

Foreword

Introduction

This manual provides information needed to operate and understand the vehicle and its components. More detailed information is contained in the *Owner's Warranty Information for North America* booklet, and in the vehicle's service and maintenance manuals.

Custom-built Freightliners are equipped with various chassis and cab components. Not all of the information contained in this manual applies to every vehicle. For details about components in your vehicle, refer to the chassis specification pages included in all new vehicles and to the vehicle specification decal, located inside the vehicle.

For your reference, keep this manual in the vehicle at all times.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Freightliner Trucks reserves the right to discontinue models and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, expressed or implied, and are subject to revisions and editions without notice.

Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should first attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

Event Data Recorder

This vehicle is equipped with one or more devices that record specific vehicle data. The type and amount of data recorded varies depending on how the vehicle is equipped (such as the brand of engine, if an air bag is installed, or if the vehicle features a collision avoidance system, etc.).

Customer Assistance Center

Having trouble finding service? Call the Customer Assistance Center at 1-800-385-4357 or 1-800-FTL-HELP. Call night or day, weekdays or weekends, for dealer referral, vehicle information, break-

down coordination, or Fleetpack assistance. Our people are knowledgeable, professional, and committed to following through to help you keep your truck moving.

Reporting Safety Defects

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Daimler Trucks North America LLC.

If the NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Daimler Trucks North America LLC.

To contact NHTSA, you may call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153); go to www.safercar.gov; or write to: Administrator, NHTSA, 1200 New Jersey Avenue, SE, Washington, DC 20590. You can also obtain other information about motor vehicle safety from www.safercar.gov.

Canadian customers who wish to report a safety-related defect to Transport Canada, Defect Investigations and Recalls, may telephone the toll-free hotline 1-800-333-0510, or contact Transport Canada by mail at: Transport Canada, ASFAD, Place de Ville Tower C, 330 Sparks Street, Ottawa, Ontario, Canada K1A 0N5.

For additional road safety information, please visit the Road Safety website at: www.tc.gc.ca/roadsafety/menu.htm.

Foreword

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1

Vehicle Identification

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Vehicle Identification

Vehicle Specification Decal

The vehicle specification decal ([Fig. 1.1](#)) lists the vehicle model, identification number, and major component models. It also recaps the major assemblies and installations shown on the chassis specification sheet. One copy of the specification decal is attached to the inside of the glove box; another copy is inside the rear cover of the *Owner's Warranty Information for North America* booklet.

FREIGHTLINER COMPONENT INFORMATION	
MANUFACTURED BY	USE VEHICLE ID NO. WHEN ORDERING PARTS
MODEL	
VEHICLE ID NO.	
DATE OF MFR	WHEELBASE
ENGINE MODEL	ENGINE NO.
TRANS MODEL MAIN	TRANS NO.
FRONT AXLE MODEL	FRT AXLE NO.
REAR AXLE MODEL	REAR AXLE NO.
	RATIO
PAINT MFR	FOR COMPLETE PAINT INFORMATION
PAINT NO.	SEE VEHICLE SPECIFICATION SHEET
IMRON PAINT-CAB CAB COLOR A: WHITE (4775) CAB COLOR B: BROWN (3295) CAB COLOR C: BROWN (29607) CAB COLOR D: DARK BROWN (7444)	
PART NO. 24-00273-010	
11/21/96	f080021

Fig. 1.1, Vehicle Specification Decal, U.S.-Built Vehicle Shown

NOTE: Labels shown in this chapter are examples only. Actual specifications may vary from vehicle to vehicle.

Federal Motor Vehicle Safety Standard (FMVSS) Labels

NOTE: Due to the variety of FMVSS certification requirements, not all of the labels shown will apply to your vehicle.

Tractors with or without fifth wheels purchased in the U.S. are certified by means of a certification label ([Fig. 1.2](#)) and the tire and rim labels. These labels are attached to the left rear door post, as shown in [Fig. 1.3](#).

If purchased for service in the U.S., trucks built without a cargo body have a certification label ([Fig. 1.4](#)) attached to the left rear door post. See [Fig. 1.3](#). In addition, after completion of the vehicle, a certification label similar to that shown in [Fig. 1.2](#) must be attached by the final-stage manufacturer. This label will be located on the left rear door post and certifies

1 2		3
MFRD BY DATE GVWR VEHICLE ID NO.		FRONT AXLE GVWR FIRST INTERMEDIATE AXLE GVWR SECOND INTERMEDIATE AXLE GVWR THIRD INTERMEDIATE AXLE GVWR REAR AXLE GVWR
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.		VEHICLE TYPE CLASSIFICATION: TRUCK/TRACTOR
11/21/96		f080053
1. Date of manufacture by month and year. 2. Gross vehicle weight rating; developed by taking the sum of all the vehicle's gross axle ratings. 3. Gross axle weight ratings; developed by considering each component in an axle system, including suspension, axle, wheels, and tires. The lowest component capacity is the value used for the system.		

Fig. 1.2, Certification Label, U.S.

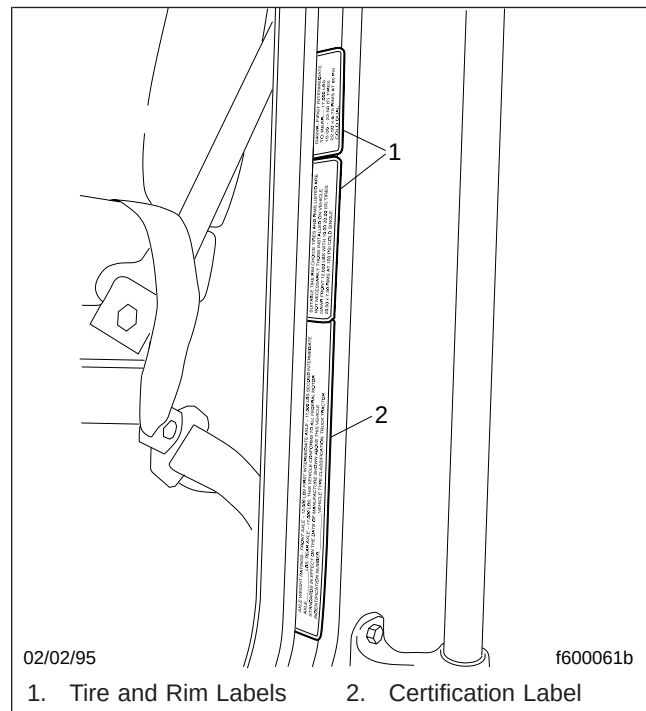


Fig. 1.3, Location of Labels

CHASSIS-CAB MFRD. BY	VEHICLE ID NUMBER
THIS CHASSIS-CAB CONFORMS TO FEDERAL MOTOR VEHICLE SAFETY STANDARD NOS. 101, 102, 103, 104, 106, 107, 111, 113, 115, 116, 120, 121, 124, 125, 126, 127, 208, 209, 210, 202. IF IT IS COMPLETED IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED IN THE INCOMPLETE VEHICLE DOCUMENT FURNISHED PURSUANT TO ARCH PART 560, THIS VEHICLE WILL CONFORM TO STANDARD NO. 208.	
09/28/98	f080023

Fig. 1.4, Incomplete Vehicle Certification Label, U.S.

that the vehicle conforms to all applicable FMVSS regulations in effect on the date of completion.

Vehicle Identification

Canadian Motor Vehicle Safety Standard (CMVSS) Labels

In Canada, tractors with fifth wheels are certified by means of a "Statement of Compliance" label and the Canadian National Safety Mark (Fig. 1.5), which are attached to the left rear door post.

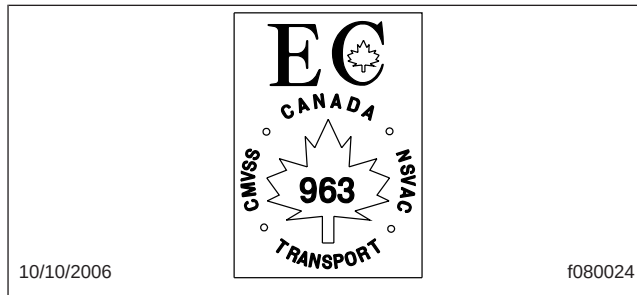


Fig. 1.5, Canadian National Safety Mark

If purchased for service in Canada, trucks built without a cargo body and tractors built without a fifth wheel are certified by a "Statement of Compliance" label, similar to Fig. 1.2. This label must be attached by the final-stage manufacturer after completion of the vehicle. The label is located on the left rear door post, and certifies that the vehicle conforms to all applicable CMVSS regulations in effect on the date of completion.

Tire and Rim Labels

Tire and rim labels (attached to the left rear door post) certify suitable tire and rim combinations that can be installed on the vehicle, for the given gross axle weight rating. See Fig. 1.6. Tires and rims installed on the vehicle at the time of manufacture may have a higher load capacity than that certified by the tire and rim label. If the tires and rims currently on the vehicle have a lower load capacity than that shown on the tire and rim label, then the tires and rims determine the load limitations on each of the axles.

Refer to Fig. 1.6 for U.S. and Canadian tire and rim labels.

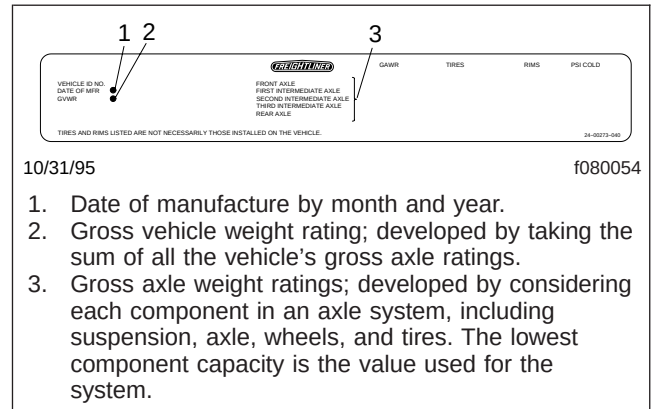


Fig. 1.6, Tire and Rim Label

EPA Emission Control Labels

Vehicle Noise Emission Control Label

A vehicle noise emission control label (Fig. 1.7) is attached either to the left side of the dashboard or to the top-right surface of the frontwall between the dash and the windshield.

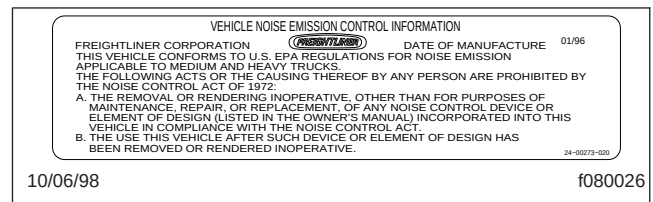


Fig. 1.7, Vehicle Noise Emission Control Label

IMPORTANT: Certain Freightliner incomplete vehicles may be produced with incomplete noise control hardware. Such vehicles will not have a vehicle noise emission control information label. For such vehicles, it is the final-stage manufacturer's responsibility to complete the vehicle in conformity to U.S. EPA regulations (40 CFR Part 205) and label it for compliance.

EPA07 Exhaust Emissions

To meet January 2007 emissions regulations, vehicles with engines manufactured after January 1, 2007, are equipped with an emission aftertreatment device. There is a warning label on the driver's sunvisor, explaining important new warning indicators in the driver's message display, that pertain to the aftertreatment system. See Fig. 1.8.

Vehicle Identification

EXHAUST AFTERTREATMENT SYSTEM INFORMATION					
INDICATOR LAMP(S)	 (Solid) Level 1	 (Flashing) Level 2	 (Flashing) CHECK Level 3	 (Flashing) CHECK STOP Level 4	 WARNING
Indicator Lamp Message(s)	Filter Regeneration Recommended	Filter Regeneration Necessary	Parked Regeneration Required – Engine Derate	Parked Regeneration Required – Engine Shut Down	HEST (High Exhaust System Temperature)
Diesel Particulate Filter Condition	Filter is reaching capacity.	Filter is now reaching maximum capacity.	Filter has reached maximum capacity.	Filter has exceeded maximum capacity.	Flashing A regeneration is in progress.
Required Action	Bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration.	To avoid engine derate bring vehicle to highway speeds to allow for an Automatic Regeneration or perform a Parked Regeneration as soon as possible.	Vehicle must be parked and a Parked Regeneration must be performed – engine will begin derate.	Vehicle must be parked and a Parked Regeneration or Service Regeneration must be performed. Check engine operator's manual for details – engine will shut down.	Solid Exhaust Components and exhaust gas are at high temperature. When stationary, keep away from people and flammable materials or vapors.
For a driver performed Parked Regeneration, vehicle must be equipped with a dash mounted Regeneration Switch.					
See Engine Operator's Manual for complete Regeneration Instructions.					24-01583-0008

Fig. 1.8, Sunvisor Warning Label

It is a violation of federal law to alter exhaust plumbing or aftertreatment in any way that would bring the engine out of compliance with certification requirements. (Ref: 42 U.S.C. S7522(a) (3).) It is the owner's responsibility to maintain the vehicle so that it conforms to EPA regulations.

2

Instruments and Controls Identification

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Instruments and Controls Identification

Instrument and Control Panel

Figure 2.1, Figure 2.2, and Figure 2.3 represent a portion of a typical Freightliner dash equipped with all of the standard and many of the optional instruments and accessories. Most standard and optional instrument gauges and switches can be mounted in this dash.

NOTE: On SilverAero models, switches for cruise control and manual control for the engine fan are standard. If these features are not requested, dummy switches with blank labels are installed.

A warning and indicator light module, located above the speedometer and tachometer, houses all of the standard and optional warning and indicator lights. Some of the controls discussed in this chapter are not dash-mounted.

Controls

Ignition Switch and Key

The ignition switch (**Fig. 2.4**) can be turned to three positions: "Off," "Accessory," and "On." In addition, the same key locks and unlocks the cab doors, baggage door(s), and, if equipped, the bunk door(s).

In the "Off" position, the key slot is vertical; the key can be inserted and removed only in this position. The low beam headlights, taillights, brake lights, fog lights, dome lights, clearance lights, turn signals, hazard warning lights, utility and baggage lights, spotlights, electric wipers, horn, CB radio, power mirrors, cigarette lighter, clock, refrigerator, fuel heater, electric oil pan heater, and electric or diesel-fired engine-coolant preheaters can be operated in the off position (regardless of whether the key is inserted or not).

In the "Accessory" position, the key is turned counterclockwise. The auxiliary (bunk) fan, windshield fan(s), radio or stereo system, mirror heat, ether start

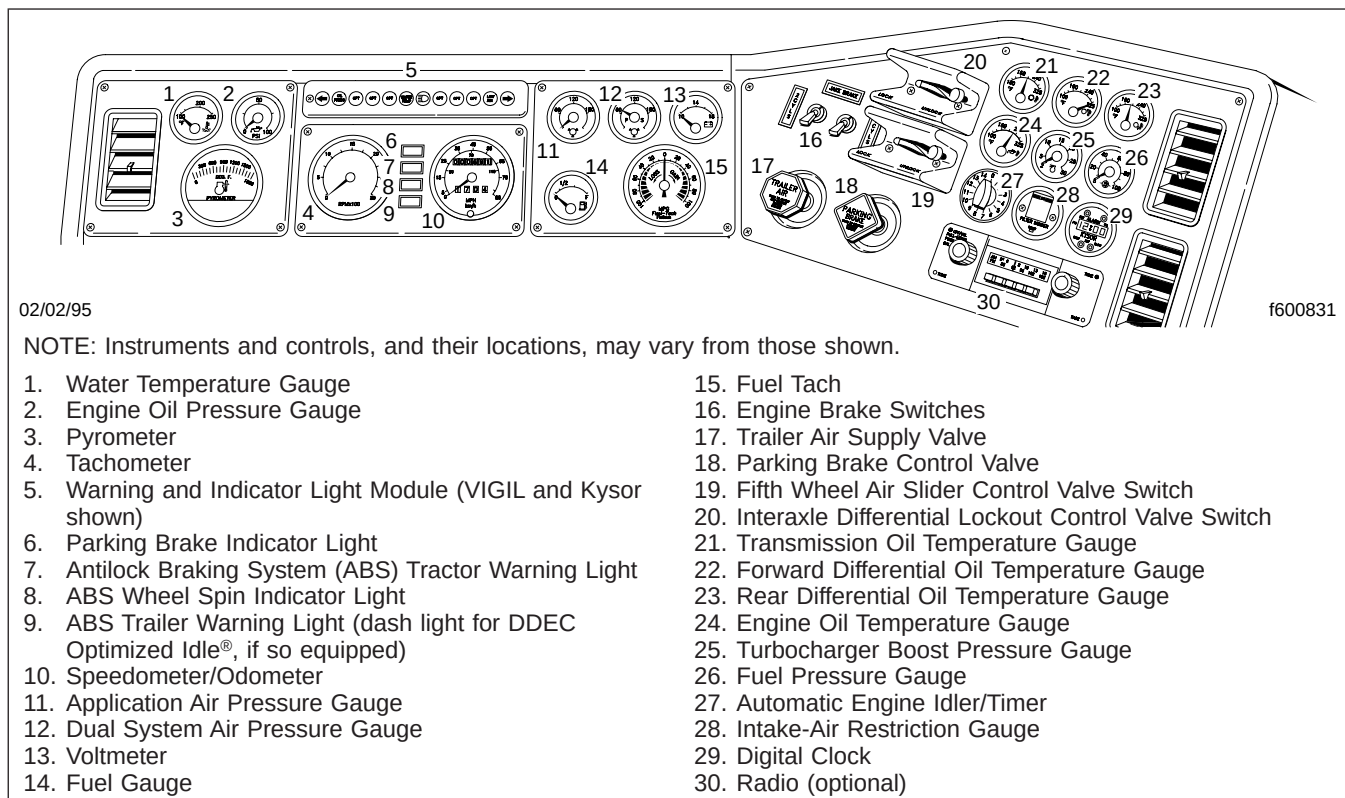


Fig. 2.1, Instrument and Control Panel Layout (upper dash) Pre-EPA07

Instruments and Controls Identification

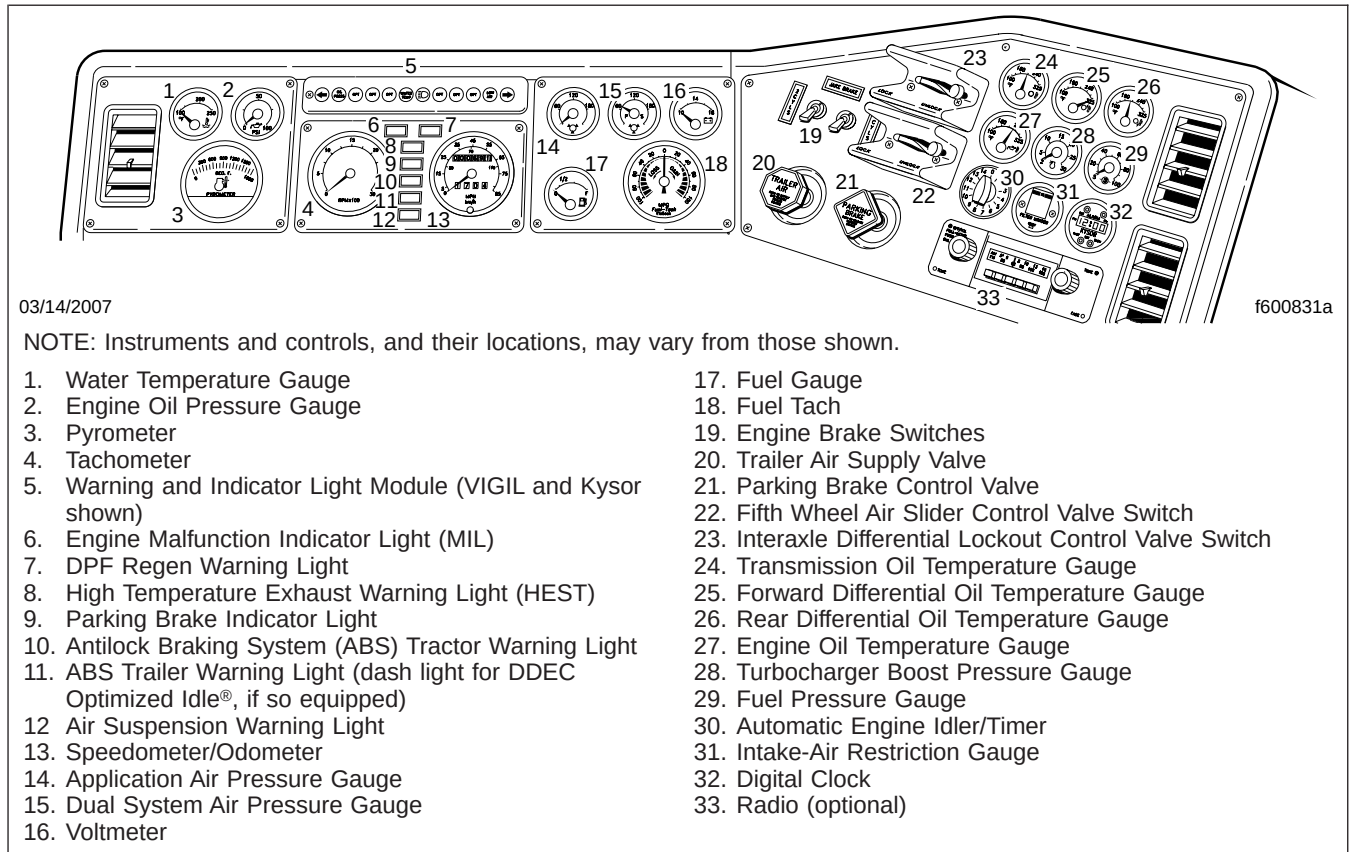


Fig. 2.2, Instrument and Control Panel Layout (upper dash) EPA07

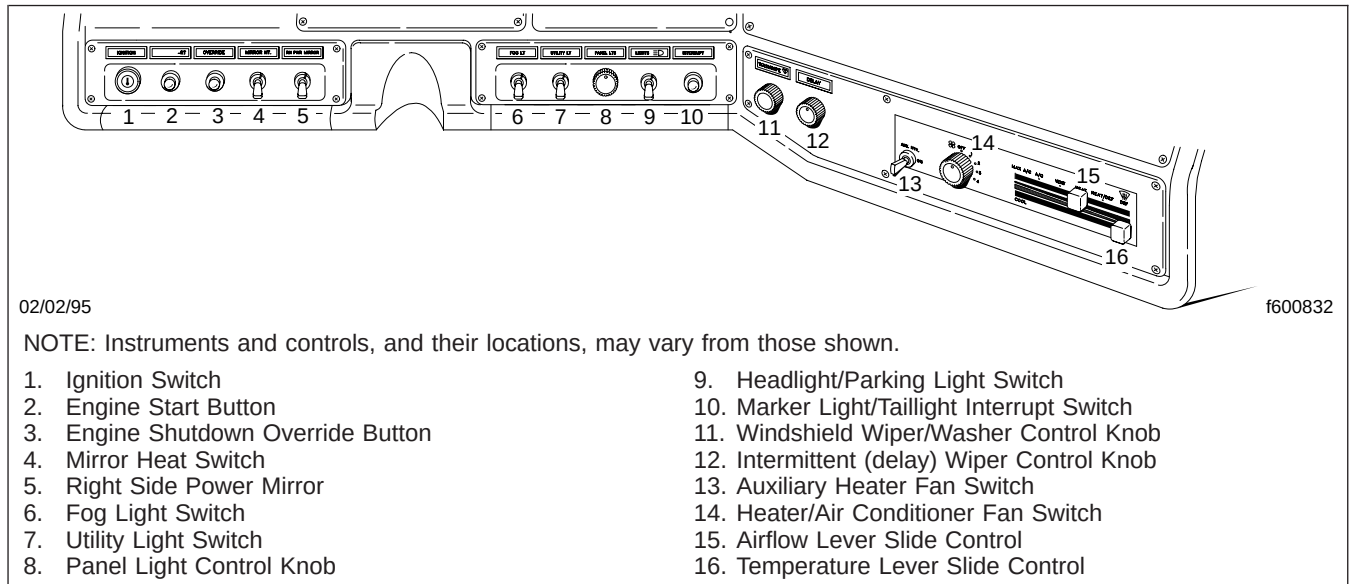


Fig. 2.3, Instrument and Control Panel Layout (lower dash)

Instruments and Controls Identification

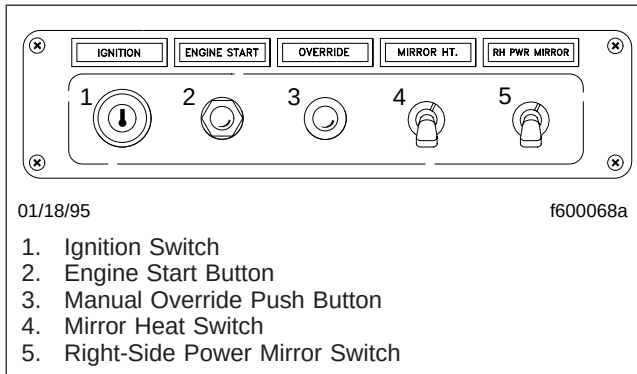


Fig. 2.4, Ignition/Start/Override/Mirror Switches

system, air dryer, backup lights, and all of the electrical systems that are operable in the "Off" position are operable in the "Accessory" position.

In the "On" position, the key is turned clockwise. All electrical systems are operable. Low air- and oil-pressure warning lights and buzzer operate until the engine is started and pressure is built up. The engine can be started and operated only when the ignition switch is on.

For vehicles built to operate in Canada, switching on the ignition and releasing the parking brakes automatically activates the headlight low beams (later model vehicles) or high beams (earlier model vehicles) at half voltage as daytime running lights. The daytime running lights will operate until the parking brakes are applied; then they will switch off. Turning on the regular headlights will override the daytime running lights. The vehicle cannot be driven unless either the headlights or daytime running lights are activated.

Engine Start Button



CAUTION

Do not push the engine start button with the engine running. To do so could result in starter damage.

With the ignition switch on, push the engine start button (Fig. 2.4) to engage the electric or air starter. See the applicable engine operating instructions in [Chapter 7](#) for complete starting instructions.

On vehicles equipped with a Neutral start switch, the transmission must be in Neutral before the engine can be started.

Manual Override Push Button, Optional Engine Shutdown System

If the vehicle is equipped with an engine shutdown system with a manual override push button (Fig. 2.4), simultaneously depress the engine start button and the manual override push button. Once the engine has started, release the engine start button, but continue to depress the override push button until the warning bell stops.

Mirror Heat Switch, Optional

One or both outside door mirrors can be heated to keep them defrosted. Whenever the mirror heat switch (Fig. 2.4) is on, an indicator light illuminates on the warning and indicator light module.

Power Mirrors

Both outside mirrors can be equipped with an electrical remote control. Move the toggle switch (Fig. 2.4) to adjust the mirror.

Detroit Diesel Electronic Engine Control (DDEC) Operator Control

The DDEC system is centered around a computer that is programmed to automatically control engine timing and fuel injection, providing maximum engine performance and fuel economy.

Some DDEC II® systems have an automatic engine shutdown option. This option will shut down the engine if potentially damaging conditions are detected. An override button (on DDEC II engines, this button is labelled "Override") is provided for emergency situations. It is mounted to the right of the ignition switch, and provides the driver with an extra 30 seconds of engine operating time.

Standard DDEC III® systems will shut down the engine if sensors indicate an emergency engine condition such as low coolant level, high coolant temperature, or high oil temperature. If such a condition occurs, the yellow "Check Engine" light in the lightbar will glow. If the problem gets bad enough to cause possible engine damage, the DDEC III will gradually cut engine power down to 70 percent of original power. At that point, the red "Shutdown Engine" light will turn on, and 30 seconds later, DDEC III will shut down the engine.

Instruments and Controls Identification

If DDEC III detects low oil pressure, both the "Check Engine" and "Shutdown Engine" lights will go on, and the engine will shut down in 30 seconds.

NOTE: If the vehicle is in a hazardous place when the "Shutdown Engine" light goes on, the driver must immediately press the "Override/Chk" button or the engine will shut down in 30 seconds. Pressing the button will give the driver an additional 30 seconds to move the vehicle. If this is still not enough time, the driver must press the button again for another 30-second delay before engine shutdown.

Once the engine has shut down, cycle the ignition key off and then on, and press the "Override/Chk" button to restart the engine.

The cruise control and PTO governor options are controlled in one of two ways:

By two switches on the instrument control panel (Fig. 2.5). The "On/Off" switch turns on the cruise control option, and the spring-loaded "Set/Resume" switch selects the cruise speed or resumes cruise control after slowing down. For PTO operation, the "On/Off" switch turns on the PTO, and the "Set/Resume" switch either selects or resumes the engine operating speed.

or

By three optional buttons on the transmission shift knob (Fig. 2.6). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set" button is used to select the engine operating speed. See [Chapter 7](#) for complete instructions.

If the vehicle is equipped with Optimized Idle®, the cruise control "On/Off" switch is also used to control this option. Optimized Idle can be used to keep the engine oil warm, recharge the battery, and maintain sleeper temperature when the vehicle is parked for long periods. See [Chapter 7](#) for more information and complete operating instructions.

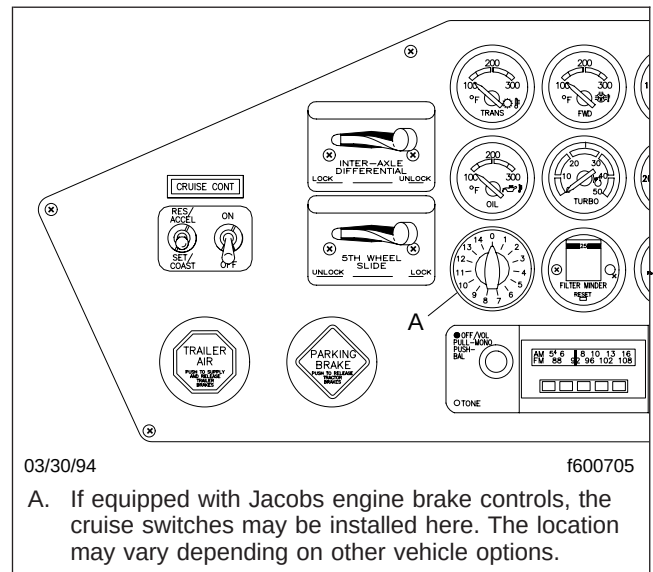


Fig. 2.5, Cruise Control Switches, Standard Location

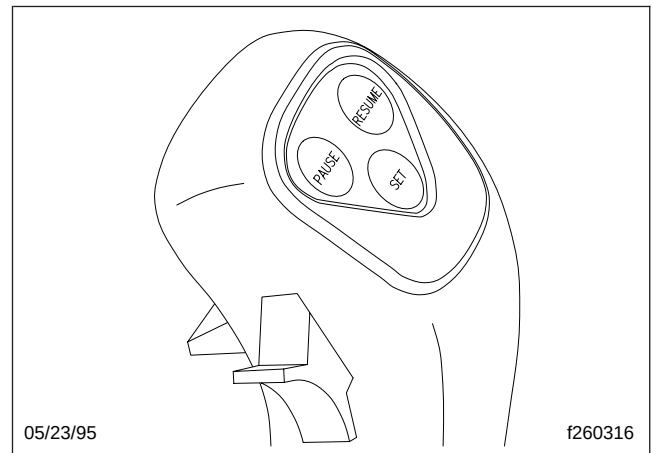


Fig. 2.6, Transmission Shift Knob Buttons

Caterpillar C-10, C-12, and C-15 Electronic Engine Operator Control

The Caterpillar C-10, C-12, and C-15 electronic engines use a computer (electronic control module) to automatically control engine timing and fuel injection. The electronic features of these engines include an electronic governor, fuel-to-air ratio control, programmable engine ratings, injection timing control, fault analysis and recording, and a data link used for programming the electronic control module and troubleshooting the system.

Instruments and Controls Identification

All Caterpillar electronic engines have an engine check light in the lightbar located above the speedometer and tachometer. This warning light comes on or flashes if the engine oil pressure is low, the coolant temperature is high, the intake manifold air temperature is high, the coolant level is low (optional), or whenever there is a problem within the electronic engine system. Some vehicles equipped with Caterpillar electronic engines have an automatic engine shutdown option. This option will shut off fuel to the engine if potentially damaging conditions are detected. See the engine manufacturer's service literature for troubleshooting procedures.

The cruise control and PTO governor options are controlled in one of two ways:

By two switches on the instrument control panel (Fig. 2.5). The "On/Off" switch turns on the cruise control option, and the spring-loaded "Set/Resume" switch selects the cruise speed or resumes cruise control after slowing down. For PTO operation, the "On/Off" switch turns on the PTO, and the "Set/Resume" switch either selects or resumes the engine operating speed.

By three optional buttons on the transmission shift knob (Fig. 2.6). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set" button is used to select the engine operating speed. See [Chapter 7](#) for complete instructions.

BrakeSaver Control, Optional

The BrakeSaver (optional on Caterpillar C-15 engines) is operated by a lever mounted in the cab. The lever controls the amount of oil being directed through the BrakeSaver. The time required to fill the BrakeSaver with pressure oil to the point of maximum braking in the BrakeSaver is about 1.8 seconds.

Cummins PACE and CELECT™ Electronic Engines, Operator Control

Cummins PACE, CELECT, and CELECT IV are electronic fuel control systems installed on model L10 and, for PACE only, Big Cam IV engines. These elec-

tronic engines are controlled by a microprocessor-based computer. This computer controls specific engine and vehicle speed modes of operation to maximize vehicle fuel economy and performance.

Vehicles with these engine systems have a yellow engine check light and a red engine stop light in the lightbar located above the speedometer and tachometer. With the ignition switch on, both lights come on for about two seconds; then, if there is no problem with the engine system, the lights will go out. Whenever there is a problem within the electronic engine system, one of the lights will come on and stay on as long as the problem exists.

If the yellow engine check light comes on while driving, some features will not work, but the vehicle can still be driven. If the red engine stop light comes on while driving, and if the engine will not accelerate, pull off of the road and shut down the engine. In either situation, have the problem repaired as soon as possible.

With the CELECT IV system—if the system is programmed to shut down—the engine shuts down 30 seconds after the red engine stop light comes on. The ignition switch will restart the engine after shutdown, but if the potentially damaging problem still exists, the engine will operate at the reduced speed or torque level allowed just prior to shutdown. To check whether a vehicle is equipped with CELECT or with CELECT IV, see the vehicle service manual.

The cruise control and PTO governor options are controlled in one of two ways:

By two switches on the instrument control panel (Fig. 2.5). The "On/Off" switch turns on the cruise control option, and the spring-loaded "Set/Resume" switch selects the cruise speed or resumes cruise control after slowing down. For PTO operation, the "On/Off" switch turns on the PTO, and the "Set/Resume" switch either selects or resumes the engine operating speed.

or

By three optional buttons on the transmission shift knob (Fig. 2.6). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set"

Instruments and Controls Identification

button is used to select the engine operating speed. See [Chapter 7](#) for complete instructions.

Ether Start Push Button, Optional

For cold weather starting, the vehicle may be equipped with one of several manual-control, ether start systems. To start the engine in cold weather, push the ether button ([Fig. 2.7](#)), then start the engine. See the engine operating instructions in [Chapter 7](#) for additional information.

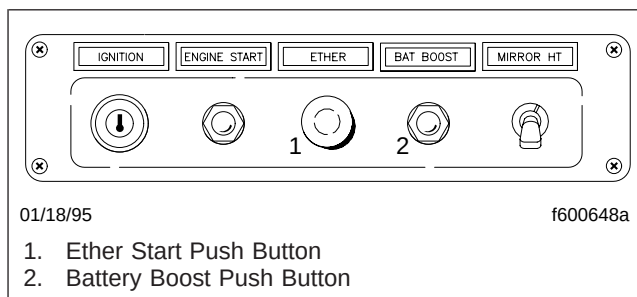


Fig. 2.7, Ether Start and Battery Boost Controls, Optional

Low Voltage Disconnect, Optional

The optional Sure Power Low Voltage Disconnect (LVD) system monitors battery power when accessories are being used when the engine is shut down. The system automatically turns off cab and sleeper accessories when voltage drops to 12.3 volts to ensure that there is enough battery power to start the vehicle. An alarm sounds for one minute before accessories are turned off. If no action is taken within that minute, the LVD module will shut off power to predetermined cab and sleeper circuits, and illuminate an LED indicator on the LVD module, located inside the baggage compartment. These circuits will remain off until the LVD measures 13.0 volts applied to the system, which can be done by starting the engine. After the engine is started, the system will reset.

All vehicles equipped with LVD should have a sticker on the dash indicating the presence of the system. Another sticker is located inside of the baggage compartment, along with the LVD module.

Battery Boost Push Button and Optional Battery Isolator System

A battery isolator system has two or three regular batteries to turn the starter motor, and one or two gel cell batteries to provide power for cab and sleeper accessories when the engine is off. The system uses an isolator relay, which is normally open. The relay isolates the engine-starting batteries while the engine is not running, so that the engine can still be started even if the gel cell battery has been used to the point of complete discharge.

When all four batteries have a charge, the engine can be started in the normal manner, by turning the ignition key to the "Start" position and pressing the starter push button.

To start the engine when the gel cell battery is drained, press and hold the BATT BOOST push button ([Fig. 2.6](#)) while pressing the starter push button. This will temporarily close the isolator relay, and connect the engine-starting batteries to the ignition switch for engine starting.

The isolator relay is closed only while the engine is running or the BATT BOOST push button is depressed. With the engine running, all four batteries are connected in parallel, allowing the alternator to charge them all, in addition to supplying power for all vehicle loads.

When the engine is not running, the gel cell provides all of the vehicle's electrical needs except for turning the starter motor. The gel cell is longer-lived and cheaper to use than a standard wet cell, but it can take a charge only within an extremely narrow range—13.8 to 14.1 volts.

At 14 volts, a gel cell has a very high charge acceptance rate. Because a truck charging system operates at approximately 14 volts, under normal conditions a gel cell will never need to be recharged with an external charger.

CAUTION

Do not attempt to charge a gel cell with a standard battery charger. All standard battery chargers supply at least 16 volts to the battery. This will damage the gel cell.

IMPORTANT: To recharge a gel cell, see an authorized Freightliner dealer or the instructions in

Instruments and Controls Identification

Group 54 of the *Heavy-Duty Trucks Service Manual*.

However, the single gel cell, like any other single battery, has limited current-supply capability, and will drain down faster than a standard multiple-battery installation that has no battery isolator system. Avoid ultra-deep discharging. Repeated ultra-deep discharging of a gel cell will reduce its life significantly.

To protect against ultra-deep discharging, a low voltage warning alarm and indicator light activate when the battery voltage falls to 12.0 volts or less. To silence the alarm, turn off all cab electrical loads or start the engine.

Fuel-Tach™ Switch, Optional

The FloScan Fuel-Tach is an electronic monitoring system that records fuel consumption and displays average miles per gallon. The Fuel-Tach gauge provides you with immediate feedback, showing a percentage difference between the current fuel consumption rate and the total trip miles per gallon average.

The system is controlled by a toggle switch. See [Fig. 2.8](#).

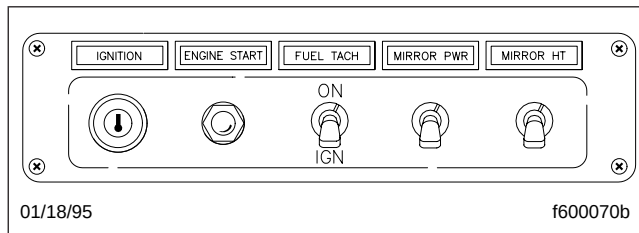


Fig. 2.8, Fuel-Tach Switch, Optional

With nonelectronically controlled engines the "On" position allows you to receive average miles per gallon information for specific periods of time. In this position, the Fuel-Tach system stays on and stores the average miles per gallon information in memory, even if the engine is shut down.

In the IGN position, the Fuel-Tach system is on only when the ignition switch is on. Shutting down the engine cancels the information in memory.

With electronically controlled engines the digital display normally shows trip average miles per gallon. If the engine datalink sends an electronic fault code, the Fuel-Tach interrupts the miles per gallon display for 60 seconds, showing an "F" plus the fault code,

for example, "F37." Fault codes are also stored in a history file for later viewing. For engine fault code instructions, see "Fuel Tach Gauge" in this chapter.

The "Reset" toggle switch cancels the information in memory used for calculating average miles per gallon and erases the fault code history file. To reset, press and hold the reset switch. The average MPG reading slowly blinks on and off for about 10 seconds, indicating that you are in the reset mode. After erasing the memory, the display blinks "Er" until you release the reset switch. If you release the reset switch before the display changes to "Er," the engine fault code history will be displayed and the memory will not be erased. After being reset, the display will show "0" MPG until you drive at least 150 feet (46 m).

Fog Light Switch, Optional

The fog light switch ([Fig. 2.9](#)) operates the fog lights, mounted on the bottom edge of the front bumper or recessed into the front bumper.

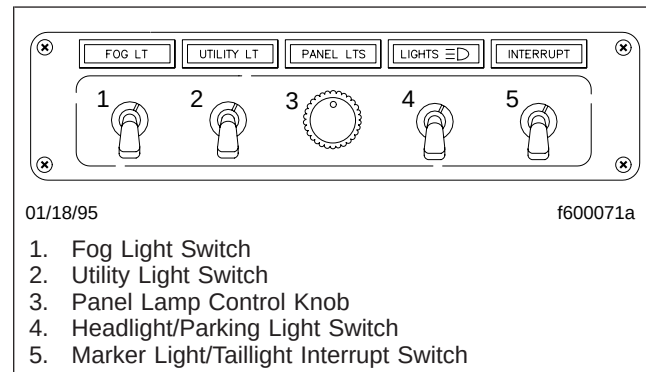


Fig. 2.9, Light Controls

For vehicles built to operate in the United States, the low beam headlights must be turned on before the fog lights can be turned on. The fog lights won't go on if the high beam headlights are already on, and switching from low beams to high beams will switch off the fog lights.

For vehicles built to operate in Canada, the taillights and clearance lights must be on before the fog lights can be turned on. Unless the headlight switch is all the way up (headlights, taillights, clearance lights, marker lights, and panel lights on) or down (taillights, clearance lights, marker lights, and panel lights on), the fog light switch will not turn on the fog lights.

Instruments and Controls Identification

Utility Light Switch, Optional

Utility lights can be swivel-mounted on top of the cab, mounted on the intake/exhaust support, or flush-mounted in the back of the cab or bunk. They are operated by the utility light switch (**Fig. 2.8**) which, when turned on, also illuminates a red indicator light on the dash.

Panel Lamp Control Knob

The circuit to the panel lamps is activated by the headlight switch. When the headlights are on, the panel lamp knob (**Fig. 2.8**) controls the intensity of the instrument panel lamps. Turn the knob counterclockwise to brighten them and clockwise to dim them. Turning the knob counterclockwise to the peg will also turn off the panel lamps.

Headlight Switch and Daytime Running Lights

A three-position headlight switch (**Fig. 2.8**) is used to operate the exterior lights. When the switch is up the headlights, and all other vehicle lights, are on. All vehicle lighting is off when the switch is in the middle position. When down, the switch activates only the clearance, instrument panel, and marker lights, and the taillights. The switch for the headlight high beams is built into the turn signal lever. When the headlights are on high beam, a green light in the warning and indicator light module goes on. The ignition switch must be on for the high beams to operate.

For vehicles built to operate in Canada, switching on the ignition and releasing the parking brakes automatically activates the headlight low beams (later model vehicles) or high beams (earlier model vehicles) at half voltage as daytime running lights. The daytime running lights will operate until the parking brakes are applied; then they will switch off. Turning on the regular headlights will override the daytime running lights. The vehicle cannot be driven unless either the headlights or daytime running lights are activated.

Interrupt Switch

A spring-loaded interrupt switch (**Fig. 2.8**) temporarily deactivates the marker lights and taillights. With the vehicle lights on, raise and release the interrupt switch to briefly turn off the marker lights and taillights.

Windshield Wiper/Washer Controls

Air Wipers

To operate the air wipers, turn the "Wash-Wipe" knob (**Fig. 2.10**) clockwise. To increase wiper speed, continue to turn the knob clockwise. Turning the knob counterclockwise decreases wiper speed. To turn the windshield wipers off, turn the knob counterclockwise to its full stop. When the wiper blades are parked, release the knob.

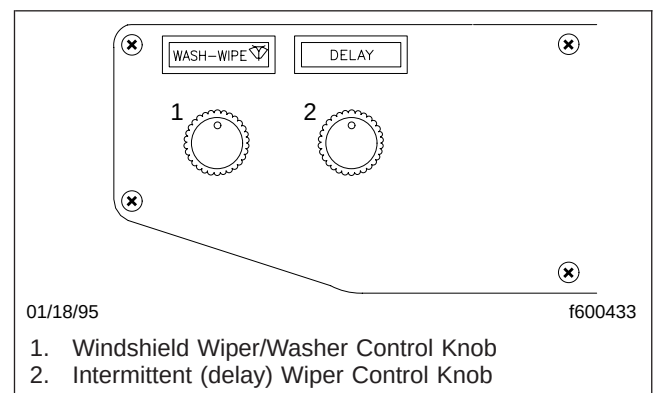


Fig. 2.10, Windshield Wiper/Washer Controls

The "Delay" switch controls intermittent operation with air wipers. Rotating the knob clockwise increases the time interval between wiper strokes. Turn the knob clockwise until the desired interval is reached. The longest delay is approximately 10 seconds between strokes.

The delay knob operates the delay feature only; it will not turn the wipers on.

IMPORTANT: After using the intermittent windshield wipers, turn off the wiper control (**Fig. 2.9**) and the intermittent (delay) control. If the wiper control is off, but the intermittent control remains on, that control will continue to cycle whenever the ignition is in the on or accessory position. Continued, constant cycling will shorten the life of the intermittent wiper control.

Electric Wipers

To operate the electric wipers, turn the knob clockwise to the first position for low speed. Turn the knob to the second position for high-speed operation.

Instruments and Controls Identification

In electric wiper systems, the delay feature is integrated with the wiper switch between the stop and low-speed positions. Turn the knob between the stop and low speed until the desired interval is reached. The longest delay is approximately 10 seconds between strokes.

CAUTION

Do not move the wiper arms manually. Wiper motor damage will occur if the arms are moved.

Windshield Washer Control

To operate the windshield washers, turn the windshield wipers to the desired speed. Push the "Wash-Wipe" knob in to actuate the washers. Hold the knob in for a constant stream of washer fluid. Push the knob in and release it for intermittent streams of fluid.

Left and Right Windshield-Fan Switches, Optional Ceiling-Mounted Fans

Ceiling-mounted defogger fans are operated by "Low/Off/High" toggle switches located in the base of the fan.

Heater/Air-Conditioner Controls (Standard) and Auxiliary Heater Switch (Optional)

Heater/air-conditioner controls ([Fig. 2.11](#)) consist of two lever slide controls, a four-speed fan control switch, and a switch for the optional auxiliary heater fan. See [Chapter 4](#) for detailed operating instructions of the heater/air-conditioner and the auxiliary heater.

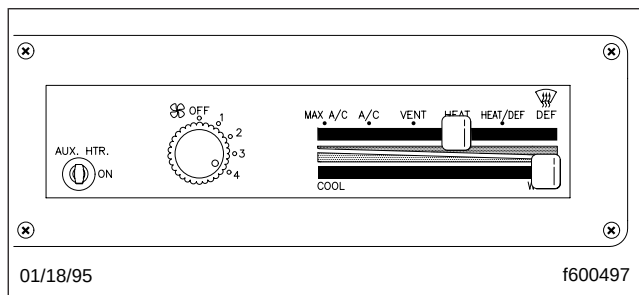


Fig. 2.11, Heater/Air-Conditioner Controls

Jacobs Engine Brake Switches, Optional

Jake Brake controls consist of two dash-mounted toggle switches ([Fig. 2.12](#)) which control the degree of engine braking. In conjunction with these switches, an engine-mounted microswitch (controlled by the throttle pedal) and an under-deck-mounted microswitch (controlled by the clutch pedal) actuate the engine brake.

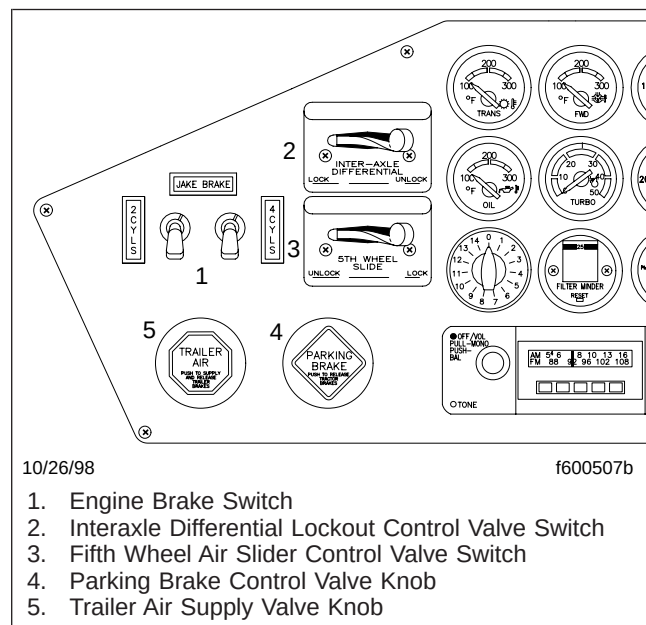


Fig. 2.12, Brake Switches and Control Valves

See [Chapter 7](#), under the heading "Engine Braking System, Optional," for additional information.

Interaxle Differential Lockout Control Valve Switch

Differential lockout, standard on all dual-drive vehicles, is driver-actuated by means of a "Lock/Unlock" control valve switch ([Fig. 2.12](#)) mounted on the control panel. A red indicator light comes on whenever the interaxle differential is locked out (switch is in the lock position; no differential action between the drive axles). A guard around the switch prevents it from being accidentally activated.

Instruments and Controls Identification

Fifth Wheel Air Slider Control Valve Switch, Optional Air-Operated Sliding Fifth Wheel

WARNING

Do not activate the fifth wheel air slider control valve when the vehicle is in motion. Doing so could result in damage to the fifth wheel member, kingpin, cab, or trailer, and ultimately, to the drivetrain. A guard is positioned around the switch to prevent it from being accidentally activated.

The fifth wheel air slider valve permits repositioning of the sliding fifth wheel from inside of the cab. Moving the air slider control valve switch (Fig. 2.12) to the lock position deactivates the control valve and locks the fifth wheel to the baseplate. Moving the switch to the unlock position activates the control valve and unlocks the fifth wheel slide mechanism, allowing changes to the total length of the tractor-trailer and changes to axle loads, to comply with varying state or provincial laws. A red indicator light, if so equipped, is illuminated whenever the fifth wheel slider is unlocked.

Parking Brake Control Valve and Trailer Air Supply Valve

The yellow diamond-shaped knob (Fig. 2.12) operates the parking brake valve. Pull the knob out to apply both the tractor and the trailer spring parking brakes. Push the knob in to release the tractor spring parking brakes. Before the spring parking brakes can be released, the air pressure in either air brake system must be at least 65 psi (447 kPa).

The red octagonal-shaped knob (Fig. 2.12) operates the trailer air supply valve. After the vehicle and its air hoses are connected to a trailer, and the pressure in the air system is at least 65 psi (447 kPa), push the trailer air supply valve knob in (it should stay in) to charge the trailer air supply system and release the trailer spring parking brakes. Before disconnecting a trailer, or when operating a vehicle without a trailer, pull the trailer air supply valve knob out.

See Chapter 6, under the heading "Brake System," for instructions regarding use of the trailer air supply valve and parking brake valve.

Controlled Traction Differential Control Valve Switch

On vehicles equipped with an Eaton single-drive rear axle, a controlled traction differential feature is standard. A control valve switch (Fig. 2.13) engages and disengages the controlled traction feature. A guard is positioned around the switch to prevent it from being accidentally activated.

See Chapter 9 for complete operating instructions.

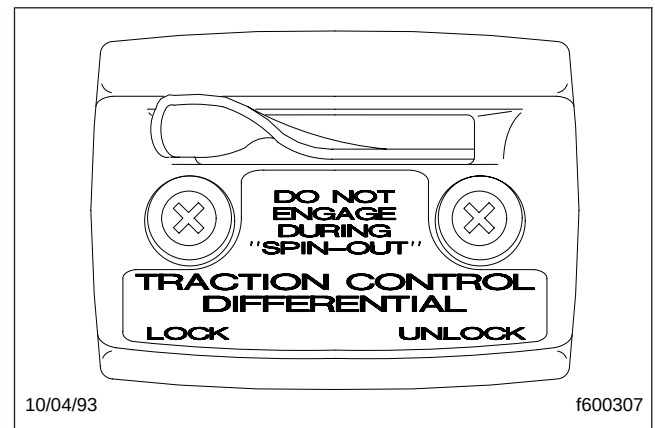


Fig. 2.13, Controlled Traction Differential Control Valve Switch

Air Suspension Dump Valve, Optional

The air suspension dump valve allows the air in the vehicle air suspension to be quickly exhausted, lowering the rear of the vehicle. This makes it easier to connect to or disconnect from a trailer. A control valve switch (Fig. 2.14) exhausts and fills the air suspension. To exhaust air from the suspension, move the switch to LOWER. A guard is positioned around the switch to prevent it from being accidentally activated.

CAUTION

Never exhaust air from the suspension while driving. If the air is exhausted, the suspension will not absorb road shocks and could be damaged.

Instruments and Controls Identification

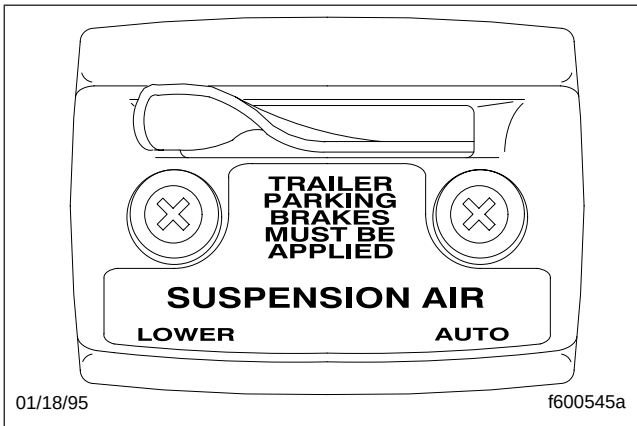


Fig. 2.14, Air Suspension Dump Valve Switch, Optional

AirLiner Plus Suspension, Optional

The AirLiner Plus suspension is used on vehicles with pusher or tag axles to improve traction performance. The system maintains an accurate leveling of frame height whether the vehicle is in motion or parked. The Meritor WABCO® ECAS (Electronically Controlled Air Suspension) system uses a height sensor mounted between the frame and the drive axle housing as well as other sensors to provide frame height information to a control unit mounted inside of the cab. The electronic control unit quickly lowers or raises the frame height, as necessary. Altering the height of the frame while the vehicle is parked can be performed using a hand-held remote control unit.

WARNING

Stand away from the rear of the vehicle when raising or lowering the height of the frame. The ECAS system operates quickly, and contact could result in personal injury.

For the optional automatic function to work, the vehicle must be equipped with a rear axle air suspension and ABS. Automatic Traction Control is recommended for optimal vehicle traction control.

Automatic Engine Idler/Timer, Optional

A Henke automatic engine idler/timer (Fig. 2.15) allows the driver to select the idle time required for engine shutdown. The driver can turn off the ignition, remove the ignition key, lock the vehicle, and leave it

with the engine idling. The automatic timer will shut the engine off at the end of the selected time.

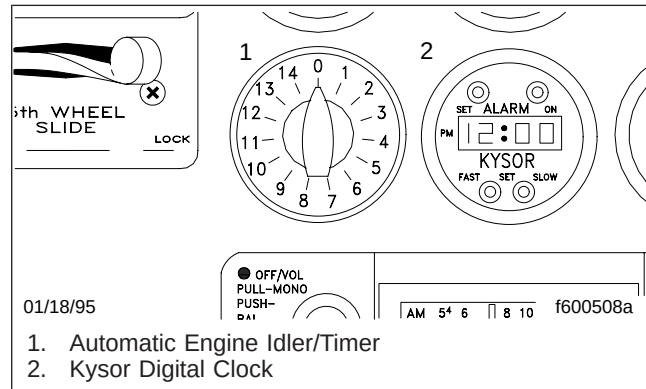


Fig. 2.15, Engine Idler/Timer and Clock

Cigarette Lighter

Push the lighter in (Fig. 2.16) to heat the element. The lighter will stay in and will automatically pop out when the element is hot.

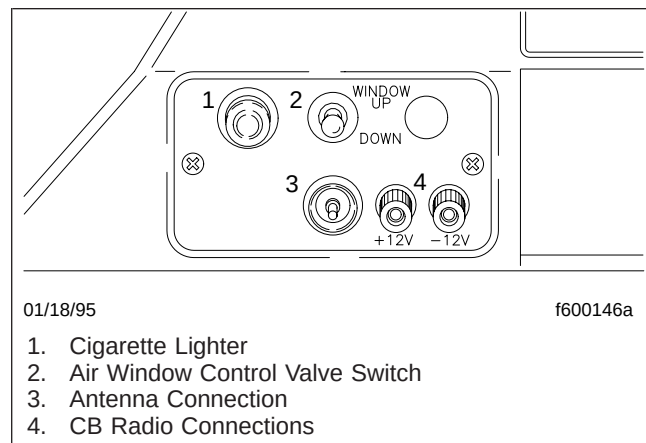


Fig. 2.16, Window Control Switch

Air Window Control Valve Switch, Optional Right-Hand Air Window

WARNING

Before raising the window, be sure that hands, fingers, and other body parts or objects are away from the window frame. Otherwise, serious physical injury could result.

Instruments and Controls Identification

A toggle switch (**Fig. 2.16**) controls the air window. Push the switch up to raise the window, or push it down to lower the window.

CB Radio Connections

An antenna connection and positive (+) and negative (–) power connections are provided for a CB radio. See **Fig. 2.16**.

Turn Signal Lever

The turn signal lever (**Fig. 2.17**) is mounted on the steering column. Pushing the lever counterclockwise turns on the left-turn signal lights; pushing it clockwise turns on the right-turn signal lights. When one of the turn signal lights is on, a green indicator light flashes at the far left or far right of the warning and indicator light panel. To cancel the signal, return the lever to the neutral position, except when equipped with an optional self-canceling switch.

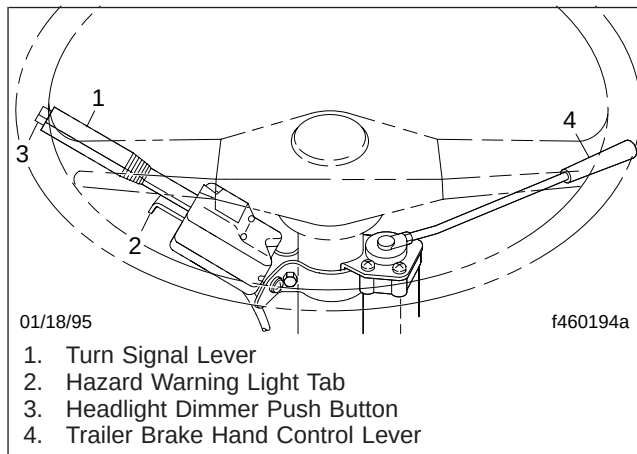


Fig. 2.17, Turn Signal Lever

Hazard Warning Light Tab

The hazard warning light tab (**Fig. 2.17**) is located below the lever on the turn signal switch. Activate the hazard warning lights by pulling the tab out. When the hazard warning light tab is pulled out, all of the turn signal lights and both of the indicator lights on the control panel will flash. To cancel the warning lights, move the turn signal lever up or down.

Headlight Dimmer

The headlight dimmer (**Fig. 2.17**) may be a push button at the end of the turn signal lever, or a lift-handle type built into the turn signal lever.

To operate the push button type dimmer, press the button once to change from low beam to high beam headlights; press it again to cancel the high beam lights.

To operate the lift-handle type dimmer, pull the turn signal lever up to change from low beam to high beam headlights, or from high beam back to low beam.

When the headlights are on high beam, a green light on the indicator light panel comes on. For vehicles built to operate in the United States, switching from low beams to high beams will switch off the fog lights.

NOTE: The ignition switch must be on for the high beams to work.

Trailer Brake Hand Control Valve Lever

This lever is used for applying the trailer brakes without applying the truck or tractor brakes and is mounted on the steering column. See **Fig. 2.17**. See **Chapter 6** under the heading "Brake System," for operating instructions.

Transmission Controls

If so equipped, the transmission range control valve and splitter valve are attached to the gearshift knob. Transmission shift pattern labels are located on the header or sun visor above the driver's windshield.

See **Chapter 8** for complete transmission operating instructions.

Suspension Seat Adjustment Controls

All adjustment controls for a suspension seat are located on the seat base. See **Chapter 5** for complete instructions.

IMPORTANT: Due to the maximum adjustability of mid- and high-back air suspension seats, it is possible to combine the seat back recline adjustment and the seat slide adjustment so that the seat back contacts the backwall. It is the

Instruments and Controls Identification

responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

Dome Light Switches

For vehicles with a single dome light mounted on the roof inside of the cab, the light is operated by a three-position switch mounted in the dome light. The switch provides both a low- and a high-intensity setting; in the middle position, the dome light is off.

For vehicles with a single dome light and two reading lights mounted on the roof inside of the cab, each light is operated by its own on/off switch, mounted in the dome light.

Tilt Steering Wheel

The tilt steering wheel (**Fig. 2.18**) has a tilt range of 15 degrees, and a telescoping range of 2-5/8 inches (67 mm). A control lever is located just below the turn signal switch on the steering column.

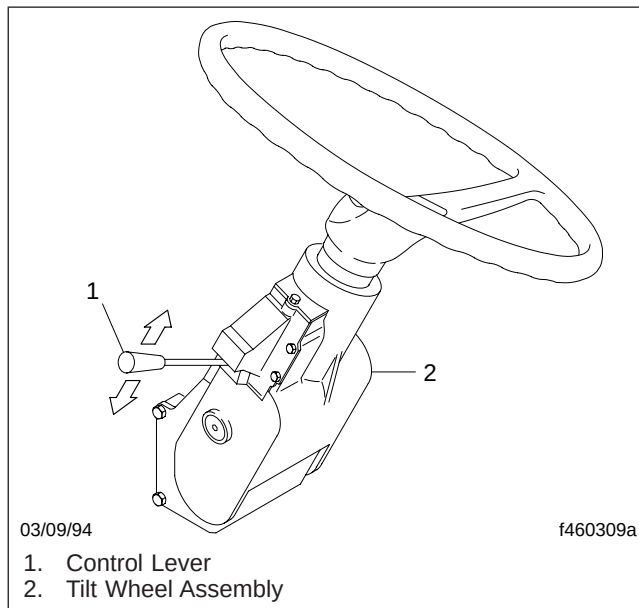


Fig. 2.18, Tilt Steering Wheel

After adjusting the seat to the desired ride position, unlock the steering column by pushing the control lever and holding it all the way down. Tilt the steering column to the desired position, then release the control lever to lock the steering column in place.

To adjust the height of the steering wheel, pull upward on the control lever. While holding the control

lever in this position, move the steering wheel upward or downward to the desired position. Release the control lever to lock the steering wheel in place.

WARNING

Make sure that the control lever is in the locked (neutral) position before driving the vehicle. Never try to adjust the height of the steering wheel or tilt the steering column while driving the vehicle. Doing so could cause loss of vehicle control, personal injury, and property damage.

Warning and Indicator Lights

All of the standard and optional warning and indicator lights are housed in a lens and bezel assembly, located above the speedometer and tachometer.

For pre-EPA07 vehicles, up to six rectangular indicator lights may be installed on the center dash panel between the tachometer and speedometer. See **Fig. 2.19**. The pre-EPA07 standard installation includes one parking brake indicator light and two antilock braking system (ABS) lights, the tractor warning light and the wheel spin indicator light. One other ABS light, the trailer warning light, is optional. The other two lights represent a variety of optional functions that may not be installed on all models.

For EPA07 vehicles, up to ten rectangular indicator lights may be installed on the center dash panel between the tachometer and speedometer. See **Fig. 2.20**. The EPA07 standard installation includes three indicator lights for the after treatment device; an engine malfunction indicator light (MIL), a diesel particulate filter (DPF) regen light, and a high exhaust system temperature (HEST) light. Details of the after-treatment lights can be found in **Chapter 7**, under the heading *EPA07 Aftertreatment System (ATS)*. The other standard lights are the parking brake indicator light, and two antilock braking system (ABS) lights. The other lights are for optional functions that may not be installed on all models.

Parking Brake Indicator Light

The red parking brake indicator light (**Fig. 2.19**) comes on whenever the parking brakes are activated and the ignition is on.

Additional optional lights may be installed in the center dash.

Instruments and Controls Identification

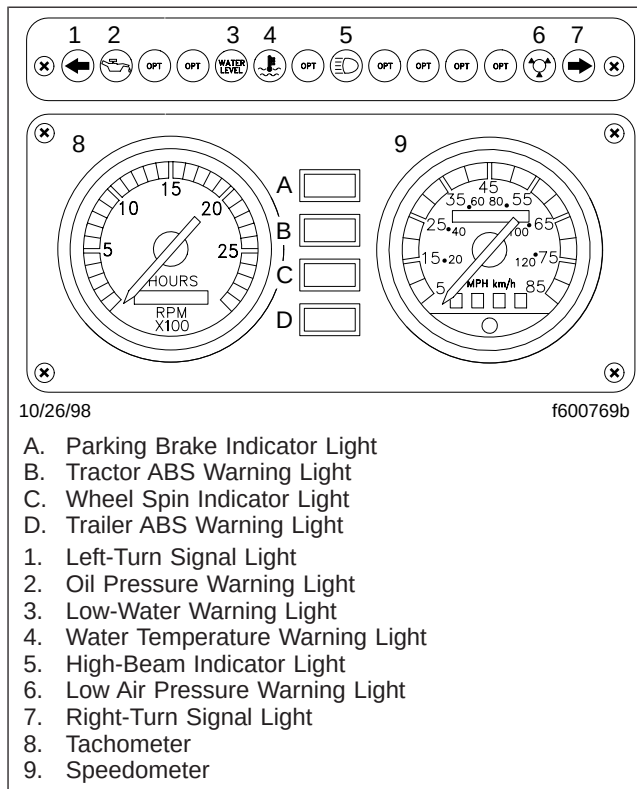


Fig. 2.19, Dash Assembly for VIGIL and Kysor Warning Systems Pre-EPA07

Meritor WABCO® Antilock Braking System (ABS)

The Meritor WABCO® Antilock Braking System (ABS) may have up to three of the following amber lights (the first two are standard: a tractor warning light (TRAC ABS), a wheel spin indicator light (WHL SPIN), and an optional trailer warning light (TRLR ABS). Vehicles built before July, 1994, also have a DEEP SNOW/MUD indicator light.

With the tractor ABS system, the tractor warning light (TRAC ABS) comes on after the engine is started (**Fig. 2.19**). Once the vehicle moves faster than about 4 mph (6 km/h), the warning light goes out only if all of the tractor's ABS components are working.

With the tractor and trailer ABS system, the vehicle also has a trailer warning light labelled TRLR ABS (**Fig. 2.19**).

After the engine is started, the TRLR ABS light comes on if the trailer is equipped with a compatible

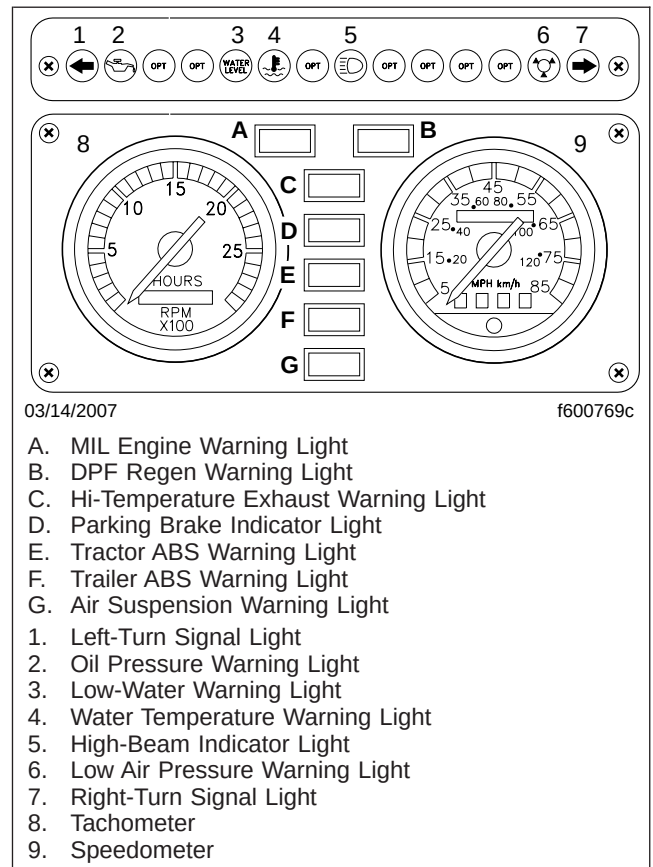


Fig. 2.20, Dash Assembly for VIGIL and Kysor Warning Systems EPA07

ABS system. Once the vehicle moves faster than about 4 mph (6 km/h), the TRLR ABS warning light goes out only if all of the trailer's ABS components are working. For more detailed information about TRLR ABS light operation, see [Chapter 6](#).

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, repair the ABS system immediately to ensure full antilock braking capability.

The wheel spin indicator light (WHL SPIN) comes on flashing if one of the drive wheels spins during acceleration (**Fig. 2.19**). The flashing light goes out when the wheel stops spinning. A label (**Fig. 2.21**) on the dash explains what actions should be taken when the WHL SPIN indicator light starts to flash.

If equipped with an electronic engine, an automatic traction control (ATC) system may be installed. On

Instruments and Controls Identification

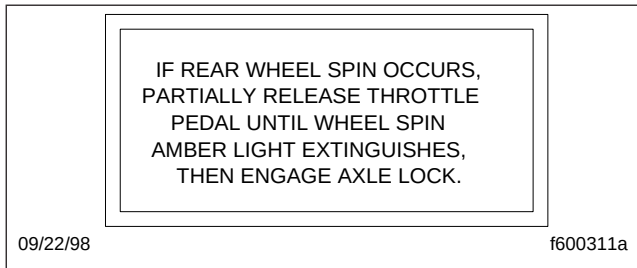


Fig. 2.21, Dash Label

these vehicles, the ATC system automatically controls wheel spin during reduced-traction starts.

An "ATC Function" switch (if equipped), allows the driver to select from two levels of drive axle traction-control assistance:

- **NORMAL**—which reduces drive axle wheel spin on icy, wet, or sand covered roads.
- **DEEP SNOW/MUD**—which allows a higher threshold of drive axle wheel spin to help burn through a thin layer of ice, or to help throw off accumulated mud or snow.

The Deep Snow/Mud mode is indicated by a flashing WHL SPIN light. To engage this mode, the ATC function switch must be in the Normal position when the vehicle is initially powered up. Once the vehicle is started, the ATC function switch can be set to the Deep Snow/Mud position. The ECU indicates this change by a constant flashing of the WHL SPIN lamp (or by illumination of the Deep Snow/Mud light on vehicles built before July, 1994).

If the ATC function switch is in the Deep Snow/Mud position when the vehicle is powered up, the ECU will not accept this function change and will remain in the Normal mode. Indication of this condition will be the absence of the flashing WHL SPIN light (on vehicles built before July, 1994, the absence of an illuminated Deep Snow/Mud light). To engage the Deep Snow/Mud mode in this situation, change the position of the ATC function switch to the Normal mode. After two seconds, move the switch to the Deep Snow/Mud position. When this occurs, the indicator light will activate as previously described.

The "ABS Chk" switch (if equipped), activates blink code diagnostics, which are used to read ABS and ATC system fault codes on the WHL SPIN light. This switch is located in the lower dash panel cover, just below the ignition switch, on the left side of the steering wheel. When turned on (in the "up" position),

blink code diagnostics are activated. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for troubleshooting procedures.

IMPORTANT: ABS and ATC blink code diagnostics should only be performed when the vehicle is stopped. If the vehicle is equipped with ATC, turning "on" the ABS CHK switch will reduce engine speed to idle for three seconds and affect ATC function performance. If the vehicle is driven with the ABS CHK switch "on" (in the "up" position), the WHL SPIN light will illuminate continuously. Under this condition, turning the ABS CHK switch "off" (in the "down" position), while the vehicle is still in motion, will only turn off the WHL SPIN light, but will not restore ATC function performance. To fully restore engine and ATC function capability, the vehicle must be brought to a complete stop. Then, move the ABS CHK switch to "off" (in the "down" position).

See the brake system operating instructions in **Chapter 6** for more information.

Bendix Antilock Braking System (ABS)

With the Bendix Antilock Braking System (ABS), the tractor warning light (TRAC ABS) comes on after the key is turned on (**Fig. 2.19**). The warning light goes out only if all of the tractor's ABS components are working properly.

If the tractor is attached to a trailer with a compatible ABS system, the trailer ABS warning lamp (TRLR ABS) will also come on momentarily after the key is turned on.

Vehicles equipped with a Bendix ABS system may also be equipped with an automatic traction control (ATC) system. The ATC system automatically controls wheel spin during reduced-traction starts.

The wheel spin indicator light (WHL SPIN) comes on if one of the drive wheels spins during acceleration (**Fig. 2.19**). The light goes out when the wheel stops spinning. The Bendix system will either reduce engine torque or apply gentle brake pressure to force the differential to drive the stationary or slowly spinning wheel. If slippery road conditions continue, engage the axle lock.

Instruments and Controls Identification

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, repair the ABS system immediately to ensure full antilock braking capability. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for troubleshooting procedures.

See the brake system operating instructions in **Chapter 6** for more information.

VIGIL I Warning System

Standard Indicator Lights

Standard indicator lights (**Fig. 2.19**) include:

1. The green right- and left-turn signal lights flash on and off whenever the outside turn signal lights are flashing.
2. The green high-beam indicator light comes on when the headlights are on high beam.

Standard Warning Lights

Standard red warning lights (**Fig. 2.19**) are for oil pressure, water temperature, and low air pressure. Whenever conditions cause one or more of these lights to come on, a warning buzzer also alerts the driver:

1. The water temperature warning light and buzzer activate whenever the engine coolant temperature exceeds a preset point determined by the engine manufacturer. See the engine manual for this temperature.
2. The oil pressure warning light and buzzer activate whenever the oil pressure falls below the minimum oil pressure recommended by the engine manufacturer.
3. The low air pressure warning light and buzzer activate whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (441 to 524 kPa).

When the ignition is turned on, oil- and air-pressure warnings activate until the engine starts and minimum pressures are exceeded. If the low-oil warning light remains lit after running the engine for 15 seconds, shut off the engine and determine the cause. See the *Heavy-Duty Trucks Service Manual* for repair procedures.

WARNING

If the warning system does not activate when the ignition is turned on, repair the system to provide warning protection for oil pressure, coolant temperature, and brake system air pressure.

Optional Warning and Indicator Lights

The most common optional warning and indicator lights (**Fig. 2.19**) consist of any combination of the following:

- Interaxle differential indicator light, which is standard on all dual-drive vehicles. An indicator light illuminates whenever the interaxle differential is locked out (switch is in the lock position).
- Automatic sludge ejector (moisture ejection valve) indicator light. An indicator light comes on whenever the ejector is operating.
- Utility light(s) indicator light. If utility lights are installed in the back of the vehicle, an indicator light comes on when they are in use.
- Mirror heat indicator light. An indicator light comes on whenever the mirror heat switch is on.
- Low-water warning light, which is standard when a low-water probe warning system or a four-way engine shutdown system is installed. A warning light comes on whenever the coolant level in the radiator drops below the low-water probe.
- Fifth wheel slider indicator light. An indicator light comes on whenever the air-operated lockpins on a fifth wheel are retracted from the baseplate (the fifth wheel slider is unlocked).

Optional warning and indicator lights and their locations may vary, because of different optional equipment installed. Other optional accessories and standard equipment that are or can be equipped with warning or indicator lights include: engine heater, parking brakes, tire sanders, spotlights, oil level, oil temperature, cruise-control system, engine fan, and other options.

Instruments and Controls Identification

VIGIL II Warning System, Optional

The VIGIL II system is an electronically controlled warning and engine shutdown system. It controls the turn signal functions and various optional functions. A solid state lightbar (Fig. 2.22) in the instrument panel contains displays for the functions.

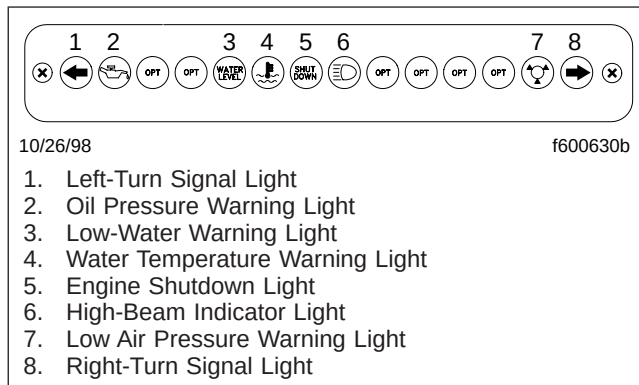


Fig. 2.22, VIGIL II and Kysor VIP Warning System, Optional

Engine Functions

The system monitors engine coolant temperature, coolant level, and oil pressure.

- If the engine overheats, a warning light comes on and a buzzer sounds. The temperature that triggers the warning light and buzzer varies with engine type and is programmed into the system at the factory. If the temperature continues to rise to critical levels, the engine shutdown light comes on, and the engine will be shut down.
- If the coolant level drops below a sensor in the cooling system, the low water level light comes on. After 5 seconds, a buzzer sounds, and after 30 seconds, the system will shut down the engine.
- If the oil pressure drops below a preset level, the low oil pressure light comes on and a warning buzzer sounds. If the oil pressure drops to a preset critical level, the engine shutdown light comes on, and the engine will be shut down.
- All shutdown features have an automatic override. If the vehicle needs to be moved to a safe location after a shutdown, just crank the en-

gine. It will run for about 30 seconds before shutting down again.

Turn Signal Functions

The system operates the turn signal relay and the indicators.

Other Functions

The system also controls several functions such as the headlight high beam indicator, low air pressure warning light, and control of indicators for six optional features. The optional features can be any combination of the following:

- transmission temperature
- axle temperature
- engine heater
- alternator no charge
- fifth wheel lock
- parking brake
- sand
- antilock
- mirror heater
- utility lights
- axle lock
- sludge ejector

or any six that are specially ordered.

Additional Features

When the ignition is turned on, all of the LEDs in the lightbar will light and the low air and low oil pressure alarms will sound. The lights and alarms will activate for two one-second periods, separated by a half second pause. This is a self-test to indicate whether or not the lightbar is working. After the test, the LEDs not in use will turn off. The low air and oil pressure warnings will not sound again until the starter is cranked. Once the starter is cranked, the alarms will sound until system air and oil reach minimum operating pressures. If the lightbar does not operate as described here, test it. For instructions, see **Group 54** of the *Heavy-Duty Trucks Service Manual*.

Instruments and Controls Identification

VIGIL III Warning System, Optional

The VIGIL III system is an electronically controlled warning system with maximum vehicle speed control, vehicle overspeed reporting, and optional engine shutdown. It controls the turn signal functions and various optional functions. A solid-state lightbar (Fig. 2.23) in the instrument panel contains displays for the functions.

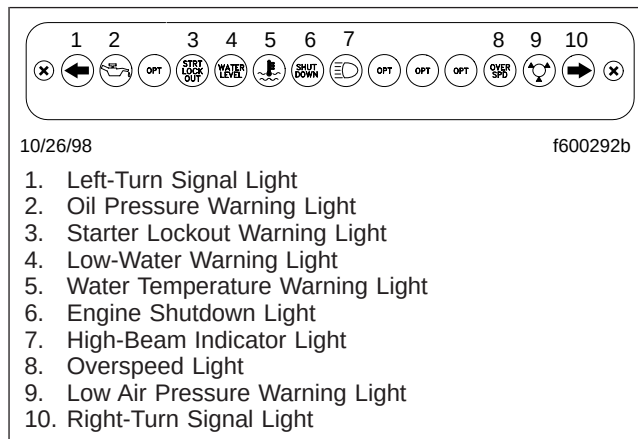


Fig. 2.23, VIGIL III Warning System, Optional

Engine Functions

The system monitors engine coolant temperature, coolant level, and oil pressure.

- If the engine overheats, a warning light (Fig. 2.23) comes on and a buzzer sounds. The temperature that triggers the warning light and buzzer varies with engine type and is programmed into the system at the factory. If the temperature continues to rise to critical levels, the engine shutdown light comes on, and the engine will shut down (if equipped with the shutdown feature).
- If the coolant level drops below a sensor in the cooling system, the low water level light comes on. After 5 seconds, a buzzer sounds, and after 30 seconds the system shuts down the engine (if equipped with the shutdown feature).
- If the oil pressure drops below a preset level, the low oil pressure light comes on and a warning buzzer sounds. If the oil pressure drops to a preset critical level, the engine shutdown light comes on, and the engine will shut down (if equipped with the shutdown feature).

- All shutdown features have an automatic override. If the vehicle needs to be moved to a safe location after shutdown, just crank the engine. It will run for about 30 seconds before shutting down again.

Turn Signal Functions

The system operates the turn signal relay and the turn indicators (Fig. 2.23).

The system features a special heavy-duty relay for flashers, capable of driving up to fourteen 32-candlepower bulbs.

Other Functions

The system protects the starter by locking out the starter button whenever any of the following conditions exist:

- Voltage at the key switch is greater than 18 volts or less than 9 volts before the starter button is pressed.
- The starter button has been pressed within the last two seconds.
- Engine speed exceeds 350 rpm.
- The starter has been cranked for a total of 30 seconds within the last minute (the starter button is locked out for two minutes to allow the starter to cool).

NOTE: If the lockout feature activates to let the starter cool, the starter lockout warning light (Fig. 2.23) will be on for the two-minute cooling period. If the lockout feature activates for any other reason, the light will glow only if the starter button is pressed within two seconds of the lockout occurring, and it will be on only as long as the button is pressed.

- The system features a speed governor for maximum vehicle speed control. The governor can be set anywhere between 45 and 85 mph (70 and 140 km/h), and controls vehicle speed by cutting fuel delivery pressure when the pre-determined speed is reached. If this system is malfunctioning, the lightbar overspeed light (Fig. 2.23) will flash on for ten seconds each time that the engine is started.

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- While driving, the overspeed light will flash on if the driver exceeds a second predetermined speed set by the customer.

The system also controls several functions such as headlight high beam indicator ([Fig. 2.23](#)), low air pressure warning light and alarm, and control for four optional features. The optional features can be any combination of the following or any four that are specially ordered:

- transmission temperature
- axle temperature
- engine heater
- alternator no charge
- fifth wheel lock
- parking brake
- sand
- antilock
- mirror heater
- utility lights
- axle lock
- sludge ejector

Additional Features

When the ignition is turned on, all the LEDs in the lightbar will light and the low air and low oil pressure alarms will sound. The lights and alarms will activate for two one-second periods, separated by a half-second pause. This is a self-test to indicate whether or not the lightbar is working. After the test, the LEDs not in use will turn off. The low air and oil pressure warnings will not sound again until the starter is cranked. Once the starter is cranked, the alarms will sound until system air and oil pressures reach minimum levels. If the lightbar doesn't operate as described here, test it. For instructions, see **Group 54** of the *Heavy-Duty Trucks Service Manual*.

Kysor Vehicle Instrumentation and Protection (VIP) System, Optional

The Kysor VIP system is an electronically controlled warning and engine shutdown system. It also controls the turn signal functions and various optional functions. A solid state lightbar ([Fig. 2.22](#)) in the instrument panel contains displays for the functions.

Engine Functions

The system monitors engine coolant temperature, coolant level, and oil pressure.

- If the engine overheats, a warning light comes on and a buzzer sounds. The temperature that triggers the warning light and buzzer varies with engine type and is programmed into the system at the factory. If the temperature continues to rise to critical levels, the engine shutdown light comes on, and the engine will be shut down.
- If the coolant level drops below a sensor in the cooling system, the low water level light comes on, and a buzzer sounds. After 30 seconds, the system will shut down the engine. The low coolant shutdown feature may be turned on or off by setting a DIP switch in the control module.
- If the oil pressure drops below a preset level, the low oil pressure light comes on and a warning buzzer sounds. If the oil pressure drops to a preset critical level, the engine shutdown light comes on, and the engine will be shut down.
- All shutdown features have an automatic override. If the vehicle needs to be moved to a safe location after a shutdown, just crank the engine. It will run for about 30 seconds before shutting down again.

Turn Signal Functions

The system operates the turn signal relay and the indicators.

Other Functions

The system also controls several functions such as the headlight high beam indicator, low air pressure warning light and intermittent buzzer, dimming of the turn signal indicators when the headlights are turned on, and control of indicators for six optional features ([Fig. 2.22](#)). The optional features can be any combination of the following:

- transmission temperature
- axle temperature
- engine heater
- alternator no charge

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- fifth wheel lock
- parking brake
- sand
- antilock
- mirror heater
- utility lights
- axle lock
- sludge ejector

or any six that are specially ordered.

Three of the six optional indicators can trigger the warning buzzer. The buzzer feature can be activated at the factory or in the field by setting DIP switches on the control module. The low air pressure buzzer is an intermittent signal; all other warning buzzers give a constant signal. When the air pressure is low, the buzzer will sound intermittently, regardless of what optional features are selected, how the DIP switches are set, or what other warnings might be on.

Additional Features

When the ignition switch is turned on and the starter is engaged, all of the LEDs in the lightbar will light up as a check that they are working. When the starter is released, those LEDs not in use will turn off.

If the ignition switch is turned on and the engine is not cranked, there will be no warning buzzer for any of the warning features. The warning buzzer is triggered by the start circuit if the engine is cranked, releasing the start switch turns on the buzzer. After releasing the starter, the oil pressure buzzer sounds during the time engine oil pressure is rising.

Collision Warning System (CWS), Eaton VORAD EVT-300, Optional

The Eaton VORAD EVT-300 is a computerized collision warning system (CWS) that uses front-mounted and side-mounted (optional) radar to continuously monitor vehicles ahead of and alongside your vehicle.

The system warns of potentially dangerous situations by means of visual and audible alerts. The system performs in fog, rain, snow, dust, smoke, and darkness. To be detected, objects must be within the

radar beam's field of view and provide a surface area that can reflect back the radar beam.

The front-looking antenna assembly transmits radar signals to, and receives them back from, vehicles and objects ahead. This allows the determination of the distance to, relative speed of, and angle to the target of vehicles and objects ahead. The system uses this information to warn the driver of potentially dangerous situations.

Optional side sensor(s) mounted on the side of the vehicle also transmit and receive radar signals for a distance of 2 to 10 feet (0.5 to 3 meters) alongside your vehicle. The side sensor(s) provide a 15 degree vertical by 15 degree horizontal beam pattern. The side sensor(s) can detect unseen vehicles and objects moving and stationary adjacent to your vehicle.



The Eaton VORAD EVT-300 Collision Warning System (CWS) is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied on to operate a vehicle. Use the system in conjunction with rear-view mirrors and other instrumentation to safely operate the vehicle. Operate this vehicle, equipped with the EVT-300 Collision Warning System, in the same safe manner as if the EVT-300 Collision Warning System were not present.

The EVT-300 Collision Warning System is not a substitute for safe, normal driving procedures, nor will it compensate for any driver impairment, such as drugs, alcohol, or fatigue.

The EVT-300 Collision Warning System may provide little or no warning of hazards such as pedestrians, animals, oncoming vehicles, or cross traffic.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

Driver Display Unit (DDU)

NOTE: All system controls are located on the DDU. See [Fig. 2.24](#). Indicators to inform the driver about the system's operation are located on both the DDU and the optional side sensor display.

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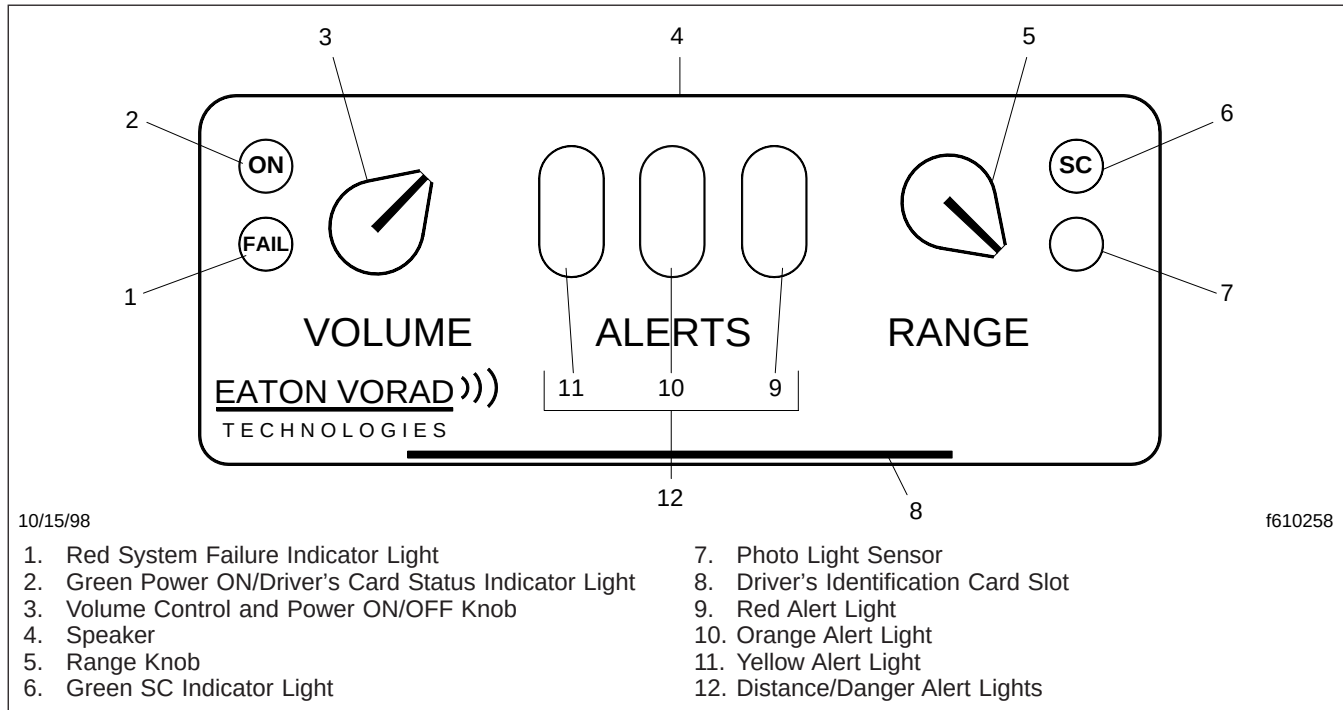


Fig. 2.24, Driver Display Unit, EVT-300

The DDU controls system power, range for vehicle warnings, speaker volume, and all other system functions. At the lower front edge of the DDU, a slot is provided to insert the optional driver's identification card. Alert and indicator lights advise of multiple warning levels, system power, system failure, and, if so configured, failure of the driver to insert the identification card.

A light sensor automatically adjusts alert and indicator light brightness depending on cab lighting conditions. A small speaker provides audible alert tones to warn of closing on an object ahead and, when equipped with an optional side sensor, of objects alongside when the turn signal is activated in preparation for a lane change. Additional tones indicate speaker volume, system failure, driver's card status, and data extraction pass or fail.

1. The green power-on/driver's card (optional) status indicator light illuminates when the system is activated and the power-on LED test is complete. If the system is configured to require that the driver's card be read, and it is not, the ON light blinks continuously.

2. Push in the volume control and power ON/OFF knob to turn power on or off. Turn the knob left or right to increase or decrease speaker volume. Press and hold the knob for 5 seconds and then release it to activate the failure display mode.

NOTE: The system may be configured to have no on/off capability and the volume may be configured to allow only some volume control.

3. The speaker is located under the top cover of the DDU. It sounds audible tones to alert the driver to potential hazards. Volume may be restricted to a range above a minimum level.

NOTE: This is a configurable electronic parameter.

4. Rotate the range knob (if enabled) to change the first alert detection range from 3 to 2 seconds. This will also change the second alert detection range from 2 to 1.75 seconds. Push and hold the knob for 5 seconds to activate the accident reconstruction function and freeze the most recent data in half of the allocated memory.

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NOTE: The system may be configured to prevent adjustment of the range levels.

5. The red system failure indicator light illuminates if a system problem is detected. Press and hold the volume control knob for 5 seconds to display fault codes. The fault codes will be blinked out as a pattern of flashes on this indicator light. See [Table 2.1](#) for fault codes.

Fault Codes (blink codes)	
Fault Code	Suspect Failure
11	Central Processing Unit (CPU)
12	CyberCard
13	Driver Display Unit (DDU)
14	Antenna Assembly
15	Right Side Sensor
16	Left Side Sensor
21	Right-Turn Signal
22	Left-Turn Signal
23	Brake
24	Speed
25	SmartCruise
31	J1587
32	J1939
33	VBUS
34	DDU Communications
35	Antenna Assembly Communications
41	No Fault or End of Fault Codes

Table 2.1, Fault Codes or Blink Codes

6. The green SC indicator light will flash 8 times if the range knob is pressed to store accident reconstruction information. It will also flash 8 times after the system is activated, after the power-on LED test is finished, and if accident reconstruction data was previously stored.
7. The photo light sensor senses lighting conditions in the cab and automatically adjusts the intensity of the indicator and alert lights.
8. If the system's configuration requires, insert the driver's identification card in the slot at the lower front edge of the DDU. A high-pitched tone will sound when the driver's identification card has been successfully read. One low tone will sound if the driver's card has been unsuccessfully read. If so configured, a repeated low tone will sound if the system is on and the requested driver's card has not been inserted.

9. The yellow alert light illuminates when an object is detected within the system's maximum range of 350 feet (107 meters) on a straight road. Range is reduced in curves by the turn radius of the curve. This light also illuminates when the proximity alarm threshold is crossed.
10. The yellow and orange alert lights illuminate when your vehicle is within a 3-second following interval behind another vehicle in the same lane. If you are within a 2-second following interval, and closing on the vehicle ahead, a warning tone will also sound.
11. The yellow, orange, and red alert lights illuminate when you are 1 second (and less than 1 second) behind a vehicle. If the vehicle ahead is opening the interval, no tone will sound. If you are closing the interval, double tones will sound. Within a 1/2-second or less following interval, opening or closing, the tones will repeat twice per second.
12. If a stationary vehicle or object, or an object moving less than 3.4 mph (5.5 km/h) in the same lane is detected within 220 feet (67 meters) and within 3 seconds, all three alert lights will illuminate and the double tones will sound. This warning overrides all others and is not affected by the range control knob setting.

IMPORTANT: The system is disabled in turns with a radius of less than 750 feet (230 meters) and when the brakes are applied.

13. If your vehicle is traveling less than 2 mph (3 km/h) and an object is detected less than 15 feet (4.5 meters) in front of your vehicle, and the closing rate is more than 1/2 mph (1 km/h), the yellow alert light will illuminate and a low-frequency double tone will sound. This is the proximity alert.

NOTE: All warnings apply only to objects within the maximum detection range and in your lane. Proximity alert tones and vehicle-closing 1/2-second and 2-second following interval tones are configured items. All tones are disabled in sharp turns or when the brakes are applied. If the configuration permits, the 3-second and 2-second alert levels may be adjusted with the range control knob. A single low-frequency tone sounds when a system failure is detected. A

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medium-frequency tone sounds when the volume control level is changed. Successful downloading of Eaton Vehicle Information Management System (EVIMS) data will cause a double tone to sound. Unsuccessful downloading will cause a low-frequency tone to sound.

14. A failure of the optional side sensor(s) will cause a continuous red light on the side sensor display to appear.

Side Sensor Display, Optional

1. The yellow indicator light illuminates continuously when no vehicle is detected by the side sensor(s). See [Fig. 2.25](#).

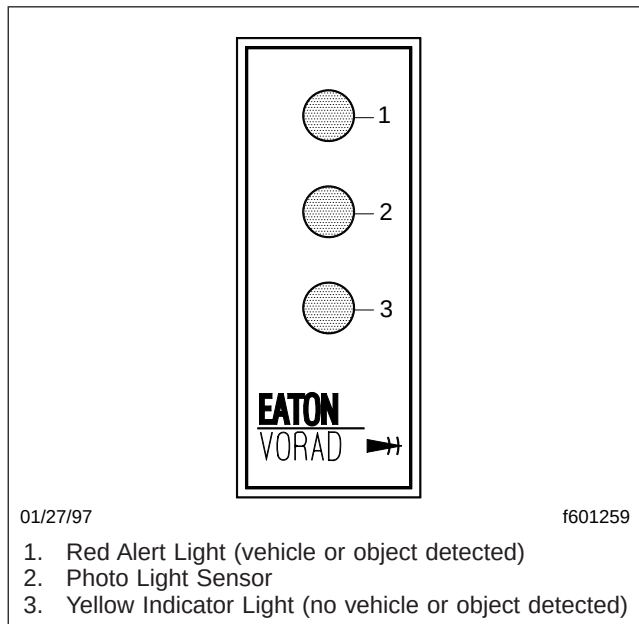


Fig. 2.25, Side Sensor Display, Optional

2. The photo light sensor senses lighting conditions in the cab and automatically adjusts the intensity of indicator and alert lights.
3. The red alert light illuminates when objects are detected by the side sensor(s). If the right turn signal is activated and the side sensor detects an object, the red alert light will illuminate and the DDU speaker will sound a high-frequency double tone. This tone is sounded only once per activation of the turn signal. The red light will also illuminate and stay on if a failure of the side sensor is detected.

Special Road Situations

WARNING

The Eaton VORAD EVT-300 Collision Warning System (CWS) is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied on to operate a vehicle. Use the system in conjunction with rear-view mirrors and other instrumentation to safely operate the vehicle. This system will not warn of many possible hazards. Do not assume it is "all clear" if no alert lights are illuminated.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

Certain special road situations may affect the system's ability to detect objects. These situations include the effects of curves, dips, and hills which can provide an unexpected result:

NOTE: A warning may sound when an object is detected in front of the vehicle even though the driver intends to turn away or stop before reaching the object.

- When an object is detected in a very sharp right- or left-hand turn, the audible alarm will not sound.
- When approaching a curve, before turning into it, alarms may sound and lights illuminate because of an object off of the road, directly in line with your vehicle. This will not occur when the brakes are applied.
- Elevated obstacles, such as overpasses and overhead signs, may be detected when approaching a roadway descending to a lower elevation.
- Vehicles cannot be detected on the other side of a hill. An alarm will not sound until the object is within the antenna assembly's field of view.
- On approaching a steep hill, objects above the beam cannot be detected. Generally, the beam hitting the road surface does not cause an alarm.

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- The side sensor only detects objects within its field of view, next to the tractor. A vehicle farther back, behind the field of view, will not be detected.
- The side sensor range is set to detect average sized vehicles, 2 to 10 feet (0.5 to 3 meters) away, in the adjacent lane. The side sensor provides a 15 degree vertical by 15 degree horizontal beam pattern.
- The radar beam of the CWS will detect near range cut-ins of approximately 30 feet (9 meters) or less, depending on the angle of entrance into the lane in front of your vehicle.

WARNING

Heavy rain or water spray at the side sensor may temporarily prevent the system from providing adequate warnings.

Failure to drive safely and use the system properly could result in personal injury and/or death and severe property damage.

NOTE: A continuous fixed object on the right side of the vehicle such as a guard rail, wall, tunnel, or bridge may cause the side sensor alert light to stay on.

In Case of Accident

The optional vehicle accident reconstruction capability provides two segments of system data, one of which can be stored in system memory. Push and hold the DDU range knob for at least 5 seconds to store the first segment. Within 6 seconds, the green SC indicator light will blink rapidly 8 times, confirming that the data has been saved. If the range knob is pushed again, a fail tone will sound. After the first segment is saved, the second segment runs continuously, but only contains the last 10 minutes (approximately) of system data. The system will cease recording data 30 seconds after the vehicle comes to a stop.

NOTE: Once the first memory segment is frozen, the other can't be frozen. Only by disconnecting the main CPU connector can the second memory segment be preserved. If you desire immediate downloading and interpretation of accident reconstruction data, you must return the CPU to Eaton VORAD. However, after 30

days the frozen information will automatically clear if the vehicle is driven.

Maintenance and Diagnostics

1. Keep the antenna assembly and side sensor(s) free of a buildup of mud, dirt, ice, or other debris that might reduce the system's range.
2. The system tests itself continuously and evaluates the results every 15 seconds. If a problem is detected with the front radar system, the red FAIL light on the DDU illuminates continuously as long as the failure is active. The corresponding fault code is stored in the CPU's memory.
3. Both active and inactive fault codes can be indicated by the DDU when the system is placed in failure display mode. Inactive faults are those that have occurred and have cleared. Active faults are still present. Fault codes provide the driver the ability to record the system faults during a trip and to notify his maintenance department or Eaton VORAD. See "Failure Display Mode/Fault Codes" below. In this mode, specific fault codes are indicated by the pattern of blinks of the driver display unit red FAIL light.
4. Each fault code is a two-digit number, as shown in [Table 2.1](#). The red FAIL light blinks the same number of times as the first digit, a pause of approximately 3/4 of a second follows, then the light blinks the same number of times as the second digit.
5. Additional fault codes are blinked out at intervals of approximately 3 seconds. After all of the fault codes have been blinked out, a code 41 will be blinked out.

Failure Display Mode/Fault Codes

NOTE: If the vehicle does not have ON/OFF control on the DDU, press and hold the volume knob after the ignition key is turned on and the 15-second self-test is complete.

1. Press and hold the DDU volume control and power ON/OFF knob for at least 9 seconds. The system will turn off if you release the knob before 9 seconds. After 9 seconds, the DDU FAIL light begins to blink out the fault codes. After a 3-second interval additional fault codes, if present, will be blinked out. A code 41 will be

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blinked out either if no faults are found or when all fault codes have been blinked out.

2. Position the DDU range knob to the left to blink active fault codes and to the right to blink inactive codes.
3. To review, test, and clear all fault codes from system memory, use a hand-held diagnostic tool or ServiceRanger.

Instruments

Tachometer

A tachometer ([Fig. 2.19](#)) indicates engine speed in revolutions per minute (rpm), and serves as a guide for shifting the transmission and keeping the engine in the appropriate rpm range. For low idle and rated rpm, see the engine identification plate.

An optional tachometer is equipped with an engine hour meter to record continuous operating hours of the engine. In cases where actual mileage doesn't indicate overall usage, maintenance and lubrication intervals for the engine and engine-operated equipment can be determined by operating hours.

Speedometer

A speedometer ([Fig. 2.19](#)) registers speed in both miles per hour (mph) and kilometers per hour (km/h). Standard speedometer gauges are equipped with a seven-digit odometer that records total distance traveled.

An optional speedometer is equipped with a seven-digit odometer, and a four-digit odometer that records trip distance. The trip odometer can be reset to zero by pressing a button near the lower edge of the gauge face.

Water Temperature Gauge

During normal engine operation, the water temperature gauge ([Fig. 2.26](#)) should read 175 to 195°F (79 to 91°C). If the temperature remains below 160°F (71°C) or exceeds the maximum temperature shown in [Table 2.2](#), inspect the cooling system to determine the cause. See the *Heavy-Duty Trucks Service Manual* for troubleshooting and repair procedures.

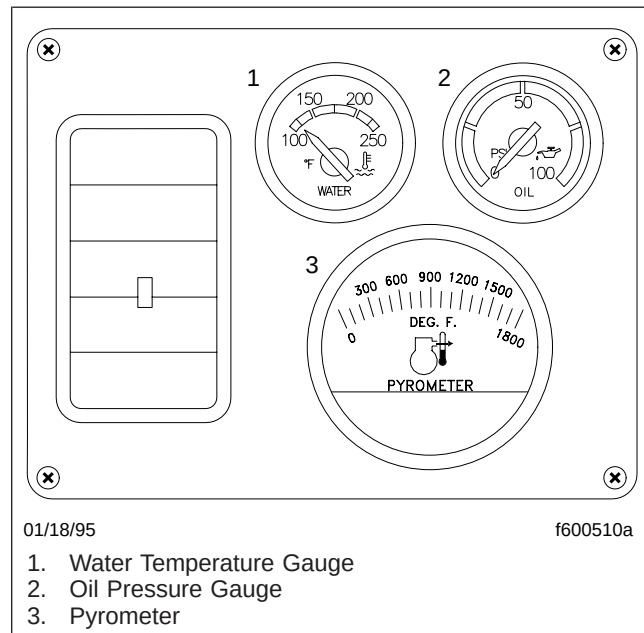


Fig. 2.26, Water Temperature and Oil Pressure Gauges and Pyrometer

Maximum Water Temperature	
Engine Model	°F (°C)
Caterpillar C-10, C-12	216 (102)
Caterpillar C-15	225 (107)
Cummins L10	212 (100)
Cummins NTC	212 (100)
Cummins NTC-444	220 (104)
Cummins C Series	212 (100)
Detroit Diesel	210 (99)

Table 2.2, Maximum Water Temperature

Engine Oil Pressure Gauge

The oil pressure gauge ([Fig. 2.26](#)) should read as shown in [Table 2.3](#).

Oil Pressure*		
Engine Model	Idle Speed: psi (kPa)	Rated Speed: psi (kPa)
Caterpillar C-10, C-12	10 (69)	43 to 53 (296 to 365)
Caterpillar C-15	23 (158) min.	61 to 71 (420 to 490) min.

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Oil Pressure*		
Engine Model	Idle Speed: psi (kPa)	Rated Speed: psi (kPa)
Cummins L10	10 (69) min.	35 to 45 (241 to 310)
Cummins NTC†	10 (69) min.	35 to 45 (241 to 310)
Cummins C Series	10 (69) min.	30 (207)
Detroit Diesel	12 (83)	50 (345) min.

* Oil pressures are given with the engine at operating temperature. With the engine cold, oil pressure may be higher.

† Individual engines may vary from the listed pressures; observe and record pressures when the engine is new to serve as a guide for checking engine condition.

Table 2.3, Oil Pressure



CAUTION

A sudden decrease or absence of engine oil pressure may indicate mechanical failure. Bring the vehicle to a safe stop, and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

Pyrometer, Optional

A pyrometer (Fig. 2.26) registers the exhaust temperature near the turbocharger. Normal exhaust temperatures are listed in Table 2.4.

Normal Exhaust Temperature	
Engine Model	°F (°C)
Caterpillar C-10, C-12	935 to 1290 (500 to 700)
Caterpillar C-15	950 to 1050 (510 to 566)
Cummins L10	800 to 1000 (430 to 540)
Cummins NTC	750 to 950 (400 to 510)
Cummins C Series	1290 (700) max.
Detroit Diesel	700 to 950 (370 to 510)

Table 2.4, Normal Exhaust Temperature

Variations in engine load can cause exhaust temperatures to vary. If the pyrometer reading shows that exhaust temperature exceeds normal, throttle less fuel to the engine until the exhaust temperature is reduced. Shift to a lower gear if the engine is overloaded.

NOTE: A pyrometer is set to ambient temperature. When the engine is cold, the pyrometer indicates the approximate outside temperature. Do not attempt to adjust the pyrometer to zero degrees.

Voltmeter

The voltmeter (Fig. 2.27) indicates the vehicle charging system voltage when the engine is running and the battery voltage when the engine is stopped. By monitoring the voltmeter, the driver can be aware of potential charging system problems and have them fixed before the batteries discharge enough to create starting difficulties.

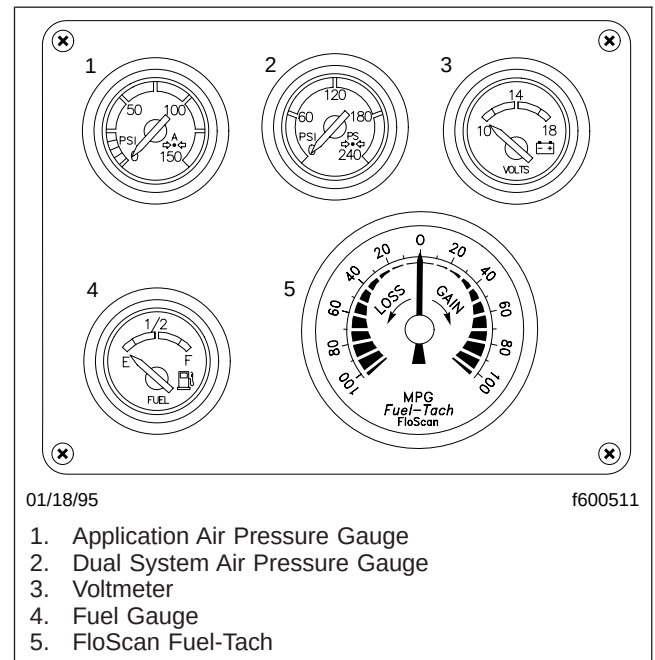


Fig. 2.27, Air Pressure, Fuel Gauges, and Voltmeter

The voltmeter will normally show approximately 13.7 to 14.1 volts when the engine is running. The voltage of a fully charged battery is 12.7 to 12.8 volts when the engine is stopped. A completely discharged battery will produce only about 12.0 volts. The voltmeter will indicate lower voltage as the vehicle is being started or when electrical devices in the vehicle are being used.

If the voltmeter shows an undercharged or overcharged condition for an extended period, have the

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charging system and batteries checked at a repair facility.

On a vehicle equipped with a battery isolator system, the voltmeter measures the average voltage of all of the batteries when the engine is running. When the engine is stopped, the voltmeter shows only the gel cell battery voltage and does not indicate the voltage of the engine-starting batteries.



CAUTION

Gel cell batteries can be damaged if the battery voltage is allowed to drop below 12.0 volts or if the charging voltage is more than 14.1 volts. Start the engine to recharge the gel cell before the battery becomes fully discharged. If an external charger is needed, disconnect the gel cell battery and use only an external battery charger that has been approved for gel cell batteries.

Fuel-Tach Gauge, Optional

The FloScan Fuel-Tach ([Fig. 2.27](#)) is an electronic monitoring system that records fuel consumption and displays average miles per gallon. The Fuel-Tach provides you with immediate feedback showing a percentage difference between the current fuel consumption rate and the total trip miles per gallon average.

The "0" point on the gauge means that the current fuel consumption rate is the same as the miles per gallon average of the total trip distance traveled.

Clockwise movement (into the green zone) of the gauge needle shows the percentage improvement in the current fuel consumption rate compared to the miles per gallon trip average.

Counterclockwise movement (into the red zone) of the gauge needle shows that the current fuel consumption rate is higher than miles per gallon trip average. Needle movement into the red zone means that the driver should shift the transmission or change vehicle speed to increase fuel efficiency, as driving conditions permit.

The Fuel-Tach system is operated by a toggle switch. For switch operating instructions, see "Fuel-Tach Switch" in this chapter.

The Fuel-Tach system installed in vehicles with electronic engines also displays fault codes corresponding to any engine problems that might occur. When the engine databus sends a fault code, it interrupts

the LED miles per gallon display for 60 seconds. An "F" appears in the display together with the fault code, for example "F37." If the engine sends a single fault code, the display blinks on and off for 60 seconds while displaying the code. It then goes back to displaying the MPG. If the engine sends more than one fault code, the display blinks each fault code on and off three times and keeps repeating them for 60 seconds. It then goes back to reading MPG. To find out the engine problem, look up the displayed number in your engine fault code list.

If you need to review the fault codes received, simply press and release the "Reset" toggle switch to display the fault code history file. The display shows "h" plus each fault code starting with the most recent, for example, (h13, h27, h17). Each code blinks three times before showing the next code. After showing all of the codes, the display shows "- -" and then goes back to displaying MPG. If there are no fault codes in the history file, the display blinks "- -" four times and goes back to showing MPG. The history file may be viewed at any time.

If there are multiple active fault codes, they are sent sequentially by the engine databus. The sequence repeats as long as the faults are not corrected. Any code appears in the history file only once even though the sequence of codes is repeating. If you view the history file several times in a short period of time, the order of the codes may change depending on which code of the repeating sequence was sent most recently.

Engine Hour Meter, Optional

An engine hour meter records continuous operating hours of the engine and is mounted in the control panel. In cases where actual mileage does not indicate overall usage, maintenance and lubrication intervals for the engine and engine-operated equipment can be determined by operating hours.

Application Air Pressure Gauge, Optional

An application air pressure gauge ([Fig. 2.27](#)) registers the air pressure being used to apply the brakes and should be used for reference only. The gauge will not register air pressure until the foot brake pedal is depressed or the trailer hand brake is applied.

Instruments and Controls Identification

Dual System Air Pressure Gauge

A dual system air pressure gauge (**Fig. 2.27**) registers the constant pressure in the primary and secondary air systems. Normal pressure, with the engine running, is 100 to 120 psi (689 to 827 kPa) in both systems. A low-air-pressure warning light and buzzer, connected to both the primary and secondary systems, activates when air pressure in either system drops below a minimum pressure of 64 to 76 psi (441 to 524 kPa). When the engine is started, the warning light and buzzer remain on until air pressure in both systems exceeds minimum pressure.

Fuel Gauge

The fuel gauge (**Fig. 2.27**) indicates the level of fuel in the fuel tank(s). If equipped with a second (optional) fuel gauge, each fuel tank level is indicated on a separate gauge.

Intake-Air Restriction Gauge, Optional

An intake-air restriction gauge (**Fig. 2.28**) measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. Vacuum is measured in inH₂O (inches of water). Service the air cleaner when the vacuum reading equals the applicable level shown under "Service" in **Table 2.5**.

Intake-Air Restriction Indicator

An intake-air restriction indicator (**Fig. 2.29**) measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the yellow signal stays locked at or above the values shown in **Table 2.5**, after the engine is shut down, service the air cleaner. Then, press the yellow button to reset the indicator.

Intake-Air Restriction		
Engine Type*	Initial inH ₂ O	Service inH ₂ O
Cummins	12	25
Detroit Diesel	12	20
Caterpillar	15	25

* Turbocharged engines must be checked at full load and governed engine speed.

Table 2.5, Intake-Air Restriction

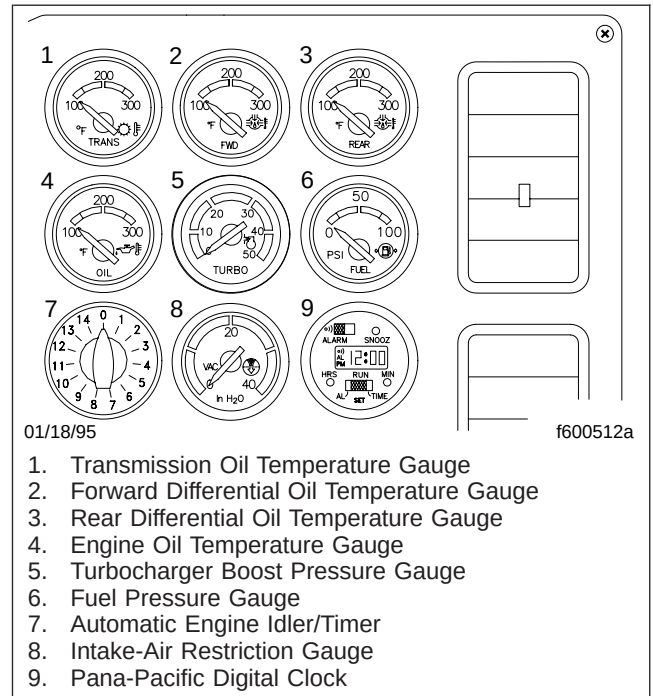


Fig. 2.28, Optional Gauges

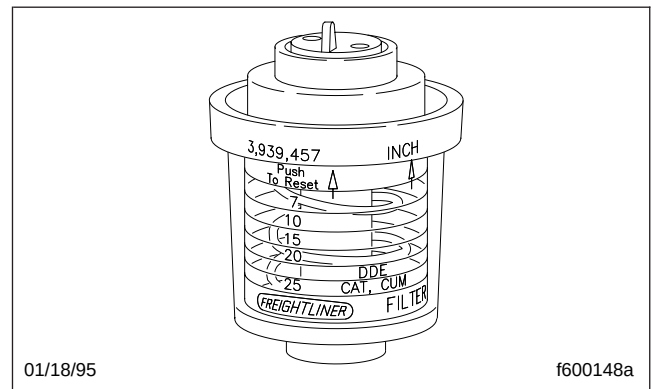


Fig. 2.29, Intake-Air Restriction Indicator

Fuel Pressure Gauge, Optional

A fuel pressure gauge (**Fig. 2.28**) registers output pressure of the fuel pump. Whenever the engine is operating, the fuel pressure reading should be constant. If the fuel pressure drops, investigate the cause and make the necessary repairs.

Instruments and Controls Identification

Ammeter, Optional

An ammeter measures current flowing to and from the battery. When the batteries are charging, the meter needle moves to the plus side of the gauge; when the batteries are being discharged, the needle moves to the minus side.

Engine Oil Temperature Gauge, Optional

During normal operation, the engine oil temperature gauge ([Fig. 2.28](#)) should read:

- 180 to 225°F (82 to 107°C) for Cummins engines;
- 190 to 235°F (88 to 113°C) for Caterpillar engines;
- 200 to 230°F (93 to 110°C) for Detroit Diesel engines.

Under heavy loads, such as when climbing steep grades, temperatures which exceed the normal oil temperature range for a short period are not unusual.

CAUTION

A sudden increase in engine oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop, and investigate the cause to prevent further damage. Do not operate the engine until the cause has been determined and corrected.

Transmission Oil Temperature Gauge, Optional

During normal operation, the transmission oil temperature gauge ([Fig. 2.28](#)) reading should not exceed 250°F (121°C) for Eaton-Fuller transmissions.

CAUTION

A sudden increase in transmission oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop, and investigate the cause to prevent further damage. Do not operate the vehicle until the cause has been determined and corrected.

Forward and Rear Differential Oil Temperature Gauges, Optional

During normal operation, forward and rear differential oil temperature gauges ([Fig. 2.28](#)) should read between:

- 160 to 220°F (71 to 104°C) for Meritor drive axles;
- 180 to 200°F (82 to 93°C) for Eaton drive axles.

Under heavy loads, such as when climbing steep grades, temperatures up to a maximum of 250°F (121°C) are not unusual.

CAUTION

A sudden increase in differential oil temperature that is not caused by a load increase may indicate mechanical failure. Bring the vehicle to a safe stop, and investigate the cause to prevent further damage. Do not operate the vehicle until the cause has been determined and corrected.

Turbocharger Boost Pressure Gauge, Optional

A turbocharger boost gauge ([Fig. 2.28](#)) measures the pressure in the intake manifold, in excess of atmospheric pressure, being created by the turbocharger.

Pana-Pacific Digital Clock, Optional

A Pana-Pacific clock ([Fig. 2.28](#)) has black characters on a constantly backlit green display, with a brightness that automatically adjusts for day or night. The clock has a 24-hour alarm, with a 3-minute snooze feature.

1. To set the time of day:

- 1.1 Push the Run/Set (lower) switch to the right (TIME-SET position).

NOTE: When the hour setting is for a time between noon and midnight, the small letters "PM" will appear in the lower left corner of the display; no "PM" indicates an A.M. setting.

- 1.2 Advance the hour setting to the correct number by pushing and releasing the hour button as many times as needed. Or, if

Instruments and Controls Identification

the button is pressed and held in for longer than two seconds, the numbers will continue to advance until the button is released.

- 1.3 Advance the minute setting by repeatedly pushing, or pushing and holding the minute button, as needed.
- 1.4 Push the Run/Set switch to the middle (RUN) position.
2. To set the alarm time:
 - 2.1 Push the Run/Set switch to the left (ALARM-SET position).
 - 2.2 Set the alarm time by using the same procedure that you used to set the time of day. Remember to set the hour for A.M. (no letters in the corner of the display), or P.M., as desired.
 - 2.3 Return the Run/Set switch to the middle (RUN) position. The readout will return to the time-of-day setting.
3. To operate the alarm:
 - 3.1 With the alarm time set, push the alarm (upper) switch to the left. An alarm "wave" symbol and the letters "AL" will appear in the upper left corner of the display when the alarm is on.
 - 3.2 When the displayed time of day coincides with the alarm time, the alarm will sound. If the "snooz" button is not pushed or the alarm switch is not moved, the alarm will automatically stop sounding after 1 minute, and will not sound again for 24 hours.
 - 3.3 If desired, press the "snooz" button while the alarm is sounding, to shut the alarm off for 3 minutes. The alarm symbol will flash in the display when the button is pushed, and will continue to flash until the alarm switch is moved or the alarm has sounded for 1 minute. The snooze procedure can be done as many times as desired.
 - 3.4 Move the alarm switch to the right when you wish to shut off or cancel the alarm; the alarm symbol will disappear.

Kysor Digital Clock, Optional

A Kysor digital clock ([Fig. 2.14](#)) has a constant red display, which automatically adjusts the brightness for day or night. The clock features a 24-hour alarm.

1. To set the time of day:
 - 1.1 Depress both of the time "Set" push buttons, labelled "Fast" and "Slow"; 12:00 A.M. will appear as the readout.

NOTE: A small illuminated red dot in the upper left side of the clock (above "PM") indicates P.M. No dot indicates A.M.

 - 1.2 Advance to the correct time by pushing either the "Fast" or "Slow" push button.
2. To set the alarm:
 - 2.1 Depress the alarm "Set" push button. Observe that a red lamp above the word "Alarm" illuminates.
 - 2.2 Set the alarm time by using the same procedure that you used to set the time of day. Remember to select either A.M. (no red dot) or P.M. (red dot illuminates) when setting the alarm time.
 - 2.3 After the desired alarm time appears, depress the alarm "Set" push button again. The readout will return to the time of day, and the red lamp will go out.
 - 2.4 To set the alarm, depress the alarm "On" push button. Observe that a red dot on the right side of the time-of-day readout is illuminated. The alarm is now set, and when the displayed time of day coincides with the alarm time, the alarm will sound.
 - 2.5 To cancel or shut off the alarm, depress the alarm "On" push button again. The red dot on the face of the clock will go out.

Tachograph, Optional

A Sangamo tachograph ([Fig. 2.30](#)) indicates and records vehicle speed, time, and distance traveled. It also records the length of time the engine is operated when the vehicle is stationary. A warning light comes on whenever a preestablished speed limit is exceeded.

Instruments and Controls Identification

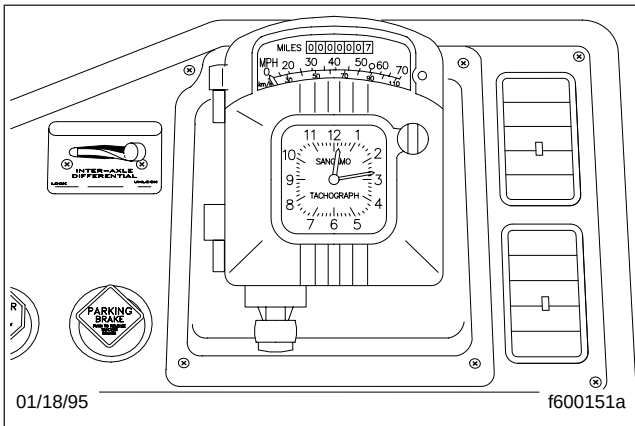


Fig. 2.30, Tachograph, Optional

Exterior Switches

Battery Disconnect Switch, Optional

The switch is used whenever service operations require that the batteries be disconnected. It is also used whenever the vehicle is placed out of service for extended periods, to prevent battery discharge. See [Fig. 2.31](#).

IMPORTANT: The battery disconnect switch does not completely isolate the batteries from the electrical system. For service operations that require that the batteries be disconnected, always shut down the engine and remove the negative battery cables.

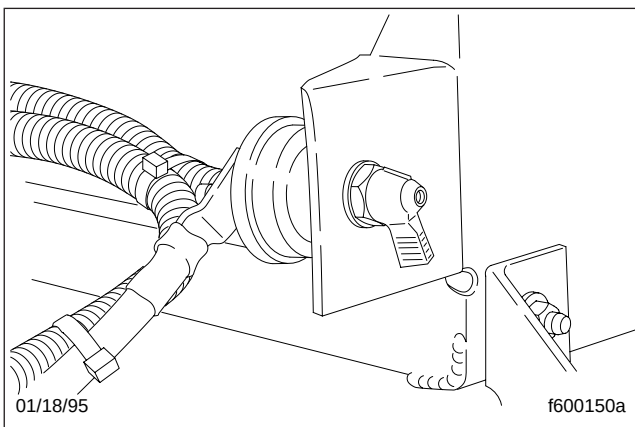


Fig. 2.31, Battery Disconnect Switch

3

Vehicle Access

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Cab Door Locks and Handles	3.1
Grab Handles and Access Steps	3.1
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Vehicle Access

Ignition and Lock Key

One key operates the ignition switch and all of the door locks for the cab, sleeper box, and glove box.

IMPORTANT: Each key is numbered. Record the number so, if needed, a duplicate key can be made.

Cab Door Locks and Handles

To unlock the driver's door from outside the cab, insert the key in the lockset and turn it one-quarter turn clockwise. See [Fig. 3.1](#). Turn the key counterclockwise to the original position to remove it. Pull out on the paddle handle to open the door. See [Fig. 3.1](#).

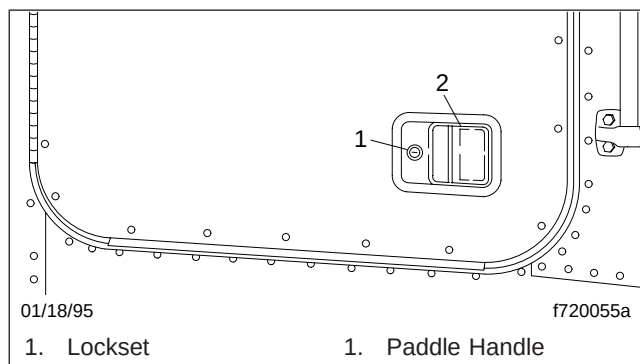


Fig. 3.1, Exterior Door Handle

To unlock the passenger's door from outside the cab, insert the key in the lockset and turn it one-quarter turn counterclockwise. Turn the key to the original position to remove it.

NOTE: The cab door locks can be operated when the doors are open.

To lock a door from outside the cab, insert the key in the lockset and turn it opposite the unlocking direction, then close the door if it is open. Or, push down the inside lock button ([Fig. 3.2](#)), then close the door.

To lock either door from inside the cab, push down the lock button ([Fig. 3.2](#)), then close the door if it is open. Pull the integral grab bar ([Fig. 3.2](#)) when closing the door.

To open the door from the inside, pull the door handle toward you. See [Fig. 3.2](#). This will unlatch the door whether or not it is locked. To unlock the door without unlatching it, pull the lock button up.

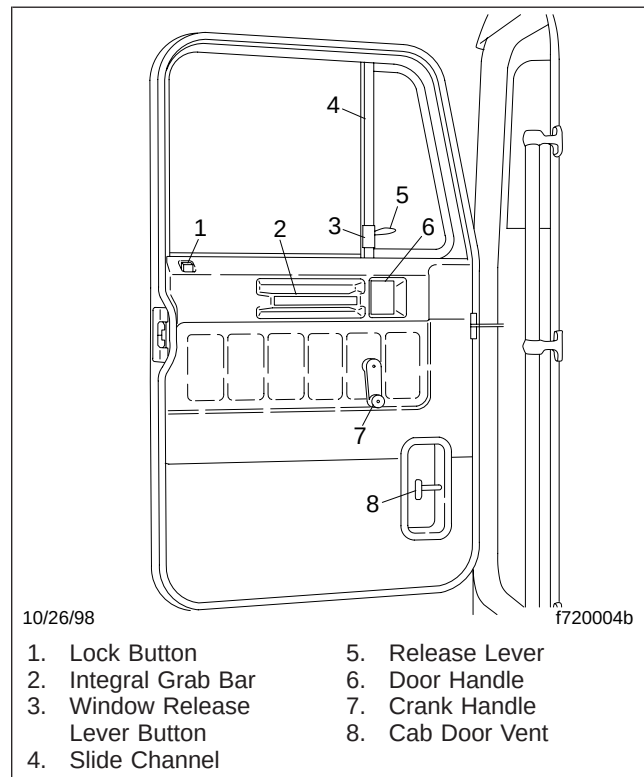


Fig. 3.2, Door Interior

Grab Handles and Access Steps



Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when climbing onto, or down from, the back-of-cab area.

Always maintain three-point contact with the back-of-cab access supports while entering and exiting the back-of-cab area. Three-point contact means both feet and one hand, or both hands and one foot, on the grab handles, steps, and deck plates. Other areas are not meant to support back-of-cab access, and grabbing or stepping in the wrong place could lead to a fall, and personal injury.

Vehicle Access

Be careful not to get hands or feet tangled in hoses or other back-of-cab equipment. Carelessness could cause a person to trip and fall, with possible injury.

Entering the Driver's Side (See Fig. 3.3)

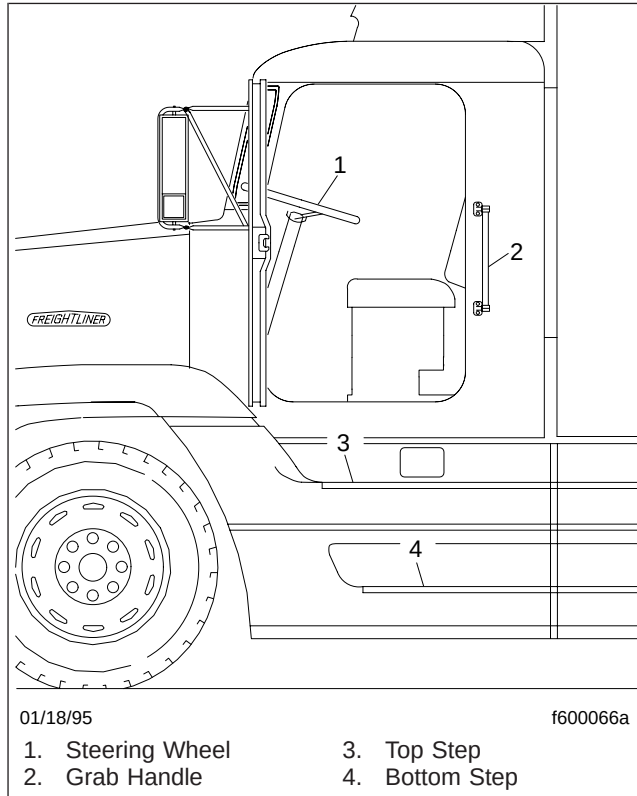


Fig. 3.3, Driver's Side Steps and Grab Handle

When entering the cab from the driver's side, use the grab handle and access steps as follows:

1. Open the driver's door, and place anything that you are carrying in the cab.
2. Grasp the grab handle with your right hand. Reach up as far as is comfortable.
3. Place your right foot on the bottom step, and pull yourself up.
4. Grasp the steering wheel with your left hand.
5. Place your left foot on the top step, and step up.
6. Step into the cab with your right foot first.

Exiting the Driver's Side (See Fig. 3.3)

Exit the cab from the driver's side as follows:

IMPORTANT: Do not attempt to exit the cab while carrying any items in your hands.

1. Grasp the steering wheel with your left hand, and stand on the threshold facing into the cab.
2. Place your left foot on the top step, then grasp the grab handle with your right hand.
3. Move your right foot to the bottom step.
4. Step to the ground with your left foot.

Entering and Exiting the Passenger's Side

Enter and exit the cab from the passenger's side, using the same procedures given for entering and exiting the driver's side, but using opposite hands and feet. Instead of the steering wheel, use the grab handle inside the upper forward corner of the passenger's door opening. See Fig. 3.4.

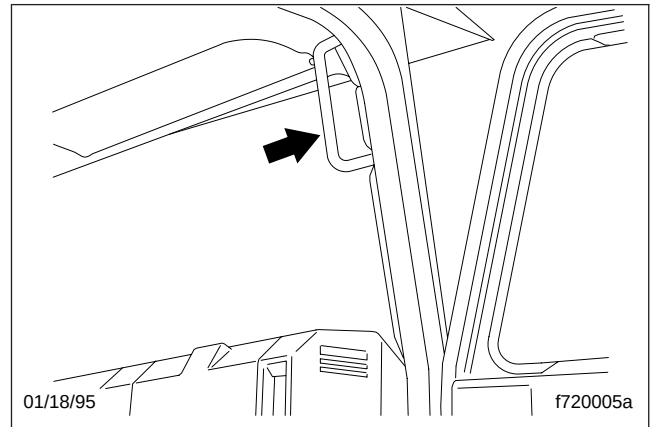


Fig. 3.4, Grab Handle

Door Windows and Vent Windows

To lower the driver's side door window, turn the crank handle clockwise. See Fig. 3.2. To lower the passenger's side, turn its handle counterclockwise. See Chapter 2 for (optional) air window operating instructions.

Vehicle Access

To open either vent window, push the vent window release lever button while pivoting the top of the release lever 90 degrees forward. When the release lever clears the slide channel, push outward on the release lever.

When closing the vent window, hold the release lever in the forward-pivoted position, and pull it inward. When the outer edge of the lever clears the slide channel, pivot the top of the lever 90 degrees rearward. The button will automatically pop out to lock the vent window.

Cab Door and Sleeper Compartment Vents

To open any cab door vent ([Fig. 3.2](#)) or sleeper compartment vent ([Fig. 3.5](#)), push the vent handle outward and to the right with your fingertips. To close the vent, turn your hand so that your fingers are pulling on the handle from the front edge, then pull in and back on the handle. Use care to avoid pinching your fingers.

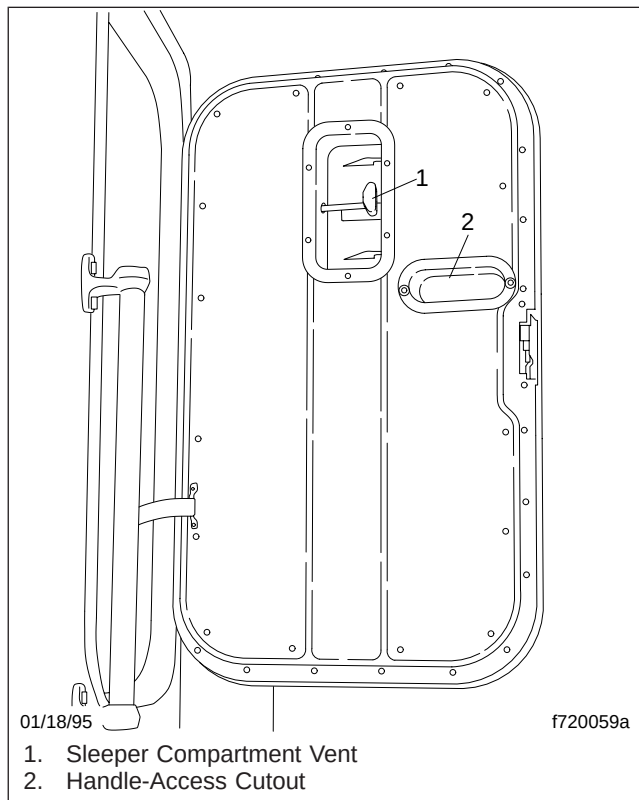


Fig. 3.5, Sleeper Door

Glove Box

The glove box ([Fig. 3.6](#)) is located on the passenger's side of the dash. To lock the glove box, insert the ignition key in the lockset, with the key teeth pointing to the left, then, without pushing in on the lockset, turn the key counterclockwise to vertical. Do not turn the key clockwise to the original position to remove it. To unlock the glove box, insert the key, and turn it clockwise to horizontal. To open the glove box door, push the door latch button (lockset) at the top center of the door.

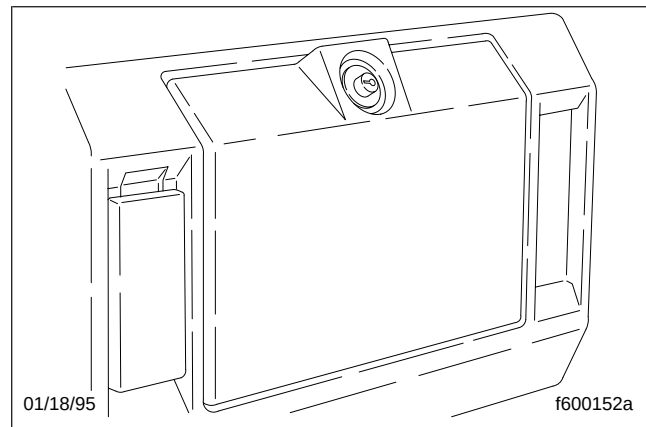


Fig. 3.6, Glove Box

Circuit Breaker/Relay Panel

The circuit breaker/relay panel (see [Fig. 3.7](#) and [Fig. 3.8](#)) is located behind the dash skirt on the front wall of the cab. To gain access to the relay panel, turn the three access panel fasteners one-quarter turn, then remove the access panel.

Cab-to-Sleeper Access

WARNING

Place rigid or heavy objects in storage areas on the floor or under the bunk. Sudden stops or swerves could cause personal injury if items fall from overhead storage shelves.

To open the sleeper access on vehicles with vinyl sleeper curtains, unzip the sleeper curtains. If desired, unsnap the curtains all the way around the sides and top, and remove the curtains.

Vehicle Access

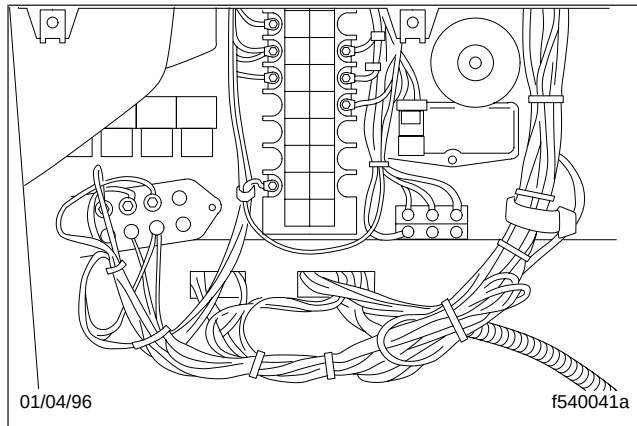


Fig. 3.7, Circuit Breaker/Relay Panel

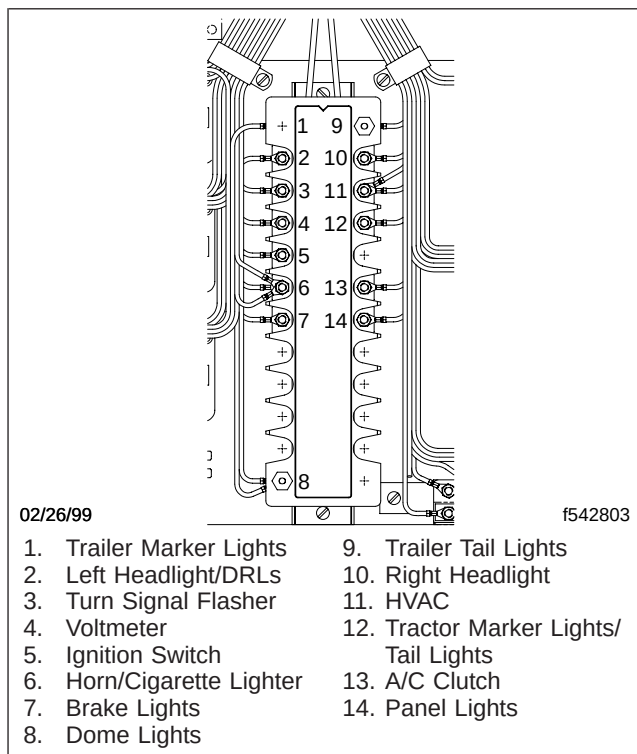


Fig. 3.8, Circuit Breaker Layout (detail)

To open the sleeper access on vehicles with velour sleeper curtains, unfasten the snaps at one side, then push the curtain to the opposite side.

Upper Bunk Access, 70-Inch Raised Roof SleeperCab

Grab handles are designed into the upper cabinets on each side of the 70-inch raised roof SleeperCab. See [Fig. 3.9](#). There is a step built into the front of the passenger's side lower cabinet. Also, a slip-resistant step pad is located on the top right corner of the driver's side lower cabinet.

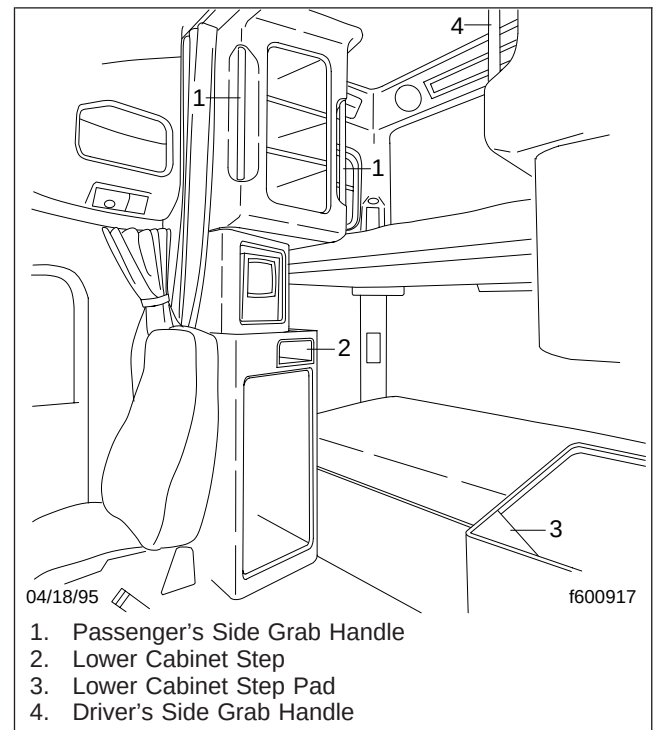


Fig. 3.9, Upper Bunk Access

IMPORTANT: Make sure the upper bunk is folded down and locked into place before attempting to access the upper bunk.

Accessing the Upper Bunk Using the Passenger's Side Cabinets

1. Grasp the passenger's side upper cabinet grab handles, one in each hand. Reach up as far as is comfortable.
2. Place your left foot in the step built into the passenger's side lower cabinet, and pull yourself up to a standing position.

Vehicle Access

3. Swing your right hip over the bunk and use the grab handles and your left foot to push yourself backwards onto the bunk.

Accessing the Upper Bunk Using the Driver's Side Cabinets

1. Grasp the driver's side upper cabinet grab handles, one in each hand. Reach up as far as is comfortable.
2. Place your right foot on the slip-resistant step pad on top of the driver's side lower cabinet, and pull yourself up to a standing position on top of the lower cabinet.
3. Swing your left hip over the bunk and use the grab handles and your right foot to push yourself backwards onto the bunk.

Sleeper Door

The sleeper door is not intended for entry or exit. The door is intended only as a convenient means to stow or remove personal belongings in or from the sleeper area. To open the door from the inside, push down on the lever handle at the bottom of the handle-access cutout; see [Fig. 3.5](#). To open the door from the outside, insert the ignition key in the lockset ([Fig. 3.10](#), Ref. 1) and turn it one-quarter turn clockwise. Turn the key to the original position to remove it. To close and lock the door, push it closed until it latches.

IMPORTANT: The sleeper doors are two-stage latching. When closing the doors, ensure that they are completely latched to prevent wind noise and water intrusion.

Baggage Compartment Doors

To open the baggage compartment door on the passenger's side, insert the ignition key in the lockset, and turn it one-quarter turn clockwise. See [Fig. 3.10](#). Hold the key in this position while pulling outward on the baggage compartment door handle. Turn the key to the original position to remove it. To close and lock the door, push it closed until it latches.

Use the same procedure to open the baggage compartment door on the driver's side, but turn the key counterclockwise.

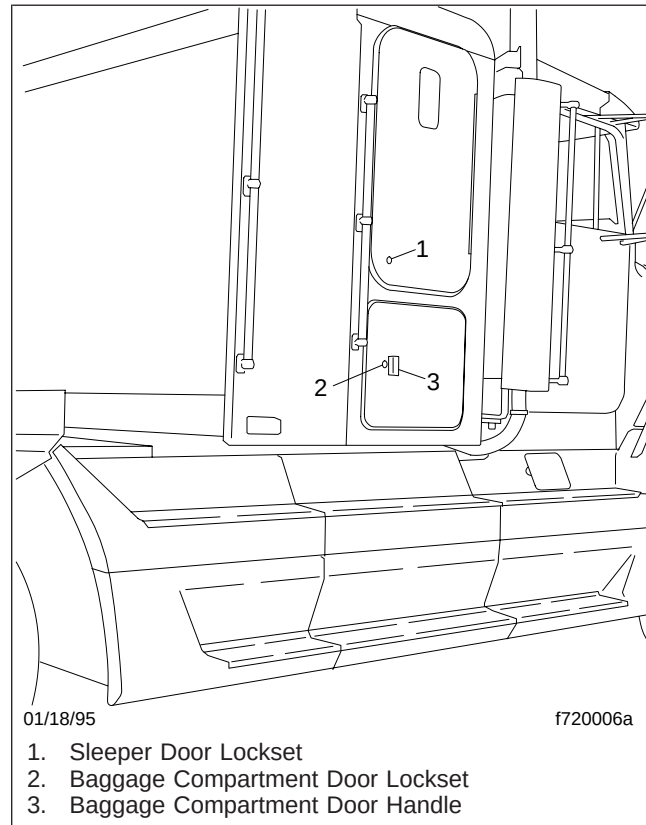


Fig. 3.10, Sleeper and Baggage Compartment Doors

If the key is difficult to turn, push inward on the door handle while turning the key.

Back-of-Cab Grab Handles, Steps, and Deck Plate

A grab handle and steps facilitate safe climbing up or down.

Accessing Back-of-Cab Area

When climbing onto the deck plate, use the grab handle and access steps (see [Fig. 3.11](#)) as follows:

1. Facing the center of the deck plate, grasp the grab handle with both hands. Reach up as far as is comfortable.
2. Place one foot on the bottom step, and pull yourself up.
3. Place your other foot on the top step.

Vehicle Access

4. Move your lower hand to a higher position on the grab handle.
5. Step onto the deck plate.

Exiting the Back-of-Cab Area

When climbing down from the deck plate, use the grab handle and access steps as follows:

1. Facing the center of the deck plate, grasp the grab handle with both hands.
2. Step one foot at a time to the top step.
3. Move your upper hand to a lower position on the grab handle.
4. Move one foot to the bottom step.
5. Move your upper hand to a lower position on the grab handle.
6. Step to the ground with your upper foot first.

Battery Box Cover

To remove the battery box cover, pull on the end of each hold-down latch until the end clears the cover-mounted catch. See [Fig. 3.12](#). Pivot the latches out of the way, then lift off the cover. When installing the cover, be sure it is positioned properly before fastening the latches.

Hood Tilting

The hood can be tilted to a full-open position. A grab handle at the front of the hood provides a hand-hold for hood tilting. See [Fig. 3.13](#). Tilt-assist springs (FLD 120 Conventionals) or a torsion bar (FLD 112 Conventionals), help you to tilt the hood open, and to return it to the operating position. Stop cables (FLD 120 Conventionals), or hood straps (FLD 112 Conventionals), prevent the hood from overtravel. In the operating position, the hood is secured to the lower cab side panels by a hold-down latch on each side of the hood.

To Tilt the Hood

1. Apply the parking brakes.
2. Release both hood hold-down latches by pulling the end outward.

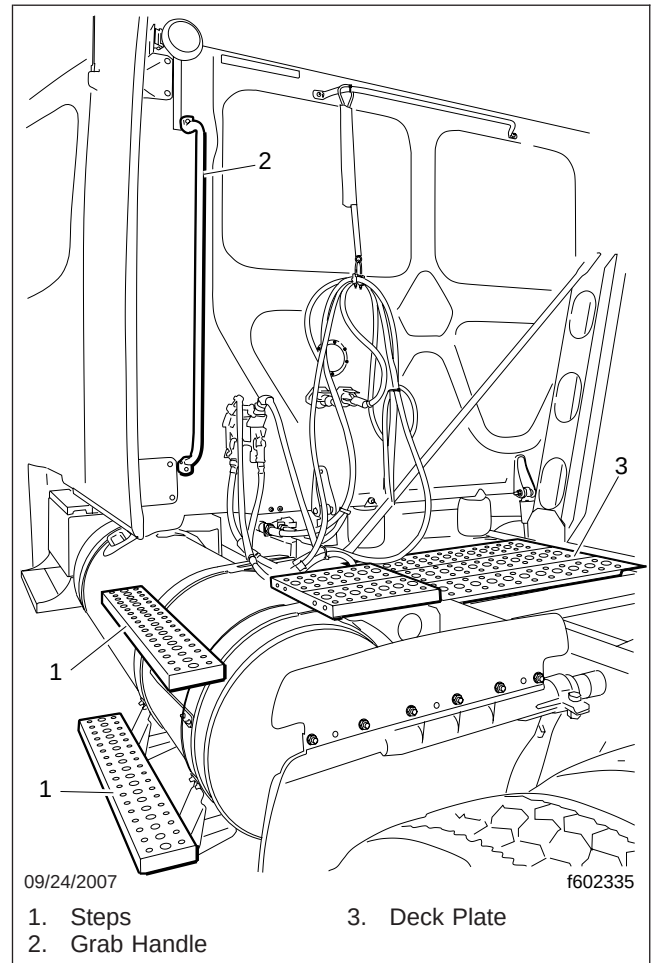


Fig. 3.11, Back-of-Cab Access

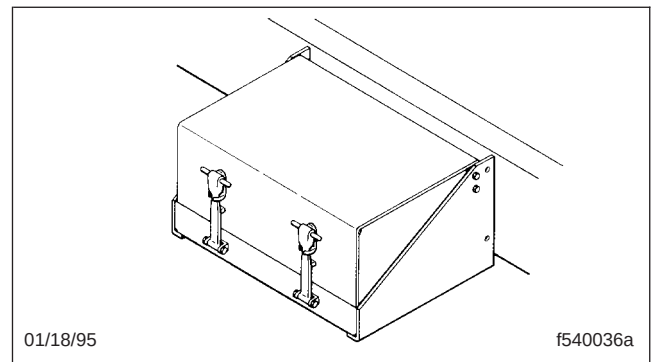


Fig. 3.12, Battery Box Cover

Vehicle Access

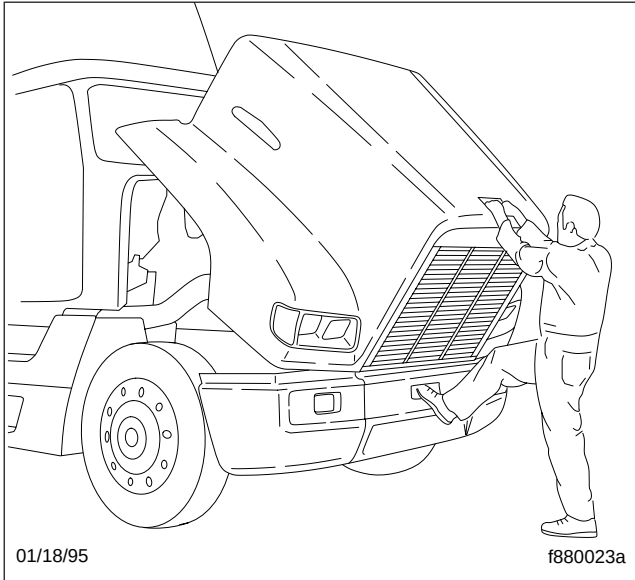


Fig. 3.13, Hood Tilting



CAUTION

Do not let the hood free-fall to the full-open position. To do so could cause damage to the hood or hood straps.

3. Using the bumper step and grab handle, slowly tilt the hood until the stop cables or straps support it.

To Return the Hood

1. Grasp the grab handle, and lift the hood to the 45-degree position.
2. As the hood goes over center, use the bumper step and grab handle to control the rate of descent to the operating position.
3. Make sure the hood is flush with the cowl, then secure the hood by engaging both hood hold-down latches.

IMPORTANT: Make sure that both hold-down latches are fully engaged before operating the vehicle.

Windshield Washer Reservoir

The windshield washer reservoir is located inside the left-side baggage compartment. See [Fig. 3.14](#).

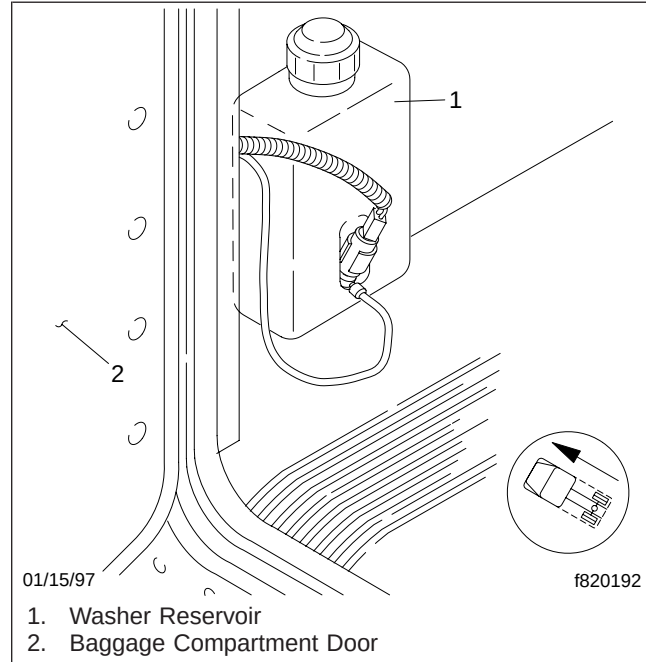


Fig. 3.14, Windshield Washer Reservoir

4

Heater and Air Conditioner

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Heating	4.2
Air Conditioning	4.3
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Heating, Sleeper Heater and Air Conditioner	4.4
Air Conditioning, Sleeper Heater and Air Conditioner	4.5

Heater and Air Conditioner

HVAC General Information

A dash-mounted climate control panel (**Fig. 4.1**) allows you to control all of the heating, air conditioning, defrosting, and ventilating functions.

A four-speed fan forces fresh or recirculated air to any selected air outlets at the windshield, door windows, dashboard face, and cab floor. See **Fig. 4.2**.

All of the dash-face outlets have adjustable louvers that pivot right and left, and up and down. The outlets can be closed by moving the louvers all the way down. Windshield defrost outlets and the passenger's door window defrost outlet have nonadjustable louvers. The bunk outlet (on the right-hand wall of the bunk) has two sets of vertical louvers that operate like the horizontal dash-face louvers.

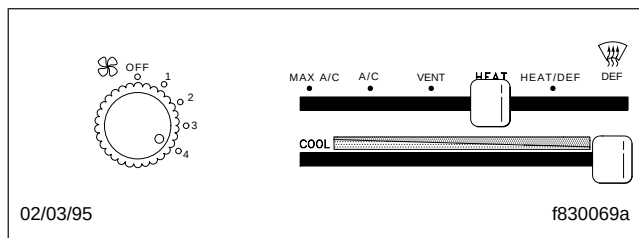


Fig. 4.1, Climate Control Panel

An auxiliary heater and air conditioner unit is standard when there is a sleeper compartment. The unit is installed in the sleeper baggage compartment and uses the cab's refrigerant system for air conditioner operation. The unit is equipped with a separate evaporator coil, expansion valve, and fan. It is also equipped with its own heater core and water valve, independent of the cab heater. On vehicles with a 60-inch sleeper the auxiliary unit's climate control panel (**Fig. 4.3** or **Fig. 4.4**) is located in the shelf area; with a 40-inch sleeper it is mounted on the left front wall. On vehicles with a 48-inch or 70-inch SleeperCab, the control panel is mounted on the left rear wall or the rear overhead storage compartment.

NOTE: Shutting off the heater supply gate valve (if equipped) on the engine limits the ability to control air conditioning temperature in the cab and in the sleeper. With the valve shut off, warm coolant is no longer available from the engine, and the outlet air temperature controls can't be used to change air temperature.

A FRESH/RECIRC push button (**Fig. 4.5**) is standard equipment when there is no air conditioning. This control is an option when air conditioning is ordered. It allows the AC, VENT, and HEAT modes to be used with either fresh or recirculated air. When the mode control (upper lever) is at HEAT/DEF or DEF, the system draws in fresh air, regardless of the FRESH/RECIRC push button setting. When the mode control is at MAX A/C, the system draws *only* recirculated air, regardless of the FRESH/RECIRC push button setting. When the mode control is at A/C and the FRESH/RECIRC control is set for recirculation (push button in), the system functions the same as when the mode control is at MAX A/C. To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Defogging and Defrosting Using Fresh Air

1. Set the mode control (upper lever) to HEAT, the fan switch to OFF and, if so equipped, the bunk fan switch to OFF before starting the engine. See **Fig. 4.6**.
2. Remove any ice or snow from the outside of the windshield, door windows, and fresh air inlet grille.
3. With the engine at operating temperature, slide the temperature control (lower lever) to WARM.
4. Move the mode control to DEF. In this position the system is engaged to dehumidify the air before heating it, unless the temperature at the evaporator coil is less than 32°F (0°C). Warm, dry air is directed to the windshield.

IMPORTANT: If equipped with a FRESH/RECIRC push button, the system draws in fresh air when the mode control (upper lever) is at HEAT/DEF or DEF, regardless of the FRESH/RECIRC push button setting.

NOTE: At DEF, airflow is directed to the windshield outlets and the extreme left and right dash-face outlets. To defrost the driver's door window, turn the extreme left dash-face outlet to direct airflow to the upper left. In all positions of the mode control, airflow is directed to the passenger's door window.

Heater and Air Conditioner

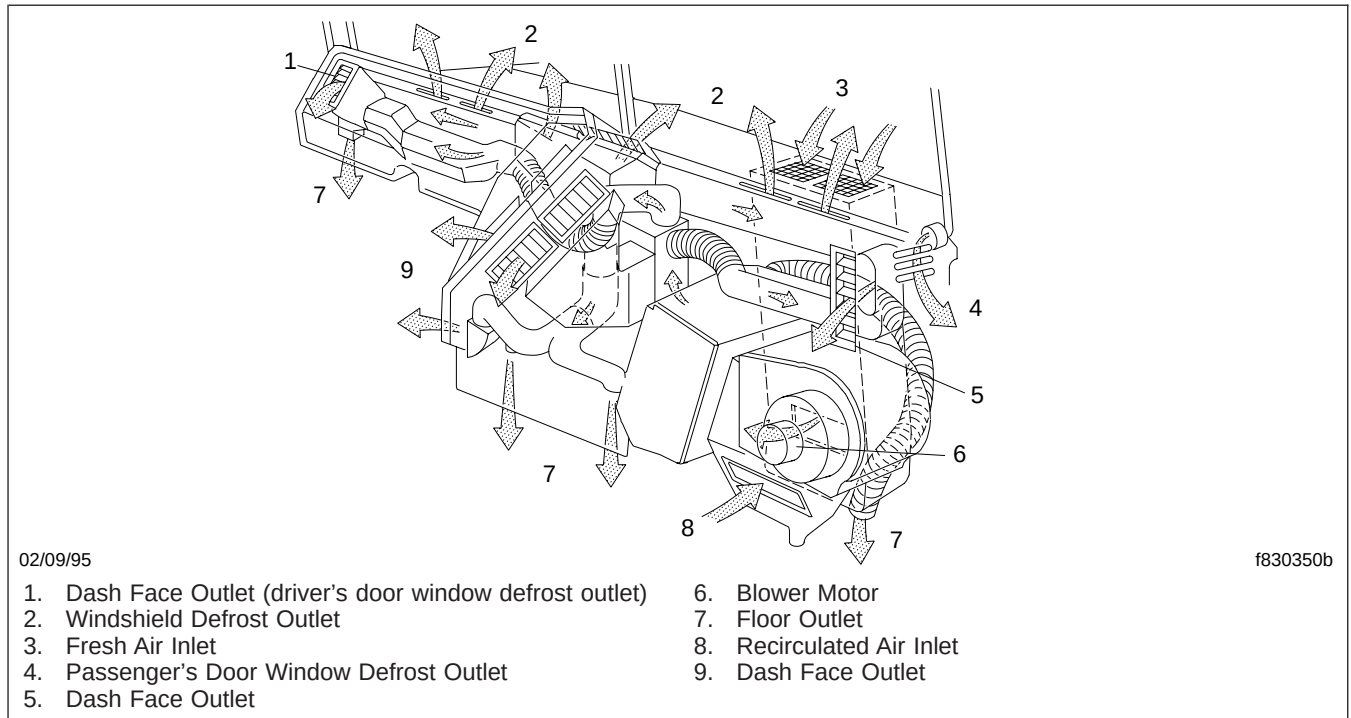


Fig. 4.2, Air Outlet and Inlet System

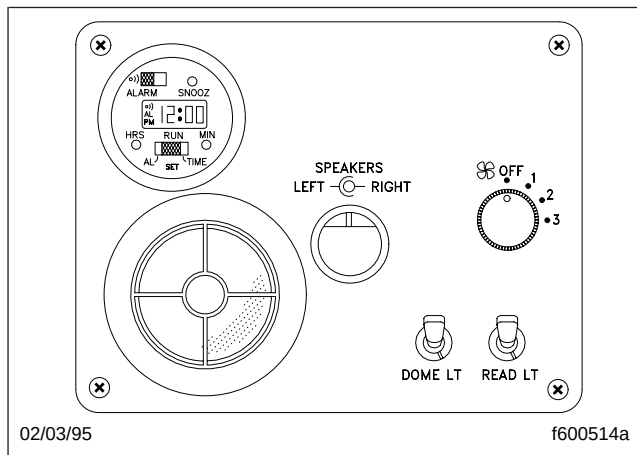


Fig. 4.3, Control Panel for a Manual Temperature Control Cable System

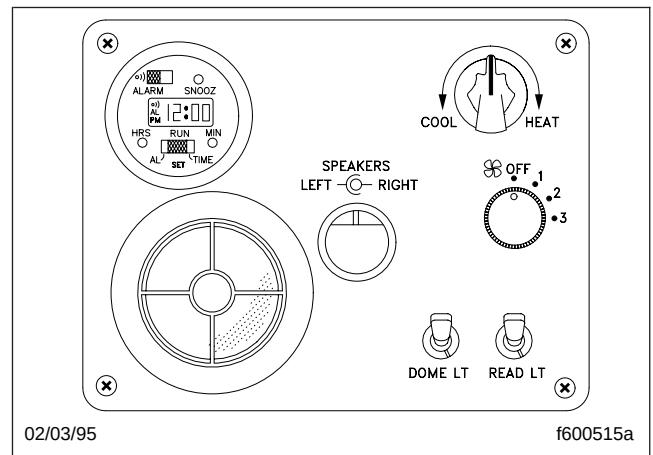


Fig. 4.4, Control Panel for Automatic Temperature Control System

Heating

1. With the engine at operating temperature, set the mode control to HEAT. See Fig. 4.7.
2. Slide the temperature control to WARM.
3. Turn on the fan switch to the desired speed.

IMPORTANT: If the windows start to fog, move the mode control to HEAT/DEF or DEF, and make sure the fan is on. To defog the driver's door window, turn the extreme left dash-face outlet to direct airflow to the upper left. In all

Heater and Air Conditioner

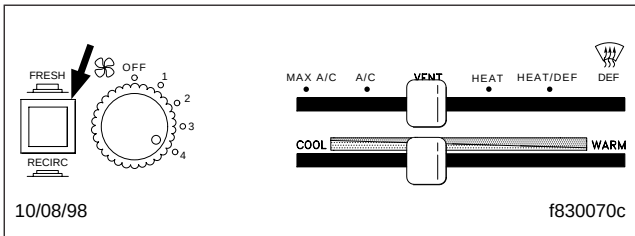


Fig. 4.5, FRESH/RECIRC Push Button

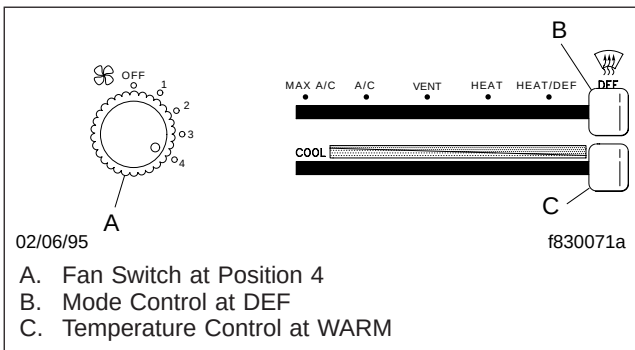


Fig. 4.6, Settings for Defog/Defrost

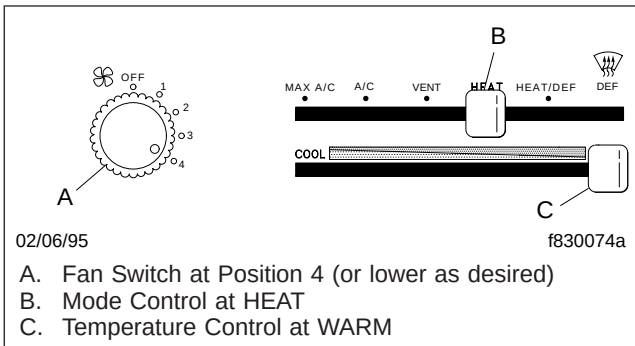


Fig. 4.7, Settings for Maximum Heat

positions of the mode control, airflow is directed to the passenger's door window.

NOTE: In mild weather the fan switch can be kept off, since forward motion of the vehicle will provide airflow through the heater.

4. If the vehicle has a sleeper with a rear climate control panel, set the controls as desired. For instructions, refer to "Heating, Auxiliary Heater and Air Conditioner."
5. When a comfortable temperature has been reached, adjust the fan switch setting and tem-

perature control as needed to maintain the temperature.

IMPORTANT: If equipped with a FRESH/RECIRC push button (Fig. 4.5), the system draws in fresh air when the mode control (upper lever) is at HEAT/DEF or DEF, regardless of the FRESH/RECIRC push button setting. However, when the mode control lever is at HEAT, and the push button is in, the system draws *only* recirculated air. To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Air Conditioning

IMPORTANT: Operate the air conditioner at least five minutes each month, even during cool weather. This helps prevent drying and cracking of tubing seals, reducing refrigerant leaks in the system. Operate the air conditioner only after the engine compartment is warm, and the interior of the cab is 70°F (21°C) or higher. During cold weather, the heater can be operated at the same time, to prevent discomfort.

1. If the cab is hot inside, temporarily open the windows to let the hot air out.
2. Set the mode control to VENT and turn the fan switch off before starting the engine.
3. Start the engine.
4. Move the mode control to A/C. See Fig. 4.8. With the control at A/C, fresh air is drawn into the cab. With the control at MAX A/C, the air inside the cab is recirculated.

IMPORTANT: If the outside air is dusty or smoky, set the mode control at MAX A/C and keep the windows and vent closed, to prevent drawing in dust or smoke. On vehicles with the FRESH/RECIRC push button, recirculated air can be selected either with the push button in or by setting the mode control to MAX A/C.

5. Move the temperature control to COOL. In this position, no heat is given off by the heater.
6. Turn the fan switch to the highest speed, 4.

Heater and Air Conditioner

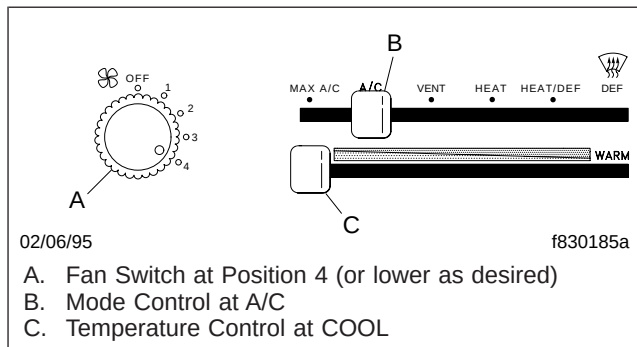


Fig. 4.8, Settings for Cooling with A/C

- As soon as cool air is flowing from the dashboard outlets, close the windows. Adjust the fan switch setting as desired.
- If the air from the vents is too cold, move the temperature control toward WARM to adjust the temperature.

IMPORTANT: A FRESH/RECIRC push button ([Fig. 4.5](#)) is standard equipment when there is no air conditioning. This control is an option when air conditioning is ordered. It allows the AC, VENT, and HEAT modes to be used with either fresh or recirculated air. When the mode control is at MAX A/C, the system draws *only* recirculated air, regardless of the FRESH/RECIRC push button setting. When the mode control is at A/C and the FRESH/RECIRC control is set for recirculation (push button in), the system functions the same as when the mode control is at MAX A/C. To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

NOTE: The mode control must be at either A/C or MAX A/C, and the fan switch must be on for the air conditioning system to work.

Fresh Air

- Move the mode control to VENT or HEAT. See [Fig. 4.9](#). In the VENT position, air comes out of the dashboard outlets but not out of the floor outlets. In the HEAT position, air comes out of the floor outlets and the outlets on either end of the

dashboard, but the center dashboard outlets are closed.

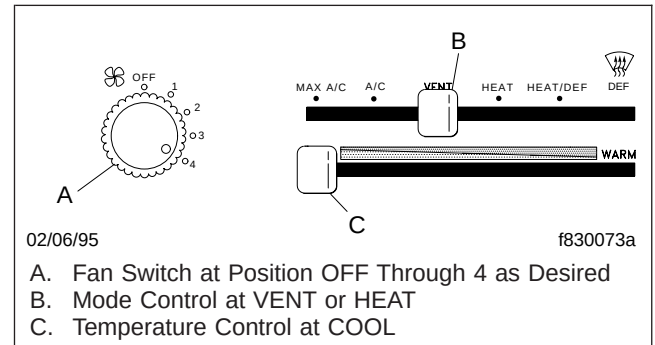


Fig. 4.9, Settings for Maximum Ventilation

- Set the temperature control to COOL for no heating, or move it toward WARM for heat.
- Set the fan switch at the desired speed.

IMPORTANT: If equipped with a FRESH/RECIRC push button ([Fig. 4.5](#)), the system draws *only* recirculated air when the mode control lever is at VENT or HEAT, and the push button is in. To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater or ventilation system in a recirculation mode for more than 20 minutes.

Heating, Sleeper Heater and Air Conditioner

- If equipped with the manual temperature control, do the following ([Fig. 4.10](#)):
 - With the engine at operating temperature, pull the temperature control cable (attached to the outlet duct at the foot of the bunk) all the way out. Turn the fan control knob to position 3.
 - When the sleeper compartment heats to the desired temperature, push in the temperature control cable to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

Use the manual temperature control and the fan control knob as needed to help maintain the desired temperature.

Heater and Air Conditioner

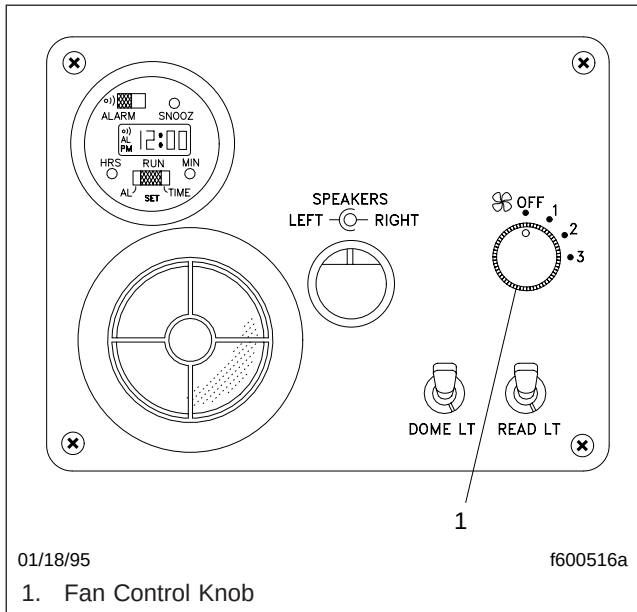


Fig. 4.10, Control Panel for Manual Temperature Control System

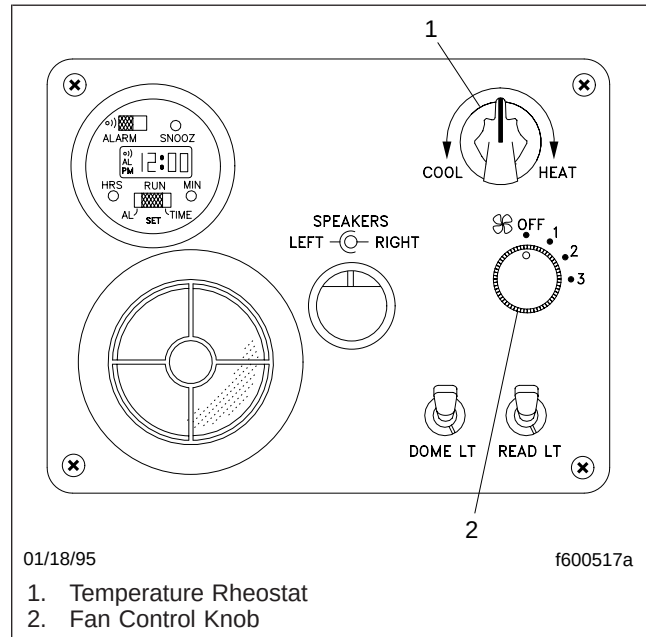


Fig. 4.11, Control Panel for Automatic Temperature Control System

Air Conditioning, Sleeper Heater and Air Conditioner

- 1.3 Whenever heat is not desired, push the temperature control cable all the way in, and turn off the fan.
2. If equipped with either the Red Dot constant temperature control (CTC™) system, or the Behr automatic temperature control system (**Fig. 4.11**), do the following:
 - 2.1 With the engine at operating temperature, turn the rotary knob on the temperature rheostat all the way clockwise to HEAT. Turn the fan control knob to position 3.
 - 2.2 When the sleeper compartment heats to the desired temperature, turn the rotary knob on the temperature rheostat counterclockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.
The system will automatically maintain the selected outlet air temperature.
 - 2.3 Whenever heat is not desired, turn the rotary knob on the temperature rheostat counterclockwise (as needed) and turn off the fan.

1. If equipped with the manual temperature control, do the following:
 - 1.1 Turn on the cab air conditioner. For instructions, refer to "Air Conditioning."
 - 1.2 Make sure that the temperature control cable (attached to the outlet duct at the foot of the bunk) is pushed in all the way. Turn the fan control knob to position 3.
 - 1.3 When the sleeper compartment cools to the desired temperature, turn the fan control knob to adjust the air flow level. If needed, pull the temperature control cable out to adjust outlet air temperature. Use the temperature control cable and the fan control knob as needed to help maintain the desired temperature.
 - 1.4 Whenever air conditioning is not desired, pull the temperature control cable out (as needed) and turn off the fan.

NOTE: Whenever the refrigerant compressor is operating, the fan will always run at a very

Heater and Air Conditioner

low speed, even with the fan control knob in the "Off" position. This prevents ice from forming on the evaporator, especially during humid weather.

2. If equipped with either the Red Dot constant temperature control (CTC™) system, or the Behr automatic temperature control system, do the following:
 - 2.1 Turn on the cab air conditioner. For instructions, refer to "Air Conditioning."
 - 2.2 Turn the rotary knob on the temperature rheostat all the way counterclockwise to COOL. Turn the fan control knob to position 3.
 - 2.3 When the sleeper compartment cools to the desired temperature, turn the rotary knob on the temperature rheostat clockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

The system will automatically maintain the selected outlet air temperature.
 - 2.4 Whenever air conditioning is not desired, turn the rotary knob on the temperature rheostat clockwise (as needed) and turn off the fan.

NOTE: Whenever the refrigerant compressor is operating, the fan will always run at a very low speed, even with the fan control knob in the "Off" position. This prevents ice from forming on the evaporator, especially during humid weather.

5

Seats and Seat Belts

Seats	5.1
Seat Belts and Tether Belts	5.8
Sleeper Compartment Bunk Restraints	5.11
Bunk Mattress	5.12

Seats and Seat Belts

Seats

General Information (See Fig. 5.1)

When adjusting seats, unless otherwise noted, all adjustments should be made while seated and before the engine is started.

Due to the maximum adjustability of mid- and high-back air suspension seats, it is possible to combine the seat back recline adjustment and the seat slide adjustment so that the seat back contacts the back-wall. It is the responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

WARNING

Keep hands, tools, and other objects away from the scissor points under the seats. Failure to do so could cause personal injury.

The following is a description of adjustments that can be made to various Freightliner-installed seats. Not all seats have all of the adjustments listed below.

1. **Back Cushion Tilt:** This adjustment enables the back cushion to pivot forward or backward.
2. **Lumbar Support:** Lumbar support changes the shape of the seat back to give more or less support to the occupant's lumbar (lower back) area.
3. **Isolator Lockout:** This feature (referred to as back-slap isolator, Chugger-Snubber™, or isolator) reduces the amount of road shock by isolating the occupant from the vehicle's motion, and allowing the upper seat to move in a simple pendulum motion. A lockout feature is used whenever the isolator is not desired.
4. **Height Adjustment:** The entire seat moves up or down when adjusting the height. The adjustment is either manually controlled or air controlled, depending on the make of the seat.
5. **Bottom Cushion Angle or Front and Aft Bottom Cushion Height:** This feature enables the occupant to raise or lower the front or back of the bottom cushion. This adjustment is easier to perform when all weight is removed from the seat.

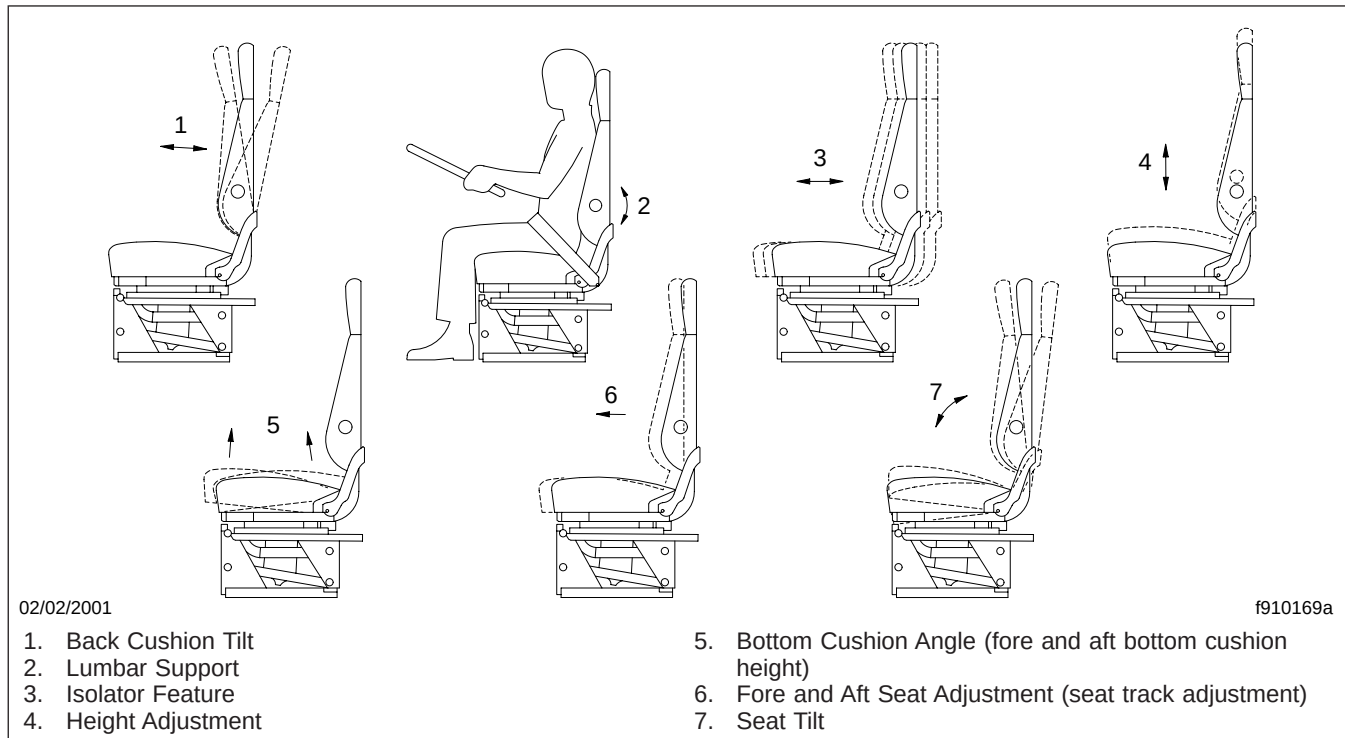


Fig. 5.1, Seat Adjustments

Seats and Seat Belts

6. Fore and Aft Seat or Seat Track Adjustment: The entire seat moves forward or backward when this adjustment is made.
7. Weight Adjustment: On those seats with weight adjustment, the feature is fully automatic. By sitting on the seat, a leveling valve places you in the center of the ride zone. Additional adjustments are possible by using the height adjustment feature.

Bostrom Seat, Air-715 Series (Fig. 5.2)

Back Cushion Tilt

By lifting the lever up, the back cushion angle position may be moved either forward or backward. Release the lever to lock the back cushion in place.

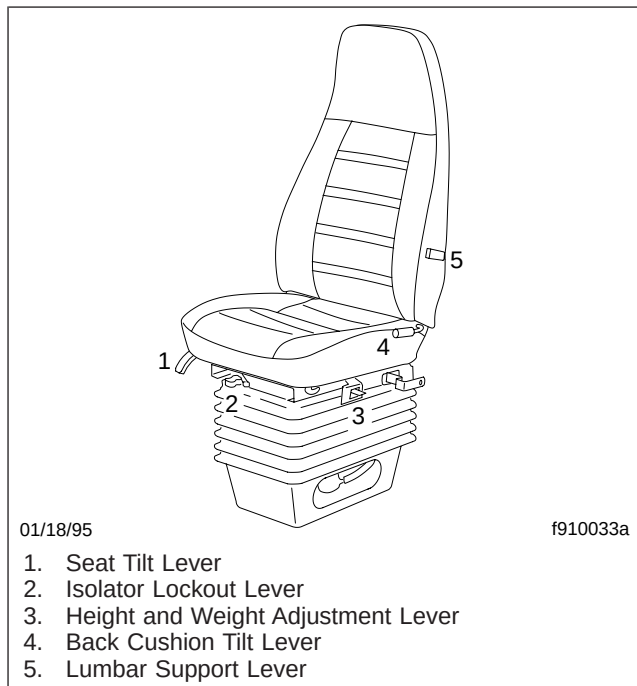


Fig. 5.2, Bostrom Air-715E High Back Seat

Lumbar Support

Move the lever forward or backward for more or less lower back support; there are three positions to choose from.

Isolator Lockout

To engage the isolator, put the lever in the center position. Lock it out by moving the lever to the right.

Height and Weight Adjustment

There are 4 inches (102 mm) of ride zone motion plus 2 inches (51 mm) of height adjustment. Pull the lever up to raise the seat, and push the lever down to lower it. The seat should be no less than 2 inches (51 mm) from either the top or bottom position.

Seat Tilt

Pull the lever up, and the back and bottom cushions may be moved forward or backward by shifting your weight.

Bostrom Air-915 Seat (Fig. 5.3)

Lumbar Support Adjustment

Move the lever forward to increase lumbar support. Move the lever rearward to decrease lumbar support.

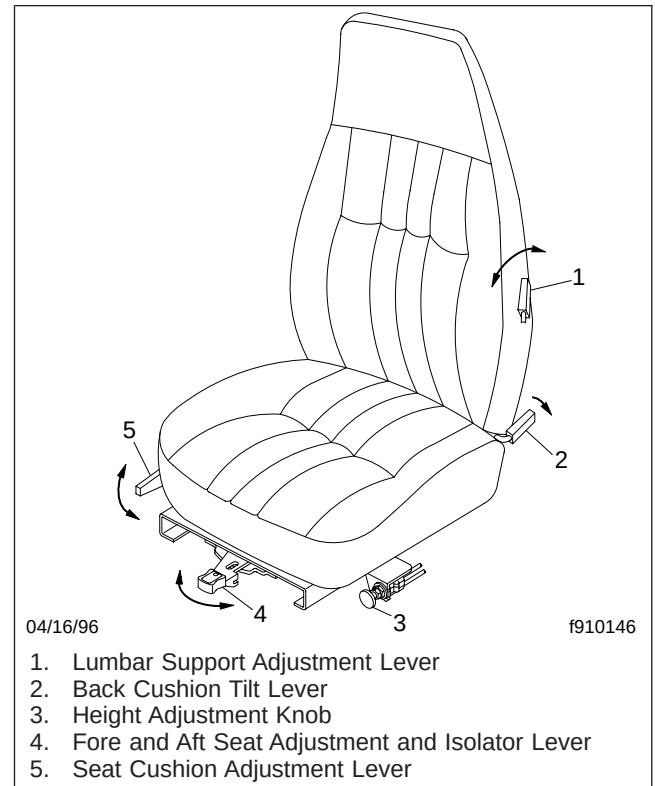


Fig. 5.3, Bostrom Air-915 Seat

Back Cushion Tilt

Hold the lever rearward and lean forward or rearward to the desired position, then release the lever.

Seats and Seat Belts

Height Adjustment

Push the knob in to inflate the suspension and raise the seat height. Pull the knob out to deflate the suspension and lower the seat.

Fore and Aft Seat Adjustment

Move the lever to the left and slide the seat forward or rearward to the desired position. The slide range is 6 inches (15 cm).

Isolator

Isolation is provided when the lever in the center position. Move the lever to the right to lock out isolation.

Seat Cushion Adjustment

Move the lever downward to decrease or upward to increase seat cushion tilt. There are five adjustment positions available.

Bostrom Talladega 900 Seat (Fig. 5.4)

NOTE: Two different sets of controls are used on Bostrom Talladega seats. On some models, the height adjustment, lumbar support and damper adjustment are controlled by switches mounted to the bottom cushion. On other models, these controls are mounted to the seat frame.

Back Cushion Tilt

To tilt the back cushion, lean forward slightly to remove pressure from the cushion and hold the lever rearward. Lean backward slowly to the desired position and release the lever to lock the cushion in place.

Height Adjustment

To raise the seat, push the top portion of the switch. To lower the seat, push the lower portion of the switch.

Isolator

To engage the isolator, put the lever in the center position. Lock out the isolator by moving the lever to the right.

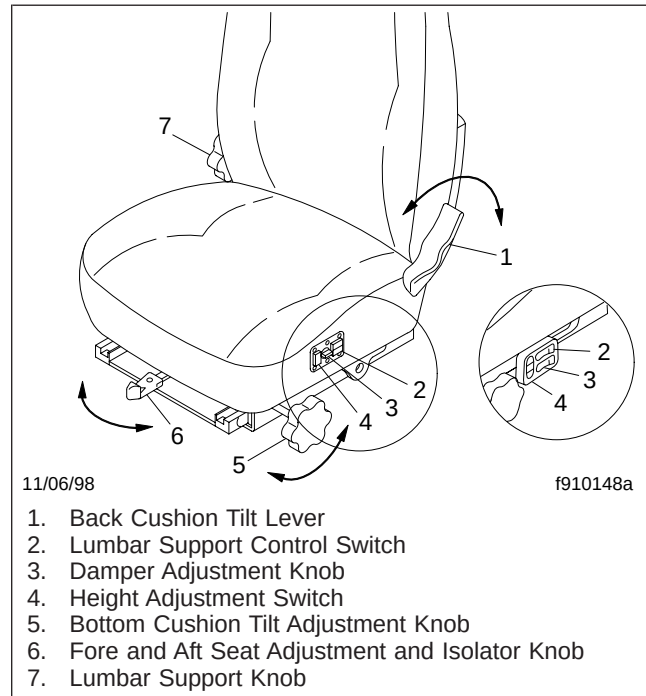


Fig. 5.4, Bostrom Talladega 900 Seat

Fore and Aft Seat Adjustment

Hold the lever to the left and slide the seat forward or backward to the desired position.

Bottom Cushion Tilt Adjustment

Rotate the knob to increase or decrease bottom cushion tilt.

Lumbar Support

To increase lumbar support on LSO models, press the plus sign on the control switch. To decrease lumbar support on LSO models, press the minus sign on the control switch. To increase lumbar support on non-LSO models, rotate the knob forward. To decrease lumbar support on non-LSO models, rotate the knob rearward.

Damper Adjustment

Rotate the knob or push the switch to adjust the damper.

Seats and Seat Belts

Bostrom Smart Seat Model (Fig. 5.5)

Back Cushion Tilt

The back angle has five positions in a 15-degree range. To release the latch, pull up on the handle.

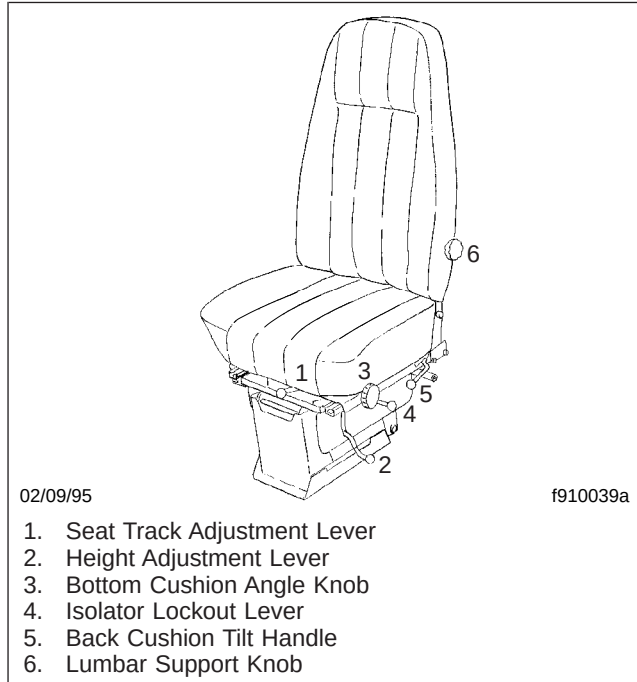


Fig. 5.5, Bostrom Smart Seat (High Back model shown)

Lumbar Support

Turn the knob clockwise to increase support.

Isolator Lockout

Push the lever back to actuate the back-slap isolator; push it forward to lock out this feature.

Height Adjustment

Height adjustment in the ride zone is continuously variable over a 6-inch (152-mm) range. Move the lever up or down to raise or lower the seat.

Weight Adjustment

The seat automatically adjusts itself regardless of the driver's weight. When unoccupied, the seat automatically moves to the adjusted height position.

Bottom Cushion Angle

The front portion of the cushion can be adjusted to any of six positions; rotate the knob to the desired angle.

Seat Track Adjustment

Seat tracks have nine adjustment positions with a total of 4 inches (102 mm) of travel. To unlatch the seat, move the lever to the left.

Freightliner AirChair (Fig. 5.6)

Back Cushion Tilt

Pull on the handle and move it to your choice of one of four settings.

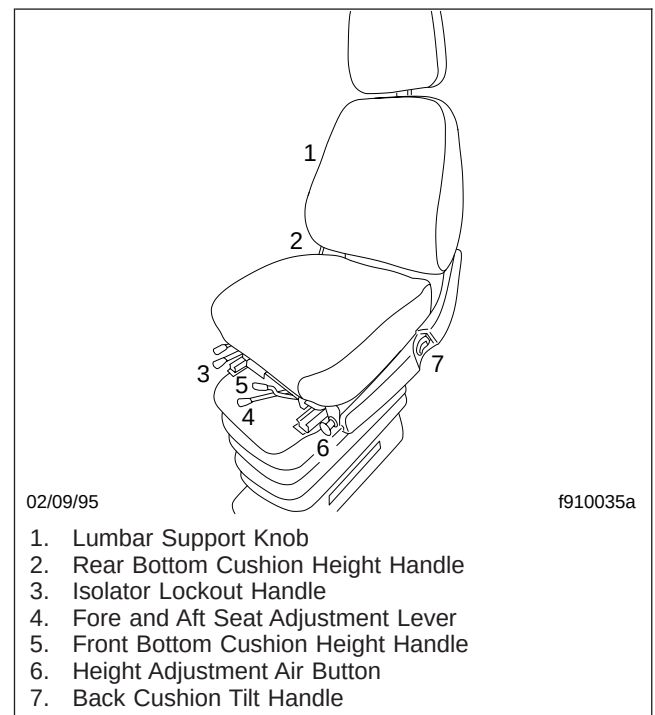


Fig. 5.6, Freightliner AirChair

Lumbar Support

Rotate the knob for precise fit.

Isolator Lockout

To lock out the fore-and-aft isolator feature, move the handle to the left. See Fig. 5.7.

Seats and Seat Belts

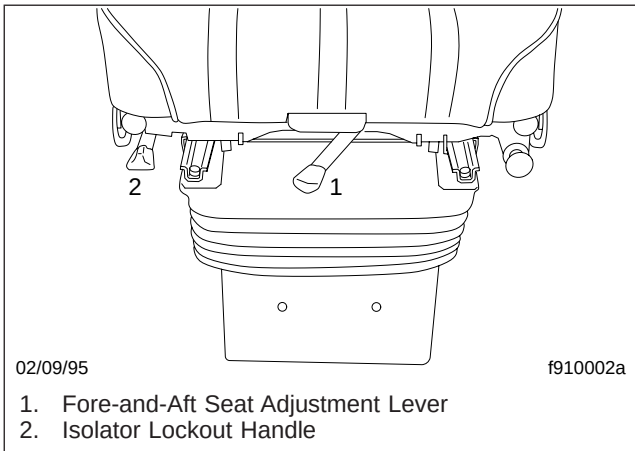


Fig. 5.7, Seat Adjustment

Height Adjustment

Push the air button to raise the seat; pull the air button to lower the seat. See [Fig. 5.6](#) or [Fig. 5.8](#).

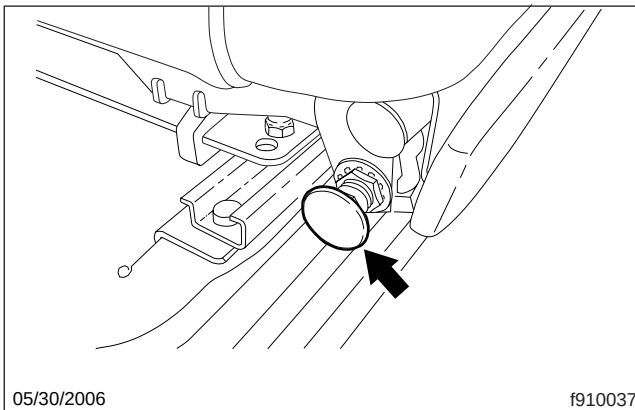


Fig. 5.8, Air Button

Front and Rear Bottom Cushion Height

To adjust the height of the front of the bottom cushion, lift the handle, and pull up and forward to one of three settings. To adjust the height of the rear of the bottom cushion, rotate the handle clockwise to one of the three settings.

Fore and Aft Seat Adjustment

Move the lever to the right, and slide the seat. Locked-in settings are in 1-1/2 inch (38 mm) increments. See [Fig. 5.6](#) or [Fig. 5.7](#).

National Cush-N-Aire Seats, Model 195 ([Fig. 5.9](#))

Back Cushion Tilt

To tilt the back cushion through a range of 12 degrees, turn the knob and lean forward or backward.

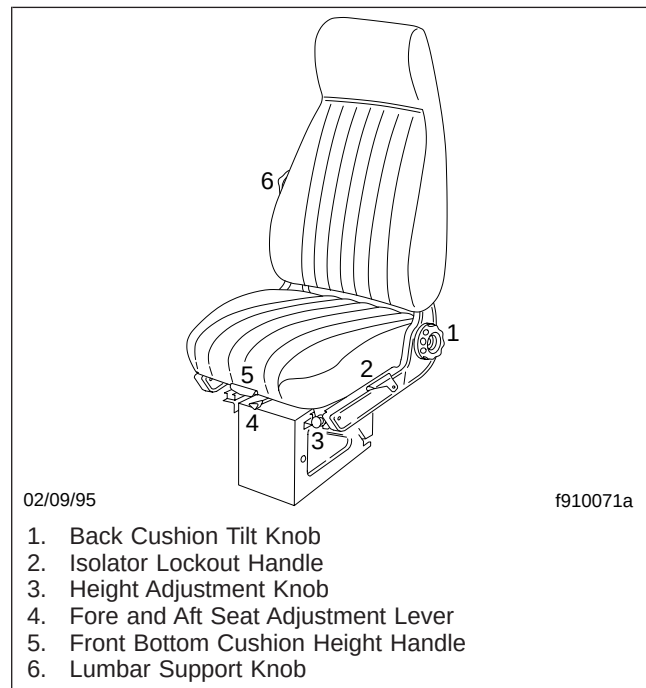


Fig. 5.9, National Cush-N-Aire Seat

Isolator Lockout

Called a Chugger-Snubber™, the isolator is locked out by moving the handle down.

Height Adjustment

Push in the knob to inflate the suspension and raise the seat height. Pull out on the knob to deflate the suspension and lower the seat height.

Fore and Aft Seat Adjustment

Move the lever to the right and slide the seat forward or backward to the desired position.

Front Bottom Cushion Height

To adjust the height of the front of the bottom cushion, lift the handle, and pull forward or push back to the desired setting.

Seats and Seat Belts

Lumbar Support

Turn the knob for precise fit.

National Cush-N-Aire II Seat (Fig. 5.10)

Back Cushion Tilt

To tilt the back cushion, turn the knob and lean forward or backward.

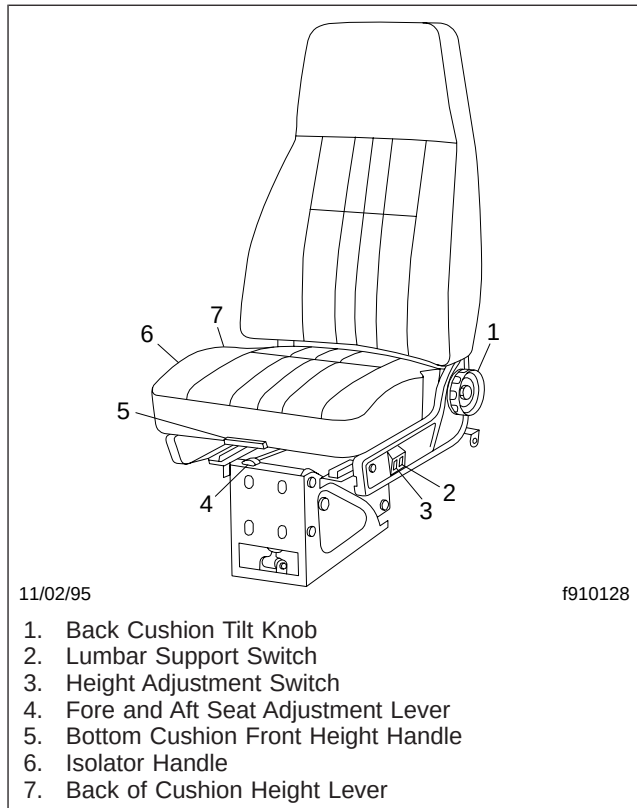


Fig. 5.10, National Cush-N-Aire II Seat

Height Adjustment

To raise the seat, push the rocker switch on the side of the seat up until the seat reaches the desired height. To lower the seat, push the rocker switch down until the seat reaches the desired height.

Fore and Aft Seat Adjustment

Move the lever to the left and slide the seat forward or backward to the desired position.

Bottom Cushion Front Height

To adjust the height of the front of the bottom cushion, lift the handle, and pull forward or push back to the desired setting.

Lumbar Support

Push the rocker switch on the side of the seat up to inflate lumbar support. Push the rocker switch down to deflate lumbar support.

Back-of-Cushion Height

To adjust the height at the back of the cushion, rotate the lever to the desired setting.

Isolator

Also called a Chugger-Snubber™, the isolator is locked out by moving the handle down.

Dura-Form Seats (Fig. 5.11)

NOTE: Some vehicles may be equipped with the Freightliner Power 6000 or nonpower 5000 seat available from Dura-Form. These seats offer air lumbar, infinite recline, a map pocket, a rear storage pocket, and a pen/glasses pocket. The Power 6000 seat offers 6-way power adjustment.

Back Cushion Tilt

To tilt the back cushion through a range of 10 degrees, push down on the handle. Move the back cushion to the desired position and release the lever.

Height Adjustment

Push in the knob to inflate the suspension and raise the seat height. Pull out on the knob to deflate the suspension and lower the seat height.

Isolator Lockout and Fore-Aft Seat Adjustment

Move the lever to the left to adjust the seat to the desired fore-aft position. Move the lever to the center position to lock out the isolator feature. Move the lever to the right to engage the isolator.

Seats and Seat Belts

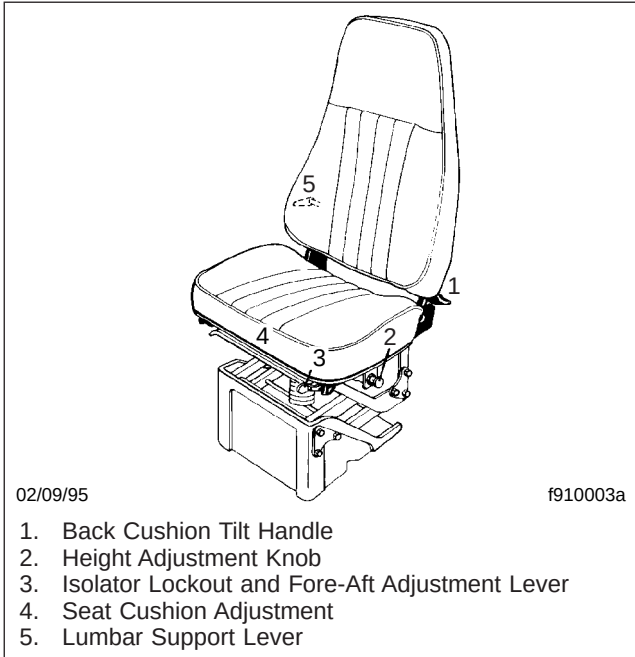


Fig. 5.11, Dura-Form Fleetcruiser Seat

Seat Cushion Adjustment

To put the seat cushion in the upper position, lift upward on the front of the cushion then push rearward. To put the seat cushion in the lower position, pull forward and then push downward.

Lumbar Support

Rotate the lever on the right side of the back cushion to any of the three positions as desired.

Eldorado Seat (Fig. 5.12)

Back Cushion Tilt

To tilt the back cushion through a range of 15 degrees, turn the knob and lean forward or backward.

Isolator

Called the Glide-A-Lator™, use the lever to engage or lock out the fore-and-aft isolator.

Fore and Aft Seat Adjustment

Use the lever to move the seat forward or backward to the desired position.

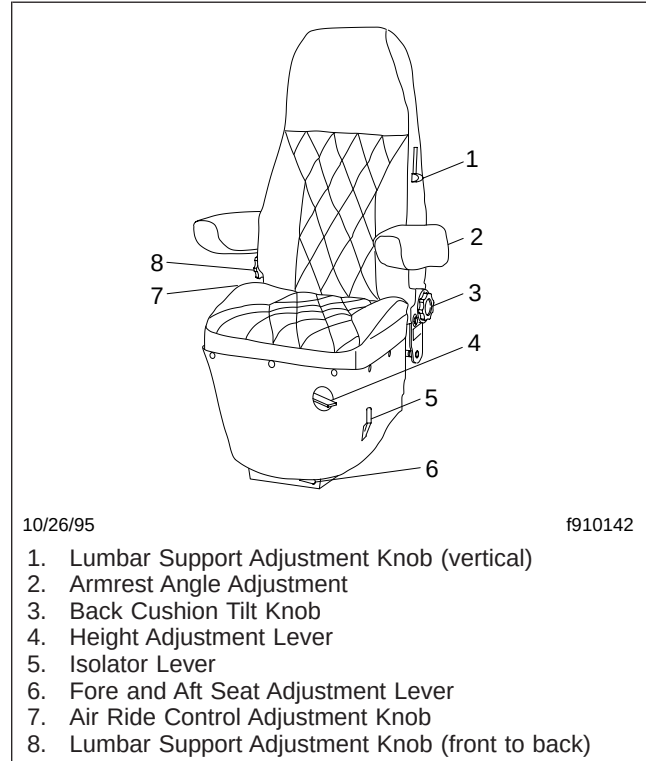


Fig. 5.12, Eldorado Seat

Height Adjustment

Lift up the lever and add or remove body weight to adjust seat height to the desired position, then firmly push the lever down into locking position.

Air Ride Control Adjustment

Depress the air valve knob until the seat cushion is level. (Height adjustment should be made prior to air ride control adjustment.)

Lumbar Support Adjustment/Front to Back

Turn the knob clockwise to increase lumbar support. Turn the knob counterclockwise to decrease lumbar support pressure.

Lumbar Support Adjustment/Vertical (Optional)

Move the knob up or down to one of five positions for desired area of back support.

Seats and Seat Belts

Armrest Angle Adjustment (Optional)

Rotate the 9/16-inch bolt head on the back of each armrest clockwise to raise the armrest and counter-clockwise to lower the armrest.

Swivel Seat (Fig. 5.13)

A swivel seat option is available for the passenger's seat only. A lever on the side of the seat base releases the swivel mechanism, allowing the seat to rotate on the base.

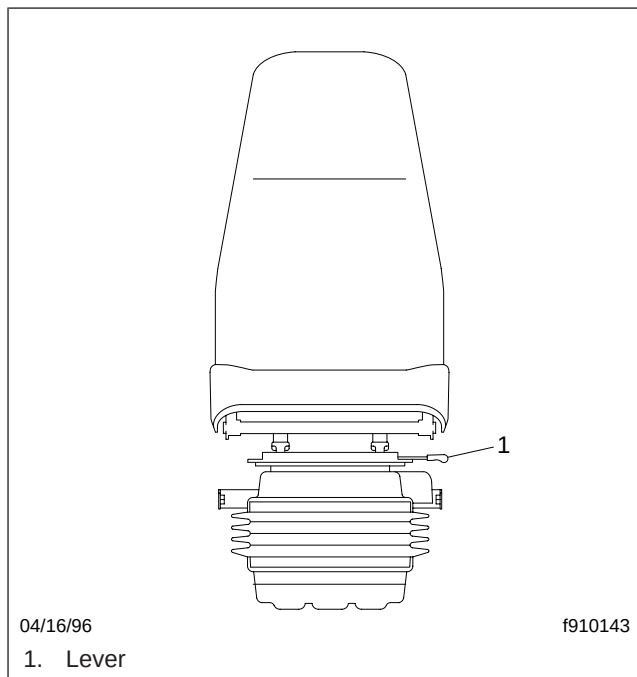


Fig. 5.13, Swivel Seat



WARNING

Do not rotate the seat while the vehicle is in motion. Doing so could increase the chance of personal injury in the event of a crash.

Seat Belts and Tether Belts

General Information

Seat belt assemblies are designed to secure persons in the vehicle to help lessen the chance of injury or the amount of injury resulting from accidents or sudden stops. For this reason, Daimler Trucks North

America LLC urges that the driver and *all* passengers, regardless of age or physical condition, use seat belts when riding in the vehicle.

Seat belt assemblies in the vehicle meet Federal Motor Vehicle Safety Standard 209, "Type 1," and "Type 2" requirements. They are recommended for all persons weighing over 50 pounds (23 kg).

A child restraint system should also be provided for each child weighing 50 pounds (23 kg) or less. It should meet the requirements of Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems." When providing such a restraint system, carefully read and follow all instructions pertaining to installation and usage for the child. Make certain the child remains in the restraint system at all times when the vehicle is in motion.

In addition to seat belt assemblies, tether belts are installed on suspension-type seats. Tether belts help secure the seat to the floor and are intended to restrain the seat and seat belt in case of an accident or sudden stop.

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle. See [Chapter 11](#) for the inspection procedure.

Tether Belt Adjustment

1. Make sure the tether belt is attached to the cab deck and seat frame. Also, check that the belt webbing is correctly routed through the buckle, as shown in [Fig. 5.14](#).
2. To lengthen the tether belt, turn the buckle at a right angle to the webbing, then pull the bottom webbing strap through the buckle until the desired length is reached. See [Fig. 5.15](#).
3. Adjust the seat to the highest ride position. With no weight on the seat, tighten each tether belt by pulling the middle webbing strap away from the buckle to remove all slack. See [Fig. 5.16](#). Tether belts should not be so tight as to restrict movement of suspension seats. Be sure the straps are not twisted.

Seats and Seat Belts

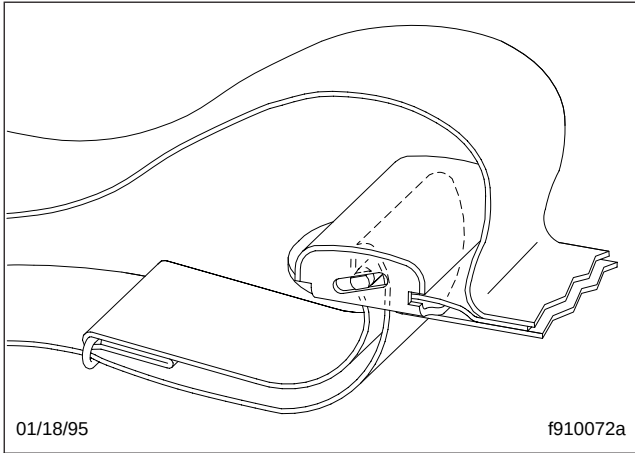


Fig. 5.14, Tether Belt Routing

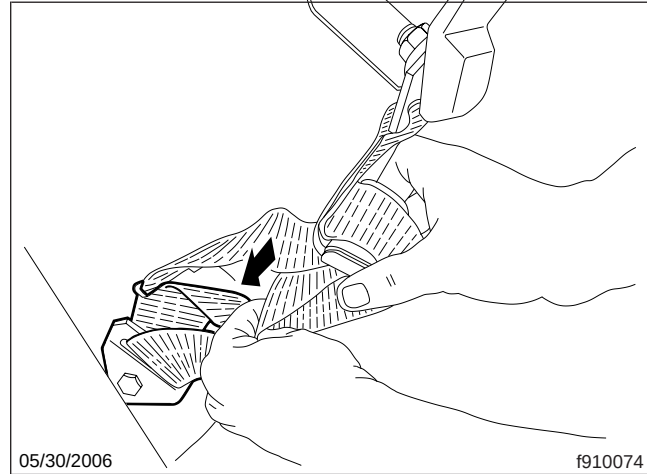


Fig. 5.16, Shortening the Tether Belt

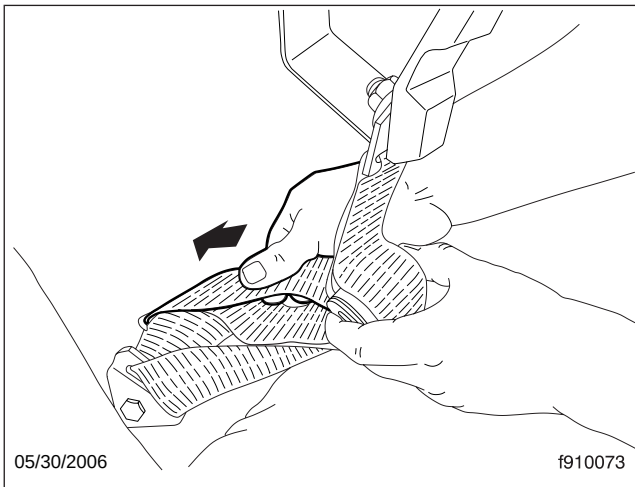


Fig. 5.15, Lengthening the Tether Belt

Seat Belt Operation Lap Belt

⚠ WARNING

Wear lap belts only as described below. In case of an accident or sudden stop, injuries could result from misuse. Lap belts are designed to be worn by one person at a time.

1. Before driving the vehicle, slowly pull the link end of the lap belt out of the retractor and pull it across your lap far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.

2. Fasten the lap belt by pushing the link into the buckle until it latches. Give the belt a tug at the buckle. If the buckle unlatches, repeat this step. If the problem continues, replace the lap belt.
3. To unbuckle the lap belt, push the button on the buckle to release the seat belt link.

NOTE: Make sure the lap belt is completely retracted when it is not in use.

Three-Point Seat Belt With Komfort Latch™

⚠ WARNING

Wear three-point seat belts only as described below. In case of an accident or sudden stop, injuries could result from misuse. Three-point seat belts are designed to be worn by one person at a time.

1. Before driving the vehicle, slowly pull the link end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to in-board) far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.
2. Fasten the three-point seat belt by pushing the link into the buckle until it latches. See [Fig. 5.17](#). Give the belt a tug at the buckle. If the buckle unlatches, repeat this step. If the problem continues, replace the three-point seat belt.

Seats and Seat Belts

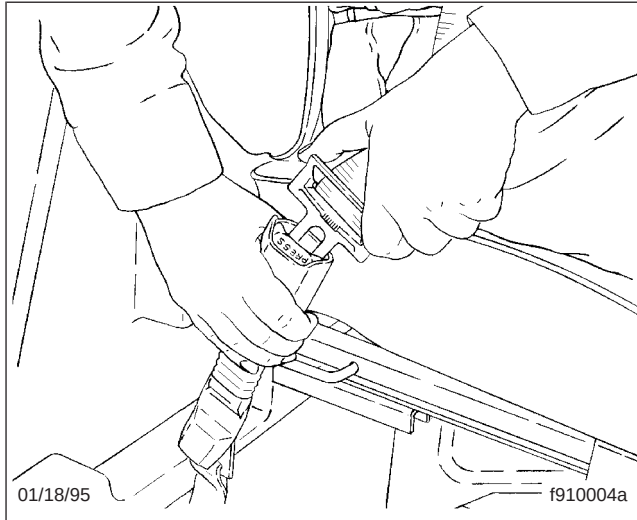


Fig. 5.17, Fastening the Three-Point Belt

3. Position the shoulder strap diagonally across your chest. If desired, engage the Komfort Latch as follows:

Pull on the shoulder strap to lessen the pressure of the strap on your shoulder and chest. Allow no more than one inch (2.5 cm) of slack between your chest and the shoulder harness. More slack can significantly reduce the seat belt's effectiveness in an accident or a sudden stop. While holding the belt slack, press the Komfort Latch lever up, clamping the belt's webbing. See [Fig. 5.18](#) and [Fig. 5.19](#).

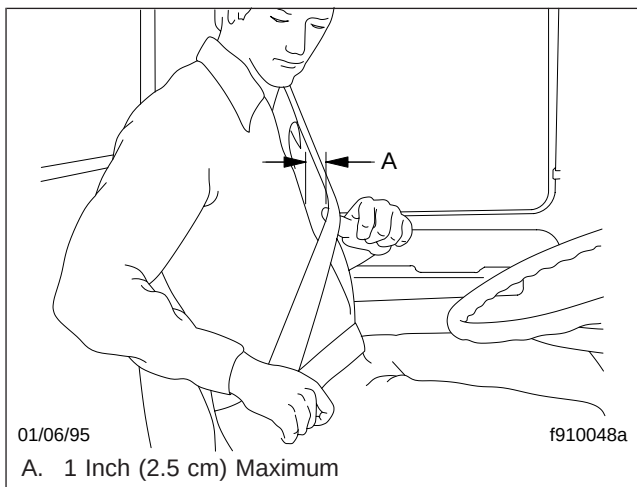


Fig. 5.18, Adjusting Shoulder Harness Clearance

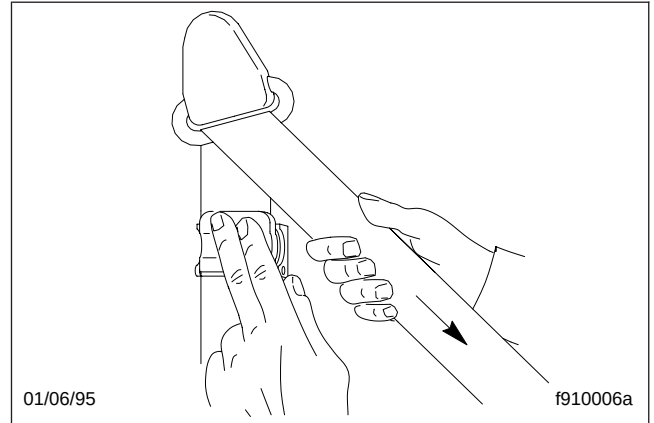


Fig. 5.19, Locking Komfort Latch

4. To unbuckle the three-point seat belt, push the button on the buckle as shown in [Fig. 5.20](#). If the Komfort Latch was used, release it by giving the shoulder belt a quick tug. If you lean forward against the shoulder belt, the Komfort Latch will automatically release, and will need to be reset.

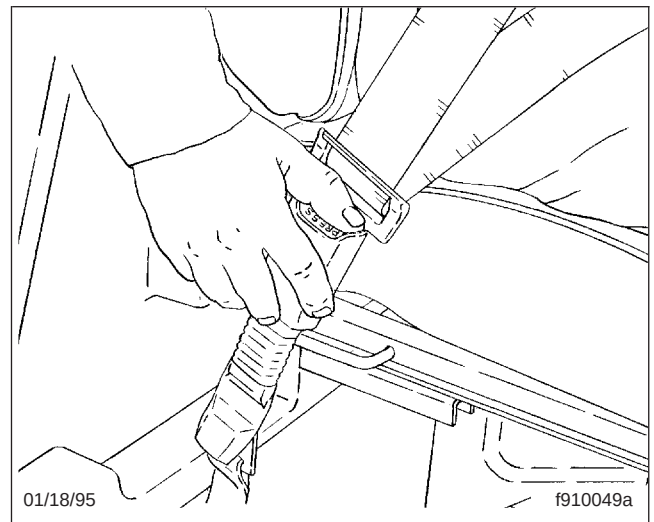


Fig. 5.20, Releasing the Three-Point Seat Belt

NOTE: The Komfort Latch does not have to be released in an emergency situation. The Komfort Latch will release by itself under rough road or other abnormal conditions. Make sure the three-point seat belt is completely retracted when it is not in use.

Seats and Seat Belts

Sleeper Compartment Bunk Restraints

General Information

On vehicles equipped with a sleeper compartment, bunk restraints should be used whenever the sleeper compartment is occupied and the vehicle is moving. Restraints are designed to lessen the chance of injury or the amount of injury resulting from accidents or sudden stops. For this reason, Daimler Trucks North America LLC urges the use of bunk restraints when the sleeper compartment is occupied in a moving vehicle.

WARNING

Do not use the sleeper compartment while the vehicle is in motion unless a bunk restraint is installed and used. Not using the bunk restraint increases the chance of injury, or the degree of injury, from accidents or sudden stops to all occupants of the vehicle.

Belt Adjustment (See Fig. 5.21)

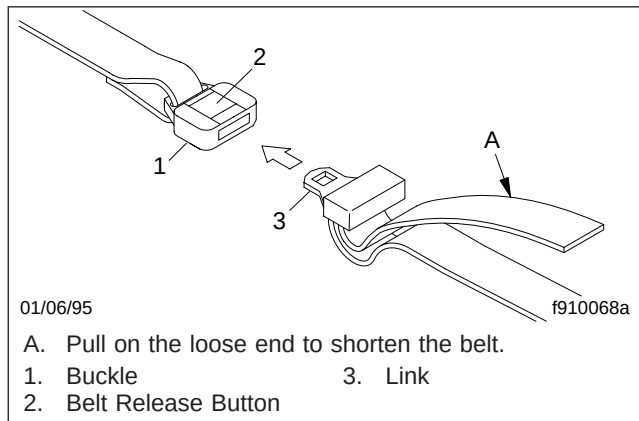


Fig. 5.21, Belt Adjustment

1. Make sure the belt is attached to the bunk support and sleeper wall.
2. To lengthen the belt, tip the link end downward and pull the link until it connects with the buckle.
3. After the belt is connected, shorten it by pulling on the loose end until the belt is snug, but comfortable. Be sure the belts are not twisted.

Bunk Restraint Operation (See Fig. 5.22)

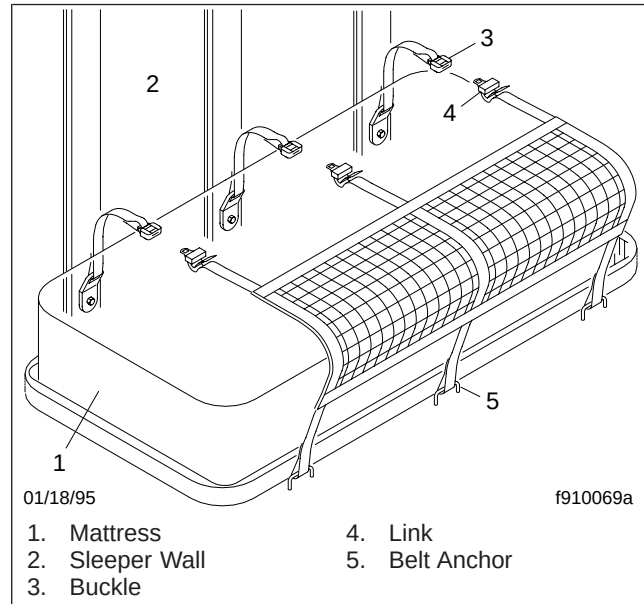


Fig. 5.22, Bunk Restraint in 40-Inch Sleeper Shown

1. Starting at the foot of the bunk, pull up the link end of the belt far enough to engage the buckle.
2. Fasten the belt by pushing the link end into the buckle until they latch. Make sure that the belt is not twisted. Check the engagement by trying to pull the link out of the buckle. If they come apart, repeat this step. If the problem continues, replace the belt. Repeat steps 1 and 2 for the other two belts located in the middle and upper portion of the bunk to lock the restraint in place.

NOTE: On 60-inch raised roof cabs, the upper bunk restraint, if present, pulls up in front of the bunk and fastens at the ceiling.

3. To release the bunk restraint, push the release button on the buckle at the head of the bunk and pull the link from the buckle.

Repeat this step for the other two buckles to completely release the bunk restraint.

NOTE: When the sleeper compartment is not occupied, the bunk restraint can be stored under the mattress.

Seats and Seat Belts

Bunk Mattress

To prevent damage to the bunk mattress and to ensure even wear, it is recommended that the mattress be turned over on a monthly basis.

6

Steering and Brake Systems

Steering System	6.1
Brake System	6.1

Steering and Brake Systems

Steering System

General Information

When there is no load on the vehicle, and the front tires are pointed straight ahead, the steering wheel spokes should be at the 4 and 8 o'clock positions, ± 10 degrees. See **Fig. 6.1**. See **Group 46** of the *Heavy-Duty Trucks Service Manual* for steering adjustment procedures.

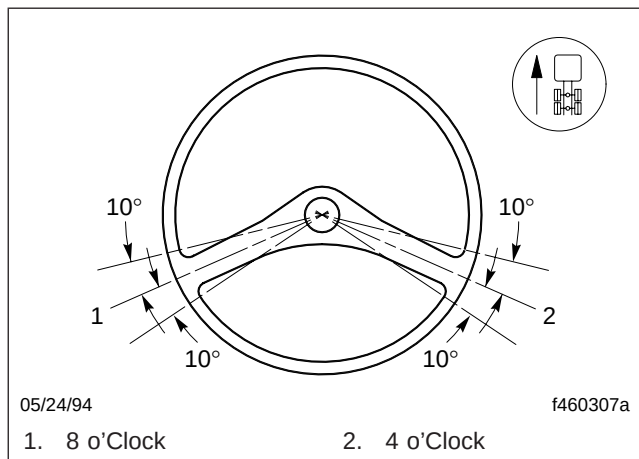


Fig. 6.1, Power Steering Wheel Position (with tires pointed straight ahead)

CAUTION

Never steam clean or high-pressure wash the steering gear. Internal damage to gear seals, and ultimately the steering gear, can result.

Manual Steering Gear Lubrication

When operating in temperatures continuously below 30°F (–1°C), using the wrong type of lubricant in the steering gear could make the steering wheel difficult to turn. To prevent trouble in cold temperatures, be sure that the steering gear lubricant complies with the cold weather recommendations specified in **Group 46** of the *Heavy-Duty Trucks Maintenance Manual*.

WARNING

Failure to comply with the cold weather recommendations could cause inadequate steering

control, which could result in an accident and possible physical injury.

Power Steering System

The power steering system consists of a steering gear (which includes a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder), hydraulic hoses, power steering pump, reservoir, and other components. Some models are also equipped with a separate hydraulic power cylinder on the right side of the front axle. The power steering pump, driven by the engine, provides the power assist for the steering system. If the engine is not running, there is no power assist. If the power-assist feature does not work due to hydraulic fluid loss, steering pump damage, or some other cause, bring the vehicle to a safe stop. Do not drive the vehicle until the cause of the problem has been corrected.

WARNING

Driving the vehicle without the power-assist feature of the steering system requires much greater effort, especially in sharp turns or at low speeds, which could result in an accident and possible injury.

Drivers should carefully use the power available with a power steering system. If the front tires become lodged in a deep chuckhole or rut, drive the vehicle out instead of using the steering system to lift the tires from the hole. Also, avoid turning the tires when they are against a curb, as this places a heavy load on steering components and could damage them.

Brake System

General Information

A dual air brake system uses a single set of brake controls to operate two independent air brake systems. Each system has its own reservoirs, plumbing, and brake chambers. The primary system operates the service brakes on the rear axle; the secondary system operates the service brakes on the front axle. Service brake signals from both systems are sent to the trailer.

Steering and Brake Systems

WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control resulting in property damage or personal injury.

The rear service brakes will not work if the primary system loses air pressure, but the front brakes and the trailer brakes will continue to work with secondary system air pressure. Loss of secondary system air pressure makes the front axle brakes inoperative, but rear service brakes and trailer brakes will operate through the primary system.

Before driving your vehicle, allow time for the air compressor to build up at least 100 psi (689 kPa) pressure in both the primary and secondary systems. Monitor the air pressure system by observing the dual system air pressure gauge and the low-air-pressure warning light and buzzer. The warning light and buzzer shut off when air pressure in both systems reaches 64 to 76 psi (441 to 524 kPa).

The warning light and buzzer come on if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the dual system air pressure gauge to determine which system has low air pressure. The brake pedal will slow the vehicle but since one brake system will not be working, stopping distance will increase. Bring the vehicle to a safe stop, and have the air system repaired before continuing.

On tractor-trailer vehicles, if both the primary and secondary systems become inoperative, the trailer service brakes or spring parking brakes will automatically apply when air pressure drops below 35 to 45 psi (242 to 310 kPa). The tractor spring parking brakes will automatically apply when air pressure drops below 20 to 30 psi (138 to 207 kPa). On straight trucks, spring parking brakes will apply when air pressure drops below 20 to 30 psi (138 to 207 kPa). Do not wait for the brakes to apply automatically; when the warning light and buzzer first come on, immediately bring the vehicle to a safe stop. Before continuing operation of the vehicle, correct the cause of the air loss.

Before the vehicle can be moved, the spring parking brakes must be released by applying an external air

source at the gladhands, or by manually caging the parking brake springs.

WARNING

Do not release the spring parking brakes and then drive the vehicle. There would be no means of stopping the vehicle, which could result in serious personal injury or vehicle damage. Before releasing the spring parking brakes, make the connection to a towing vehicle or chock the tires.

After correcting the brake system problem, uncage the spring parking brakes before resuming normal vehicle operation.

Brake System Operation

Before driving the vehicle, secure all loose items in the cab so that they will not fly forward during a full brake application. Make sure that all passengers are wearing seat belts.

IMPORTANT: An air brake proportioning system is used in tractor air brake systems. When operating in bobtail mode, the rear brake chambers (whose axle load has been greatly reduced) receive reduced or proportional air pressure, while the front axle brake chambers receive full (normal) air pressure. This results in a different brake pedal "feel," as the pedal seems to require more travel and/or effort to slow or stop the vehicle. However, the air brake proportioning system actually improves vehicle control when the tractor is in the bobtail mode of operation. When the tractor is towing a trailer, the rear brake chambers will receive full (normal) application air pressure.

During normal brake stops, depress the foot brake control pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. When the forward speed of the vehicle has decreased to almost the idling speed of the engine, push the clutch pedal in, and shift the transmission into Neutral. Apply the spring parking brakes if the vehicle is to be parked.

IMPORTANT: In the event of a total loss of service brakes with full system air pressure, use the parking brake control valve (yellow knob) to

Steering and Brake Systems

bring the vehicle to a complete stop in the safest location possible.

NOTE: If equipped with main and auxiliary transmissions, do not shift both transmissions into Neutral while the vehicle is rolling. Shifting both transmissions back into gear would be difficult while the vehicle is rolling.

The trailer brake hand control valve (**Fig. 6.2**) actuates the trailer service brakes independently from the vehicle chassis service brakes. The valve can be partially or fully applied, but in any partially-on position it will be overridden by a full application of the foot brake control pedal. Moving the valve handle clockwise actuates the trailer brakes, while moving it counterclockwise releases the trailer brakes. The valve handle remains in the position selected until it is manually moved.

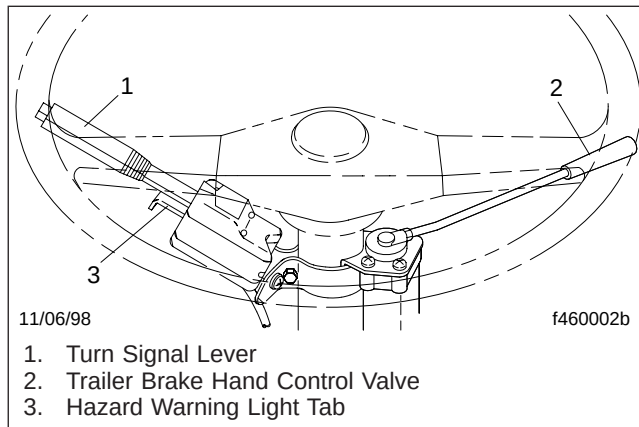


Fig. 6.2, Steering Column-Mounted Controls

WARNING

Do not use the trailer service brakes for parking; they are not designed for this purpose. If air bleeds out of the trailer air tank during parking, the vehicle could roll causing serious personal injury or property damage.

The red octagonal-shaped knob (**Fig. 6.3**) in the control panel actuates the trailer air supply valve. After the vehicle's air hoses are connected to a trailer, and the pressure in both air systems is at least 65 psi (448 kPa), the red knob must be pushed in. It should stay in, to charge the trailer air supply system and to release the trailer spring parking brakes; it must be pulled out before disconnecting a trailer. It must also

be pulled out when operating a vehicle without a trailer. If pressure in both air systems drops to 35 to 45 psi (242 to 310 kPa), the red knob automatically pops out, exhausting the trailer air supply, and applying the trailer service or spring parking brakes.

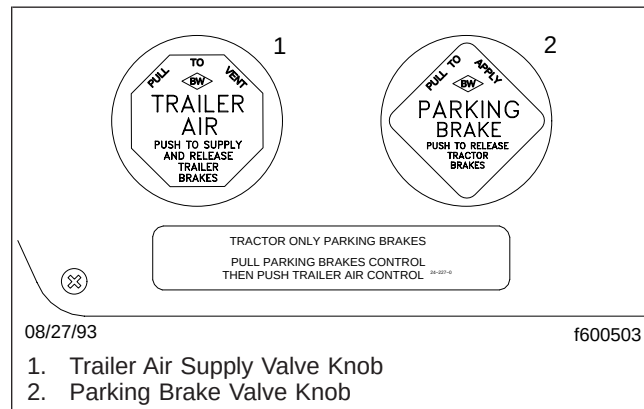


Fig. 6.3, Trailer Air Supply/Parking Brake Control Panel

The yellow diamond-shaped knob (**Fig. 6.3**) in the control panel actuates the parking brake valve. Pulling out the knob applies both the tractor and the trailer spring parking brakes and automatically causes the trailer air supply valve knob to pop out.

CAUTION

Do not use the spring parking brakes if the service brakes are hot, such as after descending a steep grade. Also, do not use the spring parking brakes during freezing temperatures if the service brakes are wet. To do so could damage the brakes if hot, or cause them to freeze during cold weather.

If the brakes are wet, drive the vehicle in low gear and lightly apply the brakes to heat and dry them. Allow hot brakes to cool before using the spring parking brakes. Always chock the tires.

If the trailer is not equipped with spring parking brakes, pulling out the yellow knob applies the tractor spring parking brakes and the trailer service brakes. When the tractor and trailer parking brakes (or trailer service brakes) are both applied, the trailer brakes are released by pushing in the red knob, leaving the tractor parking brakes applied. Air pressure in the primary or secondary reservoir must be at least 65 psi (447 kPa) before the tractor spring parking

Steering and Brake Systems

brakes, or the trailer service or spring parking brakes, can be released.

On trailers not equipped with spring parking brakes, chock the trailer tires before disconnecting the truck or tractor when parking just the trailer.

When parking a truck or tractor with a trailer (combination vehicle), and the trailer is not equipped with spring parking brakes, apply the truck or tractor spring parking brakes.

WARNING

If a trailer is not equipped with spring parking brakes, do not park it or a combination vehicle by pulling out only the trailer air supply valve knob. This would apply only the trailer service brakes. If air were to bleed from the trailer brake system, the trailer brakes would release, possibly causing an unattended runaway vehicle.

CAUTION

Never apply the service and spring parking brakes simultaneously. To do so transmits excessive input force to the brake components, which could damage or cause eventual failure of brake actuating components.

Meritor WABCO® Antilock Braking System (ABS)

The Meritor WABCO Antilock Braking System (ABS) is an electronic wheel speed monitoring and control system that works with the standard air brake system. ABS passively monitors vehicle wheel speed at all times, but *controls* wheel speed during an emergency or reduced-traction stop. In normal braking applications, the standard air brake system is in effect.

IMPORTANT: For proper ABS system operation, do not change tire sizes. The sizes of the tires installed during production are programmed into the electronic control unit. Installing different sized tires could result in a reduced braking force, leading to longer stopping distances.

ABS includes signal-generating tone wheels and sensors located in the wheel hubs of each sensed axle. The sensors transmit vehicle wheel speed information to an electronic control unit (ECU) located be-

hind the passenger seat. The ECU interprets the speed sensor signals and compares wheel speed, wheel braking and vehicle speed. If it senses wheel lockup, the ECU signals the appropriate solenoid control valve to reduce braking. During emergency braking, the solenoid control valve constantly adjusts air pressure supply in the brake chambers to prevent wheel lockup.

CAUTION

An accumulation of road salt, dirt, or debris on the ABS tone wheels and sensors can cause the ABS warning light to come on. If the ABS light does come on, the tone rings and sensors should be inspected for corrosion and serviced if necessary. The service should include cleaning of the tone rings and sensors. If any tone ring on a vehicle shows severe corrosion, all tone rings on that vehicle should be replaced.

During winter months in areas where corrosive materials are used on the highways, periodically clean the underside of the vehicle, including the tone rings and sensors, to ensure proper ABS function and to protect the components from corrosion. Clean more frequently when unusually corrosive chemicals are being used.

The electronic control unit also has a safety circuit that constantly monitors the wheel sensors, solenoid control valves, and the electrical circuitry. If only the tractor is equipped with an ABS system, the tractor warning light (TRAC ABS) comes on after the engine is started. See [Fig. 6.4](#). If all of the tractor's ABS components are working, the light should go out when the vehicle moves faster than about 4 mph (6 km/h).

If equipped with the tractor and trailer ABS system, the vehicle also has a trailer warning light labelled TRLR ABS ([Fig. 6.4](#)).

After the engine is started, the TRLR ABS light comes on if the trailer is equipped with a compatible ABS system. Once the vehicle moves faster than about 4 mph (6 km/h), the TRLR ABS warning light goes out only if all of the trailer's ABS components are working.

For more information on trailer ABS lamp operation, see *Trailer ABS Lamp Operation* in this chapter.

A wheel spin indicator light (WHL SPIN) comes on if one of the drive wheels spins during acceleration

Steering and Brake Systems

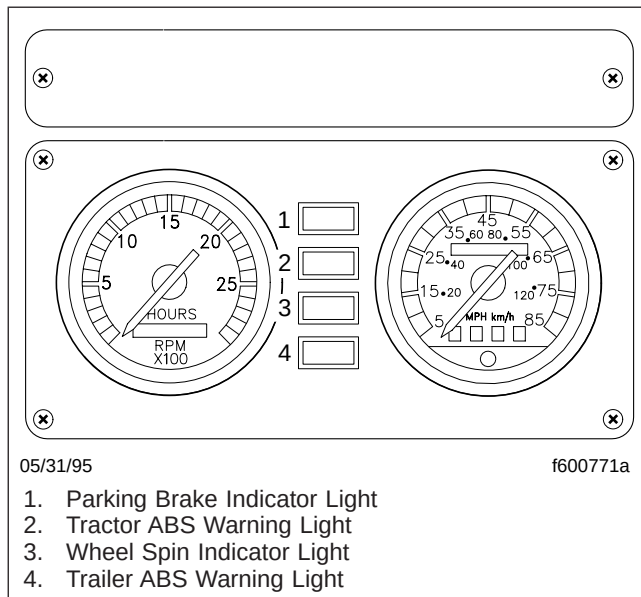


Fig. 6.4, Warning and Indicator Lights

(Fig. 6.4). The light goes out when the wheel stops spinning. When the light comes on, partially release the throttle pedal until the light goes out. If slippery road conditions continue, engage the axle lock.

CAUTION

Do not engage the axle lock while the WHL SPIN light is on. To do so could damage the rear axle. See Chapter 9, "Rear Axles," for axle lock instructions.

If the vehicle is equipped with an electronic engine, an automatic traction control (ATC) system may be installed. On these vehicles, the ATC system automatically reduces wheel spin during reduced-traction starts.

An "ATC Function" switch (if equipped), allows the driver to select from two levels of drive axle traction-control assistance:

- **NORMAL**—reduces drive axle wheel spin on icy, wet, or sand covered roads.
- **DEEP SNOW/MUD**—allows a higher threshold of drive axle wheel spin to help burn through a thin layer of ice, or to help throw off accumulated mud or snow.

The DEEP SNOW/MUD mode is indicated by a flashing WHL SPIN light. To engage this mode, the

ATC function switch must be in the NORMAL position when the vehicle is initially powered up. Once the vehicle is started, the ATC function switch can be set to the DEEP SNOW/MUD position. The ECU indicates this change by a constant flashing of the WHL SPIN lamp (or by illumination of the DEEP SNOW/MUD light (Fig. 6.4) on vehicles built before July, 1994).

If the ATC function switch is in the DEEP SNOW/MUD position when the vehicle is powered up, the ECU will not accept this function change and will remain in the NORMAL mode. Indication of this condition will be the absence of the flashing WHL SPIN light (on vehicles built before July, 1994, the absence of an illuminated DEEP SNOW/MUD light). To engage the DEEP SNOW/MUD mode in this situation, change the position of the ATC function switch to the NORMAL mode. After 2 seconds, move the switch to the DEEP SNOW/MUD position. When this occurs, the indicator light will activate as previously described.

IMPORTANT: ABS and ATC blink code diagnostics should only be performed when the vehicle is stopped. If the vehicle is equipped with ATC, turning "On" the ABS CHK switch will reduce engine speed to idle for 3 seconds and affect ATC function performance. If the vehicle is driven with the ABS CHK switch "On" (in the "Up" position), the WHL SPIN light will illuminate continuously. Under this condition, turning the ABS CHK switch "Off" (in the "Down" position), while the vehicle is still in motion, will only turn off the WHL SPIN light, but will not restore ATC function performance. To fully restore engine and ATC function capability, the vehicle must be brought to a complete stop. Then, move the ABS CHK switch to "Off" (in the "Down" position).

The Meritor WABCO ABS system combines one front-axle control channel with either one rear axle (the 4-channel system), or two rear axles (the 6-channel system) to form one control circuit. For example, the sensor and solenoid control valve at the left-front axle form a control circuit with the sensor(s) and solenoid control valve(s) on the right rear axle(s). If, during vehicle operation, the safety circuit senses a failure in any part of the ABS system (a sensor, solenoid control valve, wiring connection, short circuit, etc.), the tractor warning light (TRAC

Steering and Brake Systems

ABS) comes on and the control circuit where the failure occurred is switched to normal braking action. The remaining control circuit will retain the ABS effect. Even if the ABS system is partially or completely inoperative, normal braking ability is maintained. The vehicle is not disabled.

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, repair the ABS system immediately to ensure full antilock braking capability.

During emergency or reduced-traction stops, fully depress the brake pedal until the vehicle comes to a safe stop; *do not pump* the brake pedal. With the brake pedal fully depressed, the ABS system will control all wheels to provide steering control and a reduced braking distance.

Although the ABS system improves vehicle control during emergency braking situations, the driver still has the responsibility to drive appropriately for existing traffic and road conditions. For example, the ABS system cannot prevent an accident if the driver is speeding or following too closely on slippery road surfaces.

Trailer ABS Lamp Operation

Antilock braking systems on tractors are designed to communicate with trailer ABS systems, if they are compatible. Compatibility will result in the illumination of the trailer ABS lamp during vehicle start-up and fault detection.

The dash-mounted lamp will operate as follows when a compatible trailer is properly connected to a tractor:

- When the ignition key is turned to the ON position, the trailer ABS lamp will illuminate momentarily, then turn off.
- If the lamp comes on momentarily during vehicle operation, then shuts off, a fault was detected and corrected.
- If the lamp comes on and stays on during vehicle operation, there is a fault with the trailer ABS. Repair the trailer ABS system immediately to ensure full antilock braking capability.

The Trailer ABS lamp will not illuminate unless a compatible trailer is connected to the tractor.

IMPORTANT: If a compatible trailer is connected and the lamp is not illuminating momentarily

when the ignition key is turned to the ON position, it is possible that the lamp is burned out.

Automatic Slack Adjusters

Automatic slack adjusters are required on all vehicles equipped with air brakes manufactured after October 20, 1994. Automatic slack adjusters should never be manually adjusted except during routine maintenance of the foundation brakes (e.g., replacing shoes), during slack adjuster installation or in an emergency situation.

When the brake pushrod stroke exceeds the legal brake adjustment limit on a vehicle, there is likely a mechanical problem with the foundation brake components or the adjuster is improperly installed.

Visit a repair facility as soon as possible when brakes equipped with automatic slack adjusters are determined to be out of adjustment.



Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. In fact, continual adjustment of automatic slack adjusters may result in premature wear of the adjuster itself. Further, the improper adjustment of some automatic slack adjusters may cause internal damage to the adjuster, thereby preventing it from properly functioning.

7

Engines and Clutches

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Engines and Clutches

EPA07 Aftertreatment System (ATS)

All on-road diesel engines built after December 31, 2006 (EPA07 engines) must meet strict new guidelines for reduced emissions of particulate matter and nitrogen oxides (NOx) from the exhaust. NOx is limited to just over 1 gram per brake horsepower hour (g/bhp-hr) and particulate matter cannot exceed 0.01 g/bhp-hr.

EPA07-compliant engines require ultralow-sulfur diesel (ULSD) fuel, and they should never be run on fuel with sulfur content higher than 15 ppm. In addition, they require low-ash engine oil. The following guidelines must be followed or the warranty may be compromised.

- Use ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less, based on ASTM D2622 test procedure.
- Do not use fuel blended with used engine lube oil or kerosene.
- Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.

The "exhaust system" in EPA07-compliant vehicles is called the aftertreatment system (ATS). The ATS varies according to engine manufacturer and vehicle configuration, but instead of a muffler, an aftertreatment system has a device that outwardly resembles a muffler, called the aftertreatment device (ATD).

IMPORTANT: See your engine operation manual for complete details and operation of the aftertreatment system.

Inside the ATD on Mercedes-Benz, Detroit Diesel, and Cummins engines, the exhaust first passes over the diesel oxidation catalyst (DOC), then it passes through the diesel particulate filter (DPF), which traps soot particles. If exhaust temperature is high enough, the trapped soot is reduced to ash, in a process called passive regeneration (regen). **Passive regeneration** occurs as the vehicle is driven normally under load; the driver is not even aware that it is happening. The harder an EPA07 engine works, the better it disposes of soot, as the exhaust heat alone is enough to burn the soot to ash. Over the course of a workday, however, passive regeneration cannot always keep the ATD filter clean, so the filter must undergo **active regeneration**. In active regeneration,

extra fuel is injected into the exhaust stream to superheat the soot trapped in the DPF and turn it to ash. Active regeneration happens only when the vehicle is moving above a certain speed, determined by the engine manufacturer. Consult manufacturers' documentation for details.

Both active and passive regeneration happen automatically, without driver input.

NOTE: Caterpillar engines do not use a DOC; Cat engines burn diesel fuel at the regeneration head to superheat the exhaust and burn the trapped soot to ash. Engine software monitors and controls this process.

If conditions do not provide for at-speed active regeneration, the vehicle will need a driver-activated **parked regeneration**. The vehicle must be standing still, and the driver must initiate parked regen. Completing a parked regen takes 20 minutes to an hour, depending on ambient conditions.



During parked regeneration, exhaust temperatures are very high, and could cause a fire, heat damage to objects or materials, or personal injury to persons near the exhaust outlet.

Before initiating a parked regeneration, make certain the exhaust outlets are directed away from structures, trees, vegetation, flammable materials, and anything else that may be damaged or injured by prolonged exposure to high heat.

There are three warning lamps in the driver message center that alert the driver of the need to perform a parked regen, clean the filter, or of an engine fault that affects the emissions.

A slow (10-second) flash of the high exhaust system temperature (HEST) lamp, indicates a regeneration is in progress, and the driver is not controlling the engine idle speed.

A solid illuminated high exhaust system temperature (HEST) lamp, alerts the operator of high exhaust temperature during the regeneration process, when the speed is below 5 mph (8 km/h). The HEST lamp does not signify the need for any kind of vehicle or engine service; it only alerts the vehicle operator of high exhaust temperatures. Make sure the engine exhaust pipe outlet is not directed at any person, or

Engines and Clutches

at any surface or material that will melt, burn, or explode. See [Fig. 7.1](#).

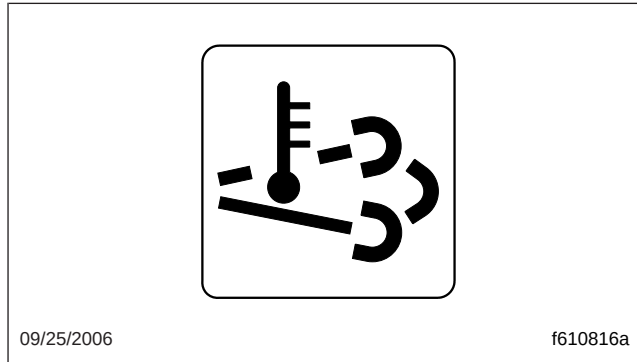


Fig. 7.1, High Exhaust System Temperature (HEST) Lamp

WARNING

Active regeneration can occur automatically any time the vehicle is moving. The exhaust gas temperature could reach 1500°F (800°C), which is hot enough to ignite or melt common materials, and to burn people. The exhaust can remain hot after the vehicle has stopped moving.

A solid yellow diesel particulate filter (DPF) lamp indicates that a parked regen is required soon, and should be scheduled for the earliest convenient time. See [Fig. 7.2](#). A blinking yellow DPF lamp indicates that a parked regen is required immediately, or an engine derate may occur.

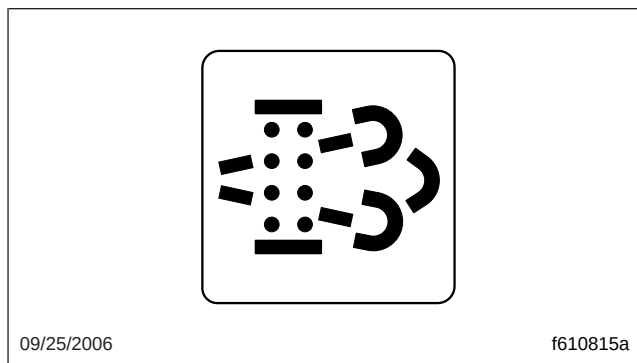


Fig. 7.2, Diesel Particulate Filter (DPF) Status Lamp

A solid yellow malfunction indicator lamp (MIL) indicates an engine fault that affects the emissions. See [Fig. 7.3](#).

Diesel particulate filter servicing must be performed by an authorized technician, and a record must be maintained for warranty purposes. The record must include:

- date of cleaning or replacement;
- vehicle mileage;
- particulate filter part number and serial number.

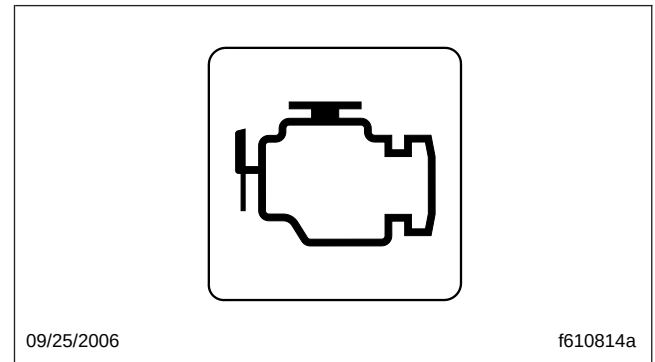


Fig. 7.3, Malfunction Indicator Lamp (MIL)

The request/inhibit regen switch ([Fig. 7.4](#)), located on the dash, may have three selectable positions:

- request regeneration;
- default (can include appropriate normal state condition—either in an automatic regeneration or inhibit state);
- inhibit regeneration.

NOTE: The regen switch can start an active regen only when at least one of two conditions exists: either the DPF light is lit, or the engine software calls for it. If neither of those conditions exist, the regen switch cannot cause a regeneration to happen.

The function of the switch will vary by the engine make and model in the vehicle. See the engine operation manual for switch operation details.

Engine Starting

For cold-weather starting, refer to "Ether Start System" in this chapter.

Engines and Clutches

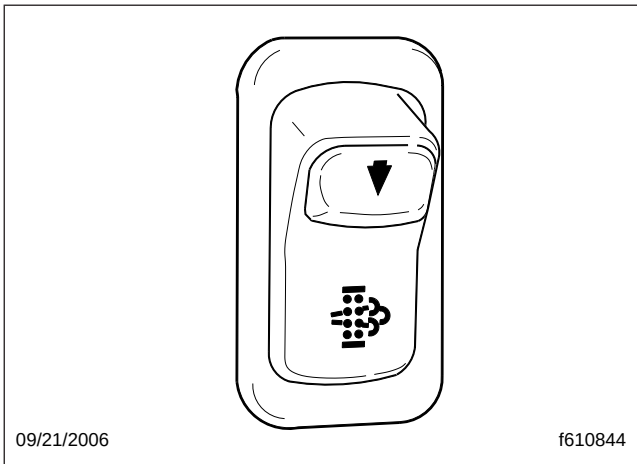


Fig. 7.4, Request/Inhibit Regen Switch

CAUTION

When starting a vehicle equipped with a manual transmission and clutch lockout switch, the clutch pedal must be fully depressed during the entire start sequence. Failure to do so can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

If a vehicle does not start on the first attempt, make sure that the engine has completely stopped rotating before reapplying the starter switch. Failure to do so can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

Moving a vehicle with the starter and/or using the starter to bump the engine for maintenance procedures is strictly prohibited. Use of these methods to bump the engine over or move the vehicle can cause the pinion to release and re-engage, which could cause ring gear and starter pinion damage.

IMPORTANT: Ring gear and starter pinion damage caused by improper starting procedures is not warrantable.

Caterpillar

NOTE: Before starting the engine, read [Chapter 2](#) in this manual for detailed information on how to read the instruments and operate the controls.

The information below contains guidelines for cold-weather starting. For additional information, refer to "Ether Start System."

WARNING

Do not use any starting aid, such as ether, in engines with an intake air preheater. This could cause an explosion, resulting in serious personal injury or death.

1. Before engine start-up, perform the engine pre-trip inspection and daily maintenance checks in [Chapter 11](#).
2. Set the spring parking brakes.
3. Turn the ignition switch to the on position. All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

NOTE: The engine electronics supply the correct amount of fuel for starting the engine. Pedal pressure is unnecessary.

4. Turn the ignition switch to the start position. Do not press down on the throttle pedal. Release the switch the moment the engine starts. If the engine does not start after 30 seconds of cranking, turn the ignition switch off.

NOTE: Some starters are equipped with optional overcrank protection. If overcranking occurs, a thermostat breaks the electrical circuit to the starter motor until the motor has cooled. For air start systems, check the air supply before starting the engine. There must be 100 psi (689 kPa) of air pressure available.

5. Wait two minutes to allow the starter motor to cool. Turn the ignition switch back to the on position and try to start the engine again.

CAUTION

If the oil pressure is less than 5 psi (35 kPa), shut down the engine immediately to prevent serious damage. If the vehicle is equipped with an automatic shutdown system, the engine will shut down after 30 seconds.

Engines and Clutches

6. C-10, C-12, and C-15 engines may be operated at low load and speed once the engine oil pressure has reached 10 to 20 psi (69 to 138 kPa). When the engine has reached the normal operating temperature of 189°F (87°C), the engine may be operated at full load

Cummins and Detroit Diesel

NOTE: Before starting the engine, read **Chapter 2** in this manual for detailed information on how to read the instruments and operate the controls. On vehicles equipped with a neutral start switch, the transmission must be in neutral before the engine can be started.

1. Before engine start-up, perform the engine pre-trip inspection and daily maintenance checks in **Chapter 11** of this manual.
2. Set the spring parking brakes.



CAUTION

Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until normal engine idle oil pressure registers on the gauge.

3. Set the throttle idle (hold down the clutch pedal).
4. Make sure the transmission is in neutral.



CAUTION

Do not crank the engine for more than 30 seconds at a time. Wait two minutes after each try to allow the starter to cool. Failure to do so could cause starter damage.

5. Turn on the ignition switch.

NOTE: A manual override knob, provided on the forward end of the electric shutdown valve, allows the valve to be opened in case of electric power failure. To use the override, open it by turning the knob fully clockwise. Return it to the run position after repair.

IMPORTANT: For Detroit Diesel engines, pumping the accelerator before or during cranking will not aid in starting. If the engine won't start, check the main engine power fuses; they may have blown. The fuses are located along the

main engine electrical harness on the left frame rail, near the batteries. If needed, replace the fuses. Be sure to find the cause of the blown fuses as soon as possible.

NOTE: Some starters are equipped with an optional thermostat. If overcranking occurs, the thermostat breaks the electrical current to the starter motor until the motor has cooled.

6. Press the start button. Release the button the moment the engine starts.

If the vehicle is equipped with an automatic engine shutdown system with a manual override push button, press the override button while pressing the engine start button. Once the engine has started, release the engine start button, but continue to press the override push button until the warning bell stops.

If the vehicle is equipped with a battery isolator system, and the gel cell battery is completely discharged, press and hold the battery boost push button while pressing the starter push button. This will temporarily disconnect the isolated battery while connecting the engine-starting batteries to the ignition switch for engine starting.

7. When the engine is started, it takes a while to get the lubricating oil film reestablished between the shafts and bearings, and between the pistons and liners. Bring the engine up to operating speed gradually as it warms up and develops stable oil pressure.

The oil pressure gauge indicates any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system. The operator should note the loss of oil pressure and shut down the engine before damage can occur.

8. During the warm-up period, apply the load gradually until the oil temperature reaches 140°F (60°C). For an engine starting a loaded vehicle, the coolant temperature must be approximately 120°F (49°C).

Starting After Extended Shutdown or Oil Change

Do the following steps after an oil change or after the engine has been shut down for more than three days:

Engines and Clutches

1. Disconnect the wire from the fuel pump solenoid valve.
2. Crank the engine until oil pressure shows on the gauge.
3. Connect the wire to the fuel pump solenoid valve.
4. Start the engine. Refer to "Engine Starting" above.

Ether Start System

Ether allows combustion with lower cylinder temperatures. A pressurized spray-can or a rag dampened with fluid will usually provide quick starting to as low as -10°F (-23°C). Below this temperature, some means of injecting a carbureted vapor directly into the intake manifold is necessary.

Caterpillar truck engines with direct injection are designed to start at temperatures above 10°F (-12°C) without using start systems. If the temperature is below 10°F (-12°C), a start system may be necessary and/or crankcase oil may need to be heated. Jacket water heaters are often used to assist starting in cold temperatures.

The cold start system, approved for use on Cummins engines, has been based upon starting aid capabilities to -25°F (-32°C).

WARNING

If using a cold-weather-start system, be sure to follow the manufacturer's instructions regarding its use, handling, and storage. Many starting fluids are in capsules or pressure cans, and improper usage can be dangerous.

Do not attempt to use any type of vapor-compound start system near heat or open flame. Engine damage due to an explosion or fire in the intake manifold could result.

Do not breathe the ether fumes; doing so could result in personal injury.

Cold-Weather Operation

IMPORTANT: If a winterfront is used on a vehicle with an electronic engine equipped with a charge air cooler, make sure that there are slit openings distributed across the face of the win-

terfront to allow airflow through the entire charge-air-cooler core. Do not use a winterfront with closed areas that block uniform air flow across any sections of the charge-air-cooler crossflow tubes. This will adversely affect the operation and durability of the charge air cooler.

Caterpillar

If the engine is in good mechanical condition and the precautions necessary for cold-weather operation are taken, ordinary cold weather will not cause difficulty in starting, or loss of efficiency.

If the engine does not start, prime the fuel system.

When the use of unblended No. 2 diesel fuel in winter cannot be avoided, install a thermostatically controlled fuel heater. Fuel heaters can prevent wax from clogging the fuel filters and formation of ice crystals from water in the fuel.

IMPORTANT: If a fuel heater is used, make sure it has thermostatic controls to prevent excessive heating of the fuel in warm weather. Excessive heating of fuel can cause a loss of engine power.

For cold-weather operation, use the following guidelines:

1. When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity. See your engine operation and maintenance manual for specifications.
2. When the temperature is below freezing, use sufficient antifreeze solution in the cooling system to prevent freezing. Refer to **Group 20** of the *Heavy-Duty Trucks Maintenance Manual* for specifications.
3. During cold weather, give more attention to the condition of the batteries. Test them frequently to ensure sufficient power for starting. Inspect all switches and connections in the electrical system and keep them in good condition to prevent losses through poor contacts. See **Group 15** of the *Heavy-Duty Trucks Service Manual* for detailed information.

WARNING

Do not use any starting aid, such as ether, in engines with an intake air preheater. This could

Engines and Clutches

cause an explosion, resulting in serious personal injury or death.

4. If so equipped, turn off the battery disconnect switch after the engine is stopped to prevent battery discharge while the starter motor is cooling.

For starting below 0°F (–18°C), an optional cold-weather starting assist is recommended. For temperatures below –10°F (–23°C), consult your Caterpillar dealer for recommendations.

5. When the customer parameters include cold mode operation and the coolant temperature is below 64°F (18°C), the system puts the engine in cold mode, limiting engine power, advancing timing, and adjusting the low idle to 600 rpm (for C-15 engines) or 800 rpm (for C-10 and C-12 engines) to improve warm-up time. The system will keep the engine in cold mode until the coolant temperature rises above 82°F (28°C). After the cold mode has been completed, operate the vehicle at low load and low rpm until the engine coolant reaches the normal operating temperature of 189°F (87°C).
6. Fuel cloud point is the temperature at which wax crystals become visible, which is generally above the pour point of the fuel. To keep the fuel filter elements from plugging with wax crystals, the cloud point should be no higher than the lowest ambient temperature at which the engine must start.

Cummins

Satisfactory performance of a diesel engine operating in low ambient temperatures requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The colder the temperatures, the greater the amount of modification required, and yet with the modifications applied the engines must still be capable of operation in warmer climates without extensive changes.

The following information is provided to engine owners, operators, and maintenance personnel on how the modifications can be applied to get satisfactory performance from their diesel engines.

There are three basic objectives:

- Reasonable starting characteristics followed by practical and dependable warm-up of the engine and equipment.

- A unit or installation which is as independent as possible from external influences.
- Modifications which maintain satisfactory operating temperatures with a minimum increase in maintenance of the equipment and accessories.

If satisfactory engine temperature is not maintained, higher maintenance cost will result due to increased engine wear. Special provisions to overcome low temperatures are definitely necessary, whereas a change to a warmer climate normally requires only a minimum of revision. Most of the accessories should be designed in such a way that they can be disconnected so there is little effect on the engine when they are not in use.

The two most commonly used terms associated with preparation of equipment for low-temperature operation are "winterization" and "arctic specifications."

Winterization of the engine and/or components so that starting and operating are possible in the lowest temperature to be encountered, requires:

- A. Proper lubrication with low-temperature lubricating oils.
- B. Protection from the low-temperature air. The metal temperature does not change, but the rate of heat dissipation is affected.
- C. Fuel of the proper grade for the lowest temperature.
- D. Heat to raise the engine block and component temperatures to at least –25°F (–32°C) for starting in lower temperatures.
- E. Electrical equipment capable of operating in the lowest expected temperature. All switches, connections, and batteries in the electrical system should be inspected and kept in good condition to prevent losses through poor contacts.

Arctic specifications refer to the design of material and specifications of components necessary for satisfactory engine operation in extremely low temperatures to –65°F (–54°C). Contact the nearest Freightliner dealer or Cummins engine dealer, to obtain the special items required.

Engines and Clutches

CAUTION

"Antileak" antifreezes are not recommended for use in Cummins engines. Although these antifreezes are chemically compatible with DCA water treatment, the "antileak" agents may clog the coolant filters.

IMPORTANT: Fuel heaters used on vehicles with Cummins PACE or CELECT engine systems could cause high fuel temperatures that affect engine performance and operation of the electronic engine controls. If a fuel heater is used, make sure it has thermostatic controls. If the fuel heater has a timer, set the timer to activate only for a limited period of time before the engine starts. Make sure the fuel heater is used only for starting the engine.

Detroit Diesel

Preparations made in advance of winter and maintenance performed during the cold months will help to ensure efficient engine starting and operation.

1. Engine oil thickens as it gets colder, slowing cranking speed. When cold, multigrade oil offers less resistance to the cranking effort of the engine and permits sufficient rpm to be developed to start the engine. Refer to "Lubricating Oil Recommendations" in the Detroit Diesel *Owner's and Operator's Guide* for specific recommendations.
2. When an engine equipped with a DDEC system is started at temperatures below 25°F (–4°C), the idle speed automatically increases to 900 rpm. The injection timing is also advanced to decrease white smoke. As the engine oil warms up, the idle speed gradually decreases. When the oil temperature reaches 122°F (50°C), both the idle speed and the injection timing return to normal.
3. During cold weather, the batteries should be tested more frequently to ensure ample power for starting. All electrical connections should be tight and in good condition to prevent losses through loose or corroded connections.
4. The ether start system should be properly charged and in good working order.
5. Ethylene-glycol-base antifreeze is recommended. An inhibitor system is included in this type of antifreeze and the corrosion protection is sufficient

as long as the recommended concentration range of 30 to 67 percent (antifreeze to water by volume) is employed. See **Group 20** of the *Heavy-Duty Trucks Maintenance Manual* for cooling system capacity and quantity of antifreeze required for the lowest anticipated temperature.

6. If the engine is to be operated in arctic temperatures, consult the nearest Freightliner dealer or an authorized Detroit Diesel engine dealer for information regarding availability of special cold weather equipment.

Engine Break-In

Every engine is tested on a dynamometer before shipment, eliminating the need for a break-in period. Before running the engine for the first time, follow the instructions in the Engine Operator's Manual.

Engine Operation

DANGER

Do not operate the engine in an area where flammable vapors such as gasoline or diesel fumes are present. Shut down the engine when in an area where flammable liquids or gases are being handled. Failure to observe these precautions could result in serious injury or death.

All diesel engines have been built to comply with the requirements of the Federal (U.S.) Clean Air Act. Once an engine is placed in service, the responsibility for meeting both state and local regulations is with the owner/operator. Good operating practices, regular maintenance, and correct adjustments are factors that will help to stay within the regulations. Proper maintenance of the engine, which is the responsibility of the owner/operator, is essential to keep the emission levels low.

Engine Protection

On electronic engines, an engine-protection system monitors all engine sensors and electronic components, and recognizes system malfunctions. If a critical fault is detected, an amber check-engine warning lamp and a red stop-engine lamp illuminate.

The standard parameters that are monitored for engine protection are: low coolant level, high coolant

Engines and Clutches

temperature, low oil pressure, high soot level (DPF), and uncontrolled DPF regeneration.

Amber Check-Engine Warning Lamp

When the amber check-engine warning lamp comes on for any reason, the vehicle can still be operated, and the driver can proceed to the required destination. This condition should be reported to an authorized service center as soon as possible.

Red Stop-Engine Lamp



When the red stop-engine light illuminates, most engines are programmed to shut down automatically within 30 seconds. The driver must immediately move the vehicle to a safe location at the side of the road to prevent causing a hazardous situation that could cause bodily injury, property damage, or severe damage to the engine.

The red stop-engine lamp illuminates to indicate that the engine-protection system has been activated. The conditions that will cause the red stop-engine lamp to come on are:

- high coolant temperature
- loss of coolant
- low oil pressure
- high soot level (DPF)
- uncontrolled DPF regeneration

On some engines, the engine ECU will derate the engine, allowing it to run at low rpm and slow vehicle speed, until the vehicle can be driven to a safe location or to a service facility. On other engines, the engine ECU will first derate the engine, then if the condition does not improve, shut it down completely 30 seconds after the light comes on. The driver must safely bring the vehicle to a stop on the side of the road before the engine shuts down.

To restart the engine (override the shutdown command) turn the ignition switch to OFF, leave it there a few seconds, and turn the switch to START. The engine will run for a short period and shut down again if the condition does not improve.

IMPORTANT: Do not attempt to restart the engine while the vehicle is moving. Bring the ve-

hicle to a safe stop and restart the engine with the vehicle stopped.

Stop-Engine Override Switch

If the vehicle is equipped with a stop-engine override (SEO) switch, it can be used to override the shutdown sequence. This override resets the shutdown timer, restoring power to the previous level before the red stop-engine lamp was illuminated. The switch must be recycled after five seconds to obtain a subsequent override.



Using the override button so the engine operates for an extended period may result in engine damage. The operator has the responsibility to take action to avoid engine damage.

Caterpillar Engine Operation

Proper operation and maintenance are key factors in obtaining the maximum life and economy of a vehicle engine. Follow the directions in the Caterpillar *Operation and Maintenance Management Manual* and this manual for trouble-free, economical engine operation.

1. Operate the engine at low load. After normal oil pressure is reached and the temperature gauge begins to move, the engine may be operated at full load.

Caterpillar electronic engines automatically idle at 900 to 1000 rpm for the correct warm up time after a cold engine start (less than 40°F [5°C]). These electronic engine systems will reduce the idle speed to 600 rpm when the engine is warm enough to drive the vehicle.

IMPORTANT: Fuel heaters used on vehicles with Caterpillar electronic engines could cause excessive fuel temperatures that affect engine performance and operation of the electronic engine controls. If a fuel heater is used, make sure it has thermostatic controls. If the fuel heater has a timer, set the timer to activate only for a limited period of time before the engine starts. Make sure the fuel heater is used only for starting the engine.

2. Keep the engine speed to a minimum. An acceptable range is 1200 to 1600 rpm.

Engines and Clutches

3. Select a gear that allows a smooth, easy start without increasing engine speed above low idle or slipping the clutch. Engage the clutch smoothly. Jerky starts waste fuel and put stress on the drivetrain.

It is not necessary to accelerate Caterpillar electronic engines to governed speed in the lower gears to get the vehicle moving, except in a high power demand situation such as starting on a grade.

4. Continue to upshift until cruising speed is reached. Use only the rpm needed to make an upshift into the next gear. The engine speed needed to make an upshift increases as the vehicle speed increases or if upshifts are made on uphill grades. If the vehicle can be operated in a higher gear after reaching the desired speed, select the highest gear available that will pull the load. Experience with your vehicle will show you what rpm is needed to make upshifts under various conditions. This progressive shifting technique will lower fuel costs because the engine will be operating at the lowest rpm needed to pull the load.

Caterpillar electronic engines can be programmed to limit engine rpm while the vehicle is operated in the lower and higher gears. This feature assists the driver in following progressive shifting techniques.

5. On uphill grades, begin downshifting when the engine rpm falls to 1200 rpm. Fuel economy will be best if you let the engine lug back to around this speed before you downshift. Downshift until a gear is reached in which the engine will pull the load. Let the engine lug down if you can make it to the top of a hill without downshifting.

IMPORTANT: Don't let the engine exceed 2300 rpm (2100 rpm if equipped with an exhaust brake).

6. On a downhill grade, do not coast or put the transmission in neutral. Select the correct gear that does not allow the engine to exceed its maximum speed. Use the brakes to limit the vehicle speed.

A simple rule to follow is to select the same gear (or one gear lower) that would be needed to go up the grade.

7. As with any engine, prolonged idling of Caterpillar engines is not recommended. An idling engine wastes fuel and if left unattended, is also unsafe.

Caterpillar engines can be programmed to shut off automatically after a specified idling time. The vehicle transmission must be in neutral and the parking brake must be set for the automatic shut-off option to work.

Cruise Control

The cruise control is activated by the "On/Off" and "Set/Resume" switches on the dash (Fig. 7.5) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (Fig. 7.6). The minimum speed at which cruise control can be used on Caterpillar electronic engines is 30 mph (48 km/h). The minimum and maximum speed cruise control set limits can be programmed, by authorized personnel, into the ECM personality module.

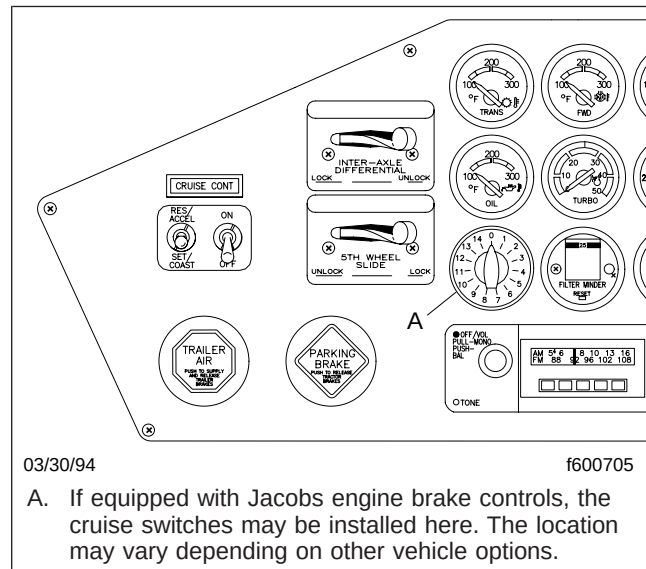


Fig. 7.5, Cruise Control Switches, Standard Location

WARNING

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, slippery, or roads with a loose driving surface. Failure to follow this precaution could cause a collision or

Engines and Clutches

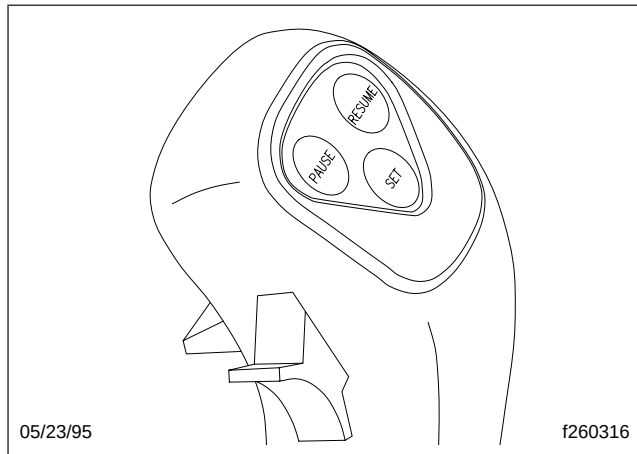


Fig. 7.6, Transmission Shift Knob Buttons

loss of vehicle control, possibly resulting in personal injury or property damage.



CAUTION

Do not attempt to shift gears without using the clutch pedal when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

1. To cruise at a particular speed:
 - 1.1 Flip the ON/OFF switch on the instrument control panel to ON.
 - 1.2 Hold the throttle pedal until the speedometer indicates the desired speed.
 - 1.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET or push the SET button on the transmission shift knob.
2. To disengage the cruise control:
 - 2.1 Depress the brake pedal, or clutch pedal, *or*
 - 2.2 Flip the ON/OFF switch on the instrument control panel to OFF or push the PAUSE button on the transmission shift knob.
3. To resume a preselected cruise speed:

- 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
- 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME, or push the RESUME button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

NOTE: The resume-vehicle-speed memory is not maintained if the ignition is shut off.

BrakeSaver, Optional

The BrakeSaver (optional on C-15 engines) permits the operator to control the speed reduction of the vehicle on grades, curves, or anytime speed reduction is necessary but long applications of the service brakes are not desired.

During downhill operation, the crankshaft is turned by the rear wheels (through the drivetrain). To reduce the speed of the vehicle, an application of braking force can be made to the crankshaft. The BrakeSaver does this by converting rotation energy into heat which is removed by the engine cooling system. The BrakeSaver is controlled by the driver, as necessary, by operating a lever on the instrument panel. Brake pressure increases as the lever is moved toward the ON position. An air pressure gauge provides a relative indication of the braking force. An oil temperature gauge indicates the heat in the BrakeSaver during its operation. If the temperature gauge indicates HOT, the BrakeSaver control lever must be moved to the OFF position. The oil temperature will decrease rapidly with the BrakeSaver off. When the temperature reaches normal, the BrakeSaver can be used.



CAUTION

Do not engage the BrakeSaver and control the wheel speed with the accelerator. The design of

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the cooling system is for the control of the temperature of the oil at full engine power or full BrakeSaver capacity, but not both at the same time.

Power Takeoff (PTO) Governor

Caterpillar electronic engines may be equipped with a PTO governor. This mode is used only when the vehicle is parked. The PTO mode is activated by the ON/OFF and SET/RESUME switches on the dash (Fig. 7.5) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob (Fig. 7.6).

1. To engage the PTO:
 - 1.1 Flip the ON/OFF switch on the instrument control panel to ON.
 - 1.2 Hold the throttle pedal until the tachometer indicates the desired speed.
 - 1.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET, or push the SET button on the transmission shift knob.
2. To disengage the PTO:
 - 2.1 Depress the brake pedal, or clutch pedal, *or*
 - 2.2 Flip the ON/OFF switch on the instrument control panel to OFF or press the PAUSE button on the shift knob.
3. To resume a previously selected engine speed:
 - 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
 - 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME, or press the RESUME button on the transmission shift knob.

To adjust engine speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

NOTE: The resume-engine-speed memory is not maintained if the ignition is shut off.

Cummins Engine Operation

Cummins diesel engines have been built by Cummins to comply with the requirements of the Federal (U.S.) Clean Air Act. Once the engine is placed in service, the responsibility for meeting both state and local regulations is with the owner/operator. Good operating practices, regular maintenance, and proper adjustments are factors which will help to stay within the regulations.

Proper maintenance of the engine, which is the responsibility of the owner/operator, is essential to keep the emission levels low.

Follow the directions in the Cummins *Operation and Maintenance Manual* and this manual for trouble-free, economical vehicle engine operation.

1. Cummins diesel engines produce high horsepower and peak torque characteristics at lower rpm. Because of this, it is not necessary to keep the engine "wound up" to deliver the required horsepower at the wheels. These characteristics may also result in less shifting, and make shifting at lower rpm (to peak torque) more practical.
2. Depending on the vehicle gearing, the posted speed limit can sometimes allow operation in either of the top two gears; however, for improved operating efficiency (fuel economy and engine life), operate in the top gear at reduced rpm, rather than in the next lower gear at the maximum rpm.
3. Cruise at partial throttle whenever road conditions and speed requirements permit. This driving technique permits operating within the most economical power range of the engine.
4. When approaching a hill, open the throttle smoothly to start the upgrade at full power, then shift down as desired to maintain the maximum vehicle speed. The higher torque of Cummins engines may permit topping some grades without shifting.
5. Cummins engines are designed to operate over a wide speed range. More frequent shifting than necessary does not allow proper utilization of this flexibility. The driver who stays in top gear and uses the wider speed range will achieve the best fuel economy.
6. The Cummins diesel engine is effective as a brake on downhill grades, but care must be used

Engines and Clutches

not to overspeed the engine going downhill. The governor has no control over engine speed when it is being pushed by the loaded vehicle.

Never turn off the ignition switch while going downhill. With the engine still in gear, fuel pressure will build up against the shutdown valve and may prevent it from opening when the ignition key is turned on.



CAUTION

Engine overspeed (engine speed exceeds high idle, no-load rpm) can damage the engine.

7. Use a combination of brakes and gears to keep the vehicle under control at all times and to keep the engine speed below the rated governed rpm.

Cruise Control

The cruise control is activated by the ON/OFF and SET/RESUME switches on the dash ([Fig. 7.5](#)) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob ([Fig. 7.6](#)). The minimum speed at which cruise control can be used on Cummins PACE and CELECT engines is 30 mph (48 km/h).



WARNING

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, slippery, or roads with a loose driving surface. Failure to follow this precaution could cause a collision or loss of vehicle control, possibly resulting in personal injury or property damage.



CAUTION

Do not attempt to shift gears without using the clutch pedal when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

1. To cruise at a particular speed:
 - 1.1 Flip the ON/OFF switch on the instrument control panel to ON.

- 1.2 Hold the throttle pedal until the speedometer indicates the desired speed.
- 1.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET or push the SET button on the transmission shift knob.

2. To disengage the cruise control:

- 2.1 Depress the brake pedal, or clutch pedal, *or*
- 2.2 Flip the ON/OFF switch on the instrument control panel to OFF or push the PAUSE button on the transmission shift knob.

3. To resume a preselected cruise speed:

- 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
- 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME, or push the RESUME button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

NOTE: The resume-vehicle-speed memory is not maintained if the ignition is shut off.

Power Takeoff (PTO) Governor

Cummins electronic engines may be equipped with a PTO governor. This mode is used only when the vehicle is parked. The PTO mode is activated by the ON/OFF and SET/RESUME switches on the dash ([Fig. 7.5](#)) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob ([Fig. 7.6](#)).

1. To engage the PTO:
 - 1.1 Flip the ON/OFF switch on the instrument control panel to ON.
 - 1.2 Hold the throttle pedal until the tachometer indicates the desired speed.

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- 1.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET, or push the SET button on the transmission shift knob.

IMPORTANT: Two PTO engine speeds can be preset on PACE and CELECT engines. With the ON/OFF switch on, move the SET/RESUME switch to SET to reach the first preset value or, move the switch to RESUME for the second preset value. After one preset value has been selected, you must turn the ON/OFF switch off, then turn it back on before using the second preset value.

2. To disengage the PTO:
 - 2.1 Depress the brake pedal, clutch pedal, or throttle pedal (CELECT engines only), or
 - 2.2 Flip the ON/OFF switch on the instrument control panel to OFF or press the PAUSE button on the shift knob.
3. To resume a previously selected engine speed:
 - 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
 - 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME, or press the RESUME button on the transmission shift knob.
 - 3.3 To adjust engine speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

NOTE: The resume-engine-speed memory is not maintained if the cruise control ON/OFF switch is turned OFF or if the ignition is shut off.

Detroit Diesel Engine Operation

Individual driving habits can make a difference in the performance and economy of any engine. The recommendations below call attention to the techniques that can be employed to save fuel and extend the operating efficiency and life of a new Detroit Diesel engine for the longest possible time.

All engines have an operating range in which the engine performs most efficiently. The operating range extends from maximum torque rpm at the low end to engine rated speed at the high end. Detroit Diesel engines deliver best fuel economy when operated in the low- and mid-speed segments of the efficiency range and produce maximum horsepower at rated speed, which is also the recommended maximum speed of the engine.

IMPORTANT: If a winterfront is used on a vehicle with an electronic engine equipped with a charge air cooler, make sure that there are slit openings distributed across the face of the winterfront to allow airflow through the entire charge-air-cooler core. Do not use a winterfront with closed areas that block uniform air flow across any sections of the charge-air-cooler crossflow tubes. This will adversely affect the operation and durability of the charge air cooler.

1. It is seldom necessary to accelerate the engine to governed speed in the lower gears to get the vehicle moving, except in a high power demand situation such as starting on a grade.

To conserve fuel, start off in low gear and develop only the engine speed needed to get rolling. Then, increase engine speed gradually as upward gear shifting progresses.

As described by Detroit Diesel, this "progressive shifting" technique will get the vehicle up to the desired cruising speed while minimizing noise emission and maximizing fuel economy. A progressive shift pattern is illustrated in [Fig. 7.7](#).

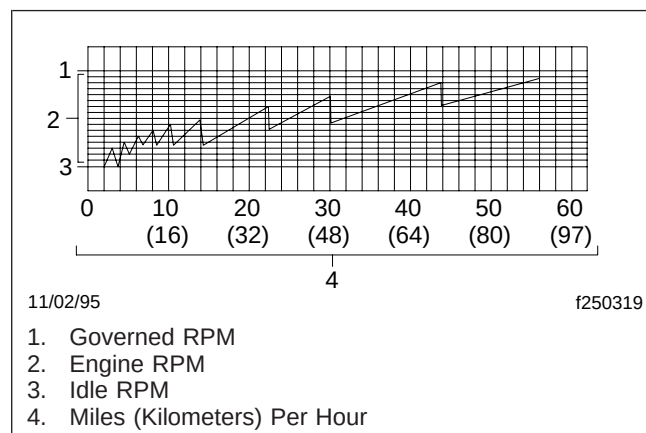


Fig. 7.7, Progressive Shift Pattern

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NOTE: A momentary hesitation in throttle response will occur when a vehicle with a turbo-charged engine is started on a grade. *Do not* disengage the clutch. The rpm will recover, and the vehicle will accelerate up the grade.

2. For city driving, run in the highest gear possible and reduce engine speed. This enables you to operate at a safe speed for traffic conditions while using less fuel and reducing noise. Also, when slowing down for reduced speed zones, remain in your running gear and reduce engine rpm to stay within the speed limit. Avoid downshifting until you are ready to return to highway cruising speed.
3. For highway cruising and for best fuel economy, run the engine at 80 to 90 percent of rated rpm to maintain highway speed. Engines with 1800 rpm ratings are exceptions and will provide fuel economy when run at their rated speed. Proper gear selection should permit cruising in the economy range with no appreciable sacrifice in desired highway speed.

It is okay to operate below rated rpm at full throttle if you are satisfied with the way the vehicle performs. However, there are times when hilly terrain, high winds, or other conditions make it impractical to operate without reserve power. Such conditions are better met if the vehicle is operated in a lower gear with reserve power available for changes in terrain, wind, etc.

4. The proper use of gears will shorten time on hills and minimize the amount of shifting. When starting up a hill, gradually depress the accelerator pedal all the way down and keep it there as the vehicle moves up the grade. If the engine continues to maintain a satisfactory road speed, remain in that gear for the entire grade.

If the hill causes a steady decline in engine rpm, downshift as required until the engine can maintain a stable uphill speed. Make full use of each gear before going to a lower gear. By remaining in a gear until arriving at the speed of the next lower gear, the vehicle will top the grade in the best possible time on less fuel and fewer shifts.

5. Because of their constant horsepower over a wide speed range, Detroit Diesel engines can be operated at full throttle at lower rpm than other engines. This offers benefits in fuel economy and

engine life. And more than likely, it will be possible to top most grades without downshifting.

When the vehicle starts into a grade, allow the engine to lug down to maximum torque rpm before downshifting. Downshift, if required, at maximum torque rpm also or at the predetermined road speed for the next lower gear.

Do not be afraid to lug the engine down. It has more than enough torque at low rpm to keep a loaded vehicle moving against a grade and it won't harm the engine.

6. The driver who is not familiar with the vehicle's shift points can greatly improve driving skill by learning them for all gears. By knowing rather than guessing where the shift points are, it is possible to avoid overspeeding the engine by downshifting too soon or missing the full use of a gear by downshifting too late. The shift points of any vehicle can be determined by a simple road-test method. Run the vehicle and determine the maximum road speed possible in every gear at the engine governed full-load speed setting.

The top road speed possible in a gear would be the shift point for that gear. The results should be recorded in the proper order of shifting and displayed inside the cab.

CAUTION

Do not allow the engine to exceed its governed speed, or serious engine damage could result.

7. To slow the vehicle on downgrades and curves (using the engine), shift to a lower gear and allow the vehicle to decelerate in that gear. The engine provides maximum braking effect when running at the top end of the operating range, but it must not be allowed to exceed its full-load rated rpm. Continue to downshift as further reduction in vehicle speed is required. If the vehicle is above the allowable maximum speed of a lower gear, use the service brakes to slow the vehicle to an acceptable speed where the transmission may be downshifted safely. Again, the importance of knowing the shift points is demonstrated.

IMPORTANT: The engine governor has no control over engine rpm when the engine is being pushed by a loaded vehicle down a grade. Use service brakes and gears in combination on

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long grades to keep the vehicle speed under control and the engine rpm below full-load rated governed speed.

8. Essential information regarding the operation and care of Allison automatic transmissions is contained in the Allison *Driver's Handbook*. Applying the knowledge presented will not only make driving easier, but will give the maximum benefits from an Allison-equipped vehicle.

Maintenance literature is also available for drivers of Allison-equipped vehicles who desire trouble-free performance and maximum life from their equipment. These maintenance books are available from any authorized Detroit Diesel engine distributor.

9. As with all engines, prolonged idling of Detroit Diesel engines is not recommended. An idling engine wastes fuel and left unattended, is also unsafe.

A Detroit Diesel Electronic Control (DDEC) engine can be equipped to shut off automatically after 5 minutes of idling. The vehicle transmission must be in neutral and the parking brake must be set for the automatic shutoff option to work. To start the engine, follow the normal start-up procedure.

Engines equipped with DDEC will idle fast when cold. As the engine warms up to operating temperature, the idle speed will decrease. Warm the engine until idle speed is normal before operating the vehicle.

Cruise Control

A DDEC engine may have cruise control. The minimum speed at which cruise control can be used is 35 mph (56 km/h).

The cruise control is activated by the ON/OFF and SET/RESUME switches on the dash (**Fig. 7.5**) or by optional PAUSE, RESUME, and SET buttons on the transmission shift knob (**Fig. 7.6**).

WARNING

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, slippery, or roads with a loose driving surface. Failure to fol-

low this precaution could cause a collision or loss of vehicle control, possibly resulting in personal injury or property damage.



CAUTION

Do not attempt to shift gears without using the clutch pedal when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

1. To cruise at a particular speed:
 - 1.1 Flip the ON/OFF switch on the instrument control panel to ON.
 - 1.2 Hold the throttle pedal until the speedometer indicates the desired speed.
 - 1.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET or push the SET button on the transmission shift knob.
2. To deactivate the cruise control:
 - 2.1 Depress the brake pedal, or clutch pedal, *or*
 - 2.2 Flip the ON/OFF switch on the instrument control panel to OFF or push the PAUSE button on the transmission shift knob.
3. To resume a preselected cruise speed:
 - 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
 - 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME, or push the RESUME button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

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NOTE: The resume vehicle speed memory is not maintained if the ignition is shut off or if the ON/OFF switch is off for more than 10 seconds.

Power Takeoff (PTO)

A power takeoff option is available for vehicles equipped with a DDEC system. The PTO operates only when the vehicle is at a standstill.

Some vehicles have separate controls for the PTO. In the case of a preset nonadjustable PTO engine speed, there is only an on/off switch labeled FAST IDLE. If the vehicle is equipped with a variable PTO engine speed, there are two controls: an on/off switch, and a potentiometer knob. Both of these are labeled GOVERNOR.

On other vehicles, the PTO mode is activated by the ON/OFF and SET/RESUME cruise control switches located on the instrument control panel on the dash (**Fig. 7.5**), or by optional PAUSE, RESUME or SET buttons on the transmission shift knob (**Fig. 7.6**).

1. Operating the PTO With Separate PTO Controls:
 - 1.1 Set the parking brake.
 - 1.2 Turn on the switch labeled GOVERNOR (or FAST IDLE for vehicles with a preset PTO system).
 - 1.3 For vehicles with a variable PTO, use the potentiometer knob to adjust the engine rpm.
2. Operating the PTO Using Cruise Control Switches:
 - 2.1 To engage the PTO, flip the ON/OFF switch on the instrument control panel to ON.
 - 2.2 Hold the throttle pedal until the tachometer indicates the desired speed.
 - 2.3 Momentarily move the SET/RESUME switch on the instrument control panel to SET or push the SET button on the transmission shift knob.
 - 2.4 To disengage the PTO, depress the brake pedal, or clutch pedal, or flip the ON/OFF switch on the instrument control panel to OFF or press the PAUSE button on the shift knob.

3. To resume a previously selected engine speed:

- 3.1 If the ON/OFF switch on the instrument control panel is in the OFF position, flip it to ON.
- 3.2 Momentarily move the SET/RESUME switch on the instrument control panel to RESUME or press the RESUME button on the transmission shift knob.

To adjust engine speed up or down, hold the SET/RESUME switch on the instrument control panel at SET to accelerate or at RESUME to decelerate until the desired speed is reached, or press the SET button on the transmission shift knob to accelerate or the RESUME button to decelerate until the desired speed is reached.

Optimized Idle®

The Optimized Idle option on DDEC III-equipped vehicles is a system that automatically stops and restarts the engine to accomplish the following:

- Keep the engine oil temperature between 60 to 104°F (16 to 40°C)
- Keep the battery charged
- Keep the cab or sleeper at a constant, desired temperature (if equipped with a thermostat)

The benefits of the system include reduced engine idle time, fuel savings, reduction of exhaust emissions and noise, increased starter and engine life, and less chance of dead batteries due to electrical loads.

Optimized Idle operates in two modes. They are the engine mode or the thermostat mode. The engine mode keeps the battery charged and the engine oil temperature within factory set limits. The thermostat mode is the same as the engine mode, but also keeps the cab and sleeper at a constant preset temperature.

The engine mode is always activated when the system is operated. The thermostat mode is activated when the thermostat is turned on.

The thermostat mode controls the set point, which is the desired temperature of the cab and sleeper, and the comfort zone, which is the number of degrees from the set point before the engine needs to heat or

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cool the cab. There are three comfort zones: 4°F (2°C), 7°F (4°C), or 10°F (6°C).

Vehicles equipped with Optimized Idle have a label and light on the dashboard. The dash light is the bottom one on the vertical array of lights in the center dash panel, and the label is located on the "B" dash panel. See [Fig. 7.8](#) for the label appearance. If equipped with the thermostat mode, a thermostat is located in the sleeper, above the bunk. See [Fig. 7.9](#).

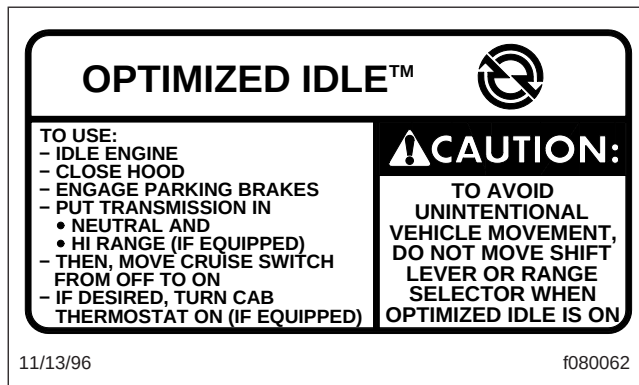


Fig. 7.8, Optimized Idle Dash Label

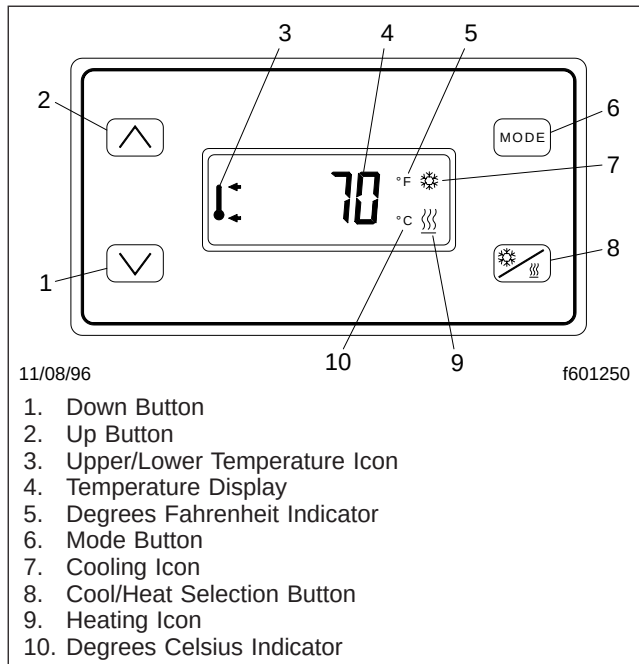


Fig. 7.9, Optimized Idle Thermostat

The thermostat consists of an LCD readout and four buttons.

The display normally shows the temperature of the sleeper, but changes accordingly as the buttons are pressed.

The button functions are as follows:

- Up Button: increases the set point and comfort zone.
- Down Button: decreases the set point and comfort zone.
- Cool/Heat Button: detects either cooling or heating operation.
- Mode Button: scrolls through the various functions. It can also be used to set desired temperature values.

1. Activate Optimized Idle (engine mode) as follows:

- 1.1 Set the parking brake.
- 1.2 If it is tilted, close and secure the hood.
- 1.3 Start the engine and let it idle.
- 1.4 Put the transmission in neutral and in the high range, if so equipped.
- 1.5 Turn on the cruise control.

IMPORTANT: The cruise control must be turned on *after* the engine is idling. If it was previously turned on, turn off the cruise control, then turn it on again.

- 1.6 The dash light will begin blinking, indicating that Optimized Idle is active. The system is now in the engine mode, and after an initial phase in which the idle speeds up to 1000 or 1500 rpm (depending on the outside temperature), the engine will stop and start automatically to keep the battery charged and the engine oil warm. The dash light stays on and shines steadily at this point.

2. Activate the thermostat mode (if so equipped) as follows:

NOTE: When the system is in the thermostat mode, it is also in the engine mode. It will continue to operate in the engine mode even if the thermostat mode is turned off.

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- 2.1 With the system in the engine mode, set the cab and sleeper heater or air conditioner controls to the highest setting.
- 2.2 Turn on the thermostat by touching any of the four buttons. See [Fig. 7.9](#).

The display will flash the current sleeper temperature and the previous mode (cooling or heating) selected. If the cab needs to be cooled or heated, the cool/heat icon will flash.
- 2.3 Choose either cool or heat by pressing the *Cool/Heat* button. Make sure the selection matches that of the cab controls.

IMPORTANT: If the heat or cool selection of the thermostat does not match that of the cab, the system will idle and cycle excessively.

- 2.4 Select Fahrenheit or Celsius by pressing and holding the *Mode* button until either the "F" or "C" is displayed.
 - 2.5 Select the temperature set point by pressing either the *Up* button or the *Down* button, as applicable. Holding the button will cause the display to count up or down rapidly. When the desired set point is displayed, release the button. The set point is stored in memory.
 - 2.6 Select the temperature comfort zone by pressing the *Mode* button until the upper and lower temperature limit icon is displayed. Then use the *Up* or *Down* button to select one of the three comfort zones of 4°F (2°C), 7°F (4°C), or 10°F (6°C).
3. To change the display to either Fahrenheit or Celsius, press the *Mode* button until only the *F°* or *C°* icon is flashing. Press the *Up* or *Down* button to change to the desired value. The main display will appear five seconds after the button is released.
 4. To deactivate the thermostat mode and return to just the engine mode, press the *Mode* button and hold it for three seconds.
 5. To shut down Optimized Idle completely, either turn off the ignition or use the drive away feature.

The drive away feature allows the use of all the DDEC features. Use the drive away feature as follows:

- 5.1 *If the engine is running:* Release the parking brakes or put the transmission in gear.

If the engine is not running: Start the engine. Release the parking brakes or put the transmission into gear.
- 5.2 Let the engine return to base idle. The active light will turn off. Optimized Idle is now disabled and all the DDEC features are available.

Engine Shutdown

Caterpillar



Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of the engine components. Excessive temperatures in the turbocharger center-housing will cause oil coking problems. Follow the procedure, outlined below, to allow the engine to cool.

1. With the vehicle stopped, apply the parking brakes. Reduce the engine speed to low idle.
2. Place the transmission shift lever in neutral.
3. If the engine has been operating at low loads, run it at low idle for 30 seconds before stopping. If the engine has been operating at highway speed or at high loads, run it at low idle for three minutes to reduce and stabilize internal engine temperatures before stopping.
4. Turn off the ignition key to shut down the engine.
5. If equipped with an idle shutdown timer, it can be set to shut the engine down after a preset amount of time. Ninety seconds before the preset shutdown time, the CHECK ENGINE light will begin to flash at a rapid rate. If the clutch pedal or service brake indicates position change during this final ninety seconds, diagnostic lamp flashing, the idle shutdown timer will be disabled until reset.
6. After stopping the engine, fill the fuel tank.

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7. Check the crankcase oil level while the engine is stopped. Maintain the oil level between the ADD and FULL marks on the dipstick.
8. If freezing temperatures are expected, allow the engine jacket water expansion tank to cool, then check the coolant for proper antifreeze protection. The cooling system must be protected against freezing to the lowest expected outside temperature. Add permanent-type antifreeze, if required. For additional information, see **Group 20** of the *Heavy-Duty Trucks Maintenance Manual*.
9. Repair any leaks, perform minor adjustments, tighten loose bolts, etc. Observe the vehicle mileage or the service meter reading, if so equipped. Perform periodic maintenance as instructed in the Lubrication and Maintenance Chart in the *Caterpillar Operation and Maintenance Management Manual*.

Cummins

1. With the vehicle stopped, apply the parking brakes and place the transmission in neutral.
2. It is important to idle an engine three to five minutes before shutting it down. This allows the lubricating oil and the water to carry heat away from the combustion chamber, bearings, shafts, etc. This is especially important with turbocharged engines.

Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 100°F (56°C). The extreme heat may cause bearings to seize or oil seals to leak.

3. Do not idle the engine for excessively long periods. Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low the fuel may not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and may result in stuck valves.

If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil; there-

fore, all moving parts of the engine will suffer from poor lubrication.

4. If the engine is not being used, shut it down by turning the ignition key off.



CAUTION

Stop the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed the warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

Detroit Diesel

1. With the vehicle stopped, apply the parking brakes, and place the transmission in neutral.
2. Allow the engine to run at half speed or slower, with no load, for four to five minutes to cool the engine gradually and uniformly.
3. Shut down the engine by turning the ignition key off.

High-Altitude Operation

Cummins

Engines lose horsepower when operated at high altitude because the air is too thin to burn as much fuel as at sea level. This loss is about three percent for each 1000 feet (300 m) altitude above sea level for a naturally aspirated engine. Most turbocharged engines are rated for higher altitudes than naturally aspirated engines. An engine will have smoky exhaust at high altitudes unless a lower gear is used. The engine will not demand full fuel from the fuel system unless the engine is altitude-compensated by the use of a turbocharger. Shift gears as needed to avoid excessive exhaust smoke.

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Bendix Cruise Control System, Optional

General Information

The Bendix cruise control system has two modes of operation: cruise control and stationary throttle control. The cruise control mode maintains a driver-selected speed above 20 mph (32 km/h). The stationary throttle control mode provides operator control of the engine throttle position when the vehicle is parked.

Cruise Control Operation

The cruise control is activated by the ON/OFF and SET/RESUME switches. See [Fig. 7.5](#). A light in the warning and indicator light module is on when the cruise control is engaged.

WARNING

Do not use the cruise control system when driving conditions do not permit maintaining a constant speed, such as in heavy traffic or on roads that are winding, icy, snow covered, slippery, or roads with a loose driving surface. Failure to follow this precaution could cause a collision or loss of vehicle control, possibly resulting in personal injury or property damage.

CAUTION

Do not attempt to shift gears without using the clutch when the cruise control is engaged. Failure to follow this precaution will result in a temporarily uncontrolled increase in engine speed; transmission damage and gear stripping could result.

1. To cruise at a particular speed:
 - 1.1 Flip the ON/OFF switch to ON.
 - 1.2 Accelerate to the desired speed.
 - 1.3 Push the SET/RESUME switch to SET.

NOTE: The cruise control will not work below 20 mph (32 km/h).
2. To disengage the cruise control:
 - 2.1 Flip the ON/OFF switch to OFF, *or*

- 2.2 Depress the brake pedal, *or*
- 2.3 Allow vehicle speed to drop below 20 mph (32 km/h).

To resume the preselected cruise speed, briefly push the SET/RESUME switch to RESUME. Cruise will return to the last speed selected.

NOTE: The resume vehicle speed memory is not maintained if the ignition is shut off or if the ON/OFF switch is flipped to OFF.

Cruise speed can be adjusted up or down by pushing the RESUME (accelerate) or SET (decelerate) switch until the desired speed is reached.

The vehicle can be accelerated normally with the cruise control engaged. Depress the throttle pedal as needed. When the throttle pedal is released, the vehicle will return to the set cruise speed.

Shifting can be done normally with the cruise control engaged. When the clutch pedal is depressed, the cruise control disengages, allowing the shift to be completed. When the clutch pedal is released, the cruise control reengages, and adjusts engine rpm to return to the selected speed.

Stationary Throttle Control Operation

This mode is used when the vehicle is parked, and is engaged by operating the ON/OFF and the SET/RESUME switches ([Fig. 7.5](#)) as follows:

1. With the engine idling, flip the ON/OFF switch to ON. A light in the warning and indicator light module will come on.
2. Depress and release the RESUME switch until the desired rpm is reached.

NOTE: It may be necessary to depress and release the switch several times before engine speed increases.

3. To reduce engine rpm, depress and release the SET switch until the desired rpm is reached.
4. To disengage the stationary throttle control:
 - 4.1 Flip the ON/OFF switch to OFF, *or*
 - 4.2 Depress the clutch pedal.

IMPORTANT: In the throttle control mode, engine speed is controlled by positioning the

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engine throttle linkage. Engine governor characteristics and engine temperature may cause engine speed to vary. Don't leave the vehicle unattended for long periods of time while the stationary throttle control feature is being used.

Engine Braking System, Optional

Jacobs Engine Brake

A Jacobs engine brake is a hydraulic-electric engine attachment that converts a diesel engine into an air compressor. This is done by changing engine exhaust valve operation; it engages or disengages in less than one-fourth of a second. An engine brake is not a substitute for a service braking system, except in emergencies.

The controls consist of:

- dual dash switches (Fig. 7.10), which are on/off toggle switches;

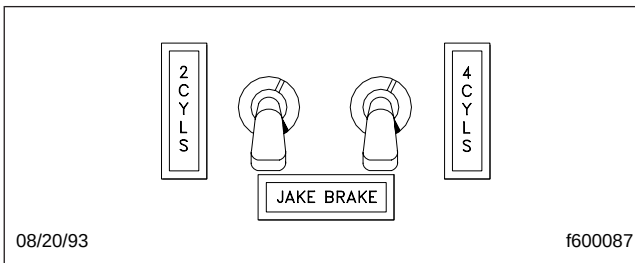


Fig. 7.10, Engine Brake Switches

- a clutch switch, which is a transmission-mounted microswitch that actuates when the driver removes his foot from the clutch pedal;
- a throttle switch, which is an engine-mounted microswitch that actuates when the driver removes his foot from the throttle pedal.

Jacobs Engine Brake Operation

WARNING

Do not use the engine brake if road surfaces are slippery. Using the engine brake on wet, icy, or snow-covered roads could result in loss of vehicle control, possibly causing personal injury and property damage.

To engage the engine brake, one or both of the dash switches must be on (up), and both the clutch and throttle pedals must be fully released. To disengage the engine brake, depress the throttle or clutch pedal, or turn both dash switches off (down). Depending on the engine type, dual dash switches enable the driver to operate the engine brake at one-third, two-thirds, and full capacity or at half and full capacity.

WARNING

Do not use the engine brake to shift gears. Using the engine brake to shift gears could result in loss of vehicle control, possibly causing personal injury and property damage.

Since the engine brake is most effective at rated engine speed, gear selection is very important. Gearing down the vehicle within the limits of the rated engine speed makes the engine brake more effective. Maximum braking occurs with the use of the lowest gear that does not exceed the rated engine speed. A rule of thumb for gear choice is to select the gear that normally would be used to climb an approaching downhill grade. Generally, this same gear can be used with the engine brake for a controlled descent of the hill.

"Control speed" is the speed at which the engine brake performs 100 percent of the required downhill braking, resulting in a constant speed of descent. The control speed varies, depending on vehicle weight and the downhill grade.

For faster descent, select a higher gear than that used for control speed. Service brakes must then be used intermittently to prevent engine overspeed and to maintain desired vehicle speed.

IMPORTANT: When descending a grade, remember that frequent use of service brakes causes them to become hot, which results in a reduction of their stopping ability. Grade descent speed should be such that the service brakes are used infrequently and that they remain cool, thus retaining their effectiveness.

A driver may descend slower than control speed by selecting a lower gear, one that will not overspeed the engine. The engine brake retarding force will then be sufficient to cause vehicle deceleration. Occasional deactivation of the engine brake may be

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necessary to maintain the designated road speed under these conditions.

The engine brake can be used to stop a vehicle if the service brakes quit working. By energizing the engine brake as soon as a service brake problem is apparent, a retarding effect is applied to the vehicle. As grade conditions permit, the driver can progressively downshift, using the engine brake in each gear. Eventually the engine brake will stop the vehicle.

WARNING

Using the engine brake as a primary braking system when the service brakes are operable is dangerous. This can cause long, unpredictable stopping distances, possibly resulting in personal injury or property damage.

Whenever vehicle braking is required, the engine brake may be used with the service brakes. There is no time limit for operation of the engine brake.

1. After the engine is warmed up and the vehicle is in motion, turn on the dash toggle switches (up position).

On vehicles equipped with a Cummins NTC engine, select either the left-side switch (one-third engine brake retarding capacity), the right-side switch (two-thirds engine brake retarding capacity), or both switches (full engine brake retarding capacity).

On vehicles equipped with a Cummins L10 or Caterpillar engine, select either the left-side switch or right-side switch (for one-half engine brake retarding capacity), or both switches (for full engine brake retarding capacity).

2. The engine brake activates when the driver's feet are removed from both the clutch and throttle pedals. If it fails to activate, stop the vehicle in a safe spot and check the adjustment of the throttle and clutch switches. If no cause can be detected in the electrical system, check the engine brake system. See **Group 01** of the *Heavy-Duty Trucks Service Manual* for instructions.
3. To obtain maximum retarding, maintain the top governed speed of the engine through appropriate selection of gears when the engine brake is in use.

4. When either the clutch or throttle pedal is depressed, the engine brake is deactivated.

CAUTION

If the engine brake fails to shut off when either the throttle or clutch pedal is depressed, place the dash switch in the OFF position and do not use the engine brake until the throttle or clutch switch system is repaired. If the engine brake fails to shut off when the dash switch is turned off, the engine should be shut down and the engine brake repaired before continuing operation. Failure to do so could result in damage to the engine.

Clutches

General Information

The major reason why clutches wear out too soon is excessive heat. Clutches are designed to absorb and dissipate more heat than encountered in typical operation. The temperatures developed in typical operation will not break down the clutch friction surfaces. However, if a clutch is slipped excessively or asked to do the job of a fluid coupling, high temperatures develop quickly and destroy the clutch. Temperatures generated between the flywheel, driven discs, and pressure plates can be high enough to cause the metal to flow and the friction facing material to char and burn.

Heat and wear are practically nonexistent when a clutch is fully engaged. But during the moment of engagement, when the clutch is picking up the load, it generates considerable heat. An improperly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

The most important items that a driver should be aware of to ensure long service life of the clutch include: starting in the right gear, clutch malfunctions, and when to adjust a clutch.

Clutch Operation

Eaton Valeo Clutch Break-In

With a newly installed Eaton Valeo clutch, the clutch may slip for a short time while the friction surfaces break-in. However, allowing the clutch to slip for more than two seconds can severely damage the clutch disc, pressure plate, and the flywheel.

Engines and Clutches

During initial operation of a new vehicle or a vehicle with a new clutch, check for clutch slippage during acceleration. If the clutch slips, decelerate until the clutch does not slip. Allow the clutch to cool 15 to 30 seconds and then gradually accelerate again. If the clutch continues to slip, repeat the procedure. If necessary, repeat the procedure up to five times. If the clutch slips after five attempts, stop the vehicle. Allow the clutch to cool for at least one hour. Notify your Freightliner dealer of the problem.



CAUTION

Do not allow sustained slippage of the clutch; this could severely damage the clutch disc, pressure plate, or flywheel. Damage caused by clutch slippage due to improper break-in is not warrantable.

Starting the Vehicle in the Proper Gear

An empty truck can be started in a higher transmission gear ratio than when partially or fully loaded. A good rule of thumb for the driver to follow is: select the gear combination that allows you to start moving with an idling engine, or, if necessary, just enough throttle to prevent stalling the engine. After the clutch is fully engaged, the engine should be accelerated to the correct rpm for the upshift into the next higher gear.

Gear Shifting Techniques

Many drivers upshift into the next gear, or even skip-shift into a higher gear, before the vehicle has reached the proper speed. This type of shifting is almost as bad as starting off in a gear that is too high since the engine rpm and vehicle speeds are too far apart, requiring the clutch to absorb the speed difference as heat. For transmission operating instructions, see [Chapter 8](#) in this manual.

The clutch brake is applied by fully depressing the clutch pedal. Its purpose is to stop the transmission gears from rotating in order to engage the transmission gears quickly in making an initial start.



CAUTION

Never apply the clutch brake when making downshifts or upshifts. The clutch pedal should never be fully depressed before the transmission is put in neutral. If the clutch brake is applied with the

transmission still in gear, a reverse load will be put on the gear. At the same time, it will have the effect of trying to stop or decelerate the vehicle with the clutch brake. Rapid wear of the friction discs will take place necessitating frequent replacement. Considerable heat will be generated, which will be detrimental to the release bearings and transmission front bearings.

Excessive Vehicle Overload, or Overloading the Clutch

Clutches are designed for specific vehicle applications and loads. These limitations should not be exceeded.



CAUTION

Overloading will not only result in damage to the clutch, but also to the entire powertrain.

Riding the Clutch Pedal

Riding the clutch pedal is very destructive to the clutch since partial clutch engagement permits slippage, generating excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing, which can thin out the lubricant. Release bearing failures can be attributed to this type of misuse.

Holding the Vehicle on an Incline With a Slipping Clutch

A slipping clutch accumulates heat faster than it can be dissipated, resulting in early clutch failures. Never use the clutch as a hill holder.

Coasting With the Clutch Released (Pedal Depressed) and the Transmission in Gear

Coasting with the clutch released and the transmission in gear can cause high driven disc rpm through multiplication of ratios from the final drive and transmission.



WARNING

Do not coast with the clutch released (pedal depressed) and the transmission in gear. High driven-disc rpm could cause the clutch facing to

Engines and Clutches

be thrown off the disc. Flying debris could cause injury to persons in the cab.

Engaging the Clutch While Coasting

Engaging the clutch while coasting can result in tremendous shock loads and possible damage to the clutch, as well as to the entire drivetrain.

Reporting Erratic Clutch Operation Promptly

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect and lubricate the clutch components, make necessary internal clutch and linkage adjustments, etc.

Clutch free pedal is a decreased resistance felt at the top of the clutch pedal stroke. See [Fig. 7.11](#). With the clutch pedal in this range, the clutch is fully engaged, and the only resistance to clutch pedal movement is the force of the return spring. If clutch free pedal is 3/4 inch (20 mm) or less, measured at the pedal, have the clutch adjusted.

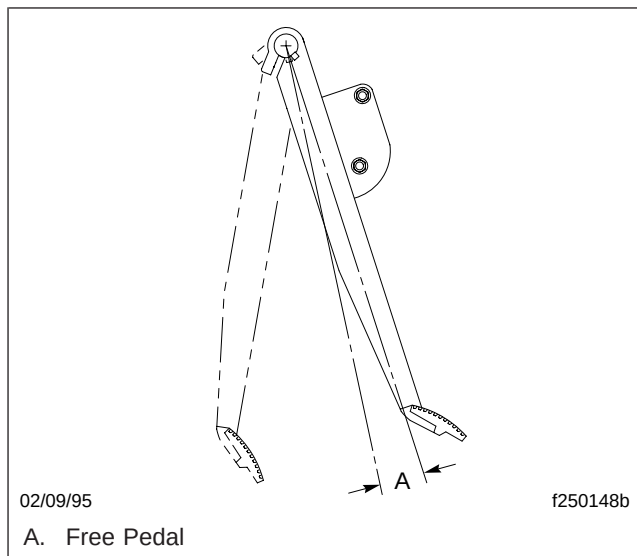


Fig. 7.11, Clutch Free Pedal

Free pedal should be included and commented on daily in the driver's report since clutch free pedal is the maintenance department's guide to the condition of the clutch and the release mechanism.

See **Group 25** of the *Heavy-Duty Trucks Service Manual* for clutch adjustment procedures and specifications.

CAUTION

Operating the vehicle with incorrect free pedal could result in clutch damage.

Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring) felt as the clutch pedal approaches the end of its stroke. If the gears grind when shifting into first or reverse gear with the clutch pedal fully depressed, the clutch is out of adjustment or the clutch brake is worn and needs to be replaced.

Clutch Adjustments

Clutches have an internal adjustment, and external linkage adjustment. See **Group 25** of the *Heavy-Duty Trucks Service Manual* for clutch adjustment procedures and specifications.

CAUTION

Operating the vehicle with the clutch improperly adjusted could result in clutch or clutch brake failure.

Lubrication

The release bearing and linkage should be lubricated at frequent intervals. See **Group 25** of the *Heavy-Duty Trucks Maintenance Manual* for intervals and procedures.

CAUTION

Failure to lubricate the release bearing and linkage as recommended could result in release bearing and clutch damage.

8

Transmissions

Eaton® Fuller® Straight-Shift Models	8.1
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Transmissions

Eaton® Fuller® Straight-Shift Models

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Eaton Straight-Shift

Eaton Fuller straight-shift model transmissions are not synchronized. They have seven forward speeds and one reverse speed. See [Fig. 8.1](#) for the shift pattern. They are designed for use with on-highway, fuel economy engines, where a minimum of shifting is desired and less gear reduction is acceptable.

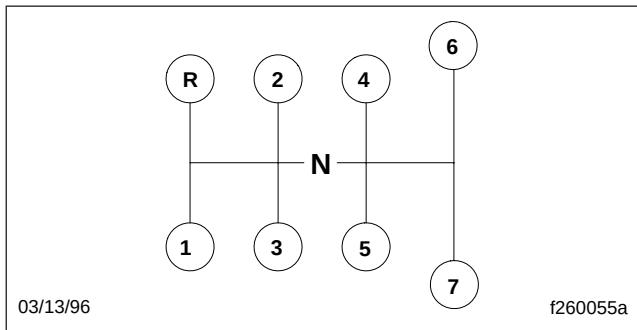


Fig. 8.1, Eaton Fuller Straight-Shift Model Transmissions Shift Pattern

Operation, Eaton Straight-Shift

1. Always use 1st gear when starting to move the vehicle forward.
2. Use the clutch brake to stop gear rotation when shifting into 1st or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.
For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Use double-clutching between all upshifts and downshifts.
4. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Upshifting

1. Position the gear shift lever in neutral, then start the engine. Bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Depress the clutch pedal to the floor. Shift into 1st gear, then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to engine governed speed.
3. Once governed speed has been reached, disengage the clutch, and shift the lever to neutral. Engage the clutch; allow the engine speed to drop about 800 rpm (the rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 2nd gear, then engage the clutch, and accelerate to engine governed speed.

Continue shifting upward, from 2nd to 3rd gear, 3rd to 4th gear, and 4th to 5th gear, using the same sequence. See [Fig. 8.1](#) for the shift pattern.

4. Again, at governed speed, disengage the clutch, and shift into neutral. Engage the clutch; allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 6th gear, then engage the clutch, and accelerate to engine governed speed.

Shift into 7th gear, using the same sequence.

Downshifting

When downshifting, shift down from 7th gear through each lower gear, as follows:

1. Allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. Disengage the clutch, shift into gear, and engage the clutch smoothly.
Follow the same sequence to downshift from 6th into 5th gear.
2. When in 5th gear, and ready for the next downshift, allow the engine speed to drop about 800 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the

Transmissions

torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. Disengage the clutch, shift into 4th gear, and engage the clutch smoothly.

Follow the same sequence to downshift from 4th into 3rd, 3rd into 2nd, and from 2nd into 1st gear.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Eaton Fuller Range-Shift Models

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Eaton Range-Shift

Range-Shift transmissions are typically upshifted by moving the shift lever through all of the low gear positions and then activating a range switch to provide an additional set of ratios in the high range using the same shift lever positions as used in low range. The shift lever then is moved sequentially through each position as before but all the positions now provide a higher gear ratio. The initial low gear is often used only in low range.

Eaton Fuller Range-Shift transmissions are not synchronized in the front section, but the range section is synchronized to prevent grinding gears during range shifts.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

9-Speed RT, RTO, and RTX Models

Eaton Fuller 9-speed range-shift model transmissions have a 5-speed front section, and a 2-speed rear range section. The low gear in the front sections of the RT-8609 and A and B ratio transmissions is used only as a starting ratio. The high gear in the front section of the "P" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range.

See **Fig. 8.2** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RT (direct ratio) and RTX-B (overdrive ratio) transmissions are opposite of the RTO (overdrive ratio) transmissions. The RTX-P ratio transmissions have the 1st/5th shift positions where LO is in the A and B ratio transmissions. The top gear in the RTX-P ratio transmissions is called 9th gear.

10-Speed RT, RTO, and RTX Models

Eaton Fuller 10-speed range-shift model transmissions have ten selective, evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed rear range section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range, the second time in high range. See **Fig. 8.3** for the shift patterns, noting that the 4th/9th and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation, Eaton Range-Shift

1. When operating off-highway, or under adverse conditions, always use low gear (if so equipped) when starting to move the vehicle.

When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle (except when equipped with a 9-speed RTO transmission, then always start in low gear).

For all conditions, use the highest gear that is still low enough to start the vehicle moving with engine idling, and without slipping the clutch excessively.

2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Do not make range shifts with the vehicle moving in reverse gear.
4. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range

Transmissions

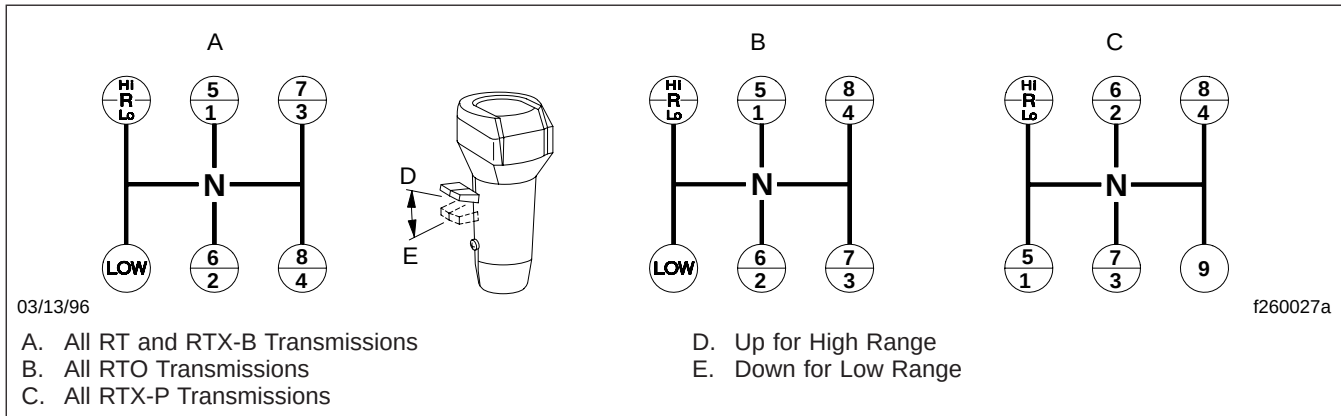


Fig. 8.2, Eaton Fuller 9-Speed Range-Shift Transmissions Shift Patterns

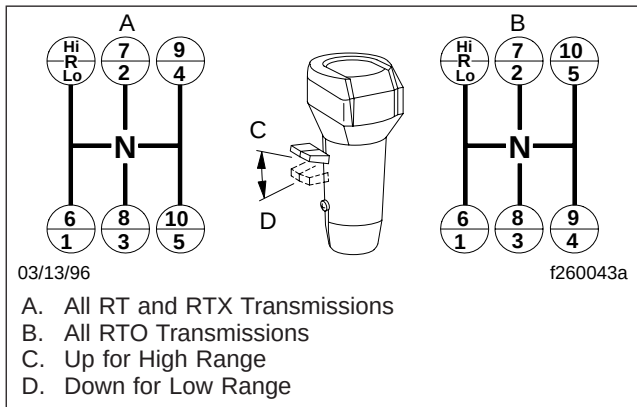


Fig. 8.3, Eaton Fuller 10-Speed Range-Shift Model Transmissions Shift Patterns

preselection lever must be made prior to moving the shift lever out of gear into neutral.

- Do not shift from high range to low range at high vehicle speeds.
- Use double-clutching between all upshifts and downshifts.
- After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

- Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).

- Position the range preselection lever down, into low range.
- Depress the clutch pedal to the floor. Shift into low or 1st gear ([Table 8.1](#)), then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
- Shift progressively upward from low or 1st gear, to the top gear in low range ([Table 8.1](#)), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.



CAUTION

To prevent damage to the range section synchros, make sure the range preselection lever is in high range before moving the shift lever to neutral. Leave the shift lever in neutral long enough to be sure the range section has shifted.

- While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. With the lever in high range, double-clutch through neutral, and shift into the bottom gear of the high range ([Table 8.1](#)). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

Transmissions

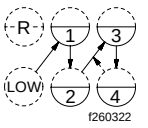
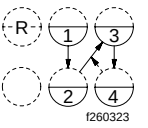
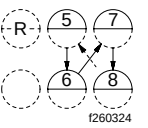
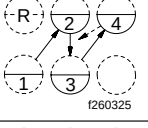
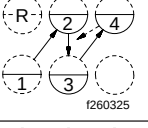
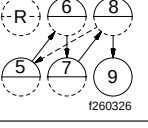
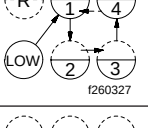
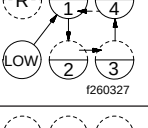
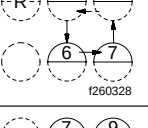
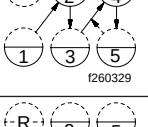
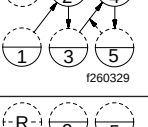
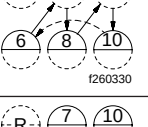
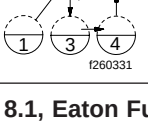
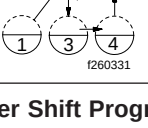
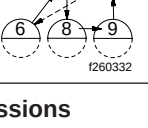
Eaton Fuller Shift Progressions			
TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
9-Speed Direct or Overdrive (RT or RTX)	 f260322	 f260323	 f260324
9-Speed Direct (RTX-P)	 f260325	 f260325	 f260326
9-Speed Overdrive (RTO)	 f260327	 f260327	 f260328
10-Speed Direct or Overdrive (RT or RTX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RTO)	 f260331	 f260331	 f260332

Table 8.1, Eaton Fuller Shift Progressions

- With the transmission in high range, shift progressively upward through each of the high range gears (Table 8.1), double-clutching between shifts.

Downshifting

- With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.



CAUTION

To prevent damage to the range section synchros, make sure the range preselection lever is in low range before moving the shift lever to neutral. Leave the shift lever in neutral long enough to be sure the range section has shifted.

- When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. With the lever in low range, double-clutch

through neutral, and shift into the top gear of the low range. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.

- With the transmission in low range, downshift through the low range gears as conditions require.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Eaton Fuller Splitter and Range-Shift Models

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Eaton Splitter and Range-Shift

Combination splitter and range-shift transmissions allow the choice of two splitter ratios in each lever position as well as the additional ratios provided in each lever position after shifting to the other range.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

13-Speed RTO Models

Eaton Fuller 13-speed RTO model transmissions have thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See Fig. 8.4 for the shift patterns.

All of the thirteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range preselection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high range gear positions can be split with the underdrive ratio (RT

Transmissions

models), or overdrive ratio (RTO models) of the splitter gear. Ratios cannot be split while the transmission is in low range.

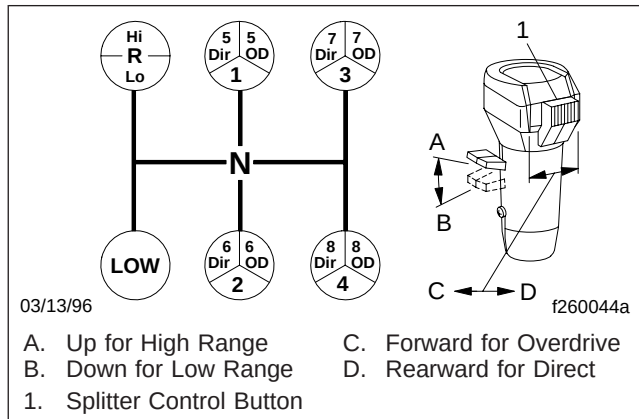


Fig. 8.4, Eaton Fuller 13-Speed RTO Model Transmissions Shift Patterns

18-Speed RTLO Models

Eaton Fuller 18-speed RTLO model transmissions have eighteen forward speeds and four reverse, consisting of a 5-speed front section and a 3-speed auxiliary section. The auxiliary section contains low and high range ratios, plus an overdrive splitter gear.

One ratio in the front section (low) is used as a starting ratio; it is never used when the transmission is in high range.

The other four ratios in the front section are used once in low range and once again in high range; however, each of the five ratios (low-1-2-3-4) in low range and each of the four ratios (5-6-7-8) in high range can be split with the overdrive splitter gear.

All of the eighteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range preselection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Operation, Eaton Splitter and Range-Shift

IMPORTANT: On 13-speed transmissions, the shifter knob has an interlock feature that prevents the splitter control button from being moved forward when the range preselection

lever is down (in low range). When in high range and the splitter control button is in the forward position, the range preselection lever cannot be moved down.

1. When operating off-road, or under adverse conditions, always use low gear when starting to move the vehicle forward.

When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle forward.

For all conditions, use the highest gear that is still low enough to start the vehicle moving with the engine at or near idle speed, and without slipping the clutch excessively.

2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.
- For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Use double-clutching between all upshifts and downshifts that require movement of the shift lever. Splitting of the high range gears does not require movement of the shift lever.
4. Never move the shift lever into low gear while in high range.
5. Never move the splitter control button while in neutral.
6. Do not preselect with the splitter control button. After moving the control button, complete the shift immediately.
7. Except when downshifting from 5th direct to 4th gear, never push the range preselection lever down into low range while operating in high range-the splitter will become inoperative.
8. Do not shift from high range to low range at high vehicle speeds.
9. Do not make range shifts with the vehicle moving in reverse gear.
10. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range

Transmissions

preselection lever must be made prior to moving the shift lever out of gear into neutral.

- After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

- Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
- Position the range preselection lever down, into low range. See [Fig. 8.4](#) or [Fig. 8.5](#).

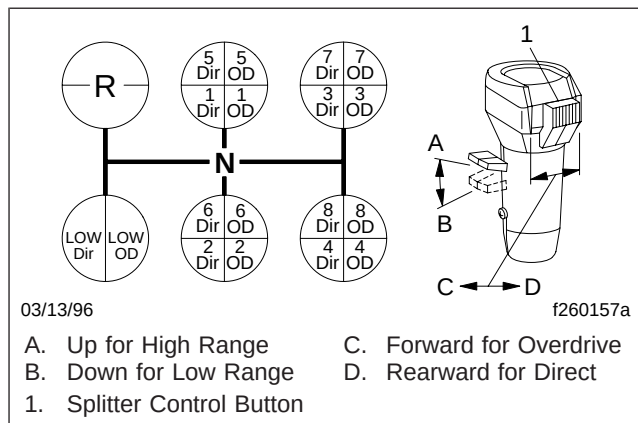


Fig. 8.5, Eaton Fuller 18-Speed RTLO Model Transmission Shift Patterns

- Make sure the splitter control button is in the direct (rearward) position. See [Fig. 8.4](#) or [Fig. 8.5](#).

- For 13-speed transmissions:

Depress the clutch to the floor, shift into low or 1st gear; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.

For 18-speed transmissions:

Depress the clutch to the floor, shift into low; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving.

To shift from low direct to low overdrive, move the splitter control button ([Fig. 8.5](#)) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch

pedal. After releasing the clutch, accelerate again.

- For 13-speed transmissions:

Shift upward from low to 1st gear, 2nd, etc. until 4th gear, double-clutching between shifts, and accelerating to 80 percent of engine governed speed. See [Fig. 8.4](#).

For 18-speed transmissions:

Shift upward from low overdrive to 1st direct by first moving the splitter control button into the direct (rearward) position ([Fig. 8.5](#)). Move the shift lever, double-clutching, to the 1st gear position.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (1st to 2nd to 3rd to 4th); single-clutch during split shifts (1st direct to 1st overdrive, etc.).

- When in 4th gear (13-speed transmissions) or 4th overdrive (18-speed transmissions) and ready to shift up to 5th gear, use the range shift lever as follows:

For 13-speed transmissions:

While in 4th gear, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral. Then, disengage the clutch; double-clutch through neutral; move the shift lever to 5th gear; engage the clutch, and accelerate the engine.

For 18-speed transmissions:

While in 4th overdrive, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral.

Move the shift lever, double-clutching, to the 5th gear position. Just before making final clutch engagement, move the splitter control button to the direct (rearward) position; then engage the clutch and accelerate. Do not move the control button while the shift lever is in neutral.

- Shift up through the high range gears as follows:

For 13-speed transmissions:

To shift from 5th direct to 5th overdrive, move the splitter control button ([Fig. 8.4](#)) into the overdrive (forward) position, then immediately release the

Transmissions

accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

For 18-speed transmissions:

To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.5**) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button to the direct (rearward) position; then, immediately release the accelerator, and disengage the clutch. Engage the clutch, and accelerate the engine only after the transmission has shifted.
2. Start the downshift from 8th direct to 7th overdrive by flipping the splitter control button to the overdrive (forward) position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Shift downward through each of the high range gears, alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct and ready for the downshift to 4th (13-speed transmissions) or 4th overdrive (18-speed transmissions), push the range preselection lever down. Then, double-clutch through neutral and move the shift lever to the 4th gear position. On 18-speed transmissions, move the splitter control button to the overdrive (forward) position *before* engaging the clutch. Do not move the control button while the shift lever is in neutral.
5. Continue downshifting from 4th to 1st as follows:
For 13-speed transmissions:
Downshift through the low range gears as conditions require.

For 18-speed transmissions:

Continue downshifting from 4th overdrive to 4th direct, then 4th direct to 3rd overdrive, 3rd overdrive to 3rd direct, etc. Single clutch when split shifting (direct to overdrive, overdrive to direct). Double clutch when making lever shifts (4th to 3rd, 3rd to 2nd, etc.).

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Eaton Fuller Deep-Reduction Models

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Deep-Reduction 10-Speed RTO Models

Eaton Fuller 10-speed RTO model transmissions have a 5-speed front section, and a 2-speed rear-range section, with a deep reduction gear. The low-low, deep reduction gear is used only when operating under adverse conditions. Low gear in the front section is used only for rough, off-highway conditions, as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. See **Fig. 8.6** for the shift pattern, noting that the 3rd/7th and 4th/8th shift positions in the RTX-LL transmissions are opposite of the RTO-LL transmissions.

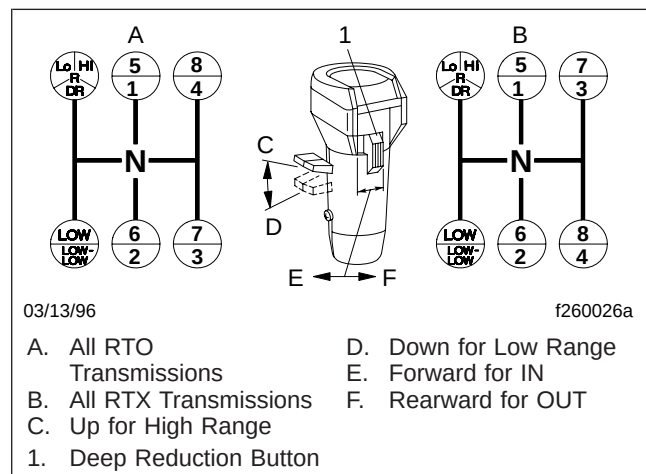


Fig. 8.6, Eaton Fuller 10-Speed RTO Model Transmissions Shift Patterns

Transmissions

15-Speed RT, RTO, and RTX Models

Eaton Fuller 15-speed RT, RTO, and RTX model transmissions have a 5-speed front section, and a 2-speed rear section. They also have five additional deep reduction ratios. The 5-speed front section, and the low- and high-range sections provide ten evenly and progressively spaced forward speeds. The five deep reduction ratios are also evenly and progressively spaced; however, they do overlap the low-range ratios, and should be used only when operating under adverse conditions. See Fig. 8.7 for the shift patterns, noting that the 4th/9th, and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation, Deep-Reduction

IMPORTANT: The shifter knob has an interlock feature that prevents the deep reduction button from being moved forward when the range preselection lever is up (in high range). When in low range and the deep reduction button is in the forward position, the range preselection lever cannot be moved up.

- For all driving conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling, and without slipping the clutch excessively.
- Use the clutch brake to stop gear rotation when shifting into low-low, low-1st (whichever is used as a starting ratio) or reverse, when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.
- Use double-clutching between all upshifts and downshifts.
- Never move the shift lever into low gear while in high range.
- Do not preselect with the deep reduction button. When making the shift from a deep reduction ratio to a low-range ratio, move the deep reduction button from a forward position to a rearward position, then complete the shift immediately.
- Never move the deep reduction button from a rearward position to a forward position when the transmission is in high range.
- Do not shift from high range to low range at high vehicle speeds.
- Do not make range shifts with the vehicle moving in reverse gear.
- Never attempt to move the range preselection lever with the gear shift lever in neutral while the

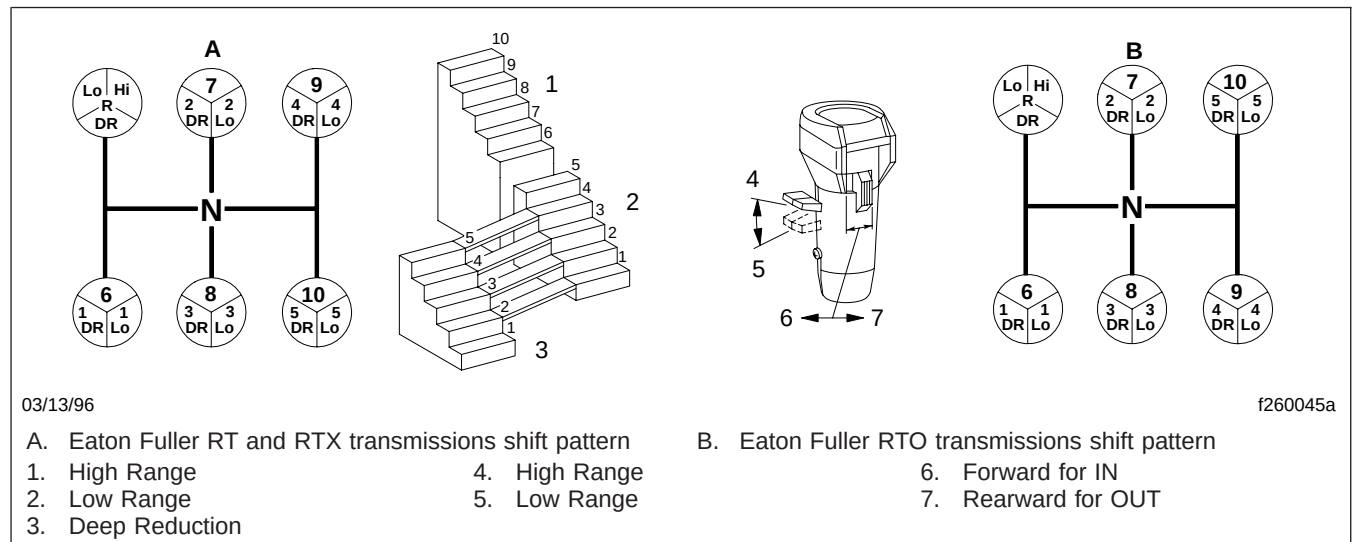


Fig. 8.7, Eaton Fuller 15-Speed RT, RTO and RTX Model Transmissions Shift Patterns

Transmissions

vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.

- After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

There are several patterns of upshifting, depending on the vehicle load and the road conditions. See [Table 8.2](#) for suggested shifting sequences. Deep reduction gears are best suited for heavy loads and steep inclines. Low gear (in 10-speed transmissions) is best suited for off-highway use.

The following instructions are recommended for starting a loaded vehicle moving, under adverse conditions.

- Position the gear shift lever in neutral. Start the engine, and bring the vehicle air system pressure up to 100 to 120 psi (689 to 827 kPa).
- Position the range preselection lever down, into low range.
- Move the deep reduction button to the forward position, to engage the deep reduction gears.
- Depress the clutch pedal to the floor. Shift into low-low gear (10-speed transmissions) or 1st gear of deep reduction (15-speed transmissions); then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.

- For 10-speed transmissions:

When ready for the next upshift, move the deep reduction button rearward, then break the torque on the gears by momentarily releasing the accelerator or depressing the clutch pedal. Do not move the shift lever.

For 15-speed transmissions:

Shift upward from 1st gear of deep reduction to 5th gear of deep reduction, double-clutching between shifts and accelerating to 80 percent of engine governed speed. See [Table 8.2](#).

When ready for the next upshift, move the deep reduction button from the forward position to the rearward position, then double-clutch through neutral, and move the shift lever to the 4th gear position in the low range.

- Shift upward from low gear (10-speed transmissions) or 4th gear (15-speed transmissions), to the top gear in low range ([Table 8.2](#)), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
- While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral, and shift into the bottom gear in high range ([Table 8.2](#)). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

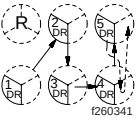
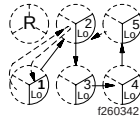
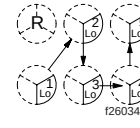
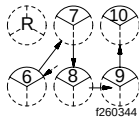
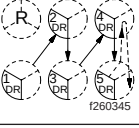
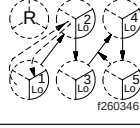
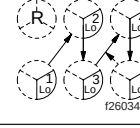
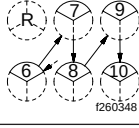
Eaton Fuller Shift Progressions				
TRANSMISSION MODEL	DEEP REDUCTION	LOW RANGE		HIGH RANGE
	Adverse Conditions Only	Off-Highway and Adverse Conditions	On-Highway and Ideal Conditions	All Conditions
15-Speed RTO				
15-Speed RT and RTX				

Table 8.2, Eaton Fuller Shift Progressions

Transmissions

- With the transmission in high range, shift progressively upward through each of the high range gears ([Table 8.2](#)), double-clutching between shifts.

Alternate Upshifting Procedures (15-Speed Transmissions Only)

The shift from deep reduction to low range can also be made from 2nd, 3rd, or 4th gear of deep reduction, but must be made to the next gear lower in the low range. The shift from 2nd gear of deep reduction to 1st gear in low range (or 3rd gear of deep reduction to 2nd gear in low range, and 4th gear of deep reduction to 3rd gear in low range), is an upshift, and the same procedure should be followed as that shown for shifting from 5th gear of deep reduction to 4th gear in low range. See step 5, under "Upshifting."

Downshifting

- With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
- When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range.

Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.

- With the transmission in low range, downshift through the low range gears, as conditions require.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Eaton Fuller Super 10, Top 2, and Lightning Semi-Automated Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Super 10/Top 2/Lightning

Super 10, Top 2, and Lightning transmissions have 10 selective forward ratios and a 2-speed rear section. Half of the 10 speed ratios are shifted with the shift lever and the other half are shifted by moving the shift button. See [Fig. 8.8](#) for the Super 10 and Top 2 shift knob, and [Fig. 8.9](#) for the Lightning shift knob.

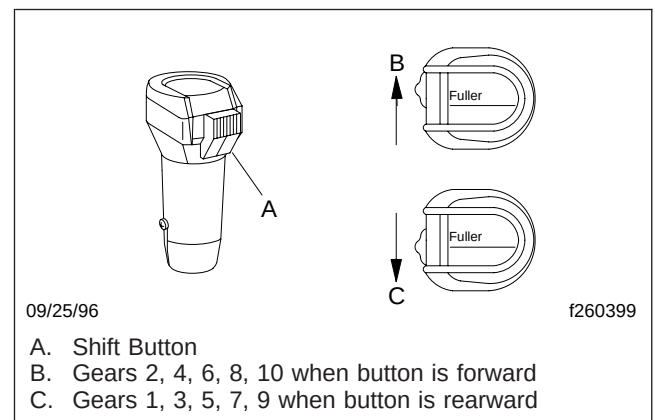


Fig. 8.8, Super 10 and Top 2 Shift Knob

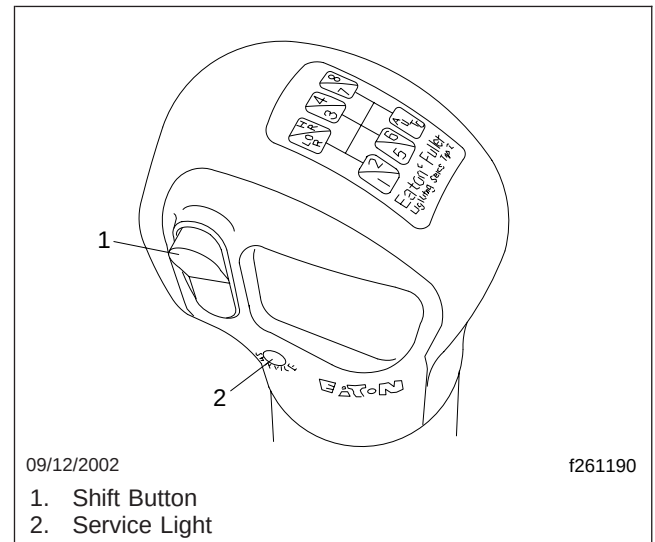


Fig. 8.9, Lightning Shift Knob

There are three types of shifts used with these transmissions. Button-only and combination button/lever shifts are both full gear changes. The lever-only shift skips a gear.

Transmissions

- The button-only shift is a gear split shift that occurs by moving the shift button.
- The lever-only shift occurs when the shift lever is moved without moving the shift button.
- The combination button/lever shift is a gear ratio change that occurs when both the shift button and the shift lever are moved.

The small red service light on the Lightning shift knob illuminates for a few seconds when the engine is turned on. This confirms that the transmission electronics are operating properly.

NOTE: If the service light stays on or flashes, or does not illuminate when the engine starts, take the vehicle to an authorized Freightliner or Eaton service facility as soon as possible.

See [Fig. 8.10](#) for the Super 10 shift pattern, which is also used by Top 2 and Lightning when the cruise control is off. Top 2 and Lightning transmissions are equipped with the Top 2 feature that allows the transmission, with cruise control on, to automatically shift between the top two gears (9th-10th) without the need for a button-only shift. See [Fig. 8.11](#).

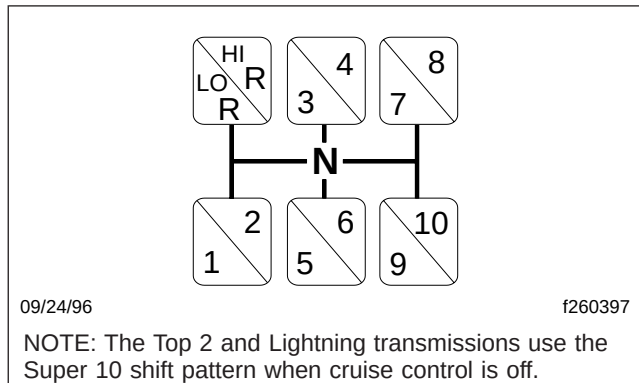


Fig. 8.10, Super 10 Shift Pattern

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

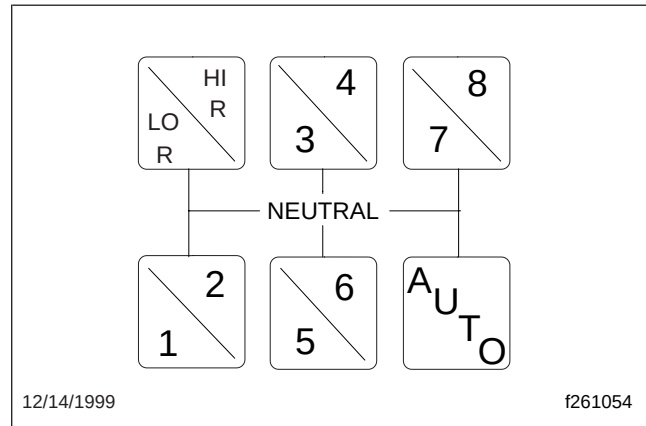


Fig. 8.11, Top 2 and Lightning Shift Patterns (with cruise control on)

Operation, Super 10/Top 2/Lightning

CAUTION

Keep the transmission in gear at all times while the vehicle in motion. Coasting in neutral could lead to transmission damage.

1. When operating off-highway, or under adverse conditions, always use low gear (if so equipped) when starting to move the vehicle.

When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle.

For all conditions, use the highest gear that is still low enough to start the vehicle moving with engine idling, and without slipping the clutch excessively.

2. Use the clutch brake to stop gear rotation when shifting into 1st or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.
For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Do not make range shifts with the vehicle moving in reverse gear.
4. The shift lever should not be moved to the center or left rail positions at vehicle speeds above 40 mph (65 km/h).

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5. Double-clutch between all upshifts and downshifts.
6. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.
7. Avoid hunting for neutral by moving the gear shift lever from the left rail to right rail. This action can cause excessive transmission wear.

Upshifting

1. Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Depress the clutch pedal to the floor. Shift into 1st gear, then engage the clutch, with the engine at or near idle speed, to start the vehicle moving.
3. Button-only shift—Preselect the next gear by sliding the shift button forward. Break torque by releasing the throttle or by depressing the clutch pedal. Decrease engine speed to synchronize the engine speed with the transmission speed. The shift will complete when the engine rpm has decreased to the proper speed.

The button-only shift is used for gear changes from 1st to 2nd, 3rd to 4th, 5th to 6th, 7th to 8th, and 9th to 10th.

4. Lever-only shift—Break torque by releasing the throttle and depressing the clutch pedal. Double-clutching, move the shift lever to the next desired gear position. Decrease engine speed to synchronize the engine speed with the transmission speed. The shift will complete when the engine rpm has decreased to the proper speed.

The lever-only shift is used to skip a full gear. With the shift button rearward—1st to 3rd, 3rd to 5th, 5th to 7th, and 7th to 9th. With the shift button forward—2nd to 4th, 4th to 6th, 6th to 8th, 8th to 10th.

NOTE: Lever-only shifts skip an entire gear ratio and will require the engine rpm to decrease twice the amount of a normal shift.

5. Combination button/lever shift—Preselect the next gear by sliding the shift button rearward. Break torque by releasing the throttle and depressing the clutch pedal. Double-clutch and

move the shift lever to the next desired gear position.

The combination button/lever shift is used for gear changes from 2nd to 3rd, 4th to 5th, 6th to 7th and 8th to 9th.

Downshifting



Do not attempt a button-only downshift at too high an engine speed (generally above 1400 rpm). Doing so could result in damage to the engine, transmission, and/or driveline.

1. Button-only shift—With the throttle still applied, preselect the next gear by sliding the shift button rearward. Break torque by releasing the throttle or by depressing the clutch pedal. Increase engine speed to synchronize the engine speed with the transmission speed. The shift will complete when the engine rpm has increased to the proper speed.

The button-only shift is used for gear changes from 10th to 9th, 8th to 7th, 6th to 5th, 4th to 3rd, and 2nd to 1st.



Do not attempt a lever-only downshift at too high an engine speed (generally above 1000 rpm). Doing so could result in damage to the engine, transmission, and/or driveline.

2. Lever-only shift—Break torque by releasing the throttle and depressing the clutch pedal. Double-clutching, move the shift lever to the next desired gear position.

The lever-only shift is used to skip a full gear. With the shift button rearward—9th to 7th, 7th to 5th, 5th to 3rd, and 3rd to 1st. With the shift button forward—10th to 8th, 8th to 6th, 6th to 4th and 4th to 2nd.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.



Do not attempt a combination button/lever downshift at too high an engine speed (generally

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above 1400 rpm). Doing so could result in damage to the engine, transmission, and/or driveline.

3. Combination button/lever shift—With the throttle still applied, preselect the next gear by sliding the shift button forward. Break torque by releasing the throttle and depressing the clutch pedal. Double-clutch and move the shift lever to the next desired gear position.

The combination button/lever shift is used for gear changes from 9th to 8th, 7th to 6th, 5th to 4th, and 3rd to 2nd.

Eaton Fuller AutoShift™ Automated Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, AutoShift 18-Speed RTLO Models

Eaton Fuller 18-speed RTLO model transmissions have 18 forward speeds and four reverse speeds. The transmission consists of a 5-speed front section and a 3-speed rear section. The driver must use the clutch to start and stop the vehicle.

10-Speed RTO Models

Eaton Fuller 10-speed RTO model transmissions have 10 forward speeds and two reverse speeds. The transmission consists of a 5-speed front section and a 2-speed rear section. The driver must use the clutch to start and stop the vehicle.

Both 10- and 18-speed AutoShift models are partially automated transmissions. The driver does not need to break torque or increase or decrease engine speed to synchronize the shift. The transmission signals the engine controller when to break torque and the engine controller automatically increases or decreases engine speed. When engine speed is correct, the transmission engages the next gear and signals the engine controller to resume operation.

The AutoShift system consists of the following components:

- The Gear Display Module ([Fig. 8.12](#)), mounted on the dashboard, indicates the current gear position. The display also flashes the next gear

to be engaged while the transmission is in neutral during a gear change.

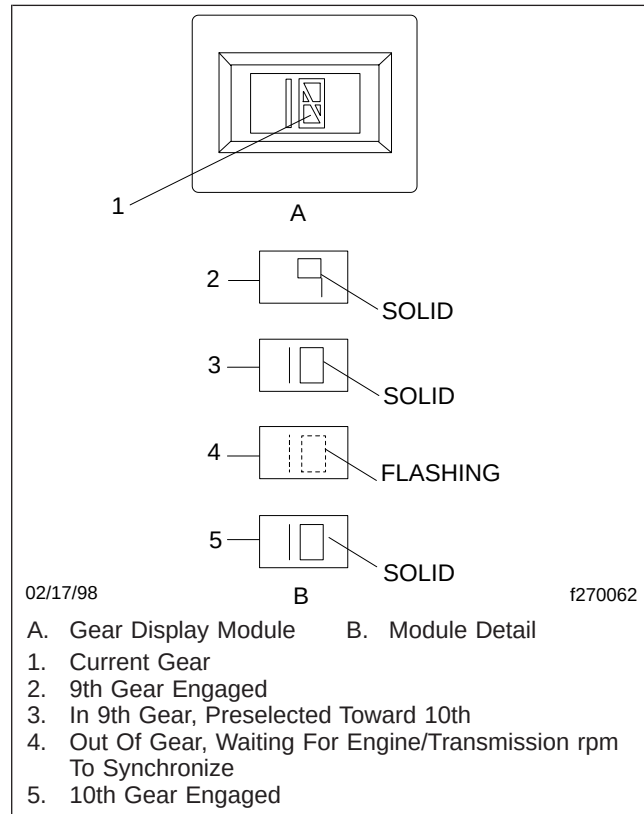


Fig. 8.12, Gear Display Module

- The Driver Command Console (DCC) replaces the shift lever and controls the transmission's shift patterns. On newer models, the SmartShift™ controller replaces the DCC. If your vehicle is equipped with a SmartShift controller, see the information under the heading "Freightliner SmartShift Transmission Shift Control."
- The Standard DCC ([Fig. 8.13](#)) has indicators for the three forward positions: Drive, Low (2nd gear), and Low1 (1st gear), plus Reverse and Neutral positions. Service and wait lamps are also located on the console. The gear select handle contains only a gear select lever detent button.
- The Enhanced DCC ([Fig. 8.14](#)) has indicators for the three forward positions: Drive, Hold, and Low, plus Reverse and Neutral positions. Service and wait lamps are also located on the

Transmissions

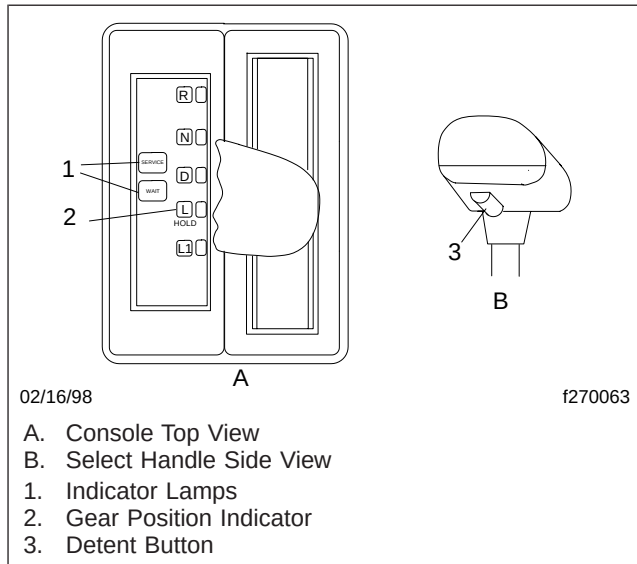


Fig. 8.13, Standard Driver Command Console (DCC)

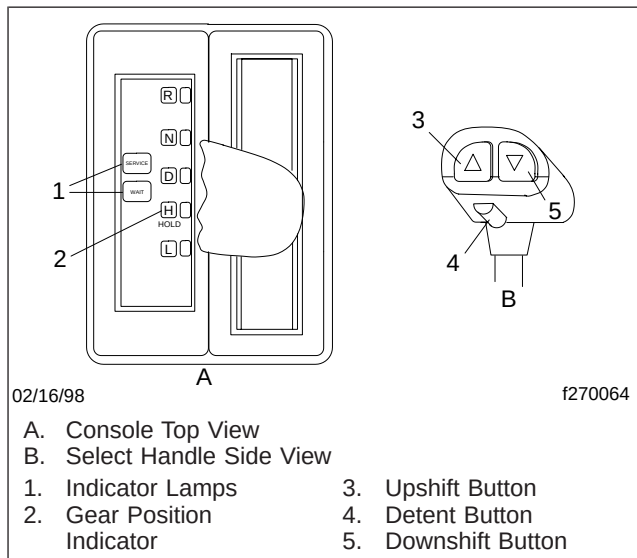


Fig. 8.14, Enhanced Driver Command Console (DCC)

console. The gear select handle contains upshift and downshift buttons and a gear select lever detent button.

- The shifter performs shifts at the front portion of the transmission. It preselects the shift to neutral and completes the gear change after driver input.

- The Electronic Control Unit (ECU) includes two controllers: a transmission ECU and a system ECU. The transmission ECU controls all transmission shift functions and the system ECU manages all vehicle interfaces for transmission shift functions.
- An electronic range valve, controlled by the transmission ECU, is used to perform range shifts.

Operation, AutoShift

WARNING

If the engine cranks in any gear other than neutral, have the vehicle serviced immediately. If the vehicle is started in gear it will suddenly move forward or backward, which could result in personal injury and damage to property and the transmission.

Start-Up

1. With the parking brake applied, press the clutch all the way down to the floor.
2. Start the engine.
3. Check to make sure the transmission is in neutral.
4. With the transmission in neutral, release the clutch.

NOTE: This allows the speed sensor on the input shaft to get a reading.

5. Press down on the clutch again and release the parking brake.
6. Select the desired starting gear.
7. Release the clutch.

Reverse

NOTE: To drive in reverse, first depress the clutch.

1. Move the gear select lever to the "R" position.
2. On 10-speed models, select either LO or HI reverse by depressing either the downshift or upshift button (Fig. 8.14) on the gear select handle (if equipped).

Transmissions

On 18-speed models, four reverse gears are available. Select either low range, low split (1R); low range, high split (R); high range, low split (1H); high range, high split (H).

3. Release the clutch.

NOTE: The clutch must be used for starting and stopping.

Driving in the "D" Mode

NOTE: The drive mode is used for normal driving conditions.

1. Fully depress the clutch.
2. Move the gear select lever from neutral to drive.

NOTE: The clutch must be fully depressed to shift from neutral to drive.

3. Upshifting and downshifting are performed automatically with no driver interaction required.

NOTE: The clutch must be used for starting and stopping.

Parking the Vehicle

1. With the clutch pedal depressed, move the gear select lever to neutral.
2. Ensure that a solid "N" appears on the gear display module. See [Fig. 8.12](#).

NOTE: If the gear display does not show a solid "N," the transmission is not yet in neutral.

3. Set the parking brakes.
4. Slowly release the clutch pedal.

Selecting the Starting Gear (push button equipped gear select handle only)

NOTE: On vehicles equipped with upshift and downshift buttons ([Fig. 8.14](#)) on the gear select handle (enhanced DCC), you may select the starting gear. The gear you select is only active while the vehicle is running. The transmission resets to the default starting gear after you have shut off the engine. Depending on the vehicle's load, you may select gears 1 through 5 as the starting gear.

1. With the vehicle stopped, place the gear select lever in the "D" or "H" position to select a starting gear.
2. Select the starting gear with the upshift or downshift buttons on the gear select handle.

Driving in the "H" Mode (if equipped)

NOTE: You must use the upshift and downshift buttons on the gear select handle to change gears while in the "H" (hold) mode.

1. Depress the clutch pedal.
2. Place the shift lever in the "H" mode.
3. Select the starting gear you want.
4. Slowly release the clutch pedal.

Upshifting

NOTE: In the "H" mode you, the driver, decide when to upshift and downshift.

1. Accelerate.
2. Press the upshift button on the gear select handle. To skip shift, press twice.
3. The transmission automatically selects and shifts to the next gear.

Downshifting

1. Decelerate.
2. Press the downshift button on the gear select handle. To skip shift, press twice.
3. The transmission automatically selects and shifts to the next gear.

Spicer Straight-Shift Models

Refer to the Spicer/TTC website for additional information, www.ttcautomotive.com.

General Information, Spicer Straight-Shift

Spicer 7-speed series transmissions are synchronized in all gears except 1st and reverse. They have seven forward gears and one reverse gear. See [Fig. 8.15](#) for the shift pattern.

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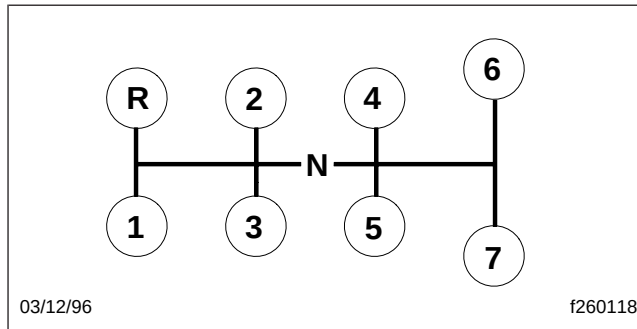


Fig. 8.15, Spicer 7-Speed Transmission Shift Pattern

Operation, Spicer Straight-Shift

1. Always use 1st gear when starting to move the vehicle forward.
2. Use the clutch brake to stop gear rotation when shifting into 1st or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor. For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.
3. Double-clutch only when shifting out of neutral, or when shifting down into 1st.

Upshifting

1. Position the gear shift lever in neutral, then start the engine. Bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Press the clutch pedal to the floor. Shift into 1st gear, then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to engine governed speed.
3. Once governed speed has been attained, disengage the clutch enough to break torque, and move the shift lever to 2nd gear. Then engage the clutch, and accelerate back to engine governed speed.
4. Continue shifting upward, using the same sequence described in step 3 above. See [Fig. 8.15](#) for the shift pattern.

Downshifting

When downshifting, shift progressively down through each successive lower gear, as follows:

1. Depress the clutch pedal enough to release the torque, shift into the next lower gear, and engage the clutch smoothly while accelerating the engine to keep the vehicle moving at the desired speed.
2. Continue downshifting, as conditions require, using the same sequence described above. When shifting down into 1st gear, remember that 1st gear isn't synchronized. Double-clutch when shifting down into 1st gear.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Meritor™ Range-Shift Models

Refer to the Meritor website for additional information, www.arvinmeritor.com.

General Information, Meritor Range-Shift

Range-shift transmissions are typically upshifted by moving the shift lever through all of the low gear positions and then activating a range switch to provide an additional set of ratios in the high range using the same shift lever positions as used in low range. The shift lever then is moved sequentially through each position as before but all the positions now provide a higher gear ratio. The initial low gear is often used only in low range.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

9-Speed Models

Meritor 9-speed M, MO, RM, RMO, and RMX model transmissions have a 5-speed front section, and a 2-speed auxiliary section. The low gear in the front sections of the "A" and "B" ratio transmissions is used only as a starting ratio. The high gear in the front section of the "R" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range.

See [Fig. 8.16](#) for the shift patterns.

Transmissions

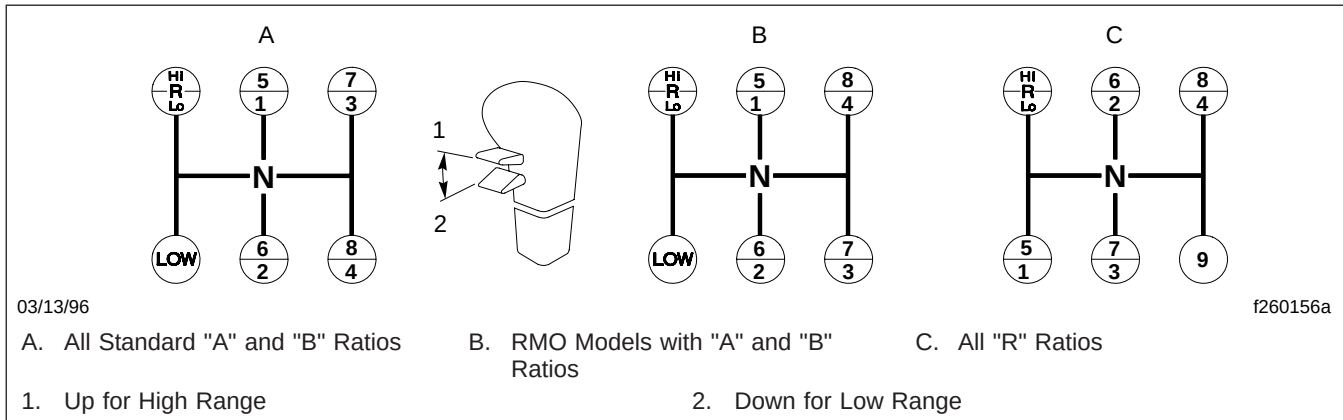


Fig. 8.16, Meritor 9-Speed Transmission Shift Patterns

NOTE: The 3rd/7th and 4th/8th shift positions in the standard "A" and "B" ratio transmissions (both direct drive and overdrive) are opposite of the RMO model (overdrive only) transmissions.

The "R" ratio transmissions have the 1st/5th shift positions where low is in the "A" and "B" ratio transmissions. The top gear in the "R" ratio transmissions is called 9th gear.

10-Speed Models

Meritor 10-speed transmissions have ten evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed auxiliary section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range, the second time in high range. See [Fig. 8.17](#) for the shift patterns.

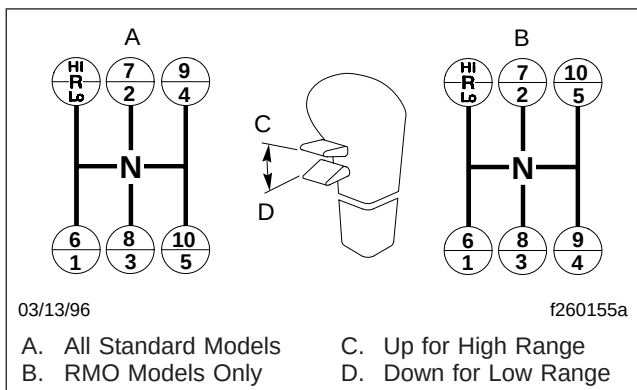


Fig. 8.17, Meritor 10-Speed Transmission Shift Patterns

NOTE: The 4th/9th and 5th/10th shift positions in the standard "A" and "B" ratio transmissions (both direct drive and overdrive) are opposite of the RMO model (overdrive only) transmissions.

Operation, Meritor Range-Shift

Reverse

To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into reverse.

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.

Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into low.

2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the

Transmissions

clutch pedal, and move the shift lever into neutral.

4. Release the clutch, and allow the engine to decelerate until the road speed and the engine RPM match.
5. Partially depress the clutch pedal, and move the shift lever into first gear.
6. Double clutch to continue upshifting until the top gear in the low range—4th gear in 9-speed models, 5th gear in 10-speed models. See [Table 8.3](#).

Meritor Shift Progressions			
MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
9-Speed Standard			
9-Speed "R" Ratio			
9-Speed RMO Models			
10-Speed Standard			
10-Speed RMO Models			

Table 8.3, Meritor Shift Progressions

7. To upshift into high range—with the transmission still in the highest low-range gear—move the range selector lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

8. Release the clutch pedal, and let the engine slow until the road speed and engine RPM match.
9. Partially depress the clutch pedal, and move the shift lever into the lowest gear in the high range—5th gear in 9-speed models, 6th gear in 10-speed models.
10. Double clutch to continue upshifting.

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range—5th gear in 9-speed models, 6th gear in 10-speed models—double-clutching between shifts. See [Table 8.3](#).
2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Meritor Splitter and Range-Shift Models

Refer to the Meritor website for additional information, www.arvinmeritor.com.

General Information, Meritor Splitter and Range-Shift

Combination splitter and range-shift transmissions allow the choice of two splitter ratios in each lever position as well as the additional ratios provided in each lever position after shifting to the other range.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

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13-Speed Models

Meritor 13-speed transmissions have thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See [Fig. 8.18](#).

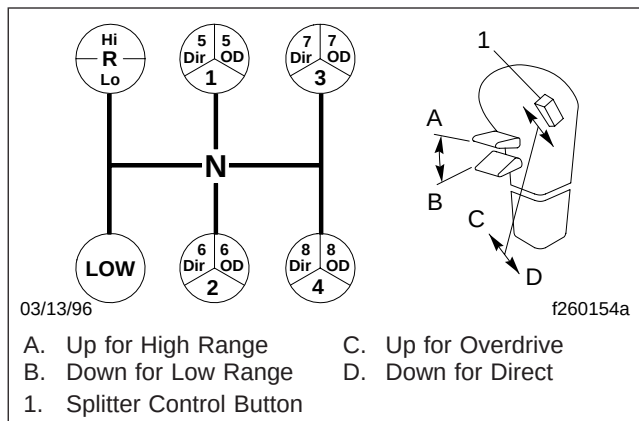


Fig. 8.18, Meritor 13-Speed Transmission Shift Pattern

All of the thirteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range selection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high range gear positions can be split with the overdrive ratio of the splitter gear. Ratios cannot be split while the transmission is in low range.

Operation, Meritor Splitter and Range-Shift

IMPORTANT: The shifter knob has an interlock feature that prevents the splitter control button from being moved up when the range selection lever is down (in the low range); when the transmission is in the high range, and the splitter control button is up, the range selection lever cannot be moved down.

Reverse

To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into reverse.

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.
Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into low.
2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the clutch pedal, and move the shift lever into neutral.
4. Release the clutch pedal, and allow the engine to decelerate until the road speed and the engine RPM match.
5. Partially depress the clutch pedal, and move the shift lever into 1st gear.
6. Double clutch to continue upshifting until in fourth gear. See [Table 8.3](#).
7. To upshift into high range—with the transmission still in 4th gear—push the range selection lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
8. Release the clutch pedal, and let the engine slow until the road speed and engine RPM match.
9. Partially disengage the clutch, and move the shift lever into 5th gear.

Transmissions

10. To upshift from 5th gear into 5th overdrive, flip the splitter control button up to the overdrive position; then, immediately release the accelerator, and press and release the clutch pedal. It is not necessary to move the shift lever when shifting from direct to overdrive; the transmission will shift when synchronization with the engine's speed is reached. Accelerate the engine only after the transmission has shifted.
11. To shift from 5th overdrive to 6th direct, partially disengage the clutch, shift into 6th—but before engaging the clutch—flip the splitter control button down into the direct drive position; then engage the clutch, and accelerate the engine.

Do not move the control button while the shift lever is in neutral.
12. Shift upward through each of the high range gears, alternating the procedures in steps 10 and 11, above.

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button down to the direct drive position; then, immediately release the accelerator, and press and release the clutch pedal. Accelerate the engine only after the transmission has shifted.
2. To downshift from 8th direct to 7th overdrive, flip the splitter control button up to the overdrive position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Downshift through each of the high range gears alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into 4th gear. See [Fig. 8.18](#). As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
5. With the transmission in low range, downshift through the low range gears as conditions require.

IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

Meritor Engine Synchro Shift™ (ESS) Automated Models

Refer to the Meritor website for additional information, www.arvinmeritor.com.

General Information, ESS

9-Speed and 10-Speed M, MO, RS, and RSX Models

Meritor 9-Speed and 10-Speed M, MO, RS, and RSX Model transmissions do not require use of the clutch except to start and stop the vehicle.

NOTE: Meritor M and MO series ESS transmissions are available only on vehicles equipped with either Caterpillar or Cummins electronic engines. Meritor RS and RSX series ESS transmissions are only available on vehicles equipped with Detroit Diesel electronic engines.

The ESS system works with the engine fuel control system to automatically synchronize engine rpm to road speed during gear changes. Use the clutch only to start and stop the vehicle and to shift into Forward or Reverse. The HI and LO ranges are automated, so the driver does not have to select ranges. A "break torque" feature allows the driver to move the shift lever and take the transmission out of gear without changing throttle position. Throttle position can be maintained while braking and downshifting through the gears when stopping the vehicle, as well as on steep grades.

The major components of the ESS system are the system switch, shift-intent switch, input and output shaft speed sensors, a Neutral position sensor, and an electro-pneumatic solenoid.

Operation, ESS

The ESS system collects and relays information pertaining to the positions of the shift-intent and system switches ([Fig. 8.19](#)), transmission input and output shaft speeds, and shift lever position. The information is received by the engine Electronic Control Module (ECM), which signals the fuel control system to increase or decrease engine rpm to match road

Transmissions

speed. The ECM also controls HI and LO range selection in the auxiliary case on the rear of the transmission.

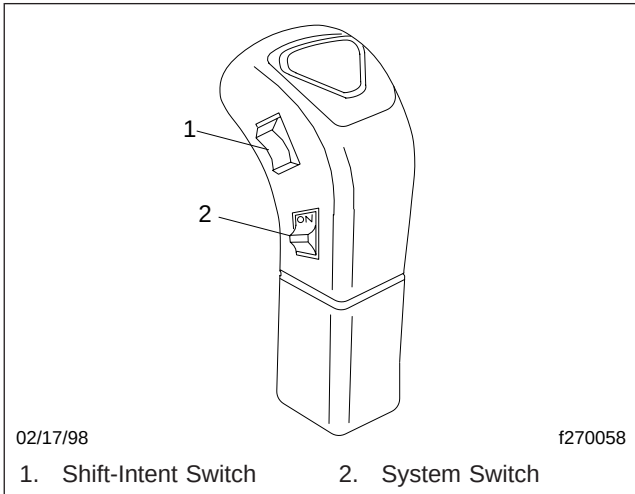


Fig. 8.19, ESS Shift Handle

The system switch (**Fig. 8.19**) is the lower switch located on the driver's side of the shift handle. It controls ESS system operation. When in the down position, the system is operating and the word ON is visible on the switch. In the up position, the word OFF is visible, the system is not operating, and the transmission can be shifted manually.

The shift-intent switch (**Fig. 8.19**) is the upper switch on the driver's side of the shift handle. It has four positions and controls upshifting and downshifting by communicating to the ECM the driver's intention of changing gears.

NOTE: If the system switch is OFF, use the shift-intent switch to select between ranges. Push the top of the switch (**Fig. 8.20**) to select the HI range on upshifts and the bottom of the switch (**Fig. 8.21**) to select the LO range on downshifts.

WARNING

Make sure that the transmission is in neutral (N) when you start the vehicle. If the vehicle is started in gear, it will suddenly move forward or backward which could result in personal injury and damage to property and the transmission.

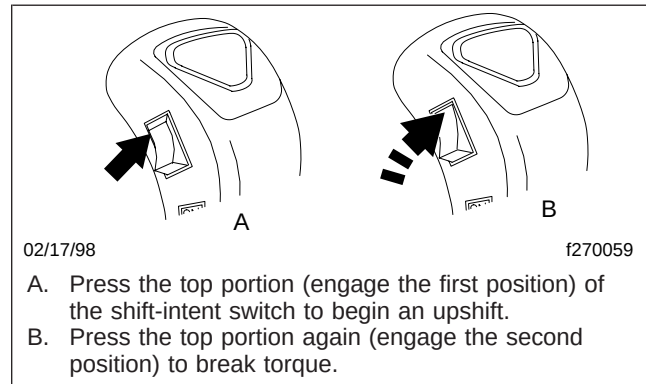


Fig. 8.20, ESS Upshifting Using the Shift-Intent Switch

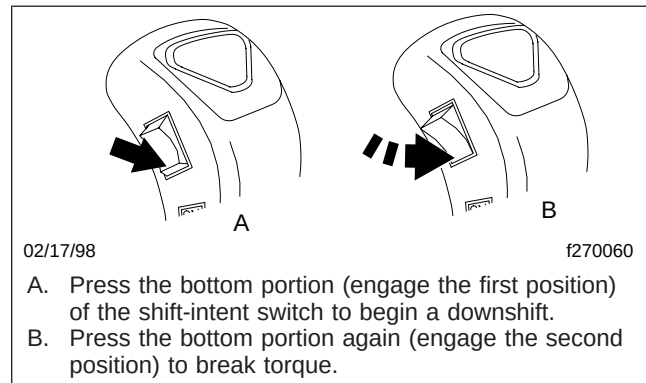


Fig. 8.21, ESS Downshifting Using the Shift-Intent Switch

Starting the Vehicle

1. Ensure that the shift lever is in the neutral (N) position.
2. Push the clutch pedal to the bottom of its travel to engage the clutch brake.
3. Start the engine.
4. Slowly release the clutch pedal.
5. Allow the system air to build up to the range specified on the gauge.
6. Release the parking brake.

Transmissions

Shifting Into a Starting Gear



CAUTION

Always use the proper starting gear. Do not shift into neutral and coast, as this will result in damage to the transmission.

1. Press the system switch down, into the ON position, to activate the ESS system.
2. Press the top portion of the shift-intent switch.

IMPORTANT: Use the clutch brake only when initially engaging a gear with the vehicle standing still.

3. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.
4. Move the shift lever and engage a starting gear.
5. Slowly release the clutch pedal.

NOTE: If you do not shift the transmission out of neutral into a gear within two seconds, the ESS system will "time out" and deactivate. The transmission returns to manual operation. To reactivate the ESS system, press the shift-intent switch again. See the following procedures for upshifting and downshifting for instructions on how to use the shift-intent switch.

Upshifting

1. To upshift into the next higher gear:
 - 1.1 Press the top portion of the shift-intent switch.
 - 1.2 Apply pressure with the shift lever toward the neutral position.
 - 1.3 Press the top portion of the shift-intent switch again, far enough so that the switch goes into a second position inside the body of the shift handle. Then release the switch. See [Fig. 8.20](#). This will break torque.
 - 1.4 Immediately move the shift lever to the neutral position.
 - 1.5 Allow engine rpm to slow down enough to synchronize with road speed.

- 1.6 Move the shift lever to the next higher gear.

2. To upshift through the rest of the gears, repeat the substeps above. Before each upshift, push the top of the shift-intent switch into the shift handle body to break torque. The range shift is automatic.
3. To skip a gear, press the shift-intent switch into the shift handle body, while in neutral, one time for every gear that is skipped.

Downshifting

1. To downshift into the next lower gear.
 - 1.1 Press the bottom portion of the shift-intent switch.
 - 1.2 Apply pressure with the shift lever toward the neutral position.
 - 1.3 Press the bottom portion of the shift-intent switch again, far enough so that the switch goes into a second position inside the body of the shift knob. Then release the switch. See [Fig. 8.21](#). This will break torque.
 - 1.4 Immediately move the shift lever to the neutral position.
 - 1.5 Allow engine rpm to speed up enough to synchronize with road speed.
 - 1.6 Move the shift lever to the next lower gear.
2. To downshift through the rest of the gears, repeat the substeps above. Before each downshift, push the bottom of the shift-intent switch into the shift handle body to break torque. The range shift is automatic.
3. To skip a gear, press the shift-intent switch into the shift handle, while in neutral, one time for every gear that is skipped.

Reverse

1. Press the system switch on the shift handle so that it is in the ON position and the ESS system is activated.
2. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.

Transmissions

3. Move the shift lever and engage reverse.
4. Slowly release the clutch pedal and move the vehicle in the reverse direction.

NOTE: If a HI reverse range is required, follow the steps below.

5. Press the system switch on the shift handle so that it is in the OFF position and the ESS system is deactivated.
6. Press the top portion of the shift-intent switch to engage the HI range.
7. Push the clutch pedal to the bottom of its travel so that the clutch brake stops the transmission input shaft from rotating.
8. Move the shift lever and engage reverse.
9. Slowly release the clutch pedal and move the vehicle in the reverse direction.

See [Fig. 8.22](#) for two ESS 9-speed shift patterns and one ESS 10-speed shift pattern.

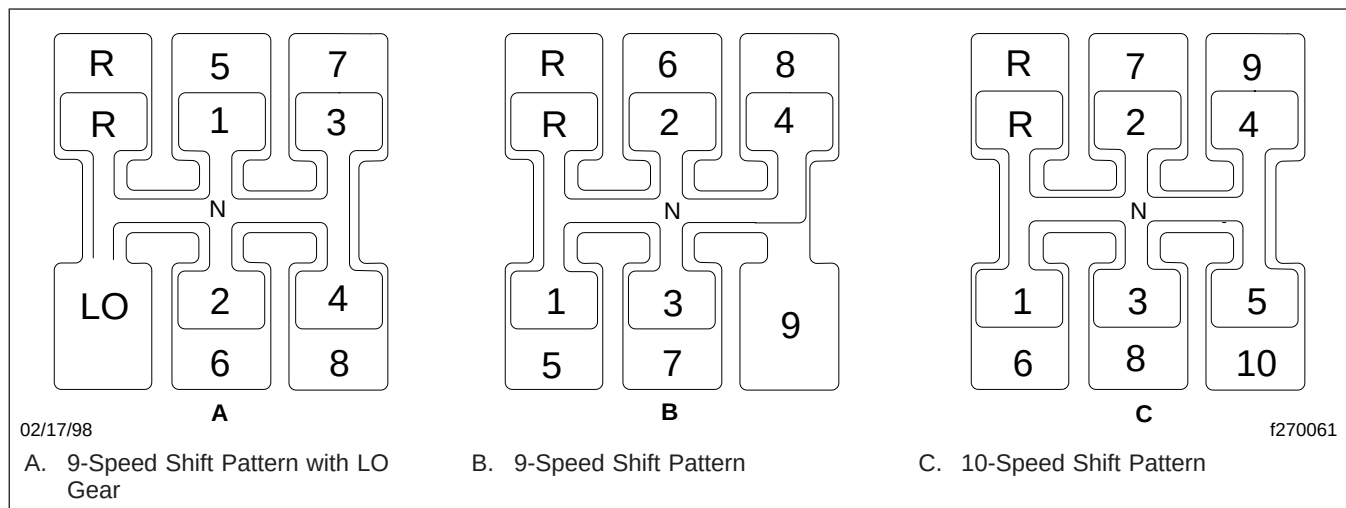


Fig. 8.22, Meritor ESS 9- and 10-Speed Shift Patterns

9

Rear Axles

Meritor Single Drive Axles With Traction Equalizer	9.1
Meritor Drive Axles With Main Differential Lock	9.1
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Rear Axles

Meritor Single Drive Axles With Traction Equalizer

Some Meritor single drive axles are equipped with a traction equalizer which is a load sensing, self-actuating feature. A traction equalizer provides normal differential action where traction is good. When one wheel begins to spin faster than the other, clutch plates in the differential housing automatically engage, delivering power to both wheels. There is no operator control with this feature.

A traction equalizer occasionally tends to slip in a jerking motion, producing irregular intervals of sharp noises. This generally occurs when the vehicle is operating at low speeds on fairly sharp turns. This condition, called slip-stick, is corrected by adding a friction modifier to the axle lubricant. This additive tends to reduce the static coefficient of friction to a value equal to, or lower than, the sliding coefficient.

See **Group 35** of the *Heavy-Duty Trucks Maintenance Manual* for additional information on friction modifiers and when to add them to axle lubricants.



CAUTION

Tire sizes on both rear wheels should be the same on axles equipped with a traction equalizer. If not, excessive wear may occur in the traction equalizer.

Meritor Drive Axles With Main Differential Lock

The Meritor main differential lock is a driver-controlled traction device operated from the vehicle cab. A switch allows the driver to lock or unlock the differential. An indicator light on the instrument panel comes on when the differential lock is engaged. An optional buzzer can also be used to indicate differential lock engagement.

The main differential lock provides maximum traction under slippery conditions. When the differential lock is engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together, maximizing traction of both wheels and protecting against spinout. Under normal traction conditions, do not engage the differential lock. Operate the axle with differential action between both wheels.



WARNING

Be especially careful when driving under slippery conditions with the differential locked. Though forward traction is improved, the vehicle can still slip sideways, causing possible loss of vehicle control, personal injury, and property damage.

Meritor Main Differential Lock Operation

To lock the main differential and obtain maximum traction under slippery conditions, move the control switch to the lock position.



WARNING

Lock the main differential only when the vehicle is standing still or moving less than 25 mph (40 km/h). Never lock the main differential when the vehicle is traveling down steep grades or when the wheels are slipping. This could damage the differential or lead to loss of vehicle control, causing personal injury and property damage.

NOTE: On some vehicles, the differential lock system is connected through the low speed range of the transmission. If this system is used, the transmission must be in the low speed range for the differential to fully lock.

If the vehicle is moving, maintain a constant vehicle speed while engaging the differential lock. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully lock. The indicator light should come on and the buzzer should sound on vehicles so equipped. When the differential is fully locked, the turning radius will increase because the vehicle understeers. See [Fig. 9.1](#). Drive cautiously and do not exceed 25 mph (40 km/h).

To unlock the main differential, move the control switch to the unlock position. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully unlock.

NOTE: If the differential lock system is connected through the low speed range of the transmission, shifting out of low speed range will also unlock the differential.

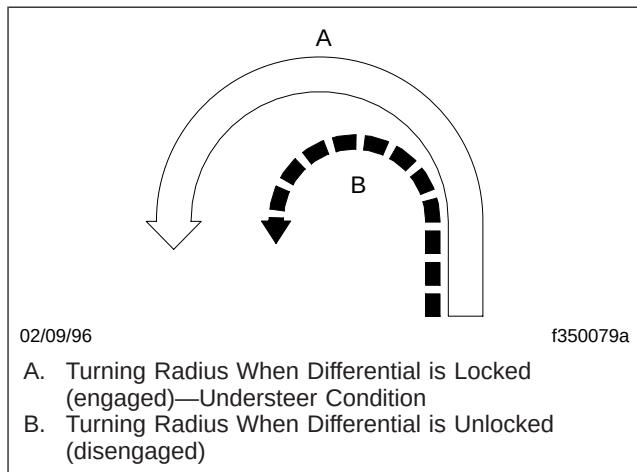


Fig. 9.1, Turning Radius

When the differential lock disengages, the indicator light will go off and the buzzer will stop.

Meritor Tandem Drive Axles With Interaxle Differential

Meritor tandem drive axles with an interaxle differential have a lockout feature. Differential lockout is controlled by a switch (Fig. 9.2) on the control panel.

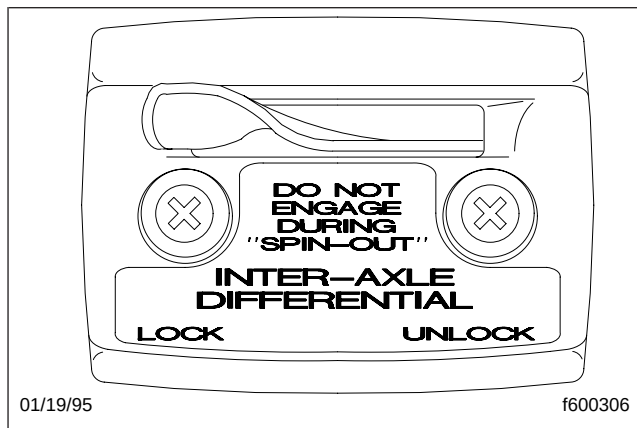


Fig. 9.2, Interaxle Differential Control

In the UNLOCK position, there is differential action between the two axles. The differential compensates for different wheel speeds and variations in tire size. Keep the interaxle differential unlocked for normal driving on roads where traction is good.

In the LOCK position, the interaxle differential is locked out and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is also transmitted straight through to the rear axle, so both axles turn together at the same speed. The LOCK position should be used when the vehicle encounters poor traction conditions; however, it also increases drivetrain and tire wear and should be used only when improved traction is required.

Meritor Interaxle Differential Lockout Operation

To lock the interaxle differential and achieve maximum pulling power when approaching slippery or poor road conditions, move the lockout control valve to LOCK while maintaining vehicle speed, before encountering the poor road conditions. Let up momentarily on the accelerator to engage the differential lock. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before locking the interaxle differential.

CAUTION

Do not actuate the interaxle differential control valve while the tires are slipping. Do not operate the vehicle continuously with the interaxle differential locked during extended good road conditions. To do so could result in damage to the axle gearing and excessive tire wear.

To unlock the interaxle differential, move the lockout control valve to UNLOCK while maintaining vehicle speed, after leaving the poor road conditions. Let up momentarily on the accelerator to allow the shift, then resume driving at normal speed.

Eaton Single Reduction Axles With Controlled Traction Differential

The controlled traction differential system is a differential assembly incorporating a friction plate assembly designed to transfer torque from the slipping wheel to the one with traction. The unit is basically a multiple disc clutch designed to slip above predetermined torque values. This controlled slipping characteristic at higher torque values enables the vehicle to negotiate turns in a normal manner. Resistance to slippage at lower torque values enables the vehicle

Rear Axles

to maintain an appreciable amount of tractive effort when one wheel encounters relatively poor traction.

A control valve (**Fig. 9.3**) in the cab is actuated by the driver to engage and disengage the controlled traction feature.

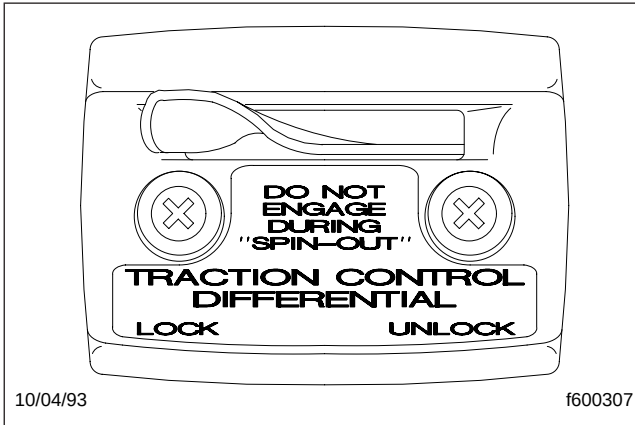


Fig. 9.3, Traction-Control-Differential Control

Disengaged, the axle has differential action all the time. One wheel will spin independently of the other, if slippery conditions are encountered.

Engaged, wheel slippage and spinout are minimized.

NOTE: The controlled traction differential can be engaged at any speed, except during spinout.

Eaton 2-Speed Tandem Axles

Each axle of the 2-speed tandem contains a high range single reduction gear set and a low range double reduction gear set. The operator selects the desired axle range by moving the range preselection lever located on the shifter knob (**Fig. 9.4**).

Dual Range 2-Speed Tandem Axle Operation With Multispeed Transmissions

NOTE: See **Chapter 8**, "Transmissions," for detailed information on how to use the range preselection lever.

On multispeed transmission applications, the 2-speed axle should be used as a dual range. Use the low range when operating off-highway or when starting out with a heavy load on-highway. After the vehicle is

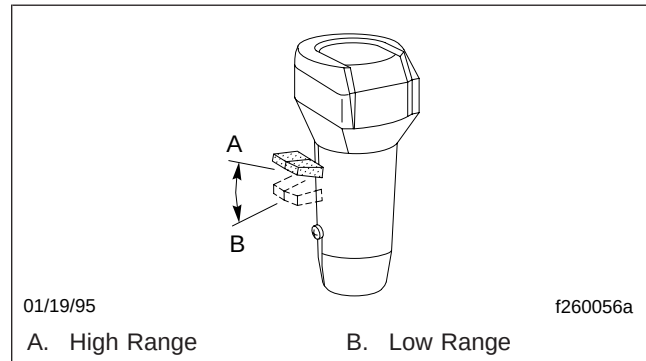


Fig. 9.4, Range Preselection Lever

moving on the highway, the axle can be shifted to high range.

To shift the axle to the high range: Make sure the interaxle differential lockout is disengaged, keep the throttle pedal down, move the range preselection lever to high, release the throttle pedal until the axle shifts, then accelerate.

To shift the axle to the low range: Keep the throttle pedal down, move the range preselection lever to low, release and depress the throttle pedal quickly to increase engine rpm. The axle will shift to low range.

NOTE: When parking the vehicle, put the axle in the low range with the engine running. Engage the clutch and transmission to be sure the axle has completed the shift into the low range. Some vehicle motion is required to ensure engagement of the axle.

IMPORTANT: See "Eaton Interaxle Differential Lockout Operation" for precautions that must be taken when shifting axles in relation to the interaxle differential lockout.

Eaton Interaxle Differential Lockout Operation

Interaxle differential lockout systems include a lockout control valve (**Fig. 9.5**) located in the cab, and an air-operated shift unit mounted on the forward rear axle.

When the interaxle differential lockout control valve is in the LOCK position, the interaxle differential is locked out and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is also transmitted straight through to

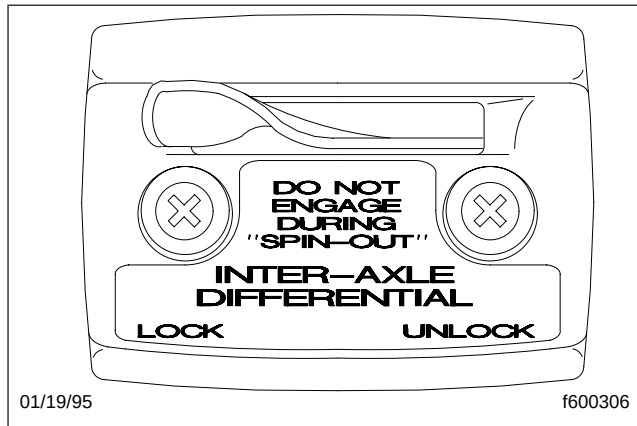


Fig. 9.5, Interaxle-Differential Control

the rear axle, so both axles turn together at the same speed. The LOCK position should be used when additional traction is needed.



CAUTION

Engage the lockout only when stopped or at slow speeds and never when the wheels are spinning. Do not operate the axles on dry pavement with the lockout engaged for prolonged periods. Use only when additional traction is needed under adverse road conditions. Disengage the interaxle differential lockout before shifting the axle to a higher range.

When the interaxle differential lockout control valve is in the UNLOCK position, the interaxle differential allows differential action between the axles thereby compensating for different wheel speeds and variations in tire size. Keep the interaxle differential lockout in the UNLOCK position for normal driving on roads where traction is good. On 2-speed axles, the interaxle differential must be in the UNLOCK position before attempting to shift the axles out of low or high range.

10

Fifth Wheels and Trailer Couplings

Holland Fifth Wheels	10.1
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Fontaine® Fifth Wheels	10.12
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Holland Trailer Coupling	10.18

Fifth Wheels and Trailer Couplings

Holland Fifth Wheels

General Information

The 2535 and 2536 sliding fifth wheel models incorporate a Model FW8, 3500 or 3600 fifth wheel (Fig. 10.1), equipped with an air-operated release slide, a double manual release slide, or a single manual release slide. Sliding fifth wheel assemblies are mounted on a baseplate which permits forward and rear movement along notched rails. Plungers are meshed into teeth on the baseplate to lock the sliding mechanism. Disengagement of the sliding member is accomplished when the plungers are withdrawn (manually or air-operated), releasing the fifth wheel assembly so that it can be positioned for optimum weight distribution over the tractor axles.

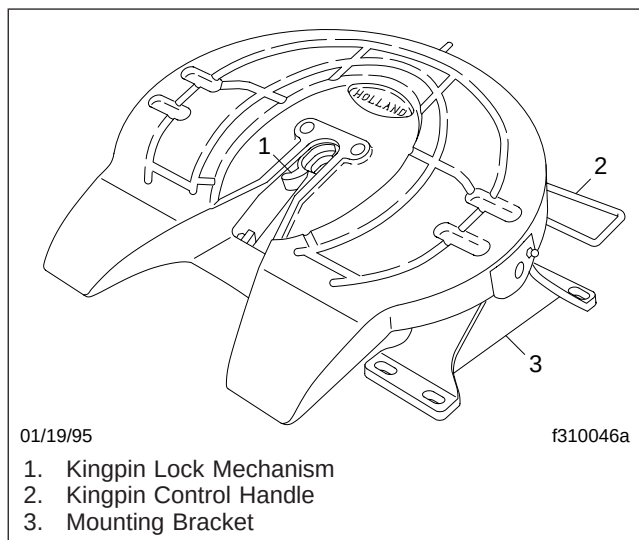


Fig. 10.1, Holland Fifth Wheel

The air-operated release slide assembly (Fig. 10.2) contains a double-ended air cylinder which locks and unlocks both sides of the sliding member at the same time. The air cylinder is activated by a two-position air-control valve in the tractor cab.

The double manual release slide assembly (Fig. 10.3) contains two slide plunger release handles, one on each side of the bracket assembly. Both handles must be manually operated to lock and unlock each side of the sliding member.

The single manual release slide assembly (Fig. 10.4) has a single lever which locks and unlocks both

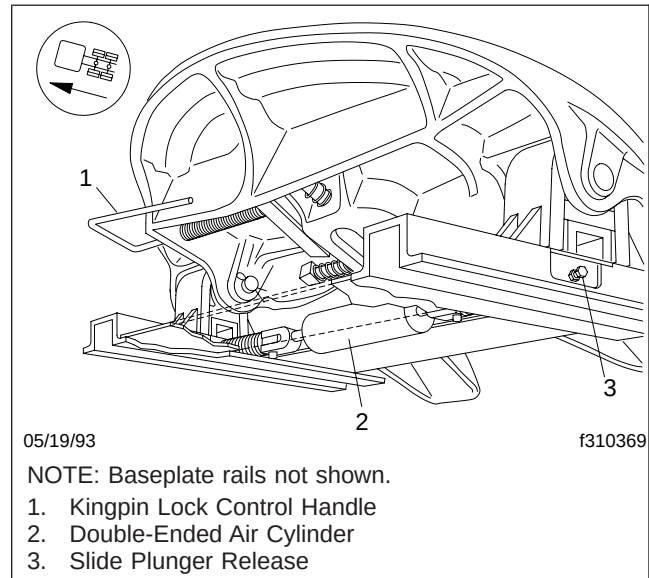


Fig. 10.2, Air-Operated Release Slide Assembly

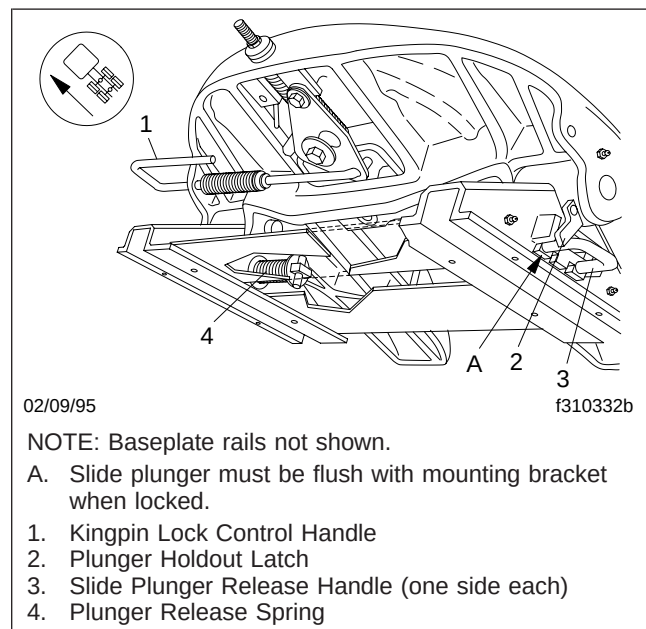


Fig. 10.3, Double Manual Release Slide

sides of the sliding member. A hook is used to move the lever to the locked and unlocked positions.

Fifth Wheels and Trailer Couplings

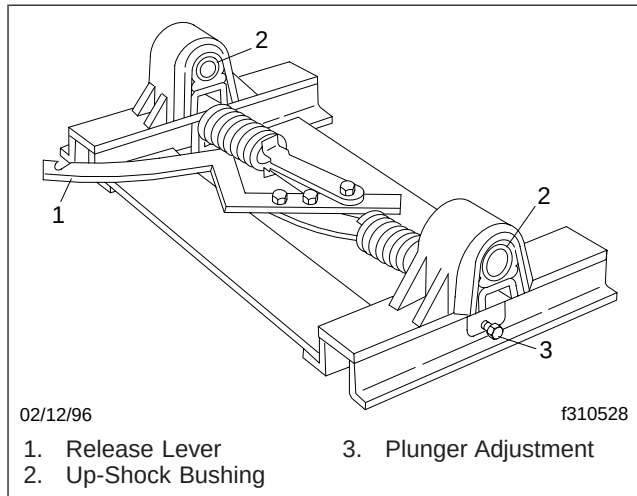


Fig. 10.4, Single Manual Release Slide

Type "B" Kingpin Lock Mechanism (Fig. 10.5)

The Type "B" kingpin lock mechanism utilizes two spring-loaded lock halves. The final forward motion of the kingpin into the open lock halves forces the locks to close in a 360 degree grip around the shoulder and neck of the kingpin, positioning sliding yokes between the lock halves and tapered rib members of the fifth wheel understructure. The kingpin can be released only by manually operating the kingpin lock control handle. The adjustment nut will compensate for wear on the lock or kingpin.

Lockguard (Fig. 10.6)

The Holland lockguard is a device that prevents a false lockup, and is used with Type "B" kingpin lock mechanisms. The Lockguard is a spring-tensioned, smooth-surfaced tongue that the kingpin passes over and depresses when entering the lock mechanism. The Lockguard will prevent the locks from engaging before the kingpin fully enters the locks. If the kingpin enters the fifth wheel incorrectly and does not depress the tongue, the locks are unable to close.

Type "A" Kingpin Lock Mechanism (Fig. 10.7)

The Type "A" kingpin lock mechanism utilizes a single hinged lock and a cam arm. The final forward motion of the kingpin into the open lock forces the hinged lock to pivot on a pin and close around the kingpin. The lock is held in place by a spring loaded

plunger. The kingpin can be released only by manually operating the release handle. The adjustment nut will compensate for wear on the lock or kingpin.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Mechanism

CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position (flush with the mounting bracket edge). This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

2. The kingpin lock mechanism must be fully open, and the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.
3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, to prevent a false lockup. See [Fig. 10.6](#). Adjust the trailer landing gear to give enough alignment height so that the fifth wheel picks up the trailer on the fifth wheel ramps.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin correctly enters the throat of the locking mechanism. When the trailer is picked up by the fifth wheel, stop the tractor, then continue slow backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.

Fifth Wheels and Trailer Couplings

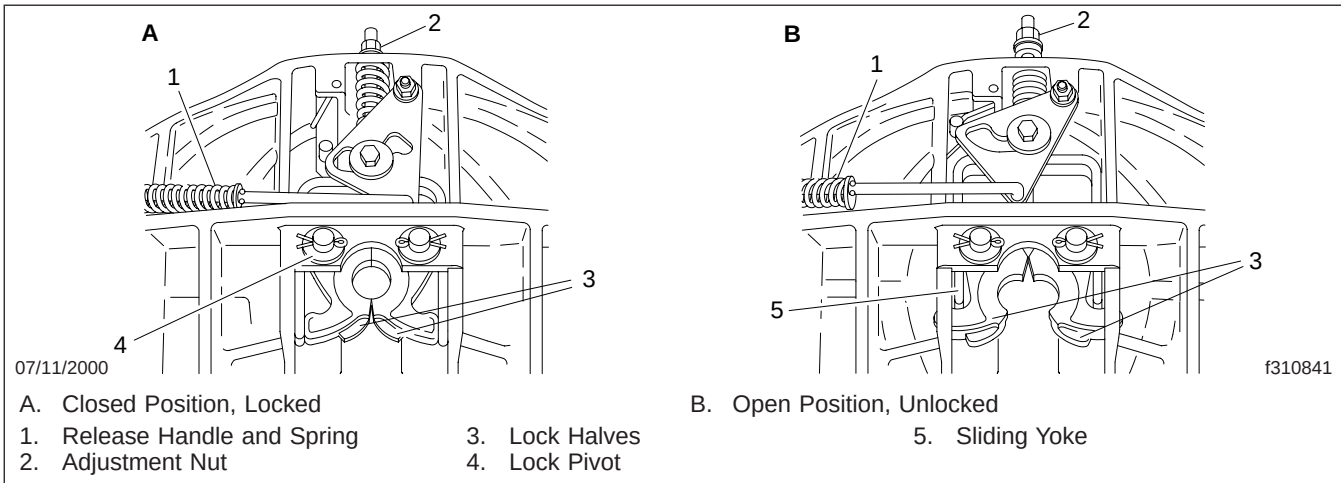


Fig. 10.5, Type "B" Kingpin Lock Mechanism (bottom view)

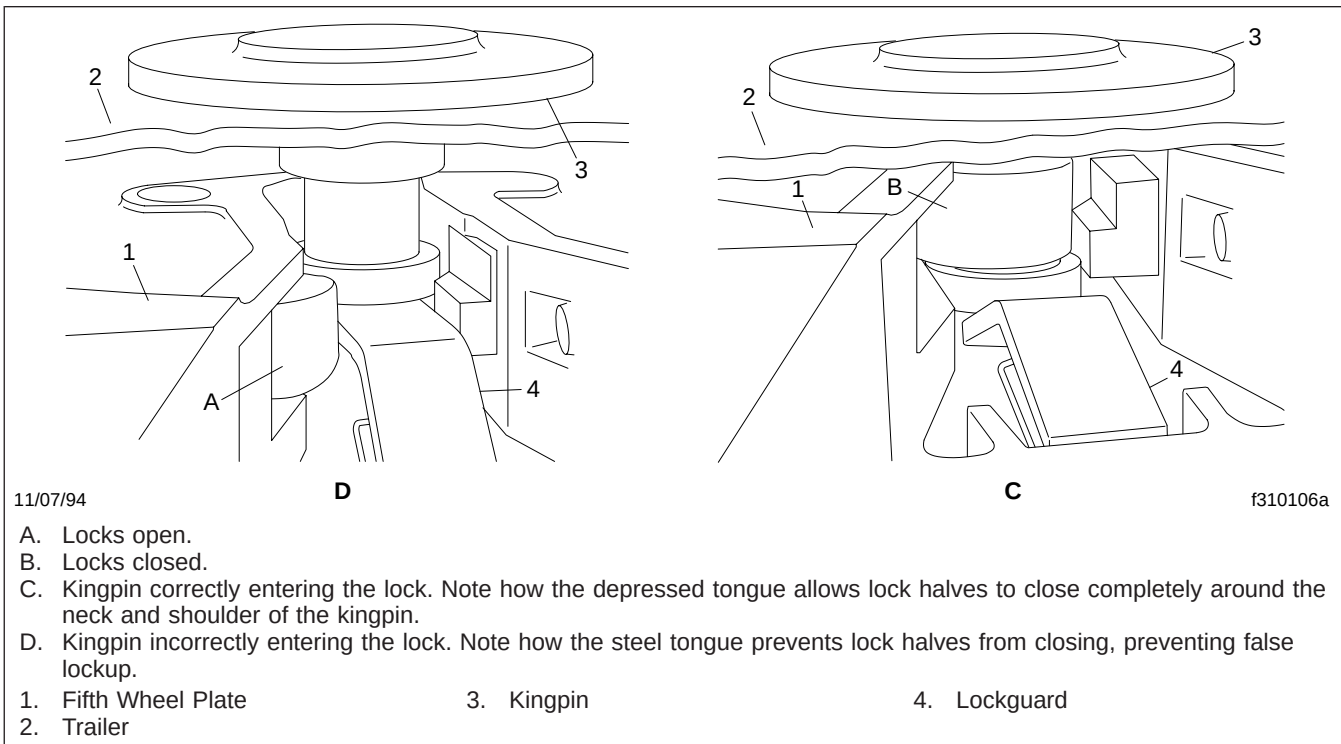


Fig. 10.6, Lockguard Mechanism (rear view)

WARNING

Adjust the locks correctly to a maximum clearance of 1/8 inch (3 mm). Incorrect adjustment of the lock could cause the trailer to disconnect,

possibly resulting in serious personal injury or death.

6. Make a visual check for proper kingpin lockup. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the

Fifth Wheels and Trailer Couplings

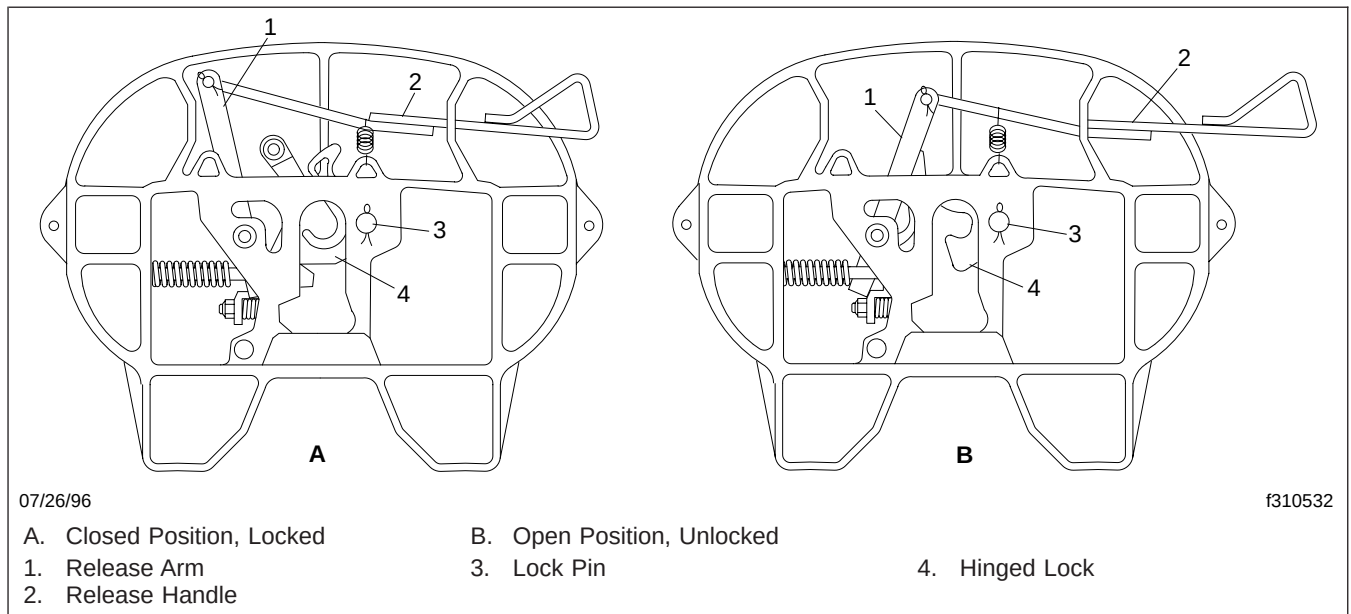


Fig. 10.7, Type "A" Kingpin Lock Mechanism

chocks. Check for correct maximum clearance between the lock halves. If more than 1/8-inch (3.2-mm) clearance exists between the lock halves, the lock must be adjusted. See **Group 31** of the *Heavy-Duty Trucks Service Manual* for adjustment procedures.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

7. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air lines.
8. Charge the air brake system with air. Make sure that the air connections do not leak.
9. Retract the trailer landing gear and secure the ratchet handle.
10. Remove the chocks from the trailer tires.

11. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.

Fifth Wheels and Trailer Couplings

2. Pull the trailer air supply valve to cut off the air supply to the trailer.
3. Chock the front and rear of the trailer tires to prevent the trailer from moving.

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

4. Lower the trailer landing gear until the weight is removed from the fifth wheel.
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position (flush with the mounting bracket edge). This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

6. Release the kingpin locking mechanism by pulling the kingpin lock control handle ([Fig. 10.1](#)) to the outward position.
7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Holland "Fifth Wheel Locking Operation," in this chapter.
2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the sliding member using one of the following methods:
 - 2.1 For air-operated models, set the cab-operated control switch ([Fig. 10.8](#)) to UNLOCK.

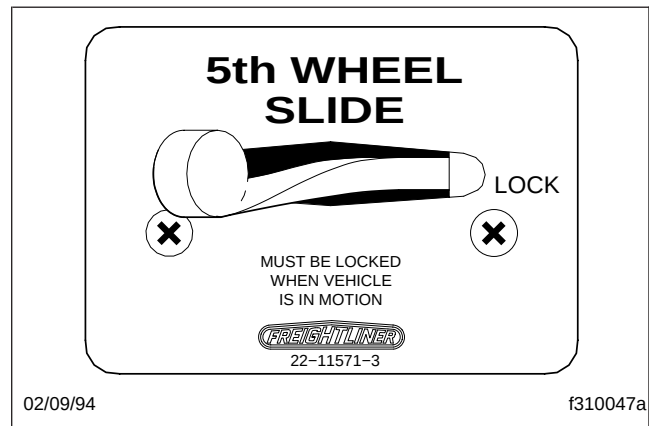


Fig. 10.8, Fifth Wheel Slide Control Switch

- 2.2 For double manual release slide models, pull both plunger release handles ([Fig. 10.3](#)) outward, from each side of the mounting brackets, to the unlocked position. Position the plunger holdout latch in the groove of the plunger. See [Fig. 10.9](#).

For single lever release slide models, use the release hook to pull the lever to the unlocked position ([Fig. 10.7](#)). Lift the release lever to the secure position behind the catch. Visually check the slide plungers to make sure they have released as shown in [Fig. 10.9](#).

3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.
5. Chock the front and rear of the trailer tires to prevent the trailer from moving.

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.

Fifth Wheels and Trailer Couplings

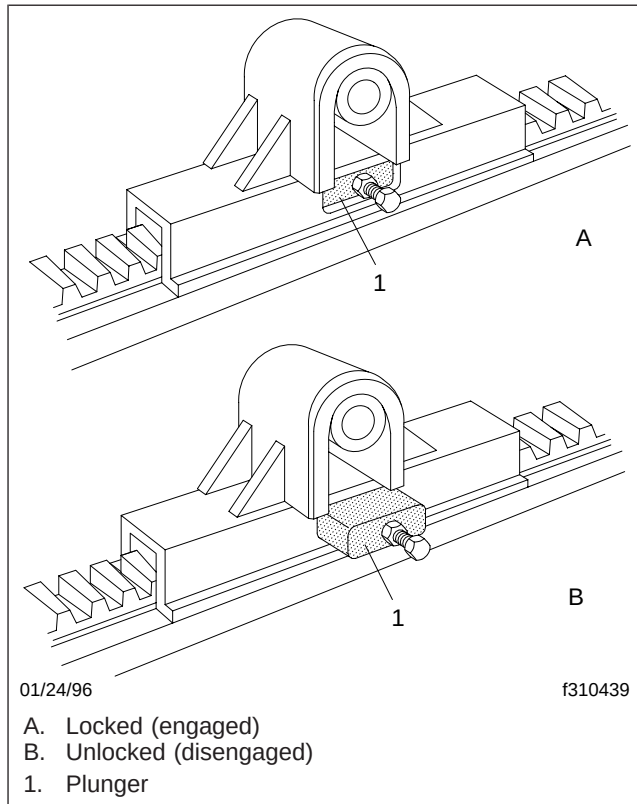


Fig. 10.9, Plunger Positions



CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking plungers to enter the fully locked position.

8. Lock the sliding member into position using one of the following methods:



WARNING

Check to be sure that the slide plungers are in the locked position. Failure to achieve complete

lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

- 8.1 For air-operated models, set the cab-operated control switch to LOCK. Visually check the slide plungers to make sure they are engaged in the fully locked position.
- 8.2 For double manual release models, lift the plunger holdout latch on each side of the mounting brackets. Then, move the release plunger on each side of the mounting brackets (Fig. 10.3) into the locked position. Make sure that the slide plungers are engaged in the fully locked position. See Fig. 10.9.
- 8.3 For single manual release models, trip the release lever (Fig. 10.4) to allow the slide plungers to retract to the locked position. Visually check the slide plungers to make sure they are in the locked position as shown in Fig. 10.9.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheels and Trailer Couplings

Fifth Wheel Lubrication

The fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer. Friction and binding, caused by insufficient grease on the fifth wheel plate, could result in erratic steering. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.

ASF Castloc® II and Simplex® Series Fifth Wheels

General Information

The ASF Castloc II and Simplex series fifth wheels are used for pulling trailers having the standard 2-inch diameter kingpin. When installed as a stationary fifth wheel (**Fig. 10.10**), they are bracket-mounted to the tractor frame in a position that best distributes the trailer load over the tractor axles. When used as a sliding fifth wheel (**Fig. 10.11**), they are mounted on the Taperloc® sliding mount (air-operated or manual release).

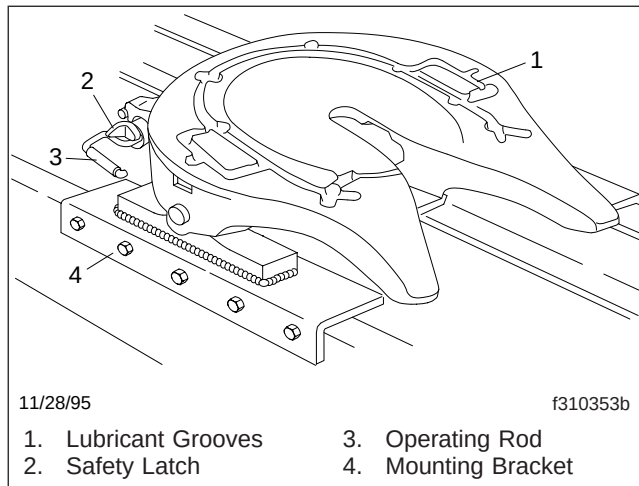


Fig. 10.10, Simplex Stationary Fifth Wheel

The fifth wheel lock mechanism for the trailer kingpin consists of a rotating jaw that grips the trailer kingpin and a spring-actuated lock. The jaw rotates on a jaw pin during coupling and uncoupling operations. Kingpin lockup occurs when the kingpin is forced into the jaw and the operating rod handle moves to the locked position. The kingpin is released either by activating a manual operating rod, or if equipped with

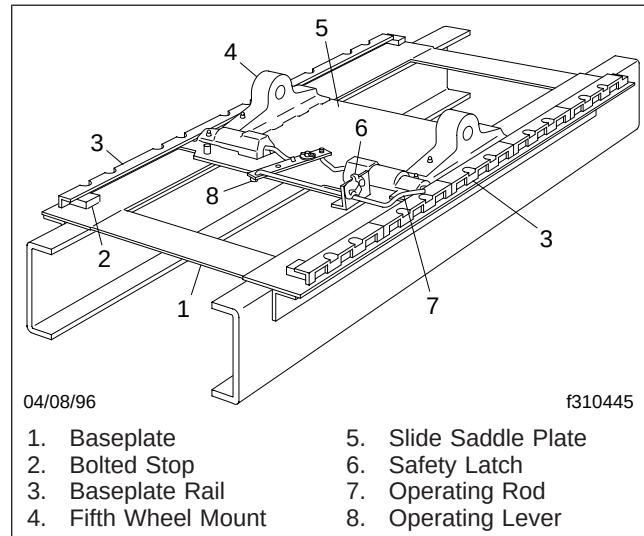


Fig. 10.11, Taperloc Slide, Manually-Operated Release

Touchloc®, by a dash mounted release-knob, which activates an air cylinder underneath the top plate. The air cylinder activates the operating rod. The operating rod is located on the left side of the fifth wheel for Castloc II and Simplex II fifth wheels, and on the right side for the Simplex fifth wheel assembly.

On sliding fifth wheels, the top plate is mounted on a sliding saddle plate, which slides along the baseplate attached to the tractor frame. The baseplate rails allow forward and rear movement of the slide assembly, for optimum weight distribution over the tractor axles.

Tapered slots in the baseplate rails, aligned in 4-inch (102-mm) increments, provide for location of the fifth wheel along the baseplate. Retractable, spring-actuated lockpins are positioned through the slots to hold the fifth wheel in the desired position. The lockpins are retracted either manually or by an air-operated cylinder controlled from the cab.

The manually-operated slide contains an operating rod (**Fig. 10.11**), which unlocks both sides of the plate at the same time.

The air-operated sliding saddle plate contains an air cylinder which moves the operating lever to unlock both sides of the plate at the same time. The air cylinder is activated by a two-position air-control valve in the tractor cab.

Fifth Wheels and Trailer Couplings

Fifth Wheel Lock Mechanism for Trailer Kingpin (Fig. 10.12)

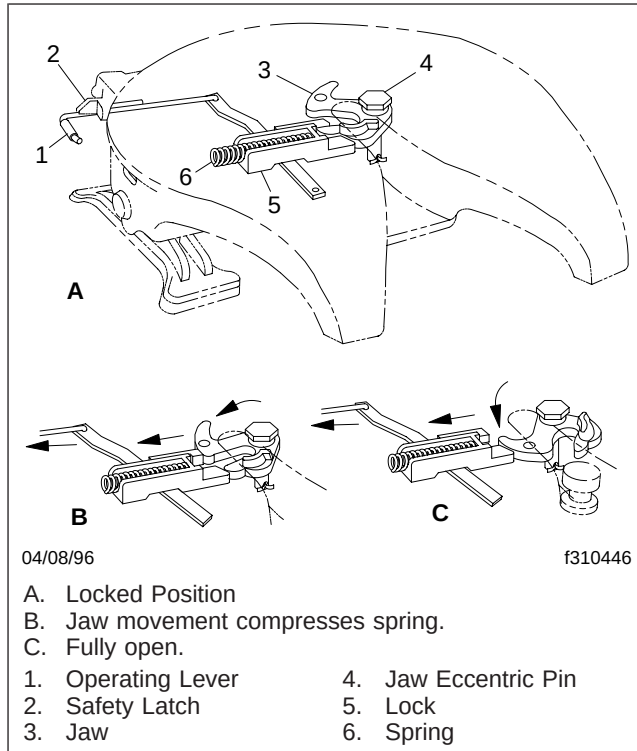


Fig. 10.12, ASF Castloc II and Simplex Series Kingpin Locking Mechanism Operation

The Castloc II and Simplex Series fifth wheel lock mechanism consists of a rotating jaw and a spring-actuated lock that grips the trailer kingpin. The jaw rotates on an eccentric pin during coupling and uncoupling operations. The spring-actuated lock holds the jaw in the locked position once kingpin lockup has occurred.

In the locked position, there is approximately 1/16-inch (1.6-mm) clearance between the jaw and kingpin. The jaw eccentric pin can be removed and rotated to compensate for wear and maintain an approximate 1/16-inch (1.6-mm) clearance during service.

Placing the operating rod in the lockset position moves the lock away from the jaw. This action unlocks the jaw so that it can be rotated by movement of the kingpin. When the tractor is moved out from under the trailer, the kingpin will rotate the jaw until the jaw is in the unlocked position, allowing the king-

pin to move out of the mechanism. With the jaw in the fully open position, the operating rod drops out of the lockset position, and the fifth wheel is ready for coupling. See Fig. 10.13.

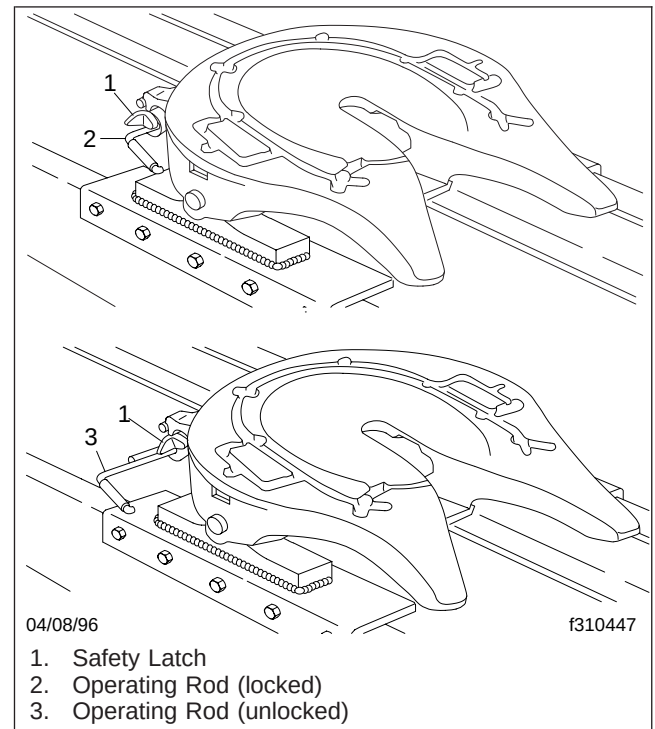


Fig. 10.13, Simplex Kingpin Locking Mechanism, Locking and Unlocking

During coupling, the kingpin contacts and rotates the jaw into the locked position. This action automatically moves the operating rod into the locked position. This securely locks the jaw around the kingpin. In the locked position the safety latch swings freely over the operating rod. See Fig. 10.14.

Fifth Wheel Locking and Unlocking

Locking the Fifth Wheel Lock Mechanism

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.



Before attempting to lock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide locking handle (Fig. 10.11) must be in the locked position. This prevents the sliding member from

Fifth Wheels and Trailer Couplings

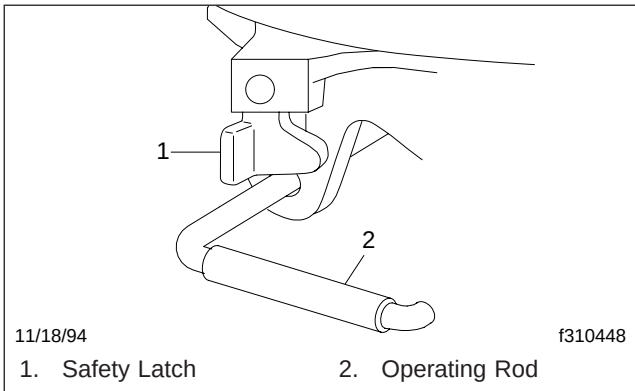


Fig. 10.14, Simplex Kingpin Locking Mechanism, Safety Latch (locked position)

moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

2. The fifth wheel jaw must be fully open. Make sure that the operating rod is in the unlocked position. The fifth wheel must be completely lubricated with chassis or multi-purpose grease. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

3. Make sure the fifth wheel top plate is tilted so the ramps are as low as possible. If equipped with an air suspension, make sure the air bags are completely inflated.
4. Position the tractor so that the center of the fifth wheel is in line with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism. See [Fig. 10.12](#). Adjust the trailer landing gear so that the lower front trailer edge contacts the top surface of the tilted fifth wheel plate, approximately 8 inches (20 cm) before the fifth wheel center.
5. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the

throat of the locking mechanism. Continue backward motion until positive lockup occurs.

6. Apply the tractor parking brakes.
7. Make a visual check (even if equipped with the Touchloc air-operated system) for positive kingpin lockup. The trailer bed plate must be flush on the fifth wheel plate surface. When positive lockup has occurred, the fifth wheel operating rod will have moved inward to the locked position, and the safety latch will swing freely over the operating rod. See [Fig. 10.14](#).

NOTE: Only when the operating rod is fully retracted in the locked position will the safety latch be freely rotated down.

8. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

9. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
10. Charge the air brake system with air. Make sure that the air connections do not leak.

WARNING

Adjust the jaw pin if there is more than 1/8-inch (3-mm) clearance between the kingpin and the lock. Incorrect adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

11. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. A clearance of approximately 1/16 inch (1.6 mm) between the jaw and kingpin is allowable. When clearance between the jaw and kingpin exceeds

Fifth Wheels and Trailer Couplings

1/8 inch (3.2 mm), adjust the jaw to restore the 1/16-inch (1.6-mm) clearance between the jaw and kingpin. For instructions, see **Group 31** of the *Heavy-Duty Trucks Service Manual*.

12. Retract the trailer landing gear, and secure the ratchet handle.
13. Remove the chocks from the trailer tires.
14. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight ratings given on the FMVSS or CMVSS label.

WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.

4. Lower the trailer landing gear until the trailer rises about 1/2 inch (13 mm).
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

CAUTION

Before attempting to unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide operating rod (Fig. 10.11) must be in the locked position, and the slide lockpins must be in the locked position, fully inserted in baseplate rail slots. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

6. *If equipped with a manual kingpin lock release:* Release the kingpin lock mechanism by raising the safety latch to the rear and pulling the lock operating rod out and up into the lockset position. See Fig. 10.13. The offset of the lock control upper rod should bottom against the plate casting above the hole. If the operating rod cannot be pulled to the lockset position, back the tractor slightly to release the kingpin force against the jaw.

If equipped with a Touchloc air-operated kingpin lock release: Pull and hold the dash-mounted control valve out (approximately 2 to 3 seconds). The air cylinder and slide cam (see Fig. 10.15) will rotate the safety indicator and move the lock control handle into the unlocked position, then retract. The safety indicator will rotate towards the rear and the lock control handle upper shoulder will rest on the fifth wheel plate just above the rod hole. When the lock control handle is in the out position, the trailer may be uncoupled from the tractor.

WARNING

If the air mechanism does not operate properly, do not attempt to use the system. Operate the fifth wheel manually until the air mechanism is repaired or replaced. Under no circumstances should the vehicle be operated or the air mechanism used when the spring brake section is caged.

7. Slowly drive the tractor away from the trailer.

Fifth Wheels and Trailer Couplings

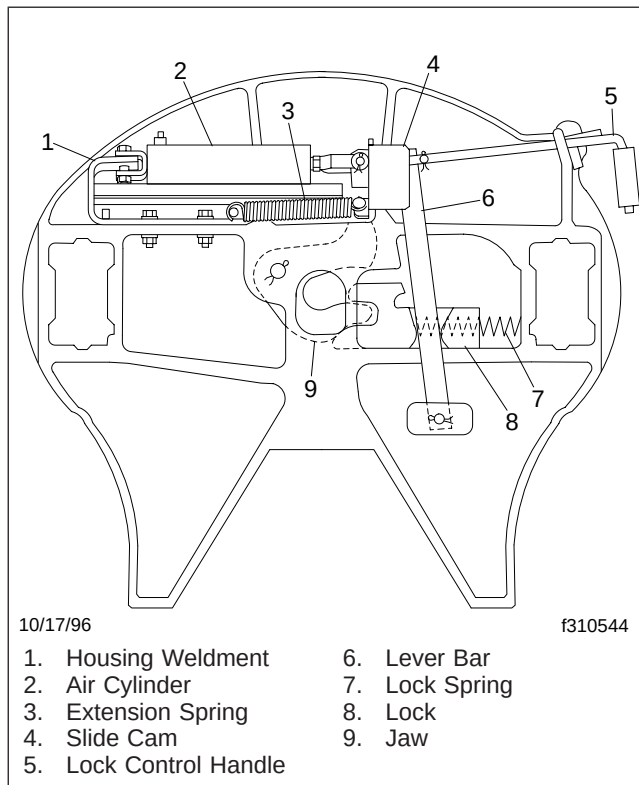


Fig. 10.15, Touchloc Air-Operated Lock Control

Fifth Wheel Slide Operation

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to "Fifth Wheel Locking Operation," in this chapter.
3. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:
 - 3.1 For air-operated models, set the cab-operated control switch (**Fig. 10.8**) to UN-LOCK.
 - 3.2 For manually-operated models, raise the safety latch and pull the slide operating rod (**Fig. 10.11**) outward until the shoulder is outside of the operating rod support, then lower the operating rod as far as it will go.
4. Lower the trailer landing gear just enough to remove the weight from the tractor.

5. Pull the trailer air supply valve to cut off the air supply to the trailer.



CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.



WARNING

Check to be sure that the lockpins are seated in the holes and that the operating rod is in the locked position with the safety latch securing the operating rod. Failure to achieve complete lockup may cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

NOTE: The fifth wheel may have to be moved slightly to enable the locking pins to enter the fully locked position.

8. Lock the sliding member into position using one of the following methods:

For air-operated models: Set the cab-operated control switch to LOCK. Visually inspect the lockpins to make sure they have seated in the base-plate rail holes.

For manually-operated models: Raise the operating rod so that it is free to move inward. Make sure that the lockpins have seated in the base-plate rail holes and the operating rod moves into the locked position. Also, the safety latch must drop downward so that it holds the operating rod in the locked position.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

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The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

The fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.

Fontaine® Fifth Wheels

General Information

The Fontaine sliding fifth wheel mount is designed to provide optimum axle loading for maximum tractor use with different lengths and types of trailers. The sliding fifth wheel mount is used with the Fontaine H5092 series, and 6000/7000 No-Slack II series fifth wheels, and is equipped with either an air-operated release slide (AWB or HAWB models) or a manual release slide (MWS or HMWS models).

On Fontaine fifth wheels, kingpin release is accomplished by activating a manual lock control handle located on either the right side or left side of the fifth wheel. Kingpin lockup occurs when the kingpin is

forced into the jaws and the lock control handle moves to the locked position.

The fifth wheel top plate is mounted on a slide assembly, which is attached to slide rails that are mounted on the vehicle frame. The slide rails permit forward and rearward movement of the slide assembly, allowing for optimum weight distribution over the tractor axles.

Slots are evenly spaced along the slide rails and retractable lockpins are positioned through the holes to hold the fifth wheel in the desired position. See **Fig. 10.16** or **Fig. 10.17**.

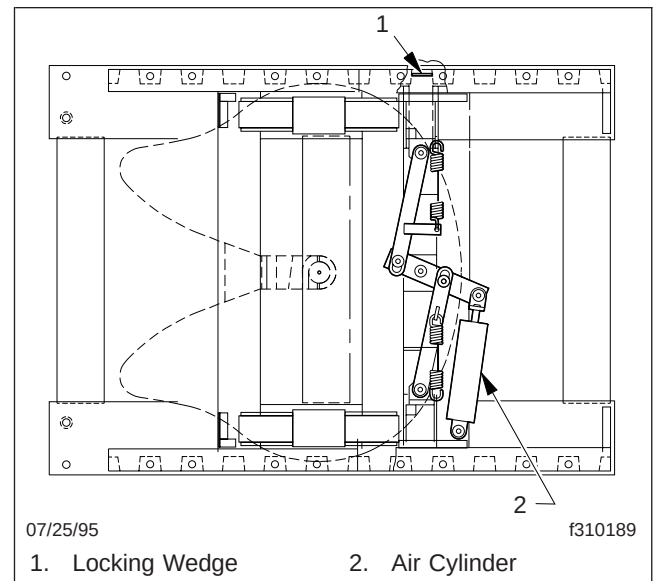


Fig. 10.16, Air-Operated Sliding Fifth Wheel Mount, AWB Model

The slide portion of the sliding model may be attached to either an air-operated release slide, or a manual release slide.

The air-operated release slide contains an air cylinder that locks and unlocks the fifth wheel slide. See **Fig. 10.16**. The air cylinder is activated by a two-position air-control valve in the tractor cab.

The manual release slide contains a slide locking control handle, located on the left side of the fifth wheel, which locks or unlocks the fifth wheel slide. See **Fig. 10.17**.

Fifth Wheels and Trailer Couplings

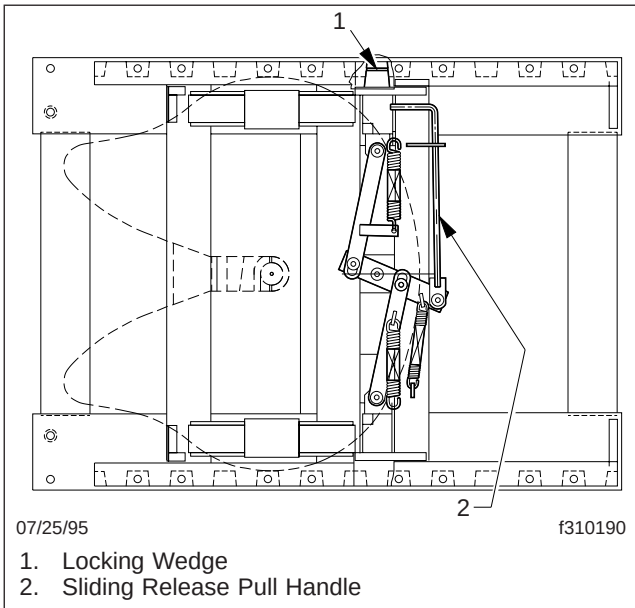


Fig. 10.17, Manual Release Sliding Fifth Wheel Mount, MWS Model

Fifth Wheel Lock Mechanism for Trailer Kingpin (See Fig. 10.18)

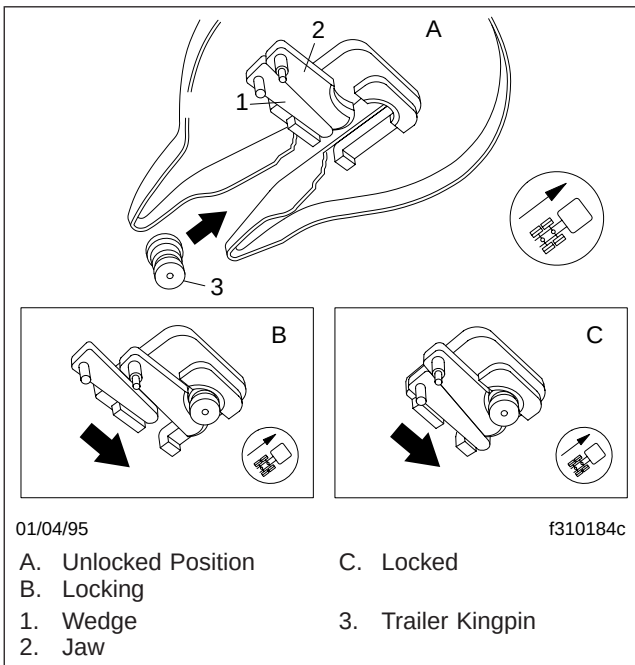


Fig. 10.18, Fontaine Kingpin Lock Mechanism

The Fontaine fifth wheel lock mechanism for the trailer kingpin consists of a spring-loaded jaw and a sliding wedge.

The jaw and wedge each have a pin permanently attached. The pin on the jaw and the pin on the wedge fit into elongated notches in the lock control handle. The notches in the handle control the limit of movement for both the jaw and wedge. The notches are arranged so that the wedge is actuated first during release of the kingpin.

During lockup, the jaw is moved first with the spring-loaded wedge being allowed to slip in place against the jaw. A timing bracket ensures that the wedge and jaw are moved at the proper time.

Placing the lock control handle in the unlocked position moves the wedge away from the jaw. This action unlocks the jaw so that it can be moved by the trailer kingpin. When the tractor is moved out from under the trailer, the kingpin moves the jaw until the kingpin is out of the mechanism. With the jaw in the unlocked position, the lock control handle will remain in the unlocked position until manually moved by the operator.

During coupling (Fig. 10.18), the motion of the kingpin entering the jaw will actuate the jaw and wedge. The jaw will move behind the kingpin, followed by the wedge. The purpose of the wedge is to reinforce the jaw and take up slack around the pin. Any wear on the jaw is immediately taken up by the wedge so there is no slack in the connection.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Lock Mechanism



Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide locking handle, if so equipped, and the slide lockpins must be in the locked position (fully inserted in the slider rail holes). This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

Fifth Wheels and Trailer Couplings

WARNING

Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

2. The kingpin lock mechanism must be fully open, the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.
3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, as shown in **Fig. 10.18**. Adjust the trailer landing gear to give enough alignment height for positive kingpin lockup.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.
6. Make a visual and physical check for positive kingpin lockup. When lockup has occurred, the fifth wheel control handle will have moved to the locked position. Make sure that the safety latch is down over the lock control handle. See **Fig. 10.19**. This will hold the control handle in the locked position.
7. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

8. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to

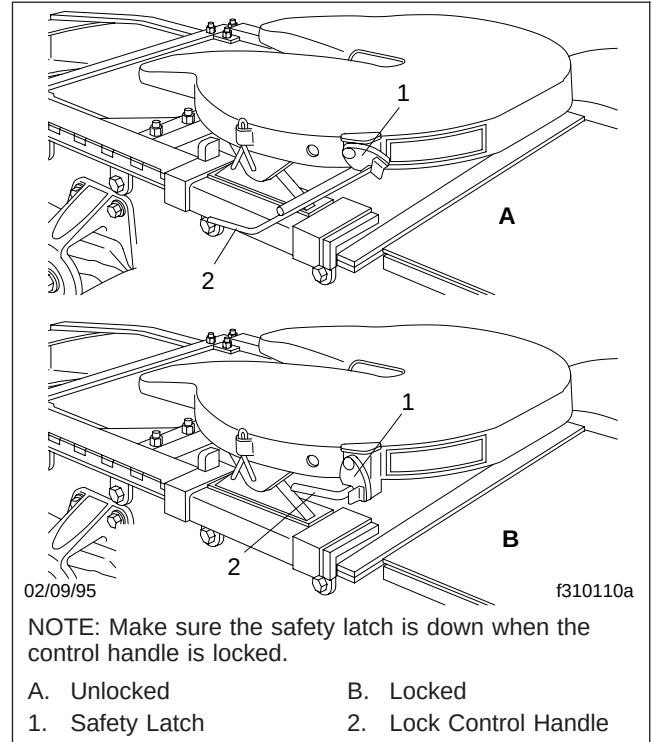


Fig. 10.19, Fontaine 5000 Series Fifth Wheel, Locking and Unlocking

the trailer. Take care to prevent dirt or foreign material from entering the air system lines.

9. Charge the air brake system with air. Make sure that the air connections do not leak.

WARNING

Eliminate slack between the trailer and the tractor. Incorrect fifth wheel adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

10. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. There should be no slack between the tractor and the trailer. If slack is present, uncouple the trailer.

For adjustment instructions, refer to the applicable manufacturer's service information.

Fifth Wheels and Trailer Couplings

11. Retract the trailer landing gear, and secure the ratchet handle. Remove the chocks from the trailer tires.
12. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.
4. Lower the trailer landing gear until the weight is removed from the fifth wheel.

5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide locking handle, if so equipped, and the slide lockpins must be in the locked position (fully inserted in the slider rail holes). This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

6. Release the kingpin locking mechanism by lifting the safety latch and pulling the lock control handle to the unlocked position. See [Fig. 10.19](#).
7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Fontaine 5000 Series "Fifth Wheel Locking Operation," in this chapter.
2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:
 - 2.1 For air-operated release models, set the cab-operated control switch to UNLOCK.
 - 2.2 For manual release models, lift the slide locking handle to disengage it from the guide plate. Then, pull out the handle ([Fig. 10.20](#)) until it is in the unlocked position and can be positioned against the guide plate to hold it out. The slide locking handle will stay in the unlocked position until it is manually disengaged from the guide plate.
3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes.

Fifth Wheels and Trailer Couplings

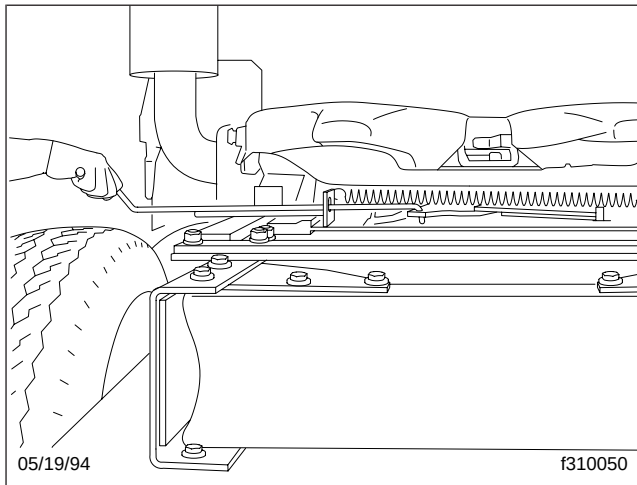


Fig. 10.20, Fontaine 5000 Series Sliding Fifth Wheel Manual Release

This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

5. Chock the front and rear of the trailer tires to prevent the trailer from moving.

CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking pin(s) to enter the fully locked position.

8. Lock the sliding member in position using one of the following methods:

WARNING

Check to be sure that the lockpins are seated in the holes. Failure to achieve complete lockup may cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

- 8.1 For air-operated release models, set the cab-operated slide control switch to LOCK. Visually inspect the lockpins to make sure that they are fully inserted in the slide rail holes.
- 8.2 For manual release models, disengage the slide locking handle from the guide plate. The slide locking handle is spring-loaded in the locked position and will seek the locked position when disengaged from the guide plate. The fifth wheel may have to be moved slightly to enable the locking pins to fully enter the locked position. When the slide lock control handle returns to the fully in position, visually and physically check the lockpins to make sure they are fully inserted into the holes in the slide rails. Make sure the slide locking handle is locked in position against the guide plate.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle. Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and

Fifth Wheels and Trailer Couplings

loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication

The fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer. Friction and binding, caused by insufficient grease on the fifth wheel plate could result in erratic steering. For lubrication instructions, see **Group 31** of the *Heavy-Duty Trucks Maintenance Manual*.

Premier Trailer Couplings

General Information

Trailer couplings, used only on trucks, are attached to the rear closing crossmember.

The Premier 260 and 460 trailer couplings (**Fig. 10.21**) have a rigid pintle hook, and are air-adjusted. An air chamber, mounted forward of the coupling, operates a push rod, which pushes against a shoe inside the coupling. The shoe maintains constant pressure on the eye of the trailer drawbar when it's over the pintle hook. This takes up any slack in the trailer connection, providing smoother towing and less wear on the pintle hook. The air pressure is activated when the trailer brakes are released.

The Premier 690 trailer coupling (**Fig. 10.22**) has a moveable pintle hook, and is non-air adjusted. It is used for heavy-duty applications.

Operation

Trailer Hookup

1. Chock the front and rear tires of the trailer.

2. Open the coupling.

Models 260 and 460 (Fig. 10.21): Pull up on the pawl lock; then, while squeezing the pawl wedges together, lift up the pawl assembly. Lift up the latch, and push it up against the pawl assembly, locking the latch in place.

Model 690 (Fig. 10.22): Remove the linchpin from the handle, then push in on the handle and turn it toward you. Open the pintle hook by pulling it down and toward you. Release the handle, locking the pintle hook open.

3. *Models 260 and 460:* Back up the vehicle until the drawbar eye is over the pintle hook, then lower the trailer.

Model 690: Back up the vehicle until the drawbar eye enters the open jaw, contacts the back of the pintle hook, and closes the coupling.

4. Close the coupling.

Models 260 and 460: Push in on the pawl wedges and lift the pawl assembly. The latch will drop into the closed position. Lock the latch by lowering the pawl assembly.

Model 690: The pintle hook will automatically close and lock from the pressure of the drawbar eye against it. Install the linchpin.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

5. Hook up the trailer's electrical and air lines.
6. Remove the chocks from the trailer's tires.

Trailer Release

1. Apply the truck and trailer parking brakes.

 WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

2. Chock the front and rear tires of the trailer.
3. Disconnect the trailer air and electrical lines. Plug the air lines to keep out dirt.
4. Take the weight of the trailer drawbar eye off the pintle hook.
5. Open the coupling.

Fifth Wheels and Trailer Couplings

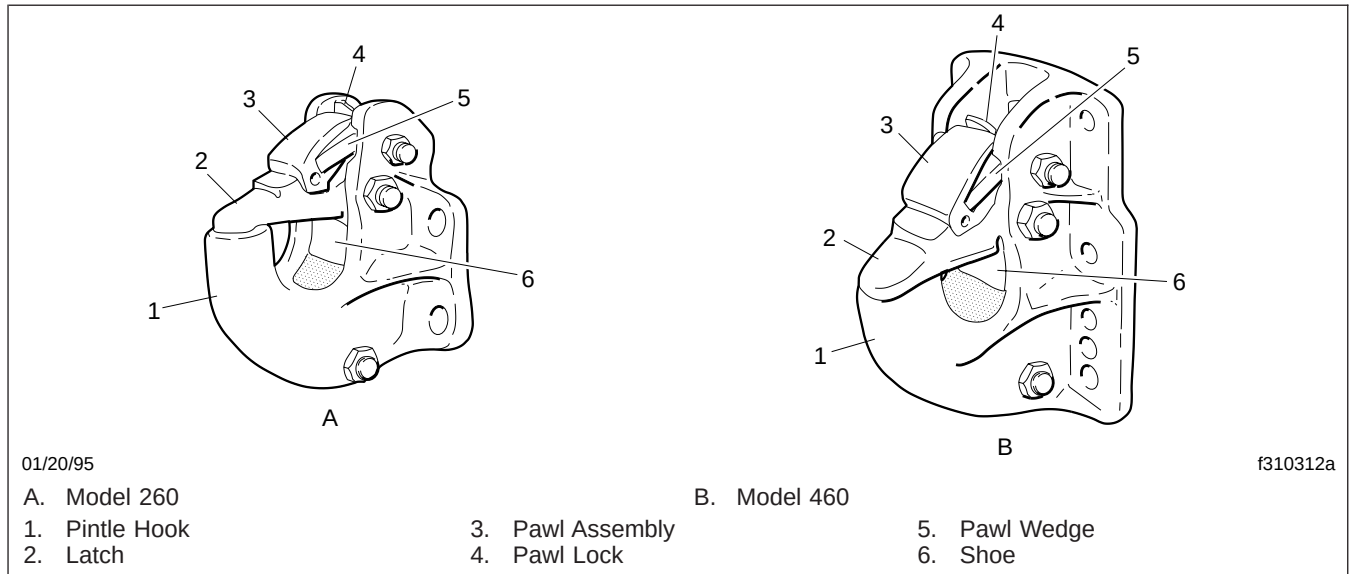


Fig. 10.21, Premier 260 and 460 Trailer Couplings

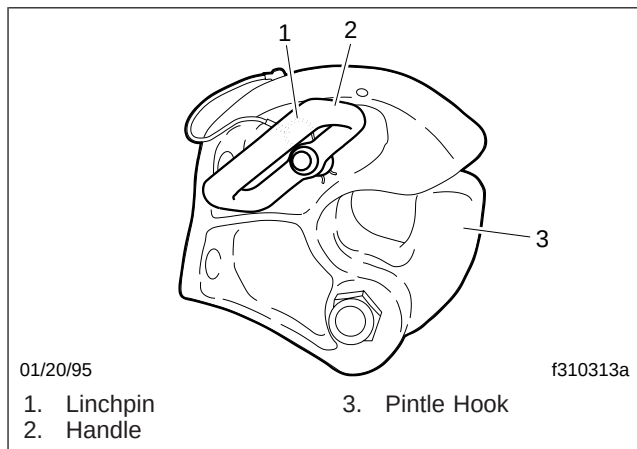


Fig. 10.22, Premier 690 Trailer Coupling

Models 260 and 460: Pull up on the pawl lock; then, while squeezing the pawl wedges together, lift up the pawl assembly. Lift up the latch, and push it up against the pawl, locking the latch in place.

Model 690: Remove the linchpin from the handle, then push in on the handle and turn it toward you. Open the pintle hook by pulling it down and toward you. Release the handle, locking the pintle hook open.

6. Slowly drive the vehicle away from the trailer.

Holland Trailer Coupling

General Information

The Holland PH-T-60-AL trailer coupling is designed for use with trailers having a maximum gross weight of 10,000 lbs (4536 kg). It is a rigid type pintle hook, used only on truck applications, and is fastened to the rear closing crossmember of the vehicle. See [Fig. 10.23](#). It is a non-air adjusted coupling.

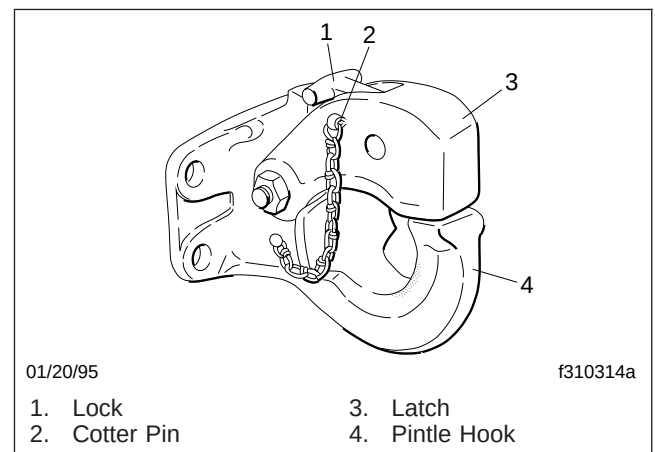


Fig. 10.23, Holland PH-T-60-AL Trailer Coupling

Fifth Wheels and Trailer Couplings

Operation

Trailer Hookup

1. Chock the front and rear tires of the trailer.
2. Remove the cotter pin, then lift the lock and raise the latch.
3. Back up the vehicle until the drawbar eye is over the pintle hook.
4. Lower the trailer until the drawbar eye rests on the pintle hook.
5. Close the latch, then insert the cotter pin.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

6. Hook up the trailer's electrical and air lines.
7. Remove the chocks from the trailer's tires.

Trailer Release

1. Apply the truck and trailer parking brakes.

 WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

2. Chock the front and rear tires of the trailer.
3. Disconnect the trailer air and electrical lines. Plug the air lines to keep out dirt.
4. Take the weight of the trailer drawbar off the pintle hook.
5. Open the latch by first removing the cotter pin, then lift up the lock and raise the latch.
6. Slowly drive the vehicle away from the trailer.

11

Pretrip and Post-Trip Inspections and Maintenance

Pretrip and Post Trip Inspection Checklists	11.1
Pretrip and Post Trip Maintenance Procedures	11.3

Pretrip and Post-Trip Inspections and Maintenance

Pretrip and Post Trip Inspection Checklists

Regulations in both Canada and the United States clearly indicate that it is the driver's responsibility to perform an inspection and ensure the complete road-worthiness of a vehicle before placing it into service for the day. Commercial vehicles may be subject to inspection by authorized inspectors, and an unsafe vehicle can be put "out of service" until the driver or owner repairs it.

IMPORTANT: The pre- and post-trip checklists, and inspections and maintenance procedures detailed in this chapter, are **not all-inclusive**. Also refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions.

Use the inspection checklists to ensure that vehicle components are in good working condition before each trip. A driver that is familiar with the vehicle, and drives it regularly, can perform the daily inspections, then add the weekly and monthly post-trip inspections as scheduled. If the driver does not operate the vehicle on a consistent basis, all three of the inspection procedures should be performed before the trip.

NOTE: Procedure reference numbers in the checklists reference the corresponding detailed instructions found under the pretrip and post-trip maintenance procedures.

Pre- and post-trip inspections cannot be done quickly. However, careful inspections save time by eliminating stops later to adjust items overlooked or forgotten.

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *Heavy-Duty Trucks Service Manual* for procedures and specifications, and see the *Heavy-Duty Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

See [Table 11.1](#) for a list of procedures that should be performed daily, before the first trip.

See [Table 11.2](#) for a list of procedures that should be performed weekly, post-trip.

See [Table 11.3](#) for a list of procedures that should be performed monthly, post-trip.

IMPORTANT: Before performing any checks, apply the parking brake and chock the tires.

Pretrip and Post-Trip Inspections and Maintenance

Procedure Performed (check off)	Daily Pretrip Inspections/Checks	Procedure Reference
_____	Drain manually drained air reservoirs (that are not equipped with automatic drain valves)	D1
Check _____	windshield washer reservoir fluid	D2
Inspect _____	wheel seal and hub cap (for leakage)	—
Check _____	surge tank coolant level	D3
Inspect _____	radiator and charge air cooler	D4
Check _____	engine for fuel, oil, or coolant leaks	—
Inspect _____	engine and chassis wiring	D5
Inspect _____	air intake system	D6
Check _____	intake-air restriction indicator mounted on air intake	D6
Check _____	engine oil level	D7
Check _____	power steering fluid level	—
Inspect _____	fuel tank(s), fuel lines, and connections	D8
Check _____	fuel level	D9
Check _____	fuel/water separator	D10
Inspect _____	front and rear suspension components	D11
Inspect _____	headlights, mirrors, and window glass, and windshield wipers	D12
Check _____	doors (open without difficulty and close securely)	—
_____	Adjust driver's seat, then align rearview and downview mirrors	—
Check _____	dash-mounted intake-air restriction indicator	D6
Check _____	oil- and air-pressure warning systems	D13
Check _____	horn, windshield wipers, and windshield washer	D14
Check _____	heater, defroster, and optional mirror heat controls	D15
Check _____	backup alarm	—
Check _____	panel lights and interior lights	D16
Check _____	exterior lights and reflectors	D17
Check _____	tire pressure	D18
Inspect _____	tire condition	D19
Inspect _____	rims and wheels	D20
Check _____	automatic transmission fluid level	—
Inspect _____	air brake chambers and pushrods	D21
Inspect _____	air brake lines	D22
Inspect _____	slack adjusters	D23
Check _____	air brake system operation	D24
Inspect _____	frame rails (missing bolts), crossmembers (bent or loose)	—
Check _____	mud flaps (aren't damaged, at least 10 inches above the ground, and brackets are secure)	—
Check _____	exhaust system (mounted securely, connected tightly, no signs of leaks such as soot trails)	—
_____	Remove chocks and test service brakes	D25
Inspector _____ Date _____		

Table 11.1, Daily Pretrip Inspection and Maintenance Checklist

Pretrip and Post-Trip Inspections and Maintenance

Procedure Performed (check off)	Weekly Post-Trip Inspections/Checks	Procedure Reference
_____	Manually drain air reservoirs that are equipped with automatic drain valves	—
Inspect _____	batteries and battery cables	W1
Check _____	wheel bearing lubricant level	W2
Inspect _____	steering components	W3
Check _____	serpentine drive belt condition	W4
Check _____	V-belt tension	W5
Inspect _____	seat belts and tether belts	W6
Inspector _____ Date _____		

Table 11.2, Weekly Post-Trip Inspection and Maintenance Checklist

Procedure Performed (check off)	Monthly Post-Trip Inspections/Checks	Procedure Reference
_____	Clean the battery terminals	M1
Inspect _____	radiator hoses and heater hoses	M2
Check _____	fluid level in the hydraulic clutch reservoir (if applicable, and if necessary, fill with DOT 4 brake fluid)	—
Check _____	steering wheel play	M3
Check _____	outer surfaces of the hood and body (for visible surface breaks and damage)	—
Check _____	hood tilt damper (attached at both ends)	—
Inspect _____	brake lining wear	M4
Inspect _____	driveshaft	—
Inspector _____ Date _____		

Table 11.3, Monthly Post-Trip Inspection and Maintenance Checklist

Pretrip and Post Trip Maintenance Procedures

Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *Heavy-Duty Trucks Service Manual* for procedures and specifications, and see the *Heavy-Duty Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals. Specific references to the manual will be found where appropriate.

Daily Pretrip Maintenance Procedures

1. Drain manually drained air reservoirs.

Water and oil normally enter the air reservoir in the form of vapor because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows:

- 1.1 Open the wet tank valve. The drain cock or pull chain drain is located on the forward end of the supply air reservoir, which is connected directly to the air compressor. Block the valve open.

WARNING

When draining the air reservoir, do not look into the air jets or direct them toward anyone. Dirt or sludge particles may be in the airstream and could cause injury.

- 1.2 Exhaust the remaining air and moisture from the system by opening the drain cocks on the bottoms of the remaining air reservoirs. Block the valves open.

Pretrip and Post-Trip Inspections and Maintenance

- 1.3 Water and oil emulsion often form pockets that will not drain while compressed air is in the reservoirs. Because of these pockets, leave the valves blocked open during the first part of the pretrip inspection.

- 1.4 If the drained water is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.

2. *Check the fluid level in the windshield washer reservoir.*

Add washer fluid as needed. Unscrew the cap to add fluid.

WARNING

Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

3. *Check the coolant level in the surge tank.*

See **Fig. 11.1**. If the coolant is low, add a 50/50 mixture of water and the type of antifreeze currently installed in your vehicle. Fill the surge tank with coolant to the MAX line when the tank is cool. If the surge tank was empty, start the engine after refilling and check the level again when the engine is at operating temperature.

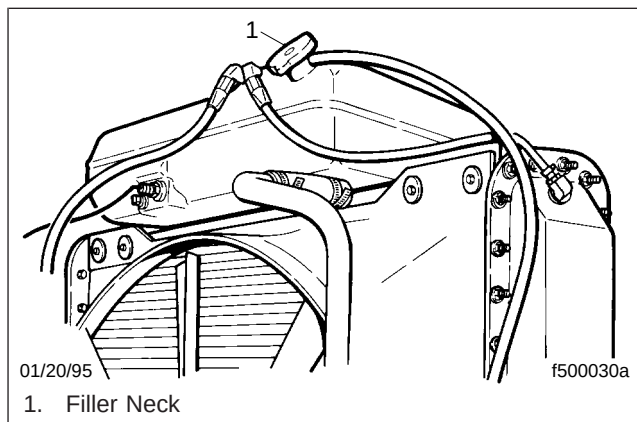


Fig. 11.1, Coolant Level Checking

CAUTION

Coolant must be filled to the full line of the surge tank. Low coolant could result in engine overheating, which could cause engine damage.

4. *Inspect the radiator and charge air cooler.*

- 4.1 Inspect the radiator and charge air cooler for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.

- 4.2 Inspect the radiator and charge air cooler for damage and accumulated debris. Straighten bent or damaged fins to permit airflow across all areas of the cores.

NOTE: When traveling through areas of high insect concentration, it may be necessary to clean the exterior of the radiator or the charge air cooler core as often as every 200 miles (320 km).

- 4.3 On vehicles equipped with air conditioning, also inspect and clean the condenser. If clogged, the condenser can restrict airflow through the radiator.

- 4.4 Check the radiator for leaks. If leaks are found, have the radiator repaired or replaced. See **Group 20** of the *Heavy-Duty Trucks Service Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.

5. *Inspect the engine and chassis wiring.*

Check for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.

6. *Inspect the air intake system for leaks or damage.*

CAUTION

Failure to maintain a sealed air intake system could allow the entry of dirt and contaminants into the engine. This could adversely affect engine performance and result in engine damage.

- 6.1 Check the intake-air restriction indicator.

Pretrip and Post-Trip Inspections and Maintenance

- 6.2 Replace the primary filter element in the air cleaner if the yellow signal stays locked at 25 inH₂O for Caterpillar and Cummins engines or 20 inH₂O for Detroit Diesel engines. See **Group 09** of the *Heavy-Duty Trucks Service Manual* for filter element replacement instructions, or take the vehicle to an authorized Freightliner dealer.

NOTE: After replacing the filter element, reset the restriction indicator by pressing the rubber reset button.

- 6.3 Inspect the secondary or safety filter element in the air cleaner when replacing the primary element, and replace it when clogged or dirty. This element should be replaced with every third primary element replacement.
- 6.4 Check the engine air intake piping from the air cleaner to the engine intake. Inspect the piping for loose connections, cracks, torn or collapsed hoses, punctures, and other damage. Tighten loose connections, and have damaged components replaced. Make sure the piping system is airtight so that all intake air passes through the air cleaner.

7. Check the engine oil level.

If the oil level is at or below the minimum fill (or "add") mark on the dipstick, add enough oil to maintain the level between the minimum fill (or "add") and the maximum fill (or "full") marks on the dipstick. See **Fig. 11.2**. Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil. Use the proper SAE viscosity rating for the temperature and time of year.

CAUTION

Operating the engine with the oil level below the minimum fill (or "add") mark or above the maximum fill (or "full") mark could result in engine damage.

8. Inspect the fuel tanks, fuel lines, and connections for leaks.

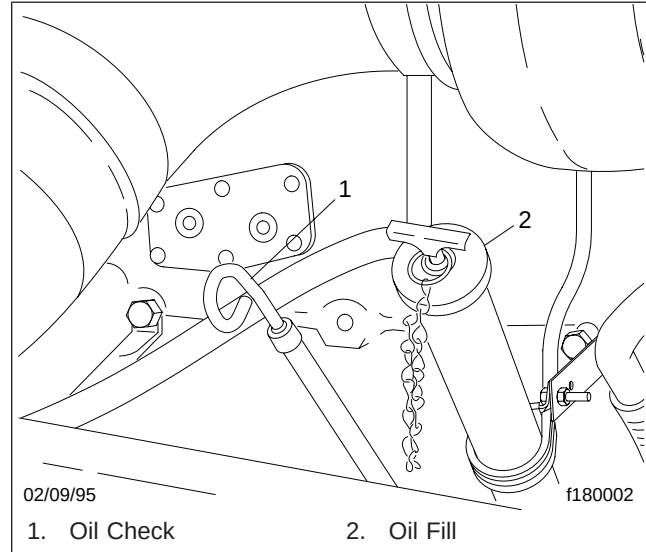


Fig. 11.2, Oil Level Checking

- 8.1 Check that the fuel tanks are secured to their mounting brackets and that the mounting brackets are secured to the frame.
- 8.2 Replace leaking fuel tanks.
- 8.3 If lines or connections are leaking, have them repaired or replaced.

For repair and/or replacement procedures, see **Group 47** of the *Heavy-Duty Trucks Service Manual*, or take the vehicle in to an authorized Freightliner dealer.

- 8.4 If equipped with fuel tank shutoff valves, be sure the valves are fully open.

WARNING

Never operate the engine with the fuel tank shut-off valves partly closed. This could damage the fuel pump, causing sudden loss of engine power, possibly resulting in serious personal injury due to reduced vehicle control.

9. Check the fuel level in the fuel tank(s).

To keep condensation to a minimum, fuel tanks should be filled at the end of each day. Federal regulations prohibit filling a fuel tank to more than 95 percent of its liquid capacity.

Pretrip and Post-Trip Inspections and Maintenance

WARNING

Never fill fuel tanks to more than 95 percent of their liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, possibly resulting in serious personal injury or death. Do not fill the fuel tanks in the presence of sparks, open flames, or intense heat. These could ignite the fuel, possibly causing severe burns.

IMPORTANT: Engines manufactured since 2007 must use ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less, based on ASTM D2622 test procedure. Failure to use ultralow sulfur diesel fuels may void the warranty on emission components.

- 9.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter and reduce the chances of dirt getting into the engine.
 - 9.2 Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.
 - 9.3 If needed, prime the fuel system. For priming procedures, see the applicable engine manufacturer's manual.
10. Drain the water from the fuel/water separator as follows:

For a Racor Model 1000FG (see Fig. 11.3): Check the water level in the sight bowl. To drain the water, loosen the valve at the bottom of the bowl two full turns and allow the water to run out. Close and tighten the valve finger-tight.

For a Davco Model 321 (see Fig. 11.4): If the separator is equipped with a fuel filter and the filter has a vent at the top, open the vent. To drain the water, open the drain valve at the bottom of the separator. Newer separators use a ball valve with a handle that turns 90 degrees. Older separators have a knurled, brass valve that unscrews to open. Allow the water to drain and close the valve finger-tight.

For a Webb Model 525 (see Fig. 11.5): Turn the drain valve handle. If nothing flows from the valve, it may be blocked. Use a pencil or screwdriver to clear the valve. Allow the water to drain and then close the valve. Start the engine and raise the rpm for two or three minutes to purge any air from the fuel system.

For ConMet Models (see Fig. 11.6): Check the water level in the sight bowl (if equipped). To drain the water, loosen the valve at the bottom and allow the water to run out. Close and tighten the valve finger-tight.

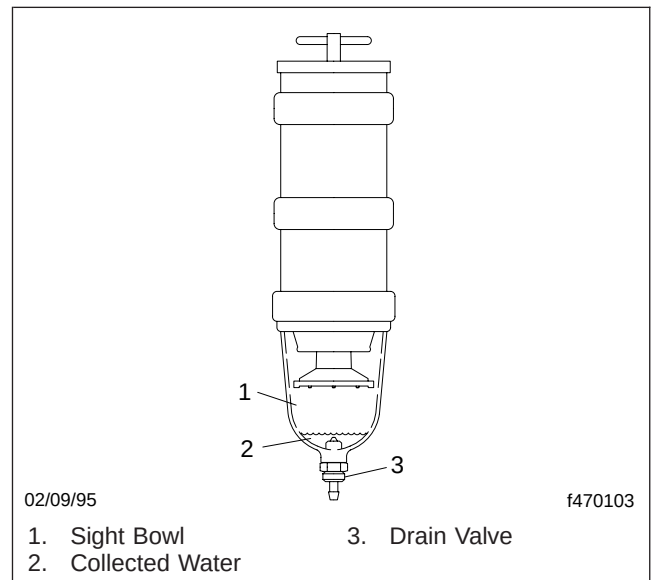


Fig. 11.3, Racor Fuel/Water Separator

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.

11. *Inspect the front and rear suspension components, including springs, spring hangers, shocks, and suspension brackets.*
 - 11.1 Check for broken spring leaves, loose U-bolts, cracks in the suspension brackets, and loose fasteners in the spring hangers and shackles.

Pretrip and Post-Trip Inspections and Maintenance

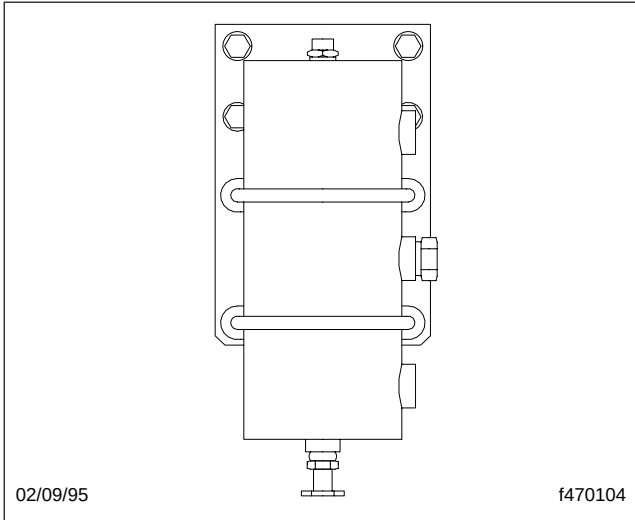


Fig. 11.4, Davco Fuel/Water Separator

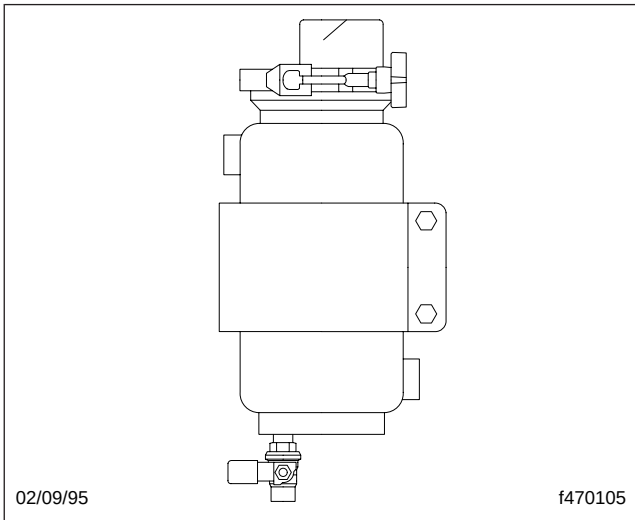


Fig. 11.5, Webb Fuel/Water Separator

- 11.2 Inspect the shock absorbers for loose fasteners and leaks.
 - 11.3 Tighten all loose fasteners and have any component(s) replaced that are worn, cracked, or otherwise damaged.
 - 11.4 On vehicles with air suspensions, check for leaks. Check air suspension components for cuts and bulges.
12. *Clean the windshield, and the side and rear windows, then check the condition of the windshield wiper arms and blades.*

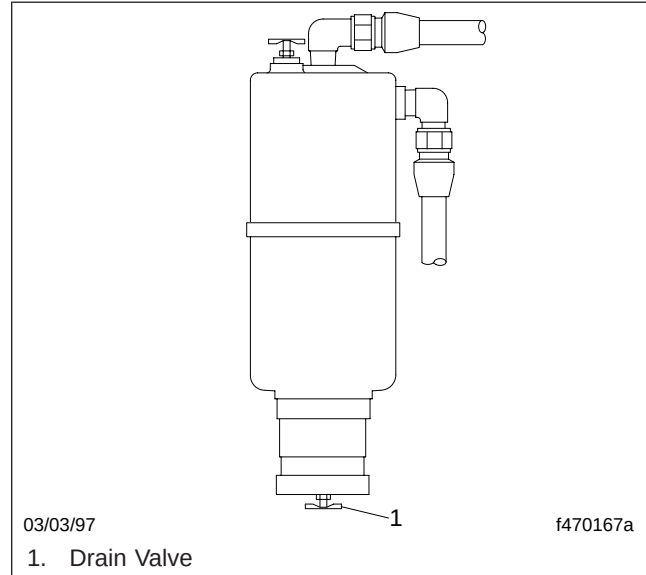


Fig. 11.6, ConMet Fuel/Water Separator

- 12.1 Replace the wiper arms if the wiper blades are not tensioned against the windshield.
- 12.2 Replace damaged or deteriorated wiper blades.

WARNING

When cleaning windshields and windows, always stand on the ground or on a secure ladder or platform. Use a long-handled window cleaner. Do not use the cab steps, tires, fenders, fuel tanks, engine, or under-hood components to access the windshield or windows. Doing so could cause a fall and result in an injury.

13. *Check the oil- and air-pressure warning systems.*
- 13.1 Check if the warning systems come on when the ignition is turned on, and if not, have the systems repaired.
 - 13.2 Start the engine, then check that the oil- and air-pressure warning systems are operating. The buzzer should stop sounding when the preset minimum is reached. If the air pressure in both systems is above the preset minimum when the engine is started, test the low air pressure warning

Pretrip and Post-Trip Inspections and Maintenance

system by lowering the pressure to below this range, or until the warning system comes on.

The air pressure in both the primary and secondary air reservoir systems must be above 65 psi (448 kPa) on most vehicles. For vehicles with an optional Bendix dryer reservoir module (DRM), the cut-out pressure is 130 psi (896 kPa).

14. *Make sure that the horn, windshield wipers, and windshield washers are operating properly. These devices must be in good working order for safe vehicle operation.*

- 14.1 Make sure that the horn works. If a horn is not working, have it repaired before trip departure.

- 14.2 Check the wiper and washer control on the multifunction turn signal switch. If the wipers and/or washers are not working, have them repaired before trip departure.

15. *During cold weather, make sure the heater, defroster, and optional mirror heat controls are operating properly. If so equipped, turn on the mirror heat switch and make sure the system is working.*

16. *Check the operation of all the panel lights and interior lights.*

Turn on the headlights, dash lights, and four-way flashers and leave them on. If any of the gauge bulbs, the dome light bulbs, or the right- and left-turn indicator bulbs are not working, replace them.

17. *Make sure all the exterior lights are working properly.*

Check that all the lights and reflectors are clean. See [Fig. 11.7](#).

- 17.1 Check that the brake lights, taillights, headlights, parking lights, turn signals, marker lights, identification lights, road lights (if so equipped), and front clearance lights are working properly and are clean.

- 17.2 Test the high and low beams of the headlights.

- 17.3 Replace light bulbs or sealed beam units that are not working.

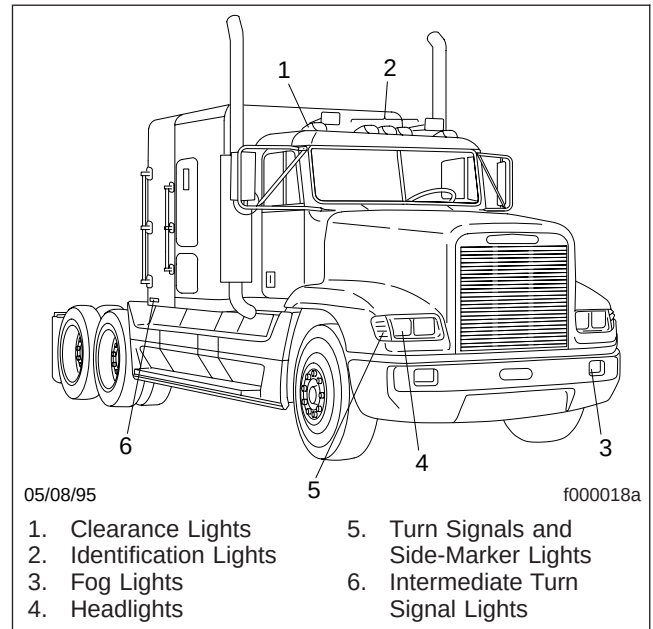


Fig. 11.7, Exterior Lights

- 17.4 Be sure all reflectors and lenses are in good condition and are clean. Replace any broken reflectors or lenses.

18. *Check tire inflation pressures using an accurate tire pressure gauge.*

Tires should be checked when cool. For inflation pressures and maximum loads (per tire) see the tire manufacturer's guidelines.

A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage. The tire should be inspected and, if necessary, repaired or replaced.

- 18.1 Be sure valve stem caps are on every tire and that they are screwed on finger-tight.

- 18.2 Inflate the tires to the applicable pressures if needed.

- 18.3 If a tire has been run flat or underinflated, check the wheel for proper locking and side-ring seating, and possible wheel, rim, or tire damage before adding air.

Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-maintained inline moisture traps and service them regularly.

Pretrip and Post-Trip Inspections and Maintenance

WARNING

Do not operate the vehicle with underinflated or overinflated tires. Incorrect inflation can stress the tires and make the tires and rims more susceptible to damage, possibly leading to rim or tire failure and loss of vehicle control, resulting in serious personal injury or death.

IMPORTANT: The load and cold inflation pressure must not exceed the rim or wheel manufacturer's recommendations, even though the tire may be approved for a higher load inflation. Some rims and wheels are stamped with a maximum load and maximum cold inflation rating. If they are not stamped, consult the rim or wheel manufacturer for the correct tire inflation pressure for the vehicle load. If the load exceeds the maximum rim or wheel capacity, the load must be adjusted or reduced.

19. *Inspect each tire for wear, bulges, cracks, cuts, penetrations, and oil contamination.*
 - 19.1 Check the tire tread depth. If tread is less than 4/32 inch (3 mm) on any front tire, or less than 2/32 inch (1.5 mm) on any rear tire, replace the tire.
 - 19.2 Inspect each tire for bulges, cracks, cuts, and penetrations.
 - 19.3 Inspect each tire for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if allowed to contact the tires, will soften the rubber and destroy the tire.
20. *Check the wheel nuts or rim nuts for indications of looseness. Examine each rim and wheel component.*
 - 20.1 Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes, metal buildup around stud holes, or out-of-round or worn stud holes may be caused by loose wheel nuts. See [Fig. 11.8](#) and [Fig. 11.9](#).
 - 20.2 Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks, or other damage.

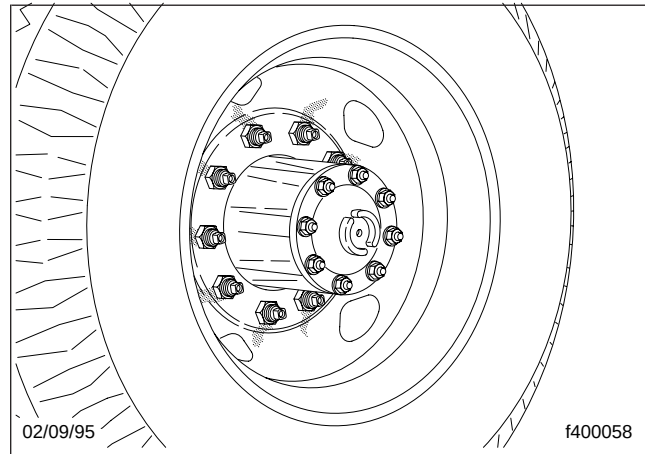


Fig. 11.8, Dirt and Rust Streaks from the Stud Holes

See **Group 33** or **Group 35** of the *Heavy-Duty Trucks Service Manual* for service procedures on the studs and hubs, and see **Group 40** in the same manual for wheel and tire servicing, or take the vehicle to an authorized Freightliner dealer.

WARNING

Have any worn or damaged wheel components replaced by a qualified person using the wheel manufacturer's instructions and the wheel industry's standard safety precautions and equipment. Otherwise a vehicle or workshop accident could occur, possibly resulting in serious personal injury or death.

- 20.3 Have broken, cracked, badly worn, bent, rusty, or sprung rings and rims replaced. Be sure that the rim base, lockring, and side ring are matched according to size and type.
- 20.4 Make sure all wheel nuts are tightened 450 to 500 lbf·ft (610 to 678 N·m) for Accuride wheels with unlubricated threads. Use the tightening pattern in [Fig. 11.10](#) for 10-hole wheels, and the tightening pattern in [Fig. 11.11](#) for 8-hole wheels. See **Group 40** of the *Heavy-Duty Trucks Service Manual* for more information.

Pretrip and Post-Trip Inspections and Maintenance

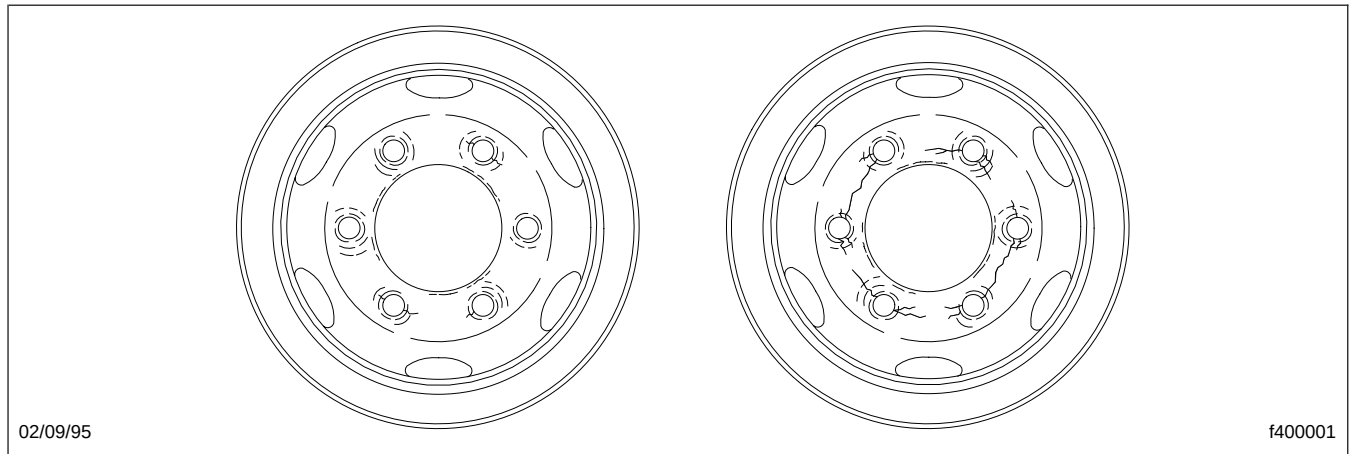


Fig. 11.9, Worn Stud Holes

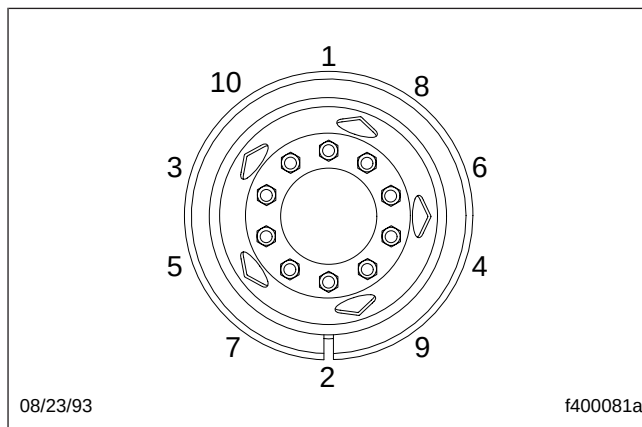


Fig. 11.10, Tightening Pattern, 10-Hole Wheels

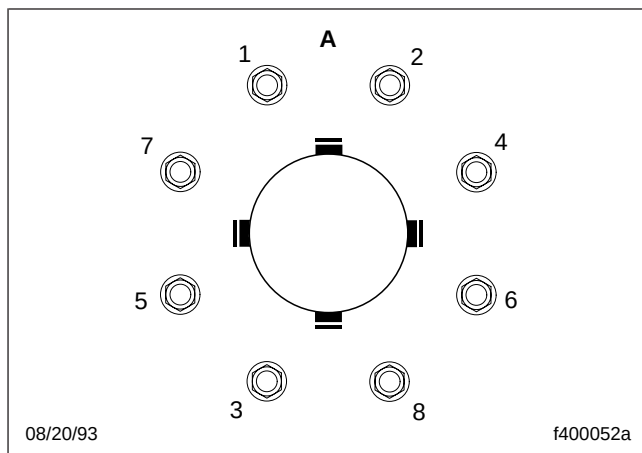


Fig. 11.11, Tightening Pattern, 8-Hole Wheels

⚠ CAUTION

Insufficient wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values and follow the proper tightening sequence.

⚠ DANGER

Do not loosen or remove the parking brake clamp ring for any purpose. The parking/emergency brake section of the brake chamber is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in Group 42 of the *Heavy-Duty Trucks Service Manual*.

21. Inspect the air brake chamber and the air brake chamber pushrods. See [Fig. 11.12](#).

⚠ WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle

Pretrip and Post-Trip Inspections and Maintenance

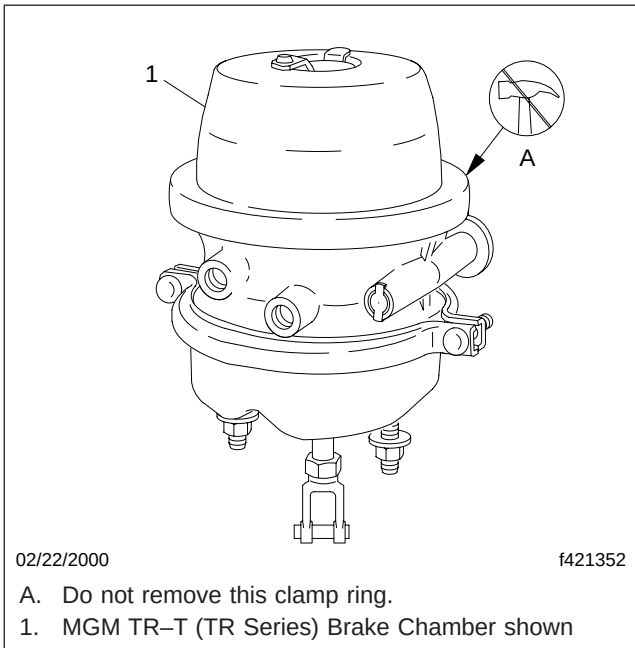


Fig. 11.12, Parking Brake Chamber Clamp

control resulting in property damage or personal injury.

- 21.1 Check that the air brake chamber is mounted securely on its mounting bracket, and that there are no loose or missing bolts.
- 21.2 Look for worn clevis pins on brake chamber pushrods and missing or damaged cotter pins on brake chamber pushrod clevis pins. Replace worn clevis pins and install new cotter pins if necessary.
- 21.3 See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the non-pressure chamber and cause a dragging brake. See **Group 42** of the *Heavy-Duty Trucks Service Manual*.



CAUTION

If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside of the chamber, dirt and debris can cause the internal parts of the chamber to deteriorate faster.

- 21.4 Inspect the exterior surfaces of the chamber for damage. Make sure that breather holes in the non-pressure section(s) are open and free of debris. See **Group 42** of the *Heavy-Duty Trucks Service Manual* to replace any damaged parts.

- 21.5 On all parking brake installations, make sure the end cover cap or dust plug is securely snapped into place.

NOTE: On most MGM parking brake chambers equipped with an integral release bolt, an end cover cap is installed over the release bolt.

- 21.6 Check for rusted connections, missing snap rings, and damaged camshaft grease seals. Have damaged or missing parts repaired or replaced.

22. Inspect the air brake lines.

- 22.1 Check the clearance between the hoses and the exhaust manifold or other hot spots. Excessive heat will cause material in the hoses to deteriorate rapidly or become brittle. Provide at least 6 inches (150 mm) of clearance. More clearance is recommended if the hose is located above the heat source.
- 22.2 Check for kinks, dents, or swelling of the hoses. If damaged, have the hose replaced with the same size and type.

NOTE: Do not route the hose on top of anything likely to be stepped on.

- 22.3 Check for damage to hoses located near moving parts, such as drivelines, kingpins, suspensions, and axles. If moving parts are catching or pinching the lines, correct as needed.
- 22.4 Check for hose damage caused by abrasion. If abraded, have the hose replaced. Check for the cause of abrasion, such as loose or damaged hose clamps. Have the clamps repaired or replaced as needed.
- 22.5 Observe the hose cover condition, especially hoses exposed to water splash and ice. If dried out or ragged (the wire or liner is showing through the cover), have the hose(s) replaced.

Pretrip and Post-Trip Inspections and Maintenance

- 22.6 Inspect the air tubing, especially tubing made of nylon. In cold weather, nylon tubing is sensitive to damage, such as nicks or cuts. Have nicked or cut tubing replaced, even if it is not leaking.
- 22.7 Check for kinked or twisted hoses. A seven-percent twist in the hose can reduce its life by up to 90 percent. A twisted hose under pressure tends to untwist, which may loosen the fitting. Reconnect hoses that are twisted.

NOTE: The front brake lines flex continuously in vehicle operation, so they require special examination. Give particular attention to the areas near where they connect to the front air brake chambers. This inspection requires two people, one in the driver seat and another to inspect the brake line connections at the wheels.

- 22.8 Both wheel air lines must be inspected with the emergency brake set, engine idling, air pressure at 80 to 90 psi (550 to 620 kPa), and the brake pedal held down.
- 22.9 Turn the wheels to full lock in one direction and inspect both air lines where they connect to the air chambers, then turn the wheels to full lock in the other direction and inspect both lines. If a hose is leaking, have it replaced.

IMPORTANT: ABS-equipped vehicles operating in regions where especially corrosive ice removal chemicals are used may experience higher than normal rotor corrosion. Tone rings should be routinely inspected for corrosion. Severe corrosion of the integral ABS tone ring may cause the ABS warning lamp in the dash to illuminate due to false wheel speed readings. If the ABS warning lamp illuminates at any time other than at vehicle start-up, have the problem repaired immediately.

23. Inspect the slack adjusters.

- 23.1 *Meritor Slack Adjusters:* Check the boot for cuts, tears, or other damage. Have it replaced if necessary.

- 23.2 *Gunite Slack Adjusters:* Inspect the slack adjuster for any signs of damage. If damaged, have the slack adjuster replaced.

Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, have it replaced. See [Fig. 11.13](#).

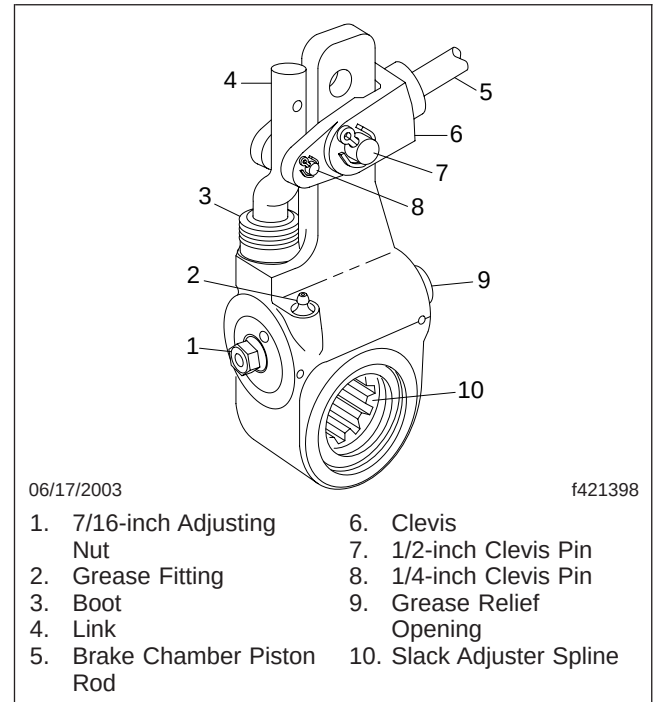


Fig. 11.13, Gunite Automatic Slack Adjuster

- 23.3 *Haldex Slack Adjusters:* Inspect each slack adjuster and anchor strap for damage. See [Fig. 11.14](#). Have any damaged components replaced.

Check that the control-arm nut is fully released. If the control arm is in the wrong position, the brakes will drag.

24. Check the air brake system for proper operation.

- 24.1 Check the air governor cut-in and cut-out pressures as follows.

Run the engine at fast idle. The air governor should cut out the air compressor at approximately 120 psi (827 kPa). With the engine idling, apply the brake pedal several times. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not

Pretrip and Post-Trip Inspections and Maintenance

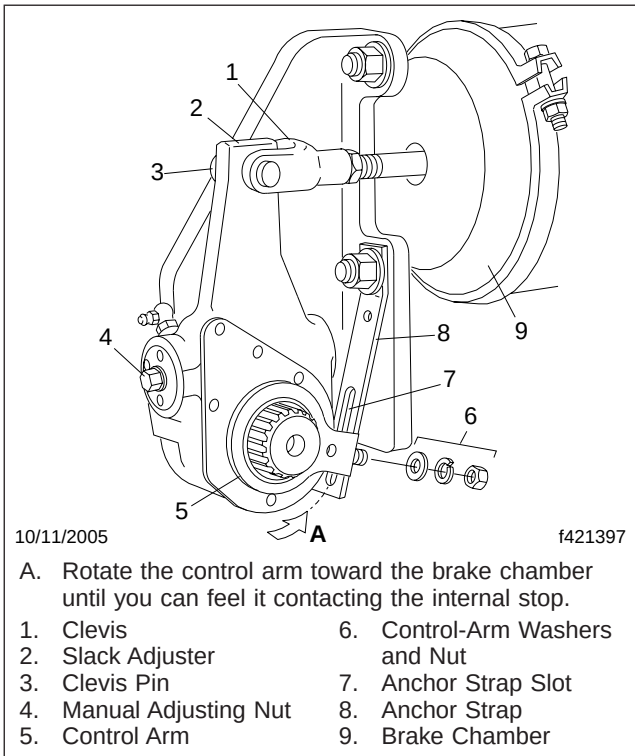


Fig. 11.14, Haldex Automatic Slack Adjuster

cut in and out as described above, it must be adjusted to these specifications. If the air governor cannot be adjusted or repaired, replace it before operating the vehicle.

- 24.2 Check the air pressure buildup time as follows.

With the air system fully charged to 120 psi (827 kPa), make one full brake application and note the air pressure reading on the gauge. Continue to reduce the air pressure by moderate brake applications to a maximum of 90 psi (620 kPa), then run the engine at governed rpm. If the time required to raise the air pressure to 120 psi (827 kPa) (from the pressure noted after one brake application) is more than 30 seconds, eliminate any leaks or replace the air compressor before operating the vehicle.

- 24.3 Check the air pressure reserve as follows.

With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

- 24.4 Check the air leakage in the system as follows.

With the parking brake (spring brake) applied, the transmission out of gear, and the tires chocked, charge the air system until cut-out pressure of 120 psi (827 kPa) is reached.

With the service brakes released, shut down the engine, wait one minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

Charge the air system until cut-out pressure of 120 psi (827 kPa) is reached. With the parking brakes released and the service brake applied, shut down the engine, wait one minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

If leakage exceeds the limits shown in [Table 11.4](#), repair all areas of leakage before driving the vehicle.

Maximum Allowable Service Brake Air Leakage		
Description	Air Leakage in psi (kPa) Per Minute	
	Released	Applied
Truck or Tractor Only	2 (14)	3 (21)
Truck or Tractor w/Single Trailer	3 (21)	4 (28)
Truck or Tractor w/Two Trailers	5 (35)	6 (42)

Table 11.4, Maximum Allowable Service Brake Air Leakage

25. *Test the service brakes.*

When starting to move the vehicle and before picking up speed, test the brakes with the foot pedal and parking brake control valve (yellow knob) to be sure they will bring the vehicle to a safe stop.

Pretrip and Post-Trip Inspections and Maintenance

Weekly Post-Trip Maintenance Procedures

WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. *Inspect the batteries and battery cables.*
 - 1.1 Access the batteries. Be sure the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.
 - 1.2 If the battery is equipped with a built-in hydrometer, examine the hydrometer. If a green dot shows in the sight glass, the battery is sufficiently charged.

If the sight glass is dark, the charge is low and the battery must be recharged.

If the sight glass is clear, the battery has a low level of electrolyte and must be replaced.

2. *Check the level of the wheel bearing lubricant in the hub cap at each end of the front axle.*

If needed, fill the hubs to the level indicated on the hub cap. See **Group 35** of the *Heavy-Duty Trucks Maintenance Manual*, for recommended lubricants.

IMPORTANT: Before removing the fill plug, always clean the hub cap and plug.

3. *Examine the steering components.*

See **Fig. 11.15**. If repairs are needed, see **Group 46** of the *Heavy-Duty Trucks Service Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.
 - 3.1 Check the mounting bolts and pitman arm nut for tightness.
 - 3.2 Check the drag link nuts for missing cotter pins.

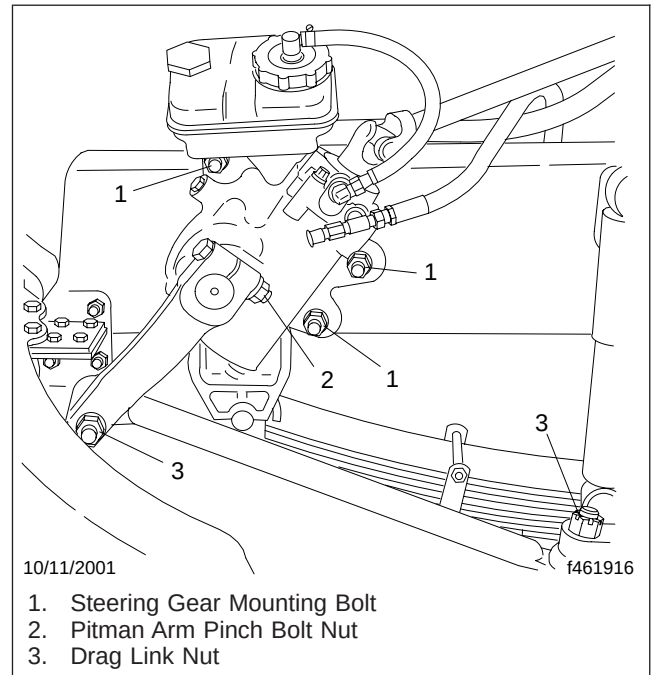


Fig. 11.15, Steering Gear Fasteners

- 3.3 Inspect the steering driveshaft and steering linkage for excessive looseness, or other damage.
- 3.4 Tighten loose nuts, and have damaged parts replaced as needed.
4. *Check the condition of the serpentine drive belt.*

Look for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, have the belt replaced, following the instructions in **Group 01** of the *Heavy-Duty Trucks Service Manual*.

CAUTION

Do not drive with a serpentine belt that is visibly worn or damaged. If it fails, the lack of coolant flow could rapidly cause damage to engine components.

5. *Check the drive belt for proper tension.*

Use your index finger to apply force at the center of the belt free-span. See **Fig. 11.16**. There is no

Pretrip and Post-Trip Inspections and Maintenance

adjustment for belt tension on engines with automatic belt tensioners. If there is not proper tension, have the belt tensioner replaced. See **Group 01** of the *Heavy-Duty Trucks Service Manual* for instructions, or take the vehicle to an authorized Freightliner dealer.

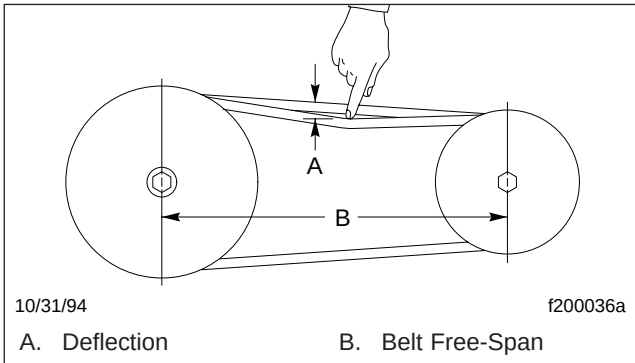


Fig. 11.16, Checking Belt Tension

6. Inspect the seat belts and tether belts.

! WARNING

Inspect and maintain seat belts as instructed below. Worn or damaged seat belts could fail during a sudden stop or crash, possibly resulting in serious injury or death.

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

NOTE: When any part of a seat belt needs replacement, the entire seat belt must be replaced, both retractor and buckle side.

- 6.1 Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
- 6.2 Check the web for extreme dirt or dust and for severe fading from exposure to sunlight.
- 6.3 Check the buckle and latch for operation and for wear or damage.
- 6.4 Check the Komfort Latch for function and cracks or other damage.

- 6.5 Check the web retractor for function and damage.
- 6.6 Check the mounting bolts for tightness and tighten any that are loose.

Monthly Post-Trip Maintenance Procedures

! WARNING

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. Clean the batteries.

- 1.1 Remove any corrosion from the hold-down and the top of the battery.

! CAUTION

Take care to keep the vent plugs tight so that the neutralizing solution does not enter any of the battery cells and damage the battery.

- 1.2 Use a soda solution to neutralize the acid present, then rinse off the soda solution with clean water.
- 1.3 If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of petroleum jelly to the posts and terminals to help retard corrosion.
2. Inspect the radiator and heater hoses, including the clamps and support brackets.
 - 2.1 Make sure the radiator inlet and outlet hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.
 - 2.2 Make sure the heater hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.

Pretrip and Post-Trip Inspections and Maintenance

- 2.3 Tighten hose clamps as necessary, but do not overtighten, as hose life can be adversely affected.
- 2.4 Be sure the hose support brackets are securely fastened. Make sure the hoses are not located near sources of wear, abrasion, or high heat.

IMPORTANT: Replace all hoses, including heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. Silicone hoses having an extended service life can be substituted for the reinforced neoprene type. See the Freightliner *Service Parts Catalog* or contact your Freightliner Dealer.

3. Check the steering wheel for excessive play.

- 3.1 With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels.
- 3.2 Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction until motion is again detected at the wheels.
- 3.3 Measure the lash (free play) at the rim of the steering wheel. Excessive lash exists if steering wheel movement exceeds 2-1/4 inches (57 mm) with an 18-inch (450-mm) steering wheel.

If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear before operating the vehicle.

4. Check the brake lining wear on all vehicles, including those with automatic slack adjusters. Proper brake operation is dependent on periodic maintenance and inspection of the brake linings.

- 4.1 Check that brake linings are free of oil and grease.
- 4.2 Inspect the thickness of the brake linings. If the axle assembly is equipped with a dust shield or backing plate, remove the inspection plugs. If *any* brake linings are worn to less than approximately 1/4 inch (6.4 mm) at the thinnest point, have the linings replaced on *all* brake assemblies on that axle. See **Group 42** of the *Heavy-*

Duty Trucks Service Manual for lining replacement instructions and camshaft end-play inspection.

- 4.3 Check the brake drums for wear and cracks.
- 4.4 Check that the inspection plugs in the dust shields or backing plates, if so equipped, are installed.

12

Cab Appearance

Cab Washing and Polishing	12.1
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Care of Chrome Parts	12.1
Dashboard Care	12.1
Vinyl Upholstery Cleaning	12.1
Velour Upholstery Cleaning	12.2
Leather Upholstery Cleaning	12.3

Cab Appearance

Cab Washing and Polishing

To protect the finish of your new vehicle, follow these guidelines carefully:

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle's finish, follow these guidelines:

- Avoid washing your vehicle in the hot sun.
- Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. Before waxing, if the finish has become dull, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Freightliner recommends that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface off with water.
- To prevent rust, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

Care of Fiberglass Parts

Wash unpainted fiberglass air fairings and shields monthly with a mild detergent, such as dishwashing liquid. Avoid strong alkaline cleansers.

Apply a wax specifically designed for fiberglass.

Care of Chrome Parts

To prevent rust, keep chrome parts clean and protected at all times. This is especially important during winter driving and in coastal areas where there is exposure to salt air.

When cleaning chrome parts, use clean water and a soft cloth or sponge. A mild detergent may also be used.

Sponge gently, then rinse. If necessary, use a non-abrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

Dashboard Care

Periodically wipe the dashboard with a water-dampened cloth. A mild detergent can be used, but avoid using strong detergents.



CAUTION

Do not use Armor-All Protectant®, STP Son-of-a-Gun®, or other equivalent treatments. These cleaners contain vinyl plasticizers that can cause stress crazing in the interior plastic panels, which can result in cracking of the panels.

Vinyl Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

Ordinary Dirt

Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times, as necessary.

Cab Appearance

If dirt is deeply imbedded, use a soft bristle brush after applying the soap.

If dirt is extremely difficult to remove, wall-washing preparations normally found around the home can be used. Powdered cleaners, such as those used for sinks and tiles, are abrasive and must be used with caution as they can scratch the vinyl or give it a permanent dull appearance.

Chewing Gum

Harden the gum with an ice cube wrapped in a plastic bag, then scrape off with a dull knife. Any remaining traces of gum can be removed with an all-purpose light oil (peanut butter will also work) and wiped off.

Tars, Asphalts, and Creosote

Each of these items stains vinyl after prolonged contact. They should be wiped off immediately and the area carefully cleaned, using a cloth dampened with naphtha.

Paint, Shoe Heel Marks

Paint should be removed immediately. Do not use paint remover or liquid-type brush cleaner on vinyl. An unprinted cloth, dampened with naphtha or turpentine may be used. Use care to prevent contact with parts of the upholstery that are not vinyl.

Sulfide Stains

Sulfide compounds, such as those found in eggs and some canned goods, can stain after prolonged contact with vinyl. These stains can be removed by placing a clean, unprinted piece of cloth over the spotted area and pouring a liberal amount of 6 percent hydrogen peroxide onto the cloth. Allow the saturated cloth to remain on the spot for 30 to 60 minutes. For stubborn spots, allow the hydrogen-peroxide saturated cloth to remain on the area overnight. Use caution to prevent the solution from seeping into the seams, or it will weaken the cotton thread.

Nail Polish and Nail Polish Remover

Prolonged contact with these substances causes permanent damage to vinyl. Careful blotting immediately after contact minimizes damage. Do not spread the liquid during removal.

Shoe Polish

Most shoe polishes contain dyes which penetrate vinyl and stain it permanently. Shoe polish should be wiped off as quickly as possible using naphtha or lighter fluid. If staining occurs, try the same procedure as that under "Sulfide Stains."

Ball Point Ink

Ball point ink can sometimes be removed if rubbed immediately with a damp cloth, using water or rubbing alcohol. If this does not work, try the procedure used under "Sulfide Stains."

Miscellaneous

If stains do not respond to any of the treatments described above, it is sometimes helpful to expose the vinyl to direct sunlight for up to 30 hours. Mustard, ball point ink, certain shoe polishes, and dyes often bleach out in direct sunlight, leaving the vinyl undamaged.

Velour Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Spot clean with a mild solvent or upholstery shampoo, or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow instructions carefully, and clean only in a well-ventilated area. Avoid any product that contains carbon tetrachloride or other toxic materials. With either method, pretest a small area before proceeding. Use a professional upholstery cleaning service when extensive cleaning is needed.

Grease and Oil-Based Stains

Dampen a small absorbent cloth with dry-cleaning solvent or spot remover. Apply carefully to the spot from the outer edge to the center. Pat and blot with a clean, dry cloth. Repeat several times, as necessary, turning cloths so that the stain does not redeposit on the fabric.

Sugar and Water-Based Stains

Apply water-based detergent or cleaner, working in circular motions. Pat and blot as dry as possible. Repeat, if necessary, before drying thoroughly.

Cab Appearance

Chewing Gum or Wax

Harden the gum or wax with an ice cube wrapped in a plastic bag, then scrape off with a dull knife. Excess wax can be absorbed by placing a thick white blotter over the wax and heating with a warm (not hot) iron. Remove the remainder by using the same procedure under "Grease and Oil-Based Stains."

Mildew

Brush the dry fabric with a soft brush. Sponge with detergent, and blot. If the fabric is colorfast, dilute a teaspoon of bleach in one quart (one liter) of cool water. Apply with a swab, directly on the mildew stain. Dab repeatedly with clear, cool water, and blot dry.

Leather Upholstery Cleaning



CAUTION

Do not apply oil to or use oil-based soaps on the upholstery. Applying oil to leather upholstery will damage the original oil finish, causing it to become tacky in texture.

When soiled, leather upholstery can be cleaned with warm water and a mild soap. Using a cheese cloth, rub the soiled area briskly. Then, use a clean damp cheese cloth and wipe away the soap residue. Finish by wiping with a dry soft cloth.

13

In an Emergency

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In an Emergency

Hazard Warning Lights

The hazard warning light tab is located on the turn signal control lever. See [Fig. 13.1](#). To operate the hazard lights, pull the tab out. All of the turn signal lights and both of the indicator lights on the control panel will flash.

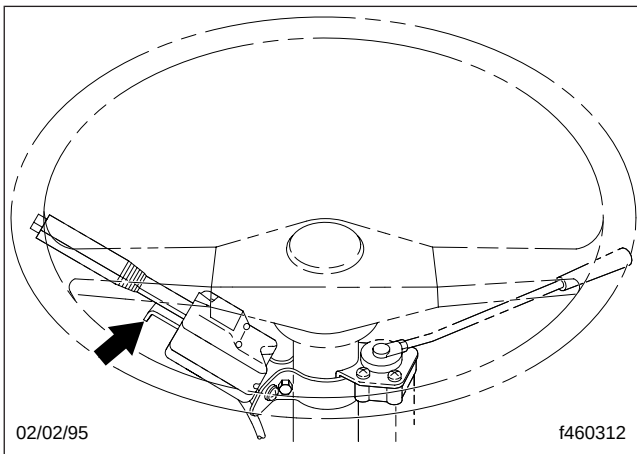


Fig. 13.1, Hazard Warning Light Tab

To cancel the hazard warning lights, push the turn signal control lever either up or down, then return the lever to its neutral position.

Emergency Kit, Optional

An optional emergency kit package is located in the baggage compartment behind the driver's seat if the vehicle has a sleeper compartment. If there is no sleeper compartment, the emergency kit is located behind and between the seats. The package includes one or more of each of the following: fire extinguisher, first aid kit, and a triangular reflector and flare kit.

If there is an emergency while driving, cautiously pull off the road, paying attention to other traffic. Turn on the hazard warning lights. Place the flares and reflector along the side of the road, to alert other drivers that an emergency situation exists.

WARNING

Use extreme care when placing flares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or fire could occur causing serious personal injury.

Towing

When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.

WARNING

Do not tow an unbraked vehicle if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWR) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

Front Towing Hookup

1. Disconnect the battery ground cables.

CAUTION

Failure to remove the axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

2. Remove both drive axle shafts. On dual drive axles, if the vehicle is to be lifted and towed, remove only the rearmost drive axle shafts.

On vehicles equipped with an air fairing, remove both the forward and rearmost drive axle shafts if there is insufficient towing clearance.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out, and will keep contaminants from getting into and damaging the wheel bearings and axle lubricant.

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

4. On dual drive axles, if the vehicle is to be lifted and towed, chain the forward rear-axle assembly to the vehicle frame. Use protection to keep the chains from damaging the frame.

In an Emergency

5. Remove the bumper extension and chrome bumper, if so equipped. Remove the bumper fairing, if so equipped.
6. On vehicles equipped with an air fairing, adjust the trim tab to the lowest position.



CAUTION

Do not pass a sling (for example, a rope or chain) from one tow hook to another to fasten for towing (see Fig. 13.2). Known as reeving, this practice is *not* permissible in most industrial applications of towing and hoisting. Reeving can overload the hooks and result in damage to the vehicle.

7. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
8. On vehicles equipped with an air fairing, measure the distance from the ground to the bumper, or from the ground to a frame bracket.
9. Lift the vehicle, and secure the safety chains. If extra towing clearance is needed, remove the front wheels.
10. On vehicles equipped with an air fairing, repeat the measurement taken in step 8. The difference between the two measurements must not exceed 14 inches (36 cm). If necessary, lower the vehicle.



WARNING

Failure to lower the vehicle could result in the air fairing striking an overhead obstruction, such as a bridge or overpass, and causing vehicle damage or personal injury.

11. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.
12. Chock the disabled vehicle's tires, and connect the towing vehicle's air brake system to the vehicle being towed. Then, release the spring parking brakes and remove the chocks.

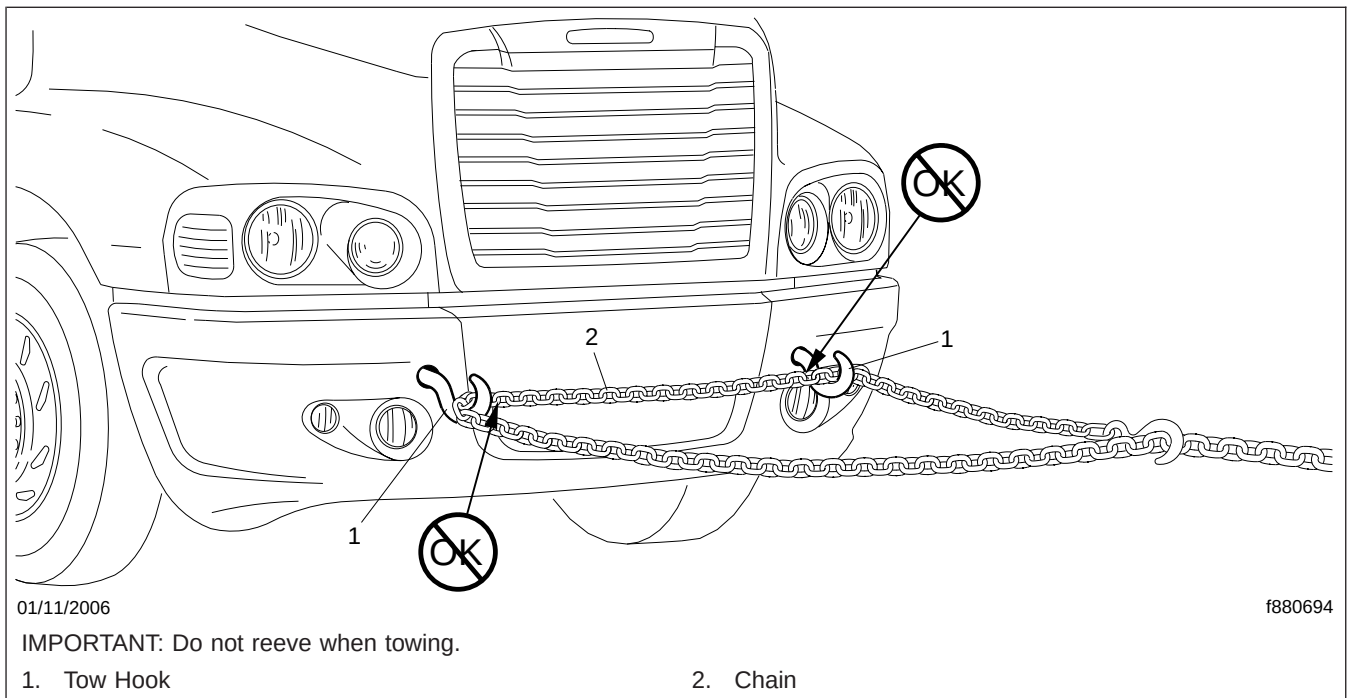


Fig. 13.2, Reeving

In an Emergency

WARNING

Failure to chock the tires or connect the tow truck's air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

Rear Towing Hookup

CAUTION

Using a rear towing hookup on a vehicle equipped with a roof fairing could cause damage to the cab structure.

IMPORTANT: Because of the possibility of excessive wind force which could cause damage to the cab, do not use a rear towing hookup on any vehicle equipped with a roof fairing.

1. Place the front tires straight forward, and secure the steering wheel in this position.
2. Disconnect the battery ground cables.

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

3. On dual drive axles, using protection to keep the chains from damaging the vehicle frame, chain the forward-rear drive axle to the frame.
4. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
5. Lift the vehicle, and secure the safety chains. If extra clearance is needed, remove the bumper extension, if equipped.
6. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.

Emergency Starting With Jumper Cables

When using jumper cables, follow the instructions below.

WARNING

Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.

CAUTION

Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Also, do not attempt to charge isolated, deep-cycle batteries with jumper cables. Follow the battery manufacturer's instructions when charging deep-cycle batteries.

NOTE: On vehicles equipped with an optional jump-start post, attach the positive cable clamp to that post instead of to the battery.

1. Apply the parking brakes and turn off the lights and all other electrical loads.
2. Connect an end of one jumper cable to the positive terminal of the booster battery (or jump-start post, if equipped), and connect the other end of the cable to the positive terminal of the discharged battery (or jump-start post, if equipped). See [Fig. 13.3](#).

WARNING

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

In an Emergency

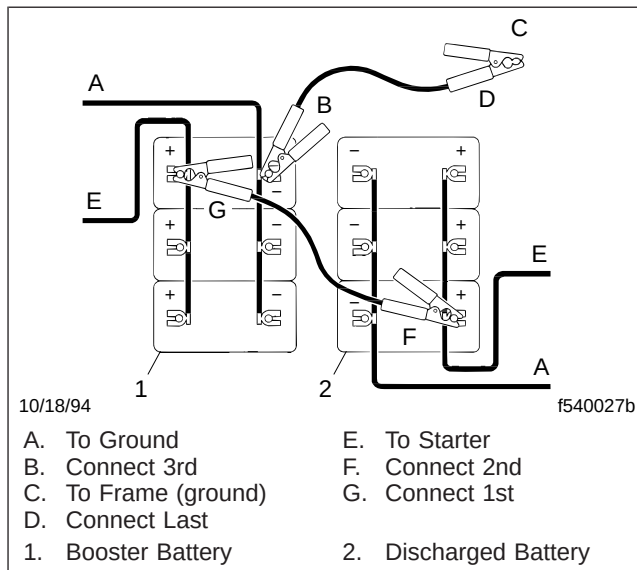


Fig. 13.3, Jumper Connections

3. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to a ground at least 12 inches (300 mm) away from the batteries of the vehicle needing the start. The vehicle frame is usually a good ground. Do *not* connect the cable to or near the discharged batteries.
4. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.
5. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.
6. When the engine starts, let it idle a few minutes.

! WARNING

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

7. Disconnect the grounded cable from the frame or other nonbattery location; then disconnect the other end of the cable.

8. Disconnect the remaining cable from the newly charged battery (or jump-start post, if equipped) first; then disconnect the other end.

Fire in the Cab

The incidence of fire in heavy- and medium-duty trucks is rare, according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab, but despite this, most materials will burn. The cab of this vehicle contains urethane foam, which is of concern in this respect.

! WARNING

Urethane foam is flammable! Do not allow any flames, sparks, or other heat sources such as cigarettes or light bulbs to contact urethane foam. Urethane foam in contact with such heat sources could cause a serious, rapid fire, which could result in death, severe burns, or gas poisoning, as well as damage to the vehicle.

In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

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