

WIPERS/WASHERS

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WIPERS/WASHERS

DESCRIPTION

An electrically operated intermittent wiper and washer system is standard factory-installed safety equipment on this model (Fig. 1). The wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Check Valve** - The washer system check valve is integral to the wye fitting located in the washer

plumbing between the cowl plenum washer hose and the washer nozzles, and is concealed beneath the cowl plenum cover/grille panel at the base of the windshield.

- **Front Control Module** - The Front Control Module (FCM) is integral to the Integrated Power Module (IPM). The IPM is located in the engine compartment, near the battery. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/INTEGRATED POWER MODULE - DESCRIPTION).

WIPERS/WASHERS (Continued)

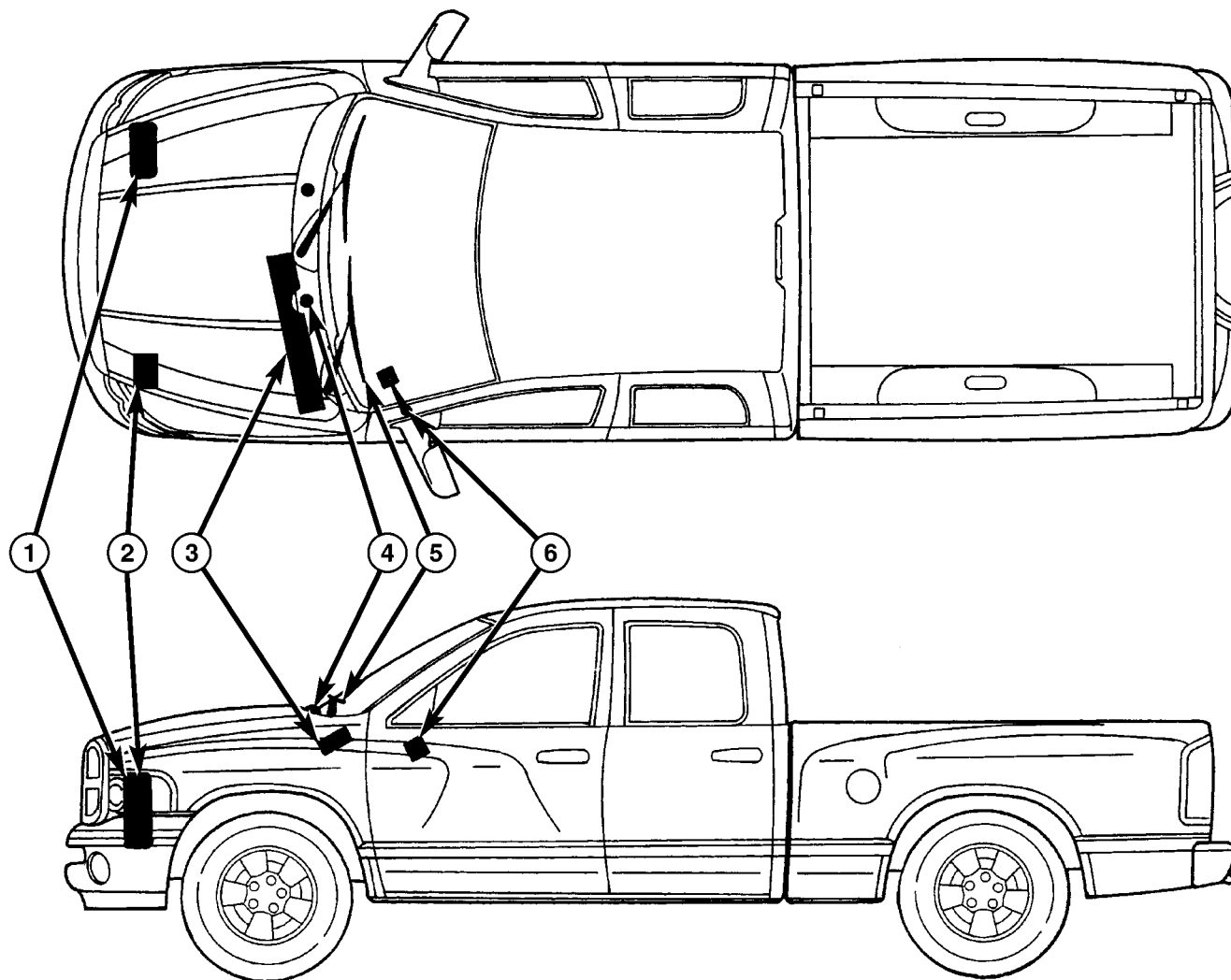


Fig. 1 Wiper & Washer System

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- 1 - WASHER RESERVOIR, PUMP/MOTOR, FLUID LEVEL SWITCH (EXCEPT V-10 & DIESEL ENGINE)
 2 - WASHER RESERVOIR, PUMP/MOTOR, FLUID LEVEL SWITCH (V-10 & DIESEL ENGINE ONLY)
 3 - WIPER MODULE

- 4 - WASHER NOZZLE (2)
 5 - WIPER ARM & BLADE (2)
 6 - MULTI-FUNCTION (WIPER, WASHER, & LIGHTING) SWITCH

• **Instrument Cluster** - In this model, the instrument cluster is also sometimes referred to as the Cab Control Node (CCN). The instrument cluster is located in the instrument panel above the steering column opening, directly in front of the driver. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DESCRIPTION).

• **Multi-Function Switch** - The multi-function switch is located on the top of the steering column, just below the steering wheel. The multi-function switch includes a control stalk that extends through an opening on the left side of the steering column shrouds and a control knob on the end of the stalk is dedicated to providing all of the driver controls for the wiper and washer systems. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION).

• **Washer Fluid Level Switch** - The washer fluid level switch is located in a dedicated hole on the out-board side of the washer reservoir in the engine compartment.

• **Washer Nozzle** - Two fluidic washer nozzles are secured with integral snap features to dedicated openings in the cowl plenum cover/grille panel located near the base of the windshield.

• **Washer Plumbing** - The plumbing for the washer system consists of rubber hoses and molded plastic fittings. The plumbing is routed along the right side of the engine compartment from the washer reservoir, and through a trough near the right end of the cowl plenum cover/grille panel into the cowl plenum to the washer nozzle fittings.

WIPERS/WASHERS (Continued)

- **Washer Pump/Motor** - The electric washer pump/motor unit is located in a dedicated hole on the rearward facing surface of the washer reservoir in the engine compartment.

- **Washer Reservoir** - On all models except those with an optional V-10 or diesel engine, the washer reservoir is secured by integral mounting tabs and a snap feature to slots in the right side of the cooling module shroud in the engine compartment. On models with an optional V-10 or diesel engine, the washer reservoir is secured by screws to the back of the upright left vertical member of the radiator support in the engine compartment. The washer reservoir filler neck is accessed from the engine compartment.

- **Wiper Arm** - The two wiper arms are secured with integral latches to the serrated ends of the two wiper pivot shafts, which extend through the cowl plenum cover/grille panel located near the base of the windshield.

- **Wiper Blade** - The two wiper blades are secured to the two wiper arms with an integral latch, and are parked on the glass near the bottom of the windshield when the wiper system is not in operation.

- **Wiper High/Low Relay** - The wiper high/low relay is an International Standards Organization (ISO) micro relay located in the Integrated Power Module (IPM) in the engine compartment near the battery.

- **Wiper Module** - The wiper pivot shafts are the only visible components of the wiper module. The remainder of the module is concealed within the cowl plenum area beneath the cowl plenum cover/grille panel. The wiper module includes the wiper module bracket, four rubber-isolated wiper module mounts, the wiper motor, the wiper motor crank arm, the two wiper drive links, and the two wiper pivots.

- **Wiper On/Off Relay** - The wiper on/off relay is an International Standards Organization (ISO) micro relay located in the Integrated Power Module (IPM) in the engine compartment near the battery.

Hard wired circuitry connects the wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and reten-

tion, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATING MODES

The components of the wiper and washer system are designed to work in concert to provide the following operating modes:

- **Continuous Wipe Mode** - The control knob on the control stalk of the multi-function switch has two continuous wipe positions, Low and High. When selected, these switch positions will cause the two-speed wiper motor to operate in a continuous low or high speed cycle.

- **Intermittent Wipe Mode** - The control knob on the control stalk of the multi-function switch has five minor detent intermittent wipe positions. When selected, these switch positions will cause the wiper system to operate with one of five delay intervals between complete wipe cycles. The intermittent wipe delay intervals are speed sensitive and will be doubled when the vehicle speed is about sixteen kilometers-per-hour (ten miles-per-hour) or less.

- **Pulse Wipe Mode** - When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for less than about one-half second, the wiper system will operate the wipers for one complete low speed cycle, then will park the wiper blades near the base of the windshield.

- **Washer Mode** - When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second with the wiper system turned Off, the washer pump/motor and the wipers will operate for as long as the washer switch is held closed up to about thirty seconds, then the wipe-after-wash mode is invoked when the control knob is released. When the Wash position is selected with the wiper system operating in a continuous wipe mode, washer fluid will be dispensed onto the windshield glass through the washer nozzles for as long as the washer switch is held closed up to about thirty seconds. When the Wash position is selected with the wiper system operating in an intermittent wipe mode, washer fluid is still dispensed until the control knob is released; however, the wipers will operate in a low speed continuous cycle from the time the washer switch is closed until several wipe cycles after the switch is released, before returning to the selected intermittent wipe interval. If the control knob is held in the depressed Wash position for more than about thirty seconds, washer system operation will be suspended until the control knob is released for about two seconds then cycled back to the Wash position.

WIPERS/WASHERS (Continued)

- **Wipe-After-Wash Mode** - When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second with the wiper system turned Off, the washer pump/motor and the wipers will operate for as long as the washer switch is held closed up to about thirty seconds, then provide several additional wipe cycles after the control knob is released before parking the wiper blades near the base of the windshield. If the control knob is held in the depressed Wash position for more than about thirty seconds, washer system operation will be suspended until the control knob is released for about two seconds then cycled back to the Wash position.

OPERATION

The wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside windshield glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions.

The vehicle operator initiates all wiper and washer system functions with the control knob on the end of the control stalk of the multi-function switch that extends from the left side of the steering column, just below the steering wheel. Rotating the control knob on the end of the control stalk, selects the Off, Delay, Low, or High wiper system operating modes. In the Delay mode, the control knob also allows the vehicle operator to select from one of five intermittent wipe Delay intervals. Depressing the control knob towards the steering column actuates the momentary washer system switch, which selects the Wash, Wipe-After-Wash, and Pulse Wipe Modes depending upon when and how long the switch is held closed. The multi-function switch provides hard wired resistor multiplexed inputs to the instrument cluster for all of the wiper and washer system functions. The instrument cluster then sends electronic messages to the Front Control Module (FCM) over the Programmable Communications Interface (PCI) data bus requesting the appropriate wiper and washer system operating modes.

Wiper and washer system operation are completely controlled by the instrument cluster and FCM logic circuits, and that logic will only allow these systems to operate when the ignition switch is in the Accessory or On positions. Battery current is directed from a B(+) fuse in the Integrated Power Module (IPM) to the wiper on/off relay and the wiper high/low relay in the IPM through a fused B(+) circuit. The FCM uses low side drivers to control wiper system operation by energizing or de-energizing the wiper high/low and wiper on/off relays. The FCM uses a high side driver to control the operation of the washer pump motor unit. The multi-function switch circuitry receives a clean ground output from the instrument cluster on a multi-function switch return circuit, then provides resistor multiplexed inputs to the instrument cluster on an intermittent wipe mux circuit to indicate the selected wiper system mode and on a wash/beam select mux circuit to indicate the selected washer system mode.

The hard wired circuits and components of the wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the FCM, or the electronic message inputs to or outputs from the instrument cluster or FCM that control the wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the instrument cluster or the FCM inputs and outputs related to the various wiper and washer system operating modes requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

OPERATING MODES

Following are paragraphs that briefly describe the operation of each of the wiper and washer system operating modes.

CONTINUOUS WIPE MODE

When the Low position of the control knob on the control stalk of the multi-function switch is selected the instrument cluster sends an electronic wiper switch low message to the FCM, then the FCM energizes the wiper on/off relay. This directs battery current through the normally open contacts of the energized wiper on/off relay and the normally closed contacts of the de-energized wiper high/low relay to the low speed brush of the wiper motor, causing the wipers to cycle at low speed.

When the High position of the control knob is selected the instrument cluster sends an electronic wiper switch high message to the FCM, then the FCM energizes both the wiper on/off relay and the wiper high/low relay. This directs battery current

WIPERS/WASHERS (Continued)

through the normally open contacts of the energized wiper on/off relay and the normally open contacts of the energized wiper high/low relay to the high speed brush of the wiper motor, causing the wipers to cycle at high speed.

When the Off position of the multi-function switch control knob is selected, the instrument cluster sends an electronic wiper switch off message to the FCM. If the wiper motor was operating at high speed, the FCM immediately de-energizes the wiper high/low relay causing the wiper motor to return to low speed operation. Then one of two events will occur. The event that occurs depends upon the position of the wiper blades on the windshield at the moment that the control knob Off position is selected.

If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the wiper motor is closed to ground and provides a hard wired park switch sense input to the FCM. The FCM then de-energizes the wiper on/off relay and the wiper motor ceases to operate. If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is an open circuit and the FCM keeps the wiper on/off relay energized, which causes the wiper motor to continue running at low speed until the wiper blades are in the down position on the windshield and the park switch input to the FCM is again closed to ground.

INTERMITTENT WIPE MODE

When the control knob on the control stalk of the multi-function switch is moved to one of the Delay interval positions the instrument cluster sends an electronic wiper switch delay message to the FCM, then the FCM electronic intermittent wipe logic circuit responds by calculating the correct length of time between wiper sweeps based upon the selected delay interval input. The FCM monitors the changing state of the wiper motor park switch through a hard wired park switch sense input. This input allows the FCM to determine the proper intervals at which to energize and de-energize the wiper on/off relay to operate the wiper motor intermittently for one low speed cycle at a time.

The FCM logic is also programmed to provide vehicle speed sensitivity to the selected intermittent wipe delay intervals. In order to provide this feature the FCM monitors electronic vehicle speed messages from the Powertrain Control Module (PCM) and doubles the selected delay interval whenever the vehicle speed is about sixteen kilometers-per-hour (ten miles-per-hour) or less.

PULSE WIPE MODE

When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for less than about one-half second, the instrument cluster sends an electronic washer switch message to the FCM, then the FCM energizes the wiper on/off relay for one complete wipe cycle. The FCM de-energizes the relay when the state of the park switch sense changes to ground, parking the wiper blades near the base of the windshield.

WASH MODE

When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second, the instrument cluster sends an electronic washer switch message to the FCM, then the FCM directs battery current to the washer pump/motor unit. This will cause the washer pump/motor unit to be energized for as long as the Wash switch is held closed up to about thirty seconds, and to de-energize when the front Wash switch is released.

When the control knob is depressed to the momentary Wash position while the wiper system is operating in one of the Delay interval positions, the washer pump/motor operation is the same. However, the FCM also energizes the wiper on/off relay to override the selected delay interval and operate the wiper motor in a continuous low speed mode for as long as the control knob is held depressed, then de-energizes the relay and reverts to the selected delay mode interval several wipe cycles after the control knob is released. If the control knob is held depressed for more than about thirty seconds, the FCM will suspend washer pump/motor operation until the knob is released for about two seconds, then cycled back to the Wash position.

WIPE-AFTER-WASH MODE

When the control knob on the control stalk of the multi-function switch is depressed to the momentary Wash position for more than about one-half second while the wiper system is not operating, the instrument cluster sends an electronic washer switch message to the FCM, then the FCM directs battery current to the washer pump/motor unit and energizes the wiper on/off relay. This will cause the washer pump/motor unit to be energized and operate the wiper motor in a continuous low speed mode for as long as the Wash switch is held closed up to about thirty seconds. When the control knob is released, the FCM de-energizes the washer pump/motor unit, but allows the wiper motor to operate for several additional wipe cycles before it de-energizes the wiper on/off relay and parks the wiper blades near the base of the windshield.

WIPERS/WASHERS (Continued)

If the control knob is held depressed for more than about thirty seconds, the FCM will suspend washer pump/motor operation until the knob is released for about two seconds, then cycled back to the Wash position; however, the wipers will continue to operate for as long as the Wash switch is held closed. The FCM monitors the changing state of the wiper motor park switch through a hard wired wiper park switch sense circuit input. This input allows the FCM to count the number of wipe cycles that occur after the Wash switch is released, and to determine the proper interval at which to de-energize the wiper on/off relay to complete the wipe-after-wash mode cycle.

DIAGNOSIS AND TESTING - WIPER & WASHER SYSTEM

If the wiper motor operates, but the wipers do not move on the windshield, replace the faulty wiper module. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the wiper and washer system components as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - INSPECTION). For diagnosis and testing of the multi-function switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

The hard wired circuits and components of the wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the Front Control Module (FCM), or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the various wiper and washer system operating modes. The most reliable, efficient, and accurate means to diagnose the instrument cluster, the FCM, or the electronic message inputs and outputs related to the various wiper and washer system operating modes requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER,

SIDE CURTAIN AIRBAG, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CLEANING - WIPER & WASHER SYSTEM**WIPER SYSTEM**

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet filter screen and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the washer nozzles, then running the washer pump/motor to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

WIPERS/WASHERS (Continued)

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

INSPECTION - WIPER & WASHER SYSTEM

WIPER SYSTEM

The wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arms for any indications of damage, or contamination. If the wiper arms are contaminated with any foreign material, clean them as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

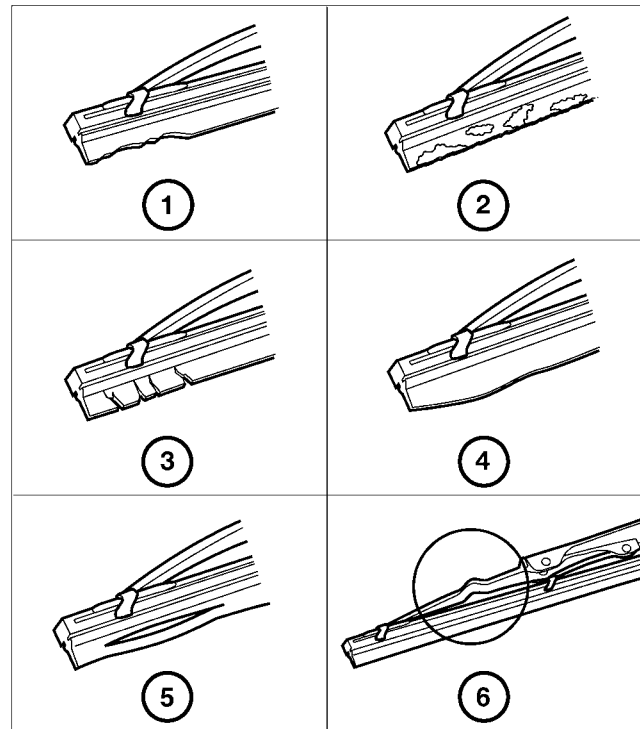
(2) Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.

(4) Inspect the wiper blades and squeegees for any indications of damage, contamination, or rubber deterioration (Fig. 2). If the wiper blades or squeegees are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING). After cleaning the wiper blade and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or the squeegee rubber is damaged or deteriorated, replace

the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.



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Fig. 2 Wiper Blade Inspection

- 1 - WORN OR UNEVEN EDGES
- 2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
- 3 - HARD, BRITTLE, OR CRACKED
- 4 - DEFORMED OR FATIGUED
- 5 - SPLIT
- 6 - DAMAGED SUPPORT COMPONENTS

WASHER SYSTEM

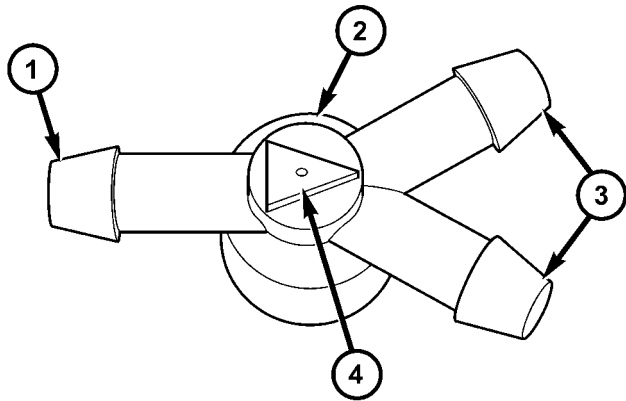
The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

CHECK VALVE

DESCRIPTION



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Fig. 3 Check Valve

- 1 - INLET NIPPLE
- 2 - CHECK VALVE
- 3 - OUTLET NIPPLE (2)
- 4 - FLOW DIRECTION ARROW

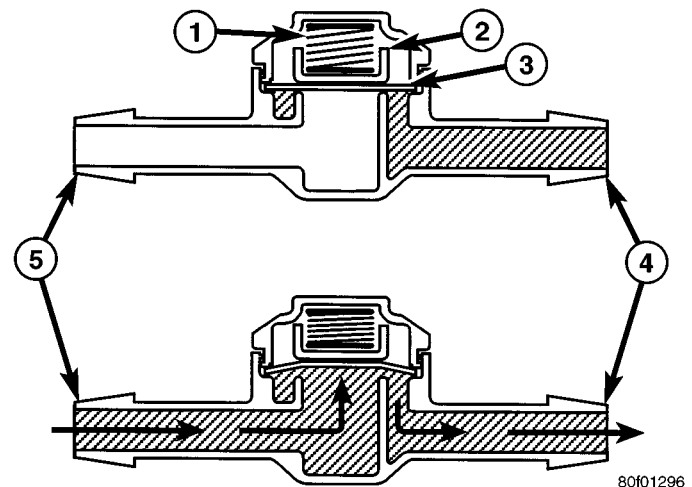
A single washer system check valve is standard equipment on this model, and is installed in the washer system plumbing (Fig. 3). The check valve is integral to the washer nozzle plumbing wye fitting located in the cowl plenum area beneath the cowl plenum cover/grille panel near the base of the windshield. The check valve consists of a molded plastic body with a raised arrowhead molded into its center section that indicates the direction of the flow through the valve, and three barbed hose nipples formed in a wye configuration on the outside circumference of the center section of the valve body. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The check valve provides more than one function in this application. It serves as a wye connector fitting between the engine compartment and washer nozzle sections of the washer supply hose. It prevents washer fluid from draining out of the washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the washer switch is actuated until washer fluid was dispensed through the washer nozzles, because the washer pump would have to refill the washer plumbing from the reservoir to the nozzles. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the

nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the check valve prevents washer fluid from siphoning through the washer nozzles after the washer system is turned Off.

When the washer pump pressurizes and pumps washer fluid from the reservoir through the washer plumbing, the fluid pressure unseats a diaphragm from over a sump well within the valve by overriding the spring pressure applied to it by a piston (Fig. 4). With the diaphragm unseated, washer fluid is allowed to flow toward the two washer nozzles. When the washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the washer plumbing is prevented. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.



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Fig. 4 Check Valve

- 1 - SPRING
- 2 - PISTON
- 3 - DIAPHRAGM
- 4 - TO WASHER NOZZLE
- 5 - FROM WASHER PUMP

REMOVAL

(1) Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).

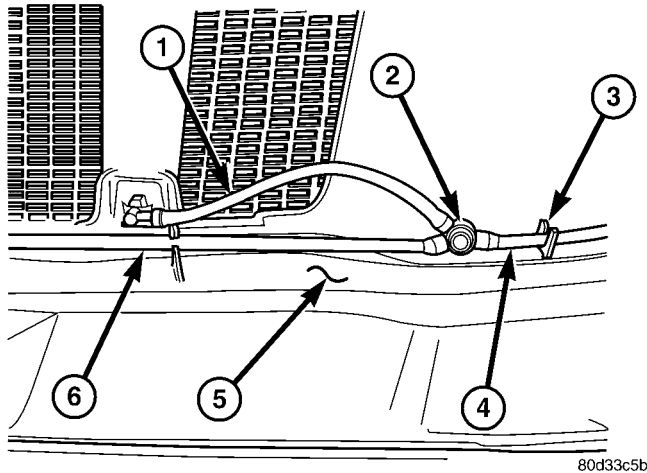
(2) Unlatch and open the hood.

(3) Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).

(4) From the underside of the cowl plenum cover/grille panel, disconnect the cowl plenum and washer nozzle hoses from the three barbed nipples of the check valve (Fig. 5).

(5) Remove the check valve from the underside of the cowl plenum cover/grille panel.

CHECK VALVE (Continued)

**Fig. 5 Check Valve Remove/Install**

- 1 - WASHER NOZZLE HOSE (RIGHT)
- 2 - CHECK VALVE
- 3 - ROUTING CLIP
- 4 - COWL PLENUM WASHER HOSE
- 5 - COWL PLENUM COVER/GRILLE PANEL (UNDERSIDE)
- 6 - WASHER NOZZLE HOSE (LEFT)

INSTALLATION

(1) Position the check valve to the underside of the cowl plenum cover/grille panel (Fig. 5). Be certain that the flow direction arrow molded into the check valve body is oriented towards the washer nozzles.

(2) From the underside of the cowl plenum cover/grille panel, reconnect the cowl plenum and washer nozzle hoses to the three barbed nipples of the check valve.

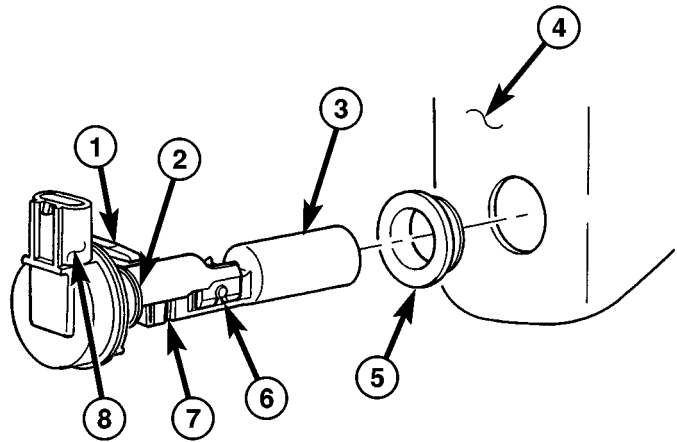
(3) Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).

(4) Close and latch the hood.

(5) Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - INSTALLATION).

WASHER FLUID LEVEL SWITCH**DESCRIPTION**

The washer fluid level switch is a single pole, single throw reed-type switch mounted on the outboard side of the washer reservoir in the engine compartment (Fig. 6). Only the molded plastic switch mounting flange and the integral connector receptacle are visible when the switch is installed in the reservoir. A short nipple formation extends from the inner surface of the switch mounting flange, and a barb on the nipple near the switch mounting flange is pressed through a rubber grommet seal installed in the mounting hole of the reservoir.

**Fig. 6 Washer Fluid Level Switch**

- 1 - MOUNTING FLANGE
- 2 - BARBED NIPPLE
- 3 - FLOAT
- 4 - RESERVOIR
- 5 - GROMMET SEAL
- 6 - PIVOT
- 7 - MAGNET
- 8 - CONNECTOR RECEPTACLE

A small, molded plastic float has two pivot pins near its center that are snapped into two receptacles near the ends of two stanchions that extend toward the float from the switch nipple formation. A small magnet is secured within the end of the float nearest the switch nipple formation, and a reed switch is concealed within the nipple. A diagnostic resistor is connected between the two switch terminals within the switch mounting flange. The washer fluid level switch cannot be adjusted or repaired. If faulty or damaged, the switch must be replaced.

OPERATION

The washer fluid level switch uses a pivoting, oblong float to monitor the level of the washer fluid in the washer reservoir. The float contains a small magnet. When the float pivots, the proximity of this magnet to a stationary reed switch within the nipple formation of the switch changes. When the fluid level in the washer reservoir is at or above the float level, the float moves to a vertical position, the influence of the float magnetic field is removed from the reed switch, and the normally open reed switch contacts open. When the fluid level in the washer reservoir falls below the level of the pivoting float, the float moves to a horizontal position, the influence of the float magnetic field is applied to the reed switch, and the contacts of the normally open reed switch close.

WASHER FLUID LEVEL SWITCH (Continued)

The washer fluid level switch is connected to the vehicle electrical system through a dedicated take out and connector of the right (except V-10 and diesel engines) or left (V-10 and diesel engines only) head-lamp and dash wire harness. The switch is connected in series between a clean ground output of the Front Control Module (FCM) on a sensor return circuit and the washer fluid switch sense input to the FCM. When the switch closes, the FCM senses the ground on the washer fluid switch sense circuit. The FCM is programmed to respond to this input by sending an electronic washer fluid indicator lamp-on message to the instrument cluster over the Programmable Communications Interface (PCI) data bus. The instrument cluster responds to this message by illuminating the washer fluid indicator and by sounding an audible chime tone warning.

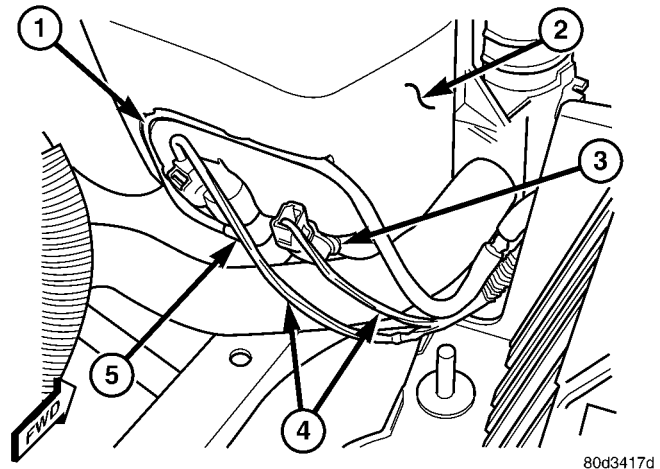
The washer fluid level switch may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the Front Control Module (FCM), or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the operation of the washer fluid visual and/or audible indicators. The most reliable, efficient, and accurate means to diagnose the washer fluid level indicator, the instrument cluster, the FCM, or the electronic message inputs and outputs related to the washer fluid indicator requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

The washer fluid level switch can be removed from the washer reservoir without removing the reservoir from the vehicle.

- (1) Unlatch and open the hood.
- (2) Disconnect and isolate the battery negative cable.
- (3) Disconnect the washer hose from the barbed outlet nipple of the washer pump/motor unit and allow the washer fluid to drain into a clean container for reuse.
- (4) Disconnect the right (except V-10 and diesel engine) or left (V-10 and diesel engine only) head-lamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle (Fig. 7) or (Fig. 8).

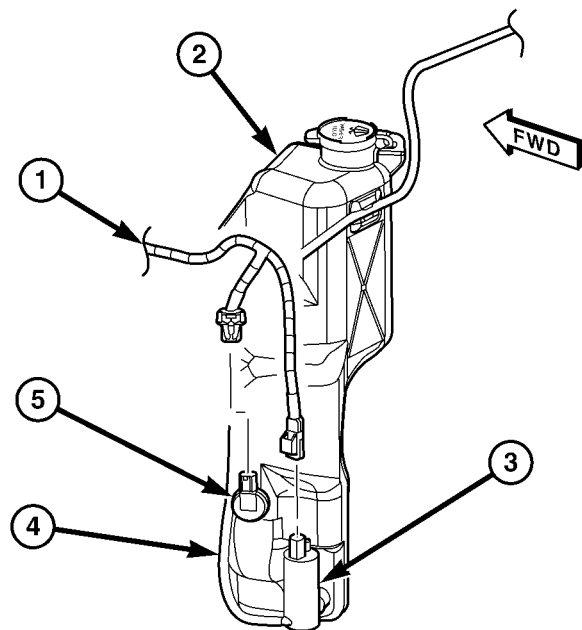
NOTE: The pivoting float of the washer fluid level switch must be in a horizontal position within the reservoir in order to be removed. With the reservoir empty and in an upright position, the pivoting float will orient itself to the horizontal position when the switch connector receptacle is pointed straight upwards.



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Fig. 7 Washer Fluid Level Switch Remove/Install - Except V-10 & Diesel Engine

- 1 - WASHER HOSE
- 2 - WASHER RESERVOIR
- 3 - WASHER FLUID LEVEL SWITCH
- 4 - WIRE HARNESS
- 5 - WASHER PUMP/MOTOR



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Fig. 8 Washer Fluid Level Switch Remove/Install - V-10 & Diesel Engine

- 1 - WIRE HARNESS
- 2 - WASHER RESERVOIR
- 3 - WASHER PUMP/MOTOR
- 4 - WASHER HOSE
- 5 - WASHER FLUID LEVEL SWITCH

(5) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed nipple of the washer fluid level switch out of the rubber grommet seal on the reservoir sump. Care must be taken not to damage the reservoir.

WASHER FLUID LEVEL SWITCH (Continued)

(6) Remove the washer fluid level switch from the washer reservoir.

(7) Remove the rubber grommet seal from the washer fluid level switch mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer fluid level switch mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Insert the float of the washer fluid level switch through the rubber grommet seal and into the washer reservoir. The connector receptacle of the washer fluid level switch should be pointed upward.

(3) Using hand pressure, press firmly and evenly on the washer fluid level switch mounting flange until the barbed nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Reconnect the right (except V-10 and diesel engine) or left (V-10 and diesel engine only) headlamp and dash wire harness connector for the washer fluid level switch to the switch connector receptacle (Fig. 7) or (Fig. 8).

(5) Reconnect the removed washer hose to the barbed outlet nipple of the washer pump/motor unit.

(6) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(7) Reconnect the battery negative cable.

(8) Close and latch the hood.

WASHER HOSES/TUBES

DESCRIPTION

The washer plumbing consists of a small diameter rubber reservoir washer hose that is routed from the barbed outlet nipple of the electric washer pump/motor unit on the washer reservoir through a trough molded into the back of the reservoir above the washer pump and to the engine compartment washer hose (Fig. 9). On models equipped with an optional V-10 or diesel engine, the reservoir washer hose is routed through routing clips on the top of the radiator fan shroud from the washer reservoir on the left side of the radiator to the engine compartment washer hose on the right side of the radiator. The engine compartment washer hose is contained within the right headlamp and dash wire harness, which is routed through the engine compartment along the top of the right front fender wheel house to the dash panel.

The engine compartment washer hose is connected to the washer reservoir washer hose and to the cowl plenum washer hose with molded plastic in-line fit-

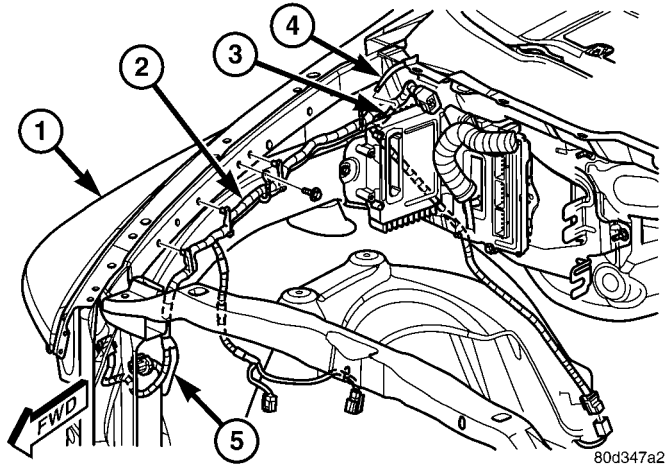


Fig. 9 Engine Compartment Washer Hose

- 1 - RIGHT FENDER
- 2 - RIGHT HEADLAMP & DASH WIRE HARNESS
- 3 - ENGINE COMPARTMENT WASHER HOSE (TO COWL PLENUM)
- 4 - COWL PLENUM WASHER HOSE
- 5 - ENGINE COMPARTMENT WASHER HOSE (TO WASHER RESERVOIR)

tings that have a barbed nipple on each end. The cowl plenum washer hose is routed from the engine compartment into the cowl plenum area through a trough formation located near the right end of the cowl plenum cover/grille panel. The cowl plenum washer hose is connected to the washer system check valve/wye fitting on the underside of the cowl plenum cover/grille panel. The cowl plenum washer hose and the two washer nozzle hoses are routed through integral routing clips on the underside of the cowl plenum cover/grille panel. The cowl plenum washer hose is connected to one nipple on the wye fitting and the two washer nozzle hoses are connected to the other two wye fitting nipples. The washer nozzle hoses are then routed along the underside of the cowl plenum cover/grille panel to the two washer nozzles.

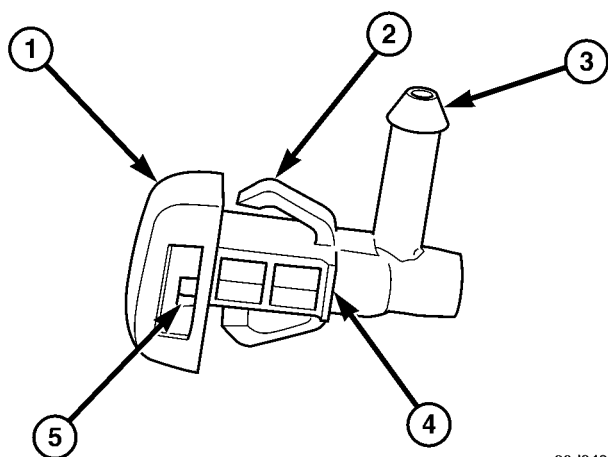
Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor through the washer system plumbing and fittings to the two washer nozzles. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

WASHER NOZZLE

DESCRIPTION



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Fig. 10 Washer Nozzle

- 1 - HOOD
- 2 - LATCH (2)
- 3 - NIPPLE
- 4 - ANTI-ROTATION TAB
- 5 - ORIFICE

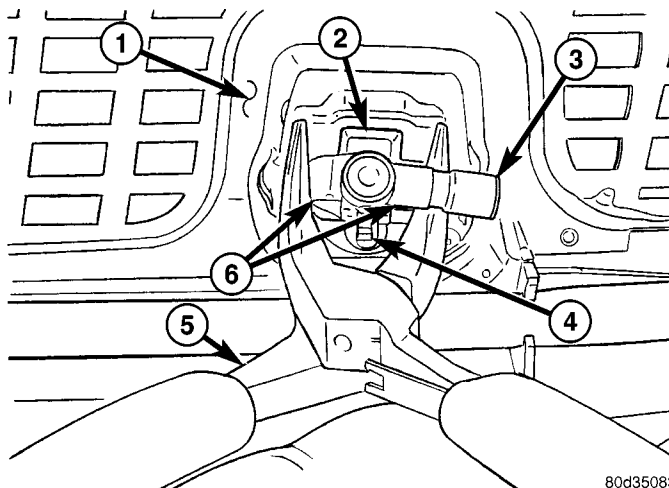
The two washer nozzles have integral snap features and an anti-rotation tab that secure them in dedicated holes in the cowl plenum cover/grille panel located near the base of the windshield (Fig. 10). The domed upper surface of the washer nozzle is visible on the top of the plenum cover/grille panel, and the nozzle orifice is oriented towards the windshield glass. The washer plumbing fittings for the washer nozzles are concealed beneath the cowl plenum cover/grille panel. These fluidic washer nozzles are constructed of molded plastic. The cowl plenum cover/grille panel must be removed from the vehicle to access the nozzles for service. The washer nozzles cannot be adjusted or repaired. If faulty or damaged, they must be replaced.

OPERATION

The two washer nozzles are designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to each nozzle from the washer reservoir by the washer pump/motor unit through a single hose, which is attached to a barbed nipple on each washer nozzle below the cowl plenum cover/grille panel. A fluidic matrix within the washer nozzle causes the pressurized washer fluid to be emitted from the nozzle orifice as an oscillating stream to more effectively cover a larger area of the glass to be cleaned.

REMOVAL

- (1) Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).
- (2) Unlatch and open the hood.
- (3) Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).
- (4) From the underside of the cowl plenum cover/grille panel, disconnect the washer nozzle hose from the barbed nipple of the washer nozzle (Fig. 11).



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Fig. 11 Washer Nozzle Remove/Install

- 1 - COWL PLENUM COVER/GRILLE PANEL (UNDERSIDE)
- 2 - ANTI-ROTATION TAB (LARGE)
- 3 - NIPPLE
- 4 - ANTI-ROTATION TAB (SMALL)
- 5 - PLIERS
- 6 - LATCH (2)

(5) From the underside of the cowl plenum cover/grille panel, release the integral snap features of the washer nozzle and push the nozzle out through the mounting hole toward the top side of the cowl plenum cover/grille panel.

(6) Remove the washer nozzle from the top of the cowl plenum cover/grille panel.

INSTALLATION

(1) From the top of the cowl plenum cover/grille panel, position the nipple end of the washer nozzle through the mounting hole and engage the anti-rotation tab of the nipple into the anti-rotation notch in the mounting hole.

(2) Using hand pressure, push firmly and evenly on the top of the washer nozzle until the integral snap features lock into place on the underside of the cowl plenum cover/grille panel.

(3) From the underside of the cowl plenum cover/grille panel, reconnect the washer hose to the barbed nipple of the washer nozzle (Fig. 11).

WASHER NOZZLE (Continued)

(4) Reinstall the washer hose for the washer nozzle into its routing clips on the underside of the cowl plenum cover/grille panel.

(5) Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).

(6) Close and latch the hood.

(7) Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - INSTALLATION).

WASHER PUMP/MOTOR

DESCRIPTION

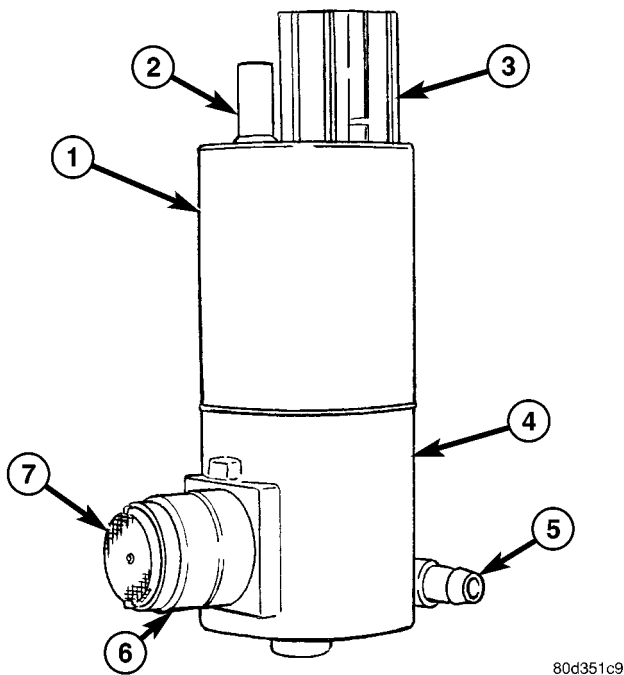


Fig. 12 Washer Pump/Motor

- 1 - MOTOR
- 2 - SNAP POST
- 3 - CONNECTOR RECEPTACLE
- 4 - PUMP
- 5 - OUTLET NIPPLE
- 6 - INLET NIPPLE
- 7 - FILTER SCREEN

The washer pump/motor unit (Fig. 12) is located on the rearward facing surface of the washer reservoir, in the right (except V-10 or diesel engine) or left (V-10 and diesel engine only) front corner of the engine compartment. A small permanently lubricated and sealed electric motor is coupled to the rotor-type washer pump. A seal flange with a barbed inlet nipple on the pump housing passes through a rubber grommet seal installed in a dedicated mounting hole of the washer reservoir. When the pump is installed in the reservoir a barbed outlet nipple on the pump

housing connects the unit to the washer system through a short washer reservoir hose.

The washer pump/motor unit is retained on the reservoir by the interference fit between the barbed pump inlet nipple and the grommet seal, which is a light press fit. The top of the washer pump is also secured to the washer reservoir by the use of a snap post on the motor housing and a snap post receptacle molded into the reservoir that allows for mounting of the washer pump without the use of fasteners. An integral connector receptacle on the top of the motor housing connects the unit to the vehicle electrical system. The washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The washer pump/motor unit features a small Direct Current (DC) electric motor. The motor is connected to the vehicle electrical system through a single take out and two-cavity connector of the right (except V-10 or diesel engine) or left (V-10 or diesel engine only) headlamp and dash wire harness. The motor is grounded at all times through another take out of the right (except V-10 or diesel engine) or left (V-10 or diesel engine only) headlamp and dash wire harness. On models without the V-10 or diesel engine a single eyelet terminal connector is secured by a nut to a ground stud located on the right front fender inner shield in the engine compartment. On models with a V-10 or diesel engine an eyelet terminal connector is secured by a ground screw to the left front fender inner shield in the engine compartment. The motor receives battery current on a washer pump/motor control circuit.

The washer pump/motor control circuit is energized through a high side driver within the Front Control Module (FCM) whenever the FCM receives an electronic message requesting washer system operation from the instrument cluster over the Programmable Communications Interface (PCI) data bus. The instrument cluster monitors a resistor multiplexed hard wired input from the momentary washer switch contacts within the multi-function switch on the steering column to determine when it should issue the electronic message requesting washer system operation.

Washer fluid is gravity-fed from the washer reservoir to the inlet side of the washer pump. When the pump motor is energized, the motor spins the rotor within the washer pump. The spinning pump rotor pressurizes the washer fluid and forces it through the pump outlet nipple, the washer plumbing, and the washer nozzles onto the windshield glass.

The washer pump/motor unit may be diagnosed using conventional diagnostic tools and methods.

WASHER PUMP/MOTOR (Continued)

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the Front Control Module (FCM), or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the operation of the washer pump/motor unit. The most reliable, efficient, and accurate means to diagnose the washer pump/motor unit, the instrument cluster, the FCM, or the electronic message inputs and outputs related to the washer pump/motor unit operation requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

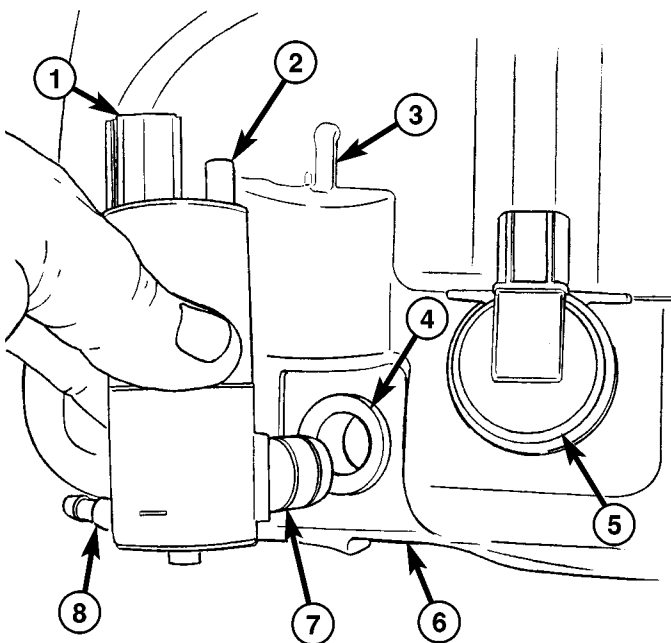
REMOVAL

The washer pump/motor unit can be removed from the washer reservoir without removing the reservoir from the vehicle.

- (1) Unlatch and open the hood.
- (2) Disconnect and isolate the battery negative cable.
- (3) Disconnect the washer hose from the barbed outlet nipple of the washer pump/motor unit and allow the washer fluid to drain into a clean container for reuse.
- (4) Disconnect the right (except V-10 or diesel engine) or left (V-10 or diesel engine only) headlamp and dash wire harness connector for the washer pump/motor unit from the motor connector receptacle (Fig. 13).
- (5) Firmly grasp the top of the washer pump/motor housing.
- (6) Pull lightly outward on the top of the washer pump/motor housing away from the washer reservoir far enough to disengage the snap post on the top of the motor from the receptacle in the reservoir.
- (7) Pull the washer pump/motor unit straight out from the washer reservoir far enough to disengage the barbed pump inlet nipple from the rubber grommet seal in the reservoir.
- (8) Disconnect the reservoir washer hose from the washer pump/motor unit outlet nipple.
- (9) Remove washer pump/motor unit from the back of the washer reservoir.
- (10) Remove the rubber grommet seal from the washer reservoir and discard.

INSTALLATION

- (1) Install a new rubber grommet seal into the washer pump mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.
- (2) Position the barbed inlet nipple of the washer pump to the rubber grommet seal in the washer reservoir (Fig. 13).



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Fig. 13 Washer Pump/Motor Remove/Install

- 1 - CONNECTOR RECEPTACLE
- 2 - SNAP POST
- 3 - SNAP POST RECEPTACLE
- 4 - GROMMET SEAL
- 5 - WASHER FLUID LEVEL SWITCH
- 6 - WASHER RESERVOIR
- 7 - INLET NIPPLE
- 8 - OUTLET NIPPLE

(3) Using hand pressure, press on the washer pump/motor unit firmly and evenly until the barbed inlet nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Align the washer pump/motor snap post on the top of the motor housing with the snap post receptacle in the washer reservoir.

(5) Using hand pressure, press firmly and evenly on the top of washer pump/motor unit until the snap post snaps into the washer reservoir receptacle.

(6) Reconnect the washer reservoir hose to the barbed outlet nipple of the washer pump.

(7) Reconnect the right (except V-10 or diesel engine) or left (V-10 or diesel engine only) headlamp and dash wire harness connector for the washer pump/motor unit to the motor connector receptacle.

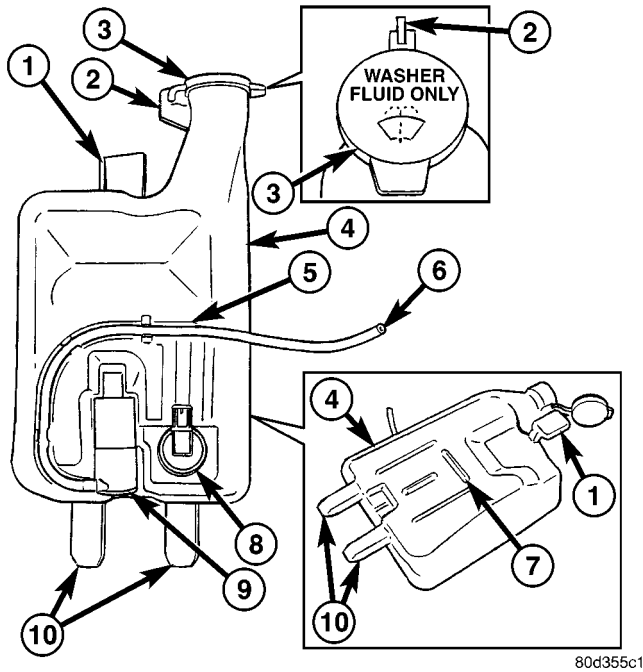
(8) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(9) Reconnect the battery negative cable.

(10) Close and latch the hood.

WASHER RESERVOIR

DESCRIPTION



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Fig. 14 Washer Reservoir - except V-10 & Diesel Engine

- 1 - TOP TAB
- 2 - HOOK FEATURE
- 3 - CAP
- 4 - RESERVOIR
- 5 - TROUGH
- 6 - HOSE
- 7 - LOCK FEATURE
- 8 - WASHER FLUID LEVEL SWITCH
- 9 - WASHER PUMP/MOTOR
- 10 - BOTTOM TAB (2)

Except on models equipped with an optional V-10 or diesel engine, the molded plastic washer fluid reservoir is mounted on the right rearward facing surface of the cooling module radiator shroud in the engine compartment (Fig. 14). On models with the V-10 or diesel engine, the molded plastic washer fluid reservoir is mounted on the rearward facing surface of the left vertical member of the radiator support in the engine compartment. The reservoir is a molded unit constructed of a translucent plastic that allows the washer fluid level to be inspected without removing the washer reservoir cap. The most visible component of the washer reservoir is the filler cap unit, which is secured to and hinges on a hook feature that is integral to the filler neck near the top of the reservoir. The bright yellow plastic filler cap snaps over the filler neck opening and seals the reservoir

opening with an integral rubber gasket. The filler cap is labeled with an International Control and Display Symbol icon for "Windshield Washer" and the text "Washer Fluid Only" that are molded into it and highlighted in black against the yellow plastic cap for visibility.

There are dedicated holes near the bottom of the rearward facing side of the reservoir provided for the mounting of the washer pump/motor unit and the washer fluid level switch. A snap post receptacle molded into the reservoir allows for mounting of the washer pump without the use of fasteners. The reservoir also features an integral hose routing trough on its rearward facing side. Except on models with a V-10 or diesel engine, the washer reservoir is secured to the cooling module radiator shroud with three integral tabs, two at the bottom and one at the top. The two bottom tabs are inserted into two slots near the bottom of the shroud, while the upper tab slides into an integral channel-like slot near the top of the shroud. A molded lock feature on the forward facing surface of the reservoir engages a molded depression on the rearward facing surface of the radiator shroud when the reservoir is fully seated on the shroud, locking the unit securely in place. On models with a V-10 or diesel engine, the washer reservoir is secured with two screws through integral mounting tabs to the left vertical member of the radiator support. On many models, a molded plastic coolant recovery container or a coolant pressure container must be detached from the top of the cooling module and moved aside to access the washer fluid reservoir for service. This may be accomplished without opening or draining the engine cooling system.

OPERATION

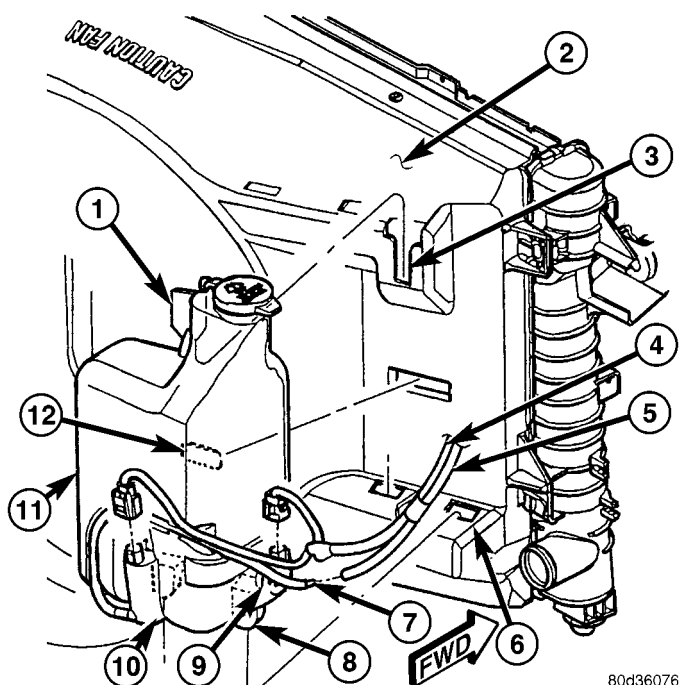
The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the washer system. The washer reservoir filler neck provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The washer/pump motor unit is located in a sump area near the bottom of the reservoir to be certain that washer fluid will be available to the pump as the fluid level in the reservoir becomes depleted. The washer pump/motor unit is mounted in the lowest position in the sump. The washer fluid level switch is mounted just above the sump area of the reservoir so that there will be adequate warning to the vehicle operator that the washer fluid level is low, well before the washer system will no longer operate.

WASHER RESERVOIR (Continued)

REMOVAL

REMOVAL - EXCEPT V-10 OR DIESEL ENGINE

- (1) Unlatch and open the hood.
- (2) Disconnect and isolate the battery negative cable.
- (3) Remove the fasteners securing the coolant recovery container or the coolant pressure container to the top of the cooling module and move the container aside. It is not necessary to open or drain the engine cooling system. (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - REMOVAL) or (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESSURE CONTAINER - REMOVAL).
- (4) Disconnect the reservoir washer hose from the barbed nipple of the inline fitting at the engine compartment washer hose in the right headlamp and dash wire harness and allow the washer fluid to drain from the reservoir into a clean container for reuse (Fig. 15).

**Fig. 15 Washer Reservoir Remove/Install**

- 1 - TOP TAB
- 2 - RADIATOR SHROUD
- 3 - TOP SLOT
- 4 - RIGHT HEADLAMP & DASH WIRE HARNESS
- 5 - ENGINE COMPARTMENT WASHER HOSE
- 6 - BOTTOM SLOT (2)
- 7 - RESERVOIR WASHER HOSE
- 8 - BOTTOM TAB (2)
- 9 - WASHER FLUID LEVEL SWITCH
- 10 - WASHER PUMP/MOTOR
- 11 - WASHER RESERVOIR
- 12 - LOCK FEATURE

(5) Disconnect the right headlamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle.

(6) Disconnect the right headlamp and dash wire harness connector for the washer pump/motor unit from the motor connector receptacle.

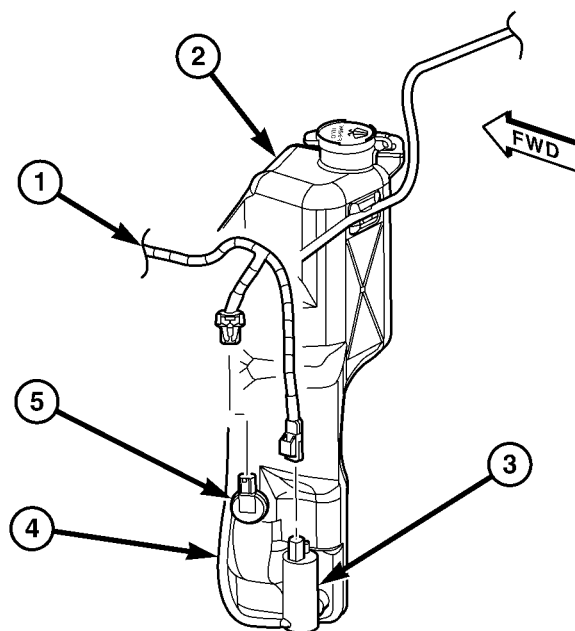
(7) Grasp the bottom of the washer reservoir firmly with both hands and pull the unit sharply upward to disengage the locking feature on the washer reservoir from the depression in the radiator shroud.

(8) Continue lifting the washer reservoir upward far enough to disengage the three mounting tabs (one at the top and two at the bottom) from the channel-like slot at the top and the two slots at the bottom of the radiator shroud.

(9) Remove the washer reservoir from the right side of the engine compartment.

REMOVAL - V-10 OR DIESEL ENGINE

- (1) Unlatch and open the hood.
- (2) Disconnect and isolate the battery negative cable.
- (3) Disengage the reservoir washer hose from the integral routing clips on the top of the radiator fan shroud (Fig. 16).

**Fig. 16 Washer Reservoir Connections - V-10 & Diesel Engine**

- 1 - WIRE HARNESS
- 2 - WASHER RESERVOIR
- 3 - WASHER PUMP/MOTOR
- 4 - WASHER HOSE
- 5 - WASHER FLUID LEVEL SWITCH

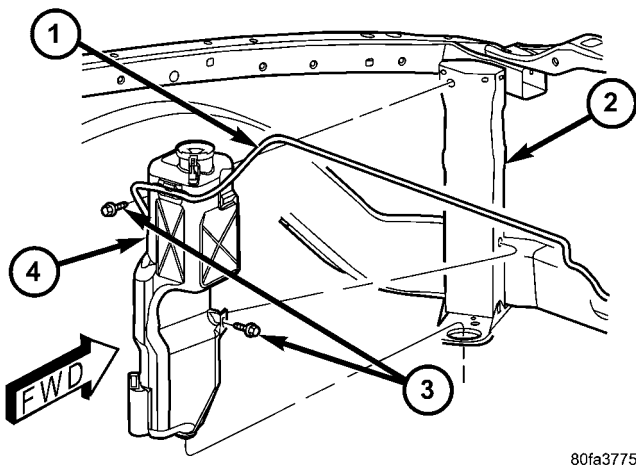
WASHER RESERVOIR (Continued)

(4) Disconnect the reservoir washer hose from the barbed nipple of the inline fitting at the engine compartment washer hose in the right headlamp and dash wire harness and allow the washer fluid to drain from the reservoir into a clean container for reuse.

(5) Disconnect the left headlamp and dash wire harness connector for the washer fluid level switch from the switch connector receptacle.

(6) Disconnect the left headlamp and dash wire harness connector for the washer pump/motor unit from the motor connector receptacle.

(7) Remove the two screws that secure the washer reservoir to the left vertical member of the radiator support (Fig. 17).



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Fig. 17 Washer Reservoir Remove/Install - V-10 & Diesel Engine

- 1 - RESERVOIR WASHER HOSE
- 2 - RADIATOR SUPPORT
- 3 - SCREW (2)
- 4 - WASHER RESERVOIR

(8) Remove the washer reservoir from the left side of the engine compartment.

INSTALLATION

INSTALLATION - EXCEPT V-10 OR DIESEL ENGINE

(1) Position the washer reservoir into the right side of the engine compartment.

(2) Align and insert the three mounting tabs (one at the top and two at the bottom) into the two slots at the bottom and the channel-like slot at the top of the radiator shroud (Fig. 15).

(3) Place both hands on the top of the washer reservoir and push the unit downward far enough for the locking feature on the washer reservoir to snap into the depression in the radiator shroud.

(4) Reconnect the right headlamp and dash wire harness connector for the washer pump/motor unit to the motor connector receptacle.

(5) Reconnect the right headlamp and dash wire harness connector for the washer fluid level switch to the switch connector receptacle.

(6) Reconnect the reservoir washer hose to the barbed nipple of the inline fitting at the engine compartment washer hose in the right headlamp and dash wire harness.

(7) Reposition the coolant recovery container or the coolant pressure container to the top of the cooling module and reinstall the fasteners that secure it there. (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY CONTAINER - INSTALLATION) or (Refer to 7 - COOLING/ENGINE/COOLANT RECOVERY PRESSURE CONTAINER - INSTALLATION).

(8) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(9) Reconnect the battery negative cable.

(10) Close and latch the hood.

INSTALLATION - V-10 OR DIESEL ENGINE

(1) Position the washer reservoir into the left side of the engine compartment (Fig. 17).

(2) Install and tighten the two screws that secure the washer reservoir to the left vertical member of the radiator support. Tighten the screws to 10 N·m (85 in. lbs.).

(3) Reconnect the left headlamp and dash wire harness connector for the washer pump/motor unit to the motor connector receptacle (Fig. 16).

(4) Reconnect the left headlamp and dash wire harness connector for the washer fluid level switch to the switch connector receptacle.

(5) Reconnect the reservoir washer hose to the barbed nipple of the inline fitting at the engine compartment washer hose in the right headlamp and dash wire harness.

(6) Engage the reservoir washer hose into the integral routing clips on the top of the radiator fan shroud.

(7) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(8) Reconnect the battery negative cable.

(9) Close and latch the hood.

WIPER ARM

DESCRIPTION

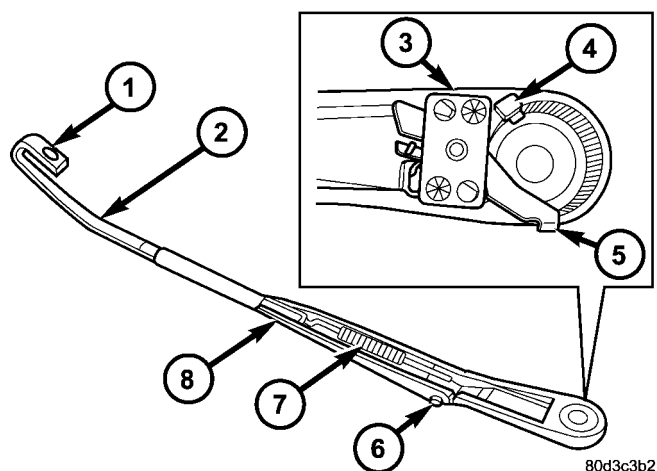


Fig. 18 Wiper Arm

- 1 - HOOK
- 2 - STRAP
- 3 - PIVOT END
- 4 - KEY
- 5 - LATCH
- 6 - HINGE PIN
- 7 - TENSION SPRING
- 8 - CHANNEL

The wiper arms are the rigid members located between the wiper pivots that protrude from the cowl plenum cover/grille panel near the base of the windshield and the wiper blades on the windshield glass (Fig. 18). These wiper arms feature an over-center hinge that allows easy access to the windshield glass for cleaning. The wiper arm has a die cast metal pivot end with a large internally serrated socket formation at one end. A key within the socket formation indexes the wiper arm to a keyway in the pivot shaft of the wiper module to provide wiper alignment, and a spring-loaded latch on the underside of the wiper arm pivot end locks the unit to the pivot shaft when it is fully installed. The right and left wiper arms for this model are not interchangeable, as the right wiper arm is slightly longer than the left one.

The wide end of a tapered, stamped steel channel hinges on and is secured with a hinge pin to the blade end of the wiper arm pivot end. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The

entire wiper arm has a satin black finish applied to all of its visible surfaces.

A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced.

OPERATION

The wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The serrated and keyed socket formation in the wiper arm pivot end interlocks with the serrations and keyway on the outer circumference of the wiper pivot shaft, providing positive engagement and alignment of this connection. The latch positively locks the wiper arm to the wiper pivot shaft when the arm is fully installed. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Lift the wiper arm to its over-center position to hold the wiper blade off of the glass and relieve the spring tension on the wiper arm to wiper pivot shaft connection.

(2) Pull the latch on the pivot end of the wiper arm outward (Fig. 19).

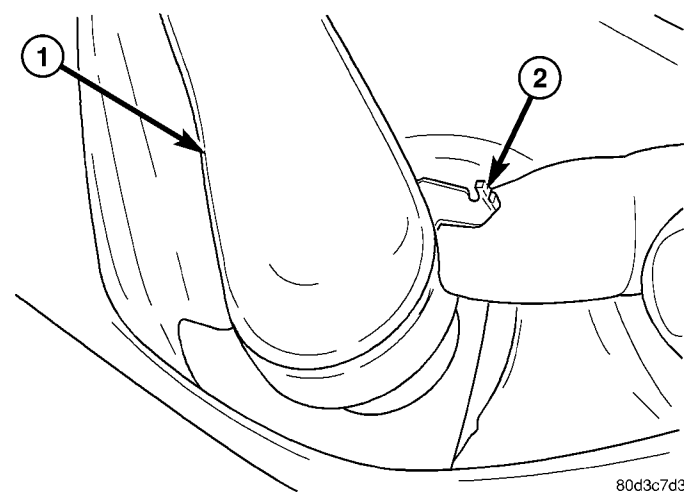


Fig. 19 Wiper Arm Remove/Install

- 1 - WIPER ARM PIVOT END
- 2 - LATCH

(3) Remove the wiper arm pivot end from the wiper pivot shaft.

WIPER ARM (Continued)

INSTALLATION

The right and left wiper arms are not interchangeable. The right wiper arm is slightly longer than the left. Be certain that each wiper arm is installed on the proper wiper pivot.

(1) Place the wiper arm hinge in its over-center position prior to attempting installation.

(2) The wiper arms are indexed to the wiper pivot shafts with integral keys in the wiper arm pivot ends and keyways in the wiper pivot shafts. Align the key of the wiper arm to the keyway on the wiper pivot shaft.

(3) Once the wiper blade is aligned, push the pivot of the wiper arm down firmly and evenly over the wiper pivot shaft until it is fully engaged. When the wiper arm is fully engaged on the wiper pivot, the spring-loaded latch (Fig. 19) will snap back into place against the wiper arm pivot end.

(4) Gently lower the wiper arm until the wiper blade is in position on the windshield glass.

WIPER BLADE

DESCRIPTION

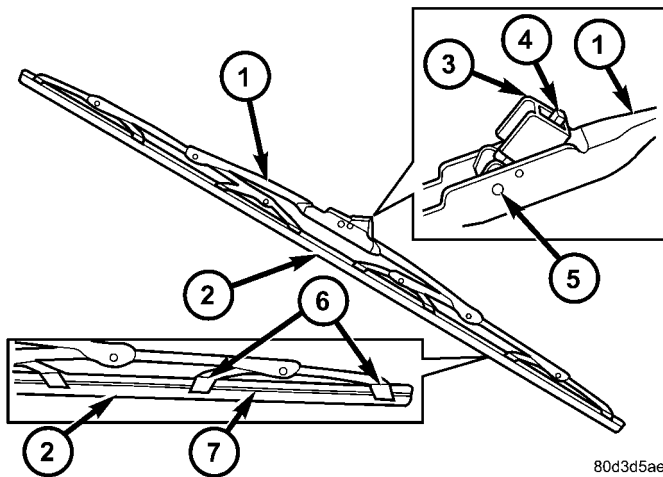


Fig. 20 Wiper Blade

- 1 - SUPERSTRUCTURE
- 2 - ELEMENT
- 3 - PIVOT BLOCK
- 4 - RELEASE TAB
- 5 - PIVOT PIN
- 6 - CLAWS
- 7 - FLEXOR

Each wiper blade is secured by an integral latching pivot block to the hook formation on the tip of each wiper arm, and rests on the glass near the base of the windshield when the wipers are not in operation (Fig. 20). The wiper blade consists of the following components:

• **Superstructure** - The superstructure includes several stamped steel bridges and links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.

• **Element** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.

• **Flexor** - The flexor is a rigid metal component running along the length of each side of the wiper element where it is gripped by the claws of the superstructure.

All models have two 60.00 centimeter (23.62 inch) long wiper blades with non-replaceable rubber elements (squeegees). The wiper blades cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface. The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, yet resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

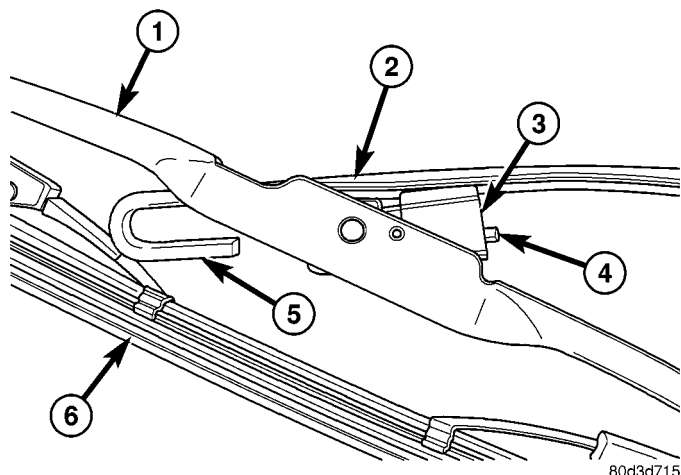
REMOVAL

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(1) Lift the wiper arm to raise the wiper blade and element off of the glass, until the wiper arm hinge is in its over-center position.

(2) To remove the wiper blade from the wiper arm, depress the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook formation on the end of the arm (Fig. 21).

WIPER BLADE (Continued)

**Fig. 21 Wiper Blade Remove/Install**

- 1 - SUPERSTRUCTURE
- 2 - WIPER ARM
- 3 - PIVOT BLOCK
- 4 - RELEASE TAB
- 5 - HOOK
- 6 - ELEMENT

(3) Extract the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure just ahead of the wiper blade pivot block/latch unit.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(4) Gently lower the tip of the wiper arm onto the glass.

INSTALLATION

NOTE: The notched end of the wiper element flexor should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

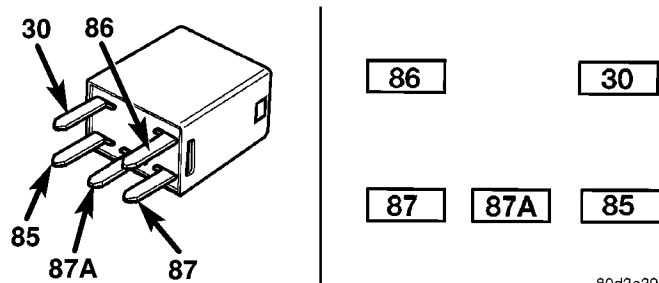
(1) Lift the wiper arm off of the windshield glass, until the wiper arm hinge is in its over-center position.

(2) Position the wiper blade near the hook formation on the tip of the arm with the notched end of the wiper element flexor oriented towards the end of the wiper arm that is nearest to the wiper pivot.

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block into the hook (Fig. 21).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position. Latch engagement will be accompanied by an audible click.

(5) Gently lower the wiper blade onto the glass.

WIPER HIGH/LOW RELAY**DESCRIPTION**

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Fig. 22 ISO Micro Relay

- 30 - COMMON FEED
- 85 - COIL GROUND
- 86 - COIL BATTERY
- 87 - NORMALLY OPEN
- 87A - NORMALLY CLOSED

The wiper high/low relay is located in the Integrated Power Module (IPM) in the engine compartment near the battery. The wiper high/low relay is a conventional International Standards Organization (ISO) micro relay (Fig. 22). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

The wiper high/low relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

The wiper high/low relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) to control a high current output to the wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

WIPER HIGH/LOW RELAY (Continued)

The wiper high/low relay terminals are connected to the vehicle electrical system through a connector receptacle in the Integrated Power Module (IPM). The inputs and outputs of the wiper high/low relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the output of the wiper on/off relay at all times through the wiper on/off relay output circuit.

- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Front Control Module (FCM) through a wiper high/low relay control circuit. The FCM controls wiper motor operation by controlling a ground path through this circuit.

- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current when the ignition switch is in the On or Accessory positions from a fuse in the Integrated Power Module (IPM) through a fused ignition switch output (run-acc) circuit.

- **Normally Open Terminal** - The normally open terminal (87) is connected to the high speed brush of the wiper motor through a wiper high/low relay high speed output circuit, and is connected to the high speed brush whenever the relay is energized.

- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to the low speed brush of the wiper motor through a wiper high/low relay low speed output circuit, and is connected to the low speed brush whenever the relay is de-energized.

The wiper high/low relay can be diagnosed using conventional diagnostic tools and methods. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the Front Control Module (FCM), or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the operation of the wiper high/low relay. The most reliable, efficient, and accurate means to diagnose the wiper high/low relay, the instrument cluster, the FCM, or the electronic message inputs and outputs related to the wiper high/low relay operation requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - WIPER HIGH/LOW RELAY

The wiper high/low relay (Fig. 23) is located in the Integrated Power Module (IPM) in the engine compartment near the battery. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

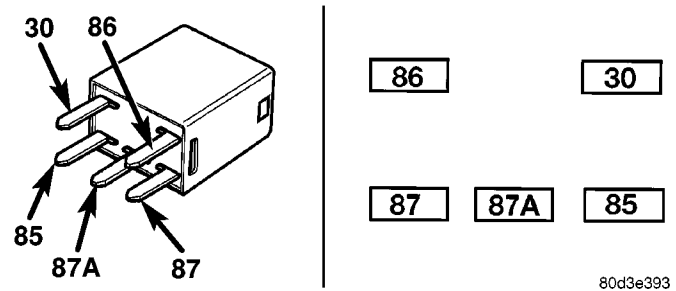


Fig. 23 ISO Micro Relay

30 - COMMON FEED
 85 - COIL GROUND
 86 - COIL BATTERY
 87 - NORMALLY OPEN
 87A - NORMALLY CLOSED

- (1) Remove the wiper high/low relay from the IPM. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER HIGH/LOW RELAY - REMOVAL).

- (2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

- (3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 8 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

- (4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

REMOVAL

- (1) Disconnect and isolate the battery negative cable.

- (2) Remove the cover from the Integrated Power Module (IPM) (Fig. 24).

- (3) Remove the wiper high/low relay by grasping it firmly and pulling it straight out from the receptacle in the IPM.

INSTALLATION

- (1) Position the wiper high/low relay to the proper receptacle in the Integrated Power Module (IPM) (Fig. 24).

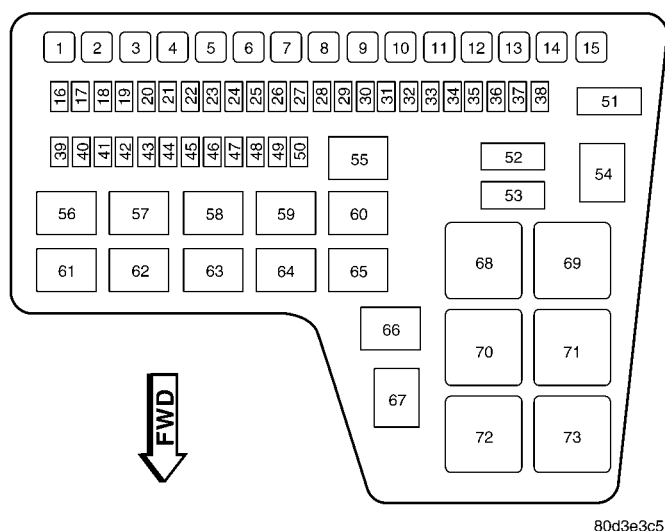
- (2) Align the wiper high/low relay terminals with the terminal cavities in the IPM receptacle.

- (3) Push firmly and evenly on the top of the wiper high/low relay until the terminals are fully seated in the terminal cavities in the IPM receptacle.

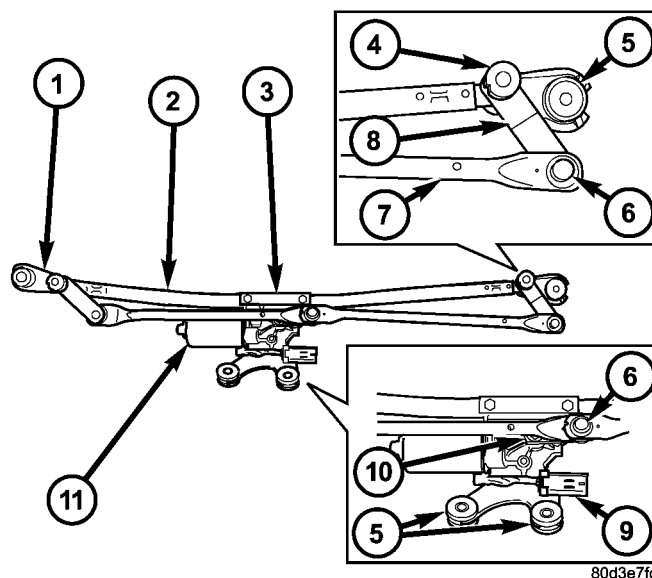
- (4) Reinstall the cover onto the IPM.

- (5) Reconnect the battery negative cable.

WIPER HIGH/LOW RELAY (Continued)

**Fig. 24 Integrated Power Module**

- 1 - 15 - CARTRIDGE FUSE
- 16 - 53 - BLADE FUSE
- 54 - HEATED MIRROR RELAY
- 55 - WIPER ON/OFF RELAY
- 56 - A/C CONDENSER FAN RELAY
- 57 - ENGINE CONTROL RELAY
- 58 - FUEL PUMP RELAY
- 59 - TRANSMISSION RELAY
- 60 - WIPER HIGH/LOW RELAY
- 61 - SPARE
- 62 - FOG LAMP RELAY
- 63 - ADJUSTABLE PEDAL RELAY
- 64 - A/C CLUTCH RELAY
- 65 - SPARE
- 66 - O2 RELAY
- 67 - SPARE
- 68 - SPARE
- 69 - SPARE
- 70 - SPARE
- 71 - SPARE
- 72 - STARTER RELAY
- 73 - PARK LAMP RELAY

**Fig. 25 Wiper Module**

- 1 - PIVOT BRACKET (2)
- 2 - TUBE
- 3 - CLAMP
- 4 - PIVOT SHAFT (2)
- 5 - INSULATOR (4)
- 6 - LINKAGE BUSHING (4)
- 7 - DRIVE LINK (2)
- 8 - PIVOT CRANK ARM (2)
- 9 - PIGTAIL WIRE CONNECTOR
- 10 - MOTOR CRANK ARM
- 11 - WIPER MOTOR

pivot bracket formation near each end where the two wiper pivots are secured. A stamped steel clamp secures the center of the tubular member to the die cast bracket integral to the wiper motor with two screws.

- **Crank Arm** - The wiper motor crank arm is a stamped steel unit with a slotted hole on the driven end that is secured to the wiper motor output shaft with a nut, and has a ball stud secured to the drive end.

- **Linkage** - Two stamped steel drive links connect the wiper motor crank arm to the wiper pivot lever arms. The left side drive link has a plastic socket-type bushing on each end. The right side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the lever arm of its respective pivot. The right side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the other socket-type bushing of the left side drive link is snap-fit over the exposed end of the wiper motor crank arm ball stud.

WIPER MODULE

DESCRIPTION

The wiper motor bracket is secured with two screws below the wiper motor through two rubber insulators to the bottom of the cowl plenum panel beneath the cowl plenum cover/grille panel (Fig. 25). Two screws secure the top of the wiper module bracket to the cowl plenum panel through rubber insulators located on the outboard end of each pivot bracket. The ends of the wiper pivot shafts that protrude through dedicated openings in the cowl plenum cover/grille panel to drive the wiper arms and blades are the only visible components of the wiper module. The wiper module consists of the following major components:

- **Bracket** - The wiper module bracket consists of a long tubular steel main member that has a die cast

WIPER MODULE (Continued)

- **Motor** - The wiper motor features an integral die cast bracket to which the wiper module bracket is secured with a stamped steel clamp and two screws near the top and which has two rubber insulated mounting ears at the bottom. This die casting also serves as the wiper motor transmission housing from which the wiper motor output shaft exits. A nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal automatic resetting circuit breaker.

- **Pivots** - The two front wiper pivots are secured within the die cast pivot brackets on the outboard ends of the wiper module main member. The lever arms that extend from the center of the pivot shafts each have a ball stud on their end. The upper end of each pivot shaft where the wiper arms will be fastened each has a serrated driver with a keyway. The lower ends of the pivot shafts are installed through lubricated bushings in the pivot brackets and are secured with snap rings.

The wiper module cannot be adjusted or repaired. If any component of the module is faulty or damaged, the entire wiper module unit must be replaced.

OPERATION

The wiper module operation is controlled by the battery current inputs received by the wiper motor through the wiper on/off and wiper high/low relays. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The park switch is a single pole, single throw, momentary switch within the wiper motor that is mechanically actuated by the wiper motor transmission components. The park switch alternately opens and closes the wiper park switch sense circuit to ground, depending upon the position of the wipers on the glass. This feature allows the motor to complete its current wipe cycle after the wiper system has been turned Off, and to park the wiper blades in the lowest portion of the wipe pattern. The automatic resetting circuit breaker protects the motor from overloads. The wiper motor crank arm, the two wiper linkage members, and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

REMOVAL

(1) Remove both wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).

(2) Unlatch and open the hood.

(3) Disconnect and isolate the battery negative cable.

(4) Remove the cowl plenum cover/grille panel from over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - REMOVAL).

(5) Disconnect the left headlamp and dash wire harness connector for the wiper motor from the motor pigtail wire connector (Fig. 26).

(6) Remove the two screws that secure the wiper module to the top of the cowl plenum panel at the pivot brackets.

(7) Remove the two screws that secure the wiper module to the bottom of the cowl plenum panel.

(8) Remove the wiper module from the cowl plenum panel as a unit.

INSTALLATION

(1) Position the wiper module into the cowl plenum as a unit (Fig. 26).

(2) Install the two screws that secure the wiper module to the top of the cowl plenum panel at the pivot brackets. Tighten the screw on the driver side, followed by the screw on the passenger side. Tighten the screws to 7 N·m (60 in. lbs.).

(3) Install and tighten the screws that secure the wiper module to the bottom of the cowl plenum panel. Tighten the screw on the passenger side, followed by the screw on the driver side. Tighten the screws to 7 N·m (60 in. lbs.).

(4) Reconnect the left headlamp and dash wire harness connector for the wiper motor to the motor pigtail wire connector.

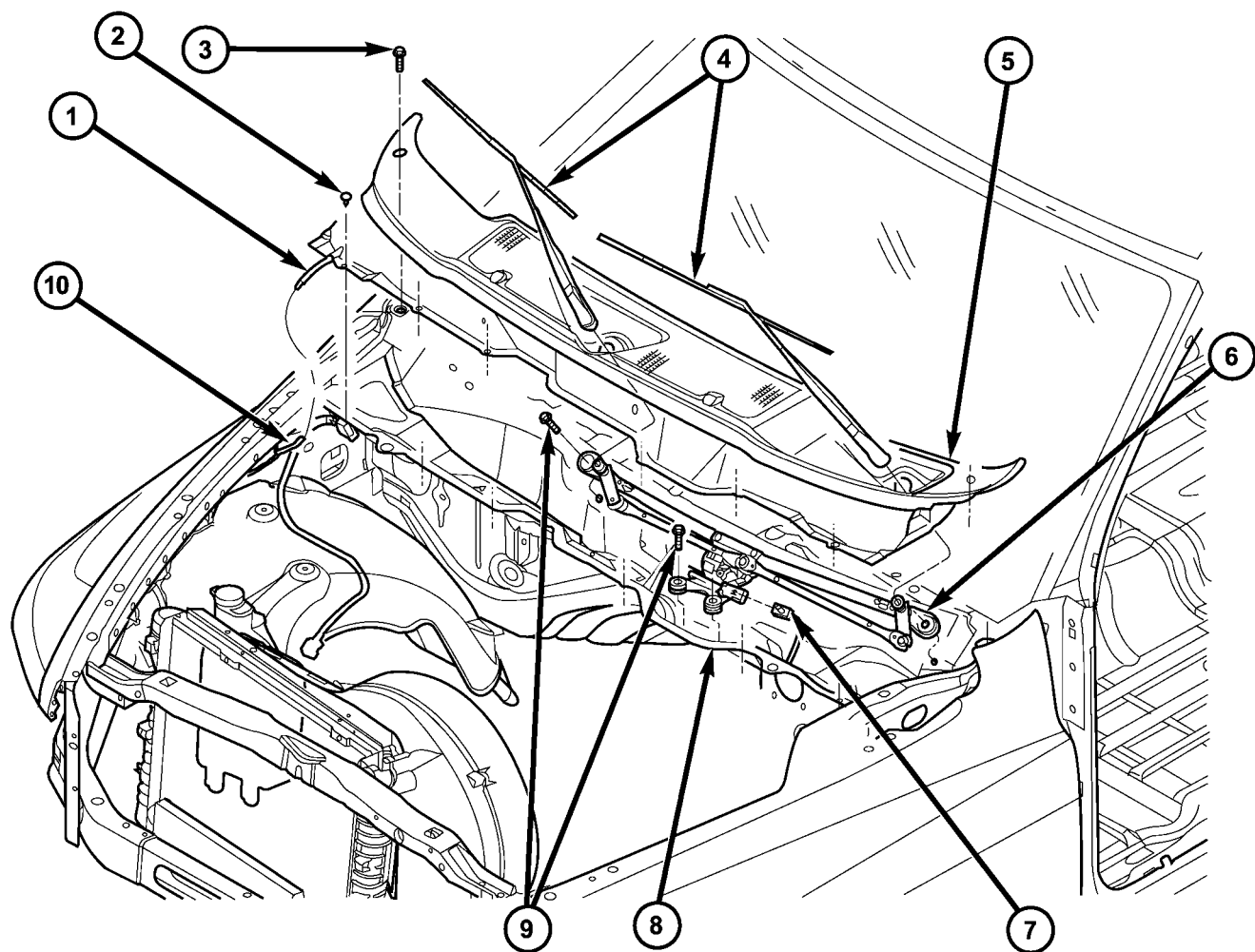
(5) Reinstall the cowl plenum cover/grille panel over the cowl plenum. (Refer to 23 - BODY/EXTERIOR/COWL GRILLE - INSTALLATION).

(6) Reconnect the battery negative cable.

(7) Close and latch the hood.

(8) Reinstall both wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION).

WIPER MODULE (Continued)



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Fig. 26 Wiper Module Remove/Install

- 1 - COWL PLENUM WASHER HOSE
- 2 - PLASTIC FASTENER (6)
- 3 - SCREW (2)
- 4 - WIPER ARM & BLADE (2)
- 5 - COWL PLENUM COVER/GRILLE PANEL

- 6 - WIPER MODULE
- 7 - WIRE HARNESS CONNECTOR
- 8 - PLENUM PANEL
- 9 - SCREW (4)
- 10 - ENGINE COMPARTMENT WASHER HOSE

WIPER ON/OFF RELAY

DESCRIPTION

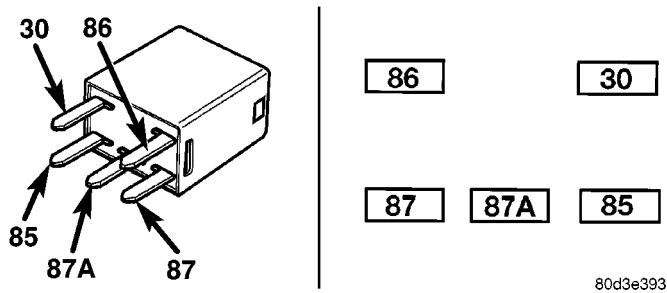


Fig. 27 ISO Micro Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

The wiper on/off relay is located in the Integrated Power Module (IPM) in the engine compartment near the battery. The wiper on/off relay is a conventional International Standards Organization (ISO) micro relay (Fig. 27). Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing and is connected to all of the required inputs and outputs by five integral male spade-type terminals that extend from the bottom of the relay base.

The wiper on/off relay cannot be adjusted or repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

The wiper on/off relay is an electromechanical switch that uses a low current input from the Front Control Module (FCM) to control a high current output to the wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper on/off relay terminals are connected to the vehicle electrical system through a connector receptacle in the Integrated Power Module (IPM). The inputs and outputs of the wiper on/off relay include:

- **Common Feed Terminal** - The common feed terminal (30) is connected to the common feed terminal of the wiper high/low relay at all times through the wiper on/off relay output circuit.

- **Coil Ground Terminal** - The coil ground terminal (85) is connected to a control output of the Front Control Module (FCM) through a wiper on/off relay control circuit. The FCM controls wiper motor operation by controlling a ground path through this circuit.

- **Coil Battery Terminal** - The coil battery terminal (86) receives battery current at all times from a fuse in the IPM through a fused ignition switch output (run-acc) circuit.

- **Normally Open Terminal** - The normally open terminal (87) receives battery current at all times from a fuse in the IPM through a fused ignition switch output (run-acc) circuit, and provides battery current to the wiper on/off relay output circuit whenever the relay is energized.

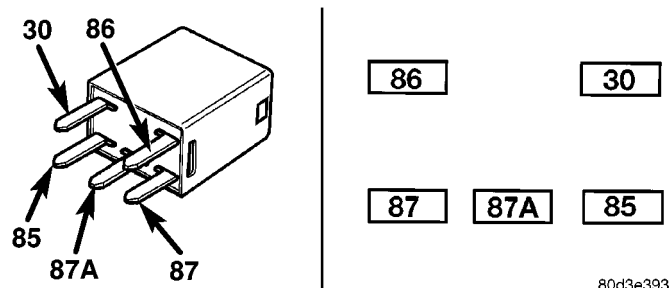
- **Normally Closed Terminal** - The normally closed terminal (87A) is connected to ground at all times through a take out of the left headlamp and dash wire harness with an eyelet terminal connector that is secured by a screw to the front end sheet metal, and is connected to the wiper on/off relay output circuit whenever the relay is de-energized.

The wiper on/off relay may be diagnosed using conventional diagnostic tools and methods. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster, the Front Control Module (FCM), or the electronic message inputs to or outputs from the instrument cluster and the FCM that control the operation of the wiper on/off relay. The most reliable, efficient, and accurate means to diagnose the wiper on/off relay, the instrument cluster, the FCM, or the electronic message inputs and outputs related to the wiper on/off relay operation requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WIPER ON/OFF RELAY (Continued)

DIAGNOSIS AND TESTING - WIPER ON/OFF RELAY

The wiper on/off relay (Fig. 28) is located in the Integrated Power Module (IPM) in the engine compartment near the battery. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

**Fig. 28 ISO Micro Relay**

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

(1) Remove the wiper on/off relay from the IPM. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ON/OFF RELAY - REMOVAL).

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 8 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

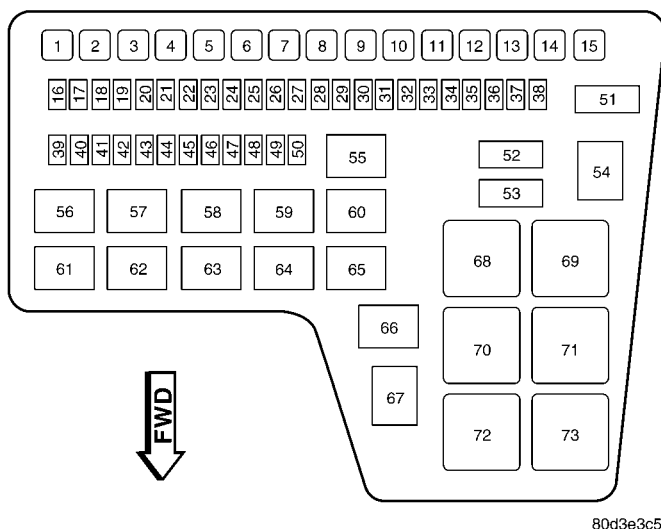
(4) Connect a battery to terminals 85 and 86. There should now be continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, reinstall the relay and use a DRBIII® scan tool to perform further testing. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Integrated Power Module (IPM) (Fig. 29).

(3) Remove the wiper on/off relay by grasping it firmly and pulling it straight out from the receptacle in the IPM.

**Fig. 29 Integrated Power Module**

1 - 15 - CARTRIDGE FUSE
16 - 53 - BLADE FUSE
54 - HEATED MIRROR RELAY
55 - WIPER ON/OFF RELAY
56 - A/C CONDENSER FAN RELAY
57 - ENGINE CONTROL RELAY
58 - FUEL PUMP RELAY
59 - TRANSMISSION RELAY
60 - WIPER HIGH/LOW RELAY
61 - SPARE
62 - FOG LAMP RELAY
63 - ADJUSTABLE PEDAL RELAY
64 - A/C CLUTCH RELAY
65 - SPARE
66 - O2 RELAY
67 - SPARE
68 - SPARE
69 - SPARE
70 - SPARE
71 - SPARE
72 - STARTER RELAY
73 - PARK LAMP RELAY

INSTALLATION

(1) Position the wiper on/off relay to the proper receptacle in the Integrated Power Module (IPM) (Fig. 29).

(2) Align the wiper on/off relay terminals with the terminal cavities in the IPM receptacle.

(3) Push firmly and evenly on the top of the wiper on/off relay until the terminals are fully seated in the terminal cavities in the IPM receptacle.

(4) Reinstall the cover onto the IPM.

(5) Reconnect the battery negative cable.