the block for the new repair sleeve, thoroughly clean the bore of all metal chips, debris and oil residue before installing the sleeve.

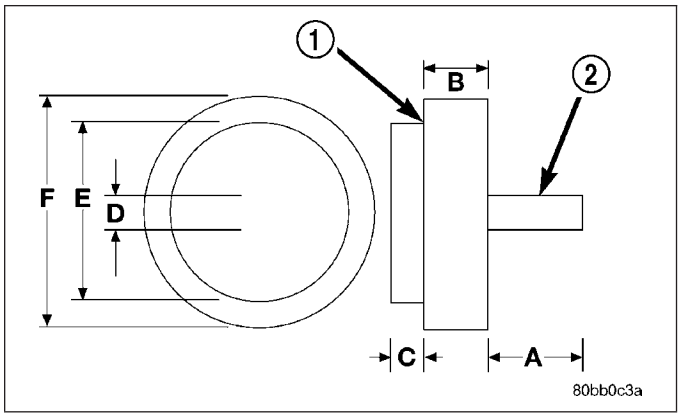
Cool the repair sleeve(s) to a temperature of -12°C (10°F) or below for a minimum of one hour. Be ready to install the sleeve immediately after removing it from the freezer.

Apply a coat of Loctite 620, or equivalent to the bore that is to be sleeved.

Wear protective gloves to push the cold sleeve into the bore as far as possible.

Using a sleeve driver (1), drive the sleeve (2) downward until it contacts the step at the bottom of the bore.





SLEEVE DRIVER CONSTRUCTION SPECIFICATION CHART

ITEM	MEASUREMENT
A	127 mm (5 in.)
B	38 mm (1.5 in.)
C	6.35 mm (0.25 in.)
D	25.4 mm (1 in.)
E	101 mm (3.976 in.)
F	107.343 mm (4.226 in.)

A sleeve driver can be constructed as shown.

SLEEVE MACHINING DIMENSIONS CHART

ITEM	MEASUREMENT
SLEEVE PROTRUSION	MIN. - FLUSH WITH BLOCK
	MAX. - 0.050 mm (0.0019 in.)
SLEEVE DIAMETER	101.956 mm (4.014 in.)
SLEEVE CHAMFER	APPROX. 1.25 mm (0.049 in.) by 15°

Set up a boring bar and machine the sleeve to 101.956 mm (4.014 inch).

After removing the boring bar, use a honing stone to chamfer the corner of the repair sleeve(s).

A correctly honed surface will have a crosshatch appearance with the lines at 15° to 25° angles with the top of the cylinder block. For the rough hone, use 80 grit honing stones. To finish hone, use 280 grit honing stones.

Finished bore inside dimension is 102.020 ±0.020 mm (4.0165 ±0.0008 inch).

A maximum of 1.2 micrometer (48 microinch) surface finish must be obtained.

After finish honing is complete, immediately clean the cylinder bores with a strong solution of laundry detergent and hot water.

After rinsing, blow the block dry with compressed air.

Wipe the bore with a white, lint-free, lightly oiled cloth. Make sure there is no grit residue present.

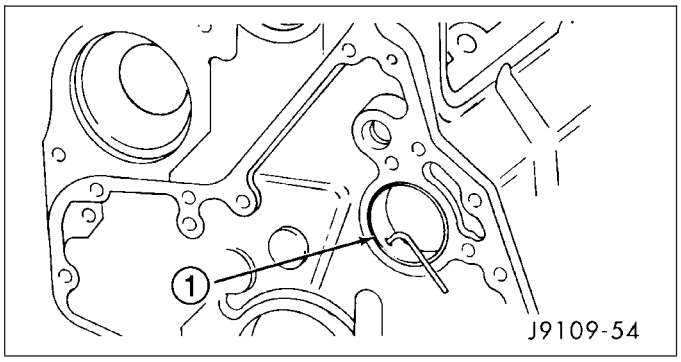
Apply a rust-preventing compound if the block will not be used immediately.

A standard diameter piston and a piston ring set must be used with a sleeved cylinder bore.

STANDARD PROCEDURE - CAM BORE REPAIR

For standard bushings, not oversized, maximum front cam bushing bore diameter is 59.248 mm. (2.3326 in.). DO NOT bore the intermediate cam bore to the front cam bore oversize dimensions. Maximum front camshaft bushing installed diameter is 54.147 mm. (2.1318 in.). Minimum installed diameter is 54.083 mm. (2.1293 in.). Maximum intermediate camshaft bore diameter is 54.164 mm. (2.1324 in.).

A surface finish of 2.3 micrometers (92 microinch) must be maintained. Not more than 20% of an area of any one bore may be 3.2 micrometers (126 microinch).



Camshaft bores can be repaired individually. It is not necessary to repair undamaged cam bores in order to repair individually damaged cam bores. The standard front bushing (1) cannot be used to repair intermediate bores.

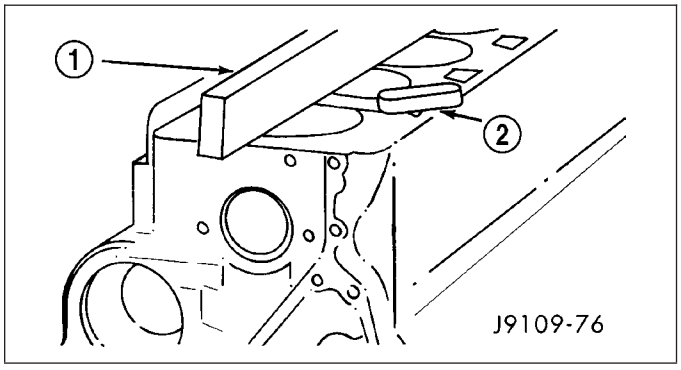
Install all cam bushings flush or below the front and rear cam bore surface. The front camshaft bushing should be installed flush with front face of block. The oil hole must align to allow a 3.2 mm (0.125 inch) rod to pass through freely.

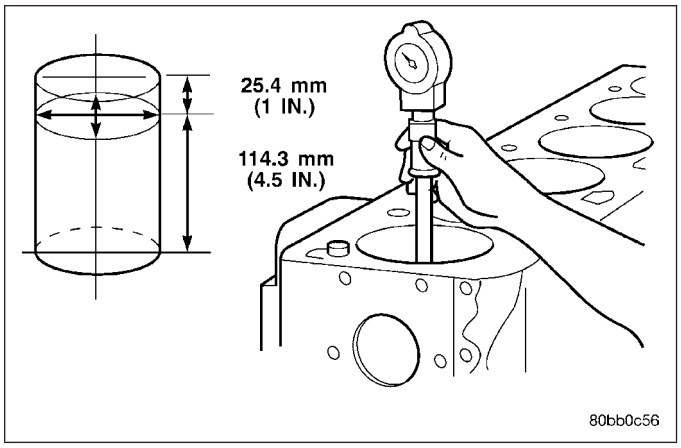
INSPECTION

Measure the combustion deck face using a straight edge (1) and a feeler gauge (2). Cylinder block flatness: End-to-end 0.076 mm (.003 in.). Maximum variation side-to-side 0.051 mm (.002 in.).

Inspect for any localized dips or imperfections.

If the surface exceeds the limit, (Refer to 9 - ENGINE/ ENGINE BLOCK - STANDARD PROCEDURE).





BORE SPECIFICATIONS

BORE DIAMETER		
	Min.	102.000 mm (4.0157 in.)
	Max.	102.116 mm (4.0203 in.)
OUT OF ROUNDNESS		
	Max.	0.038 mm (0.0015 in.)
TAPER		
	Max.	0.076 mm (.003 in.)

Inspect the cylinder bores for damage or excessive wear.

Measure the cylinder bores. If the cylinder bores exceed the limit, (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE).

Inspect the camshaft bores for scoring or excessive wear.

Measure the camshaft bores (Refer to 9 - ENGINE - SPECIFICATIONS).

If a bore exceeds the limit, (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - STANDARD PROCEDURE).

Inspect the tappet bores for scoring or excessive wear.

Measure tappet bore from bottom of block. Minimum tappet bore diameter 16.000 mm (0.0630 in.). Maximum tappet bore 16.055 mm. (0.632 in.).

If out of limits, replace the cylinder block.

CAMSHAFT & BEARINGS (IN BLOCK)

REMOVAL

CAMSHAFT BEARINGS

NOTE: Measure the diameter of each bore. If the camshaft bore for the first or rear cam bushing is worn beyond the limit, install a new service bushing. Inspect the rest of the camshaft bores for damage or excessive wear.If the bores without a bushing are worn beyond the limit, the engine must be removed for machining and installation of service bushings. If badly worn, replace the cylinder block.

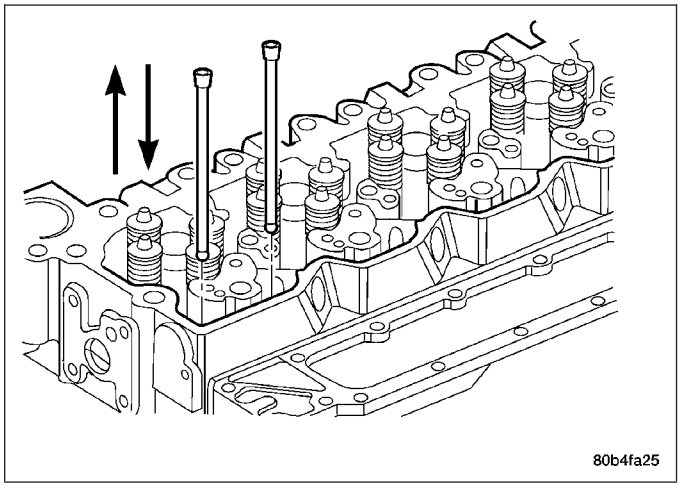
1. Remove the camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).
2. Remove the bushing from the No.1 bore.

3. Mark the cylinder block so you can align the oil hole in the cylinder block with the oil hole in the bushing.

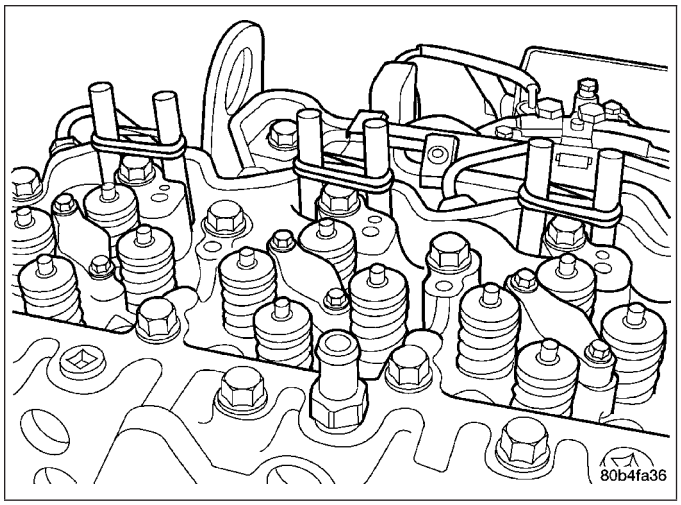
CAMSHAFT

1. Disconnect both battery negative cables.
2. Recover A/C refrigerant (if A/C equipped) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
3. Raise vehicle on hoist.
4. Drain engine coolant into container suitable for re-use (Refer to 7 - COOLING - STANDARD PROCEDURE).
5. Lower vehicle.
6. Remove radiator upper hose.
7. Remove viscous fan/drive/shroud assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
8. Disconnect the coolant recovery bottle hose from the radiator filler neck.
9. Disconnect lower radiator hose from radiator outlet.
10. **Automatic Transmission models:** Disconnect transmission oil cooler lines from front of radiator using Special Tool 6931 (unless equipped with finger-release disconnect).
11. Remove radiator mounting screws and lift radiator out of engine compartment.
12. Remove upper radiator support panel.
13. If A/C equipped, disconnect A/C condenser refrigerant lines.
14. Disconnect charge air cooler piping from the cooler inlet and outlet.
15. Remove the two charge air cooler mounting bolts.
16. Remove charge air cooler (and A/C condenser if equipped) from vehicle.
17. Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
18. Remove accessory drive belt tensioner.
19. Remove the fan support/hub assembly.
20. Remove crankshaft damper and speed indicator ring (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
21. Remove the gear cover-to-housing bolts and gently pry the cover away from the housing, taking care not to mar the sealing surfaces. Remove dust seal with cover.
22. Using Special Tool 7471–B Crankshaft Barring Tool, rotate the crankshaft to align the timing marks on the crankshaft and the camshaft gears.
23. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
24. Remove the rocker arms, cross heads, and push rods. Mark each component so they can be installed in their original positions.

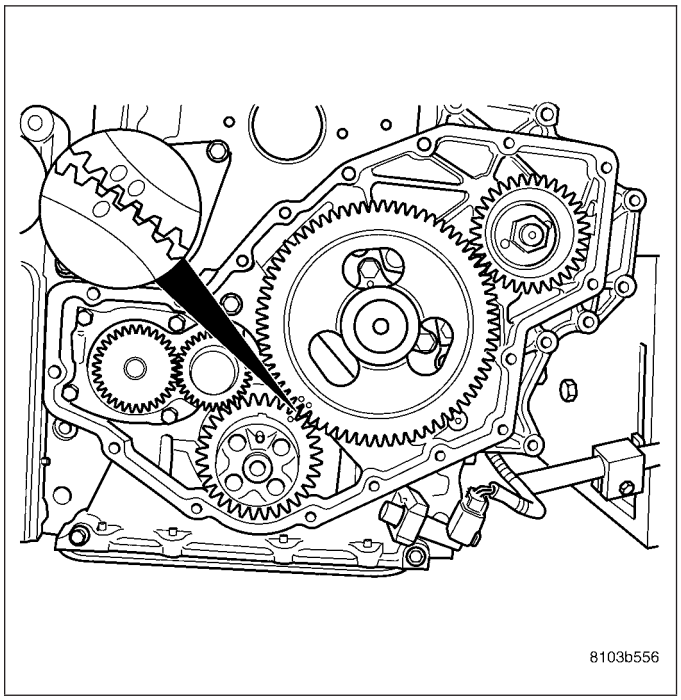
NOTE: The #5 cylinder intake and the #6 cylinder intake and exhaust pushrods are removed by lifting them up and through the provided cowl panel access holes. Remove the rubber plugs to expose these relief holes.



25. Raise the tappets as follows, using the wooden dowel rodsprovided with the Miller Tool Kit 8502.
    a. Insert the slotted end of the dowel rod into the tappet. **The dowel rods for the rear two cylinders will have to be cut for cowl panel clearance.** Press firmly to ensure that it is seated in the tappet.
    b. Raise the dowel rod to bring the tappet to the top of its travel, and wrap a rubber band around the dowel rods to prevent the tappets from dropping into the crankcase.
    c. Repeat this procedure for the remaining cylinders.



26. Verify that the camshaft timing marks are aligned with the crankshaft mark.
27. Remove the bolts from the thrust plate.
28. Remove engine mount through bolts.
29. Install engine support fixture special tool # 8534, **and steel bracket/wing nut special tool # 8534A**.
30. Raise engine enough to allow camshaft removal.
31. Remove the camshaft, gear and thrust plate.



INSPECTION

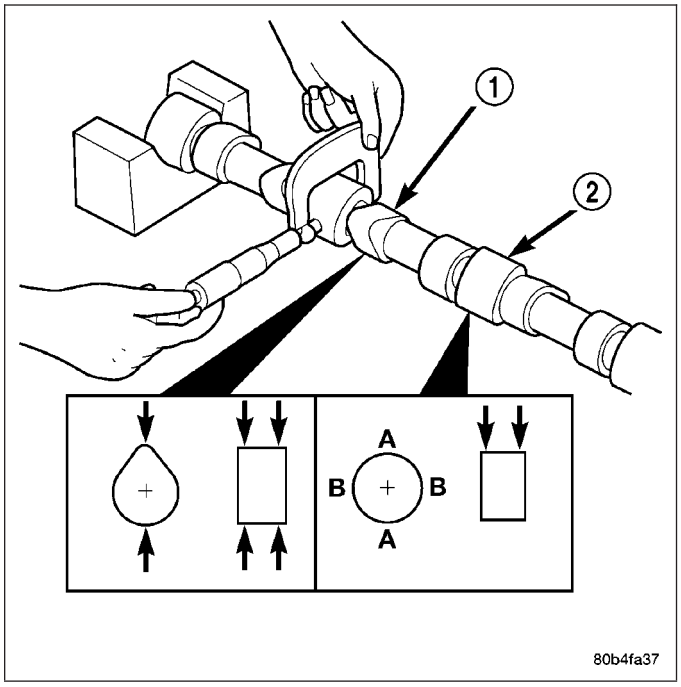
Camshaft

CAMSHAFT DIMENSIONS

CAMSHAFT DIMENSIONS	
Journal diameter (No.1 and No.7)	
Min.	54.028 mm. (2.127 in.)
Max.	54.048 mm. (2.128 in.)
Journal diameter (No.2 through No.6)	
Min.	53.962 mm. (2.1245 in.)
Max.	54.013 mm. (2.1265 in.)
Diameter of peak of lobe	
Intake	
Min.	47.175 mm (1.857 in.)
Max	47.855 mm.
Exhaust	
Min.	45.632 mm. (1.797 in.)
Max.	46.312 mm. (1.823 in.)

1. Inspect the valve lobes (1) and bearing journals (2) for cracks, pitting, scoring, or generally excessive wear. Replace any camshaft that exceeds the allowable limits.
2. Measure the bearing journals and lobes.

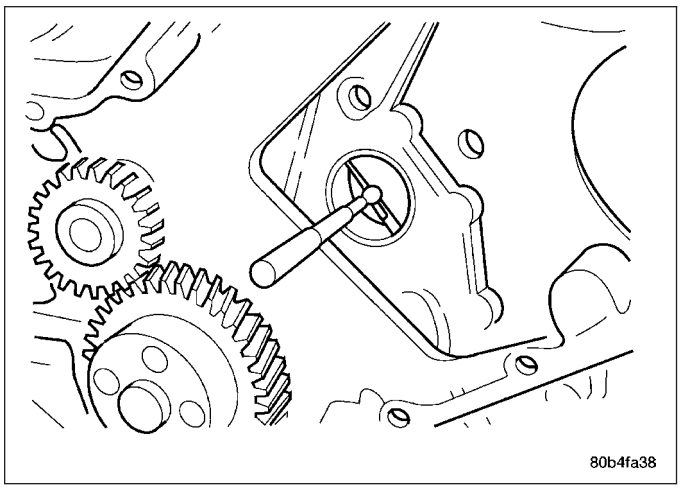
CAUTION: If Camshaft lobes are worn, requiring camshaft replacement, it is necessary to replace the tappets also. (Refer to 9 - ENGINE/ENGINE BLOCK/SOLID LIFTERS - REMOVAL).



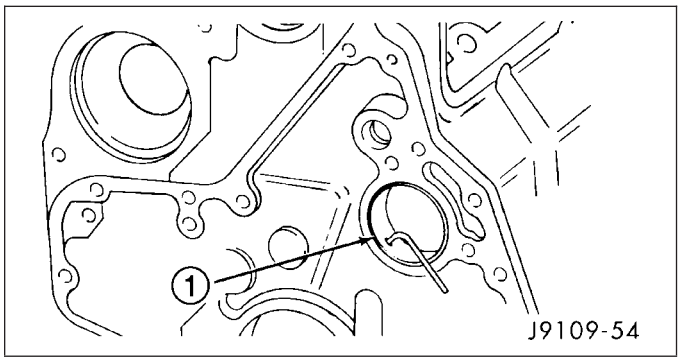
Camshaft Bushing/Bores

Camshaft bores No. 2–7 **do not** use a bushing.

1. Inspect the camshaft bushing and bores for signs of excessive wear.
2. Measure the camshaft bushing and bores with a telescoping bore gauge and micrometer. If out of specification, (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).



3. Inspect the camshaft bushing (1) oil holes for alignment with cylinder block.



Camshaft Gear

Inspect the camshaft gear for cracks (gear and hub), and chipped/broken/fretted teeth. If replacement is necessary, camshaft and gear are replaced as an assembly. (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).

Thrust Plate

CAMSHAFT THRUST PLATE THICKNESS CHART

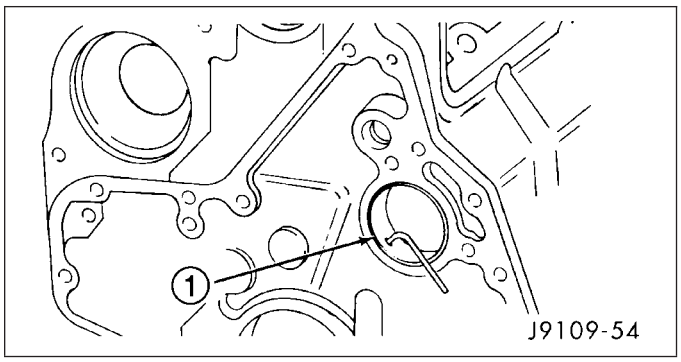
MIN. 9.34 mm (0.368 in.)
MAX. 9.60 mm (0.378 in.)

Inspect the camshaft thrust plate for excessive wear in the camshaft contact area. Measure thrust plate thickness using the CAMSHAFT THRUST PLATE THICKNESS CHART . Replace any thrust plate that falls outside of these specifications:

INSTALLATION

CAMSHAFT BEARINGS

1. Apply a coating of Loctite® 640 Adhesive to the backside of the new bushing. Avoid getting adhesive in the oil hole.
2. Use a universal cam bushing installation tool and install the front bushing (1) so that it is even with the front face of the cylinder block. The oil hole must be aligned. A 3.2 mm (0.128 inch) diameter rod must be able to pass through the hole.
3. Measure the installed bushings at the front bore. The minimum inside diameter is 54.083 mm (2.1293 inch), and the maximum inside diameter is is 54.147 mm. (2.1318 in.).

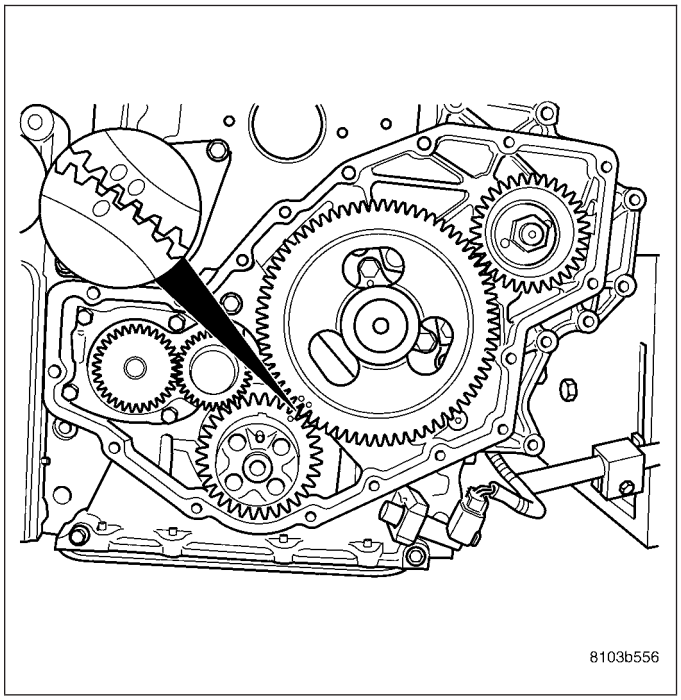


CAMSHAFT

1. Lubricate the camshaft bushing and bores with fresh engine oil or suitable equivalent.
2. Liberally coat the camshaft lobes, journals, and thrust washer with fresh engine oil or suitable equivalent.

CAUTION: When installing the camshaft, DO NOT push it in farther than it will go with the thrust washer in place.

3. Install the camshaft and thrust plate. Align the timing marks as shown.



BACKLASH - 0.075 - 0.250 mm (0.003 - 0.010 inch)
CLEARANCE - 0.025 - 0.500 mm (0.001 - 0.020 inch)

4. Install the thrust plate bolts and tighten to 24 N·m (18 ft. lbs.) torque.
5. Measure camshaft back lash and end clearance.
6. Remove the wooden dowel rods and rubber bands from the tappets.
7. Lubricate the push rods with engine oil and install in their original location. **Verify that they are seated in the tappets.**
8. Lubricate the valve tips with engine oil and install the crossheads in their original locations.
9. Lubricate the crossheads and push rod sockets with engine oil and install the rocker arms and pedestals in their original locations. Tighten bolts to 36 N·m (27 ft. lbs.) torque.

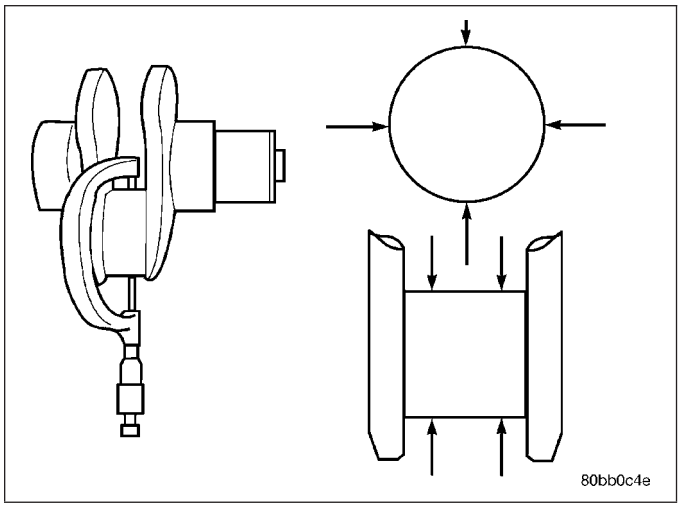
10. **Verify valve lash adjustment (Refer to 9 - ENGINE/CYLINDER HEAD/INTAKE/EXHAUST VALVES & SEATS - STANDARD PROCEDURE).**
11. **FOR EARLY BUILDS** Install the cylinder head cover and reusable gasket (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
12. **FOR LATE BUILDS** Install the cylinder head cover.
13. Install gear housing cover (Refer to 9 - ENGINE/VALVE TIMING/GEAR HOUSING COVER - INSTALLATION). Install front crankshaft dust seal.
14. Install the crankshaft damper with the speed indicator ring (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
15. Install the fan support/hub assembly Refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
16. Install the power steering pump.
17. Install accessory drive belt tensioner. Torque bolt to 43 Nm (32 ft. lbs.).
18. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
19. Install the charge air cooler (with a/c condenser and auxiliary transmission oil cooler, if equipped) and tighten the mounting bolts to 2 N·m (17 in. lbs.) torque.
20. Connect charge air cooler inlet and outlet pipes. Tighten clamps to 11 N·m (95 in. lbs.) torque.
21. Install the radiator upper support panel.
22. Close radiator petcock and lower the radiator into the engine compartment. Tighten the mounting bolts to 11 N·m (95 in. lbs.) torque.
23. Raise vehicle on hoist.
24. Connect radiator lower hose and install clamp.
25. Connect transmission auxiliary oil cooler lines (if equipped).
26. Lower vehicle.
27. Install the fan /drive/shroud assembly. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION)
28. Install the coolant recovery and windshield washer fluid reservoirs to the fan shroud.
29. Connect the coolant recovery hose to the radiator filler neck.
30. Add engine coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
31. Charge A/C system with refrigerant (if A/C equipped) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
32. Connect the battery negative cables.
33. Start engine and check for engine oil and coolant leaks.

BEARINGS - CONNECTING ROD

STANDARD PROCEDURE - CONNECTING ROD BEARING AND CRANKSHAFT JOURNAL CLEARANCE

DESCRIPTION	MEASUREMENT
CONNECTING ROD BORE, BEARINGS REMOVED	MIN. 72.99 mm (2.874 in.) MAX. 73.01 mm (2.875 in.)
CONNECTING ROD BORE, BEARINGS INSTALLED	MIN. 69.05 mm (2.719 in.) MAX. 69.10 mm (2.720 in.)

1. Measure the connecting rod bore with bearings **removed** and the bolts tightened to 100 N·m (73 ft. lbs.) torque..
2. Measure the connecting rod bore with the bearings **installed** and the bolts tightened to 100 N·m (73 ft. lbs.) torque.



Measure within 20° arc from each side of the parting line. Also measure 90° from parting line.

Record the smallest and largest diameter.

Measure the diameter of the rod journal at the location shown. Calculate the average diameter for each side of the journal.

Determine minimum bearing clearance by calculating the differance between the smallest connecting rod bore diameter with the bearing installed and the average diameter for each side of the crankshaft journal.

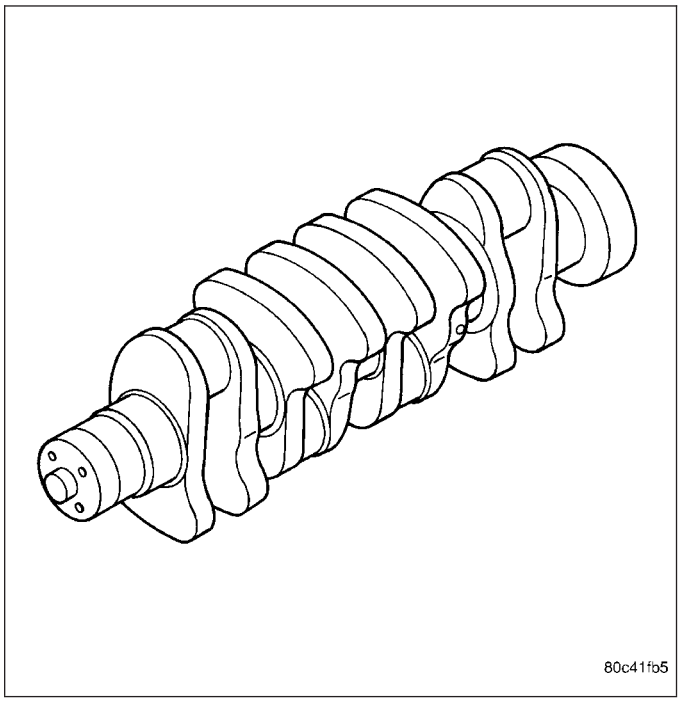
Determine the maximum bearing clearance by calculating the difference between the largest connecting rod bore diameter and the average diameter with the bearing installed for each side of the crankshaft journal.

If the crankshaft is within limits, replace the bearing. If the crankshaft is out of limits, grind the crankshaft to the next smaller size and use oversize rod bearings.

CRANKSHAFT & GEAR

DESCRIPTION

The crankshaft is a forged steel, integrally balanced unit. It is supported by seven main bearings, with position number six designated as the thrust journal. The crankshaft is held in place by main caps and 12 mm capscrews. The crankshaft also has internal cross drillings to supply the connecting rods with engine oil.

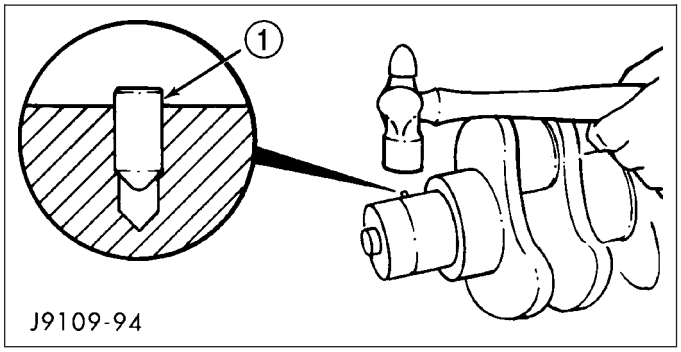


REMOVAL - GEAR

1. Remove the gear housing cover. (Refer to 9 - ENGINE/VALVE TIMING/GEAR HOUSING COVER - REMOVAL)
2. Split the gear and remove it from the crankshaft.

INSTALLATION - GEAR

1. Remove all burrs and make sure the gear surface on the end of the crankshaft is smooth.
2. If removed, install a new alignment pin. Drive the pin in using a ball- peen hammer, leaving it protruding 1.0 mm (0.039 inch) to 1.5 mm (0.059 inch) above the crankshaft.



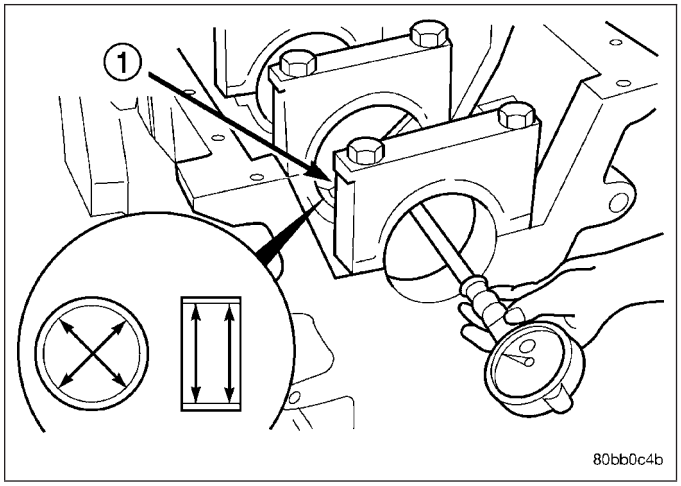
WARNING: WEAR PROTECTIVE GLOVES TO PREVENT INJURY.

CAUTION: DO NOT heat the gear longer than 45 minutes.

3. Heat the crankshaft gear for 45 minutes at a temperature of 149°C (300°F). **Do not use torch, gear failure will occur.**
4. Apply a thin coat of lubricant to the nose of the crankshaft.
5. Position the gear with the timing mark out and install it on the crankshaft using the alignment pin. Make sure the gear contacts the shoulder.

BEARINGS - CRANKSHAFT MAIN

STANDARD PROCEDURE - MAIN BEARING CLEARANCE

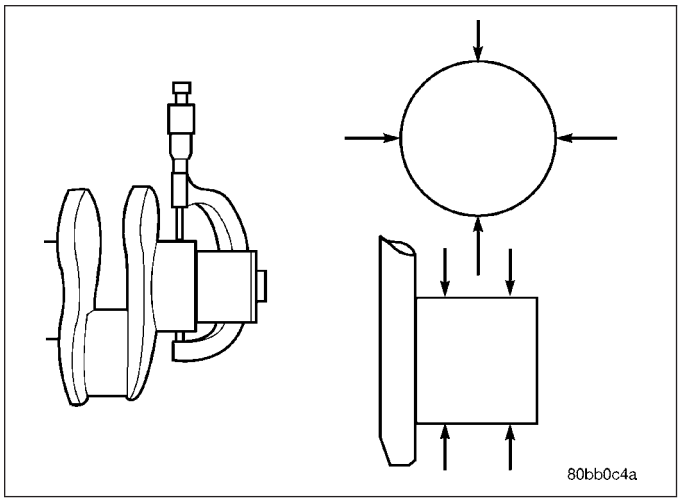


MAIN BEARING BORE DIAMETER CHART

ITEM	MAIN BEARING BORE DIAMETER (MAXIMUM)
BEARINGS INSTALLED	83.106 mm (3.2719 in.)
BEARINGS REMOVED	Min 87.983 mm (3.4639 in.) Max. 88.019 mm (3.4653 in.)

Inspect the main bearing bores for damage or abnormal wear.

1. Remove bearings and measure main bearing bore diameter after torquing main bearing cap bolts to 176 Nm (130 ft. lbs.).
2. Install the crankshaft main bearings and measure main bearing bore diameter with the main bolts tightened to 176 N·m (130 ft. lbs.) torque.



CRANKSHAFT MAIN JOURNAL DIAMETER CHART

ITEM	SPECIFICATION
Minimum diameter	82.962 mm (3.2662 in.)
Maximum diameter	83.013 mm (3.2682 in.)
Maximum out of roundness	0.050 mm (.002 in.)
Maximum taper	0.013 mm (.0005 in.)
Thrust distance (at No.6 position)	Min. 0.065 mm (.003 in.) Max. 0.432 mm (.017 in.)

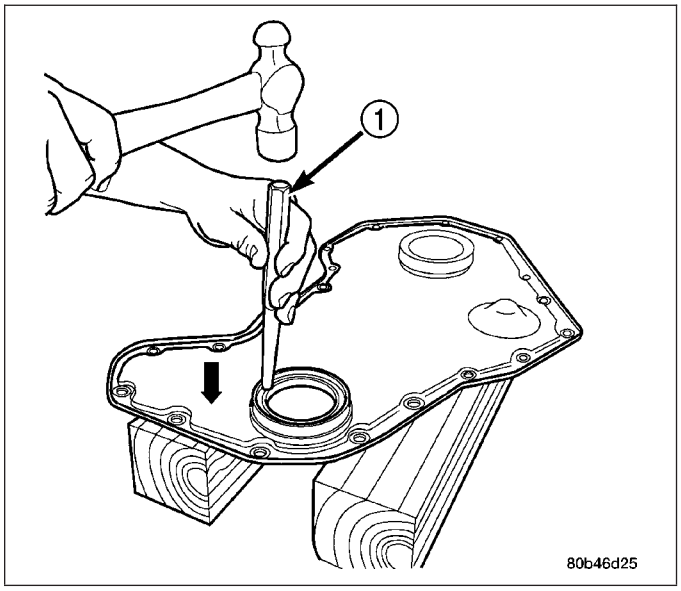
3. Measure the diameter of the main journal at the locations shown. Calculate the average diameter for each side of the journal.
4. Calculate the main bearing journal to bearing clearance. Maximum clearance is 0.119 mm (0.00475 inch). If the crankshaft journal is within limits, replace the main bearings. If not within specifications, grind the crankshaft to next size and use oversize bearings.
5. Measure thrust distance at the No.6 position.

SEAL - CRANKSHAFT OIL - FRONT

REMOVAL

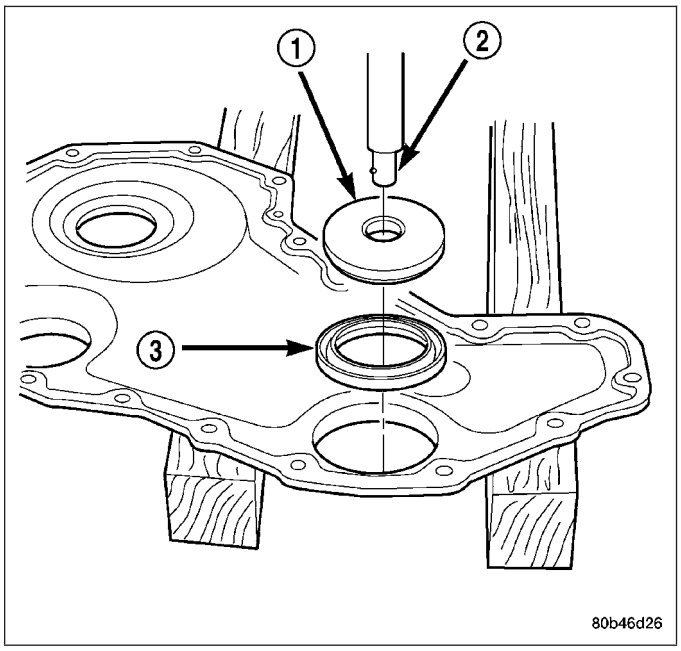
1. Disconnect both battery negative cables.
2. Raise vehicle on hoist.
3. Partially drain engine coolant into container suitable for re-use (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Lower vehicle.
5. Remove radiator upper hose.
6. Disconnect coolant recovery bottle hose from radiator filler neck.
7. Disconnect windshield washer pump supply hose and electrical connections and lift washer bottle off of fan shroud.
8. Remove viscous fan/drive assembly. (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
9. Remove cooling fan shroud and fan assembly from the vehicle.
10. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
11. Remove the cooling fan support/hub from the front of the engine.
12. Raise the vehicle on hoist.
13. Remove the crankshaft damper and speed indicator ring.

14. Remove power steering pump.
15. Remove accessory drive belt tensioner.
16. Remove the gear cover-to-housing bolts and gently pry the cover away from the housing, taking care not to mar the gasket surfaces. Remove crank seal dust shield with cover.
17. Support the cover on a flat work surface with wooden blocks, and using a suitable punch (1) and hammer, drive the old seal out of the cover from the back side of the cover to the front side.



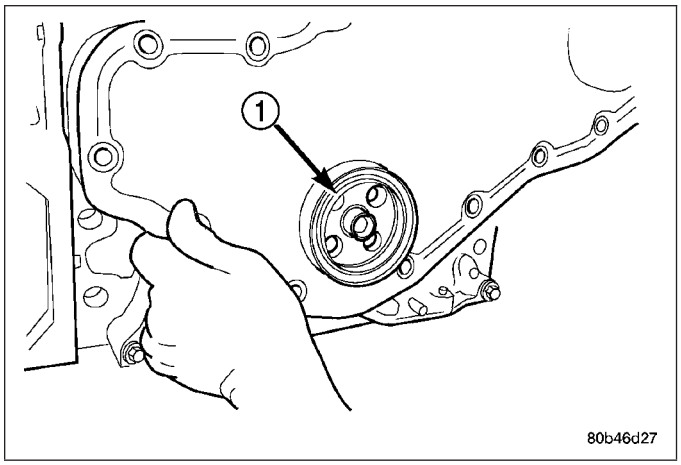
INSTALLATION

CAUTION: The seal lip and the sealing surface on te crankshaft must be be from all oil residue, to prevent leaks. The crankshaft and seal surface must be completely dry when the seal is installed.



1. Clean cover and housing gasket mating surfaces. Use a suitable scraper and be careful not to damage the gear housing surface. Remove any old sealer from the oil seal bore. Thoroughly clean the front seal area of the crankshaft. The seal lip and the sealing surface on the crankshaft must be free from all oil residue to prevent seal leaks.
2. Inspect the gear housing and cover for cracks and replace if necessary. Carefully straighten any bends or imperfections in the gear cover with a ball-peen hammer on a flat surface. Inspect the crankshaft front journal for any grooves or nicks that would affect the integrity of the new seal.
3. Apply a bead of Mopar® Stud & Bearing Mount to the outside diameter of the seal. Do not lubricate the inside diameter of the new seal.
4. With the cover supported by wood blocks, install the seal into the rear of the cover using crankshaft seal installer Special Tool 8281 and driver handle C-4171. Strike the driver handle until the installation tool bottoms out on the inside of the cover.

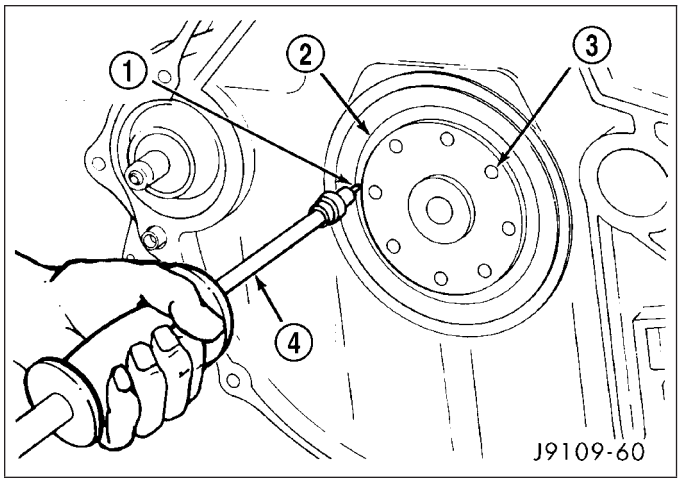
CAUTION: Do not distort or damage seal.



5. Install the plastic seal pilot (provided with seal kit) into the crankshaft seal.
6. Apply a bead of Mopar® Silicone Rubber Adhesive Sealant or equivalent to the gear housing cover sealing surface.
7. Install the cover to the gear housing, aligning the seal pilot with the nose of the crankshaft.
8. Install the cover bolts and tighten to 24 N·m (18 ft. lbs.) torque. Remove pilot tool.
9. Install dust shield over nose of crankshaft.
10. Install the crankshaft damper and speed indicator ring. Torque the bolts to 40 N·m (30 ft. lbs.). Then rotate an additional 60°. Use the engine barring tool to keep the engine from rotating during tightening operation.
11. Install the fan support/hub assembly and torque bolts to 32 N·m (24 ft. lbs.).
12. Install power steering pump.
13. Install accessory drive belt tensioner. Torque bolt to 43 Nm (32 ft.lbs.).
14. Install cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
15. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
16. Refill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
17. Connect battery negative cables.
18. Start engine and check for oil leaks.

SEAL - CRANKSHAFT OIL - REAR

REMOVAL



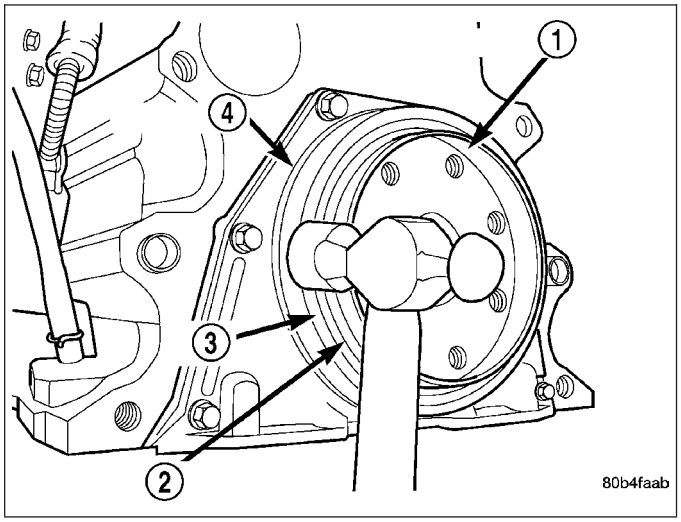
1. Disconnect the battery negative cables.
2. Remove the transmission and transfer case (if equipped).
3. Remove the clutch cover and disc (if manual transmission equipped) (Refer to 6 - CLUTCH/CLUTCH DISC - REMOVAL).
4. Remove the flywheel or converter drive plate.
5. **FOR LATE BUILDS** Remove the flywheel adapter plate.
6. Drill holes 180° apart into the seal. Be careful not to contact the drill against the crankshaft.
7. Install #10 sheet metal screws (1) in the drilled holes and remove the rear seal with a slide hammer (4).

INSTALLATION

CAUTION: The seal lip and the sealing surface on the crankshaft must be free from all oil residue to prevent seal leaks. The crankshaft and seal surfaces must be completely dry when the seal is installed. Use a soap and water solution on outside diameter of seal to ease assembly.

1. Clean the crankshaft journal with a suitable solvent and dry with a clean shop towel or compressed air. Wipe the inside bore of the crankshaft seal retainer with a clean shop towel.

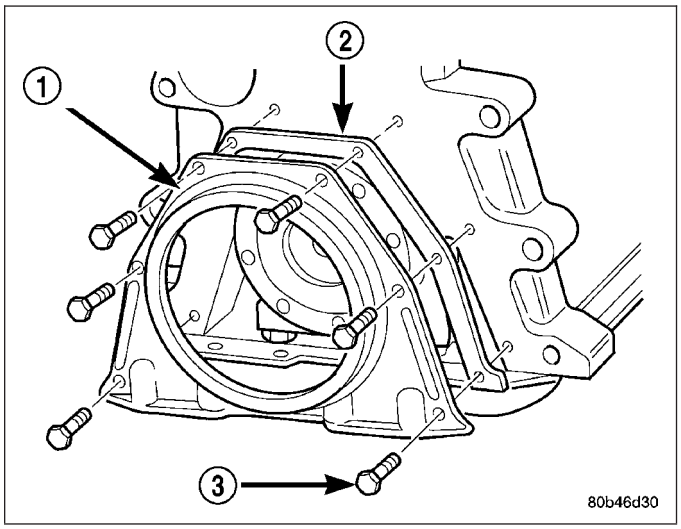
2. Inspect the crankshaft journal for gouges, nicks, or other imperfections. If the seal groove in the crankshaft is excessively deep, install the new seal 1/8” deeper into the retainer bore, or obtain a crankshaft wear sleeve that is available in the aftermarket.
3. Install the seal pilot and new seal, provided in the replacement kit, onto the crankshaft.
4. Remove the seal pilot.
5. Install the installation tool over crankshaft.
6. Using a ball peen hammer, strike the tool (2) at the 12, 3, 6, and 9 o’clock positions until the alignment tool bottoms out on the retainer.
7. Install the flywheel or converter drive plate. Tighten the bolts to 137 N·m (101 ft. lbs.) torque.
8. Install the clutch cover and disc (if equipped) (Refer to 6 - CLUTCH/CLUTCH DISC - INSTALLATION).
9. Install the transmission and transfer case (if equipped).
10. Lower vehicle.
11. Connect battery negative cables.
12. Check engine oil level and adjust, if necessary.
13. Start engine and check for oil leaks.



RETAINER - CRANK REAR OIL SEAL

REMOVAL

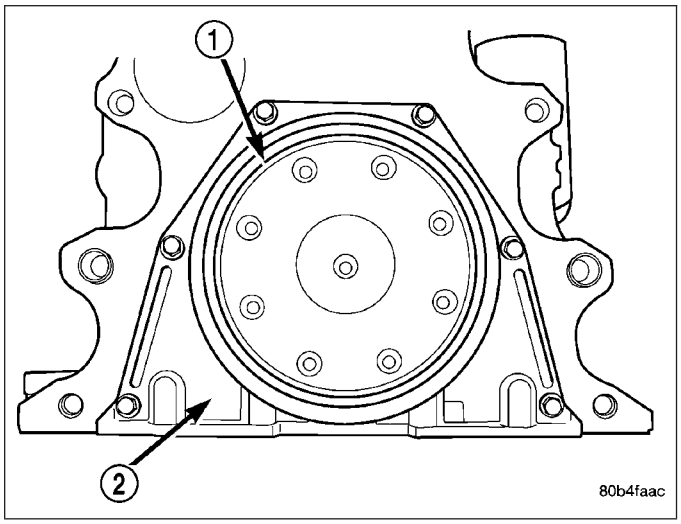
1. Disconnect the battery negative cables.
2. Raise vehicle on hoist.
3. Remove the oil pan drain plug and drain the engine oil. Re-install plug and torque to 50 N·m (44 ft. lbs.) torque.
4. Remove transmission and transfer case (if equipped) from vehicle.
5. Remove flywheel or torque converter drive plate.
6. **FOR LATE BUILDS** Remove flywheel adapter plate.
7. Disconnect starter cables from starter motor.
8. Remove starter motor (Refer to 8 - ELECTRICAL/ STARTING/STARTER MOTOR - REMOVAL) and transmission adapter plate assembly.
9. Remove four 4 oil pan rear bolts. Slide a feeler gauge between the seal retainer and oil pan gasket to break the seal.
10. Remove the six 6 retainer-to-block bolts (3).
11. Remove the rear seal retainer and gasket (3).
12. Support the seal retainer and drive out the crankshaft seal with a hammer and suitable punch.



INSTALLATION

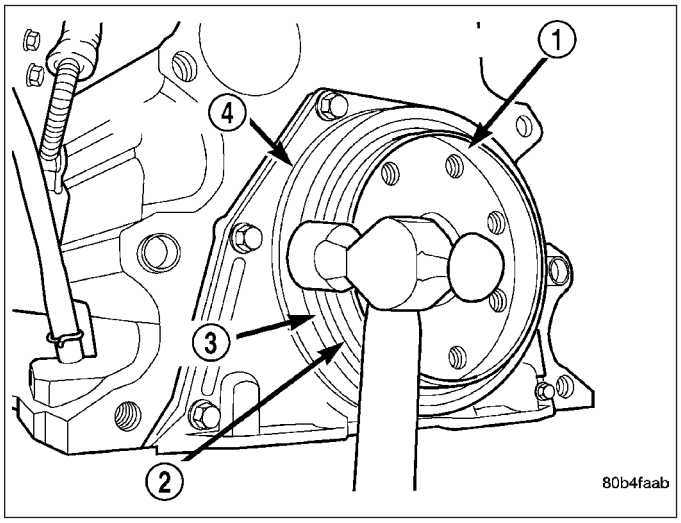
NOTE: Late and Early build engines use different retainers, they are not interchangeable.

1. If using the old seal retainer, the crankshaft seal must be replaced.
2. Inspect oil pan gasket for nicks or cuts. If gasket is damaged, the oil pan must be removed and gasket must be replaced. Wipe oil pan gasket dry and apply light coating of RTV.
3. Using the retainer alignment/seal installation tool provided in the seal service kit, install the alignment tool into the retainer and install to the cylinder block, using a new gasket. Tighten the six (6) mounting bolts by hand.
4. The seal alignment tool is used to align rear cover properly. Starting with the center two bolts, tighten the retainer in a circular pattern to 10 N·m (89 in. lbs.). Remove the alignment tool.



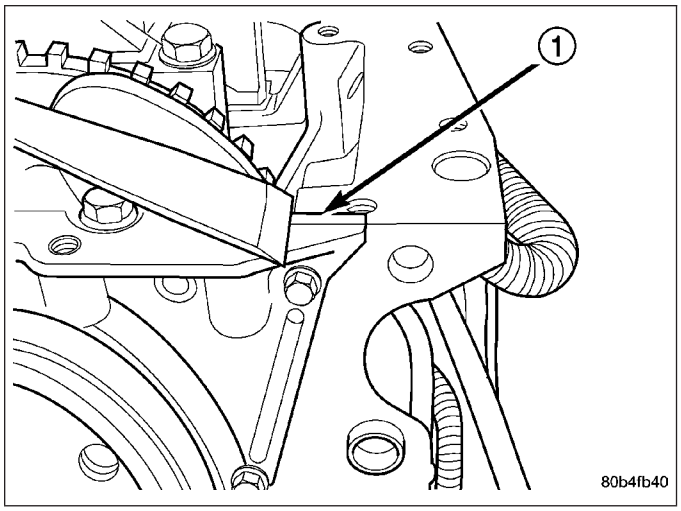
CAUTION: The seal lip and the sealing surface on the crankshaft must be free from all oil residue to prevent seal leaks. The crankshaft and seal surfaces must be completely dry when the seal is installed. Use a soap and water solution on outside diameter of seal to ease assembly.

NOTE: Later build engines are equipped with a dual mass flywheel, which uses a crankshaft adapter. The rear seal retainer will not interchange with a non dual mass flywheel. The rear seal retainer for a dual mass flywheel is shorter and will not fit on earlier engines which have a standard flywheel.



5. Make sure the provided seal pilot (1) is installed into the new crankshaft seal (3). Use the alignment/installation tool and press the seal onto the crankshaft. Alternately drive the seal at the 12, 3, 6 and 9 o'clock positions.

6. Remove the alignment tool and trim the retainer gasket (1) even with the oil pan mounting surface.
7. Remove the seal pilot.
8. Apply a small amount of Mopar® Silicone Rubber Adhesive Sealant to the oil pan rail T-joints.
9. Install the four (4) oil pan rear mounting bolts and torque to 28 N·m (21 ft. lbs.).
10. Install new rectangular ring seal for cam bore.
11. Install the flywheel housing and bolts. Torque bolts to 77 N·m (57 ft. lbs.).
12. Install the flywheel housing and bolts. Torque bolts to 77 N·m (57 ft. lbs.).
13. **FOR EARLY BUILDS** Install the flywheel or converter drive plate. Tighten bolts to 137 N·m (101 ft. lbs.).



14. **FOR LATE BUILDS** Install the dual mass flywheel with crankshaft adapter. Tighten bolts to 137 N·m (101 ft. lbs.).

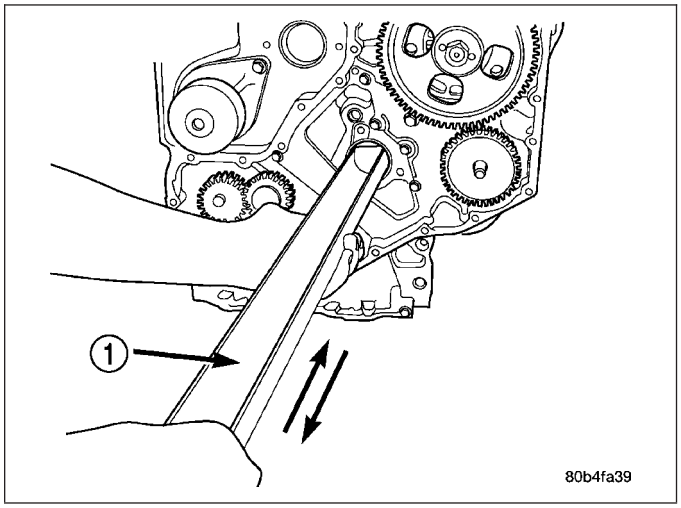
15. Install the starter motor Refer to (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - INSTALLATION).
16. Install the transmission and transfer case (if equipped).
17. Lower vehicle.
18. Fill the crankcase with new engine oil.
19. Connect the battery negative cables.
20. Start engine and check for oil leaks.

TAPPETS - VALVE

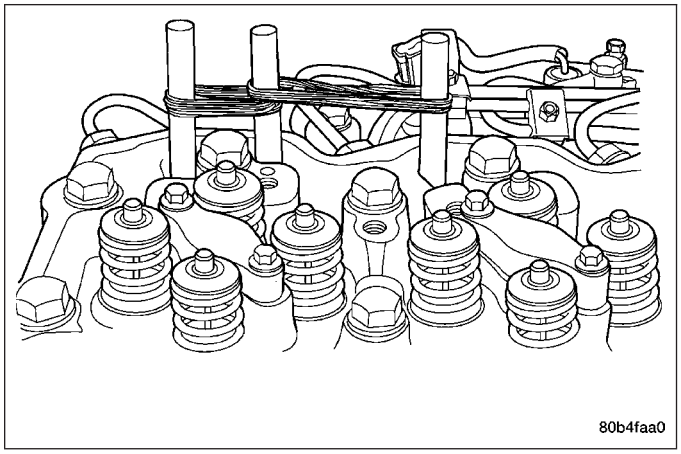
REMOVAL

NOTE: This procedure requires use of Miller Tool 8502 Tappet Replacement Kit.

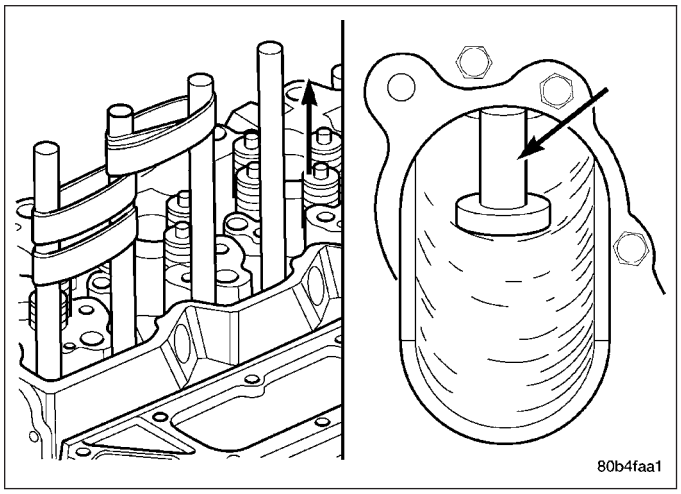
1. Remove camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).
2. Insert the trough (1) (provided with tool kit) the full length of the camshaft bore. Make sure the cap end goes in first and the open side faces up (towards tappets).



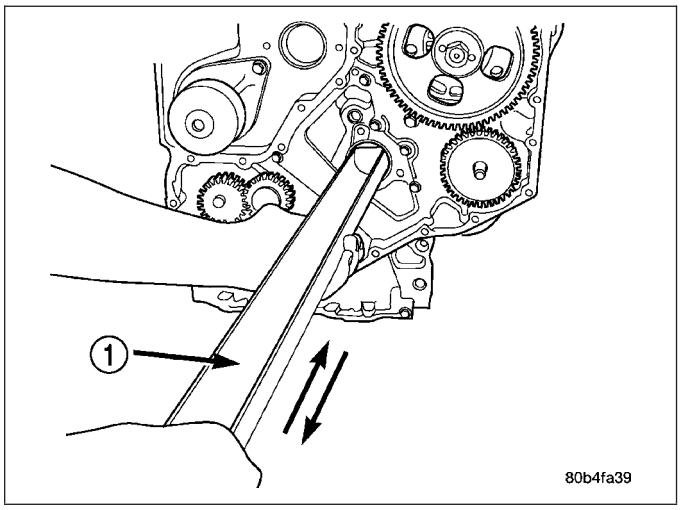
3. **Remove only one tappet at a time.** Remove rubber band from one cylinder pair and attach tappet dowel not being removed to the next cylinder pair.



4. Raise dowel rod (disengage from tappet) and allow tappet to fall into trough.
5. Carefully remove trough **(do not rotate)** and tappet. If the tappet is not being replaced, mark it so it can be installed in its original location.



6. Re-install trough (1) and repeat procedure on remaining tappets.

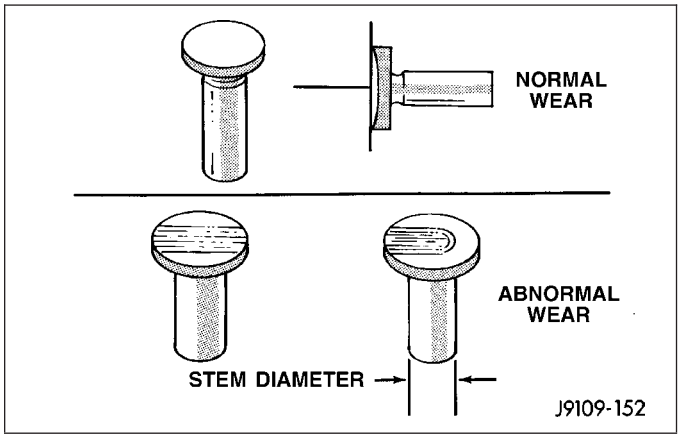


CLEANING

Clean tappet with a suitable solvent. Rinse in hot water and blow dry with a clean shop rag or compressed air.

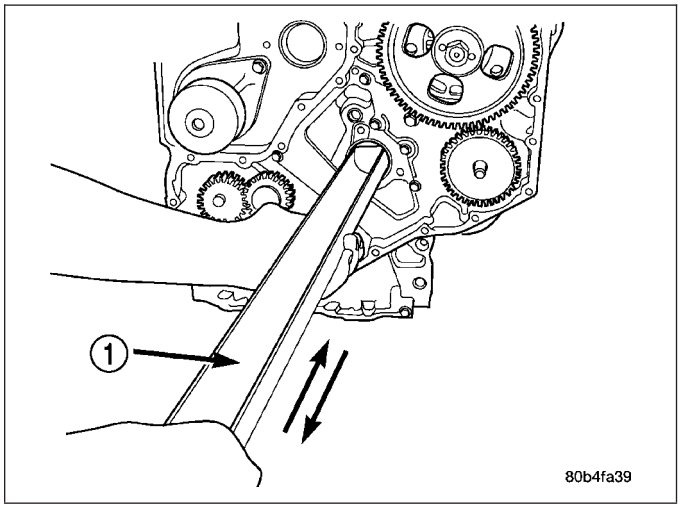
INSPECTION

1. Visually inspect the tappet the tappet socket, stem, and face for excessive wear, cracks, or obvious damage.
2. Measure the tappet stem diameter. Replace the tappet if it falls below the minimum size.

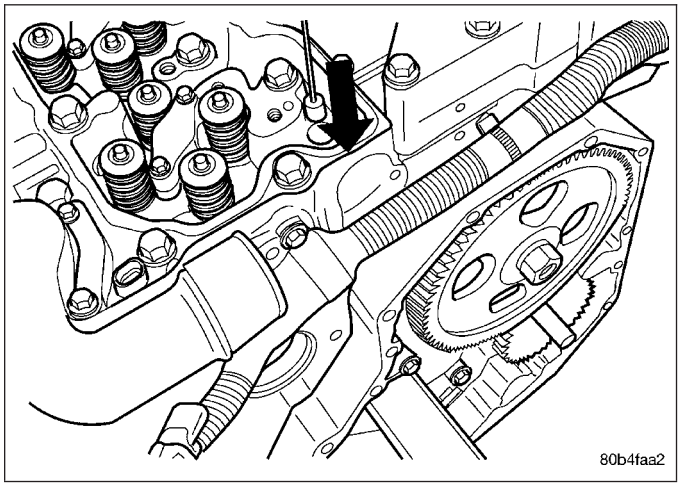


INSTALLATION

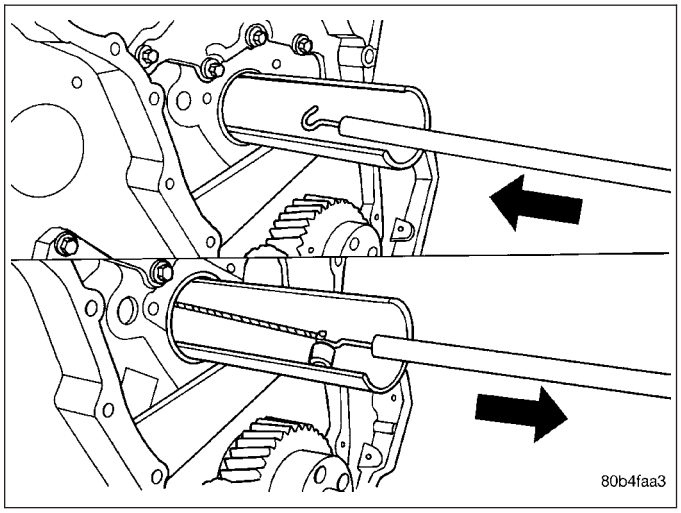
1. Insert the trough (1) the full length of the camshaft bore. Again, make sure the cap end goes in first and the open side faces up (towards tappets).



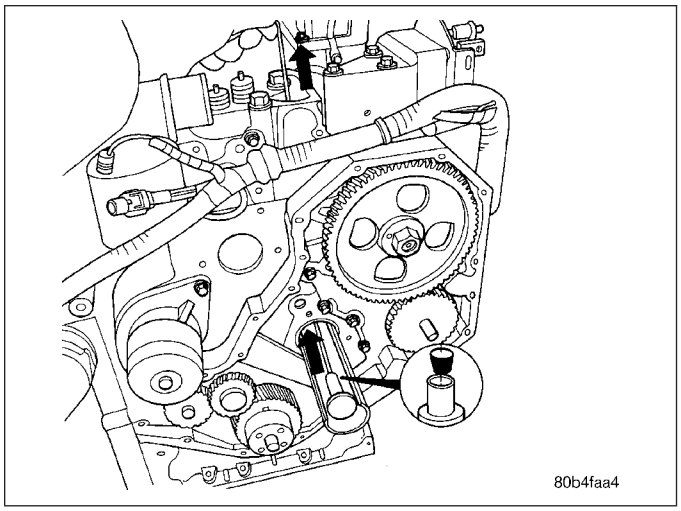
2. Lower the tappet installation tool through the push rod hole and into the trough.



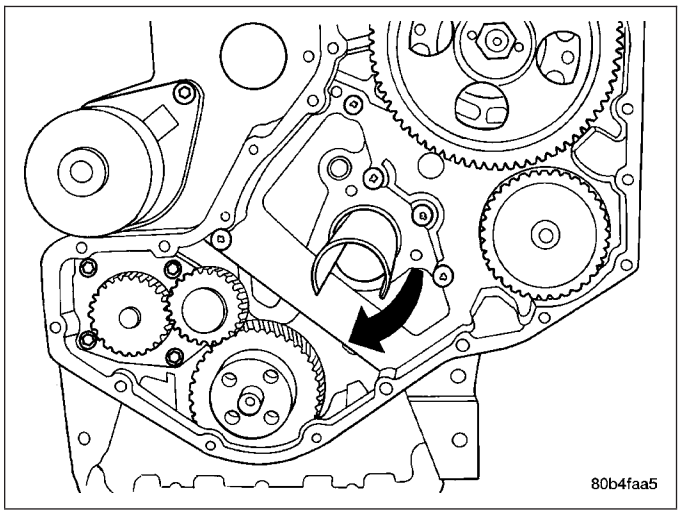
3. Retrieve the tappet installation tool using the hooked rod provided with the tool kit
.



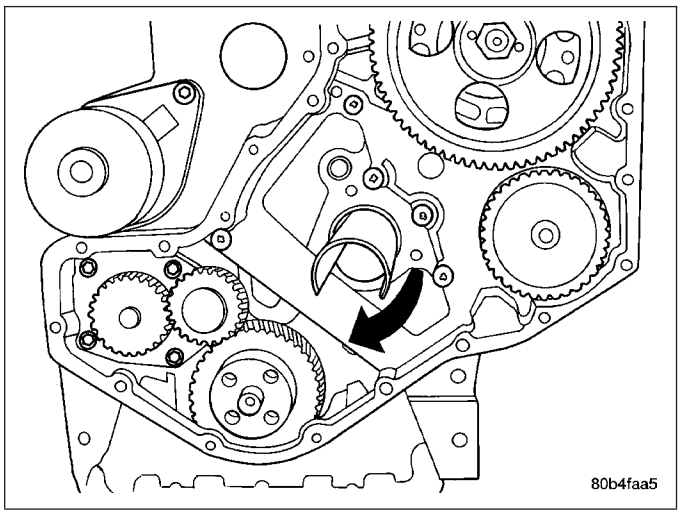
4. Lubricate the tappet with clean engine oil or suitable equivalent and install the tappet to the installation tool.
5. Pull the tappet up and into position. If difficulty is experienced getting the tappet to make the turn into the tappet bore, wiggle the trough while **gently** pulling up on the tappet.



6. With the tappet in place, rotate the trough one half turn so the open side is down (toward crankshaft).
7. Remove the tappet installation tool from the tappet.
8. Re-install a dowel rod and secure the rod with a rubber band.



9. Rotate the trough one half turn and repeat the procedure for the remaining tappets.
10. Install the camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - INSTALLATION).

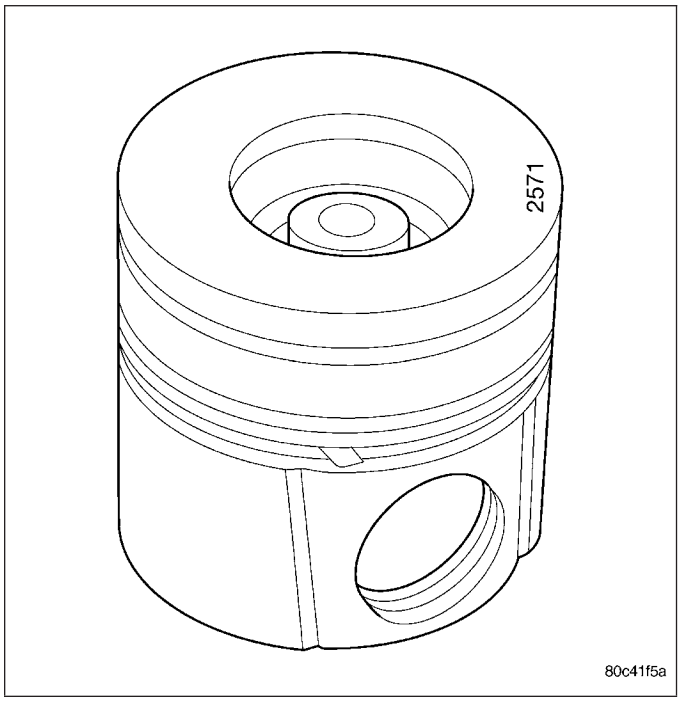


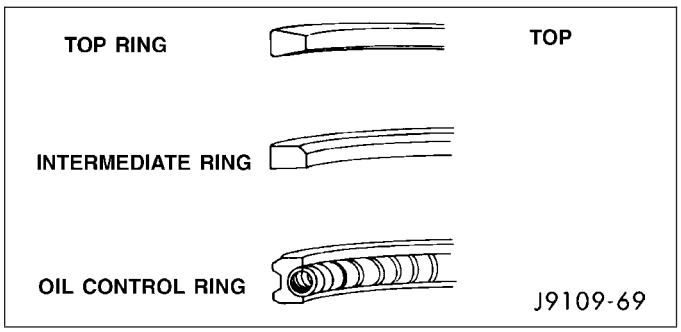
PISTON & CONNECTING ROD

DESCRIPTION

PISTONS

The piston is constructed of aluminum and is gravity cast, free floating design. The piston incorporates a centrally located high swirl combustion bowl, and utilizes a “keystone” style top compression ring, and a “Tapered Face” intermediate ring, for superior cylinder wall scraping. Piston cooling nozzles cool the piston and pin with engine oil supplied by the crankshaft main journals. High horsepower pistons are gallery cooled and utilize J-jet piston cooling nozzles. Pistons are directional in order to provide clearance to piston cooling nozzles.





CONNECTING RODS

The connecting rods are a split angle design. They have a pressed-in-place wrist pin bushing that is lubricated by piston cooling nozzle oil spray.

Machined connecting rods are no longer used in the diesel engine. Do not install machined connecting rods into an engine that has fractured split connecting rods.

Fractured split connecting rods are first manufactured as a single piece and then fractured into two pieces. Fractured split connecting rods can be identified by a rough and irregular surface at the connecting rod split face. To properly assemble the rod cap to the connecting rod, the bearing tangs on the connecting rod and cap must be located on the same side of the rod. The long end of the connecting rod must be assembled on the intake or camshaft side of the engine.

Each matched fractured split connecting rod and cap is an assembly and are not interchangeable. If a connecting rod or cap is damaged, the entire assembly must be replaced.

STANDARD PROCEDURE - HEAD GASKET SELECTION

1. Measure piston protrusion for all six pistons.
2. Calculate the average piston protrusion. Maximum allowable protrusion is 0.516 mm (0.020 inch).

NOTE: There are two different head gaskets available. One gasket is for Average piston protrusion less than 0.30 mm (0.011 inch). The other gasket is for Average piston protrusion greater than 0.30 mm (0.011 inch)

REMOVAL

1. Disconnect the battery cables.
2. Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
3. Remove the oil pan and suction tube (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
4. Remove bolts and the block stiffener.
5. Using Miller Tool 7471-B crankshaft barring tool, rotate the crankshaft so all of the pistons are below TDC.
6. Before removing the piston(s) from the bore(s):
   a. Remove any carbon ridge formations or deposits at the top of the bore with a dull scraper or soft wire brush.
   b. If cylinder bore wear ridges are found, use a ridge reamer to cut the ridge from the bore. DO NOT remove more metal than necessary to remove the ridge.
7. Remove the J-jet cooling nozzles, if equipped.

NOTE: If cylinders have ridges, the cylinders are oversize and will more than likely need boring.

8. Using a hammer and steel stamp, stamp the cylinder number in the top of each piston. The front of the piston is identified by a stamping on the top of the piston. DO NOT stamp in the outside 5 mm (.197 in.) of the piston diameter. DO NOT stamp over the piston pin.
9. Mark the connecting rod and cap with the corresponding cylinder numbers.
10. Remove the connecting rod bolts and rod caps. Use care so the cylinder bores and connecting rods are not damaged.
11. Use a hammer handle or similar object to push the piston and connecting rod through the cylinder bore.
12. Store the piston/rod assemblies in a rack.

CLEANING—PISTON AND CONNECTING ROD

CAUTION: DO NOT use bead blast to clean the pistons. DO NOT clean the pistons and rods in an acid tank.

PISTON

Clean the pistons and pins in a suitable solvent, rinse in hot water and blow dry with compressed air. Soaking the pistons over night will loosen most of the carbon build up. De-carbon the ring grooves with a broken piston ring and again clean the pistons in solvent. Rinse in hot water and blow dry with compressed air.

CONNECTING ROD

Clean the connecting rods in a suitable solvent, rinse in hot water and blow dry with compressed air.

INSPECTION

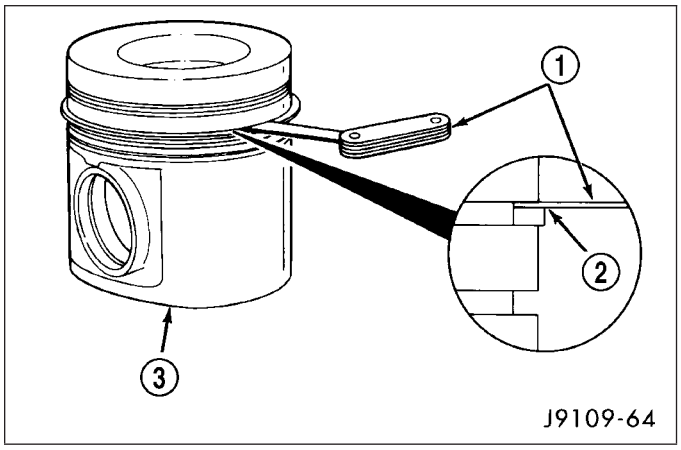
INSPECTION - PISTONS

PISTON SKIRT DIAMETER (MIN.)
101.775 mm (4.006 in.)

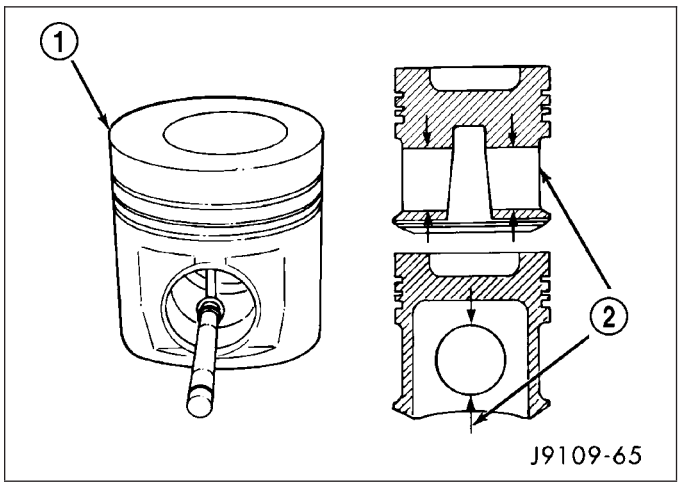
Inspect the pistons for damage and excessive wear. Check top of the piston, ring grooves, skirt and pin bore. Measure the piston skirt diameter. If the piston is out of limits, replace the piston.

The upper groove only needs to be inspected for damage. Use a new piston ring (2) to measure the clearance in the intermediate ring groove. Minimum clearance is 0.045 mm (0.0018 inch), maximum clearance is 0.095 mm (.0037 inch). If the clearance of the intermediate ring exceeds specifications, replace the piston (3).

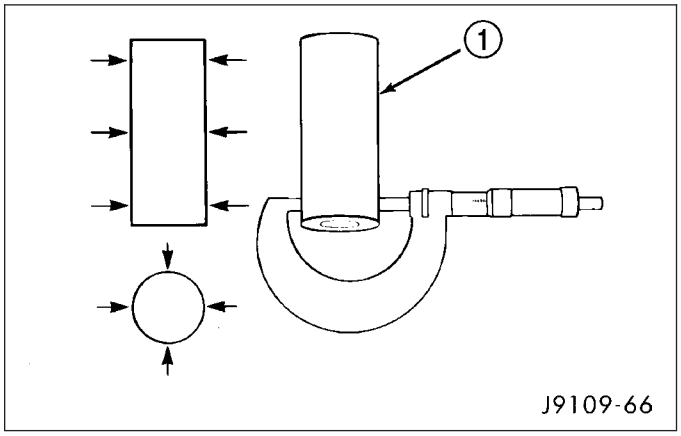
Use a new oil ring to measure the clearance in the oil groove. Minimum clearance is 0.040 mm (0.0016 inch), maximum clearance is 0.085 mm (.0033 inch). If the clearance exceeds specifications, replace the piston.



Measure the pin bore (2). The maximum diameter is 40.012 mm (1.5753 inch), Minimum is 40.006 mm (1.575 inch). If the bore is over limits, replace the piston (1).



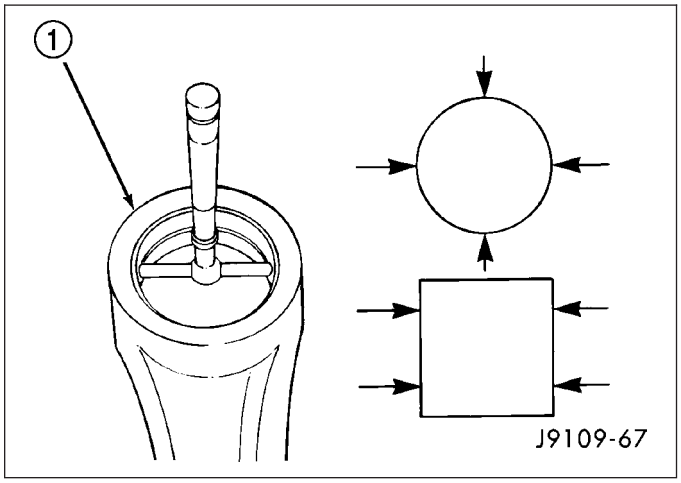
Inspect the piston pin for nicks, gouges and excessive wear. Measure the pin diameter (1). The minimum diameter is 39.990 mm (1.5744 inch), maximum 40.003 mm (1.5749 inch). If the diameter is out of limits, replace the pin (1).



INSPECTION - CONNECTING ROD

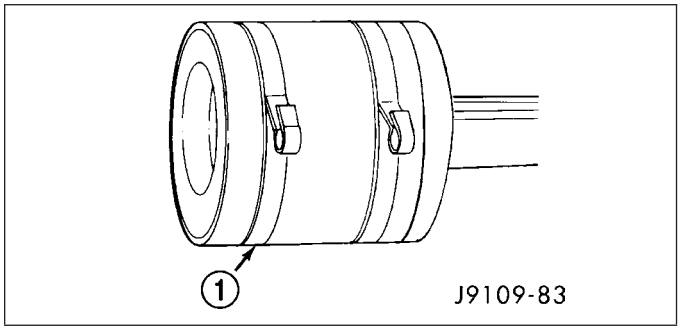
Inspect the connecting rod for damage and wear. The I-Beam section of the connecting rod cannot have dents or other damage. Damage to this part can cause stress risers which will progress to breakage.

Measure the connecting rod pin bore (1). The maximum diameter is 40.042 mm (1.5765 inch), minimum diameter is 40.019 mm (1.5756 inch). If out of limits, replace the connecting rod.

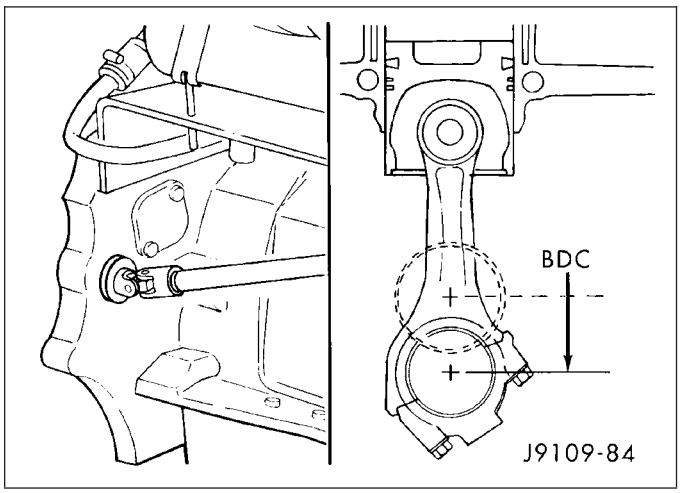


INSTALLATION

1. Lubricate the cylinder bores with clean engine oil.
2. Generously lubricate the rings and piston skirts with clean engine oil.
3. Orientate the rings on the piston (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON RINGS - STANDARD PROCEDURE).
4. Compress the rings using a piston ring compressor tool (1). If using a strap-type ring compressor, make sure the inside end of the strap does not hook on a ring gap and break the ring.



5. Bar the crankshaft so the rod journal for the piston to be installed is at BDC (Bottom Dead Center).
6. Make sure the front of the piston is oriented properly according to the marking on the top of the piston and the connecting rod is oriented properly.



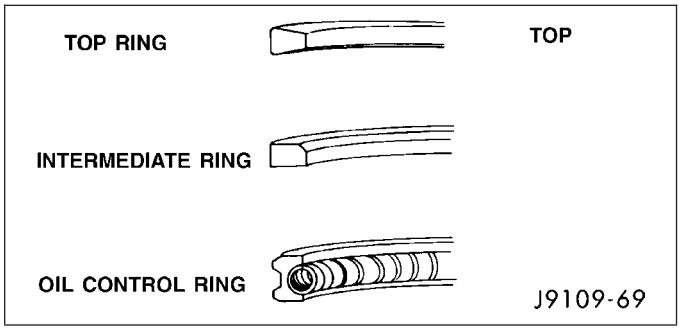
7. Position the piston and rod assembly into the cylinder bore with the front of the piston oriented properly according to the stamping in the top of the piston. Use care when you install the piston and connecting rod so the cylinder bore is not damaged. The long side of the connecting rod must be installed on the intake side of the engine.
8. Push the piston into the bore until the top of the piston is approximately 50 mm (2 inch) below the top of the block. Carefully pull the connecting rod onto the crankshaft journal.
9. Use clean engine oil to lubricate the threads and under the heads of the connecting rod bolts.

10. **For fractured/split type connecting rods,** the long end of the rod must be installed towards the intake side of the engine.
    a. The connecting rod split/face must face toward the same side as the piston notch feature on the skirt. The split face will face toward the exhaust side of the engine if properly installed.
11. Install the rod cap and bolts to the connecting rod. Tighten the connecting rod bolts evenly in 3 steps.
    - Tighten the bolts to 30 N·m (22 ft. lbs.) torque.
    - Tighten the bolts to 60 N·m (44 ft. lbs.) torque.
    - Rotate 60° clockwise.
12. The crankshaft must rotate freely. Check for freedom of rotation as the caps are installed. If the crankshaft does not rotate freely, check the installation of the rod bearing and the bearing size.
13. Measure the side clearance between the connecting rod and the crankshaft. DO NOT measure the clearance between the cap and crankshaft.
14. Install J-jet piston cooling nozzles if equipped.
15. Install block stiffener. Torque to 43 N·m (32 ft. lbs.).
16. Install the suction tube and oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).
17. Install the cylinder head onto the engine (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
18. Install a new filter and fill the crankcase with new engine oil.**Prefill the filter with clean oil.**
19. Connect the battery negative cables and start engine.

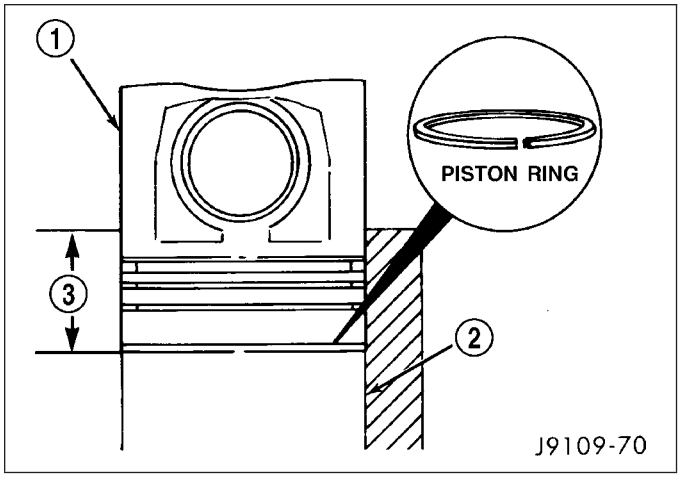
RINGS - PISTON

STANDARD PROCEDURE - PISTON RING FITTING

1. Determine the piston diameter and obtain the appropriate ring set. The piston rings can be identified as shown.



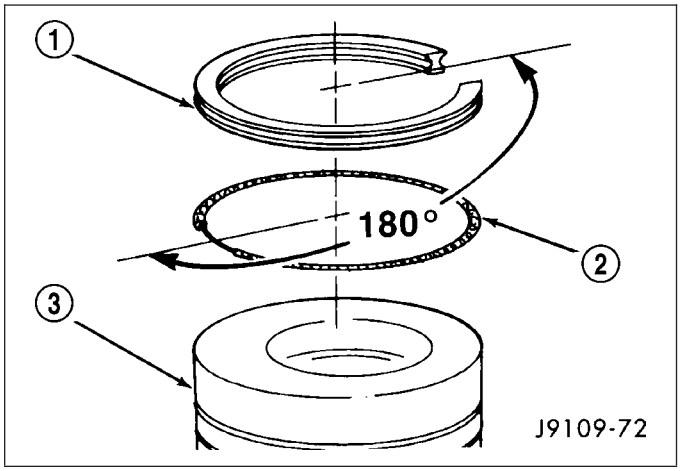
2. Position each ring in the cylinder and use a piston (1) to square it with the bore at a depth (3) of 89.0 mm (3.5 inch).



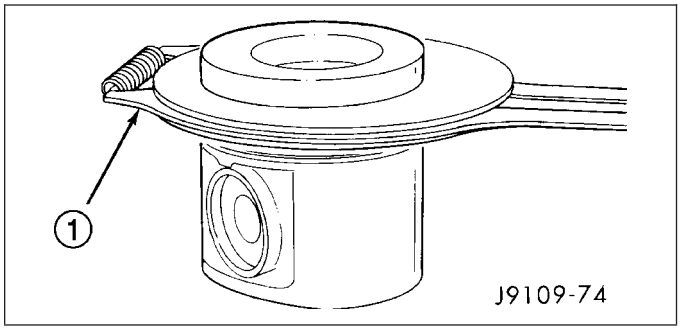
PISTON RING GAP CHART		
TOP RING	0.26 - 0.36 mm	(0.010 - 0.014 in.)
INTERMEDIATE RING	0.85-1.15 mm	(0.033 - 0.045 in.)
OIL CONTROL RING	0.25-0.55 mm	(0.010 - 0.022 in.)

3. Use a feeler gauge to measure the piston ring gap.

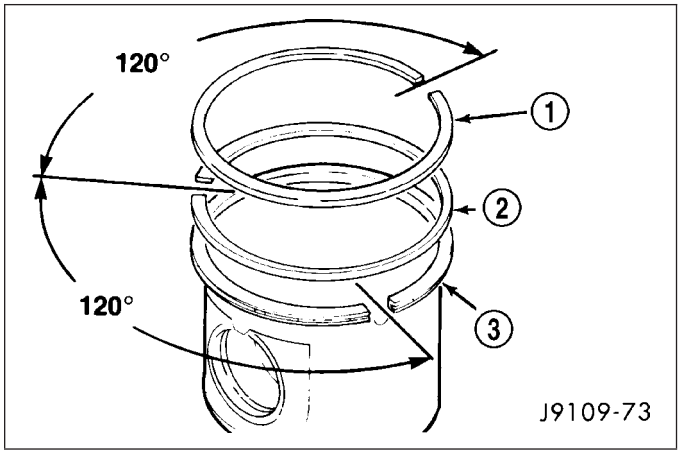
4. The top surface of all of the rings are identified with the word TOP or the supplier's MARK. Assemble the rings with the word TOP or the supplier's MARK up.
5. Position the oil ring expander (2) in the oil control ring (1) groove (bottom groove).
6. Install the oil control ring (1) with the end gap OPPOSITE the ends on the expander.



7. Install the intermediate piston ring in the second groove.
8. Install the top piston ring in the top groove.



9. Position the rings as shown.



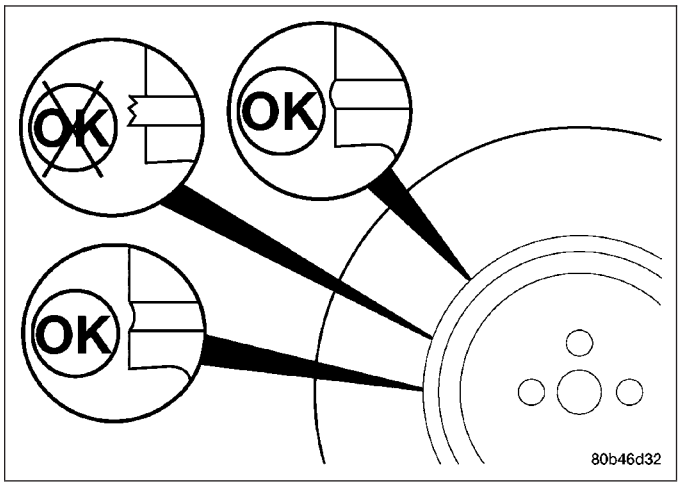
DAMPER - CRANKSHAFT

REMOVAL

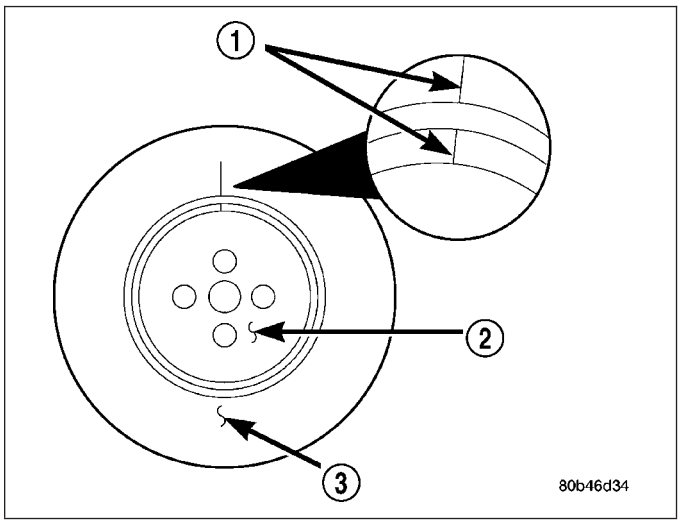
1. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
2. Remove the four (4) damper to crankshaft bolts and remove damper and speed indicator ring.

INSPECTION

1. Inspect the damper hub for cracks and replace if any are found.
2. Inspect the rubber member for deterioration or missing segments.



3. Inspect the index lines (1) on the damper hub (2) and the inertia member (3). If the lines are more than 1.59 mm (1/16 in.) out of alignment, replace the damper.



INSTALLATION

1. Install speed indicator ring.

NOTE: The speed indicator ring is located over a dowel pin.

2. Install the crankshaft damper and bolts. Tighten bolts to 40 N·m (30 ft. lbs.) torque, plus an additional 60°.

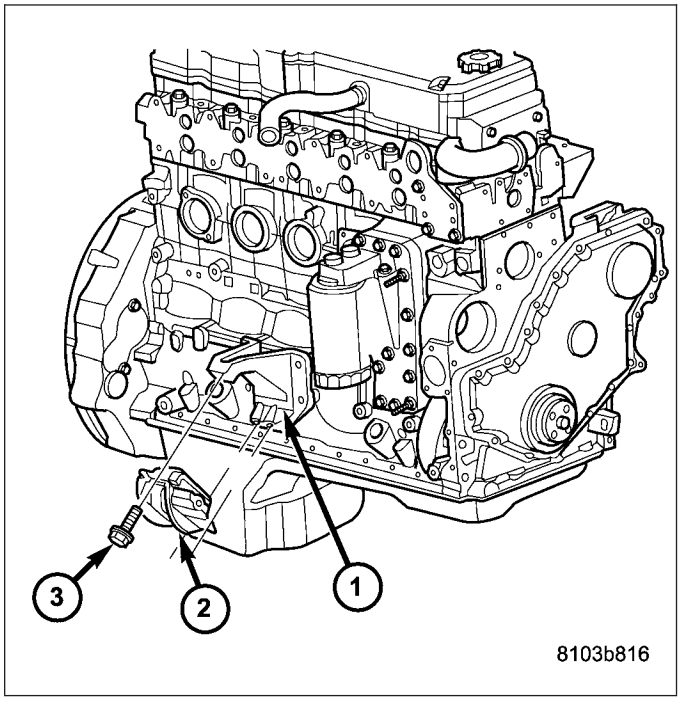
NOTE: The damper must be installed so the hole is located over the dowel pin.

3. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

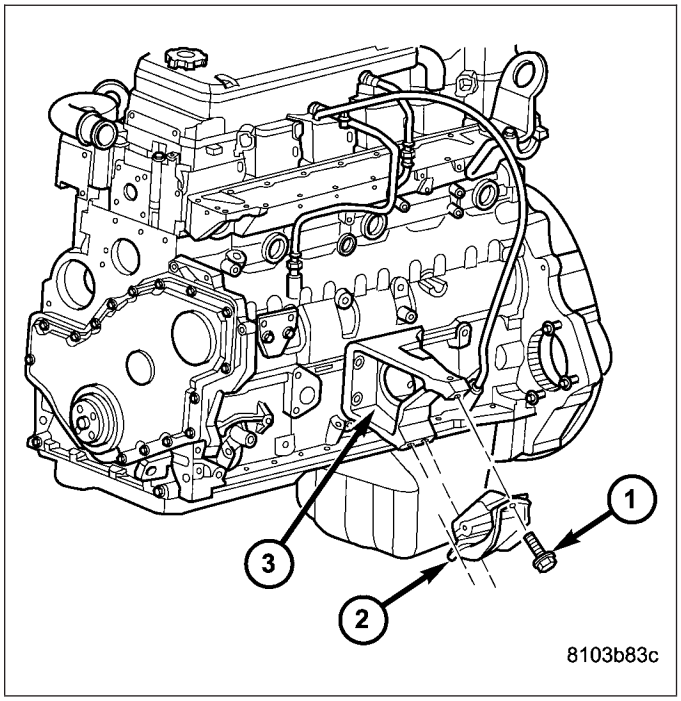
MOUNT - FRONT

REMOVAL

1. Disconnect the battery negative cables.
2. Remove the viscous fan/drive assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Raise vehicle on hoist.
4. Install engine support fixture tool# 8534 and steel bracket tool # 8534A
5. Loosen the thru-bolt and nut.
6. Lift the engine SLIGHTLY and remove the insulator to block bolts.
7. Remove the RH insulator (2) from the vehicle.

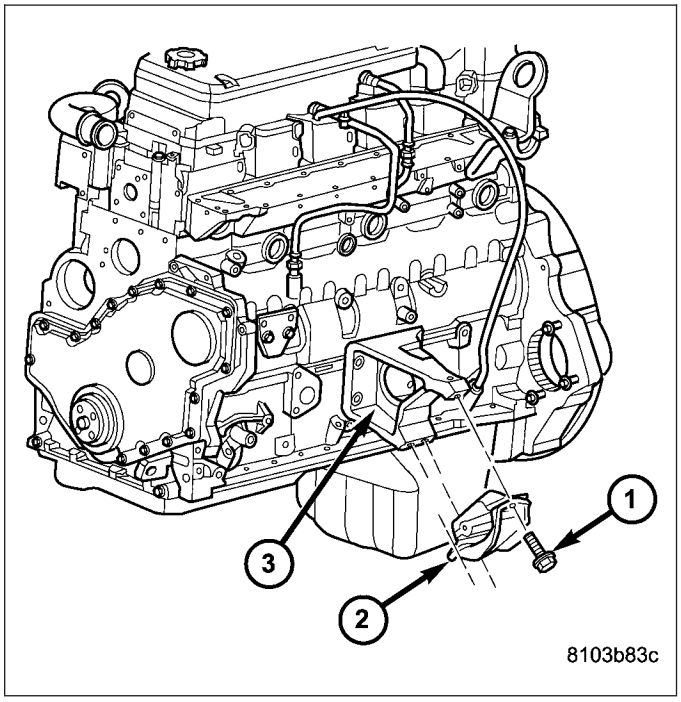


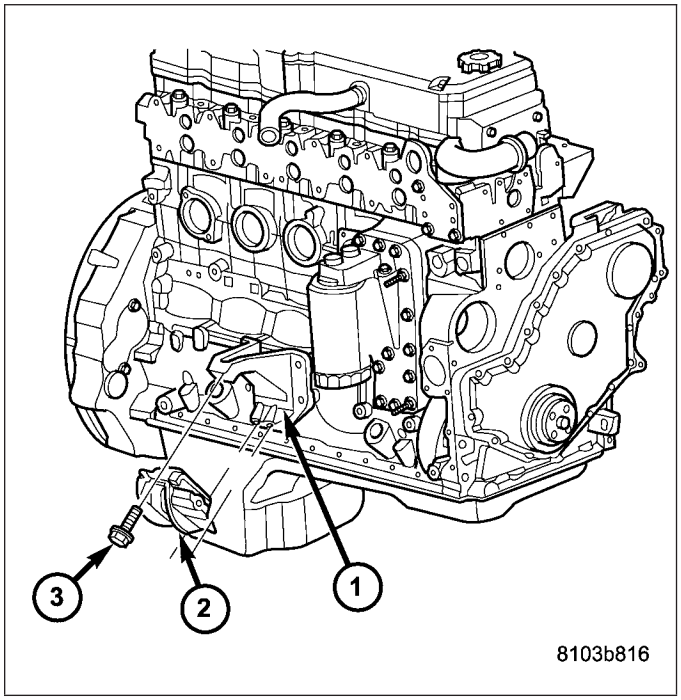
8. Remove the LH insulator (2) from the vehicle.



INSTALLATION

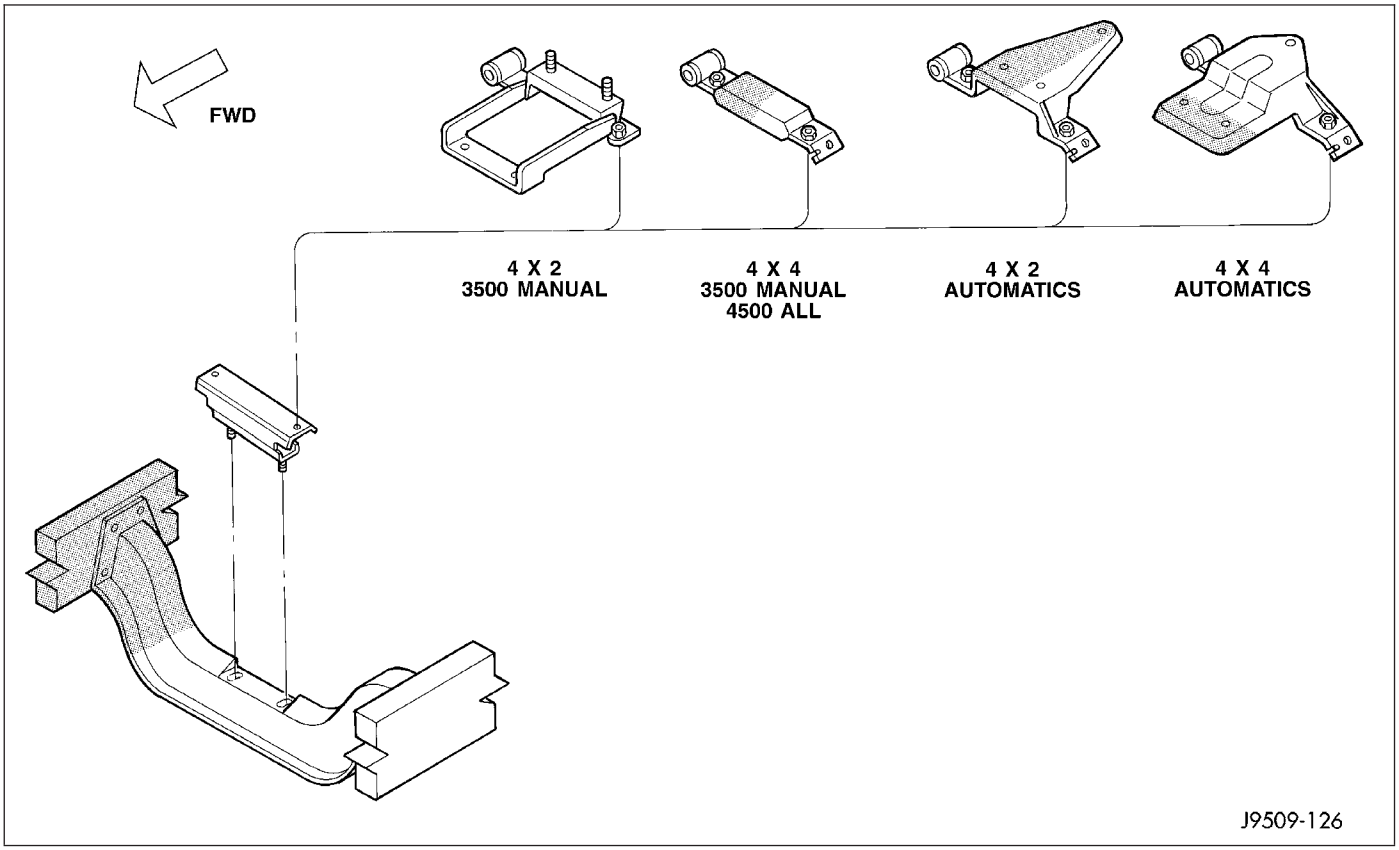
1. With engine raised SLIGHTLY, position the LH insulator (2) to the mount. Install the bolts and torque to specification.
2. With engine raised SLIGHTLY, position the RH insulator (2) to the mount. Install the bolts and torque to specification.
3. Lower the engine using tool # 8534, while guiding the mount and thru-bolt into the frame mounted support cushion brackets.
4. Install the thru-bolt nut and tighten the nut to 95 N·m (70 ft. lbs.) torque.
5. Remove the engine support fixture tool #8534.
6. Lower the vehicle.
7. Install the viscous fan/drive assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
8. Connect the battery negative cables.





MOUNT - REAR

REMOVAL



1. Raise the vehicle on a hoist.
2. Position a transmission jack in place.
3. Remove support cushion stud nuts.
4. Raise rear of transmission and engine SLIGHTLY.
5. Remove the bolts holding the support cushion to the transmission support bracket. Remove the support cushion.
6. If necessary, remove the bolts holding the transmission support bracket to the transmission.

INSTALLATION

1. If removed, position the transmission support bracket to the transmission. Install new attaching bolts and tighten to 102 N·m (75 ft. lbs.) torque.
2. Position support cushion to transmission support bracket. Install stud nuts and tighten to 47 N·m (35 ft. lbs.) torque.
3. Using the transmission jack, lower the transmission and support cushion onto the crossmember .
4. Install the support cushion bolts and tighten to 47 N·m (35 ft. lbs.) torque.
5. Remove the transmission jack.
6. Lower the vehicle.

LUBRICATION

DESCRIPTION

NOTE: Refer to and for circuit illustrations.

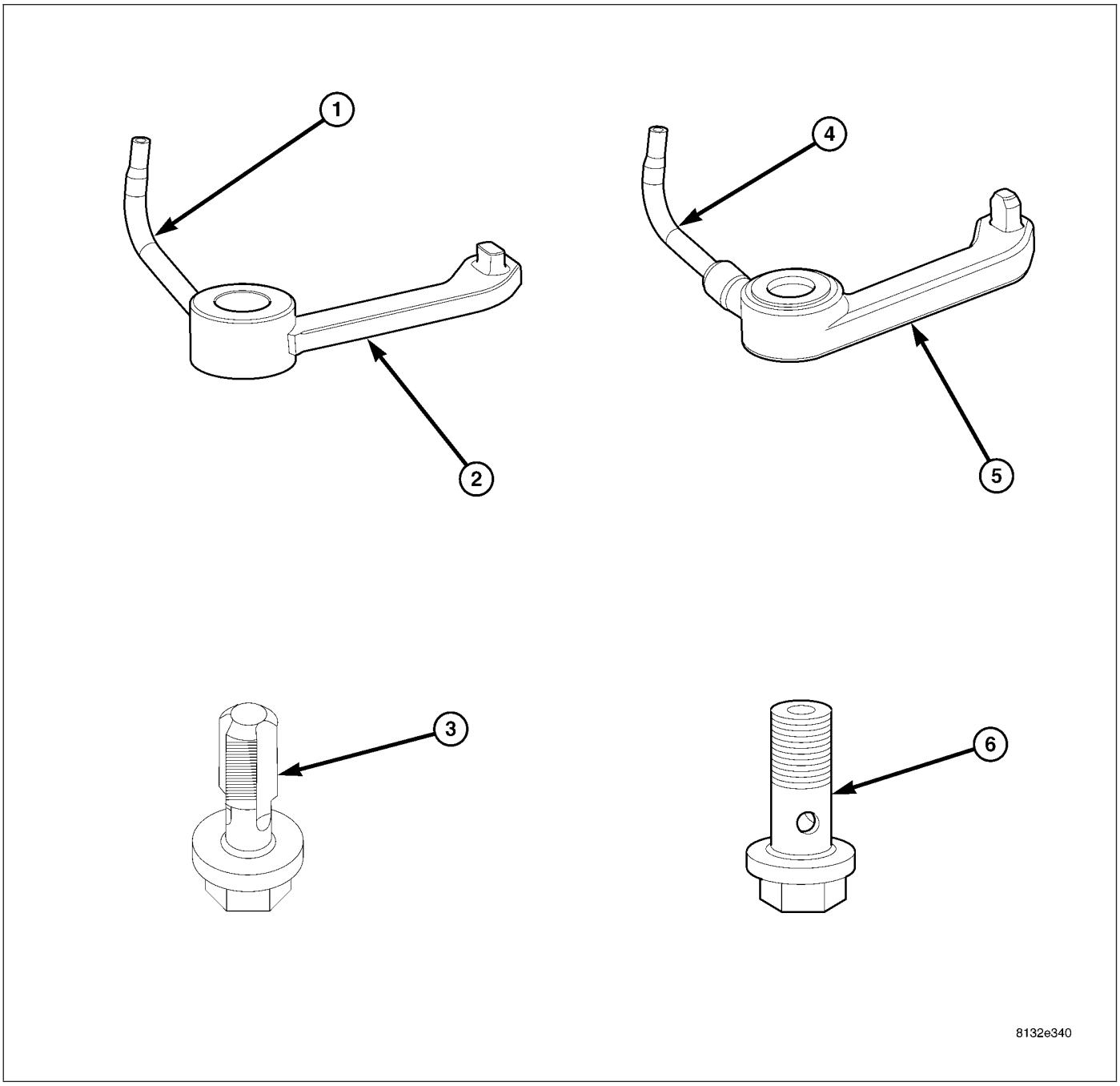
A gear driven gerotor type oil pump is mounted behind the front gear cover in the lower right portion on the engine.

OPERATION

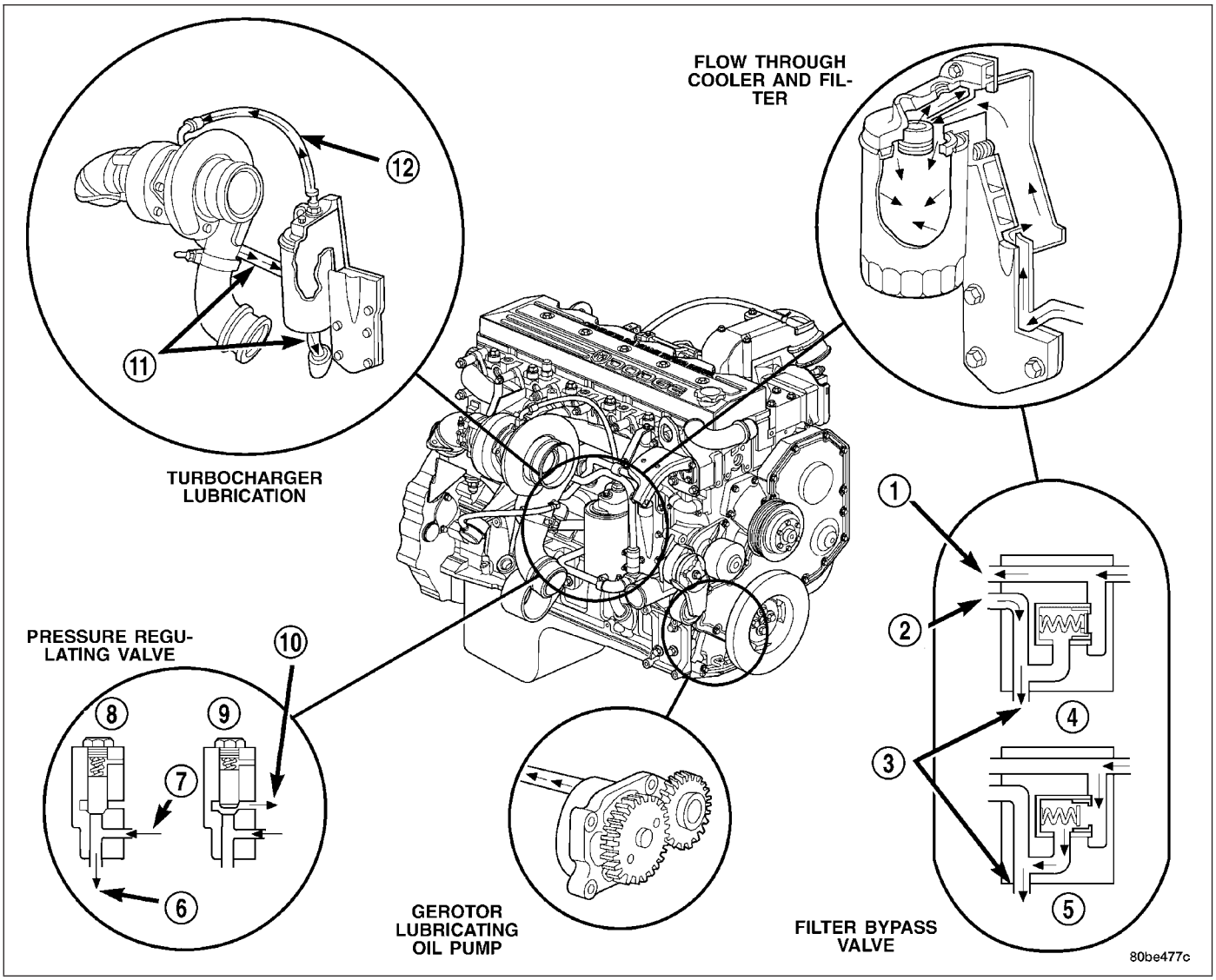
A gerotor style oil pump draws oil from the crankcase through the suction tube and delivers it through the block where it enters the oil cooler cover and pressure regulator valve. When oil pressure exceeds 517 kPa (75 PSI), the valve opens exposing the dump port, which routes excess oil back to the oil pump.

At the same time, oil is directed to a cast in passage in the oil cooler cover, leading to the oil cooler element. As the oil travels through the element plates, it is cooled by engine coolant traveling past the outside of the plates. It is then routed to the oil filter head and through a full flow oil filter. If a plugged filter is encountered, the filter by-pass valve opens, allowing unfiltered oil to lubricate the engine. This condition can be avoided by frequent oil and filter changes, per the maintenance schedules found in the owners manual. The by-pass valve is calibrated to open when it sees a pressure drop of more than 345 kPa (50 psi) across the oil filter.

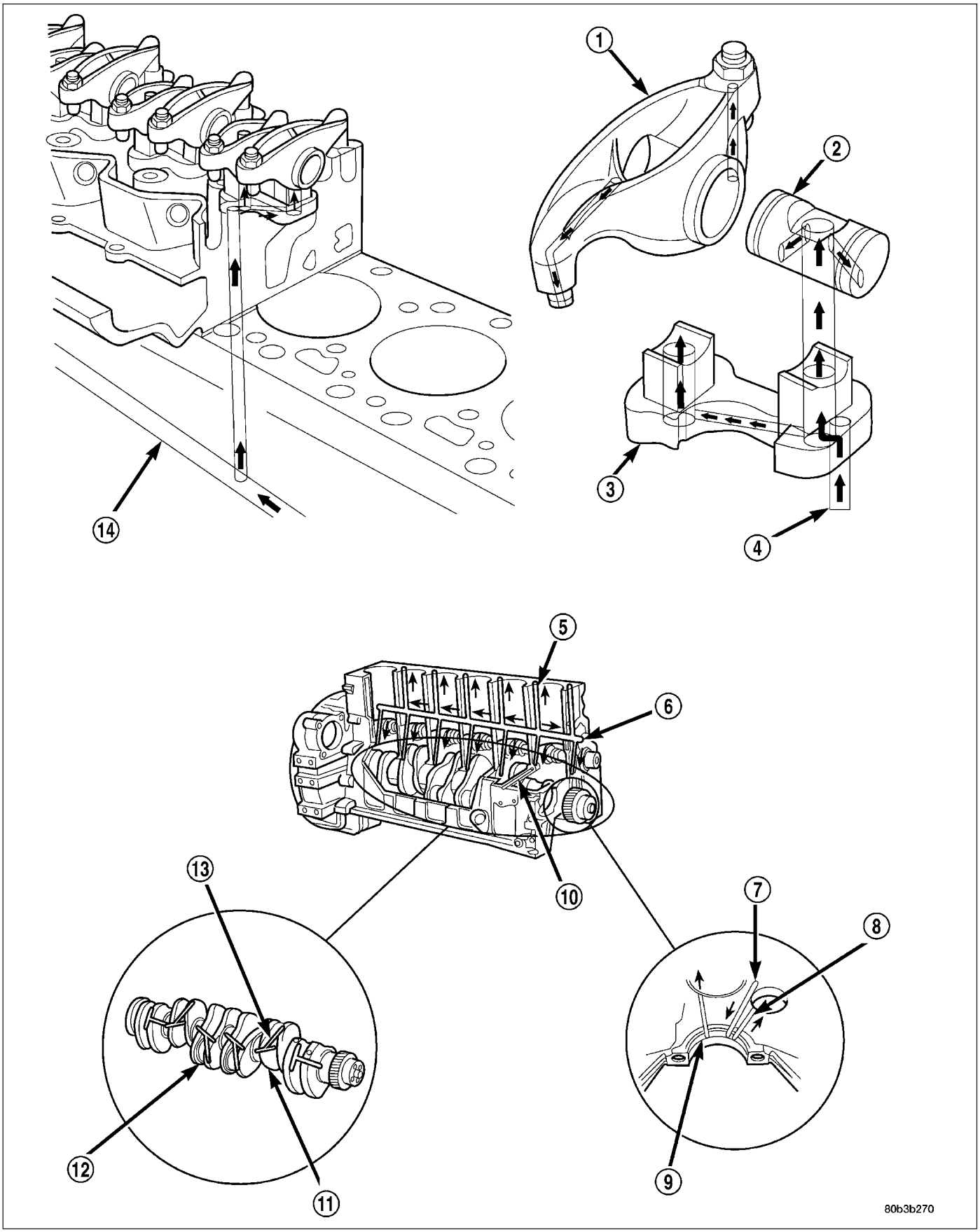
The oil filter head then divides the oil between the engine and the turbocharger. The turbocharger receives filtered, cooled and pressurized oil through a supply line from the filter head. The oil lubricates the turbocharger and returns to the pan by way of a drain tube connecting the bottom of the turbocharger to a pressed in tube in the cylinder block.



CAUTION:
Two different styles of J-jet piston cooling nozzles and nozzle mounting fasteners are used, depending on engine build date. The two designs are NOT interchangeable. One design uses an all metal piston cooling nozzle (1) with a fluted mounting capscrew (3). The second design uses a plastic nozzle/body/locating arm (5) , and a metal nozzle tip (4). The second design nozzle must be used with a banjo bolt (6). When replacing piston cooling nozzles, it is important to replace the cooling nozzle mounting fastener with the same type that was removed. Do not intermix both designs in the same engine. Severe engine damage can result if the two designs are intermixed.



Oil is then carried across the block to an angle drilling which intersects the main oil rifle (3). The main oil rifle (3) runs the length of the block and delivers oil to the crankshaft main journals and valve train. Oil travels to the crankshaft through a series of transfer drillings (one for each main bearing) and lubricates a groove in the main bearing upper shell. From there another drilling feeds the camshaft main journals. J-jet piston cooling nozzles (1,4) are supplied by a separate oil rifle. Plugs are used in place of saddle jets when J-jets are used. Crankshaft internal cross-drillings supply oil to the connecting rod journals.



Another series of transfer drillings intersecting the main oil rifle supply (14) the valve train components. Oil travels up the drilling, through a hole in the head gasket, and through a drilling in the cylinder head (one per cylinder), where it enters the rocker arm pedestal (3) and is divided between the intake and exhaust rocker arm (1). Oil travels up and around the rocker arm mounting bolt, and lubricates the rocker shaft (2) by cross drillings that intersect the

mounting bolt hole. Grooves at both ends of the rocker shaft supply oil through the rocker arm where the oil travels to the push rod and socket balls and.

DIAGNOSIS AND TESTING—ENGINE OIL PRESSURE

1. Remove the 1/8 npt plug from the top of the oil filter housing.
2. Install Oil Pressure Line and Gauge Tool C-3292 with a suitable adapter.
3. Start engine and warm to operating temperature.
4. Record engine oil pressure and compare with engine oil pressure chart.

CAUTION: If engine oil pressure is zero at idle, DO NOT RUN THE ENGINE.

Engine Oil Pressure (MIN)	
At Idle	68.9 kPa (10 psi)
At 2500 rpm	206.9 kPa (30 psi)

If minimum engine oil pressure is below these ranges, (Refer to 9 - ENGINE - DIAGNOSIS AND TESTING).

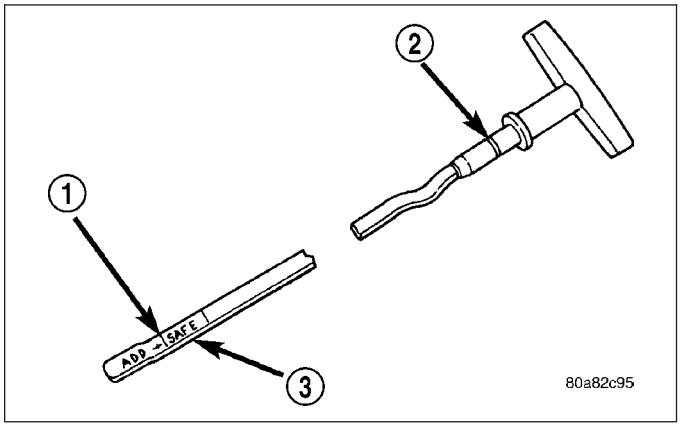
5. Remove oil pressure gauge and install the 1/8 npt plug.

OIL

STANDARD PROCEDURE

STANDARD PROCEDURE - ENGINE OIL LEVEL

CAUTION: Do not overfill crankcase with engine oil, oil foaming and oil pressure loss can result.



To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable oil level is in the SAFE RANGE (3) on the engine oil dipstick.

1. Position vehicle on level surface.
2. With engine OFF, allow approximately 15 minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.
3. Wipe dipstick clean.
4. Replace dipstick and verify it is seated in the tube.
5. Remove dipstick, with handle held above the tip, take oil level reading.
6. Add oil only if level is below the SAFE RANGE area on the dipstick.
7. Replace dipstick.

STANDARD PROCEDURE - ENGINE OIL SERVICE

WARNING: HOT OIL CAN CAUSE PERSONAL INJURY.

NOTE: Change engine oil and filter at intervals specified in the owner's manual.

1. Operate the engine until the water temperature reaches 60°C (140°F). Shut the engine off.
2. Use a container that can hold at least 14 liters (15 quarts) to hold the used oil. Remove the oil drain plug and drain the used engine oil into the container.

3. Always check the condition of the used oil. This can give you an indication of engine problems that might exist.
   - Thin, black oil indicates fuel dilution.
   - Milky discoloration indicates coolant dilution.
4. Clean the area around the oil filter head. Remove the filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - REMOVAL).
5. Install new oil filter (Refer to 9 - ENGINE/LUBRICATION/OIL FILTER - INSTALLATION).
6. Clean the drain plug and the sealing surface of the pan. Check the condition of the threads and sealing surface on the oil pan and drain plug.
7. Install the drain plug. Tighten the plug to 50 N·m (37 ft. lbs.) torque.
8. Use only High-Quality Multi-Viscosity lubricating oil in the Cummins Turbo Diesel engine. Choose the correct oil for the operating conditions (Refer to LUBRICATION & MAINTENANCE/FLUID TYPES - DESCRIPTION).
9. Fill the engine with the correct grade of new oil (Refer to LUBRICATION & MAINTENANCE/FLUID CAPACITIES - SPECIFICATIONS).
10. Start the engine and operate it at idle for several minutes. Check for leaks at the filter and drain plug.
11. Stop engine. Wait 15 minutes to allow the oil to drain back to the pan and check the level again.

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing of used engine oil after it has been drained from a vehicle's engine.

COOLER - ENGINE OIL & LINES

CLEANING

CLEANING AND INSPECTION

Clean the sealing surfaces.

Apply 483 kPa (70 psi) air pressure to the element to check for leaks. If the element leaks, replace the element.

FILTER - ENGINE OIL

REMOVAL

1. Clean the area around the oil filter head. Remove the filter from below using a cap-style filter wrench.
2. Clean the gasket surface of the filter head. The filter canister O-Ring seal can stick on the filter head. Make sure it is removed.

INSTALLATION

1. Fill the oil filter element with clean oil before installation. Use the same type oil that will be used in the engine.
2. Apply a light film of lubricating oil to the sealing surface before installing the filter.

CAUTION: Mechanical over-tightening may distort the threads or damage the filter element seal.

3. Install the filter until it contacts the sealing surface of the oil filter adapter. Tighten filter an additional ½ turn.

PAN - ENGINE OIL

REMOVAL

1. Disconnect the battery negative cables.
2. Install engine support fixture # 8534.
3. Raise vehicle on hoist.
4. Disconnect starter cables from starter motor.
5. Remove transmission and transfer case (if equipped).

6. Remove flywheel or flexplate.
7. Remove starter motor (Refer to 8 - ELECTRICAL/STARTING/STARTER MOTOR - REMOVAL) and transmission adapter plate assembly.

WARNING: HOT OIL CAN CAUSE PERSONAL INJURY.

8. Drain the engine oil (Refer to 9 - ENGINE/LUBRICATION/OIL - STANDARD PROCEDURE).
9. Install the oil pan drain plug if sealing surface is not damaged and tighten to 50 N·m (37 ft. lbs.) torque.
10. Remove oil pan bolts, break the pan to block seal, and lower pan slightly and remove oil suction tube fasteners.
11. Remove oil pan and suction tube.

CLEANING

Remove all gasket material from the oil pan and cylinder block sealing surfaces. Extra effort may be required around T-joint areas. Clean oil pan and flush suction tube with a suitable solvent.

INSPECTION

Inspect the oil pan, suction tube, and tube braces for cracks and damage. Replace any defective component. Inspect the oil drain plug and drain hole threads. Inspect the oil pan sealing surface for straightness. Repair any minor imperfections with a ball-peen hammer. Do not attempt to repair an oil pan by welding.

INSTALLATION

1. Fill the T-joint between the pan rail/gear housing and pan rail/rear seal retainer with sealant. Use Mopar® Silicone Rubber Adhesive Sealant or equivalent.
2. Place suction tube in oil pan and guide them into place. Slide oil pan gasket into postion.Using a new tube to block gasket, install and tighten the suction tube bolts by hand. Starting with the oil pump inlet bolts, tighten the bolts to 24 N·m (18 ft. lbs.) torque. Tighten the remaining tube brace bolts to 43 N·m (32 ft. lbs.) torque.
3. Starting in the center and working outward, tighten the oil pan bolts to 28 N·m (21 ft. lbs.) torque.
4. Install the flywheel housing assembly with the starter motor attached and tighten bolts to 77 N·m (57 ft. lbs.) torque.
5. Connect starter motor cables.

NOTE: Early build engines are equipped with a standard flywheel with an NV 5600 transmission. Later builds use a G 56 transmission, and a dual mass flywheel, which uses a crankshaft to flywheel adapter.

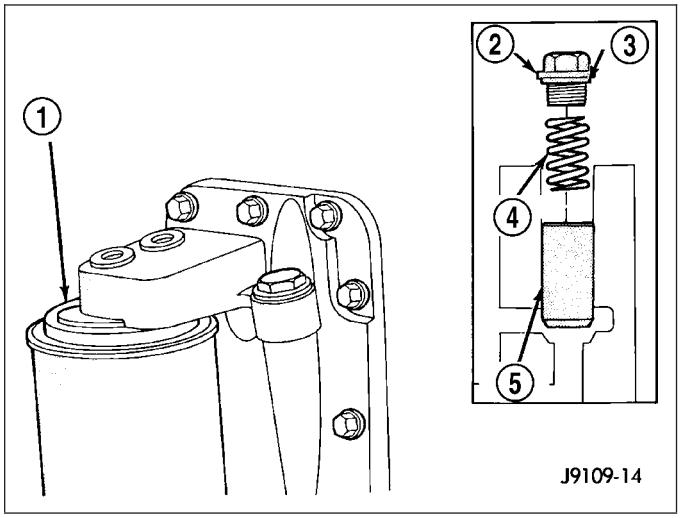
6. **FOR EARLY BUILDS** Install the flywheel or flexplate. Torque to 137 N·m (101 ft. lbs.).
7. **FOR LATE BUILDS** Install the flywheel to crankshaft adapter. Torque to 137 N·m (101 ft. lbs.).
8. Install transmission and transfer case (if equipped).
9. Lower vehicle.
10. Remove the engine support fixture # 8534.
11. Install battery negative cables.
12. Fill the crankcase with new engine oil.
13. Start engine and check for leaks. Stop engine, check oil level, and adjust, if necessary.

VALVE - OIL PRESSURE RELIEF

REMOVAL

1. Disconnect the battery negative cables.
2. Remove the threaded plug (2), spring (4) and valve (5). Insert a finger or a seal pick to lift the plunger from the bore.

NOTE: If the plunger is stuck in the bore, it will be necessary to remove the filter head.



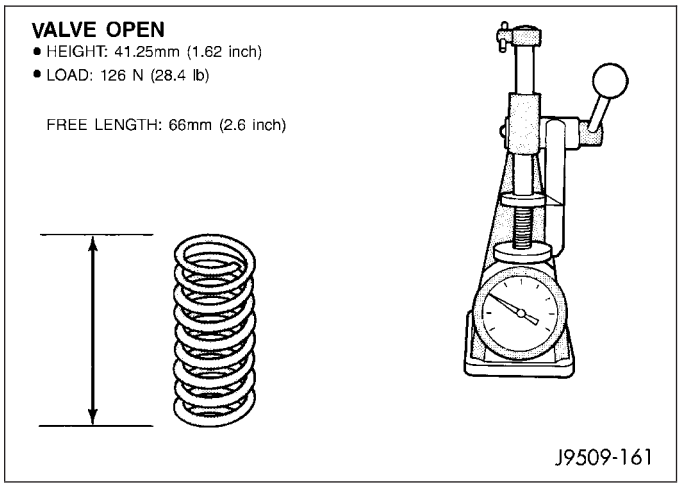
CLEANING

1. Clean the regulator spring and plunger with a suitable solvent and blow dry with compressed air. If the plunger bore requires cleaning, it is necessary to remove the oil filter head to avoid getting debris into the engine.

INSPECTION

Inspect the plunger and plunger bore for cracks and excessive wear. Polished surfaces are acceptable. Verify that the plunger moves freely in the bore.

Check the spring for height and load limitations. Replace the spring if out of limits shown in the figure.



INSTALLATION

1. Install the plunger, spring, and plug as shown in. Tighten the plug to 80 N·m (59 ft. lbs.) torque.
2. Connect the battery negative cables.
3. Start the engine and verify that it has oil pressure.

SWITCH - OIL PRESSURE

REMOVAL

1. Disconnect the battery negative cables.
2. Disconnect the oil pressure switch connector.
3. Using a suitable socket, remove the oil pressure switch from the block (counter-clockwise).

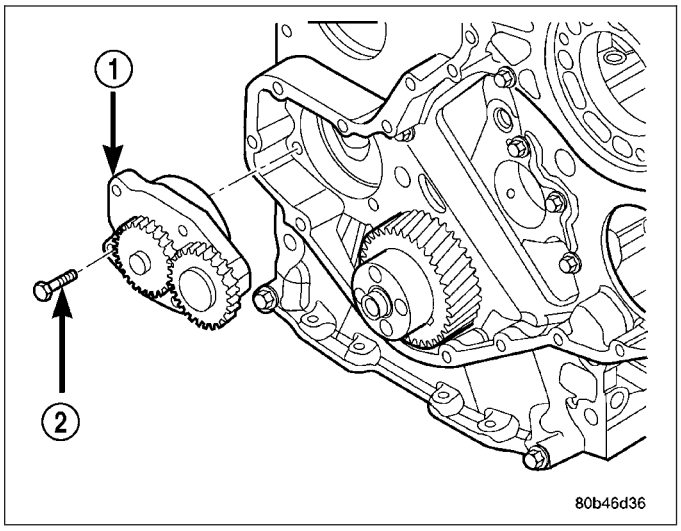
INSTALLATION

1. If the switch is not being replaced, replace and lubricate the o-ring.
2. Install the oil pressure switch and tighten to 18 N·m (159 in. lbs.) torque.
3. Connect oil pressure switch connector.
4. Connect the battery negative cables.
5. Start engine and check for oil leaks at the switch.

PUMP - ENGINE OIL

REMOVAL

1. Disconnect the battery negative cables.
2. Remove fan/drive assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
3. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
4. Remove the fan support/hub assembly.
5. Remove crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and speed indicator ring.
6. Remove power steering pump.
7. Remove accessory drive belt tensioner.
8. Remove the gear housing cover (Refer to 9 - ENGINE/VALVE TIMING/GEAR HOUSING COVER - REMOVAL).
9. Remove the four mounting bolts (2) and pull the oil pump (1) from the bore in the cylinder block.



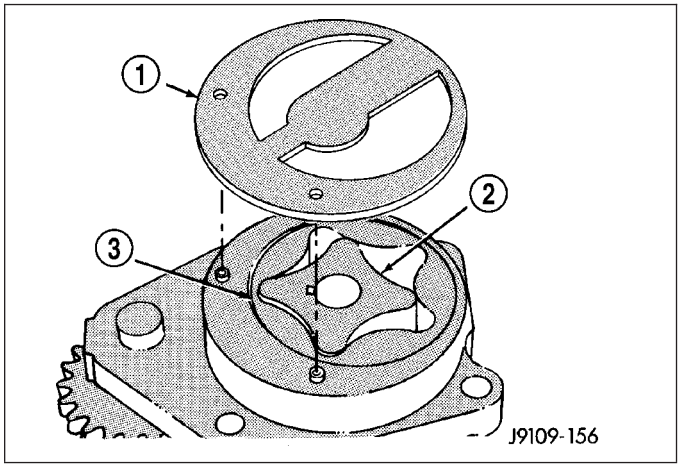
CLEANING

Clean all parts in solvent and dry with compressed air. Clean the old sealer residue from the back of the gear housing cover and front of the gear housing.

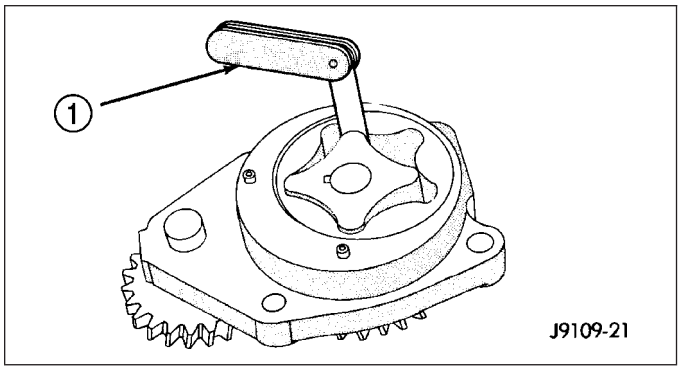
INSPECTION

Disassemble and inspect the oil pump as follows:

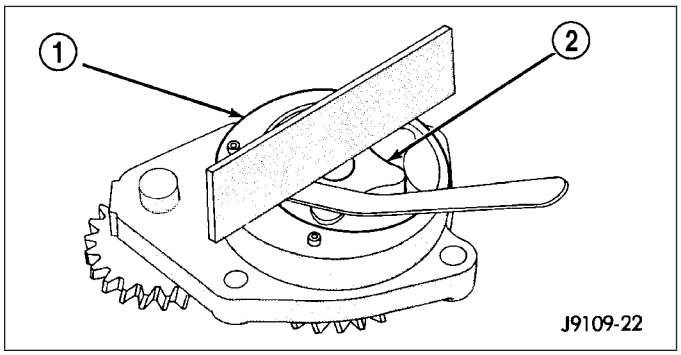
1. Visually inspect the lube pump gears for chips, cracks or excessive wear.
2. Remove the back plate (1).
3. Mark TOP on the gerotor planetary (3) using a felt tip pen.
4. Remove the gerotor planetary (3) inspect for excessive wear or damage. Inspect the pump housing and gerotor drive (2) for damaged and excessive wear.



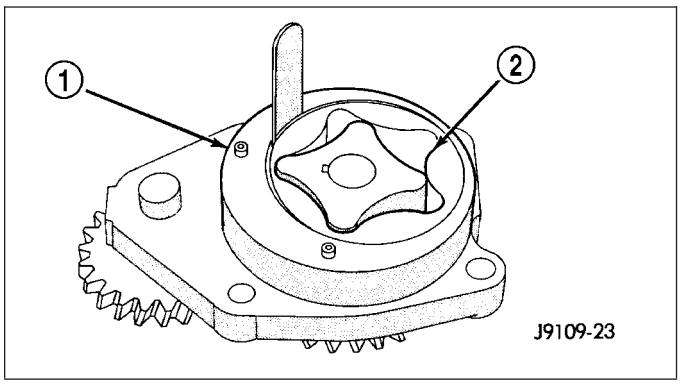
5. Install the gerotor planetary in the original position.
6. Measure the tip clearance (1). Maximum clearance is 0.1778 mm (0.007 inch). If the oil pump is out of limits, replace the pump.



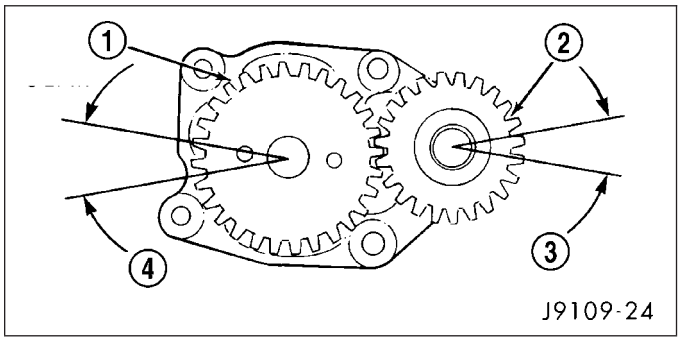
7. Measure the clearance of the gerotor drive/gerotor planetary (2)to port plate (1). Maximum clearance is 0.127 mm (0.005 inch). If the oil pump is out of limits, replace the pump.



8. Measure the clearance of the gerotor planetary to the body bore (1). Maximum clearance is 0.381 mm (0.015 inch). If the oil pump is out of limits, replace the pump.

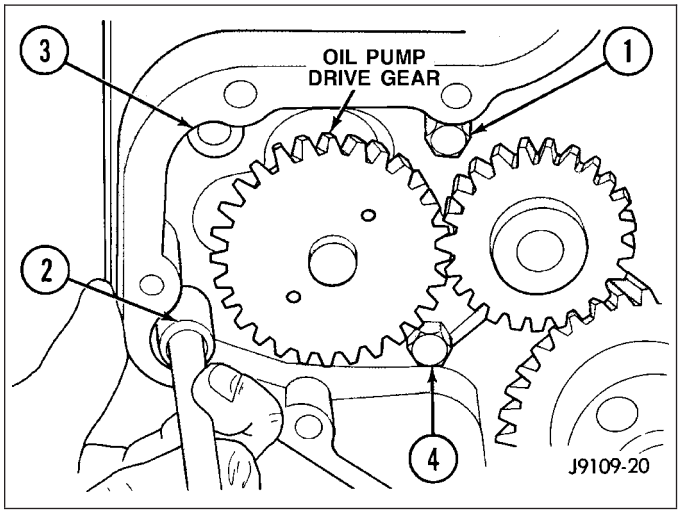


9. Measure the gears backlash (3,4). The limits of a used pump is 0.15- 0.25 mm (0.006-0.010 inch). If the backlash is out of limits, replace the oil pump.
10. Install the back plate.

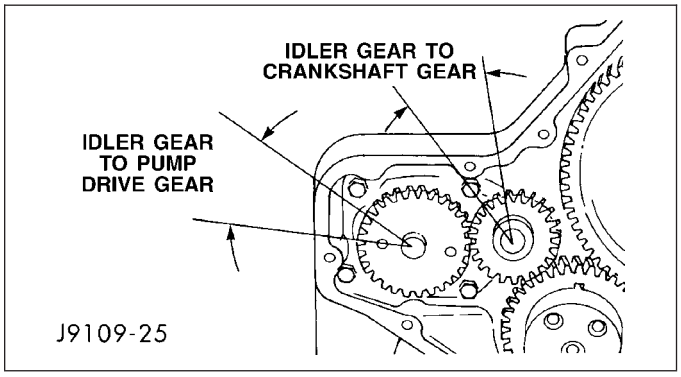


INSTALLATION

1. Lubricate the pump with clean engine oil. Filling the pump with clean engine oil during installation will help to prime the pump at engine start up.
2. Install the pump. Verify the idler gear pin is installed in the locating bore in the cylinder block. Tighten the oil pump mounting bolts in two steps, in the sequence shown in.
   - Step 1—Tighten to 8 N·m (71 in. lbs.) torque.
   - Step 2—Tighten to 24 N·m (18 ft. lbs.) torque.



3. The back plate on the pump seats against the bottom of the bore in the cylinder block. When the pump is correctly installed, the flange on the pump will not touch the cylinder block.
4. Measure the idler gear to pump drive gear backlash and the idler gear to crankshaft gear backlash. The backlash should be 0.15- 0.25 mm (0.006-0.010 inch). If the backlash is out of limits, replace the oil pump.
5. If the adjoining gear moves when you measure the backlash, the reading will be incorrect.

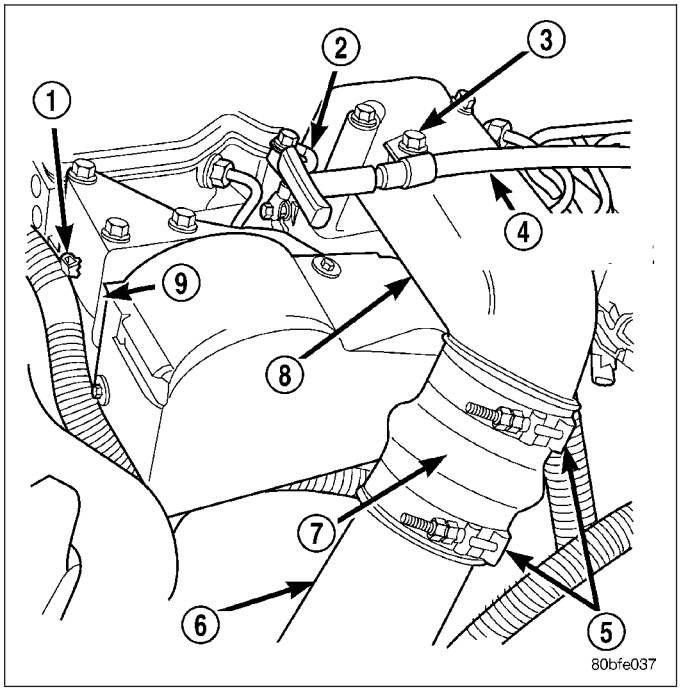


6. Apply a bead of Mopar® Silicone Rubber Adhesive Sealant or equivalent to the gear housing cover sealing surface.
7. Install the gear housing cover (Refer to 9 - ENGINE/VALVE TIMING/GEAR HOUSING COVER - INSTALLATION).
8. Install the vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION) and speed indicator ring.
9. Install the fan support/hub assembly Refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION)
10. Install power steering pump.
11. Install accessory drive belt tensioner. Torque bolt to 43 N·m (32 ft. lbs.).
12. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
13. Install the cooling fan (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
14. Connect battery negative cables.
15. Start engine and check for oil leaks.

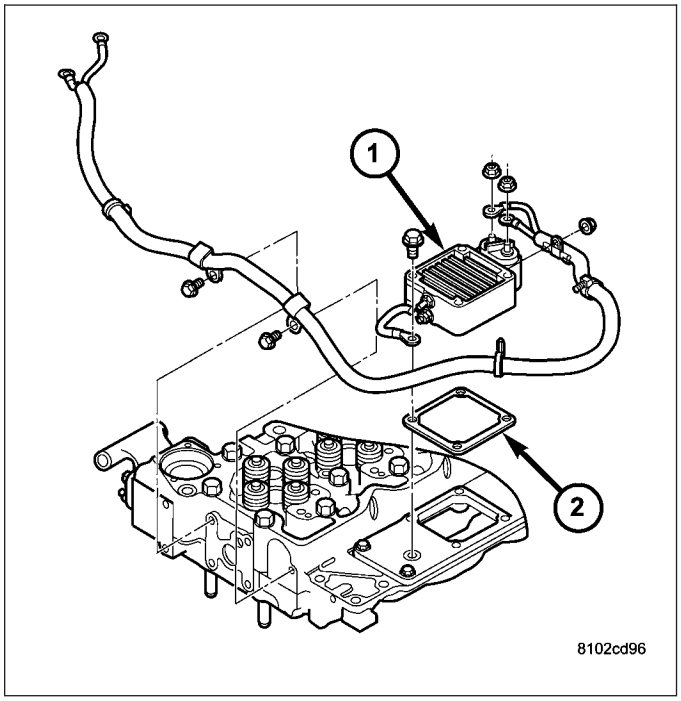
MANIFOLD - INTAKE

REMOVAL

1. Disconnect the battery negative cables.
2. Remove the charge air cooler outlet tube (6) from the air inlet housing (8).



3. Remove the engine oil dipstick tube mounting bolt.
4. Remove dipstick support at fuel filter housing. Position dipstick tube to the side.
5. Disconnect the air grid heater power cables at the cable mounting studs.
6. Remove the engine wiring harness connections at the air inlet housing elbow.
7. Remove the four (4) air inlet housing mounting bolts and remove the housing from top of the heater elements.
8. Remove the intake air grid heater (1)from the manifold.



9. Remove the high pressure fuel lines and fuel rail (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - REMOVAL).
10. Disconnect manifold air temperature/pressure sensor connector.
11. Remove the remaining intake manifold cover-to-cylinder head bolts.

12. Remove the intake manifold cover and gasket. Keep the gasket material and any other material out of the air intake.
13. Clean the intake manifold cover and cylinder head sealing surface.

CLEANING

Clean manifold in solvent and blow dry with compressed air.

Clean cylinder block gasket surfaces using a suitable solvent.

The plenum pan rail must be clean and dry (free of all foreign material).

INSPECTION

Inspect manifold for cracks.

Inspect mating surfaces of manifold for flatness with a straightedge.

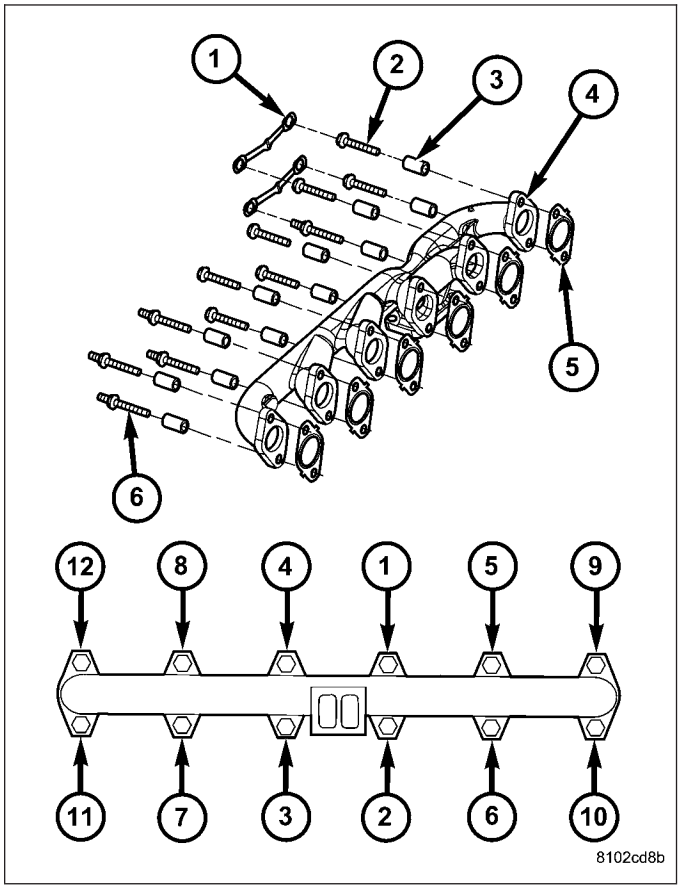
INSTALLATION

1. Using a new gasket, install the intake manifold cover.
2. Install the cover-to-cylinder head bolts that do not hold down the fuel rail. Tighten the bolts to 24 N·m (18 ft. lbs.) torque.
3. Install the high pressure rail and fuel lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - INSTALLATION).
4. Using two (2) new gaskets, install the intake air grid heater and air inlet housing.
5. Connect the manifold air temperature/pressure sensor connector.
6. Install and tighten the air intake heater power supply nuts to 14 N·m (120 in. lbs.) torque.
7. Install oil dipstick tube support at fuel filter housing.
8. Install the engine oil dipstick tube and mounting bolt.
9. Position the charge air cooler outlet tube onto the air inlet housing. Tighten the clamps to 11 N·m (100 in. lbs.) torque.
10. Attach the engine wire harness to the air inlet housing at two locations.
11. Prime the fuel system. Refer to the fuel priming procedure in Group 14, Fuel System.
12. Connect the battery negative cables.

MANIFOLD - EXHAUST

REMOVAL

1. Disconnect the battery negative cables.
2. Raise vehicle on hoist.
3. Disconnect the exhaust pipe from the turbocharger elbow.
4. Disconnect oil drain tube from turbocharger.
5. Lower vehicle.
6. Disconnect the electronic wastegate command valve from harness.
7. Disconnect the turbocharger air inlet hose.
8. Remove air cleaner assembly.
9. Disconnect the turbocharger oil supply line.
10. Disconnect the charge air cooler inlet pipe from the turbocharger.
11. Remove the turbocharger and gasket from the exhaust manifold.
12. Remove the cab heater return pipe nuts from the exhaust manifold stud. Position the tube out of the way.
13. Remove heat shield.
14. Remove exhaust manifold bolt lockplates (1).
15. Remove the exhaust manifold-to-cylinder head bolts(2,6) and spacers (3).
16. Remove the exhaust manifold and gaskets.



CLEANING

Clean the cylinder head and exhaust manifold sealing surfaces with a suitable scraper. Use a Scotch-Brite™ pad or equivalent.

INSPECTION

Inspect the exhaust manifold for cracks. Measure the exhaust manifold for flatness. Place a ruler over all of the exhaust ports and insert a feeler gauge between the port flange and the ruler. Maximum deviation from flat is 0.20 mm (.008 inch).

INSTALLATION

1. Using new gaskets, install the exhaust manifold and gaskets. Install the bolts and spacers and tighten the bolts in the sequence shown in to 43 N·m (32 ft. lbs.) torque.
2. Retorque the four center bolts.
3. Install heat shield and torque nuts to 24 Nm (18 ft. lbs.).
4. Install cab heater tube.
5. Install exhaust manifold bolt retention straps.
6. Install the cab heater return hose to the manifold bolt stud. Tighten the nut to 24 N·m (18 ft. lbs.) torque.
7. Install the turbocharger and a new gasket. Tighten the turbocharger mounting nuts to 43 N·m (32 ft. lbs.) torque.
8. Raise vehicle on hoist.
9. Install the oil drain tube and a new gasket to the turbocharger. Tighten the drain tube bolts to 24 N·m (18 ft. lbs.) torque.

10. Connect the exhaust pipe to the turbocharger and tighten the bolts to 11 N·m (100 ft. lbs.) torque.
11. Connect the wastegate command valve connector.
12. Lower the vehicle.
13. **Pre-lube the turbocharger.** Pour 50 to 60 cc (2 to 3 oz.) clean engine oil in the oil supply line fitting on the turbo. Rotate the turbocharger impeller by hand to distrubute the oil thoroughly.
14. Install and tighten the oil supply line fitting nut to 24 N·m (18 ft. lbs.) torque.
15. Position the charge air cooler inlet pipe to the turbocharger. With the clamp in position, tighten the clamp nut to 11 N·m (95 in. lbs.) torque.
16. Position the air inlet hose to the turbocharger. Tighten the clamp to 4 N·m (35 in. lbs.) torque.
17. Connect the battery negative cables.
18. Start the engine to check for leaks.

VALVE TIMING

STANDARD PROCEDURE - TIMING VERIFICATION

1. Remove the cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
2. Remove fuel injector from cylinder number 1 (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
3. Using Special Tool 7471B rotate the engine until the TDC mark on the damper is at 12 o'clock.
4. Using a 8 in.x 1/4 in. dowel rod inserted into cylinder number 1, rock the crankshaft back and forth to verify piston number 1 is at TDC.
5. With cylinder number still at TDC, inspect the keyway on the crankshaft gear for proper alignment (12 o'clock position).
6. If the keyway is not at 12 o'clock position replace the crankshaft gear assembly.
7. If the keyway is at 12 o'clock position, remove front gear cover and verify timing mark alignment between the camshaft gear and crankshaft gear, if not aligned inspect keyway on camshaft gear.
8. Inspect keyway on camshaft gear for proper alignment with the key in the camshaft, if alignment is off replace the camshaft/gear assembly.
9. If timing marks alignment is off and no damage is found at either the crankshaft or camshaft gear keyways, realign timing marks as necessary.

CASE - FRONT

REMOVAL

1. Disconnect the battery negative cables.
2. Raise vehicle on hoist.
3. Partially drain engine coolant into container suitable for re-use (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Lower vehicle.
5. Remove radiator upper hose.
6. Disconnect coolant recovery bottle hose from radiator filler neck.
7. Remove viscous fan/drive/shroud assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
8. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
9. Remove the cooling fan support/hub from the front of the engine.
10. Raise the vehicle on hoist.
11. Remove the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL) and speed indicator ring.
12. Remove the lower fan shroud bracket.

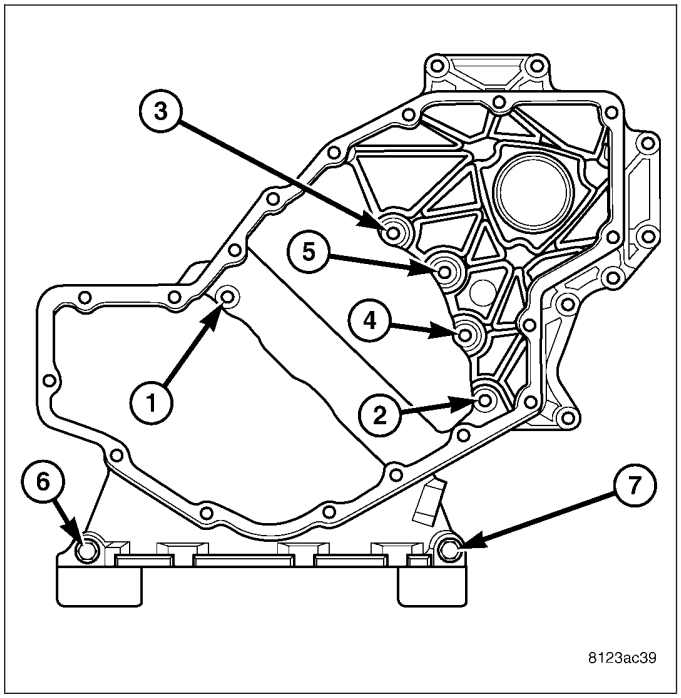
13. Remove the upper fan shroud bracket that is mounted to the gear housing.
14. Lower the vehicle.
15. Remove the power steering pump.
16. Remove the accessory drive belt tensioner.
17. Remove the gear cover-to-housing bolts and gently pry the cover away from the housing, taking care not to mar the gasket surfaces.
18. Remove the fuel injection pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).
19. Disconnect the camshaft position sensor connector.
20. Disconnect and remove engine speed sensor.
21. Remove the camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - REMOVAL).
22. Remove the six front oil pan fasteners.
23. Remove the gear housing fasteners.

NOTE: Use care when removing the gear housing, to avoid damage to the oil pan gasket, as the gasket will be reused if it is not damaged.

24. Slide a feeler gauge between the gear housing and oil pan gasket, to break the gasket seal.
25. Remove the gear housing and gasket.
26. Clean the gasket material from the cylinder block and gear housing.

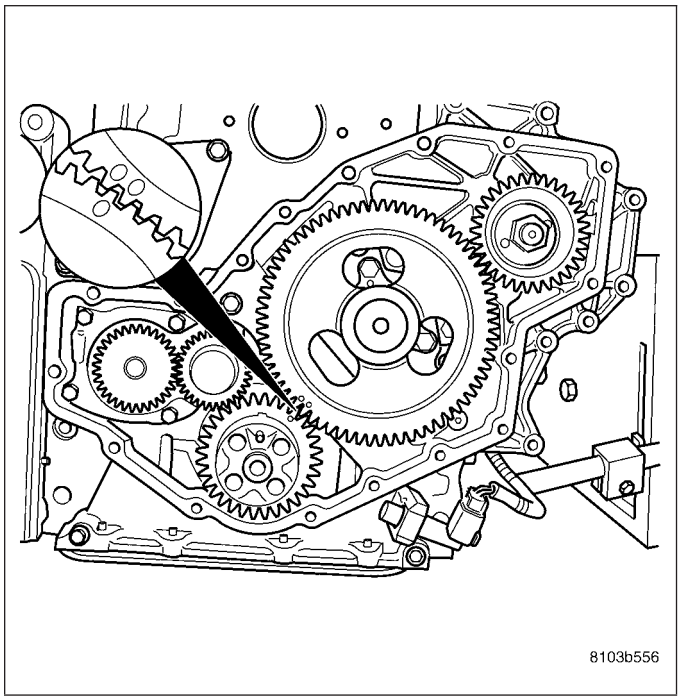
INSTALLATION

1. Inspect oil pan gasket. If torn, gasket must be replaced.
2. Install a new gear housing gasket onto cylinder block and trim any excesss gasket material flush to oil pan rail.
3. Install the gear housing. Torque bolts to 24 N·m (18 ft. lbs.).



4. If a new housing is installed, the camshaft position sensor, and engine speed sensor must be transferred to the new housing.
5. Connect the camshaft position sensor connector.
6. Install and connect engine speed sensor.
7. Install the injection pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

8. Install the camshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CAMSHAFT & BEARINGS (IN BLOCK) - INSTALLATION). Align the crankshaft and camshaft gear marks as shown.



9. Install a new front crankshaft seal into the gear cover.
10. Apply a bead of Mopar® Silicone Rubber Adhesive Sealant or equivalent to the gear housing cover. Be sure to surround all through holes.
11. Using the seal pilot to align the cover, install the cover to the housing and install the bolts. Tighten the bolts to 24 N·m (18 ft. lbs.) torque.
12. Remove the seal pilot. Install front seal dust shield.
13. Raise the vehicle.
14. Trim any excess gear housing gasket to make it flush with the oil pan rail.
15. Install the crankshaft damper and speed indicator ring (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION). Torque bolts to 40 Nm (30 ft. lbs.), plus an additional 60°.
16. Install the lower fan shroud bracket. Torque bolts to 24 N·m (18 ft. lbs.) torque.
17. Install the upper fan shroud brackets.
18. Lower vehicle.
19. Install the fan support/hub assembly and tighten bolts to 32 N·m (24 ft. lbs.) torque.
20. Install the power steering pump.
21. Install the accessory drive belt tensioner. Torque bolt to 43 N·m (32 ft. lbs.) torque.
22. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
23. Install the upper cooling fan/drive/shroud assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
24. Connect the coolant recovery bottle hose to the radiator filler neck.
25. Install the radiator upper hose and clamps.
26. Add engine oil.
27. Add coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
28. Connect the battery cables.
29. Start engine and inspect for leaks.

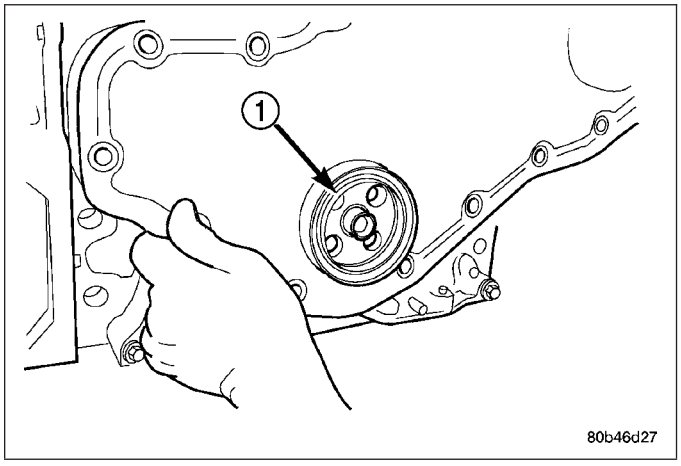
COVER - TIMING

REMOVAL

1. Disconnect both battery negative cables.
2. Raise vehicle on hoist.
3. Partially drain engine coolant into container suitable for re-use (Refer to 7 - COOLING - STANDARD PROCEDURE).
4. Lower vehicle.
5. Remove radiator upper hose.
6. Remove viscous fan/drive/shroud assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).
7. Remove the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
8. Remove the cooling fan support/hub from the front of the engine.
9. Raise the vehicle on hoist.
10. Remove power steering pump.
11. Remove accessory drive belt tensioner.
12. Remove the crankshaft damper and speed indicator ring (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).
13. Lower the vehicle.
14. Remove the gear cover-to-housing bolts and gently pry the cover away from the housing, taking care not to mar the gasket surfaces.

INSTALLATION

1. Install a new front crankshaft oil seal.
2. Obtain a seal pilot (1) installation tool from a crankshaft front seal service kit and install the pilot into the seal.
3. Apply a bead of Mopar® Silicone Rubber Adhesive Sealant or equivalent to the gear housing cover. Be sure to surround all through holes.
4. Using the seal pilot to (1) align the cover , install the cover to the housing and install the bolts. Tighten the bolts to 24 N·m (18 ft. lbs.) torque.
5. Remove the seal pilot. Install front seal dust shield.



6. Raise the vehicle.
7. Install the speed indicator ring and the crankshaft damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).
8. Lower vehicle.
9. Install the fan support/hub assy, and tighten bolts to 32 N·m (24 ft. lbs.) torque.
10. Install power steering pump.
11. Install accessory drive belt tensioner. Torque bolt to 43 N·m (32 ft. lbs.) torque.
12. Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
13. Install the cooling fan/drive/shroud assembly (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).
14. Install the radiator upper hose and clamps.
15. Add coolant (Refer to 7 - COOLING - STANDARD PROCEDURE).
16. Connect the battery cables.
17. Start engine and inspect for leaks.