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 Book* and 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 LLC 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

In this manual, whenever you see instructions 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.

Customer Assistance Center

Having trouble finding service? Call the Freightliner 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, breakdown coordination, or Fleetpack assistance. Our people are knowledgeable, professional, and committed to following through to help you keep your truck moving.

National Highway Traffic Safety Administration Reporting Procedure

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

STI-199 (09/00P)
Printed in U.S.A.

Foreword

Highway Traffic Safety Administration (NHTSA) in addition to notifying Freightliner 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 Freightliner LLC.

To contact NHTSA, you may either call the Auto Safety Hotline toll free at 1-800-424-9393 (or 366-0123 if you are in the Washington, D.C. area) or write to: NHTSA, U.S. Department of Transportation, Washington, D.C. 20590. You can also obtain other information about motor vehicle safety from the Hotline.

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1

Vehicle Identification

Vehicle Specification Decal **1.1**
Federal Motor Vehicle Safety Standard (FMVSS) Labels **1.1**
Canadian Motor Vehicle Safety Standard (CMVSS) Labels **1.1**
Tire and Rim Labels **1.2**
EPA Vehicle Noise Emission Control Label **1.3**

Vehicle Specification Decal

The vehicle specification decal 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 Book.* An illustration of the decal is shown in **Fig. 1.1**.

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

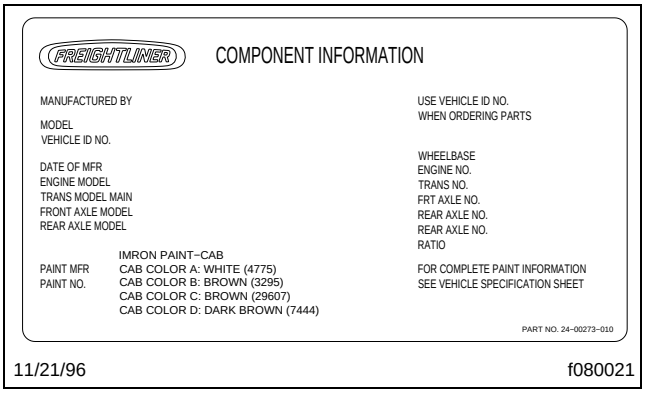


Fig. 1.1, Vehicle Specification Decal, U.S.-Built Vehicle Shown

Federal Motor Vehicle Safety Standard (FMVSS) Labels

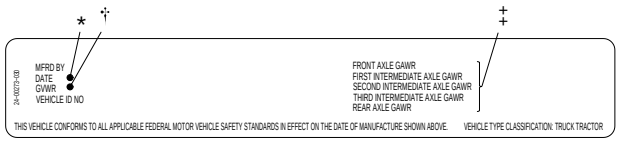
NOTE: Due to the variety of FMVSS certification requirements, not all of the labels shown will apply to your vehicle.

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

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. In addition, tire and



* Date of Manufacture: by month and year.

† Gross Vehicle Weight Rating: developed by taking the sum of all the vehicle's gross axle ratings.

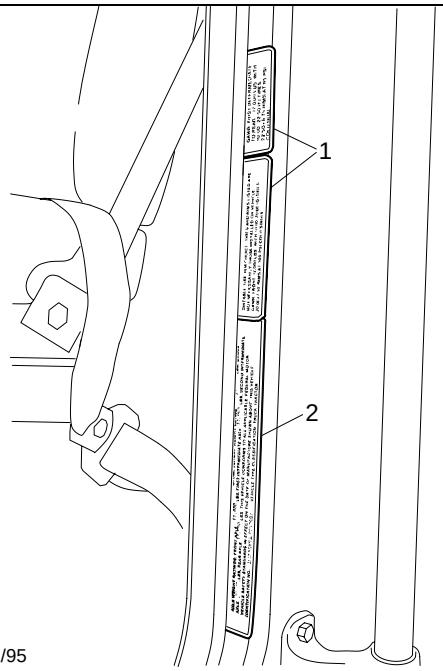
‡ Gross Axle Weight Ratings: developed by considering each component in an axle system; including suspension, axle, wheels, and tires. The lowest component capacity is the value used for the system.

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Fig. 1.2, Certification Label, U.S.

rim labels (**Fig. 1.6**) are also attached to the left rear door post.

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.



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1. Tire and Rim Labels
2. Certification Label

Fig. 1.3, Label Location at Left Rear Door Post

Tire and Rim Labels

Tire and rim labels certify suitable tire and rim combinations that can be installed on the vehicle, for the given gross axle weight rating. Tires and rims installed on the vehicle at the time of manufacture may have a higher

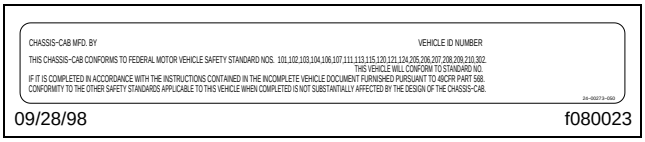


Fig. 1.4, Certification Label for Trucks Without a Cargo Body

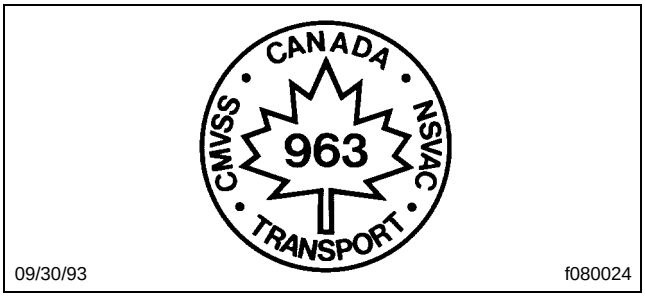


Fig. 1.5, Canadian National Safety Mark Label

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.

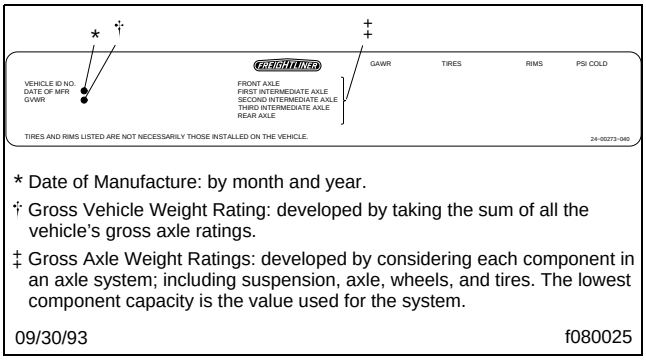


Fig. 1.6, Tire and Rim Label

EPA 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 nosebeam between the dash and the windshield.

It is the owner's responsibility to maintain the vehicle so that it conforms to EPA regulations.

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 com-

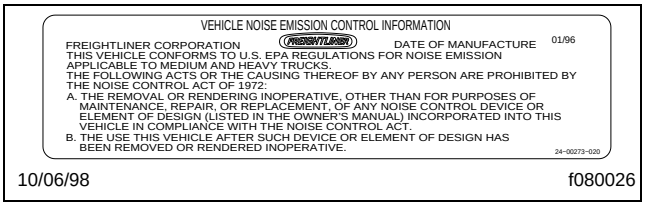


Fig. 1.7, Vehicle Noise Emission Control Label

plete the vehicle in conformity to U.S. EPA regulations (40 CFR Part 205) and label it for compliance.

2

Instruments and Controls Identification

Instrument and Control Panel **2.1**
Controls **2.1**
Exterior Switches **2.18**
Warning and Indicator Lights **2.19**
Instruments **2.30**

Instruments and Controls Identification

Instrument and Control Panel

Figure 2.1 and **figure 2.2** each show a portion of the dash equipped with standard and optional instruments and controls.

A warning and indicator light module is located above the speedometer and tachometer. This module houses all of the standard and optional warning indicators.

Right-hand-drive (RH DR) vehicles have a different dash layout than that found on the left-hand-drive vehicles described in this chapter. It is not a left-hand-drive dash in reverse, however, many of the instruments and controls are the same or similar. See **Fig. 2.3** for a typical RH DR instrument cluster layout. See **Fig. 2.4** for the RH DR center console control panel layout. See **Fig. 2.5** for the overhead gauge panel layout. For the layout of RH DR HVAC controls, see **Chapter 4** in this manual.

NOTE: On RH DR vehicles, the trailer brake hand valve is located on the right-hand side of the steering column.

Controls

Ignition Switch and Key **(Fig. 2.6)**

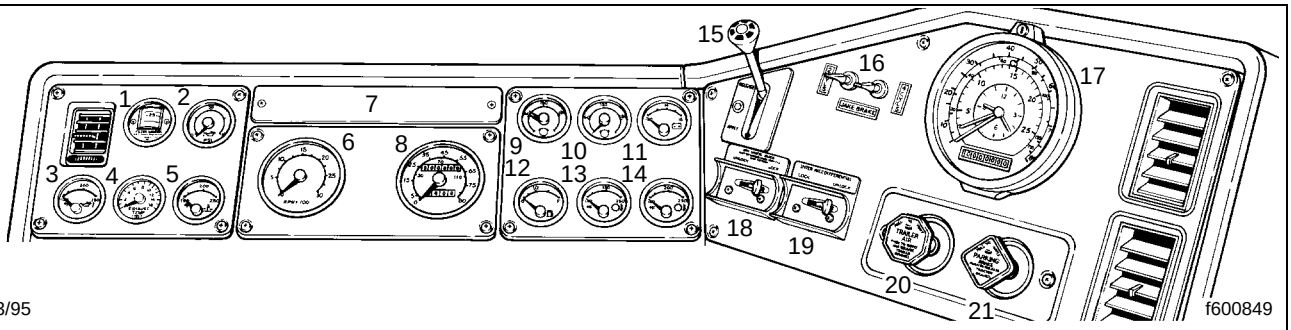
The ignition switch can be turned to any of three positions: Off, Accessory, and On. The ignition switch key also locks and unlocks the cab doors.

In the off position, the key slot is vertical; the key can be inserted and removed only from this position. Low-beam headlights, brake lights, fog lights, dome lights, clearance lights, turn signals, hazard warning lights, horn, parking lights, and the cigarette lighter operate with the ignition switch off, regardless of whether or not the key is inserted.

In the accessory position, the key is turned counterclockwise. The heater fan, electric wipers, heated mirrors, backup lamps, radio, ether start system, and all electric gauges operate with the key in the accessory position.

In the on position, the key is turned clockwise. All electrical systems are operable. The low air- and oil-pressure warning lights and buzzer operate until the engine has run long enough for the pressure to build 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 low-beam headlights (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.

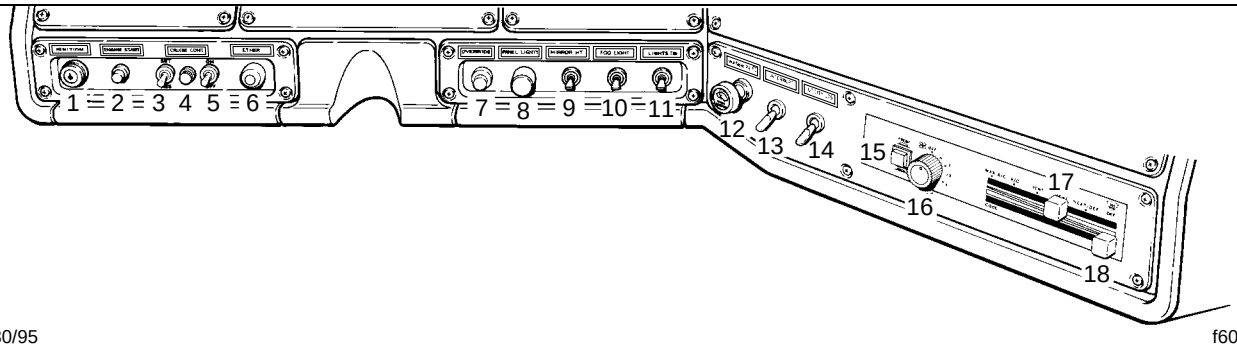


NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Intake-Air Restriction Indicator (optional)
2. Engine Oil Pressure Gauge
3. Engine Oil Temperature Gauge (optional)
4. Pyrometer (optional)
5. Coolant Temperature Gauge
6. Tachometer
7. Warning and Indicator Light Module
8. Speedometer
9. Dual Air Pressure Gauge
10. Application Air Pressure Gauge (optional)
11. Voltmeter
12. Fuel Gauge
13. Forward Rear Axle Oil Temperature Gauge (optional)
14. Rearmost Axle Oil Temperature Gauge (optional)
15. Trailer Brake Hand Control Valve Lever (optional)
16. Jacobs Engine Brake Switches (optional)
17. Tachograph/Combination Graph (optional)
18. Fifth Wheel Air Slide Control Valve Switch (optional)
19. Interaxle Differential Lockout Control Valve Switch (optional)
20. Trailer Air Supply Valve
21. Parking Brake Control Valve (optional: trailer air supply valve with parking brake control valve)

Fig. 2.1, Instrument and Control Panel Layout (upper dash shown)

Instruments and Controls Identification

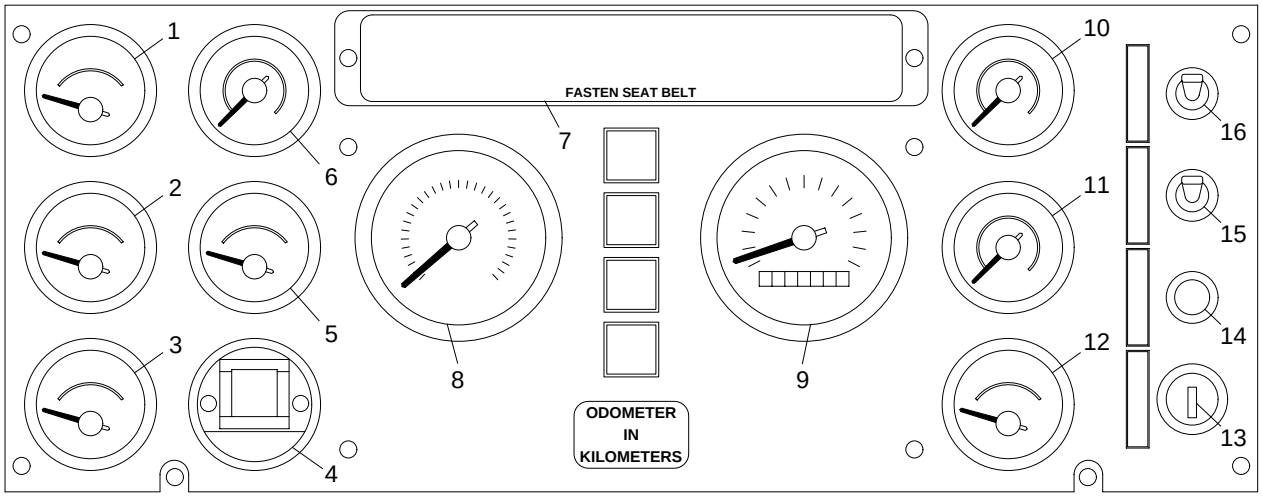


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NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Ignition
2. Engine Start Button
3. Cruise Control Set/Resume Switch (optional)
4. Cruise Control Indicator, ETEC (optional)
5. Cruise Control On/Off Switch (optional)
6. Engine Starting Assist Button (optional)
7. Manual Override Push Button (optional)
8. Panel Light Control Knob
9. Mirror Heat Switch (optional)
10. Fog Light Switch
11. Headlight Switch
12. Windshield Wiper and Washer Control Knob
13. Marker Light and Taillight Interrupt Switch
14. Utility Light Switch (optional)
15. Fresh- or Recirculated-Air Push Button
16. Heater and Air Conditioner Fan Switch
17. Airflow Direction Lever Slide Control
18. Temperature Lever Slide Control

Fig. 2.2, Instrument and Control Panel Layout (lower dash shown)

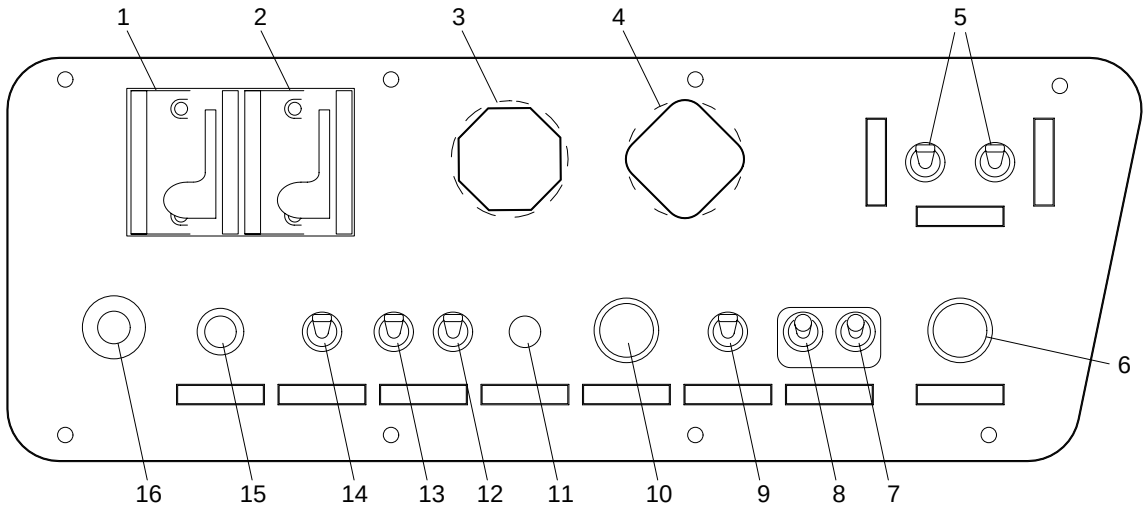


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NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Engine Oil Temperature Gauge
2. Pyrometer
3. Voltmeter
4. Intake-Air Restriction Indicator
5. Coolant Temperature Gauge
6. Engine Oil Pressure Gauge
7. Warning and Indicator Light Module
8. Tachometer
9. Speedometer
10. Primary and Secondary Air Pressure Gauge
11. Application Air Pressure Gauge
12. Fuel Gauge
13. Ignition Key Switch
14. Engine Start Button
15. Marker Light Switch
16. Headlight Switch

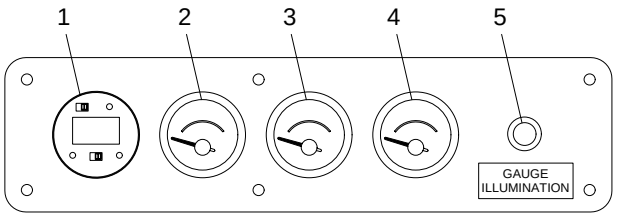
Fig. 2.3, RH DR Instrument Cluster Layout (typical)



NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Rear Suspension Air Control Valve Switch
2. Traction Control/Differential Lockout Control Valve Switch
3. Trailer Air Supply Valve
4. Parking Brake Control Valve
5. Jacobs Engine Brake Switch
6. Windshield Wiper and Washer Control Knob
7. Cruise Control On/Off Switch
8. Cruise Control Set/Resume Switch
9. Road/Fog Light Switch
10. Panel Light Control Knob
11. Blank Position
12. Left-Hand Power Mirror Switch
13. Mirror Heat Switch
14. Power Window Switch
15. Manual Override Push Button
16. Cigarette Lighter

Fig. 2.4, RH DR Center Console Control Panel Layout (typical)



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NOTE: Instruments and controls, and their locations, may vary from those shown.

1. Clock
2. Transmission Temperature Gauge
3. Forward Axle Oil Temperature Gauge
4. Rear Axle Oil Temperature Gauge
5. Gauge Illumination Control

Fig. 2.5, RH DR Overhead Gauge Panel Layout (typical)

Engine Start Button **(Fig. 2.6)**

CAUTION

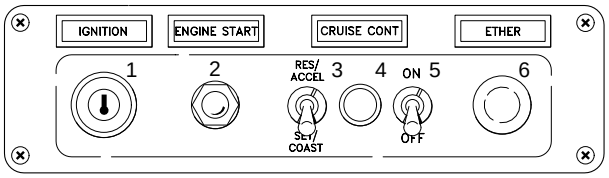
Do not push the engine start button with the engine running. To do so could result in starter damage.

Move the transmission shift lever to neutral before starting the engine. On vehicles equipped with neutral start switches, the engine will not start with the transmission in gear.

With the ignition switch on, push the engine start button to engage the starter. See the applicable engine operating instructions in **Chapter 7** for complete starting instructions.

Engine Start System Button, Optional **(Fig. 2.6)**

For cold weather starting, the vehicle may be equipped with an electric ether-injection engine start system. To



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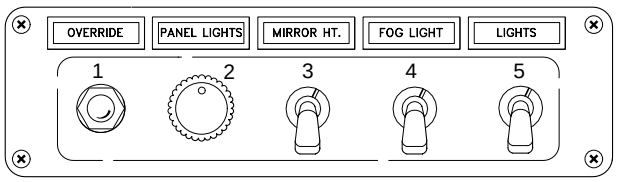
1. Ignition Switch
2. Engine Start Button
3. Cruise Control Set/Resume Switch
4. Cruise Control Indicator, ETEC
5. Cruise Control On/Off Switch
6. Ether Injection System Push Button

Fig. 2.6, Left-Side Control Panel (lower dash)

start the engine in cold weather, depress the ether-injection system push button. Then start the engine. See the engine operating instructions in **Chapter 7** for more information.

Mirror Heat Switch, Optional **(Fig. 2.7)**

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



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1. Manual Override Push Button
2. Panel Light Control Knob
3. Mirror Heat Switch
4. Fog Light Switch
5. Headlight Switch

Fig. 2.7, Right-Side Control Panel (lower dash)

Panel Light Control Knob **(Fig. 2.7)**

The panel lights are turned on by the headlight switch. When the headlights are on, the panel light control knob controls the brightness of the instrument panel lights. Turn the knob counterclockwise to brighten the lights, and clockwise to dim them. Turn the knob counterclockwise to the peg to turn them off.

Fog Light Switch, Optional **(Fig. 2.7)**

The fog light switch operates the fog lights, which are recessed in the front bumper.

For later model 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 later model 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.

Headlight Switch and Daytime Running Lights **(Fig. 2.7)**

A three-position headlight switch 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 high-beam headlights 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 low-beam headlights (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.

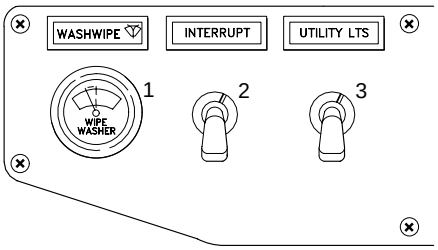
Interrupt Switch **(Fig. 2.8)**

A spring-loaded interrupt switch 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 and Washer Control Knob **(Fig. 2.8)**

The windshield wipers and washers are controlled by a single switch. The delay option (if equipped) is operated by the same switch.

Turn the knob clockwise to low or high speed for operation without the delay function.



1. Windshield Wiper and Washer Control Knob
2. Interrupt Switch
3. Utility Light Switch

Fig. 2.8, Heater and Air Conditioner Control Panel (partial view)

To operate the wipers with the delay (intermittent) option, turn the knob clockwise through the intermittent range (from long to short delay). Continue to turn the knob clockwise to set the wipers at low or high speed.

Turn the knob to its full counterclockwise position to shut off the wiper motor and park the wiper arms.

To operate the washer, turn on the wipers and then push the wiper/washer control knob. Wash fluid will be sprayed on the windshield as long as the control knob is pushed in.

Heater Controls **(Fig. 2.9)**

Heater controls consist of two lever slide controls, a four-speed fan control switch, and a fresh-air/ recirculated-air push button. See **Chapter 4** for detailed operating instructions.

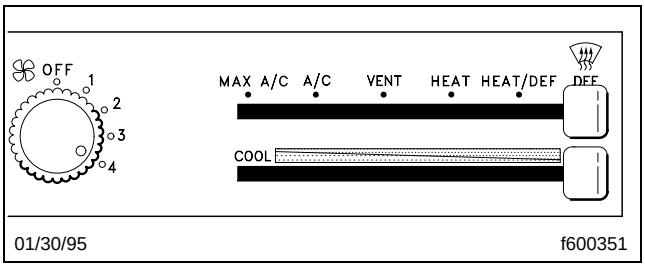


Fig. 2.9, Heater and Air Conditioner Controls

Air Conditioner Controls **(Fig. 2.9)**

When equipped with an air conditioner, the standard heater controls described above, also include an air conditioner switch. See **Chapter 4** for detailed operating instructions.

Trailer Brake Hand Control Valve Lever, Optional **(Fig. 2.10)**

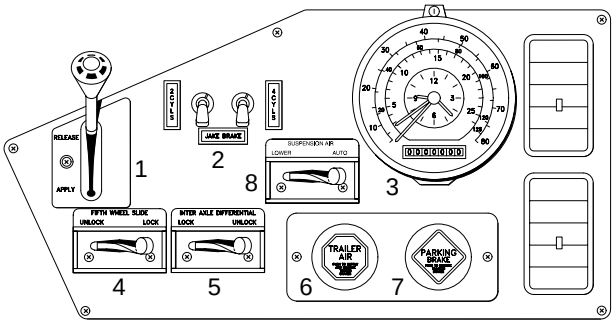
On vehicles with a trailer air brake hookup, the trailer brake hand control valve is used to apply the trailer brakes without applying the truck brakes.

On vehicles without a trailer air brake hookup, this lever is used to apply the truck's rear service brakes.

See **Chapter 6** for detailed operating instructions.

Fifth Wheel Air Slider Control Valve Switch, Optional Air-Operated Sliding Fifth Wheel **(Fig. 2.10)**

The fifth wheel air slider valve permits repositioning of the sliding fifth wheel from inside the cab. Moving the air slider control valve switch to the lock position turns off the control valve and locks the fifth wheel to the baseplate. Moving the switch to the unlock position turns on



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1. Trailer Brake Hand Control Valve Lever
2. Jacobs Engine Brake Switches
3. Tachograph/Combination Graph (optional)
4. Fifth Wheel Air Slider Valve
5. Interaxle Differential Lockout Control Valve Switch
6. Trailer Air Supply Valve Knob
7. Parking Brake Control Valve Knob
8. Air Suspension Dump Valve

Fig. 2.10, Auxiliary Gauge and Switch Panel

the control valve and unlocks the slide mechanism, allowing changes to the total length of the tractor-trailer and changes to the axle loads, to comply with varying state or provincial laws. A red indicator light goes on whenever the fifth wheel slider is unlocked.

⚠ CAUTION

The fifth wheel air slider control valve must not be turned on when the vehicle is in motion. To do so could cause the slider to slam against its stops, resulting in possible damage to the fifth wheel member, the kingpin, the cab, the trailer, or the drivetrain.

Jacobs Engine Brake Switches, Optional **(Fig. 2.10)**

Jake Brake controls consist of four switches: two on/off toggle switches, which control the degree of engine braking and are mounted in the control panel; an engine-mounted microswitch (controlled by the throttle pedal); and an under deck-mounted microswitch (controlled by the clutch pedal). See **Chapter 7** for more information.

TRW Electronic Truck Engine Control (ETEC™), Optional **(Fig. 2.6)**

The TRW ETEC system is an electronic engine and cruise control system installed on some vehicles equipped with a Cummins NTC-series (rated at 350 horsepower or below) or Cummins L10 series engine. The ETEC system is controlled by a microprocessor-based computer. This computer controls specific engine

and vehicle speed modes of operation to maximize vehicle fuel economy and performance.

Cruise control and variable speed governing are controlled with two switches mounted to the right of the engine start button. An "On/Off" switch allows the driver to select cruise control or to drive with the foot throttle. A spring-loaded "Set/Resume" switch allows the driver to select the cruise speed or resume the cruise speed after slowing down.

The variable speed governing mode of operation is also controlled with the dash switches, when the vehicle is stationary. The engine speed can be set in the 800 to 1200 rpm range by placing the "On/Off" switch in the "On" position, then pressing the "Set/Resume" switch when the desired rpm is reached.

Whenever the "On/Off" switch is in the "On" position, the indicator light located between the switches comes on.

See **Chapter 7** for detailed operating instructions.

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 thirty seconds later, DDEC®III will shut down the engine.

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 DDEC® cruise control option (**Fig. 2.6**) is controlled by two switches. The "On/Off" switch turns on the cruise control option, and the spring loaded "Set/Resume" switch is used to select the cruise speed, or to resume cruise control after slowing down. See **Chapter 7** for complete instructions.

Caterpillar 3176, PEEC, PEEC III, and 3406 Electronic Engine Operator Control

The Caterpillar 3176, PEEC, PEEC III, and 3406 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.

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 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 vehicle service manual for troubleshooting procedures.

The cruise control and PTO governor options (**Fig. 2.6**) are controlled by two switches. For cruise control, the "On/Off" switch turns on the cruise control, and the "Set/Resume" switch is used to select the cruise speed or to resume cruise control after slowing down. For PTO operation, the "On/Off" switch turns on the PTO, and the "Set/Resume" switch is used to either select or resume the engine operating speed. The dash-mounted cruise control switches are also used to check the electronic control module (ECM) for system faults when the engine is not running. The "Set/Resume" switch is spring-loaded to return to neutral. See **Chapter 7** for complete instructions.

BrakeSaver Control, Optional

The BrakeSaver (optional on Caterpillar 3406E 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

The Cummins PACE is a fuel control system installed on model L10 and Big Cam IV engines. The PACE system is 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 PACE engines 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 PACE 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 PACE 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 the road and shut down the engine. In either situation, have the problem repaired as soon as possible. See the vehicle service manual for troubleshooting procedures.

Cruise control and the PTO governor (**Fig. 2.6**) are controlled with two switches. An "On/Off" switch allows the driver to select cruise control or to drive using the foot throttle. A spring-loaded "Set/Resume" switch allows the driver to select the cruise speed or to resume the cruise speed after slowing down.

The power takeoff mode of operation is also controlled with the dash switches, when the vehicle is stationary. The engine speed can be set in the 800 to 1600 rpm range by placing the "On/Off" switch in the "On" position, then pressing the "Set/Resume" switch when the desired rpm is reached.

See **Chapter 7** for detailed operating instructions.

Bendix Cruise Control System, Optional **(Fig. 2.6)**

The Bendix cruise control system is operated by two switches mounted to the right of the engine start button. An "On/Off" switch allows the driver to select cruise control or to drive with the foot throttle. A spring-loaded "Set/Resume" switch allows the driver to select the cruise speed or to resume the cruise speed after slowing down.

The system can also be used for throttle control when the vehicle is parked.

Whenever the "On/Off" switch is in the "On" position, an indicator light in the warning and indicator light module comes on.

See **Chapter 7** for detailed operating instructions.

Manual Override Push Button, Optional Engine Shutdown System

(Fig. 2.7)

If the vehicle is equipped with a Kysor engine shutdown system with a manual override push button, press the engine start button and the manual override push button at the same time. Once the engine has started, release the engine start button, but continue to press the override push button until the warning bell stops.

Utility Light Switch, Optional **(Fig. 2.8)**

An optional utility light is swivel-mounted on top of the cab. It is operated by the utility light switch, which also turns on a light in the warning and indicator light module.

Interaxle Differential Lockout Control Valve Switch, Optional **(Fig. 2.10)**

Differential lockout, standard on all dual-drive vehicles, is controlled by means of a "Lock/Unlock" control valve switch mounted in the instrument panel. A red indicator light goes on whenever the interaxle differential is locked out (switch is in the lock position; no differential action between the drive axles).

Air Suspension Dump Valve, Optional

(Fig. 2.10)

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 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.

Parking Brake Control Valve, Vehicles Without Trailer Air Brake Hookup

(Fig. 2.10)

The diamond-shaped parking brake control knob in the control panel operates the parking brake valve. Pulling

the knob applies the spring parking brakes. Pushing the knob releases the spring parking brakes. Before the spring parking brakes can be released, the air pressure in either brake system must be at least 65 psi (447 kPa). See **Chapter 6** for detailed operating instructions.

Trailer Air Supply Valve and Parking Brake Control Valve, Optional **(Fig. 2.10)**

The yellow diamond-shaped knob operates the parking brake valve. Pulling the knob applies both the tractor and the trailer spring parking brakes. Pushing in the knob releases 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).

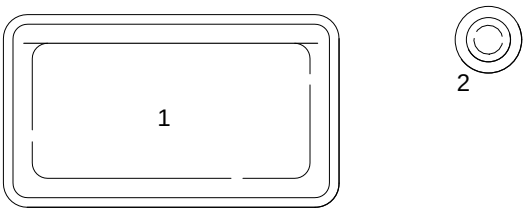
The red octagonal-shaped knob operates the trailer air supply valve. After the vehicle and its air hoses are connected to a trailer, and the pressure in the air system is at least 65 psi (447 kPa), the trailer air supply valve knob must be pushed in (and should stay in) to charge the trailer air supply system and release the trailer spring parking brakes. Before disconnecting a trailer, or when operating a vehicle without a trailer, the trailer air supply valve knob must be pulled out. See **Chapter 6** for detailed instructions on the use of the trailer air supply valve and parking brake valve.

Cigarette Lighter **(Fig. 2.11)**

Push in on the lighter to heat the element. The lighter will stay in and automatically pop out when the element is hot.

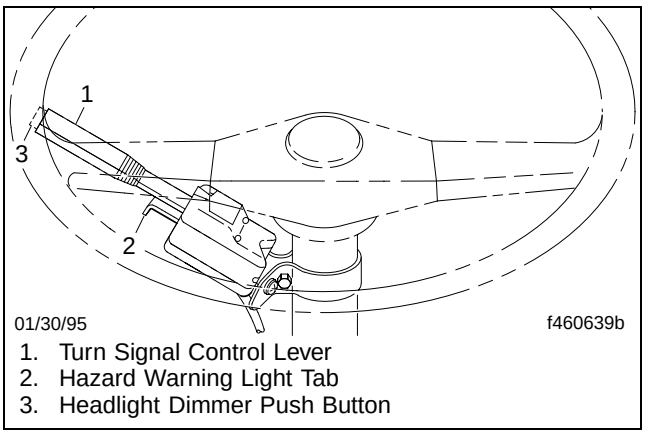
Steering Column-Mounted Controls **(Fig. 2.12)**

The turn signal control lever is mounted on the steering column. Pushing the lever counterclockwise (down) turns on the left turn signal lights; pushing it clockwise (up) turns on the right turn signal lights. When a turn signal light is on, a green indicator light flashes at the far left or far right of the warning and indicator light module. To cancel the signal, return the lever to the neutral (middle) position.



1. Ashtray
2. Lighter

Fig. 2.11, Cigarette Lighter and Ashtray



1. Turn Signal Control Lever
2. Hazard Warning Light Tab
3. Headlight Dimmer Push Button

Fig. 2.12, Turn Signal Control Lever

Hazard Warning Light Tab **(Fig. 2.12)**

The hazard warning light tab is located below the turn signal control lever on the turn signal switch. To operate the hazard warning lights, pull 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 flash simultaneously. To cancel the warning lights, push the turn signal control lever to either the left- turn or right-turn position, then return the lever to the neutral position.

Headlight Dimmer Switch **(Fig. 2.12)**

For later model vehicles, pull the turn signal control lever toward the steering wheel to change from low-beam to high-beam headlights, or from high beams back to low beams. For earlier model vehicles, the headlight dimmer push button is located in the end of the turn signal control lever. Press the button once to change from low-beam to high-beam headlights. Press once more to cancel the high-beam lights. When the headlights are on high beam, a green light in the indicator light module goes on.

For later model 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.

Dome Light **(Fig. 2.13)**

A two-bulb dome light, with a built-in three-position rocker switch, is mounted in the center of the rear wall, just beneath the cab roof.

When the rocker switch is in the center position, the dome light will remain off, whether or not the cab doors are open.

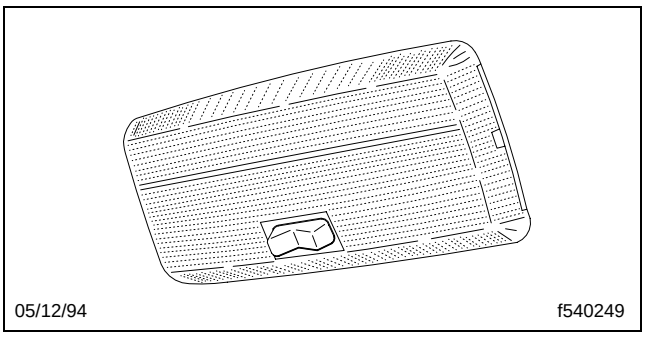


Fig. 2.13, Dome Light

When the driver's side of the switch is pushed in, the light will remain on, whether or not the cab doors are open.

When the passenger's side of the switch is pushed in, the light will work in conjunction with the driver's and passenger's door contact switches to turn the light on when either of the cab doors is open, and turn it off when they are both closed.

Electric Horn

The electric horn is operated by pushing the button in the center of the steering wheel.

Air Horn, Optional

An air-operated horn is sounded by pulling the cable located above the driver's door.

Vernier Throttle Control, Optional

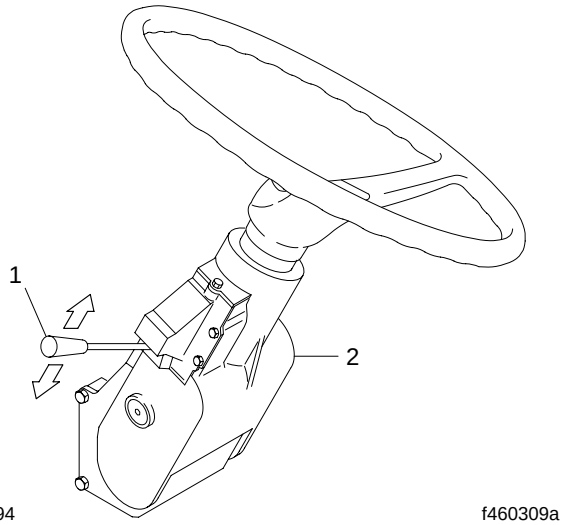
The vernier throttle control, located on the steering column, can be used to adjust engine speed when the vehicle is parked. Turn the outer knob to the right to increase engine speed, or to the left to reduce engine speed. To quickly return the engine to idle, push the center knob.

Tilt Steering Wheel **(Fig. 2.14)**

The tilt steering wheel 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.

After adjusting the seat to the desired ride position, unlock the steering column by pushing and holding the control lever 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 up the control lever. Holding the control lever in this position, move the steering wheel up or down to the desired position. Release the control lever to lock the steering wheel in place.



1. Control Lever
2. Tilt Wheel Assembly

Fig. 2.14, Tilt Wheel Assembly

⚠ 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 column while driving the vehicle. Doing so could cause loss of vehicle control, personal injury, and property damage.

Exterior Switches

Battery Disconnect Switch, Optional

(Fig. 2.15)

A battery disconnect switch cuts off all battery power to the vehicle. 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.

Backup Alarm

An optional backup alarm, mounted at the rear of the left frame rail, sounds when reverse gear is engaged. See **Fig. 2.16**. Check the operation of the backup alarm daily.

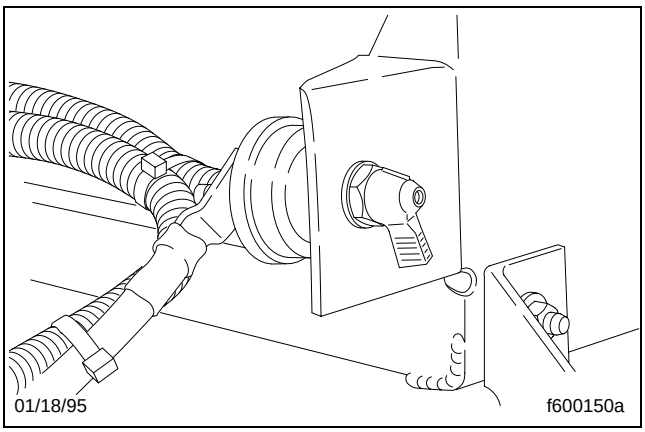


Fig. 2.15, Battery Disconnect Switch

Warning and Indicator Lights

All of the standard and optional warning and indicator lights are housed in a lens and bezel assembly (**Fig. 2.17**) located above the speedometer and tachometer.

Parking Brake Indicator Light

The red parking brake indicator light (located in the lens and bezel assembly above the speedometer and tachometer) comes on whenever the parking brakes are activated and the ignition is on.

VIGIL I Warning System

Standard Indicator Lights (Fig. 2.17)

Standard indicator lights include:

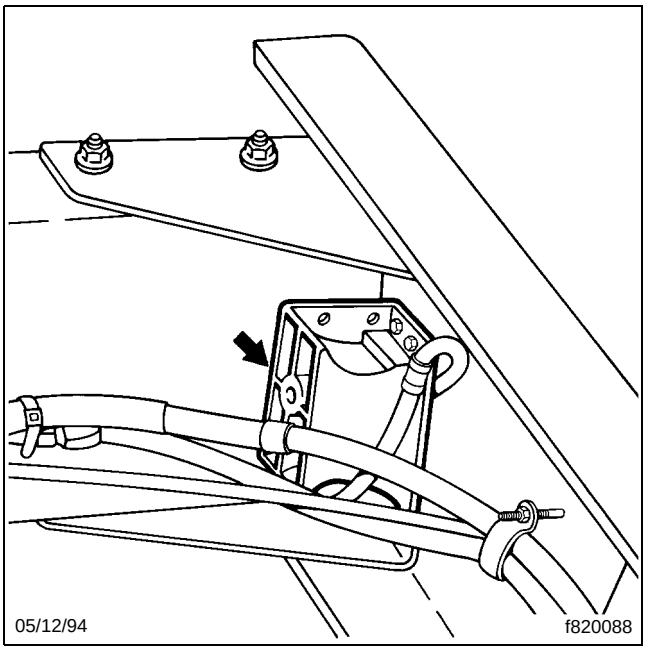
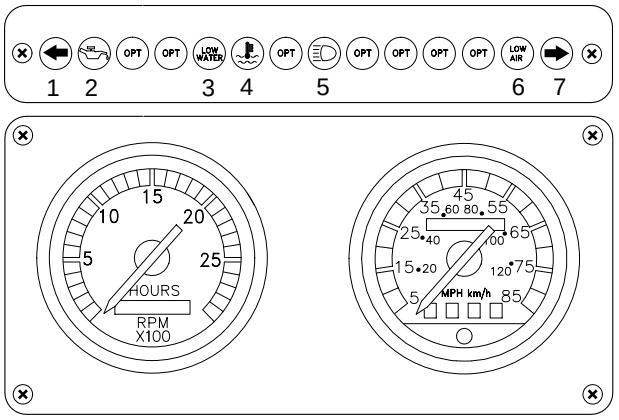


Fig. 2.16, Backup Alarm



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1. Left-Turn Signal Indicator Light
2. Oil Pressure Warning Light
3. Low-Water Warning Light
4. Water Temperature Warning Light
5. High-Beam Indicator Light
6. Low Air Pressure Warning Light
7. Right-Turn Signal Indicator Light

Fig. 2.17, Warning and Indicator Lights Location

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 (Fig. 2.17)

Standard red warning lights 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 62 to 68 psi (427 to 469 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 fifteen seconds, shut off the engine and determine the cause. See the vehicle service manual for repair procedures.

IMPORTANT: 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. 2.17**) 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).
- 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 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.

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 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. 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 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

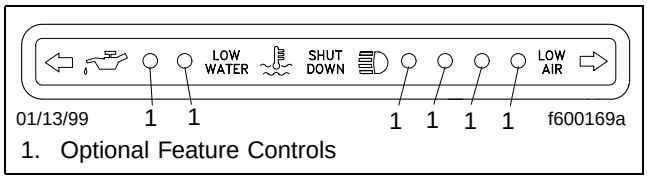
The system also controls several functions such as the headlight high beam indicator, low air pressure warning light and control of indicators for six optional features (**Fig. 2.18**). The optional features can be any combination of the following:

- 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 switch 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



1. Optional Feature Controls

Fig. 2.18, Optional Warning and Indicator Lights

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 the vehicle service manual.

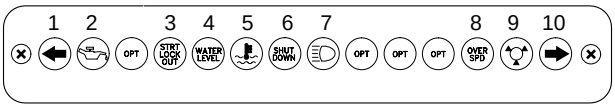
VIGIL III Warning System, Optional

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. 2.19**) 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 (**Fig. 2.19**) 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 warning 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 warning 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



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1. Left-Turn Signal Indicator Light
2. Oil Pressure Warning Light
3. Starter Lockout Warning Light
4. Low-Water Warning Light
5. Water Temperature Warning Light
6. Engine Shutdown Light
7. High-Beam Indicator Light
8. Overspeed Light
9. Low Air Pressure Warning Light
10. Right-Turn Signal Indicator Light

Fig. 2.19, VIGIL III Warning System Lights

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. 2.19**).

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. 2.19**) 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 predetermined speed is reached. If this system is malfunctioning, the lightbar overspeed light (**Fig. 2.19**) will flash on for ten seconds each time the engine is started.
- 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 high-beam headlight indicator (**Fig. 2.19**), 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 the electrical section in the vehicle 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 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.

- The system controls automatic radiator shutters and on/off fan clutches. A single sensor is used to monitor temperature for engine protection, to drive the temperature gauge, and to control the radiator shutters and fan clutch. On some vehicles separate switches may be used to control the radiator shutters, fan clutch, and the temperature gauge.

  When the coolant temperature rises above a preset point, the system opens the radiator shutters on vehicles so equipped. When the temperature falls 5°F (3°C) below the opening setpoint, the system closes the shutters. If the temperature continues to rise even after the shutters are opened, the system engages the fan clutch. When the temperature falls 5°F (3°C) below the engaging setpoint, the system disengages the clutch. These temperatures will vary according to the engine type and are programmed into the system at the factory.

Turn Signal Functions

The system operates the turn signal relay and the indicators.

Other Functions

The system also controls several functions such as the high-beam headlight 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. 2.18**). 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.

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 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 lightbar does not light up when the starter is engaged, check the lightbar. For instructions, see the vehicle service manual.

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.

Meritor WABCO® Antilock Braking System (ABS)

The Meritor WABCO® Antilock Braking System (ABS) may have up to three of the following amber warning lights (**Fig. 2.20**): a tractor warning light (TRAC ABS), a wheel spin indicator light (WHL SPIN), and a trailer warning light (TRLR ABS).

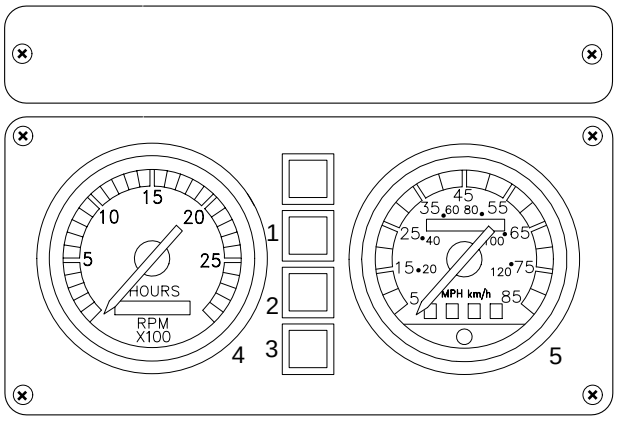
With the tractor ABS system, the tractor warning light (TRAC ABS) works as shown in **Table 2.1**.

With the tractor and trailer ABS system, the vehicle also has a trailer warning light labelled TRLR ABS (**Fig. 2.20**).

After the engine is started, the TRLR ABS light comes on if the trailer is equipped with the Meritor WABCO® 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.

The wheel spin indicator light (WHL SPIN) comes on if one of the drive wheels spins during acceleration (**Fig. 2.20**). The 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 comes on. The light will flash continuously if the "ATC Function" or "Deep Mud/Snow" switch is on.

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



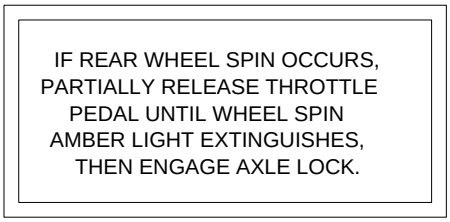
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1. TRAC ABS
2. WHL SPIN
3. TRLR ABS
4. Tachometer
5. Speedometer

Fig. 2.20, Antilock Braking Warning and Indicator Light Panel

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

An "ATC Function" switch (if equipped), may be used under more adverse conditions. Turning on this switch causes the WHL SPIN indicator light to flash (**Fig. 2.20**). The ATC system now allows some wheel spin (for example, to help burn through a thin layer of ice) during reduced-traction starts.



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Fig. 2.21, Antilock Wheel Spin Label

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 "ABS Chk" switch (if equipped), is located below the left side of the upper steering column cover panel, and is used to read system fault codes on the "ABS" light. Refer to the vehicle service manual for troubleshooting procedures.

Refer to the brake system operating instructions in Chapter 6 for more information.

Tractor ABS Lamp Operation			
Ignition Position	**Condition**	**Action**	**Diagnosis**
ON	Normal Operation	ABS lamp comes on at ignition momentarily for a bulb check, then goes out.	System is okay.
	After Servicing the ABS System	ABS lamp does not go out at ignition.	When the vehicle is driven at speeds above 4 mph (6 km/h), the lamp goes out. The system is okay.
	Existing Fault	ABS lamp does not go out at ignition.	The lamp does not go out at speeds above 4 mph (6 km/h) – a fault exists in the ABS system.

Table 2.1, Tractor ABS Lamp Operation

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. 2.20**). The warning light goes out only if all of the tractor's ABS components are working properly.

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. 2.20**). 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.

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*** in the *FLC112 Conventional Service Manual* for troubleshooting procedures.

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

Instruments

Tachometer **(Fig. 2.20)**

A tachometer 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 **(Fig. 2.20)**

A speedometer 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.

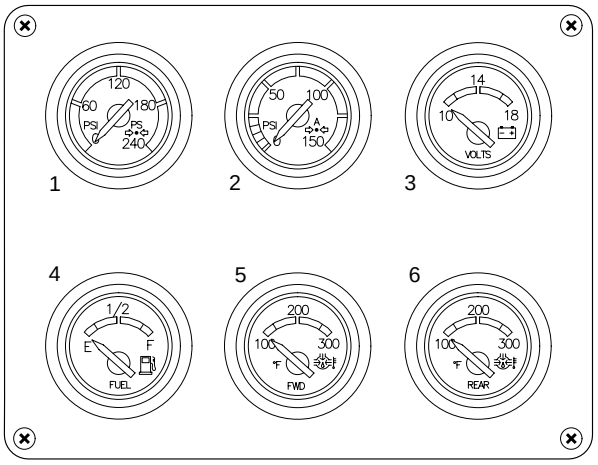
Voltmeter **(Fig. 2.22)**

The voltmeter 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.

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 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 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.



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1. Dual Air Pressure Gauge
2. Application Air Pressure Gauge
3. Voltmeter
4. Fuel Gauge
5. Forward Rear Axle Oil Temperature Gauge
6. Rearmost Axle Oil Temperature Gauge

Fig. 2.22, Gauge Identification

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.

Engine Oil Pressure Gauge **(Fig. 2.23)**

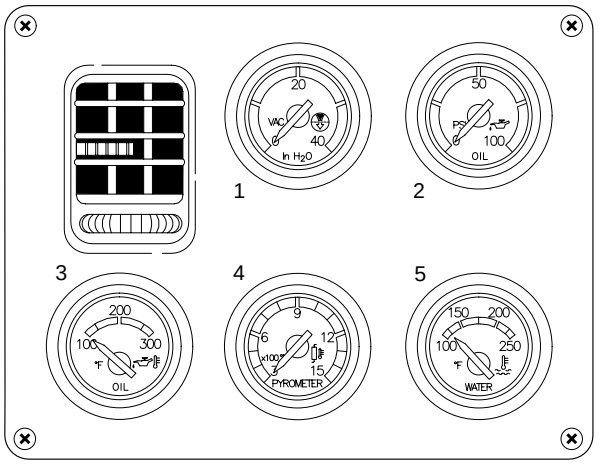
The engine oil pressure gauge should read as shown in **Table 2.2**.

CAUTION

A sudden decrease or absence of 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.

Engine Oil Temperature Gauge, Optional **(Fig. 2.23)**

During normal operation, the engine oil temperature gauge should read:



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1. Intake-Air Restriction Gauge
2. Engine Oil Pressure Gauge
3. Engine Oil Temperature Gauge
4. Pyrometer
5. Water Temperature Gauge

Fig. 2.23, Gauge Identification

- 180 to 225°F (82 to 107°C) for Cummins engines;
- 190 to 220°F (88 to 104°C) for Caterpillar engines;
- 200 to 235°F (93 to 113°C) for Detroit Diesel engines.

Under heavy loads, such as when climbing mountains, temperatures that exceed the normal range for a short period are not unusual.

⚠ CAUTION

A sudden increase in 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 corrected.

Coolant Temperature Gauge **(Fig. 2.23)**

During normal engine operation, the water temperature gauge 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 2.3**, inspect the cooling system to determine the cause. See the vehicle service manual for troubleshooting and repair procedures.

Oil Pressure*		
Engine Model	**Oil Pressure at Idle Speed psi (kPa)**	**Oil Pressure at Rated Speed psi (kPa)**
Caterpillar 3176	10–20 (69–138)	30–45 (207–310)
Caterpillar 3306	10 (69) min.	45 (310) min.
Caterpillar 3406	18 (124) min.	60 (414) min.
Caterpillar 3406E	15 (100) min.	40 (275) min.
Cummins L10	10 (69) min.	35–45 (241–310)
Cummins NTC†	10 (69) min.	35–45 (241–310)
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 2.2, Oil Pressure

Pyrometer, Optional **(Fig. 2.23)**

A pyrometer registers the exhaust temperature near the turbocharger. Normal exhaust temperatures are listed in **Table 2.4**.

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.

Maximum Water Temperature	
Engine Model	**Maximum Water Temperature °F (°C)**
Caterpillar (all models)	210 (99)
Cummins L10	212 (100)
Cummins NTC	212 (100)
Cummins NTC-444	220 (104)
Cummins C Series	212 (100)
Detroit Diesel	210 (99)

Table 2.3, Maximum Water Temperature

Primary and Secondary System Air Pressure Gauge **(Fig. 2.22)**

A dual system air pressure gauge 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.

Normal Exhaust Temperatures	
Engine Model	**Exhaust Temperature °F (°C)**
Caterpillar 3176	935–1290 (500–700)
Caterpillar 3306	800–1100 (430–595)
Caterpillar 3406	900–1100 (480–595)
Cummins L10	800–1000 (430–540)
Cummins NTC	750–950 (400–510)
Cummins C Series	1290 (700) max.
Detroit Diesel	700–950 (370–510)

Table 2.4, Normal Exhaust Temperatures

Application Air Pressure Gauge, Optional **(Fig. 2.22)**

An application air pressure gauge 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.

Fuel Gauge **(Fig. 2.22)**

The fuel gauge 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.

Transmission Oil Temperature Gauge, Optional (not shown)

During normal operation, the transmission oil temperature gauge reading should not exceed 250°F (121°C) for Fuller or Spicer manual transmissions.

⚠ CAUTION

A sudden increase in 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.

Rear Axle Oil Temperature Gauge(s)

(Fig. 2.22)

During normal operation, forward and rear axle oil temperature gauges should read between 160 to 220°F (71 to 104°C).

Tachograph/Combination Graph, Optional **(Fig. 2.10)**

A tachograph indicates and records vehicle speed, time, and distance traveled. A combination graph records these functions plus engine rpm. If selected, a warning light goes on whenever a preestablished speed limit is exceeded.

To use the tachograph, wind the clock with the key marked WIND. Set the clock hands to the correct time with the knob marked SET HANDS. Then prepare a chart for installation. Write in the date, trip, odometer mileage reading, name, and vehicle number. Slide the edge of the chart under the time pointer and then press the chart down snugly over the rectangular hub of the chart disk. It is held firmly without a spring. See the manufacturer's instructions for additional information.

Intake-Air Restriction Gauge, Optional

(Fig. 2.23)

An intake-air restriction gauge measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. Vacuum is measured in inH_2O (inches of water). When the vacuum reading equals the applicable level shown under "Service" in **Table 2.5**, the air cleaner needs to be serviced.

Intake-Air Restriction Indicator

An intake-air restriction indicator is mounted in the top of the cab-mounted air intake duct (**Fig. 2.24**), or an optional indicator is mounted in the dash panel. An intake-air restriction indicator 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, the air cleaner needs to be serviced. The indicator then needs to be reset by pressing the yellow button.

Intake-Air Restriction		
Engine Type*	**Initial inH_2O**	**Service inH_2O**
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

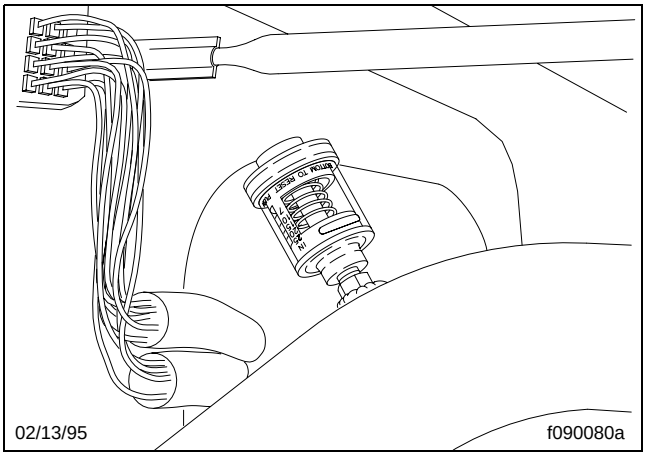


Fig. 2.24, Intake-Air Restriction Indicator

3

Vehicle Access

Cab Door Locks and Handles **3.1**
Grab Handles and Access Steps **3.1**
Door Windows and Vent Windows **3.2**
Glove Box and Circuit Breaker Panel **3.3**
Hood Tilting **3.3**
Cab Access Panels **3.4**

Cab Door Locks and Handles

The same key that operates the ignition switch is used to lock and unlock the cab doors from the outside.

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

To unlock a door from outside the cab, insert the key in the lockset, and turn the top of the key toward the front. To lock the door, turn the top of the key toward the back; the lock cannot be operated when the door is open.

To lock the door from inside the cab, close the door, then push the lock knob down. See **Fig. 3.1**.

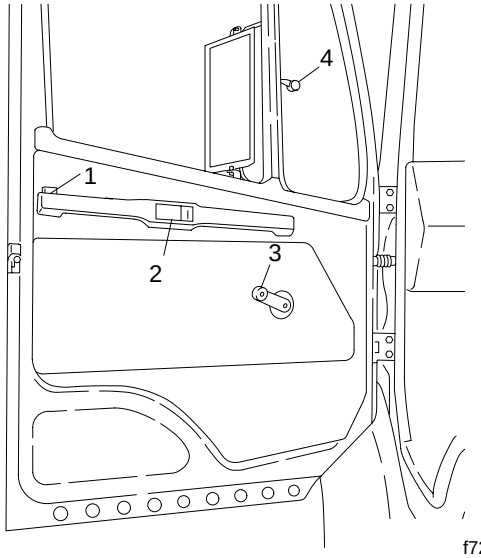
To open the door from the inside, pull the door latch handle toward you. See **Fig. 3.1**. This will unlatch the door whether or not it was locked. To unlock the door without unlatching it, push up on the bottom of the lock knob. See **Fig. 3.1**.

Grab Handles and Access Steps

⚠ WARNING

Wet or dirty shoe soles greatly increase the chance of slipping or falling. If your soles are wet or dirty, be especially careful when entering or exiting the vehicle.

IMPORTANT: While entering or leaving the cab, maintain three-point contact with the cab access system at



1. Lock Knob
2. Door Latch Handle
3. Window Regulator Handle
4. Vent Window Knob

Fig. 3.1, Cab Door Locks and Handles

all times. Three-point contact means both feet and one hand, or both hands and one foot.

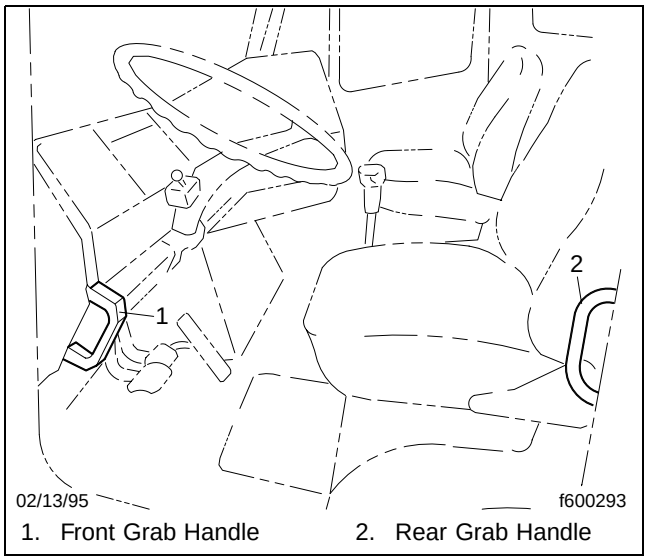
When entering and exiting the cab, use the grab handles and access steps. On each side of the vehicle, there are two interior grab handles (**Fig. 3.2**), and one exterior grab handle (**Fig. 3.3**). The dual-level access steps on the driver's side are mounted directly beneath the cab door, on the chassis brackets for the air reservoirs (standard), or on the fuel tank supports and straps (if optional dual tanks are installed). See **Fig. 3.3**. On the passenger's side, the steps are mounted beneath the door on the fuel tank supports and straps, or on the air reservoir brackets for SD models.

On right-hand-drive vehicles, driver entry is on the right side of the vehicle. See **Fig. 3.4**. There are two grab handles: the rear grab handle, and the front grab handle.

Door Windows and Vent Windows

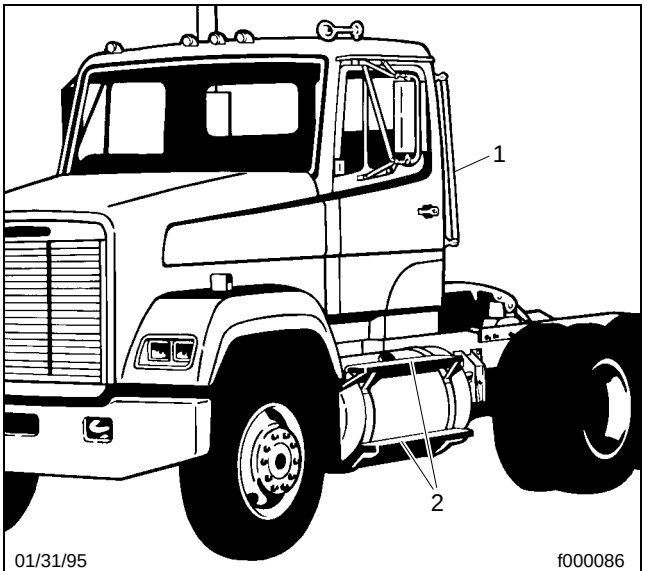
To lower the driver's side door window, turn its regulator handle clockwise; to lower the passenger's side, turn its handle counterclockwise. See **Fig. 3.1**.

To open either vent window, pull on the red knob, turn the knob until the release lever is vertical, then push it outward. See **Fig. 3.1**. When closing the vent window, hold the knob so the release lever is vertical while pulling the window closed. When the end of the lever clears the slide piece, turn the knob until the lever is horizontal, then push the knob in to lock the vent window.



1. Front Grab Handle
2. Rear Grab Handle

Fig. 3.2, Interior Grab Handle Location



1. Exterior Grab Handle 2. Cab Access Steps

Fig. 3.3, Exterior Grab Handle and Cab Access Steps

Glove Box and Circuit Breaker Panel

The glove box is located on the passenger's side of the dash. To open the glove box door, push the door latch button at the top center of the glove box door.

The circuit breaker panel is located behind the glove box. To access the panel, open the glove box door, then push both stops (see **Fig. 3.5**) at the upper edge of the back of the box toward each other, and hold them there while swinging the box down; a cable will hold the box open. See **Fig. 3.6**. To close the box, push the stops toward each other and hold there while rotating the box up.

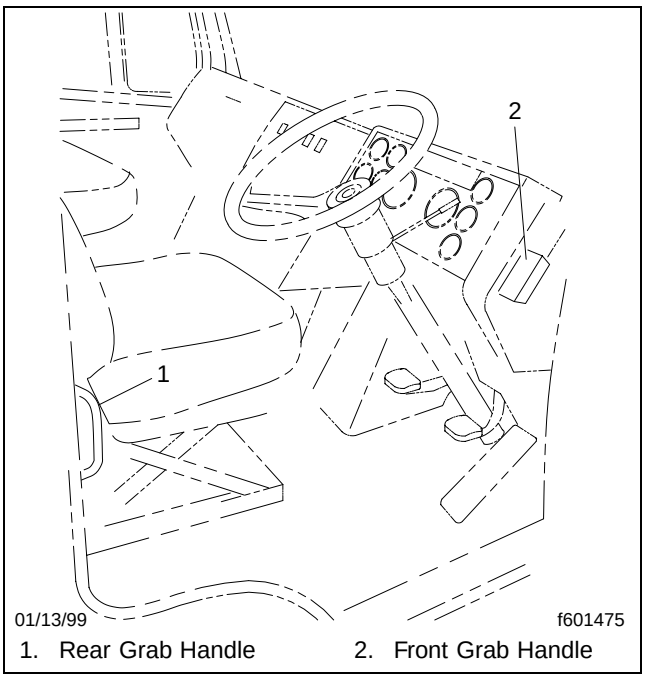
On right-hand-drive vehicles, the glove box door and circuit breaker panel are in similar positions. See **Fig. 3.7**.

Hood Tilting

The hood can be tilted to a 70-degree position. See **Fig. 3.8**. A molded recess or a grab handle in the top forward edge of the hood provides a handhold for hood tilting. Tilt-assist springs help the operator to tilt the hood open and to return it to the operating position. The stop cables prevent the hood from tilting more than 70 degrees. In the operating position, each side of the hood is secured to the lower cab side panels by a hold-down latch. See **Fig. 3.9**.

To tilt the hood, apply the parking brakes, release both of the hold-down latches by pulling the end outward (**Fig. 3.10**), then pull the hood forward at the handhold. See **Fig. 3.11**. Control the descent of the hood while allowing it to open to the 70-degree position.

To return the hood to the operating position, push up and back on the top forward edge of the hood. Control



1. Rear Grab Handle
2. Front Grab Handle

Fig. 3.4, Exterior Grab Handle and Cab Access Steps (right-hand-drive vehicle)

the rate of descent by pulling forward at the handhold. Fasten both of the hold-down latches.

IMPORTANT: Make sure that both hold-down latches are fully engaged before operating the vehicle. See **Fig. 3.9**.

Cab Access Panels

A hinged cab access panel is located on each side of the lower rear of the cab. See **Fig. 3.12**. Each of the access panels is hinged at the forward edge, and held closed at the rear edge by two latches. See **Fig. 3.13**.

The access panel on the right side provides access to the horizontally mounted air cleaner. On some models, louvers in the face of the panel function as an air intake for the cleaner. See **Fig. 3.14**.

The access panel on the left side provides access to the windshield washer bottle, batteries, sliding battery tray, and (optional) battery disconnect switch. See **Fig. 3.15**.

To open the access panels, open the cab door, push back on one of the latch handles, unhook the catch from the latch pin, and repeat for the other latch. See **Fig. 3.16**. Pull the access panel all the way open.

IMPORTANT: When opening or closing an access panel, the cab door on that side of the vehicle must be open.

To close the access panel, push the panel closed until the stationary portion of each of the panel-mounted halves of the latches are partially enclosing the latch pins, then hook each of the catches over its latch pin

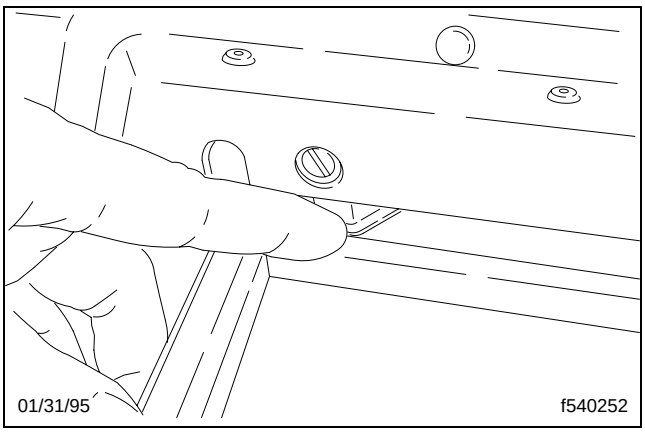


Fig. 3.5, Circuit Breaker Panel Access

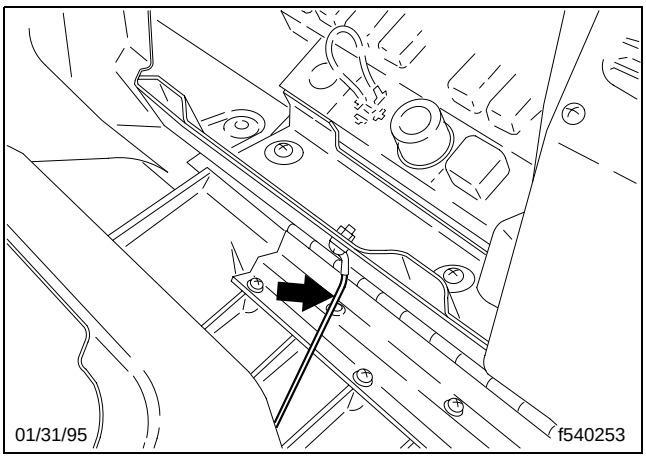
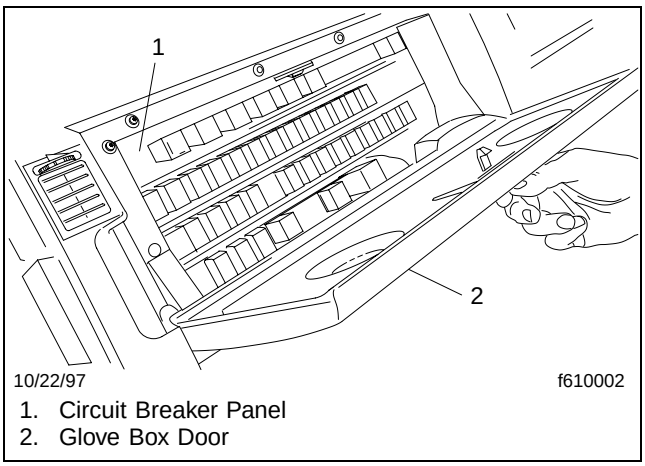


Fig. 3.6, Closing the Glove Box Door

and pull outward on each of the latch handles to lock the catches in place.



1. Circuit Breaker Panel
2. Glove Box Door

Fig. 3.7, Glove Box Door and Circuit Breaker Panel (right-hand-drive vehicle)

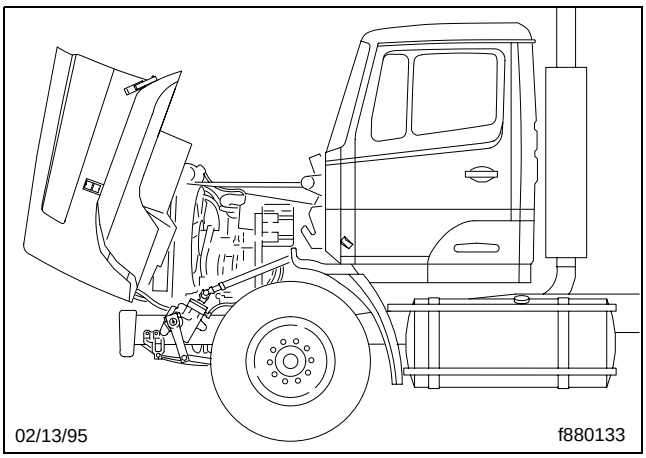


Fig. 3.8, Hood Tilted to the 70-Degree Position

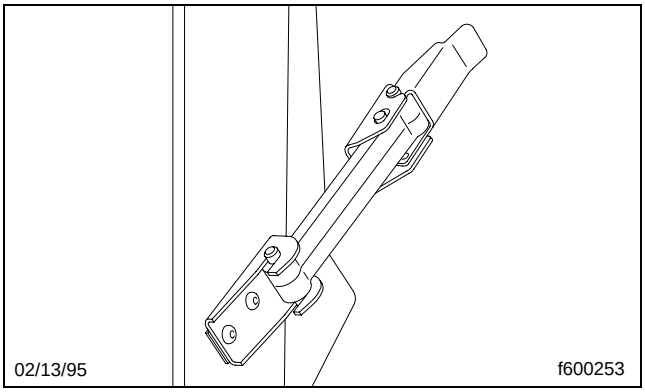


Fig. 3.9, Hood Hold-Down Latch

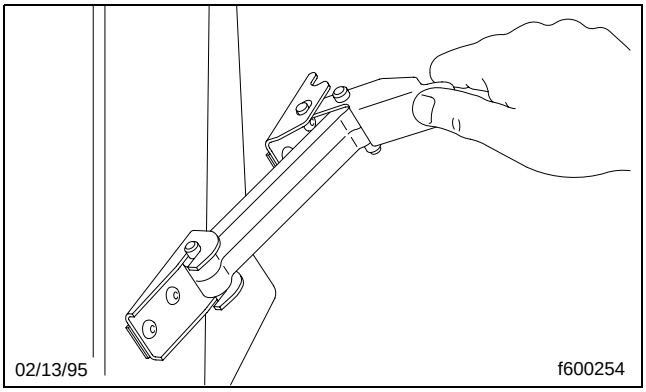


Fig. 3.10, Release the Hold-Down Latches

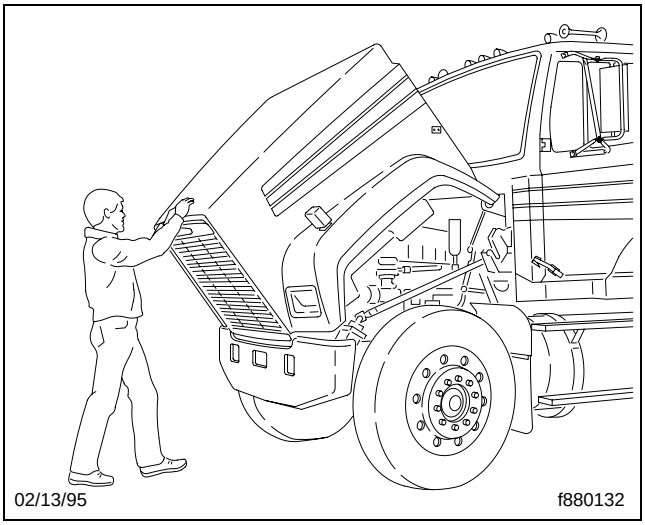


Fig. 3.11, Opening the Hood

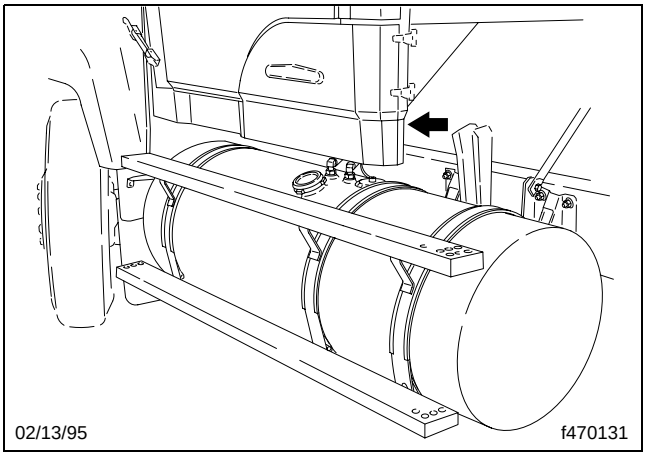


Fig. 3.12, Cab Access Panel

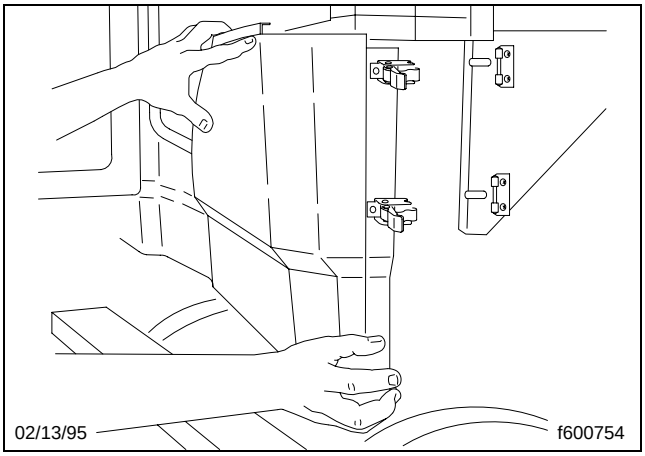


Fig. 3.13, Opening a Cab Access Panel

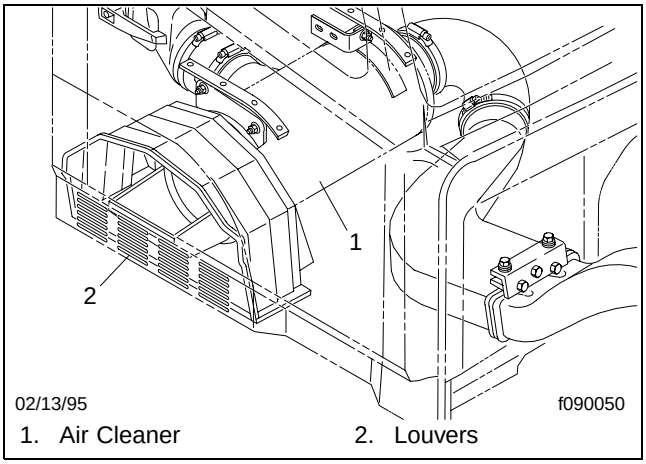
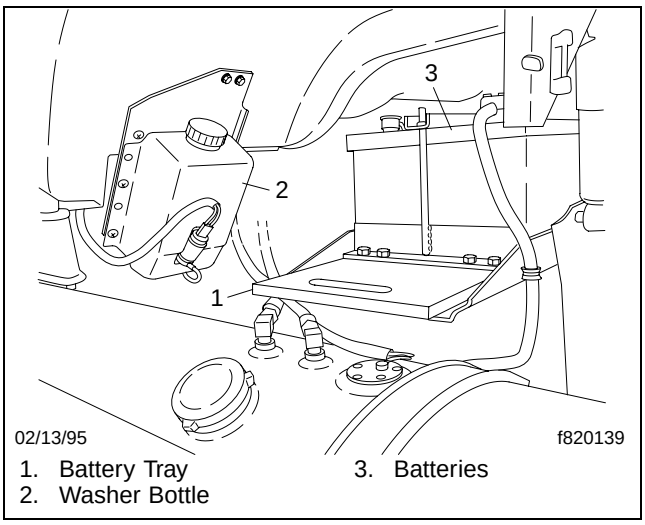


Fig. 3.14, Air Cleaner Location



1. Battery Tray
2. Washer Bottle
3. Batteries

Fig. 3.15, Left-Side Access Panel

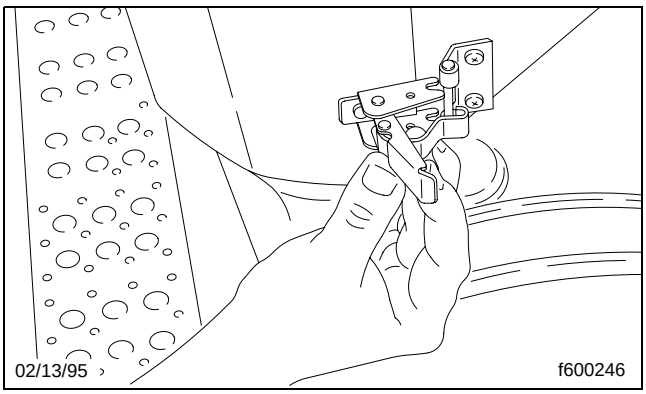


Fig. 3.16, Access Panel Latch Handle

4

Heater and Air Conditioner

General Information **4.1**
Defogging and Defrosting **4.1**
Heating **4.3**
Air Conditioning Using Fresh Air **4.4**
Fresh Air **4.6**

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 center outlets can be closed by moving the louvers all the way down. The side outlets can be closed by turning the thumb wheel at the base of each outlet. The windshield defrost outlets can be turned to direct the air as desired, but cannot be closed.

A FRESH/RECIRC push button (**Fig. 4.3**) 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 twenty minutes.

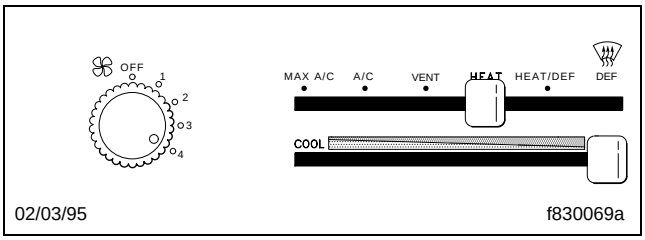


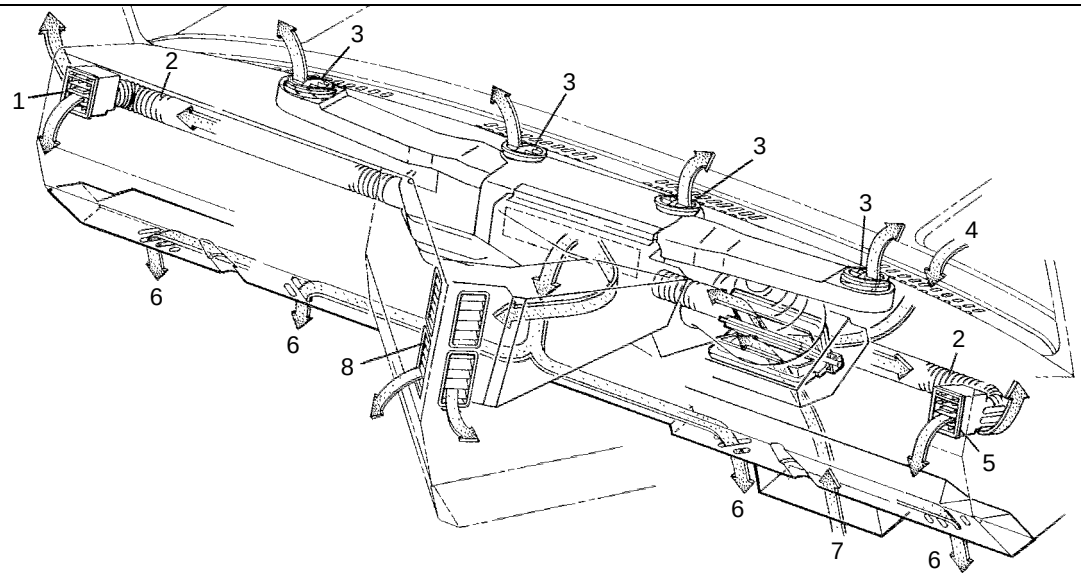
Fig. 4.1, Climate Control Panel

Right-hand-drive (RH DR) vehicles have a different type of dash-mounted climate control panel. See **Fig. 4.4**.

NOTE: On RH DR vehicles, open the ducts in the climate control panel when using air conditioning. Close the ducts when using the heater, defroster, or air recirculation function.

Defogging and Defrosting (Fig. 4.5)

1. Set the mode control (upper lever) to HEAT, the fan switch to OFF.
2. Remove any ice or snow from the outside of the windshield, door windows, and fresh air inlet grille.



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1. Dash Side Vent
2. Dash Side Duct
3. Windshield Defroster Vent
4. Fresh Air
5. Side Window Vent
6. Under Dash Vent
7. Recirculated Air
8. Center Dash Vents

Fig. 4.2, Air Outlet and Inlet System

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 air conditioner is engaged to dehumidify the air before heating it, unless the temperature at the

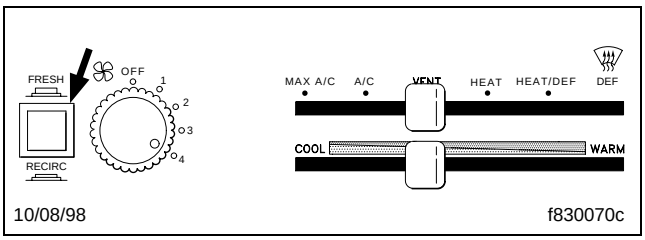


Fig. 4.3, FRESH/RECIRC Push Button

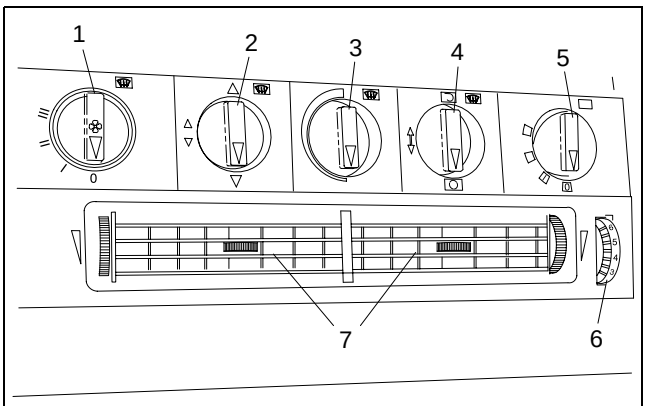
evaporator coil is less than 32°F (0°C). Warm, dry air is directed to the windshield.

IMPORTANT: If equipped with a FRESH/RECIRC push button (**Fig. 4.3**), 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 left and right dash-face outlets. To defrost the door windows, open the left and right dash-face outlets halfway. This will direct most of the air through the dash side vents and onto the door windows.

Heating (Fig. 4.6)

1. With the engine at operating temperature, set the mode control to HEAT.
2. Slide the temperature control to WARM.

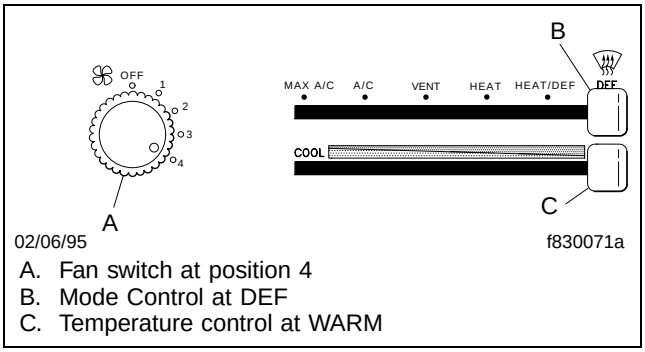


1. Fan Speed Control
2. Defroster Control
3. Heater Control
4. Air Recirculation Control
5. Air Conditioning Control
6. Air Conditioning Temperature Control
7. Air Conditioning Ducts

Fig. 4.4, Climate Control Panel (right-hand-drive vehicles)

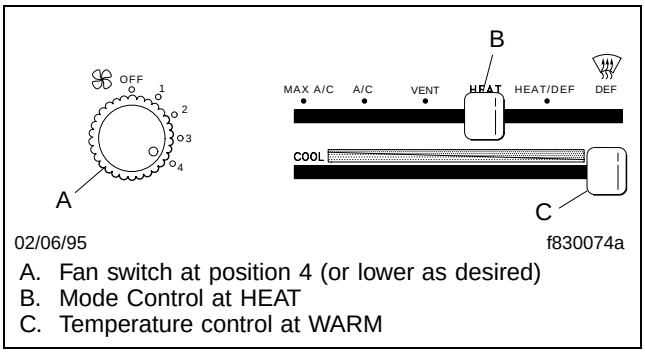
3. Turn on the fan switch to the desired speed.

IMPORTANT: If the windows start to fog, move the mode control to HEAT/DEF or DEF and make sure the fan is



A. Fan switch at position 4
B. Mode Control at DEF
C. Temperature control at WARM

Fig. 4.5, Defogging and Defrosting Control Settings



A. Fan switch at position 4 (or lower as desired)
B. Mode Control at HEAT
C. Temperature control at WARM

Fig. 4.6, Heating Control Settings

on. To defog the door windows, open the left and right dash face outlets halfway. This will direct most of the air through the dash side vents and onto the door windows.

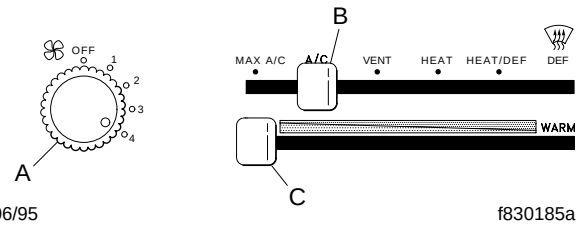
NOTE: In mild weather the fan switch can be kept off, since forward motion of the vehicle will provide airflow through the heater.

4. When a comfortable temperature has been reached, adjust the fan switch setting and temperature control as needed to maintain the temperature.

IMPORTANT: If equipped with a FRESH/RECIRC push button (**Fig. 4.3**), 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 twenty minutes.

Air Conditioning Using Fresh Air (Fig. 4.7)

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



A. Fan switch at position 4 (or lower as desired)
B. Mode Control at A/C
C. Temperature control at COOL

Fig. 4.7, Air Conditioning Using Fresh 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. 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.
7. As soon as cool air is flowing from the dashboard outlets, close the windows. Adjust the fan switch setting as desired.
8. If the air from the vents is too cold, move the temperature control toward WARM to adjust the temperature.

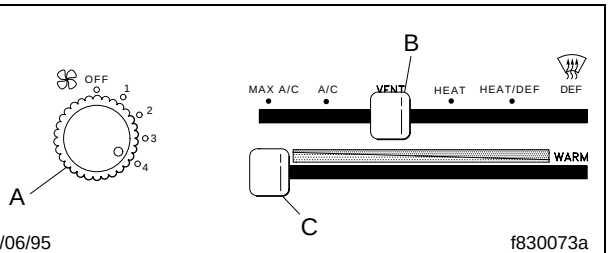
IMPORTANT: A FRESH/RECIRC push button (**Fig. 4.3**) is standard equipment when there is no air conditioning. This control is an option when air conditioning is ordered. It allows the AC, VENT, and HEAT modes to be used with either fresh or recirculated air. When the mode control is at MAX A/C, the system 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 twenty 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 (Fig. 4.8)

1. Move the mode control to VENT or HEAT. 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.
2. Set the temperature control to COOL for no heating, or move it toward WARM for heat.
3. Set the fan switch at the desired speed.



A. Fan switch at position OFF through 4 as desired
B. Mode Control at VENT or HEAT
C. Temperature control at COOL

Fig. 4.8, Fresh Air Control Settings

IMPORTANT: If equipped with a FRESH/RECIRC push button (**Fig. 4.3**), 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 twenty minutes.

5

Seats and Seat Belts

Seats **5.1**
Seat Belts and Tether Belts **5.11**

Seats

General Information **(Fig. 5.1)**

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

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 backslap 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 or air controlled depending on the make of the seat.
5. 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.
6. 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.
7. Fore and Aft Seat or Seat Track Adjustment: The entire seat moves forward or backward when this adjustment is made.
8. Seat Tilt: When this adjustment is made, the seat assembly (back and bottom cushions) tilts forward or backward.

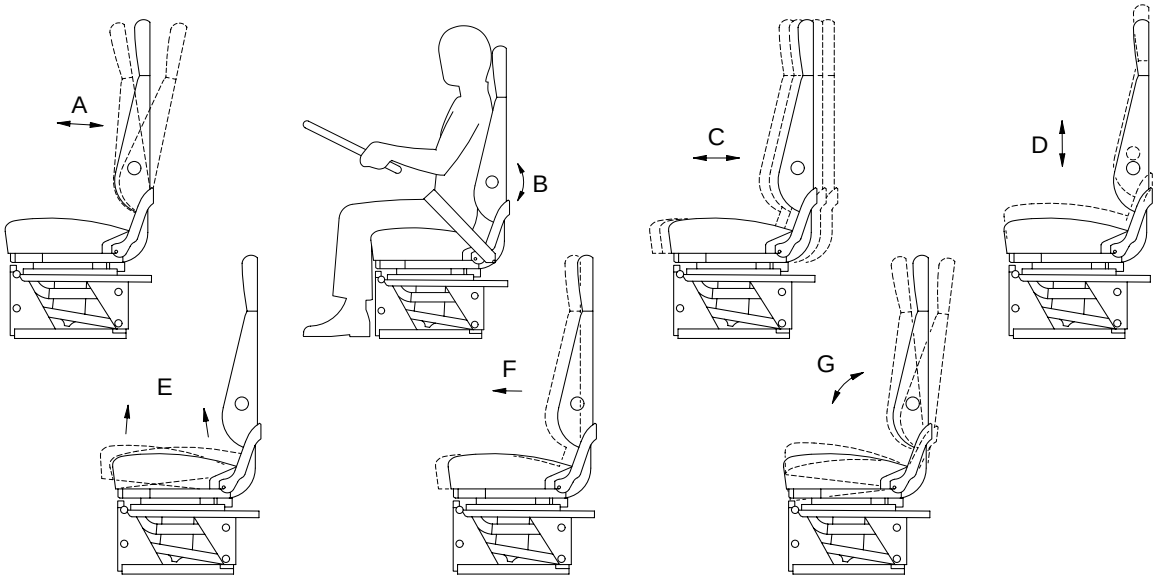
Mercedes-Benz Seat **(Fig. 5.2)**

Seat Track Adjustment

Pull the lever up and slide the seat forward or backward by shifting your weight.

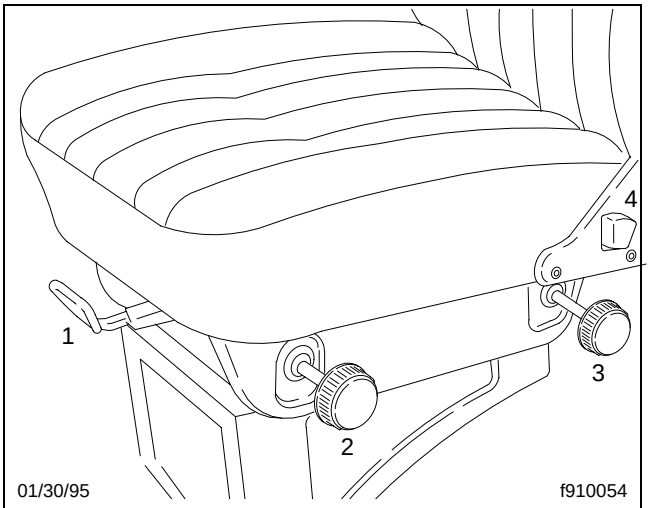
Bottom Cushion Angle

The front portion of the cushion can be adjusted to many positions. Rotate the knob to the desired cushion



A. Back Cushion Tilt
B. Lumbar Support
C. Isolator Feature
D. Height Adjustment
E. Bottom Cushion Angle (fore and aft bottom cushion height)
F. Fore and Aft Seat Adjustment (seat track adjustment)
G. Seat Tilt

Fig. 5.1, Seat Adjustments



1. Seat Track Adjustment Lever
2. Front Cushion Height Knob
3. Rear Cushion Height Knob
4. Back Cushion Tilt Knob

Fig. 5.2, Mercedes-Benz Seat Operation

angle. For rear cushion height adjusting, rotate the knob to the desired cushion angle.

Back Cushion Tilt

Push the knob down, and the back cushion angle position may be moved either forward or backward. Release the knob to lock the back cushion in place.

Bostrom Seat, Air-710E™ **(Fig. 5.3)**

Seat Cushion Tilt

Pull the lever up, and tilt the bottom cushion by shifting your weight.

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

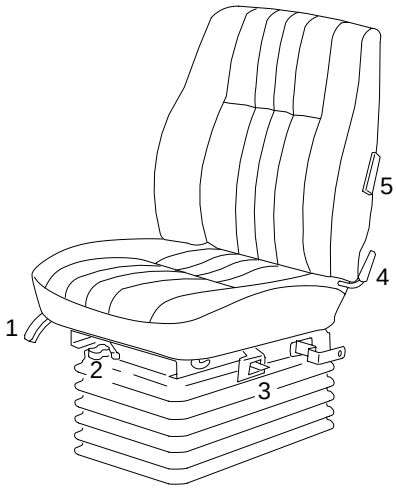
Push the air button to raise the seat; pull the air button to lower the seat.

Back Cushion Tilt

By moving the lever back, the back cushion may be tilted either forward or backward. Release the lever to lock the back cushion in place.

Lumbar Support

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



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1. Seat Cushion Tilt Lever
2. Isolator Lever
3. Height and Weight Adjustment Air Button
4. Back Cushion Tilt Lever
5. Lumbar Support Lever

Fig. 5.3, Bostrom Seat Operation

Seat Track Adjustment

Move the lever to the left and slide the seat forward or backward by shifting your weight.

Bostrom Talladega 900 Seat **(Fig. 5.4)**

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.

Fore and Aft Seat Adjustment

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

Isolator

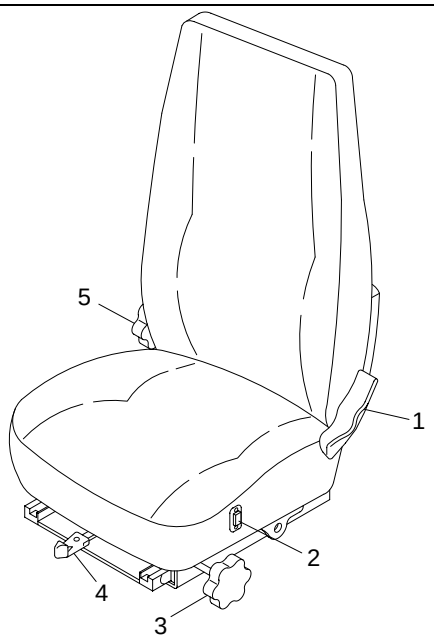
To engage the isolator, put the lever in the center position. Lock out the isolator by moving the lever to the right.

Bottom Cushion Tilt Adjustment

Rotate the knob to increase or decrease bottom cushion tilt.

Lumbar Support

Turn the knob for precise fit.



1. Back Cushion Tilt Lever
2. Height Adjustment Switch
3. Bottom Cushion Tilt Adjustment Knob
4. Fore/Aft Seat Adjustment and Isolator Lever
5. Lumbar Support Knob

Fig. 5.4, Bostrom Talladega 900 Seat Operation

Bostrom Air-910 Seat **(Fig. 5.5)**

Lumbar Support Adjustment

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

Back Cushion Tilt

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

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

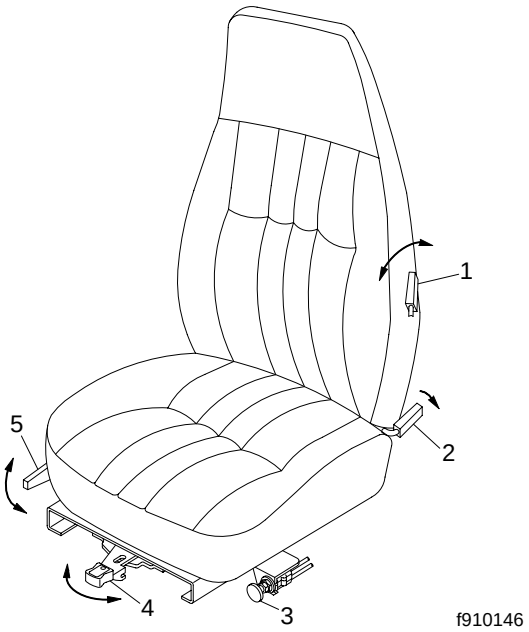
Move the lever to the left and slide the seat forward or rearward to the desired position. The slide range is six inches.

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.



1. Lumbar Support Adjustment Lever
2. Back Cushion Tilt Lever
3. Height Adjustment Knob
4. Fore/Aft Seat Adjustment and Isolator Lever
5. Seat Cushion Adjustment Lever

Fig. 5.5, Bostrom Air-910 Seat Operation

Isringhausen Seat, ISRI 6500 **(Fig. 5.6)**

Headrest Adjustment

Pull the headrest up or push it down for height adjustment. Pivot it forward or backward for horizontal adjustment.

Seat Cushion Tilt

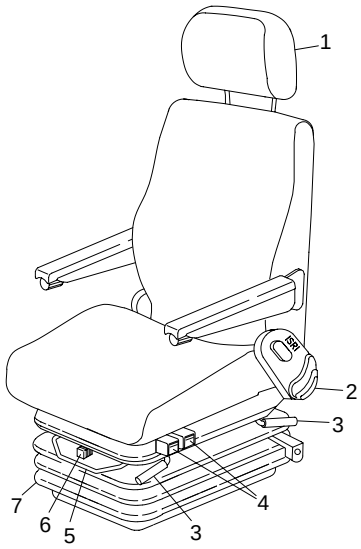
Pull up on the front or rear seat cushion tilt lever and hold it to release the spring-loaded cushion from its current position. Adjust the cushion to the desired position by shifting your weight to the front or rear of the cushion. Release the handle to lock the seat in place.

Lumbar Support

Press on the top half of each rocker switch and hold the switch to increase lumbar support by inflating two pillows in the seat back. Each rocker switch controls a pillow. Press on the bottom half of each switch to decrease lumbar support.

Seat Track Adjustment

Lift up the lever and hold it. Slide the seat to the desired position, and release the lever to lock the seat in place.



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1. Headrest
2. Seat Back Adjustment Lever
3. Seat Cushion Tilt Lever
4. Lumbar Support Switches
5. Seat Track Adjustment Lever
6. Isolator Lever
7. Seat Air Suspension

Fig. 5.6, Isringhausen Seat Operation

⚠ WARNING

Do not adjust the seat on the seat track while the vehicle is in motion. Adjust it only when the vehicle is stopped. Adjusting the seat on the seat track while the vehicle is moving could cause loss of vehicle control and resulting personal injury.

Isolator

Move the lever to the left to activate the isolator. Move the lever to the right to lock out the isolator.

Seat Back Adjustment

Lift the seat back adjustment lever to tilt the seat back forward or backward. Release the lever to lock the seat back into position.

Height and Weight Adjustment

No manual adjustment is required. Once occupied, the seat's air suspension will automatically inflate in seconds to lift the seat to the mid-ride position. When unoccupied, the seat will automatically return to the lowest position for ease of entry.

National Cush-N-Aire Cush-N-Aire® Seats, Models 96 (low back) and 196 (high back) **(Fig. 5.7)**

Back Cushion Tilt

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

Isolator Lockout

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

Height Adjustment

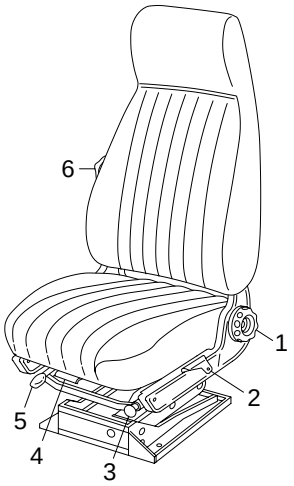
Push in the knob to inflate the suspension and raise the seat height. Pull out on the knob to deflate the suspension and lower the seat height.

Fore and Aft Seat Adjustment

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

Front 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 isolator lockout handle clockwise to one of the three settings.



1. Back Cushion Tilt Knob
2. Isolator Lockout Handle
3. Height Adjustment Knob
4. Fore/Aft Seat Adjustment Lever
5. Front and Rear Bottom Cushion Height Handle
6. Lumbar Support Knob

Fig. 5.7, National Cush-N-Aire Seat (Model 196 shown)

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.

Lumbar Support

Turn the knob for precise fit.

National Cush-N-Aire II Seat **(Fig. 5.8)**

Back Cushion Tilt

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

Height Adjustment

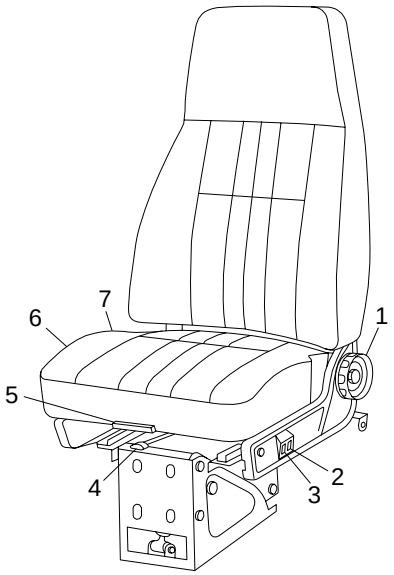
To raise the seat, push the rocker switch on the side of the seat up until the seat reaches the desired height. To lower the seat, push the rocker switch down until the seat reaches the desired height.

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.



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1. Back Cushion Tilt Knob
2. Lumbar Support Rocker Switch
3. Height Adjustment Rocker Switch
4. Fore/Aft Seat Adjustment Lever
5. Bottom Cushion Front Height Handle
6. Isolator Handle
7. Back-of-Cushion Height Lever

Fig. 5.8, National Cush-N-Aire II Seat Operation

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. 5.9)**

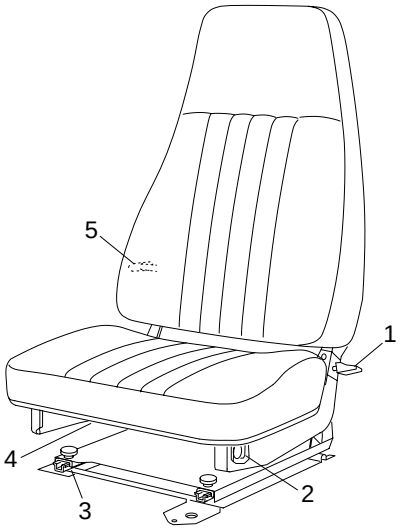
NOTE: Some of the following controls are not available, or are optional, on some Dura-Form seats.

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.



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1. Back Cushion Tilt Handle
2. Height Adjustment Knob
3. Isolator Lockout and Fore-Aft Seat Adjustment Lever
4. Seat Cushion Adjustment
5. Lumbar Support Lever

Fig. 5.9, Dura-Form Seat

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.

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.

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, Freightliner Corporation 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 inspection procedure.

NOTE: Seat belts are installed on the bench seat of the FLC 112 Crew Cab. See **Fig. 5.10**. The Crew Cab bench seat has two shoulder-harness seat belts, and a lap-type seat belt in the middle of the bench seat.

Seat Belt Operation

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, slowly pull the link end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to inboard) 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. 5.11**. 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.
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

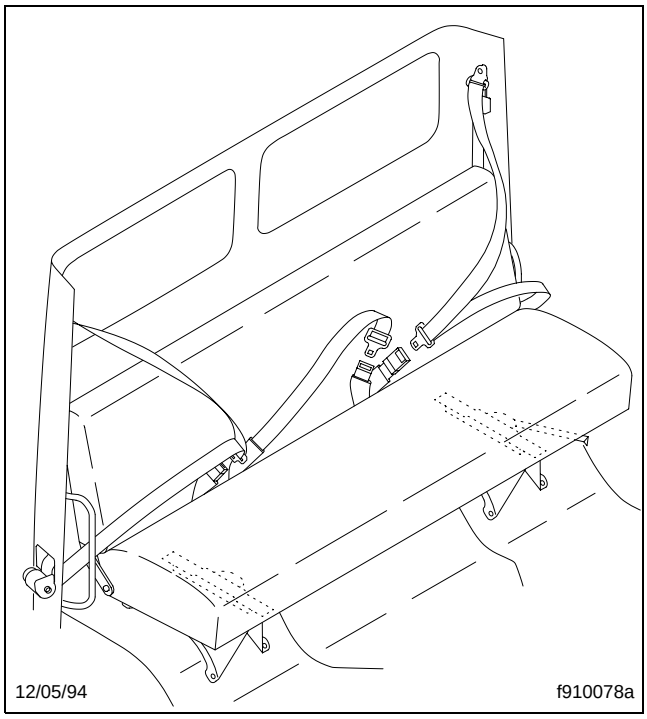


Fig. 5.10, Crew Cab Bench Seat Belts

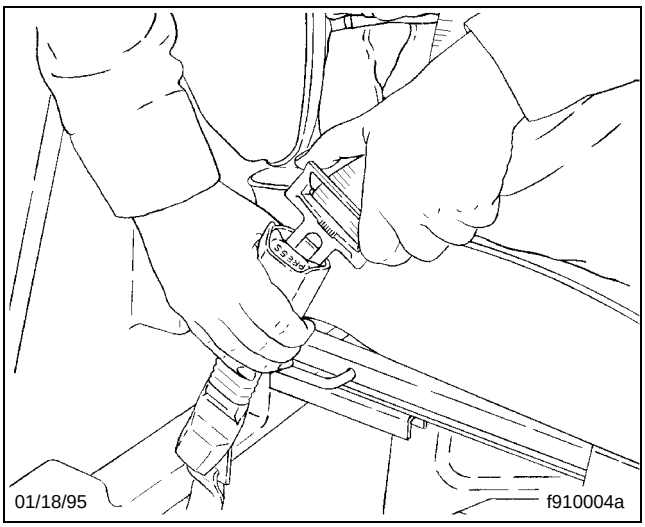


Fig. 5.11, Fastening the Three-Point Belt

an accident or a sudden stop. While holding the belt slack, press the Komfort Latch lever up, clamping the belt's webbing. See **Fig. 5.12** and **Fig. 5.13**.

4. To unbuckle the three-point seat belt, push the button on the buckle. 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.

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.

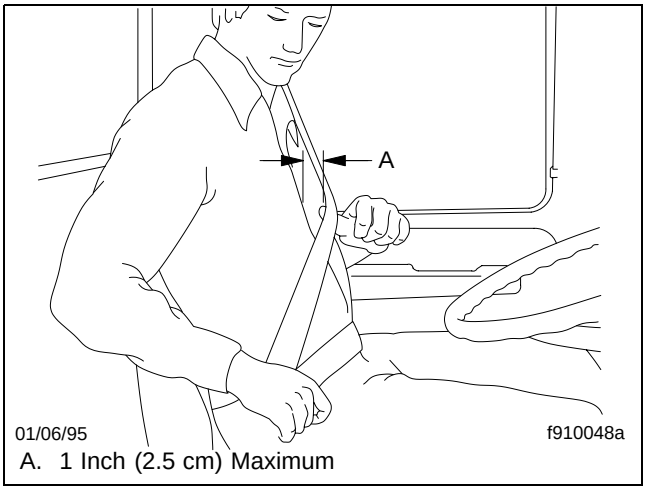


Fig. 5.12, Adjusting Shoulder Harness Clearance

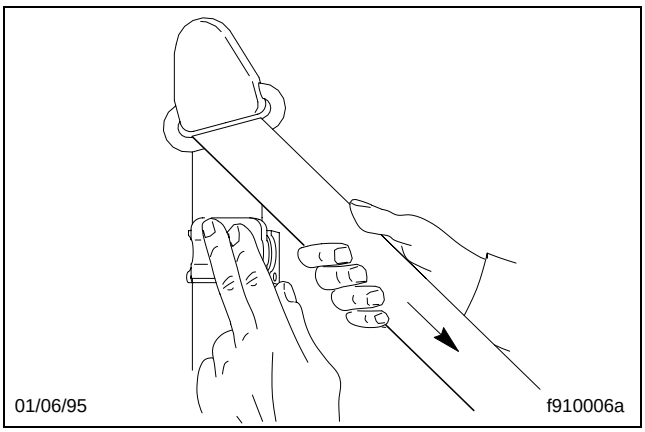


Fig. 5.13, Locking Komfort Latch

6

Steering and Brake Systems

Steering System **6.1**
Brake System **6.2**

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**. Refer to the steering section in the vehicle service manual for steering adjustment procedures.

Manual Steering Gear Lubrication

⚠ CAUTION

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

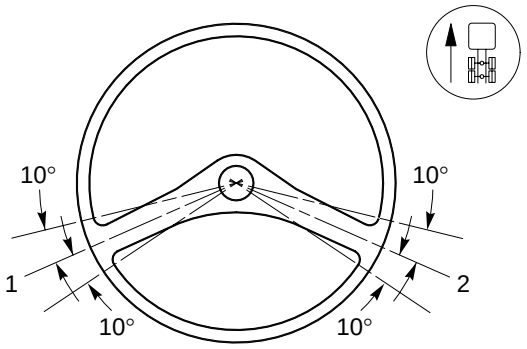
When operating in temperatures continuously below 30°F (–1°C), the wrong type of lubricant used in the steering gear could make the steering wheel difficult to turn. To prevent trouble in cold temperatures, be sure the steering gear lubricant complies with the cold weather recommendations specified in the steering section in the vehicle 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 hy-



1. 8 o' Clock
2. 4 o' Clock

Fig. 6.1, Centering the Steering Wheel

draulic 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

The dual air brake system consists of two independent air brake systems that are operated by a single set of controls. Each system has its own reservoir, 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. On vehicles with trailers, service brake signals from both systems are sent to the trailer.

⚠ 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.

If air pressure in the primary system is lost, rear axle service brakes won't work; front service brakes will continue to be operated by secondary system air pressure. If air pressure is lost in the secondary system, front axle service brakes won't work; rear axle service brakes will continue to be operated by primary system air pressure.

On vehicles with a trailer air brake hookup, service brake signals from both systems are sent to the trailer. If

air pressure in one system is lost, air pressure from the other system will supply the trailer service brakes.

Before driving your vehicle, allow time for the air compressor to build up a minimum of 100 psi (689 kPa) pressure in both the primary and secondary systems. System air pressure is monitored by observing the dual 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 62 to 68 psi (427 to 469 kPa).

The warning light and buzzer come on if air pressure drops below 62 to 68 psi (427 to 469 kPa) in either system. If this happens, either the front or rear service brakes will be operating at a reduced level or not at all; this means it will take longer than normal to stop.

The truck spring parking brakes automatically apply when air pressure drops to about 30 psi (207 kPa). On vehicles with a trailer air brake hookup, if both systems lose air pressure, the trailer service brakes or spring parking brakes automatically apply when air pressure drops to about 45 psi (310 kPa).

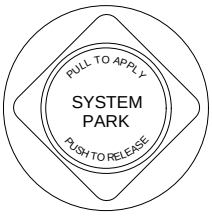
Controls, Vehicles Without Trailer Air Brake Hookup

The foot pedal operates the truck service brakes.

The diamond-shaped knob (**Fig. 6.2**) in the control panel operates the parking brake control valve. When the knob is out, the truck's spring parking brakes are applied. When the knob is in, the parking brakes are released. Before the parking brakes can be released, air pressure in either brake system must be at least 65 psi (448 kPa).

An optional brake hand control valve (**Fig. 6.3**) operates the rear axle service brakes. Pulling the valve down applies the brakes; the harder it is pulled, the harder the brakes are applied. A hard application of the foot brake pedal will override a partial application of the hand control valve. The hand control valve is spring loaded; release it, and it moves up, releasing the rear service brakes.

On right-hand drive vehicles, the optional brake hand control is mounted on the steering column.



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Fig. 6.2, Parking Brake Control Valve Knob

Controls, Vehicles With Trailer Air Brake Hookup

The foot pedal operates the truck and trailer service brakes.

The red octagonal-shaped knob (**Fig. 6.4**) in the control panel operates the trailer air supply valve. With the knob pushed in, the truck's air supply charges the trailer air brake system and releases the trailer parking or service brakes. Air pressure must be at least 65 psi (448 kPa) in the primary or the secondary system.

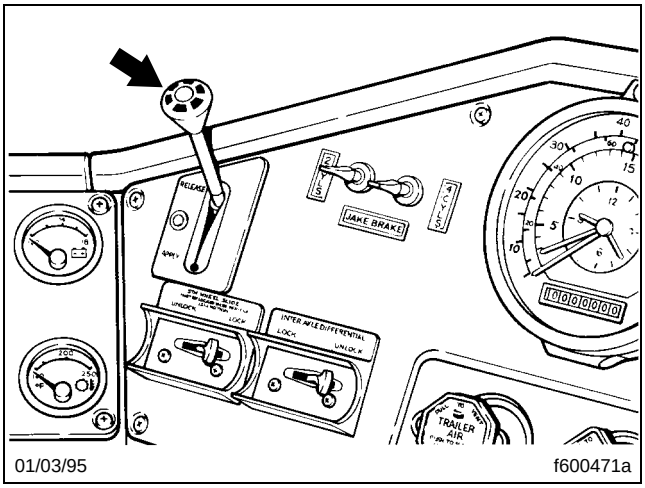


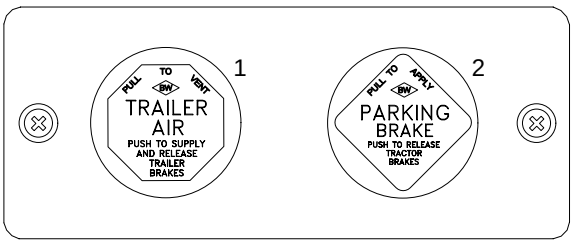
Fig. 6.3, Brake Hand Control Valve Lever

When the red knob is out, the trailer spring parking or service brakes are applied. If pressure in both the primary and secondary air systems drops to about 45 psi (310 kPa), the red knob automatically pops out, exhausting the air supply to the trailer, and applying the trailer service or spring parking brakes. The red knob must be pulled out before disconnecting a trailer. It must also be pulled out when operating a vehicle without a trailer.

The yellow diamond-shaped knob (**Fig. 6.4**) operates the parking brake valve. The truck's spring parking brakes are released when the knob is pushed in. Air pressure in either system must be at least 65 psi (447 kPa) before the truck spring parking brakes can be released.

Pulling out the yellow knob will apply the parking brakes on both the truck and the trailer. The trailer air supply valve knob (**Fig. 6.4**) will automatically pop out, applying the trailer service or spring parking brakes.

On right-hand drive vehicles, the parking brake knob may feature a hook-latch device that prevents the parking brake knob from releasing. See **Fig. 6.5**.



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1. Trailer Air Supply Valve Knob
2. Parking Brake Valve Knob

Fig. 6.4, Parking Brake Control Module

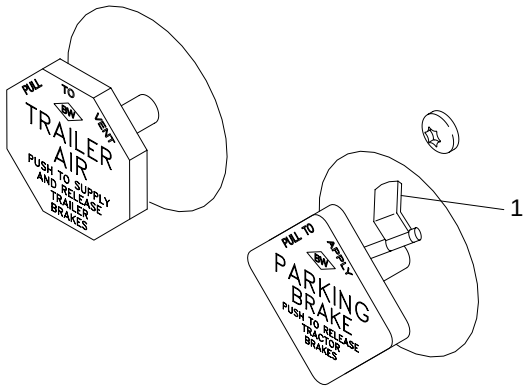
CAUTION

Don't use the spring parking brakes if the service brakes are hot, such as after descending a steep grade. Also, don't use the spring parking brakes during freezing temperatures if the service brakes are wet. In both cases, always chock the tires. Using the spring parking brakes could damage the brakes if hot or, cause them to freeze during cold weather.

IMPORTANT: 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.

When the truck and trailer spring parking brakes (or trailer service brakes) are both applied (both knobs out), the trailer brakes can be released by pushing in the red knob, leaving the tractor parking brakes applied.

The trailer brake hand control valve (**Fig. 6.3**) operates the trailer service brakes. Pulling the valve down applies the brakes; the harder it is pulled, the harder the brakes are applied. A hard application of the foot brake pedal will override a partial application of the trailer brake hand control valve.



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1. Hook-Latch Device

Fig. 6.5, Parking Brake Control Lever

On right-hand drive vehicles, the optional brake hand control is mounted on the steering column.

The trailer brake hand control valve is spring-loaded; release it, and it moves up, releasing the trailer service brakes.

Brake System Operation

⚠ CAUTION

Don't apply the service and spring parking brakes at the same time. This could transmit too much force to the brake components, possibly damaging them.

Driving

Secure all loose items in the cab so they will not be thrown forward during hard braking. Make sure both you and the passenger are wearing seat belts.

IMPORTANT: On vehicles with a trailer air brake hookup, if driving without a trailer, pull the red trailer air supply valve knob out and leave it out.

Make sure both brake systems have at least 100 psi (689 kPa) air pressure. Just before driving off, push in the truck parking brake control knob to release the truck parking brakes. If you are pulling a trailer, push in the trailer air supply knob to release the trailer brakes.

During normal stops, press the foot brake pedal until the vehicle slows down. Use more or less pressure on the pedal so that the vehicle comes to a smooth, safe stop. When vehicle speed has slowed the engine almost to idling speed, push the clutch pedal in and shift the transmission into neutral.

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.

Check the dual air pressure gauge often. Normal operating pressure, with the engine running, is 100 to 120 psi (689 to 827 kPa) in both systems.

If the warning light and buzzer come on, immediately bring the vehicle to a safe stop. Air pressure is low in at least one system and it will take longer than normal to stop. If pressure continues to drop in both systems, the truck and trailer brakes will automatically apply. Have the air system repaired before driving on.

If the spring parking brakes have applied because of a problem with the air system, they must be released before the vehicle can be moved. Apply an external air source at the gladhands, or manually cage the parking brake springs.

⚠ WARNING

Do not drive the vehicle after releasing the spring parking brakes by using an external air source or by caging. There would be no means of stopping the vehicle, and this 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 parking brake springs or remove the external air source before driving the vehicle again.

Parking, Vehicles Without Trailer Air Brake Hookup

Pull the parking brake knob to apply the truck spring parking brakes.

⚠ WARNING

Use the parking brakes to park. The brake hand control valve (rear service brakes) is not a parking brake, and could release, allowing the vehicle to roll away, possibly resulting in serious personal injury or death.

Parking, Vehicles With Trailer Air Brake Hookup

Pull out the yellow parking brake knob to apply the parking brakes on both the truck and the trailer. (The trailer air supply valve knob will automatically pop out, applying the trailer service or spring parking brakes.)

Before disconnecting a trailer, apply the trailer brakes by pulling the red trailer air supply valve knob out.

When the truck and trailer spring parking brakes (or trailer service brakes) are both applied (both knobs out), the trailer brakes can be released by pushing in the red knob, leaving the tractor parking brakes applied.

⚠ WARNING

Use the parking brakes to park. The trailer brake hand control valve (trailer service brakes) is not a parking brake, and could release, allowing the vehicle to roll away, possibly resulting in serious injury or death.

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.

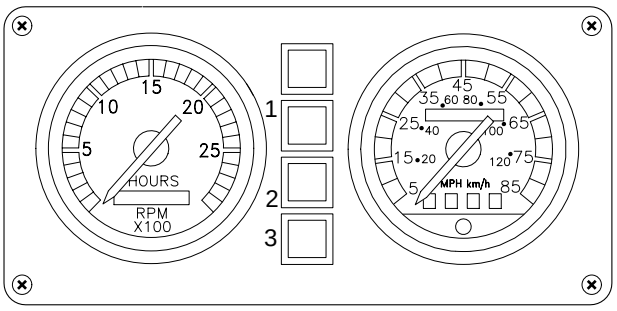
ABS includes signal-generating tone wheels and sensors located in the wheel hubs of each sensed axle. The sensors transmit vehicle wheel speed information to an electronic control unit (located behind the passenger seat). The control unit's main circuit interprets the speed sensor signals and calculates wheel speed, wheel retardation, and a vehicle reference speed. If the calculations indicate wheel lockup, the main circuit signals the appropriate solenoid control valve to reduce braking pressure. During emergency braking, the solenoid control valve alternately reduces, increases, or maintains air pressure supply in the brake chamber to prevent front and rear wheel lockup.

The electronic control unit also has a safety circuit that constantly monitors the wheel sensors, solenoid control valves, and the electrical circuitry. If equipped only with the tractor ABS system, the tractor warning light (TRAC ABS) comes on after the engine is started. The light should go out after a few seconds. This is a simple bulb check. If the light does not come on or stays on then the ABS system should be checked by a technician. This could mean there is a fault in the system.

If equipped with the tractor and trailer ABS system, the vehicle also has a trailer warning light labelled TRLR ABS (**Fig. 6.6**).

After the engine is started, the TRLR ABS light comes on if the trailer is equipped with the Meritor WABCO® 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.

A wheel spin indicator light (WHL SPIN) comes on if one of the drive wheels spins during acceleration (**Fig. 6.6**).



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1. Tractor ABS Warning Light
2. Wheel Spin Indicator Light
3. Trailer ABS Warning Light

Fig. 6.6, Antilock Braking Warning and Indicator Lights

This indicates that that ATC is active (if equipped with ATC). The light goes out when the wheel stops spinning (deactivating ATC). 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. Refer to Chapter 9, "Rear Axles," for axle lock instructions.

If 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), may be used under more adverse conditions. Turning on this switch blinks the wheel spin (WHL SPIN) indicator light (**Fig. 6.6**). The ATC system now allows some wheel spin (for example, to help burn through a thin layer of ice) during reduced-traction starts.

The Meritor WABCO® ABS system combines one front-axle control channel with either one rear axle (the four-channel system), or two rear axles (the six-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 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 change driving styles depending on the 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.

Bendix Antilock Braking System (ABS)

The Bendix Antilock Braking System (ABS) is an electronic wheel monitoring and control system that works with the 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 (ECU). 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 wheel. The sensors transmit vehicle wheel speed information to an ECU. According to programmed specifications, the control unit signals the appropriate modulator assembly to increase, reduce, or maintain air pressure supply in the brake chamber which regulates braking force during emergency braking situations. This prevents front and rear wheel lockup, and enhances steering control during emergency braking situations.

The ECU constantly monitors the wheel sensors, modulator assemblies, and the electrical circuitry. After the key is turned on, the tractor warning light (TRAC ABS) comes on. See **Fig. 6.6**. The warning light goes out if all of the tractor's ABS components are working properly.

On vehicles with traction control, a wheel spin indicator light (WHL SPIN) comes on if one of the drive wheels spins during acceleration. See **Fig. 6.6**. 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.

⚠ CAUTION

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

The Bendix Antilock Brake System uses individual sensors, modulators and an electronic controller to control the four vehicle wheel ends. The rear axle brakes are controlled independently. Each steering axle brake is under the control of an individual modulator. During operation, the Bendix system handles equipment failure using a conservative fail-safe philosophy. Any failure of the system results in simultaneous illumination of the appropriate condition lamp on the dash and a disabling of a part or all of the system. The vehicle will retain standard braking on all wheels if the ABS system is 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 change driving styles depending on the 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.

7

Engines and Clutches

Engine Starting **7.1**
Ether Start System **7.4**
Cold Weather Operation **7.4**
Engine Break-In **7.8**
Engine Operation **7.8**
Engine Shutdown **7.21**
High Altitude Operation **7.23**
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Clutches **7.31**

Engine Starting

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

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

Caterpillar

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

Caterpillar 3306 engines ('93 models) use an intake air preheater to reduce smoke emissions.

⚠ WARNING

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

1. Before engine start-up, perform the engine pretrip inspection and daily maintenance checks in Chapter 11.
2. Set the spring parking brakes.
3. Place the transmission in neutral and disengage the clutch. On vehicles equipped with neutral start switches, the engine will not start with the transmission in gear.

NOTE: For air start systems, check the air supply before starting the engine. There must be 100 psi (689 kPa) of air pressure available.

4. Push the accelerator pedal to the floor once, then release it.

⚠ CAUTION

Don't 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: Some starters are equipped with an optional thermostat. If overcranking occurs, the thermostat breaks the electrical circuit to the starter motor until the motor has cooled.

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

   When the temperature is below 10°F (–12°C), begin cranking the engine, press the ether start system switch for one second, then release it.

   If the vehicle is equipped with an automatic engine shutdown system with a manual override push but-

ton, 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.

7. If the engine doesn't start after step 6, press the start button. After the engine begins to crank, push the accelerator pedal down halfway and hold it while cranking. As soon as the engine starts, release the accelerator pedal so the engine runs at low idle, and release the starter button.

8. Do not apply a load to the engine or increase the engine speed until the oil pressure gauge reading is normal. Within 15 seconds after the engine starts, oil pressure should rise to 10 psi (69 kPa) for 3306 engines and 18 psi (124 kPa) for 3406 engines. If low oil pressure or no oil pressure is indicated, shut down the engine immediately to prevent serious damage. Do not operate the engine until the cause of the problem has been corrected. If the vehicle is equipped with an automatic shutdown system, the engine will shut down after 30 seconds if the oil pressure does not build up to the preset minimum. If the engine shuts down, do not operate it until the cause of the problem has been corrected.

9. 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. Check all gauges during the warm-up period.

Cummins and Detroit Diesel

1. Before engine start-up, perform the engine pretrip 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. Place the transmission in neutral and disengage the clutch. On vehicles equipped with neutral start switches, the engine will not start with the transmission in gear.

⚠ CAUTION

Don't 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.

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:

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

Do not attempt to use "Fleetguard" or other vapor compound type start systems 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; to do so could result in personal injury.

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.

Cold Weather Operation

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.

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.

Refer to your engine operation and maintenance manual or to the vehicle maintenance manual for specifications.

2. When the temperature is below freezing, use sufficient antifreeze solution in the cooling system to prevent freezing. Refer to the engine cooling section in the vehicle 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. Refer to the alternators and starters section in the vehicle service manual for detailed information.

⚠ WARNING

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

   Caterpillar 3306 engines ('93 models) use an intake air preheater to reduce smoke emissions.
5. When 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 to improve warm-up time. The system will keep the engine in cold mode until coolant temperature rises above 82°F (28°C) or until the engine has been running for 12 minutes. The system will then stop the cold mode and allow the engine to operate normally.
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

IMPORTANT: Fuel heaters used on vehicles with Cummins PACE engines 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.

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.

⚠ 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, multi-grade 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. Refer to the vehicle 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

Caterpillar

Every Caterpillar engine must pass a full-load operation test on a dynamometer before shipment, eliminating the need for a break-in period. Only an initial operational check is necessary.

Cummins

Cummins engines are also run on a dynamometer before being shipped from the factory. In most applications, the engine can be put to work immediately, but the operator has an opportunity to establish conditions for the best service life during the initial 100 hours or 3000 miles (5000 km) of service by:

1. Operating as much as possible at three-quarter load.
2. Avoiding operation at engine idle speeds or at maximum horsepower levels longer than five minutes.
3. Developing the habit of closely watching the engine instruments during operation. Let up on the throttle if the oil temperature reaches 250°F (121°C) or if the coolant temperature exceeds 195°F (91°C).
4. Operating with a power requirement that allows acceleration to governed speed when conditions require more power.
5. Checking the oil level periodically during the break-in period.

Detroit Diesel

Detroit Diesel engines can be put to work upon delivery without having to follow a formal break-in schedule. The engine has been "run-in" on a factory dynamometer during performance and quality assurance tests prior to shipment.

Engine Operation

Operating vehicles with diesel engines in areas where there are concentrated flammable vapors (such as diesel, gasoline, or propane fumes) can create a hazardous situation. These vapors can be drawn into the engine through the air intake and cause engine overspeed. Be especially cautious of low-lying or closed-in areas, and always check for signs that flammable vapors may be present.

⚠ DANGER

Don’t 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.

Caterpillar

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.

Caterpillar 3176, PEEC, PEEC III, and 3406 electronic engines can be equipped with a variety of options designed to warn the driver of engine malfunctions. The driver of a vehicle equipped with these engines should know the extent of the warning system in order to bring the vehicle to a safe stop if the engine malfunctions. If the driver doesn’t understand how the warning system works, an engine shutdown could cause a safety hazard. See Chapter 2 for information on the control panel for these engines.

The electronic control system can monitor engine oil pressure, coolant temperature, intake manifold air temperature, and coolant level. There are four customer programmable levels for Caterpillar engine monitoring: off, warning (factory default), derate, and shutdown.

In the engine monitoring "off" mode the ECM will ignore the oil pressure sensor and coolant level sensor (if installed). Engine monitoring "warning" mode uses oil pressure, coolant temperature, intake manifold temperature, and the coolant level sensor (if equipped and enabled). The "check engine" lamp will flash and the warning lamp will come on when the diagnostic code is active. Engine monitoring "derate" and "shutdown" modes allow the ECM to alter engine performance or stop the engine to help the engine avoid damage and return to normal conditions.

IMPORTANT: If a winterfront is used on a vehicle with an electronic engine equipped with a charge air cooler, make sure there are vertical slit openings to allow airflow through the core of the charge air cooler. Do not use a winterfront with a diamond-shaped opening, 12 inches by 12 inches (30.5 x 30.5 cm). This will adversely affect the operation and durability of the charge air cooler.

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 truck.

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. 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.

3. 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 truck speed increases or if upshifts are made on uphill grades. If the truck 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 truck 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 truck is operated in the lower and higher gears. This feature assists the driver in following "progressive shifting" techniques.

4. On uphill grades, begin downshifting when the engine rpm falls to 60 percent of rated rpm for 3306 engines or to peak torque rpm for 3406 engines. 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 3306 engines exceed 2400 rpm. Caterpillar 3406 mechanical, and 3176, PEEC, PEEC III, and 3406 electronic engines should not exceed 2300 rpm (2100 rpm if equipped with an exhaust brake).

5. 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 truck 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.

6. 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 3176 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 shutoff option to work.

Cruise Control (Fig. 7.1)

The cruise control is activated by the "On/Off" and "Set/Resume" switches. The minimum speed at which cruise control can be used on Caterpillar electronic engines is 30 mph (48 km/h). On the Caterpillar 3406E engine, the minimum and maximum speed cruise control set limits can be programmed, by authorized personnel, into the ECM personality module.

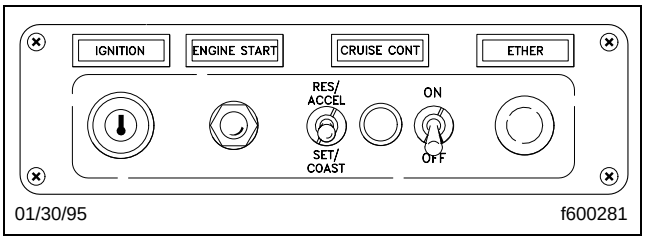


Fig. 7.1, Cruise Control Switches

WARNING

Do not use the cruise control in heavy traffic or when road conditions are wet or slippery. Failure to follow this precaution could result in a loss of vehicle control and possible property damage or personal injury.

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 to "On."

   1.2 Hold the throttle down until the speedometer reaches the desired speed.

   1.3 Momentarily move the "Set/Resume" switch to "Set."

2. To disengage the cruise control:

   2.1 Depress the foot brake, trailer brake, clutch pedal, *or*

2.2 Flip the "On/Off" switch to "Off."

3. To resume a preselected cruise speed:

3.1 Switch the "On/Off" switch to "On" *and/or*

3.2 Momentarily move the "Set/Resume" switch to "Resume." Cruise will return to the last speed selected.

Cruise speed can be adjusted up or down by holding the "Set/Resume" switch at "Set" (accelerate) or at "Resume" (decelerate) until the desired speed is reached.

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

BrakeSaver, Optional

⚠ CAUTION

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

The BrakeSaver (optional on 3406E engines) permits the operator to control the speed reduction of the vehicle on grades, curves, or anytime that 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.

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.

1. Engage the PTO as follows:

1.1 Flip the "On/Off" switch to "On."

1.2 Hold the throttle down until the tachometer reaches the desired engine speed.

1.3 Momentarily move the "Set/Resume" switch to "Set."

2. To disengage the PTO:

   2.1 Depress the foot brake pedal, trailer brake, clutch pedal, *or*

   2.2 Flip the "On/Off" switch to "Off."

3. To resume a previously selected engine speed:

   3.1 Switch the "On/Off" switch to "On" *and/or*

   3.2 Momentarily move the "Set/Resume" switch to "Resume."

   Engine speed can be adjusted up or down by holding the "Set/Resume" switch at "Set" (accelerate) or at "Resume" (decelerate) until the desired speed is reached.

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

Cummins

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.

Cummins electronic engines are equipped with warning lights designed to alert the driver to engine malfunctions. The driver should be familiar with the warning system in order to bring the vehicle to a safe stop if the engine malfunctions. If the driver doesn't understand how the warning system works, an engine shutdown could cause a safety hazard. See Chapter 2 for information on the control panel for these engines.

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 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 (Fig. 7.1)

The cruise control is activated by the "On/Off" and "Set/Resume" switches. 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 in heavy traffic or when road conditions are wet or slippery. Failure to follow this precaution could result in a loss of vehicle control and possible property damage or personal injury.

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 to "On."
   - 1.2 Hold the throttle down until the speedometer reaches the desired speed.
   - 1.3 Momentarily move the "Set/Resume" switch to "Set."
2. To disengage the cruise control:
   - 2.1 Depress the foot brake, clutch pedal, *or*
   - 2.2 Flip the cruise control or engine brake "On/Off" switch to "Off."

To resume a preselected cruise speed, momentarily move the "Set/Resume" switch to "Resume." Cruise will return to the last speed selected.

Cruise speed can be adjusted up or down by holding the "Set/Resume" switch at "Set" (accelerate) or at "Resume" (decelerate) until the desired speed is reached.

NOTE: The resume vehicle speed memory is not maintained if the cruise control "On/Off" switch is turned "Off" or 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.

1. Engage the PTO as follows:
   - 1.1 Flip the "On/Off" switch to "On."
   - 1.2 Hold the throttle down until the tachometer reaches the desired engine speed.
   - 1.3 Momentarily move the "Set/Resume" switch to "Set."

   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 foot brake pedal, trailer brake, clutch pedal, throttle pedal (CELECT engines only), *or*

2.2 Flip the cruise control or engine brake "On/Off" switch to "Off."

To resume a previously selected engine speed, momentarily move the "Set/Resume" switch to "Resume."

Adjust engine speed up or down by holding the "Set/Resume" switch at "Set" (accelerate) or at "Resume" (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

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.

Engines with Detroit Diesel Electronic Control (DDEC®) can be equipped with a variety of options designed to warn the operator of engine problems. The operator of a DDEC®-equipped engine should know the extent of the warning system in order to bring the vehicle to a safe stop if the engine malfunctions. If the operator doesn't understand how the system works, an engine shutdown could cause a safety hazard. See Chapter 2 for information on the DDEC® control panel.

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.

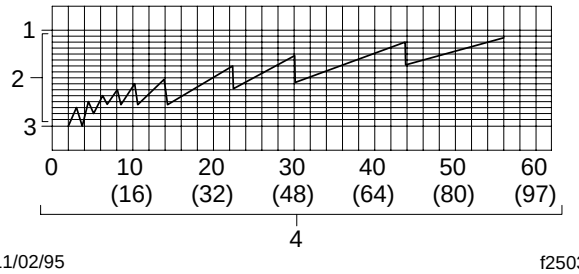
IMPORTANT: If a winterfront is used on a vehicle with an electronic engine equipped with a charge air cooler, make sure there are vertical slit openings to allow airflow through the core of the charge air cooler. Do not use a winterfront with a diamond-shaped opening, 12 inches by 12 inches (30.5 x 30.5 cm). 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. 7.2**.

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



1. Governed RPM
2. Engine RPM
3. Idle RPM
4. Miles (Kilometers) Per Hour

Fig. 7.2, Progressive Shift Pattern

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

8. To slow the vehicle using an engine with automatic transmission as a braking force, shift the range selector to the next lower range. If the vehicle is exceeding the maximum speed for a lower gear, use the service brakes to slow the vehicle to an acceptable speed where the transmission may be downshifted safely.

9. Highway vehicles equipped with Allison automatic transmissions must be driven differently than vehicles with manual transmissions. Gear shifting becomes a matter of proper range selection, and gear changes, although influenced by the throttle position held by the operator, occur automatically in response to the changing power demands on the vehicle.

   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.

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

    A Detroit Diesel Electronic Control (DDEC®) engine can be equipped to shut off automatically after five 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 **(Fig. 7.1)**

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.

⚠ WARNING

Do not use the cruise control in heavy traffic or when road conditions are wet or slippery. Failure to follow this precaution could result in a loss of vehicle control and possible property damage or personal injury.

⚠ 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 to "On."

   1.2 Hold the throttle down until the speedometer indicates the desired speed.

   1.3 Momentarily depress the "Set/Resume" switch to "Set."

2. To deactivate the cruise control:

   2.1 Depress the foot brake, trailer brake, clutch pedal, *or*

   2.2 Flip the cruise control or engine brake "On/Off" switch to "Off."

3. To resume a preselected cruise speed:

   3.1 If the "On/Off" switch is in the "Off" position, flip it to "On."

   3.2 Momentarily depress the "Set/Resume" switch to "Resume." Cruise will return to the last speed selected.

   Cruise speed can be adjusted up or down by holding the "Set/Resume" switch at "Set" (decelerate) or at "Resume" (accelerate) until the desired speed is attained.

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

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."

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 Set the parking brake.

   2.2 Turn on the cruise control switch.

   2.3 Change the engine rpm by using the cruise control "Set" switch to decrease engine rpm, or the "Resume" switch to increase the engine rpm.

Engine Shutdown

Caterpillar

⚠ CAUTION

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 centerhousing 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. On the 3406E engine, 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 a 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.

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, refer to the engine cooling section in the vehicle 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.*

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; therefore, 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 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

Caterpillar

Maximum turbocharger speed is determined by the rack setting, the high idle speed setting, and the altitude at which the engine is operated. The high idle speed and the rack setting are not the same for all altitudes; they have been established to permit the engine to be operated at the altitude marked on the engine information plate.

CAUTION

If the high idle speed or the rack setting is greater than specified for the altitude at which the engine is operated, damage to engine or turbocharger parts can result.

The fuel pump rack has been set by qualified personnel for a particular engine application. The governor housing and turbocharger are sealed to prevent unqualified personnel from tampering with the adjustments.

The engine can be operated at a lower altitude than specified without danger of engine damage. In this situation the engine will perform at slightly less than maximum efficiency. When operated at a higher altitude, the rack setting and high idle speed setting must be changed. These settings should be made only by an authorized Caterpillar engine dealer. The adjustments can be made by reprogramming the personality module in the ECM.

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.

TRW Electronic Truck Engine Control Control (ETEC™), Optional

General Information

ETEC is an electronic control system, available on Cummins-powered vehicles, that regulates engine and vehicle speed to increase fuel economy and performance. The ETEC system consists of six operating modes constantly monitored by an electronic control unit. The electronic control unit contains a microprocessor-based computer that is programmed to monitor the engine and vehicle speed according to preset specifications.

Two of the operating modes, cruise control and variable speed governing, are driver activated. The other four (engine speed governing, road speed governing, top engine limit, and engine shutdown) operate automatically and according to preset, programmed specifications.

NOTE: The following is a general description of ETEC system modes of operation. For driver operating instructions, refer to "Electronic Truck Engine Control System Operation" in this chapter.

Engine Shutdown

This mode closes the ETEC system fuel control valve which replaces the standard shutdown solenoid on the fuel pump. It cuts off fuel flow when:

A. the ignition switch is placed in the "Off" or "Accessory" position, *or*

B. the electronic control unit detects certain mechanical problems.

Engine Speed Governing (ESG)

This mode sets the upper limit of engine speed when the vehicle is parked to prevent overrevving and accidental engine damage during the warm-up period. The ESG mode is programmed to limit engine speed unless:

A. the vehicle is moved and travels faster than the low speed crossover point (usually 2 mph), *or*

B. the variable speed governor (VSG) is engaged.

Variable Speed Governing (VSG)

This function is used mainly for power takeoff operations. However, the fast idle feature of this mode can also be used for engine warm-up and for operating vehicle accessories, such as the heater or air conditioner. Its upper and lower limits are usually 1200 and 800 rpm respectively; they are selectable in 10 rpm steps. The VSG mode can be used only when the vehicle is not moving or is traveling less than the low speed crossover point (usually two mph). This mode is driver-operated by dash-mounted switches.

Top Engine Limiting (TEL)

This mode limits engine speed while shifting through the gears. The TEL is selectable in 10 rpm steps and is set at the engine's rated rpm. The TEL is programmed to always be in effect at vehicle speeds above the low speed crossover point (usually two mph) unless:

A. the cruise control is engaged, *or*

B. the vehicle reaches the high speed crossover point (usually above 50 mph) at which point the control unit automatically switches to the road speed governing mode.

Road Speed Governing (RSG)

This mode limits vehicle speed. It is selectable in five vehicle speed settings: 57 mph, 59 mph, 61 mph, 63 mph, and 65 mph. This mode is programmed to always limit vehicle speed when the vehicle exceeds the high speed crossover point and the cruise control is not engaged.

Cruise Control

This function maintains vehicle speed, selectable in one mph increments, usually from 40 to 62 mph. This mode is driver activated with maximum cruise control speed preset at three mph less than the selected road speed governing limit. However, the selected 57 mph road speed will have a maximum cruise control speed of 55 mph.

Electronic Truck Engine Control (ETEC™) System Operation **(Fig. 7.1)**

Cruise Control Operation

The cruise control is activated by the "On/Off" and "Set/Resume" switches on the instrument control panel. A light between the "On/Off" and "Set/Resume" switches glows when the cruise control mode is engaged.

⚠ WARNING

Do not use the cruise control in heavy traffic or when road conditions are wet or slippery. Failure to follow this precaution could result in a loss of vehicle control and possible property damage or personal injury.

⚠ 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 to "On."

   1.2 Hold the throttle down until the speedometer indicates the desired speed.

   1.3 Momentarily depress the "Set/Resume" switch to "Set."

2. To deactivate the cruise control:

   2.1 Depress the foot brake, trailer brake, clutch pedal, *or*

   2.2 Flip the cruise control or engine brake "On/Off" switch to "Off."

3. To resume a preselected cruise speed:

   3.1 If the "On/Off" switch is in the "Off" position, flip it to "On."

   3.2 Momentarily depress the "Set/Resume" switch to "Resume." Cruise will return to the last speed selected.

   Cruise speed can be adjusted up or down by holding the "Set/Resume" switch at "Set" (accelerate) or at "Resume" (decelerate) until the desired speed is attained.

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

Variable Speed Governing (VSG)

This mode is used when the vehicle is parked. VSG is engaged by activating the instrument control panel "On/Off" switch and the "Set/Resume" switch.

To engage variable speed governing:

1. Flip the "On/Off" switch to "On."
2. Select the desired rpm by accelerating the engine to the desired speed. Set that speed by pressing the "Set" switch. A light between the "On/Off" and "Set/

Resume" switches glows when the VSG mode is engaged. The engine speed can be adjusted up or down with the "Set" (accelerate) or "Resume" (decelerate) switch. Briefly press the "Resume" to return to a previously selected rpm.

To disengage variable speed governing:

Depress the foot brake, trailer brake, or clutch pedal, or flip the "On/Off" switch to "Off," or turn the ignition switch to an "Off" or "Accessory" position.

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

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. 7.1**. 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 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. 7.1**) 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 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. 7.3**) which are on/off toggle switches;
- a clutch switch which is a transmission-mounted micro-switch that actuates when the driver removes his foot from the clutch pedal;

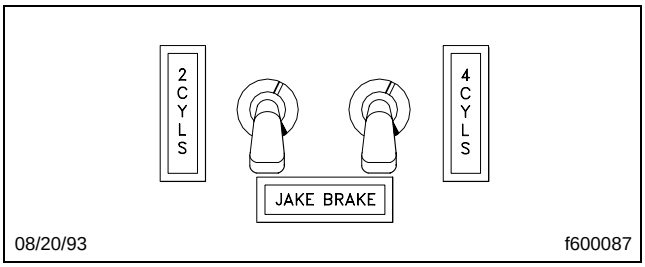


Fig. 7.3, Engine Brake Switches

- a throttle switch which is an engine-mounted micro-switch that actuates when the driver removes his foot from the throttle pedal.

Jacobs Engine Brake Operation

WARNING

Don't 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

Don't 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 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

Do not use the engine brake as a primary braking system when the service brakes are operable. This could cause long, uncertain 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. Refer to the vehicle 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 control toggle switches in the off (down) positions, 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 control switches are 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 new or 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.

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, refer to 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

Don't allow the clutch driven disc to overspeed. Clutch components could fly apart, possibly causing serious personal 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.

Free-pedal travel should be included and commented on daily in the driver's report since clutch free-pedal travel is the maintenance department's guide to the condition of the clutch and the release mechanism.

⚠ CAUTION

Operating the vehicle with incorrect pedal free-travel could result in clutch damage. Refer to the clutch section in the vehicle service manual for free-pedal adjustment procedures and specifications.

Clutch Adjustments

Clutches have an internal adjustment and external linkage adjustment. Refer to the clutch section in the vehicle 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. Refer to the vehicle maintenance manual for intervals and procedures.

⚠ CAUTION

Failure to lubricate the release bearing and linkage as recommended could result in release bearing damage and damage to the clutch.

8

Transmissions

Fuller Straight-Shift Models **8.1**
Fuller Range-Shift Models **8.2**
Fuller Splitter and Range-Shift Models **8.7**
Fuller Deep-Reduction and Range-Shift Models **8.12**
Spicer Straight-Shift Models **8.17**
Meritor Range-Shift Models **8.18**
Meritor Splitter and Range-Shift Models **8.21**
Meritor Engine Synchro Shift™ (ESS) Automated Models **8.24**

Fuller Straight-Shift Models

General Information

Fuller T-8607A/B and T-14607A/B transmissions have seven forward speeds and one reverse speed. They are designed for use with on-highway, fuel economy engines, where a minimum of shifting is desired and less gear reduction is acceptable. See **Fig. 8.1** for the shift pattern.

Operation

1. Always use 1st gear when starting to move the vehicle forward.

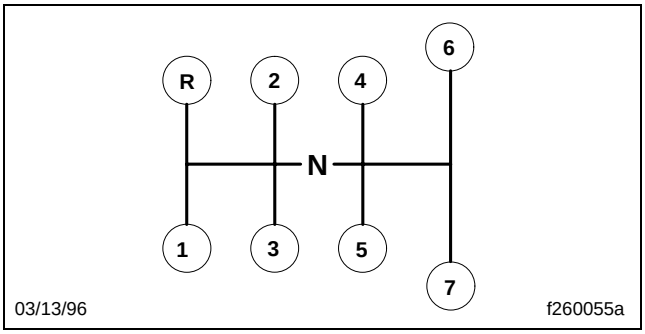


Fig. 8.1, Fuller T-8607A/B and T-14607A/B Transmissions Shift Pattern

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.

   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. While holding full throttle, disengage the clutch; shift into gear; 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 torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. While holding full throttle, disengage the clutch; shift into 4th gear; engage the clutch smoothly.

   Follow the same sequence to downshift from 4th into 3rd, 3rd into 2nd, and from 2nd into 1st gear.

   Never use the clutch brake when downshifting or as a brake to slow the vehicle.

Fuller Range-Shift Models

General Information

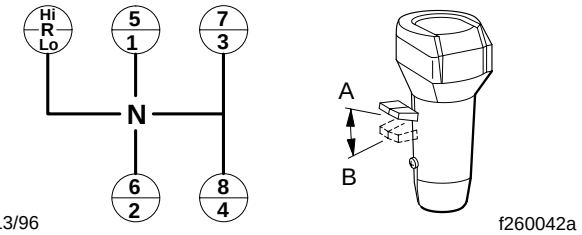
8-Speed RT Models

Fuller RT-11608 transmissions have eight, selective, evenly-spaced forward ratios, and two reverse ratios. Eight forward speeds are obtained by twice using a 4-speed shift pattern: the first time in low range; the

second time in high range. See **Fig. 8.2** for the shift pattern.

9-Speed RT, RTO, and RTX Models

Fuller RT-8608L, RT-8609, RT-11609A, RT-12609A, RT-14609A, RTO-11609A/B, RTO-12609A/B, RTO-14609A/B, RTX-11609B, RTX-12609B, RTX-14609B, RTX-11609P, RTX-12609P, and RTX-14609P 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.



A. Up for High Range
B. Down for Low Range

Fig. 8.2, Fuller RT-11608 Transmission Shift Pattern

See **Fig. 8.3** 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.

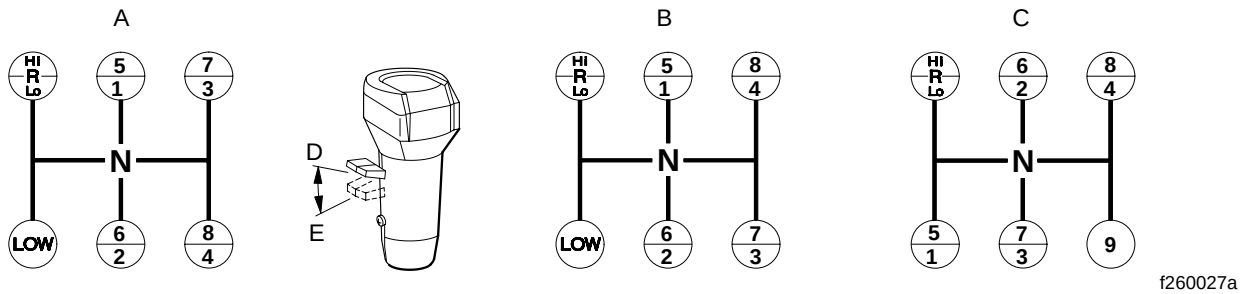
10-Speed RT, RTO, and RTX Models

Fuller RT-11610, RT-12610, RT-14610, RTO-11610, RTO-14610, RTX-11610, and RTX-14610 transmissions have ten selective, evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed rearrange 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. 8.4** 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

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



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A. All RT and RTX-B Transmissions
B. All RTO Transmissions
C. All RTX-P Transmissions
D. Up for High Range
E. Down for Low Range

Fig. 8.3, Fuller RT-8609, RT-11609A, RT-12609A, RT-14609A, RTO-12609A/B, RTO-14609B, RTX-11609B, RTX-12609B, RTX-14609B, RTX-11609P, RTX-12609P, and RTX-14609P Transmissions Shift Patterns

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 preselection lever must be made prior to moving the shift lever out of gear into neutral.

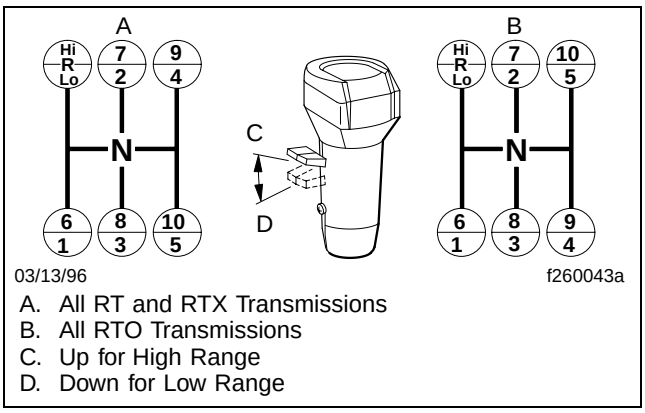
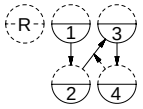
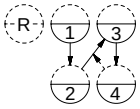
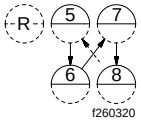
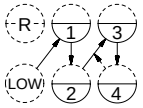
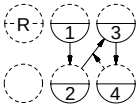
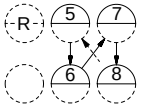
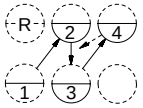
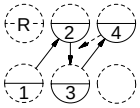
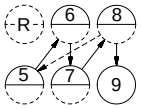
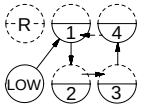
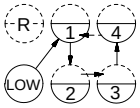
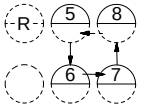


Fig. 8.4, Fuller RT-11610, RT-12610, RT-14610, RTO-11610, RTO-14610, RTX-11610, and RTX-14610 Transmissions Shift Patterns

5. Do not shift from high range to low range at high vehicle speeds.
6. Use double-clutching between all upshifts and downshifts.
7. 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

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. Position the range preselection lever down, into low range.
3. 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.
4. 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.
5. 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 8.1**). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
6. With the transmission in high range, shift progressively upward through each of the high range gears (**Table 8.1**), double-clutching between shifts.

Fuller Shift Progressions			
TRANS MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
8-Speed Direct (RT)	 f260321	 f260321	 f260320
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

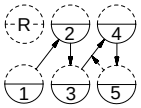
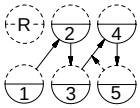
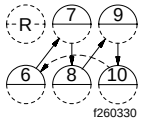
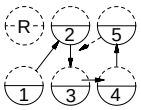
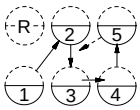
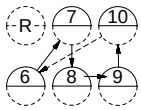
Fuller Shift Progressions			
TRANS MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
10-Speed Direct or Overdrive (RT or RTX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RTO)	 f260331	 f260331	 f260332

Table 8.1, Fuller Shift Progressions

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
2. 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.

3. With the transmission in low range, downshift through the low range gears as conditions require.

   Never use the clutch brake when downshifting or as a brake to slow the vehicle.

Fuller Splitter and Range-Shift Models

General Information

13-Speed RTO Models

Fuller RTO-11613, RTO-14613, and RTO-15613 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. 8.5** for the shift patterns.

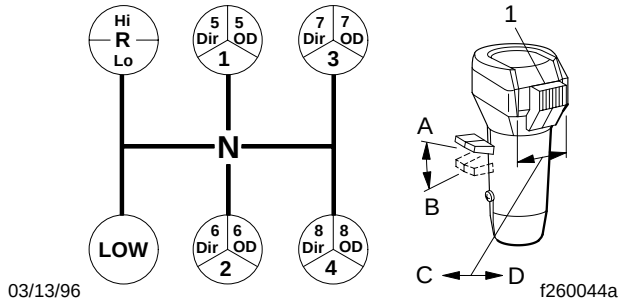
All of the thirteen speeds are controlled with one shift lever. Built into the shift knob of the lever, are a range preselection lever and a splitter control button (on the side of the shift knob), that control range selection and gear splits, respectively.

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 models), or overdrive ratio (RTO models) of the splitter gear. Ratios cannot be split while the transmission is in low range.

18-Speed RTO Models

Fuller RTLO-14618 and RTLO-16618 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.



A. Up for High Range
B. Down for Low Range
C. Forward for Overdrive
D. Rearward for Direct
1. Splitter Control Button

Fig. 8.5, Fuller RTO-11613, RTO-14613, and RTO-15613 Transmissions Shift Patterns

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

IMPORTANT: 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 preselection lever must be made prior to moving the shift lever out of gear into neutral.
11. 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

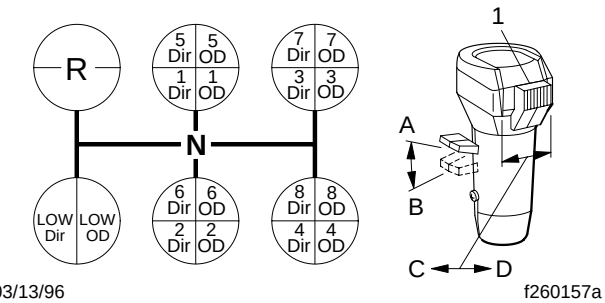
1. Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range. See **Fig. 8.5** or **Fig. 8.6**.
3. Make sure the splitter control button is in the direct (rearward) position. See **Fig. 8.5** or **Fig. 8.6**.
4. 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. 8.6**) into the overdrive (forward) position, then immediately release the ac-



A. Up for High Range
B. Down for Low Range
C. Forward for Overdrive
D. Rearward for Direct
1. Splitter Control Button

Fig. 8.6, Fuller RTLO-14618 and RTLO-16618 Transmission Shift Patterns

celerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

5. 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. 8.5**.

   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. 8.6**). 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.).

6. 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.

7. 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. 8.5**) 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.).

For 18-speed transmissions:

To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.6**) 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. Never use the clutch brake when downshifting or as a brake to slow the vehicle.

   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.).

Fuller Deep-Reduction and Range-Shift Models

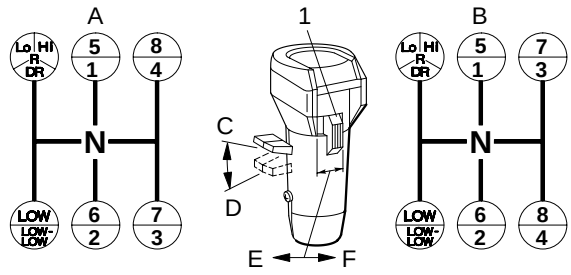
General Information

10-Speed RTO and RTX Models

Fuller RTO-11708LL, RTO-14708LL, RTX-11708LL, and RTX-14708LL 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. 8.7** 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.

15-Speed RT, RTO, and RTX Models

Fuller RT-11715, RT-14715, RT-15715, RTO-11715, RTO-14715, RTO-15715, RTX-11715, RTX-14715, and RTX-15715 transmissions have a 5-speed front section, and a 2-speed rear, range 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. 8.8** 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.



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A. All RTO Transmissions
B. All RTX Transmissions
C. Up for High Range
D. Down for Low Range
E. Forward for IN
F. Rearward for OUT

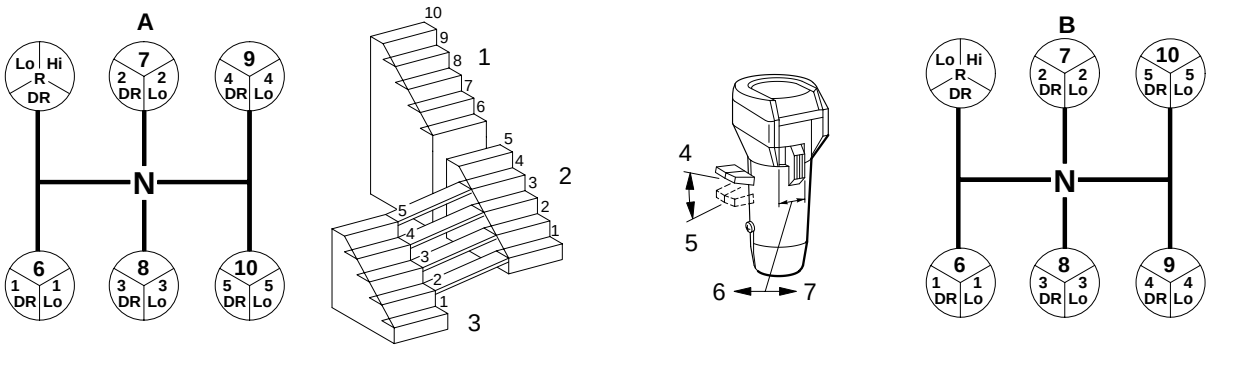
1. Deep Reduction Button

Fig. 8.7, Fuller RTO-11708LL, RTO-14708LL, RTX-11708LL, and RTX-14708LL Transmissions Shift Patterns

Operation

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.

1. 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.
2. 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 sta-



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A. Fuller RT and RTX transmissions shift pattern

1. High Range
2. Low Range
3. Deep Reduction
4. High Range
5. Low Range
6. Forward for IN

B. Fuller RTO transmissions shift pattern

7. Rearward for OUT

Fig. 8.8, Fuller 15-Speed RT, RTO and RTX Model Transmissions Shift Patterns

tionary. 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. Never move the shift lever into low gear while in high range.
5. 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.
6. Never move the deep reduction button from a rearward position to a forward position when the transmission is in high range.
7. Do not shift from high range to low range at high vehicle speeds.
8. Do not make range shifts with the vehicle moving in reverse gear.
9. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
10. 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.

1. 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).
2. Position the range preselection lever down, into low range.
3. Move the deep reduction button to the forward position to engage the deep reduction gears.
4. 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.

5. For 10-speed transmissions:

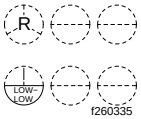
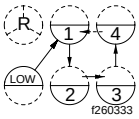
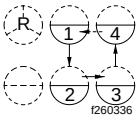
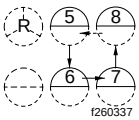
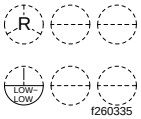
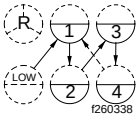
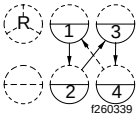
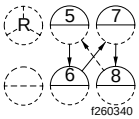
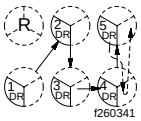
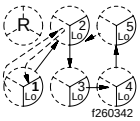
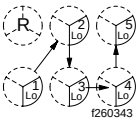
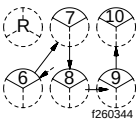
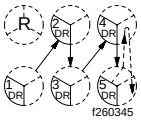
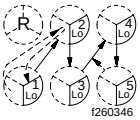
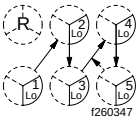
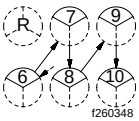
Fuller Shift Progressions				
TRANSMISSION MODEL	DEEP REDUCTION	LOW RANGE		HIGH RANGE
	Adverse Conditions Only	Off-Highway and Adverse Conditions	On-Highway and Ideal Conditions	All Conditions
10-Speed RTO	 f260335	 f260333	 f260336	 f260337
10-Speed RTX	 f260335	 f260338	 f260339	 f260340
15-Speed RTO	 f260341	 f260342	 f260343	 f260344
15-Speed RT and RTX	 f260345	 f260346	 f260347	 f260348

Table 8.2, Fuller Shift Progressions

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.

6. 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.

7. 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.

8. 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

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.

2. 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.

3. With the transmission in low range, downshift through the low range gears as conditions require.

   Never use the clutch brake when downshifting or as a brake to slow the vehicle.

Spicer Straight-Shift Models

General Information

Spicer 7-speed (PS140-7A and PS125-7B; formerly 1372A and 1372B) series transmissions have seven forward gears, and one reverse gear. See **Fig. 8.9** for the shift pattern.

Operation

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.

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 attained, disengage the clutch, and shift the lever to neutral. Engage the clutch; allow the engine speed to drop,

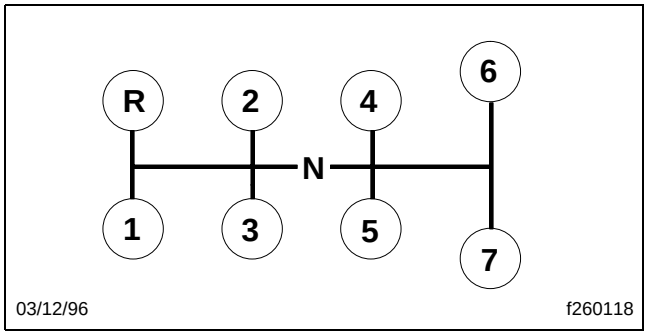


Fig. 8.9, Spicer 7-Speed Transmission Shift Pattern

then disengage the clutch. Move the shift lever to 2nd gear, then engage the clutch and accelerate to engine governed speed.

4. Continue shifting upward using the same sequence described in step 3 above. See **Fig. 8.9** for the shift pattern.

Downshifting

When downshifting, shift progressively down through each successive lower gear as follows:

1. Allow the engine speed to drop to the same rpm to which it fell immediately after upshifting to that same gear. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to the governed speed. While holding full throttle: disengage the clutch, shift into the next lower gear, and engage the clutch smoothly.

2. Continue downshifting, as conditions require, using the same sequence described in step 1 above. Never use the clutch brake when downshifting or as a brake to slow the vehicle.

Meritor Range-Shift Models

General Information

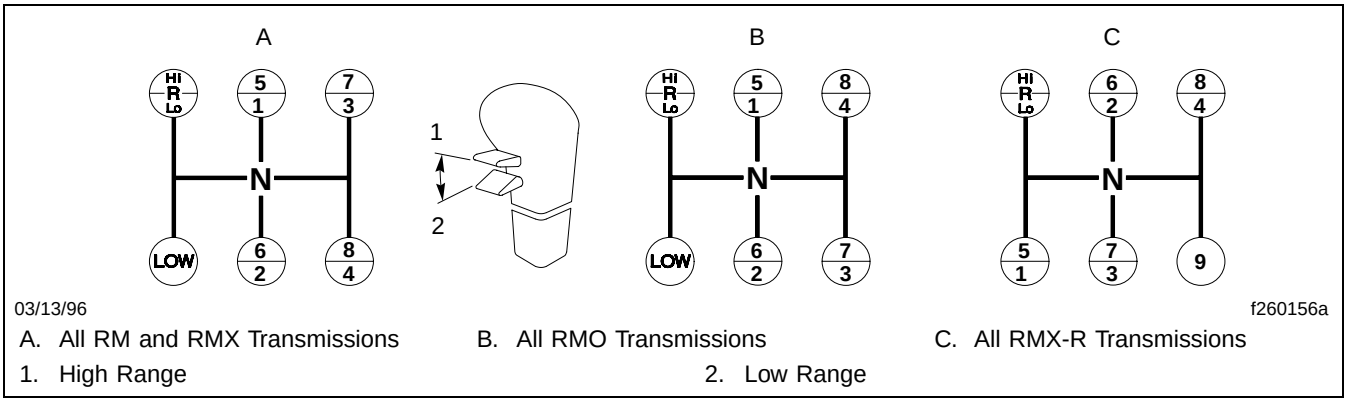
9-Speed RM, RMO, and RMX Models

Meritor RM9-115A, RM9-125A, RM9-135A, RM9-145A, RM9-155A, RMO9-115B, RMO9-125A/B, RMO9-135A/B, RMO9-145A/B, RMX9-115B, RMX9-125A/B, RMX9-135A/B, RMX9-145A/B, RMX9-155B, RMX9-115R, RMX9-125R, RMX9-135R, and RMX9-145R 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. 8.10** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RM and RMX (direct ratio) are opposite of the RMO (overdrive ratio) transmissions. The RMX-R ratio transmissions have the 1st/5th shift positions where low is in the A and B ratio transmissions. The top gear in the RMX-R ratio transmissions is called 9th gear.

10-Speed RMX Models

Meritor RMX10-115A, RMX10-125A, RMX10-135A, RMX10-145A, and RMX10-155A transmissions have ten



A. All RM and RMX Transmissions
B. All RMO Transmissions
C. All RMX-R Transmissions
1. High Range
2. Low Range

Fig. 8.10, Meritor 9-Speed RM, RMO and RMX Model Transmissions Shift Patterns

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. 8.11** for the shift pattern.

Operation

Reverse

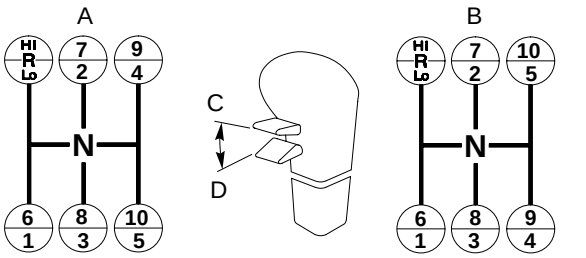
To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement. Holding the clutch pedal at the bottom of travel, shift into reverse.

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



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A. All RM and RMX Transmissions
B. All RMO Transmissions
C. Up for High Range
D. Down for Low Range

Fig. 8.11, Meritor 10-Speed RM, RMO and RMX Model Transmissions Shift Patterns

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 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**.
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

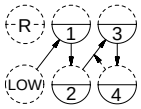
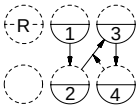
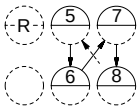
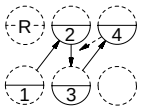
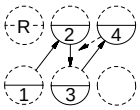
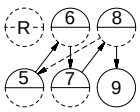
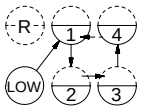
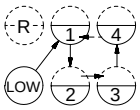
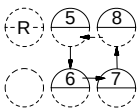
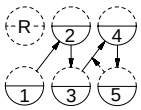
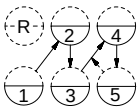
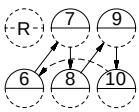
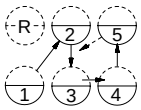
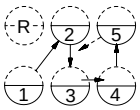
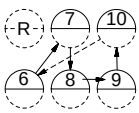
Meritor Shift Progressions			
MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
9-Speed Direct or Overdrive (RM or RMX)	 f260322	 f260323	 f260324
9-Speed Direct (RMX-R)	 f260325	 f260325	 f260326
9-Speed Overdrive (RMO)	 f260327	 f260327	 f260328
10-Speed Direct or Overdrive (RM or RMX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RMO)	 f260331	 f260331	 f260332

Table 8.3, Meritor Shift Progressions

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.

   Never fully depress the clutch pedal to use the clutch brake when downshifting or as a brake to slow the vehicle.

Meritor Splitter and Range-Shift Models

General Information

13-Speed RMO Models

The Meritor RMO13-145A transmission has 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. 8.12**.

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

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.

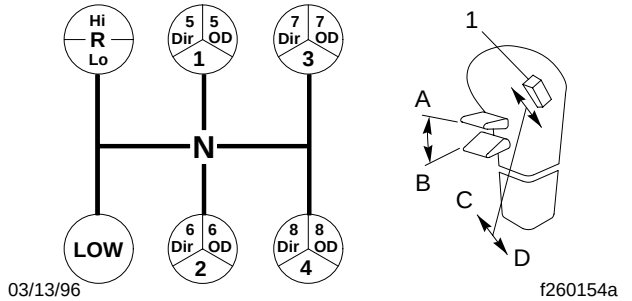
Reverse

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



A. Up for High Range
B. Down for Low Range
C. Up for Overdrive
D. Down for Direct
1. Splitter Control Button

Fig. 8.12, Meritor RMO13-145A Transmission Shift Pattern

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.

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. 8.12**. 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.

   Never fully depress the clutch pedal to use the clutch brake when downshifting or as a brake to slow the vehicle.

Meritor Engine Synchro Shift™ (ESS) Automated Models

General Information

9–Speed and 10–Speed M, MO, RS, and RSX Models

Meritor 9-speed M–11F9A–E11, M–12F9A–E12, M–13F9A–E13, M–14F9A–E14, M–15F9A–E15, MO–12F9A–E12, MO–13F9A–E13, MO–14F9A–E14, MO–11F9B–E11, MO–12F9B–E12, MO–13F9B–E13, MO–14F9B–E14, MO–15F9B–E15, RS9–115A, RS9–125A, RS9–135A, RS9–145A, RS9–155A, RSX9–115B, RSX9–115R, RSX9–125A, RSX9–125B, RSX9–125R, RSX9–135A, RSX9–135B, RSX9–135R, RSX9–145A, RSX9–145B, RSX9–145R, RSX9–155B, and 10-speed M–11F10A–E11, M–12F10A–E12, M–13F10A–E13, M–14F10A–E14, M–15F10A–E15, MO–11F10A–E11, MO–12F10A–E12, MO–13F10A–E13, MO–14F10A–E14, MO–15F10A–E15, MO–16F10A–E16, MO–11F10C–E11, MO–12F10C–E12, MO–13F10C–E13, MO–14F10C–E14, MO–15F10C–E15, MO–16F10C–E16, M–14F10A–E16, MO–14F10A–E16, MO–14F10C–E16, MO–16F10C–E18, RS10–115A, RS10–125A, RS10–135A, RS10–145A, RSX10–115A, RSX10–115C, RSX10–125A, RSX10–125C, RSX10–135A, RSX10–135C, RSX10–145A, RSX10–145C, RSX10–155A, RSX10–155C, RSX10–165A, and

RSX10–165C 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.

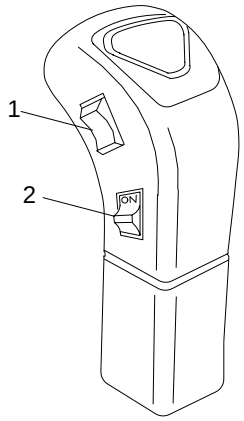
The ESS system works with the engine fuel control system to automatically synchronize engine rpm to road speed during gear changes. Use the clutch only to start and stop the vehicle and to shift into Forward or Reverse. The HI and LO ranges are automated, so the driver does not have to select ranges. 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

The ESS system collects and relays information pertaining to the positions of the shift-intent and system switches (**Fig. 8.13**), 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 speed. The ECM also controls HI and LO range selection in the auxiliary case on the rear of the transmission.

The system switch (**Fig. 8.13**) 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



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1. Shift-Intent Switch 2. System Switch

Fig. 8.13, ESS Shift Handle

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. 8.13**) 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. 8.14**) to select the HI range on upshifts and the bottom of the switch (**Fig. 8.15**) to select the LO range on downshifts.

⚠ WARNING

Ensure 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.

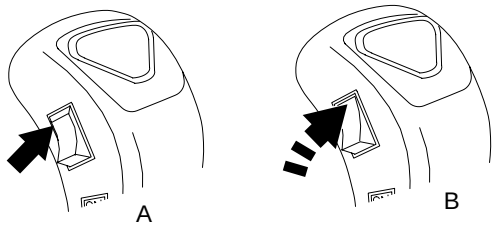
Starting The Vehicle

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.

Shifting Into a Starting Gear

⚠ CAUTION

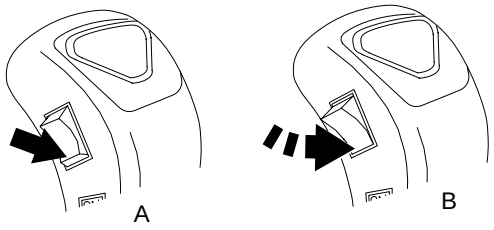
Always use the proper starting gear. Do not shift into Neutral and coast, as this will result in damage to the transmission.



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A. Press the top portion (engage the first position) of the shift-intent switch to begin an upshift.
B. Press the top portion again (engage the second position) to break torque.

Fig. 8.14, ESS Upshifting Using the Shift-Intent Switch



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A. Press the bottom portion (engage the first position) of the shift-intent switch to begin a downshift.
B. Press the bottom portion again (engage the second position) to break torque.

Fig. 8.15, ESS Downshifting Using the Shift-Intent Switch

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. 8.14**. 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. 8.15**. 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.

3. Move the shift lever and engage Reverse.

4. Slowly release the clutch pedal and move the vehicle in the Reverse direction.

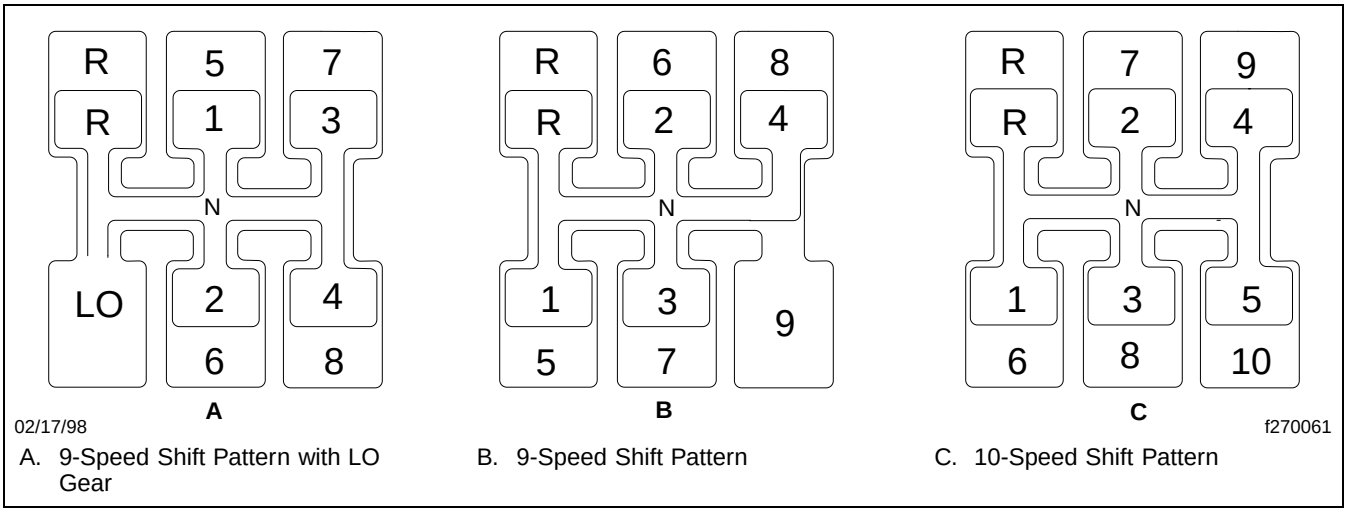
Note: If a HI Reverse range is required, follow the steps below.

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. 8.16** for two ESS 9-speed shift patterns and one ESS 10-speed shift pattern.



A. 9-Speed Shift Pattern with LO Gear
B. 9-Speed Shift Pattern
C. 10-Speed Shift Pattern

Fig. 8.16, 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**
Meritor Main Differential Lock Operation **9.2**
Meritor Tandem Drive Axles With Interaxle Differential **9.3**
Meritor Interaxle Differential Lockout Operation **9.3**
Eaton Interaxle Differential Lockout Operation **9.4**

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.

Refer to the vehicle 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

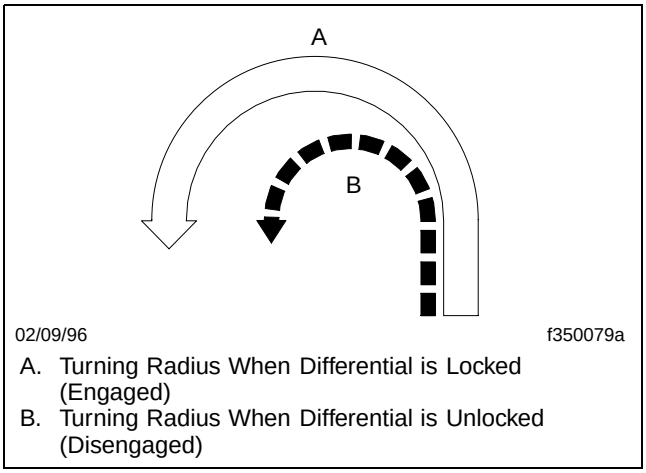
Lock the main differential only when the vehicle is standing still or moving less than 25 mph (40 km/h). Never lock the main differential when the vehicle is traveling down steep grades or when the wheels are slipping. This could damage the differential or lead to loss of vehicle control, causing personal 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.



A. Turning Radius When Differential is Locked (Engaged)
B. Turning Radius When Differential is Unlocked (Disengaged)

Fig. 9.1, Vehicle Turning Radius When Differential is Fully Locked

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 (see **Fig. 9.2**) on the control panel.

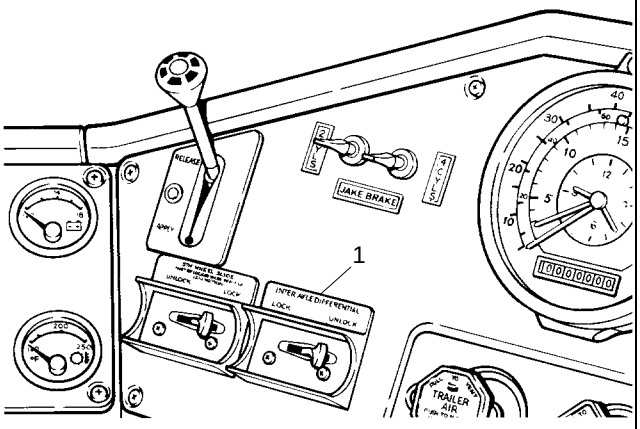
On right-hand drive vehicles, the differential lockout is controlled by a switch mounted on the B-panel, which is the dash panel mounted to the left side of the main dash panel.

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



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1. Interaxle Differential Lockout Switch

Fig. 9.2, Interaxle Differential Lockout Switch Position

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 Interaxle Differential Lockout Operation

Interaxle differential lockout systems include a lockout control valve (see **Fig. 9.2**) 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 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**
ASF Castloc® II and Simplex® Series Fifth Wheels **10.12**
Fontaine 5000 Series Fifth Wheels **10.20**
Premier Trailer Couplings **10.28**
Holland Trailer Coupling **10.31**

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.

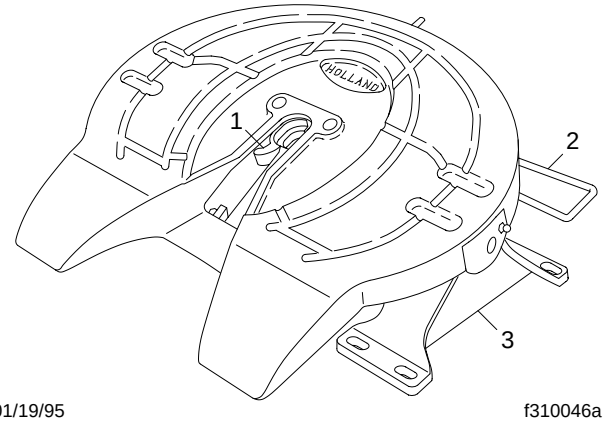
The air-operated release slide assembly (**Fig. 10.2**) contains a double-ended air cylinder which locks and unlocks both sides of the sliding member at the same time. The air cylinder is activated by a two-position air-control valve in the tractor cab.

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 sides of the sliding member. A hook is used to move the lever to the locked and unlocked positions.

Type "B" Kingpin Lock Mechanism (Fig. 10.5)

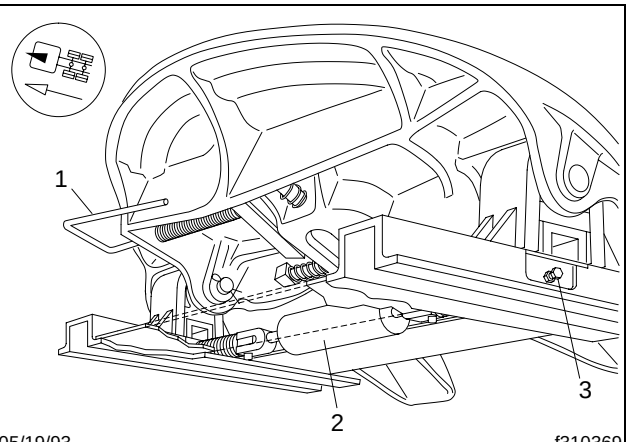
The Type "B" kingpin lock mechanism utilizes two spring-loaded lock halves. The final forward motion of the kingpin into the open lock halves forces the locks to



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1. Kingpin Lock Mechanism
2. Kingpin Control Handle
3. Mounting Bracket

Fig. 10.1, Holland Fifth Wheel



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NOTE: Baseplate rails not shown.

1. Kingpin Lock Control Handle
2. Double-Ended Air Cylinder
3. Slide Plunger Release

Fig. 10.2, Air-Operated Release Slide Assembly

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.

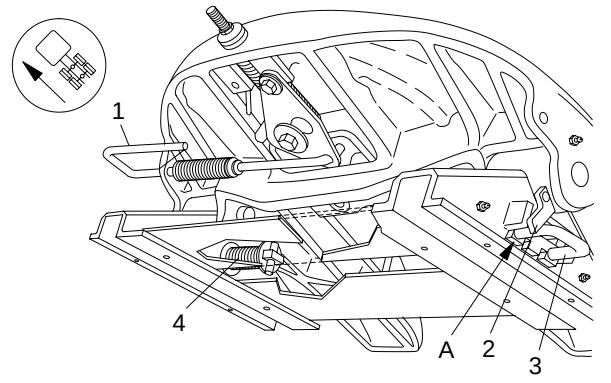
The adjustment nut will compensate for wear on the lock or kingpin.

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.



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NOTE: Baseplate rails not shown.

A. Slide plunger must be flush with mounting bracket when locked.

1. Kingpin Lock Control Handle
2. Plunger Holdout Latch
3. Slide Plunger Release Handle (one side each)
4. Plunger Release Spring

Fig. 10.3, Double Manual Release Slide

Fifth Wheel Locking Operation

Locking the Fifth Wheel Mechanism

⚠ CAUTION

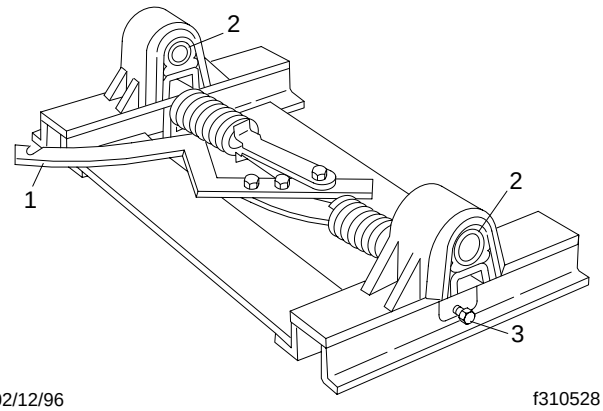
Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position (flush with the mounting bracket edge). This prevents the sliding member from moving rapidly to the far forward or rearward position, which could 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, refer to the frame and fifth wheel section in the vehicle maintenance manual.



1. Release Lever
2. Up-Shock Bushing
3. Plunger Adjustment

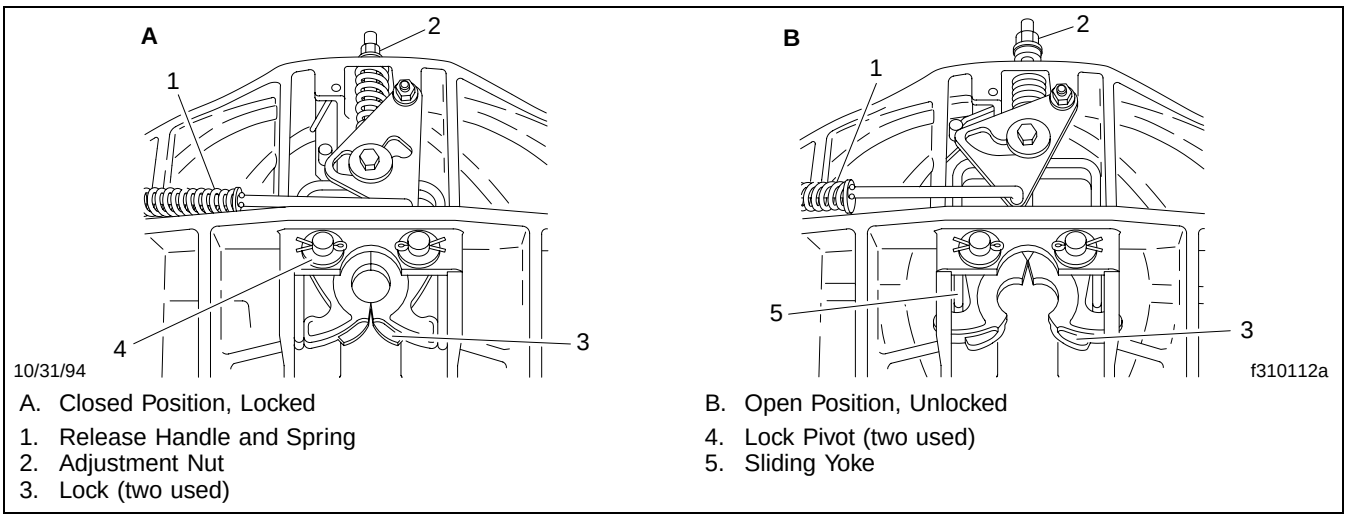
Fig. 10.4, Single Manual Release Slide

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.

⚠ WARNING

Adjust the locks correctly to a maximum clearance of 1/8 inch (3.2 mm). Incorrect adjustment of the lock could cause a trailer 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 chocks. Check for kingpin clearance in the lock. If more than 1/8-inch (3.2-mm) clearance exists between the kingpin and the lock, the lock must be adjusted. Refer to the frame and fifth wheel section in the vehicle service manual for adjustment procedures.
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.



A. Closed Position, Locked
1. Release Handle and Spring
2. Adjustment Nut
3. Lock (two used)

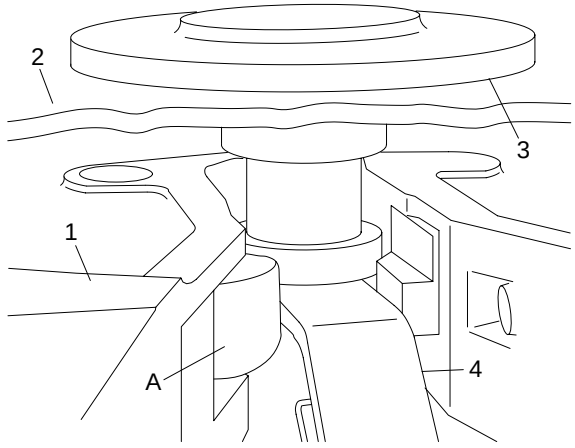
B. Open Position, Unlocked
4. Lock Pivot (two used)
5. Sliding Yoke

Fig. 10.5, Type B Kingpin Lock Mechanism (bottom view)

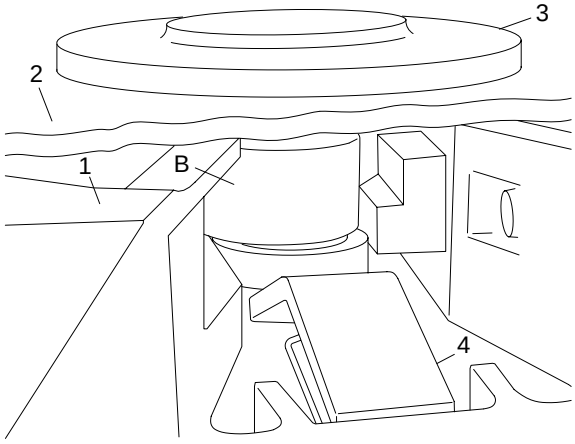
8. Charge the air brake system with air. Make sure that the air connections do not leak.
9. Retract the trailer landing gear and secure the ratchet handle.
10. Remove the chocks from the trailer tires.
11. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect 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



D



C

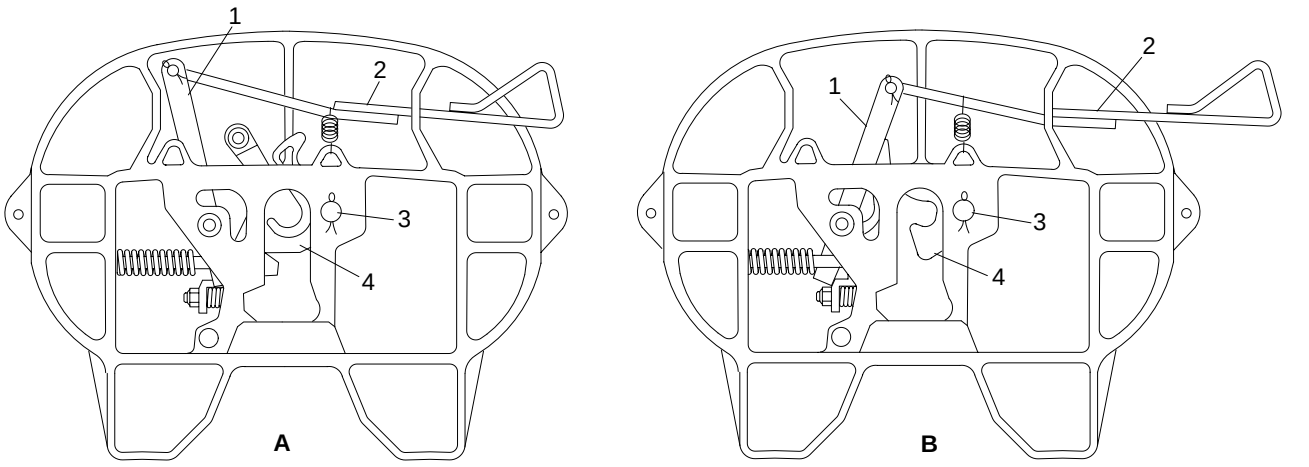
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A. Locks open.
B. Locks closed.
C. Kingpin correctly entering the lock. Note how the depressed tongue allows lock halves to close completely around the neck and shoulder of the kingpin.
D. Kingpin incorrectly entering the lock. Note how the steel tongue prevents lock halves from closing, preventing false lockup.

1. Fifth Wheel Plate
2. Trailer
3. Kingpin
4. Lockguard

Fig. 10.6, Lockguard Mechanism (rear view)



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A. Closed Position, Locked
1. Release Arm
2. Release Handle

B. Open Position, Unlocked
3. Lock Pin
4. Hinged Lock

Fig. 10.7, Type "A" Kingpin Lock Mechanism

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.
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 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 (see **Fig. 10.8**) to UNLOCK.

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**.

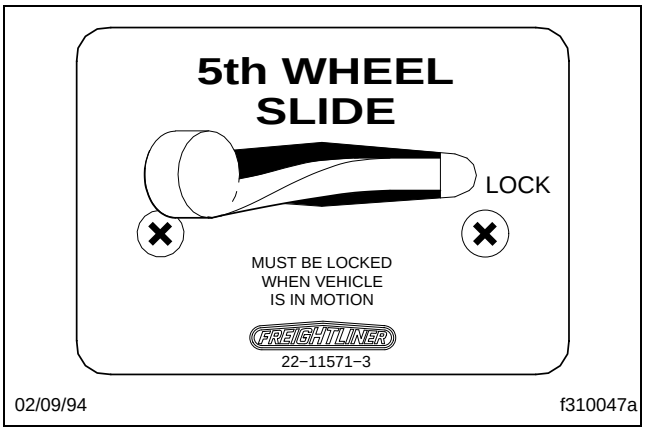


Fig. 10.8, Fifth Wheel Slide Control Switch

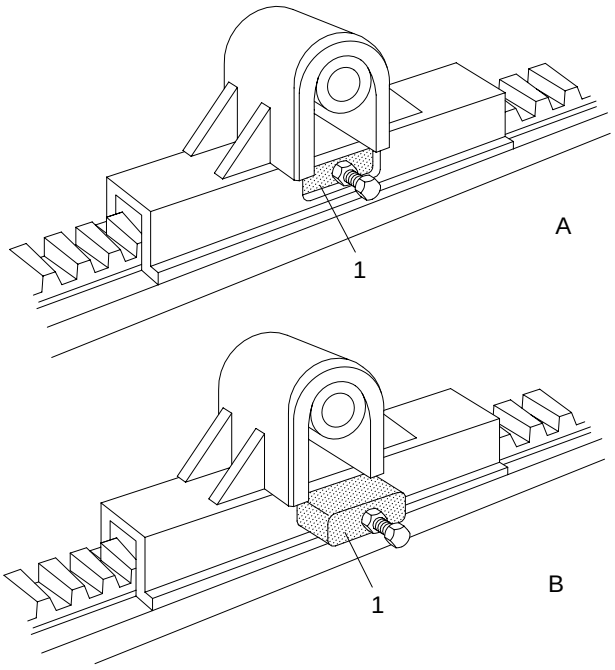
3. Lower the trailer landing gear just enough to remove the weight from the tractor.

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.



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A. Locked (engaged)
B. Unlocked (disengaged)
1. Plunger

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.

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 plungers to enter the fully locked position.

8. Lock the sliding member into position using one of the following methods:

⚠ WARNING

Physically check to be sure that the slide plungers are in the locked position (flush with the mounting bracket edge). 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**.

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 improperly 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

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 wheelplate, could result in erratic steering. For lubrication instructions, refer to the frame and fifth wheel section in the vehicle maintenance manual.

ASF Castloc® II and Simplex® Series Fifth Wheels

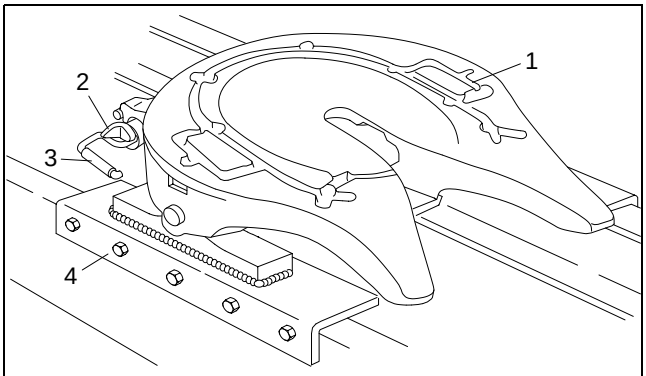
General Information

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).

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 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.

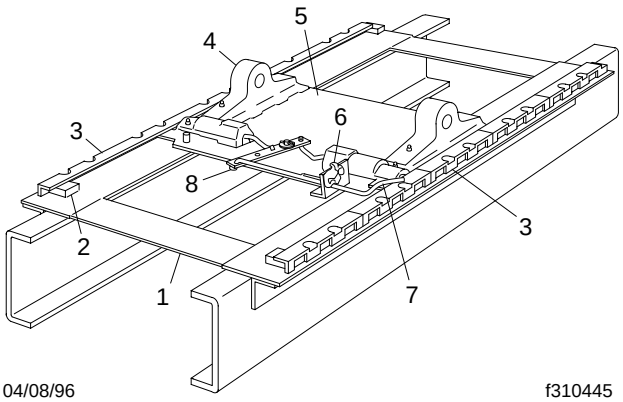
Tapered slots in the baseplate rails, aligned in 4-inch (102-mm) increments, provide for location of the fifth wheel along the baseplate. Retractable, spring-actuated lockpins are positioned through the slots to hold the fifth wheel in the desired position. The lockpins are retracted either manually or by an air-operated cylinder controlled from the cab.



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1. Lubricant Grooves
2. Safety Latch
3. Operating Rod
4. Mounting Bracket

Fig. 10.10, Simplex Stationary Fifth Wheel



1. Baseplate
2. Baseplate Rail
3. Fifth Wheel Mount
4. Slider Saddle Plate
5. Safety Latch
6. Operating Rod
7. Operating Lever
8. Bolted Stop

Fig. 10.11, Taperloc Slide, Manually-Operated Release

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.

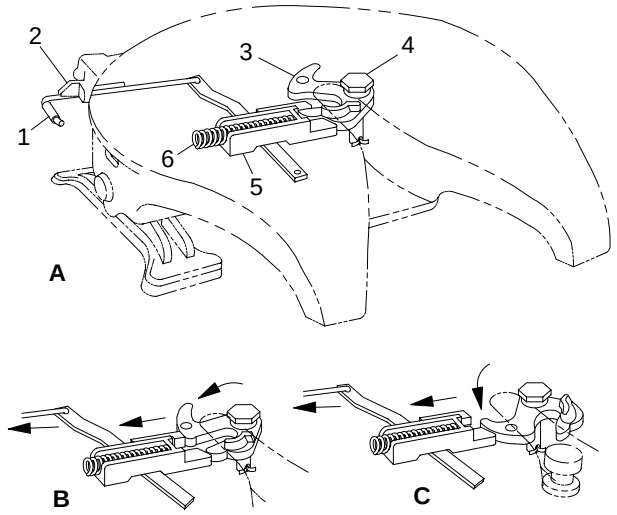
Fifth Wheel Lock Mechanism for Trailer Kingpin (Fig. 10.12)

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 kingpin 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**.

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



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A. Locked Position
B. Jaw movement compresses spring.
C. Fully open.

1. Operating Lever
2. Safety Latch
3. Jaw
4. Jaw Eccentric Pin
5. Lock
6. Spring

Fig. 10.12, ASF Castloc II and Simplex Series Kingpin Locking Mechanism Operation

the safety latch swings freely over the operating rod. See **Fig. 10.14**.

Fifth Wheel Locking and Unlocking

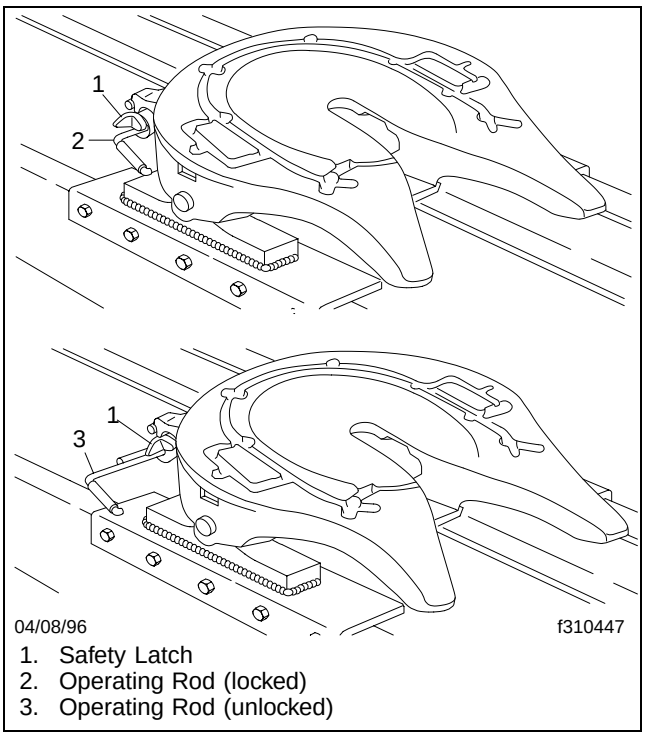
Locking the Fifth Wheel Lock Mechanism

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.

CAUTION

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 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, refer to the frame and fifth wheel section in the vehicle maintenance manual.



1. Safety Latch
2. Operating Rod (locked)
3. Operating Rod (unlocked)

Fig. 10.13, Simplex Kingpin Locking Mechanism, Locking and Unlocking

⚠ WARNING

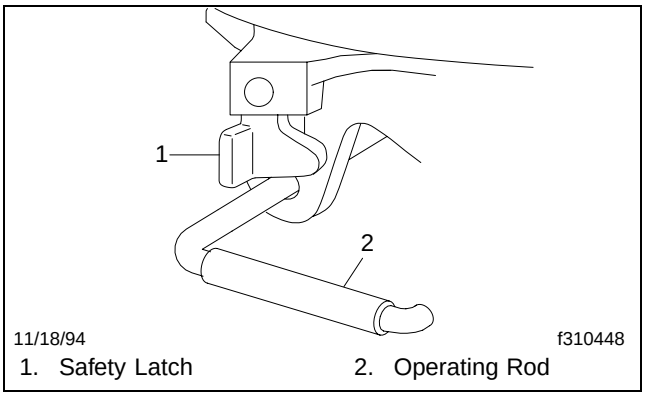
Keep the fifth wheel plate lubricated to prevent binding between the tractor and trailer. A binding fifth wheel could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

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.



1. Safety Latch 2. Operating Rod

Fig. 10.14, Simplex Kingpin Locking Mechanism, Safety Latch (locked position)

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 is there is more than 1/8-inch (3.2-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 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, refer to the frame and fifth wheel section in the vehicle workshop 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 incorrectly 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 an air-operated kingpin lock release: Pull the air-release knob on the dash. *From outside the cab,* visually check that the operating rod has bottomed out against the plate casting above the hole. See **Fig. 10.13**. If the operating rod isn't in the unlocked position, back the tractor slightly to release the kingpin force against the jaw.

IMPORTANT: If equipped with an air-operated lock release, you still must make a visual check of the operating rod to make sure it is in the unlocked position

7. Slowly drive the tractor away from the trailer.

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. 10.15**) to UNLOCK.

   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.

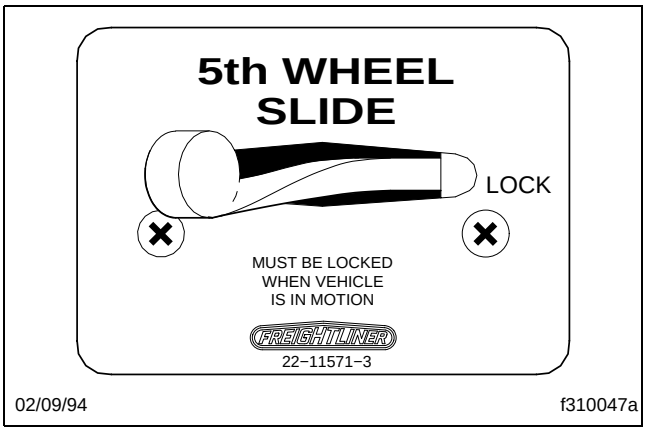


Fig. 10.15, Fifth Wheel Slide Control Switch

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

Visually check to be sure that the lockpins are seated in the holes and the operating rod is in the locked position with the safety latch securing the operating rod. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, 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 baseplate 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 baseplate 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.

   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 incorrect 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 top plate lubricated to prevent binding between the tractor and the 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, refer to the frame and fifth wheel section in the vehicle maintenance manual.

Fontaine 5000 Series Fifth Wheels

General Information

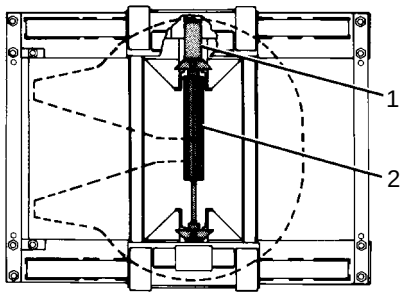
On Fontaine fifth wheels kingpin release is accomplished by activating a manual lock control handle located on either the right side (curbside) or left side (roadside) of the fifth wheel. Kingpin lockup occurs when the kingpin is forced into the jaws and the lock control handle moves to the locked position.

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.

Tapered holes are evenly spaced along the slider rails. Retractable lockpins are positioned through the holes to hold the fifth wheel in the desired position. See **Fig. 10.16** or **Fig. 10.17**.

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 slider 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.



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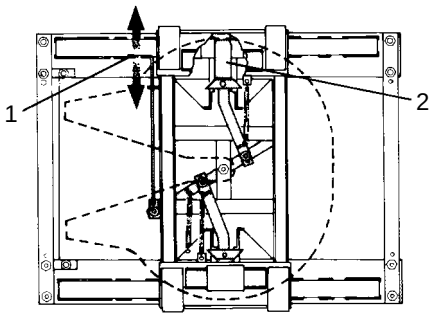
1. Lockpin (each side) 2. Air Cylinder

Fig. 10.16, Fontaine 5000 Series Air-Operated Sliding Fifth Wheel (top view)

The manual release slide contains a slide locking control handle located on the left side (roadside) of the fifth wheel, which locks or unlocks the fifth wheel slide. See **Fig. 10.17**.

Fifth Wheel Lock Mechanism for Trailer Kingpin (See Fig. 10.18)

The Fontaine fifth wheel lock mechanism for the trailer kingpin consists of a spring-loaded jaw and a sliding wedge.



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1. Slider Locking Control Handle
2. Lockpin (each side)

Fig. 10.17, Fontaine 5000 Series Sliding Fifth Wheel, Manual Release (top view)

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.

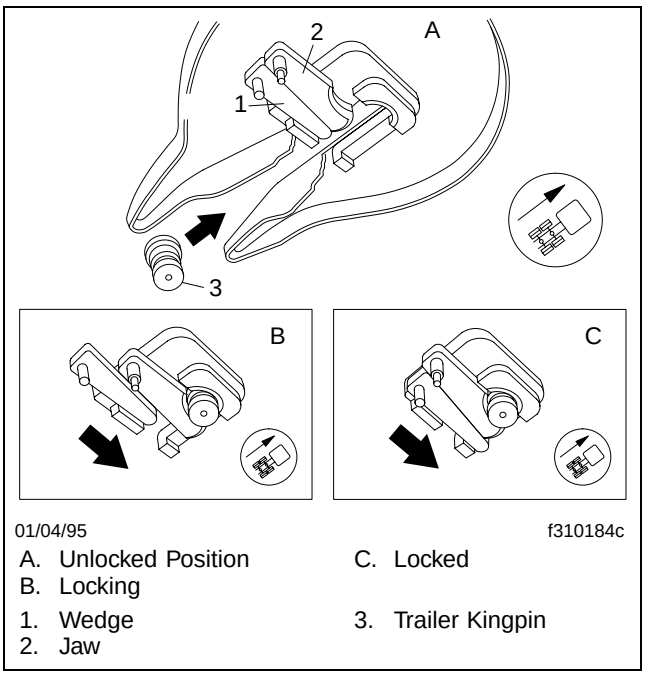


Fig. 10.18, Fontaine Kingpin Lock Mechanism

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

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.

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.

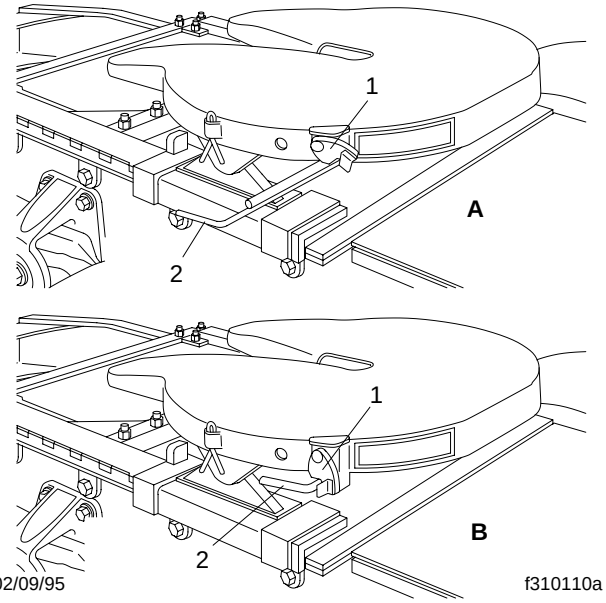
2. The kingpin lock mechanism must be fully open and the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, refer to the frame and fifth wheel section in the vehicle maintenance manual.
3. Position the tractor so that the fifth wheel lock opening is in 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.
8. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to 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.



NOTE: Make sure the safety latch is down when the control handle is locked.

A. Unlocked
B. Locked
1. Safety Latch
2. Lock Control Handle

Fig. 10.19, Fontaine 5000 Series Fifth Wheel, Locking and Unlocking

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 slide 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 (**Fig. 10.20**) 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. 10.21**) 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.

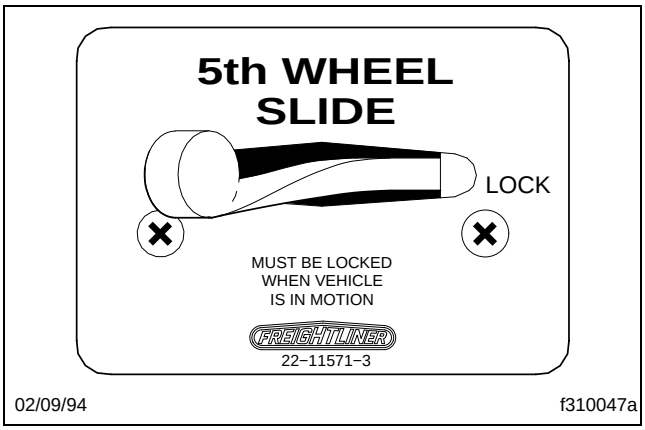


Fig. 10.20, Fifth Wheel Slide Control Switch

4. Pull the trailer air supply valve to cut off the air supply to the trailer.

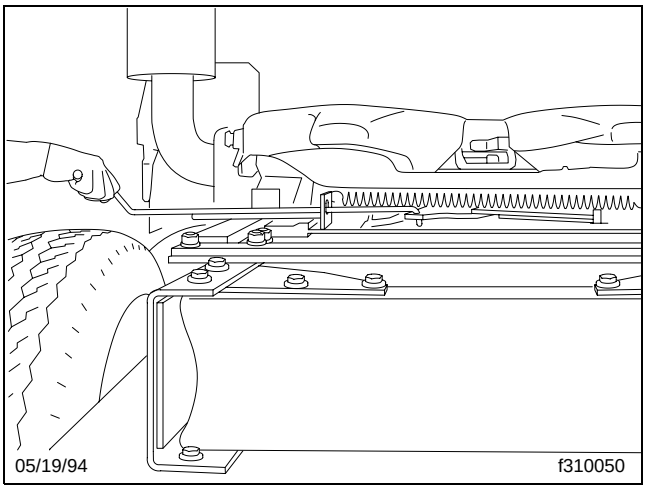


Fig. 10.21, Fontaine 5000 Series Sliding Fifth Wheel Manual Release

⚠ 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.

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

Physically check to be sure that the lockpins are seated in the holes. 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 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 improperly 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

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 wheelplate, could result in erratic steering. For lubrication instructions, refer to the frame and fifth wheel section in the vehicle maintenance manual.

Premier Trailer Couplings (See Fig. 10.22 and Fig. 10.23)

General Information

Trailer couplings, used only on trucks, are attached to the rear closing crossmember.

The Premier 260 and 460 trailer couplings (**Fig. 10.22**) have a rigid pintle hook and are air-adjusted. An air chamber, mounted forward of the coupling, operates a pushrod 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.

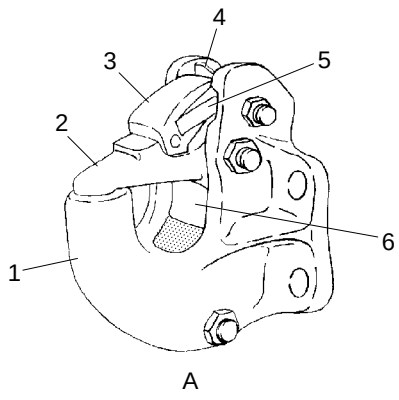
The Premier 690 trailer coupling (**Fig. 10.23**) has a moveable pintle hook, and is non-air adjusted. It is used for heavy-duty applications.

Operation

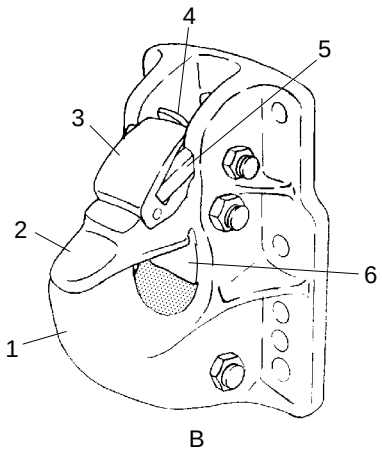
Trailer Hookup

1. Chock the front and rear tires of the trailer.
2. Open the coupling.

Models 260 and 460 (**Fig. 10.22**): 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.



A



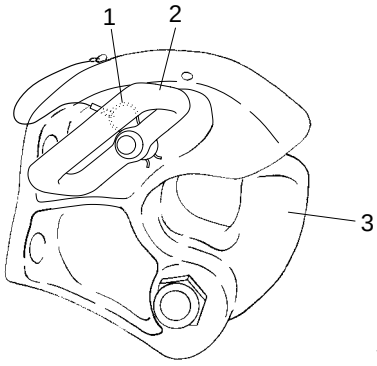
B

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A. Model 260
B. Model 460

1. Pintle Hook
2. Latch
3. Pawl Assembly
4. Pawl Lock
5. Pawl Wedge
6. Shoe

Fig. 10.22, Premier 260 and 460 Trailer Couplings



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1. Linch Pin
2. Handle
3. Pintle Hook

Fig. 10.23, Premier 690 Trailer Coupling

Model 690 (**Fig. 10.23**): Remove the linch pin 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 linch pin.

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.

   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 linch pin 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 (See Fig. 10.24)

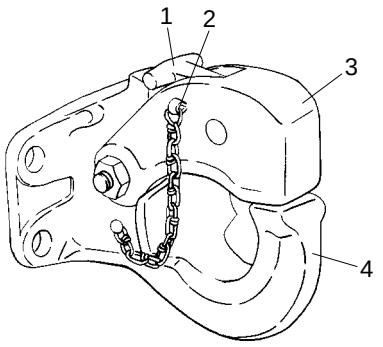
General Information

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. It is a non-air adjusted coupling.

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.



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1. Lock
2. Cotter Pin
3. Latch
4. Pintle Hook

Fig. 10.24, Holland PH-T-60-AL Trailer Coupling

5. Close the latch, then insert the cotter pin.
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 Inspection and Daily Maintenance

Pretrip Inspection Checklist **11.1**
Pretrip Inspection and Daily Maintenance Procedures **11.3**

Pretrip Inspection Checklist

The following pretrip inspection checklist helps ensure that the vehicle components are in good working condition before each trip.

Pretrip inspections cannot be performed in a short period. In checklist form, the sequence below may seem to be overly time-consuming. However, careful pretrip inspections save time by eliminating stops later to adjust items overlooked or forgotten.

Numbers in parentheses within each of the checklist steps reference the corresponding detailed instructions found under "Pretrip Inspection and Daily Maintenance Procedures."

If any system or component does not pass this inspection, it must be corrected before operating the vehicle see the *FLC 112 Conventional Service Manual* for repair procedures, and see the *Heavy-Duty Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

1. Apply the parking brakes and chock the tires.
2. Drain the air brake system air tanks (1).
3. Inspect the batteries and battery cables (2).
4. Check the fluid level in the windshield washer reservoir (3).
5. Check the wheel bearing lubricant level (4).
6. Tilt the hood. Examine the steering gear components (5).
7. Check the coolant level in the radiator (6) and check the radiator and charge air cooler fins for clogging or damage (7). Check the radiator for coolant leaks.
8. Check the condition of the coolant hoses and heater hoses (8).
9. Check the condition of the drive belts (9).
10. Inspect the engine for fuel, oil, and coolant leaks.
11. Inspect the engine and chassis wiring (10).
12. Inspect the air intake system for leaks or damage (11). Check the intake-air restriction indicator.
13. Check the engine oil level (12).
14. Close the hood and engage the hood hold-down latches.

    Close the drain valves on the air brake system air tanks.
15. Inspect the fuel tank(s) and fuel line connections. If so equipped, be sure the fuel tank shutoff valves are open (13). Check the fuel level in the fuel tank(s) and be sure the fuel cap vent area is clean (14). If equipped with a fuel/water separator, check the sight glass. Drain any water found (15). Also check the fuel/water separator for leaks.

16. If so equipped, check the transmission oil cooler for debris and for leaks.
17. If so equipped, inspect the fifth wheel (16) and check it for adequate lubrication (17).
18. Inspect the front and rear suspension components, including the springs, spring hangers, equalizers, and shocks (18).
19. If so equipped, check that the exhaust rain cap covers the top of the exhaust stack.
20. Clean the headlights, rearview and downview mirrors, and the outside of the windshield and all window glass. Check the condition of the windshield wiper arms and blades (19).
21. Clean the inside of the windshield, the gauges on the dash, and all window glass.
22. Check for excessive play at the steering wheel (20).
23. Adjust the driver's seat, then align the rearview and downview mirrors.
24. Check the clutch free pedal and clutch brake squeeze (21).
25. Check the seat belts and, if so equipped, the tether belts for secure mounting and for damage (22).
26. Check the cab interior for loose items and secure or remove them. Check the emergency equipment and warning devices (23).
27. Turn on the ignition and start the engine. Be sure the oil- and air-pressure warning systems are operating (24). Leave the engine running.
28. Make sure the headlights, turn signals, electric horn and air horn, windshield wipers and washer, heater and defroster, and mirror heat (if so equipped) are operating properly (25).
29. Check the operation of the interaxle differential if so equipped.
30. Check the operation of the backup alarm if so equipped.
31. Turn on the lights. Check the operation of all gauge lights and interior lights (26). Leave the lights on.
32. If not already done, hook the trailer(s) to the vehicle.

    Whether or not the trailer was already hooked to the vehicle, check the following:

    - Make sure all fifth wheel connections are engaged and locked (27). If so equipped, check the operation of the fifth wheel air slide. Check that all connections to the dolly or trailer hitch and safety chains are secure.
    - Make sure the gladhands in front of each trailer are engaged and that all air hoses are properly suspended.

- Make sure the air shutoff valves are turned on and air is available to the lines on the trailer(s). The air shutoff valve at the back of the last trailer must be turned off.
- Make sure all light cables are connected and correctly suspended. Check that all trailer lights are working.
- On semi-trailers, make sure the landing gear supports are raised and the handles are secure.

NOTE: See the trailer manufacturer's detailed trailer inspection procedures for additional information.

33. If so equipped, see if the exhaust rain cap opens as the engine is accelerated. Turn the engine off.
34. Make sure all of the lights are working, including the brake lights, fog lights (if so equipped), high- and low-beam headlights, clearance lights, and four-way flashers (28). Check the condition of the reflectors. Turn the lights off.
35. Check the outer surfaces of the hood, cab, and trailers for visible surface breaks and damage. Make sure the trailer doors are secure.
36. Inspect the air brake components, including the brake chamber pushrods, air reservoirs, and air lines (29).
37. Make sure the brakes are adjusted on all axles (30).
38. Check the tire inflation pressures (31) and inspect each tire for bulges, cracks, cuts, and penetrations (32).
39. Check for indications of loose wheel nuts or rim nuts and examine each rim and wheel component (33).
40. Check the air brake system for proper operation (34).
41. Remove the chocks from the tires. Release the spring parking brakes, then test the fifth wheel hookup by slowly pulling the tractor away from the trailer while applying the trailer brakes with the trailer hand control valve lever.
42. Test the service brakes before leaving the lot (35).
43. Test the parking brakes on a 20 percent grade (36).

Pretrip Inspection and Daily Maintenance Procedures

Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *FLC 112 Conventional Service Manual* for procedures and specifications, and see the *Heavy-Duty Trucks Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

1. Air reservoirs serve as storage tanks for compressed air. They collect water condensed from the

air and small amounts of oil from the air compressor. Water and oil normally enter the 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:

⚠ WARNING

Failure to drain the air reservoirs as instructed could cause sludge formation in the air brake system. Sludge could adversely affect braking, causing loss of control, which could cause injury or damage.

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.

NOTE: If the air reservoirs are not equipped with automatic drain valves, they must be drained daily. If they are equipped with automatic drain valves, they must be drained in this same manner at least once a week.

1.1 Open the wet tank valve (the drain cock or pull chain drain located on the forward end of the supply air reservoir which is connected directly to the air compressor). Block the valve open.

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.

1.3 Water and oil emulsion often forms pockets which 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.

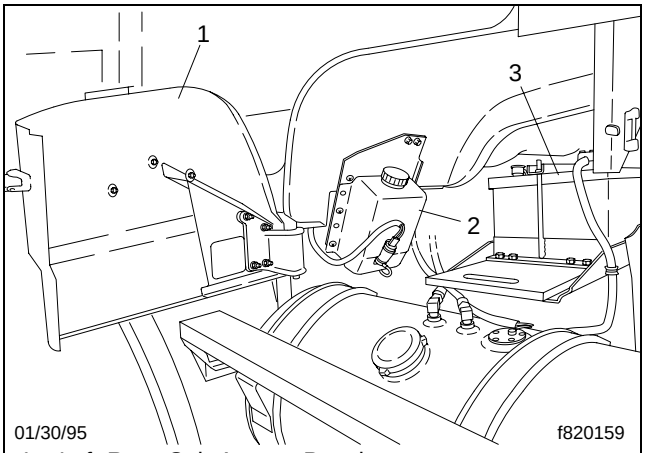
2. Inspect the batteries and battery cables as follows:

⚠ 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.

2.1 Unlatch the left rear cab access panel and pull it open. See **Fig. 11.1**. Be sure the battery hold-down is securely held in place. If it is loose, tighten the hold-down bolts; if it is broken, replace it.

2.2 If equipped with maintenance-free batteries 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 clear, the battery has a low level of electrolyte and must be replaced.



1. Left Rear Cab Access Panel
2. Windshield Washer Reservoir
3. Batteries

Fig. 11.1, Inspect the Batteries, Battery Cables, and the Windshield Washer Reservoir

CAUTION

Care must be taken to keep the vent plugs tight so that the neutralizing solution does not enter any of the battery cells.

2.3 Remove any corrosion from the hold-down and the top of the battery. Use diluted ammonia or a soda solution to neutralize the acid present, then rinse off the ammonia or soda solution with clean water.

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.

3. Check that the windshield washer reservoir is filled. See **Fig. 11.1**. Add washer fluid as needed. Close and latch the access panel.

   On right-hand drive vehicles, the windshield washer reservoir may be mounted under the right hand side of the cab.

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.

4. Observe the level of the wheel bearing lubricant in the hub cap at each end of the front axle and, if

needed, fill the hubs to the level indicated on the hub cap. Use the lubricant recommended for use in the drive axle. 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.

5. Examine the steering gear mounting bolts, pitman arm nut, and the drag link nuts for tightness. See **Fig. 11.2**. Be sure the steering driveline and the U-joints are in roadworthy condition, without cracks, breaks, looseness, or other damage. If so equipped, check the right side power cylinder mount bolts and ball-joint nuts for tightness. See **Fig. 11.3**. Tighten loose nuts and replace damaged parts as needed. See ***Group 46*** of the *FLC 112 Conventional Service Manual*.

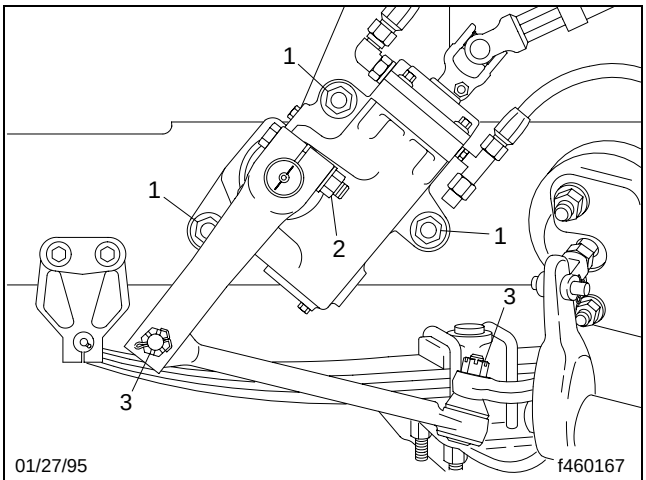
   On right-hand drive vehicles, the steering gear components are installed on the right frame rail.

⚠ CAUTION

Coolant must be filled to the bottom of the radiator filler neck. Low coolant could result in engine overheating, which could cause engine damage.

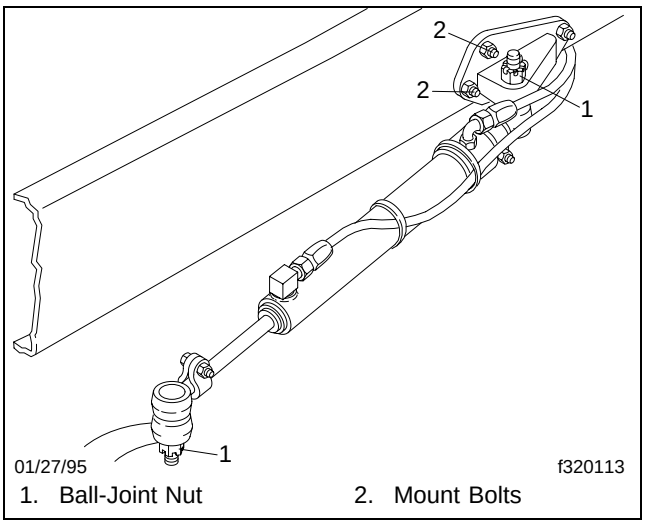
6. Check the coolant level in the radiator. See **Fig. 11.4**. If the coolant is low, check the amount of antifreeze protection. If the protection is adequate, add a 50/50 mixture of water and antifreeze. If additional protection is needed, add antifreeze only. Fill the radiator with coolant to the level of the bottom of the radiator filler neck.

7. Good airflow through the radiator core and charge air cooler core is essential for proper engine cooling. The cores allow air passage, but form a particle



1. Steering Gear Mounting Bolt
2. Pitman Arm Pinch Bolt Nut
3. Drag Link Nut

Fig. 11.2, Steering Gear Fasteners



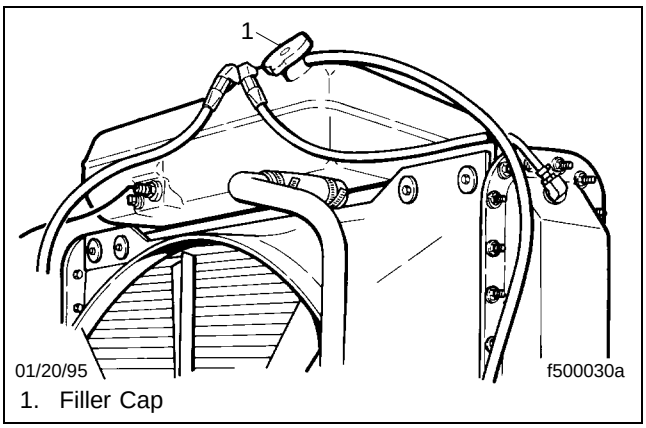
1. Ball-Joint Nut
2. Mount Bolts

Fig. 11.3, Right Side Power Cylinder Fasteners

barrier which tends to collect insects and airborne debris.

Inspect for clogged fins. Use compressed air or water directed from the fan side of the core to back flush any material restricting airflow.

On vehicles equipped with air conditioning, also inspect and clean the condenser. If clogged, the condenser can restrict airflow through the radiator.



1. Filler Cap

Fig. 11.4, Check the Coolant Level

Bent or damaged fins should also be straightened to permit airflow across all areas of the cores.

Repair or replace the radiator if it is leaking. See ***Group 20*** of the *FLC 112 Conventional Service Manual* for instructions.

NOTE: When traveling through areas of high insect concentrations, it may be necessary to clean the exterior of the radiator or charge air cooler core as often as every 200 miles (320 km).

8. Make sure the radiator inlet and outlet coolant hoses and heater hoses are pliable and are not

cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning. 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 *Parts Book* or contact your Freightliner Dealer.

Tighten hose clamps as necessary, but do not overtighten as hose life can be adversely affected.

Be sure the hose support brackets are securely fastened. Make sure the hoses are not located near sources of wear, abrasion, or high heat.

9. Check the fan belt(s), alternator belt, and refrigerant compressor belt for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, replace the belt, following the instructions in ***Group 01*** of the *FLC 112 Conventional Service Manual*.

   Check all of the belts for proper tension. Use your index finger to apply approximately 25 pounds (11 kg) of force at the center of the belt free-span. See **Fig. 11.5**. Deflection should be one belt thickness per foot (305 mm) of belt free-span. If the tension is more than or less than this value, measure it with a belt-tension gauge, and adjust it to the proper tension. See ***Group 01*** of the *FLC 112 Conventional Service Manual* for instructions.

10. Inspect the engine and chassis for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.

11. Check the intake-air restriction indicator to determine if the air cleaner filter element needs to be changed. See **Fig. 11.6**.

    If the recorded indicator reading equals or exceeds the value shown in **Table 11.1** for maximum air restriction at *full load* and governed rpm, push the reset button on the dash-mounted or intake-duct-

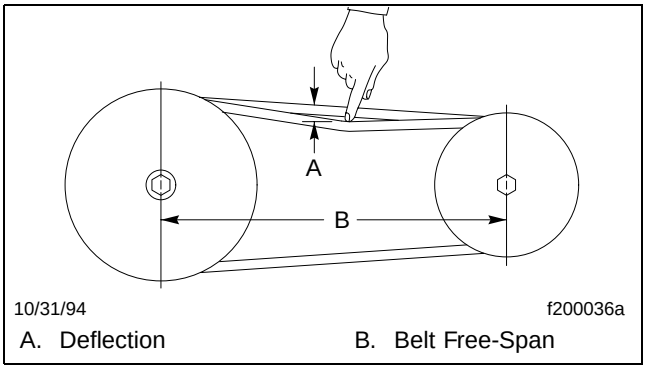


Fig. 11.5, Checking Belt Tension

mounted indicator. Then operate the engine at *no load* and governed rpm and compare the indicator reading with the value shown in **Table 11.1** for maximum air restriction at *no load* and governed rpm.

If air restriction equals or exceeds the value shown in **Table 11.1** for maximum air restriction at *no load* and governed rpm, replace the air cleaner element using the instructions in ***Group 09*** of the *FLC 112 Conventional Service Manual*. After replacing the filter element, reset the restriction indicator by pressing the rubber reset button.

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 replace damaged components. Make sure the piping system is airtight so that all intake air passes through the air cleaner.

⚠ CAUTION

Failure to maintain a sealed air intake system could allow entry of dirt and contaminants into the engine. This could adversely affect engine performance and could result in engine damage.

12. Check the engine oil level. See **Fig.11.7**. If the oil is low, add enough oil to bring the level up to the high ("H") or "full range" mark on the dipstick. See the engine manufacturer's operation and maintenance manual for recommended lubricants.

⚠ CAUTION

Operating the engine with the oil level below the low ("L") mark or above the high mark could result in engine damage.

IMPORTANT: Some dipsticks installed on Caterpillar 3176 and 3406 engines use a "full range" mark instead of a high ("H") mark. If you wish to determine the correct

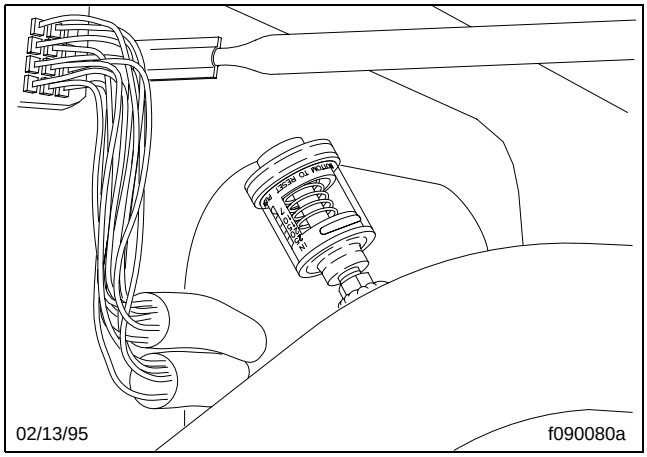


Fig. 11.6, Air Restriction Indicator

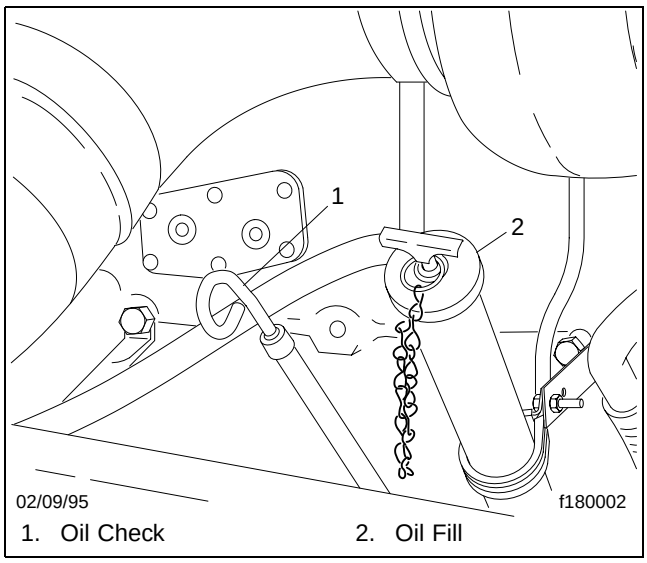
Maximum Air Restriction		
Engine	**At Full Load and Governed RPM**	**At No Load and Governed RPM**
Caterpillar	25	12
Cummins	25	12
Detroit Diesel	20	10

Table 11.1, Maximum Air Restriction (in inches of water)

full or high mark on these dipsticks, calibration of the dipstick is required. For information on calibrating these dipsticks, see the applicable Caterpillar Maintenance and Operation Manual.

13. Inspect the fuel tanks, fuel lines, and connections for leaks. Replace leaking fuel tanks. Repair or replace any lines or connections that are leaking. For procedures, see ***Group 47*** of the *FLC 112 Conventional Service Manual*.

    If equipped with fuel tank shutoff valves, be sure the valves are fully open.



1. Oil Check 2. Oil Fill

Fig. 11.7, Oil Level Checking (Cummins L10 shown)

⚠ WARNING

Never operate the engine with the fuel tank shutoff 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.

14. Check the fuel level in the tank(s). To keep condensation to a minimum, the fuel tanks should be filled at the end of each day but not to more than 95 percent of liquid capacity. Federal regulations prohibit filling a fuel tank to more than 95 percent of its liquid capacity. Select the proper grade of fuel as specified by the engine manufacturer.

⚠ 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. When filling fuel tanks, do not smoke or use an open flame near the fuel tanks; combustion of diesel fuel oil or fuel vapors could result.

IMPORTANT: Use only low-sulfur diesel fuels. Low-sulfur diesel fuels have a maximum 0.05 percent sulfur content compared to a 0.26 to 0.30 percent sulfur content. Failure to use low-sulfur diesel fuels may void the warranty on emission components.

14.1 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.

14.2 Before installing the fuel cap, check the vent area (annular opening between the casting and the top stamped cover plate). Clean the area with a rag, or if necessary, clean the cap with solvent. Make sure the fuel cap vent is open.

⚠ CAUTION

Don't crank the engine for more than 30 seconds at a time during any of the following procedures. Wait two minutes after each try to allow the starter to cool. Failure to do so could cause starter damage.

IMPORTANT: Before doing any of the following procedures, make sure there is an adequate amount of fuel in the tank(s). Do not fill the tank(s) to more than 95 percent of liquid capacity.

14.3 On vehicles equipped with a single tank, prime the fuel system, if needed. On vehicles with dual tanks, go to the next substep.

If the engine is equipped with a priming pump, do the following:

Unlock and operate the engine priming pump plunger until resistance is felt.

Push the plunger in and tighten it by hand.

Start the engine. If it doesn't start, more priming is needed. Once the engine has started, it may run rough. If this occurs, run the engine at low idle until it runs smoothly.

If the engine is not equipped with a priming pump, do the following:

Remove the fuel tank cap.

Loosen the fuel supply line at the fuel transfer pump.

Partially cover the fuel tank opening with your hand. Using an air hose, apply no more than 5 psi (35 kPa) air pressure to the fuel tank and look for a constant fuel flow at the loosened fuel supply line.

Remove the air hose and tighten the fuel supply line.

Start the engine. Once the engine has started, it may run rough. If this occurs, run the engine at low idle until it runs smoothly.

IMPORTANT: To prevent fuel loss or entry of air into a fuel line, make sure that all fuel line connections are tight.

14.4 On vehicles equipped with dual tanks and dual suction and return lines, prime the fuel system if needed.

Disconnect the fuel return line from the primary tank and plug the tank return port.

Open (if necessary) the control valve to each tank to allow fuel flow between the tanks.

Remove the fuel tank cap from each tank.

Partially cover the fuel tank opening with your hand. Using an air hose, apply no more than 5 psi (35 kPa) air pressure to the primary tank to fill the supply lines with fuel. Apply air pressure until air bubbles appear. Close the control valve to the secondary tank.

Loosen the fuel supply line at the fuel transfer pump.

Using an air hose, apply no more than 5 psi (35 kPa) air pressure to the primary tank and look for a constant fuel flow at the loosened fuel supply line.

Remove the air hose and tighten the fuel supply line.

Remove the plug from the primary tank's return port and connect the fuel return line.

Open the control valve to the secondary tank. Install the fuel tank caps.

Start the engine. Once the engine has started it may run rough. If this occurs, run the engine at low idle until it runs smoothly.

IMPORTANT: To prevent fuel loss or entry of air into a fuel line, make sure that all fuel line connections are tight.

14.5 On vehicles equipped with dual tanks and single suction and return lines (with crossover line), prime the fuel system if needed.

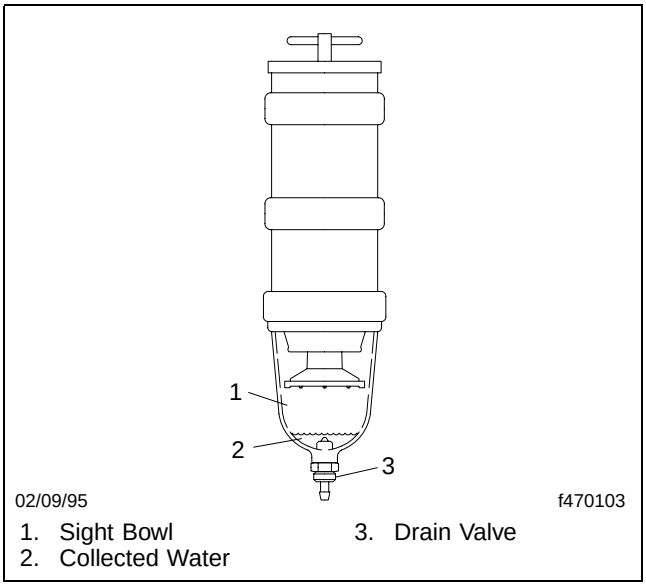
Use the same procedure provided previously for vehicles equipped with a single tank. Do the procedure on the tank equipped with the supply line.

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.

15. Drain the water from the fuel/water separator as follows:

– *For a Racor Model 1000FG* (**Fig. 11.8**): 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* (**Fig. 11.9**): If the separator is equipped with a fuel filter and the filter has a vent at the top, open the vent. To



1. Sight Bowl
2. Collected Water
3. Drain Valve

Fig. 11.8, Racor Fuel/Water Separator

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 Webb Model 525* (**Fig. 11.10**): Turn the drain valve handle. If nothing flows from the valve, it maybe blocked—use a pencil or screwdriver to clear the valve. Allow the water to drain and close the valve. Start the engine and raise the rpm for two or three minutes to purge any air from the fuel system.

– *For ConMetCo Models* (**Fig. 11.11**): 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.

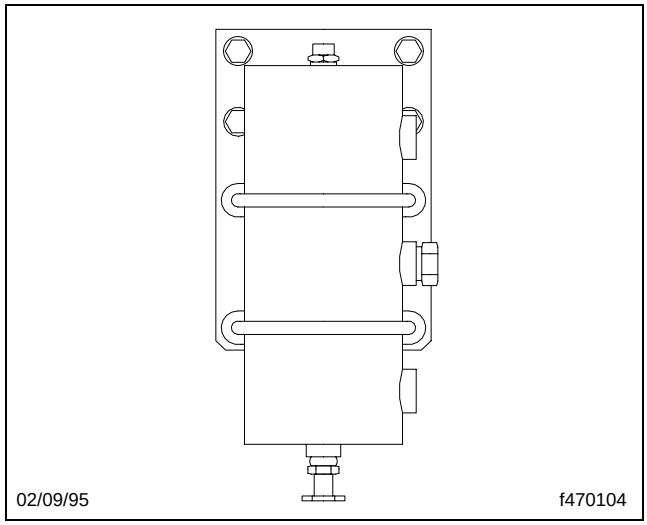


Fig. 11.9, Davco Fuel/Water Separator

16. If so equipped, inspect the fifth wheel.

⚠ WARNING

Physically check to be sure that the trailer is securely connected to the tractor. Failure to achieve complete fifth wheel lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

16.1 If the vehicle is a truck-trailer combination, be sure the trailer hitch is locked and the safety cable or chains are connected. Be sure air hoses and the light cable are connected.

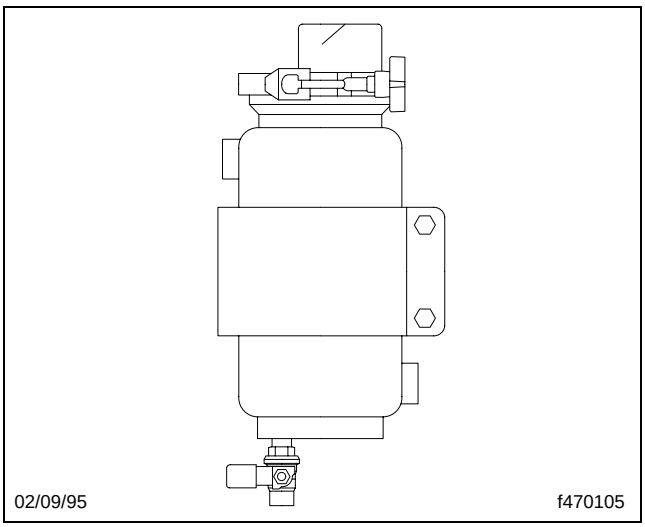


Fig. 11.10, Webb Fuel/Water Separator

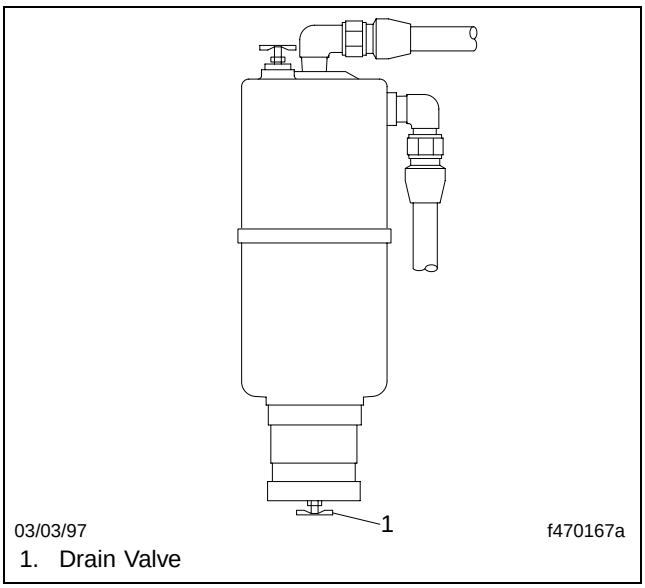
⚠ WARNING

Check the lock mechanisms described above. Otherwise the trailer could disengage from the tractor, possibly resulting in serious personal injury or death.

16.2 If the vehicle is a tractor-trailer combination, check that the fifth wheel lock mechanism is locked to the trailer kingpin. If equipped with a sliding fifth wheel, be sure the sliding portion of the fifth wheel is locked in place. See **Chapter 10** for instructions.

16.3 With the trailer unhooked from the tractor, inspect the fifth wheel (daily) for the following conditions:

- Loose nuts or broken bolts on the fifth wheel assembly, slider mechanism, and mounting brackets. Replace broken bolts and tighten loose nuts.
- Cracks or wear on the fifth wheel assembly, slider mechanism, and mounting brackets. Replace each damaged or worn component.
- Incorrect jaw locking action and cracks or wear on the jaw locking mechanism. Replace the mechanism if cracked or worn; repair it if the jaw locking action is incorrect.
- Gouges or wear on the fifth wheel plate. Replace the plate if damaged or worn.
- Fatigue or cracking of welds, which must be repaired according to the manufacturer's specifications.



1. Drain Valve

Fig. 11.11, ConMetCo Fuel/Water Separator

WARNING

Repair or replace damaged fifth wheel components. Otherwise the trailer could disengage from the tractor, possibly resulting in serious personal injury or death.

NOTE: For adjustment and replacement instructions, see ***Group 31*** of the *FLC 112 Conventional Service Manual*.

17. Before connecting the fifth wheel to the trailer kingpin, always be sure that the fifth wheel plate is completely lubricated with chassis grease.

    Lubricate the fifth wheel top plate and other grease points at least once a week, and more often in severe service.

    Clean all foreign material from the fifth wheel top plate. Lubricate the top plate surface, pickup ramps, and mounting bracket pivot pins, using a waterproof or multipurpose chassis lubricant. Lubricate the jaw mechanism on all units except the Fontaine 5000 series fifth wheel. Fontaine recommends that jaws and wedges remain dry to avoid accumulation of abrasive matter.

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.

18. Inspect the front and rear suspension components, including the springs, shocks, and suspension brackets.

Check for broken spring leaves, loose U-bolts, cracks in the suspension brackets, and loose fasteners in the spring hangers and shackles. Inspect the shock absorbers for loose fasteners and leaks.

Tighten all loose fasteners and replace any component that is worn, cracked, or otherwise damaged.

⚠ WARNING

Do not replace individual leaves of a damaged front or rear suspension leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. On front spring assemblies, if cracks or breaks exist in either of the two top leaves, a loss of vehicle control could occur. Failure to replace a damaged spring assembly could cause an accident resulting in serious personal injury or property damage.

19. Be sure the windshield wiper blades are tensioned against the windshield. Inspect the wiper blades for damage and deteriorated rubber. Replace the wiper arms if the wiper blades are not tensioned against the windshield; replace damaged or deteriorated wiper blades.

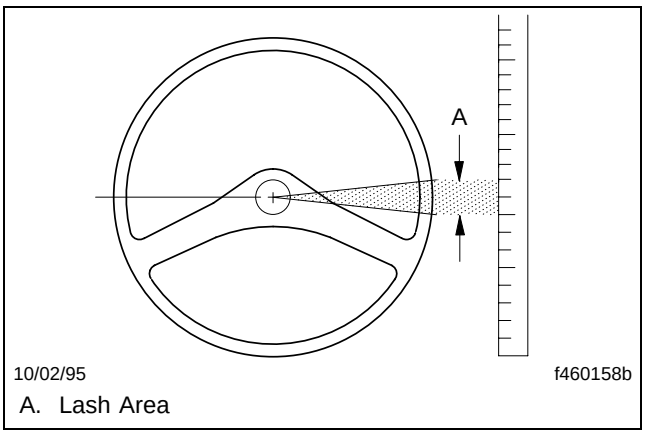
⚠ WARNING

Replace wiper arms and blades whenever necessary to maintain good visibility. Poor visibility could interfere with the driver's ability to control the vehicle, possibly resulting in serious personal injury or death.

20. Check the steering wheel for excessive play. With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels. 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. Measure the lash (free play) at the rim of the steering wheel. See **Fig. 11.12**.

    Excessive lash exists if steering wheel movement exceeds 2-3/4 inches (70 mm) with a 22-inch (550-mm) steering wheel or 2-1/2 inches (64 mm) with a 20-inch (500-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.

21. The main indicators for assessing clutch wear are clutch free pedal and clutch brake squeeze. Clutch free pedal is a decreased resistance felt at the top of the clutch pedal stroke. See **Fig. 11.13**. With the clutch pedal in this range, the clutch is fully engaged and the only resistance to clutch pedal movement is



A. Lash Area

Fig. 11.12, Measuring Lash at the Steering Wheel

the force of the return spring. Clutch free pedal should be approximately 1-1/2 to 2 inches (38 to 51 mm). If the clutch free pedal is less than 1/2 inch (13 mm), the clutch must be adjusted internally.

Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring tension) felt when the pedal is approximately 1 to 1-1/4 inches (25 to 33 mm) from the end of pedal travel. See **Fig. 11.13**. If clutch brake squeeze does not occur until the pedal is less than 1/2 inch (13 mm) from the end of pedal travel, the clutch is out of adjustment, or the clutch brake is worn and needs to be replaced.

For instructions, see ***Group 25*** of the *FLC 112 Conventional Service Manual*.

CAUTION

Excessive clutch free pedal may prevent complete clutch disengagement; insufficient clutch pedal free-travel causes slippage and short clutch life. Never wait for the clutch to slip before making a clutch adjustment.

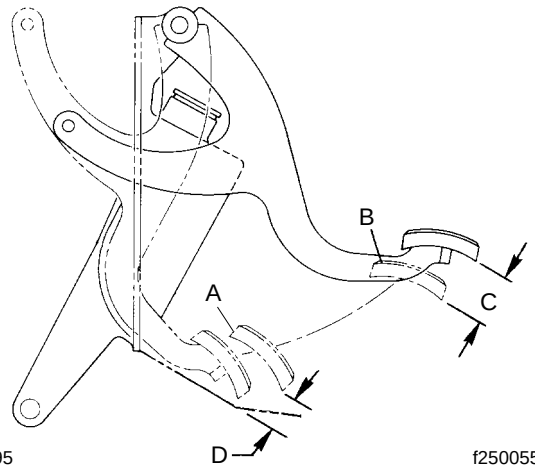
22. Inspect the seat belts and tether belts (if so equipped). See **Fig. 11.14** and **Fig. 11.15**.

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.

NOTE: When any part of a seat belt system needs replacement, the entire seat belt must be replaced, both retractor and buckle side.

22.1 Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.



A. Clutch brake resistance is first encountered here.
B. Clutch resistance is first encountered here.
C. Approximately 1-1/2 to 2" (38 to 51 mm) Free Pedal
D. Approximately 1 to 1-1/4" (25 to 33 mm) Brake Squeeze

Fig. 11.13, Clutch Free Pedal and Clutch Brake Squeeze

22.2 Check the web for extreme dirt or dust and for severe fading from exposure to sunlight.

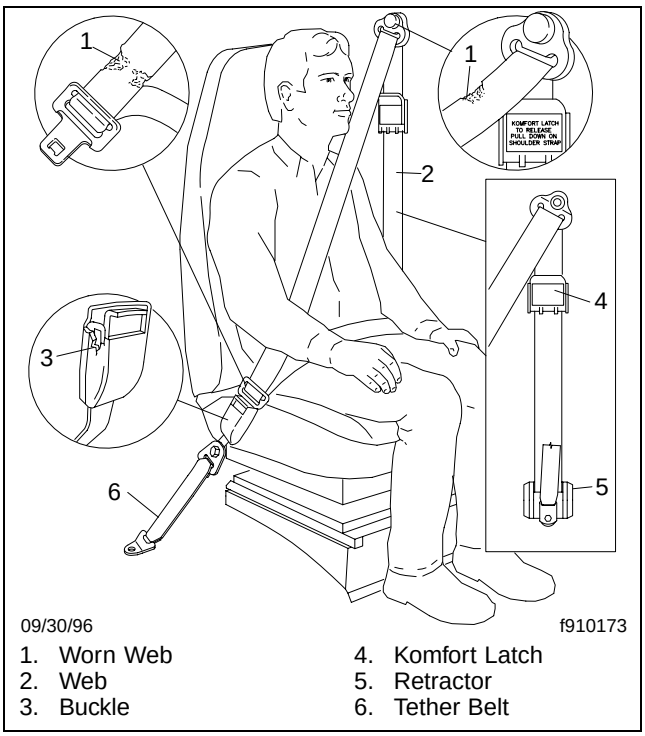
22.3 Check the buckle and latch for operation and for wear or damage.

22.4 Check the Komfort Latch for function and cracks or other damage.

22.5 Check web retractor for function and damage.

22.6 Check the mounting bolts for tightness and tighten any that are loose.

23. Check the cab interior for loose items and secure or remove them. Be sure the following emergency equipment and warning devices are in place and in good working condition:
    - one fully charged fire extinguisher
    - three standard reflectors
    - three red flags with standards
    - fusees (flares) if not hauling explosives or combustibles
    - tire chains (in winter weather)
24. After starting the engine, make sure the oil- and air-pressure warning systems are working. When the engine is started, oil- and air-pressure warnings will come on until the oil pressure rises above a preset minimum, and the air pressure in both the primary and secondary air reservoir systems goes above 64 to 76 psi (441 to 524 kPa). If the air pressure in both systems is above 64 to 76 psi when the engine



1. Worn Web
2. Web
3. Buckle
4. Komfort Latch
5. Retractor
6. Tether Belt

Fig. 11.14, Seat Belt Inspecting

is started, test the low pressure warning system by lowering the pressure to below this range or until the warning system comes on. If the warning systems do not come on when the ignition is turned on, repair the systems.

CAUTION

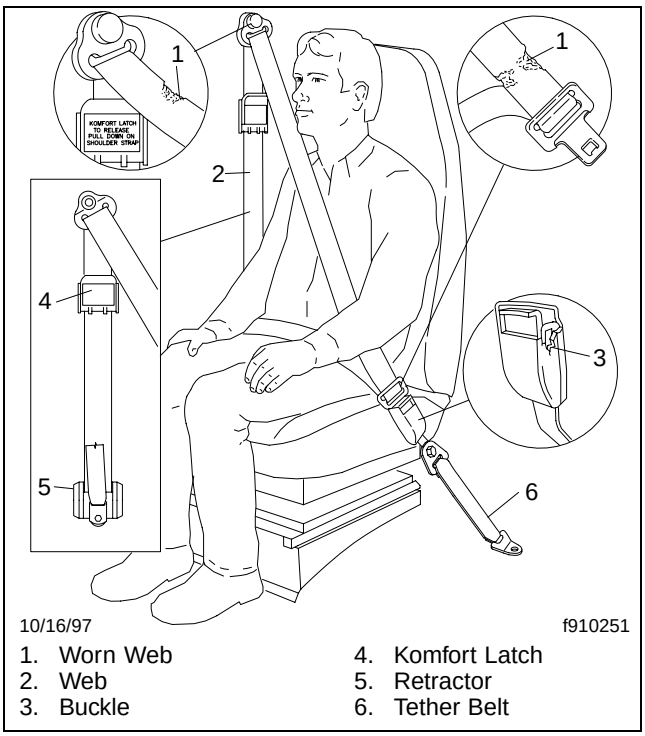
Failure to repair the engine shutdown/warning system could result in a sudden engine shutdown without warning during vehicle operation.

25. Make sure that both the electric horn and the air horn work. Then check the wiper and washer control. These devices must be in good working order for safe vehicle operation. If they are not working, repair them before trip departure.

    During cold weather, check the operation of the heater and defroster controls, and if equipped with optional mirror heat, turn on the mirror heat switch and make sure the system is working.

26. Turn on the headlights, dash lights, and four-way flashers and leave them on. Check the operation of the dome light.

    If any of the gauge bulbs, the switch panel label bulb, the dome light bulb, or the right- and left-turn indicator bulbs are not working, replace them.



1. Worn Web
2. Web
3. Buckle
4. Komfort Latch
5. Retractor
6. Tether Belt

Fig. 11.15, Seat Belt Inspecting (right-hand drive vehicle)

⚠ WARNING

Check the lock mechanisms described above. Otherwise the trailer could disengage from the tractor, possibly resulting in serious personal injury or death.

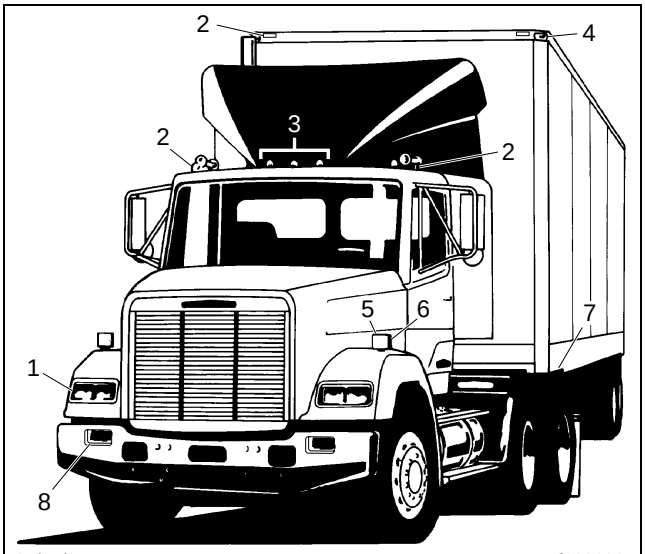
27. If so equipped, check that the fifth wheel lock mechanism is locked to the trailer kingpin. If equipped with a sliding fifth wheel, be sure the sliding portion of the fifth wheel is locked in place.

28. Be sure the brake lights, taillights, side marker lights, fog lights (if so equipped), headlights, signal lights, and clearance and identification lights are working and are clean. See **Fig. 11.16**. Test the high and low beams of the headlights. Replace light bulbs or sealed beam units that are not working.

    Be sure all reflectors and lenses on the tractor and trailer(s) are in good condition and are clean. Replace any broken reflectors or lenses.

29. Look for worn pins on brake chamber pushrods and missing or damaged cotter pins on the brake chamber pushrod pins. Replace worn pins and install new cotter pins if necessary.

    Check for rusted connections, missing snap rings, and damaged camshaft grease seals. Repair or replace damaged or missing parts.



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1. Dual Headlights
2. Clearance Light
3. Identification Lights
4. Side Marker Light
5. Signal Light
6. Side Marker Light and Reflector
7. Reflector
8. Fog Light

Fig. 11.16, Exterior Lights

Check the air reservoir band fasteners. Tighten loose nuts 20 lbf·ft (27 N·m). Make sure the outside surfaces of the reservoirs are painted to prevent corrosion damage. Inspect the reservoir surfaces for damage, such as cracks and dents. Replace corroded or damaged reservoirs with new ones. Do not repair damaged reservoirs. Old or used reservoirs are not acceptable as replacements. If a reservoir requires replacement, see ***Group 42*** of the *FLC 112 Conventional Service Manual* for instructions.

Inspect the air lines as follows:

29.1 Check the clearance between the hoses and the exhaust manifold or other hotspots. Excessive heat will cause the material in the hoses to deteriorate rapidly or become brittle. Provide at least six inches (150 mm) of clearance. More clearance is recommended if the hose is located above the heat source.

29.2 Check for kinks, dents, or swelling of the hoses. If damaged, replace the hose with the same size and type.

29.3 Do not route the hose on top of anything likely to be stepped on or walked on.

29.4 Check for damage to hoses located near moving parts, such as drivelines, trailer bodies, kingpins, suspensions, and axles. If the moving parts are catching or pinching the lines, correct as needed.

29.5 Check for hose damage caused by abrasion. If abraded, replace the hose. Check for the cause of abrasion, such as loose or damaged hose clamps. Repair or replace the clamps, as needed.

29.6 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), replace the hose(s).

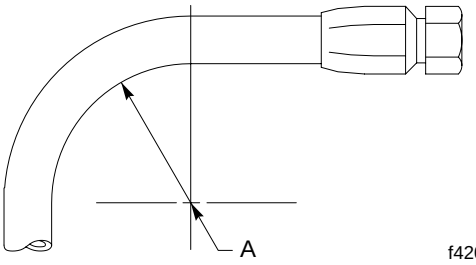
29.7 Inspect air tubing, especially tubing made of nylon. In cold weather, nylon tubing is sensitive to damage, such as nicks or cuts. Replace nicked or cut tubing, even if it is not leaking.

29.8 Check the minimum bend radii of all hoses. The minimum bend radius of a hose is that bend which the hose will withstand without experiencing damaging stresses or kinking. See **Fig. 11.17**. For minimum bend radius values, see ***Group 42*** of the *FLC 112 Conventional Service Manual*.

When a rubber hose does not meet minimum bend radius requirements, the outside may appear smooth even if the inner tube is kinked. Reroute the hose or replace it with one of adequate length if the bend radius is not within minimum specifications.

29.9 Check straight hose installations (those hoses that do not bend along their routings). Pressure changes can cause a hose to lengthen up to two percent, or shorten up to four percent. A 100-inch (2540-mm) length of hose for example, can contract to 96 inches (2440 mm). If the hose has no slack when it is exhausted of air, replace it with one of adequate length to avoid a possible blow-off from the fitting during vehicle operation.

29.10 Check for kinked or twisted hoses. A seven-percent twist in the hose can reduce its life by up to 90 percent. Also, a twisted



NOTE: Center of hose bend radius should be well away from the fitting.

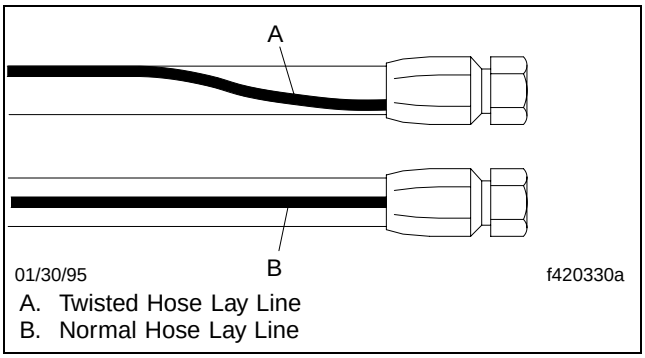
A. Bend Radius

Fig. 11.17, Minimum Bend Radius

hose under pressure tends to untwist. This will cause it to loosen the fitting. Reconnect hoses that are twisted; the lay lines on the hoses should be straight. See **Fig. 11.18**.

30. Check the brake adjustment and adjust the brakes if necessary. See ***Group 42*** of the *FLC 112 Conventional Service Manual* for checking and adjusting procedures.

IMPORTANT: Brake checking and adjusting is necessary for all vehicles, including trucks equipped with automatic slack adjusters.



A. Twisted Hose Lay Line
B. Normal Hose Lay Line

Fig. 11.18, Twisted Hose Checking

⚠ 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.

31. Check the inflation pressures of the tires before each trip using an accurate tire pressure gauge. Tires should be checked when cool. Be sure the valve stem caps are on every tire and that they are screwed on finger-tight. Inflate the tires to the applicable pressures if needed.

    See **Table 11.3**, **Table 11.4**, and **Table 11.5** for the correct tire inflation pressures for the vehicle load. When traveling at unusual speeds, use **Table 11.2** to adjust tire pressure.

    If a tire has been run flat or underinflated, before adding air, check the wheel for proper lock ring and side ring seating, and possible wheel, rim, or tire damage.

    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 in line moisture traps and service them regularly.

32. Inspect the tires for bulges, cracks, cuts, or penetrations. A tire pressure check will assist in uncovering hidden damage. A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage and the tire should be inspected and repaired or replaced.

    Tires should also be inspected for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if allowed to contact the tires, will soften the rubber and destroy the tire.

Variations in Load and Inflation Limits According to Speed		
Speed Range mph (km/h)	**Inflation Pressure Increase in psi (kPa)**	**Percent Increase/ (Decrease) in Load**
70–75 (113–121)	10 (69)	(–10)
61–70 (98–113)	10 (69)	0
51–60 (82–97)	0	0
41–50 (66–80)	0	+9
31–40 (50–64)	0	+16
21–30 (34–48)	10 (69)	+24
11–20 (18–32)	15 (103)	+32

Table 11.2, Variations in Load and Inflation Limits According to Speed

CAUTION

Insufficient wheel nut (rim 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.

33. Check the wheel nuts or rim nuts for indications of looseness. Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes (**Fig. 11.19**), metal buildup around stud holes, or out-of-round or worn stud holes (**Fig. 11.20**) may be caused by loose wheel nuts. See ***Group 40*** of the *FLC 112 Conventional Service Manual* for torque specifications and the correct tightening sequence.

    Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks, or other damage.

    See ***Group 33*** or ***Group 35*** of the *FLC 112 Conventional Service Manual* for service procedures on the studs and hubs, and see ***Group 40*** of the same manual for wheel and tire servicing. Replace broken, cracked, badly worn, bent, rusty, or sprung rings and rims. Be sure that the rim base, lock ring, and side ring are matched according to size and type.

Tire Load Limits for Radial Ply Tubeless Tires—Maximum 60 mph (97 km/h)												
Size	Load Range/Ply Rating	Application	Pressure in psi (kPa)									
			70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)	115 (793)	120 (827)
11R–22.5	G/14	Single	4530	4570	4990	5220	5430	5640	5840	6040	—	—	—
		Dual	4380	4580	4760	4950	5120	5300	—	—			
11R–22.5	H/16	Single	4530	4770	4990	5220	5430	5640	5840	6040	6240	6430	6610
		Dual	4380	4580	4760	4950	5120	5300	5470	5630	5800	—	—
11R–24.5	G/14	Single	4820	5070	5310	5550	5780	6000	6210	6430	—	—	—
		Dual	4660	4870	5070	5260	5450	5640	—	—			
11R–24.5	H/16	Single	4820	5070	5310	5550	5780	6000	6210	6430	6630	6840	7030
		Dual	4660	4870	5070	5260	5450	5640	5820	6000	6170	—	—

Table 11.3, Tire Load Limits for Radial Ply Tubeless Tires–Maximum 60 mph (97 km/h)

Tire Load Limits for Low Profile Radial Ply Tubeless Tires—Maximum 65 mph (105 km/h)										
Size	Load Range/Ply Rating	Application	Pressure in psi (kPa)								
			70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)
285/75R24.5	G/14	Single	4545	4770	4990	5210	5420	5675	5835	6040	6175
		Dual	4540	4740	4930	5205	5310	5495	5675	—	—
295/75R22.5	G/14	Single	4500	4725	4945	5155	5370	5510	5780	5980	6175
		Dual	4500	4690	4885	5070	5260	5440	5675	—	—

Table 11.4, Tire Load Limits for Low Profile Radial Ply Tubeless Tires–Maximum 65 mph (105 km/h)

Tire Load Limits for Michelin Standard and Low Profile Radial Ply Tubeless Tires—Maximum 65 mph (105km/h)													
Size	Load Range/ Ply Rating	Application	Pressure in psi (kPa)										
			65 (448)	70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)	115 (793)
10R–22.5	G/14	Single	—	—	4693	4950	5215	5470	5755	6040	—	—	—
		Dual			4224	4550	4693	4923	5180	5440			
10R–24.5	G/14	Single	—	—	4960	5235	5513	5780	6105	6430	—	—	—
		Dual			4534	4740	4976	5200	5495	5790			
255/70R22.5	H/16	Single	3385	3598	3810	4023	4235	4448	4652	4805	4940	5273	5510
		Dual	3135	3329	3521	3713	3905	4096	4280	4420	4540	4851	5070
275/80R22.5	G/14	Single	—	4560	4825	5090	5365	5625	5920	6175	—	—	—
		Dual		4113	4350	4588	4833	5070	5335	5675			
275/80R22.5	H/16	Single	4155	4435	4715	4990	5260	5535	5805	6080	6345	6615	6940
		Dual	3680	3920	4168	4425	4675	4930	5175	5415	5650	5883	6175
275/80R24.5	G/14	Single	—	4520	4775	5030	5280	5530	5767	6005	—	—	—
		Dual		4070	4300	4530	4755	4980	5245	5510			

Table 11.5, Tire Load Limits for Michelin Standard and Low Profile Radial Ply Tubeless Tires–Maximum 65 mph (105km/h)

⚠ 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.

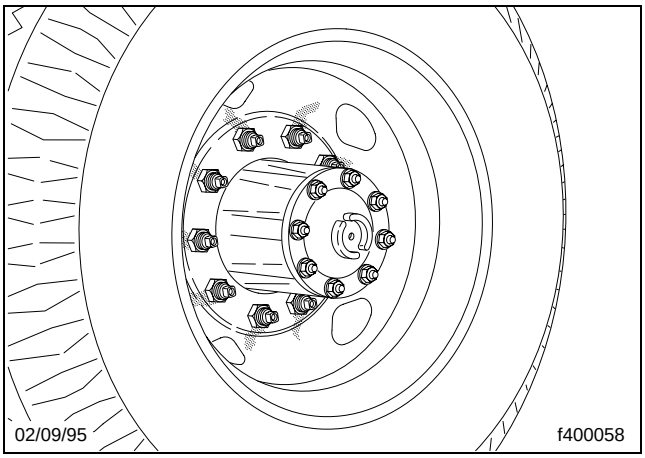


Fig. 11.19, Check the Wheel and Rim Assembly

34. Check components of the air brake system for proper operation as follows:

    34.1 Check the air governor cut-in and cut-out pressures. 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, make a series of foot valve applications. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not 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.

    34.2 Check the air pressure buildup time as follows:

    For vehicles without a trailer air brake hookup, release the parking brakes on the vehicle by pushing in the parking brake control valve knob. See **Fig. 11.21**.

    For vehicles with a trailer air brake hookup, release the parking brakes on the vehicle by pushing in the parking brake control valve knob. See **Fig. 11.22**. Apply the trailer parking brakes by pulling out the trailer air supply valve knob. see **Fig. 11.22**.

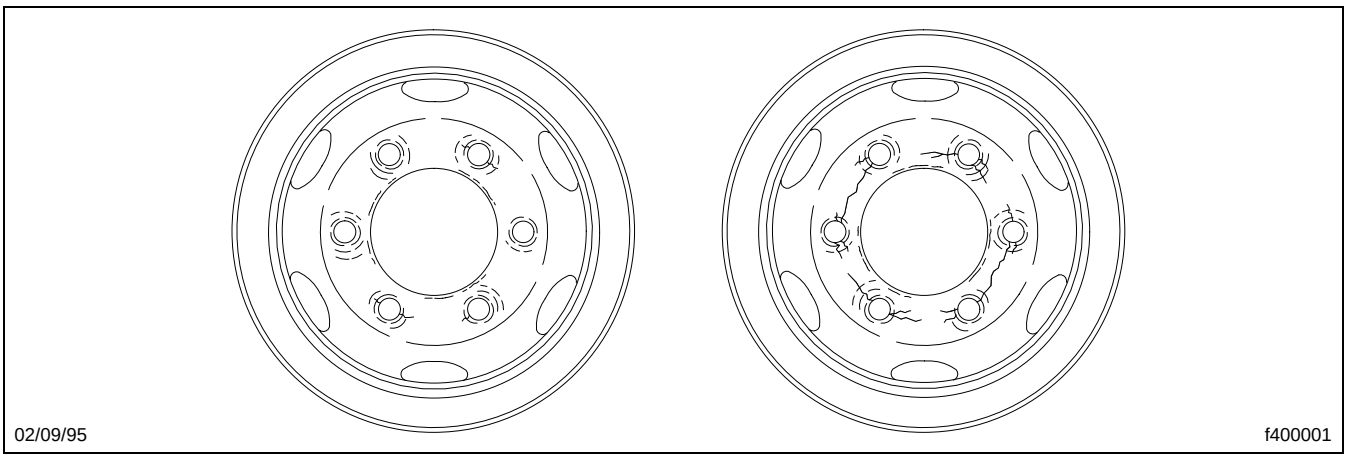


Fig. 11.20, Check the Stud Holes

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.

34.3 Check the air pressure reserve. 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.

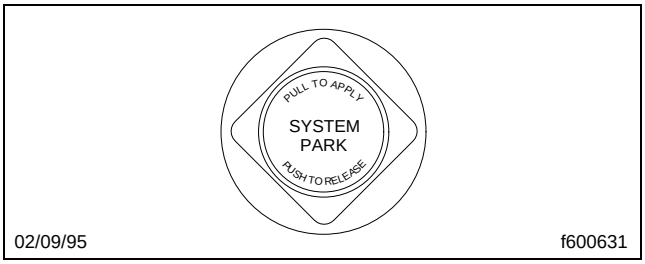
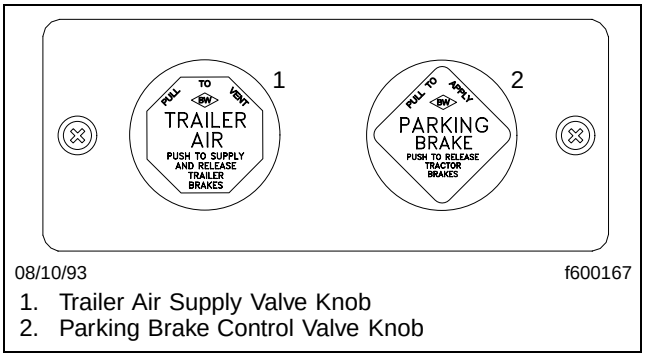


Fig. 11.21, Parking Brake Valve (Vehicles Without Trailer Air Brake Hookup)



1. Trailer Air Supply Valve Knob
2. Parking Brake Control Valve Knob

Fig. 11.22, Trailer Brake and Parking Brake Control Valve Knobs

NOTE: On vehicles with a trailer air brake hookup, charge the trailer-brake system with air by pushing in the trailer air supply valve knob.

34.4 Check the air leakage in the system.

With the parking brakes applied, the transmission out of gear, and the tires chocked, charge the air system until cutoff 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 cutoff 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 11.6**, repair all areas of leakage before driving the vehicle.

34.5 On vehicles with a trailer air brake hookup, be sure the trailer brake hand control valve operates the trailer brakes and not the tractor brakes. Apply the hand control valve and observe which brakes apply. If the tractor

Maximum Allowable Service Brake Air Leakage		
Description	**Service Brakes Maximum Allowable 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 Trailer	5 (35)	6 (42)

Table 11.6, Maximum Allowable Service Brake Air Leakage

brakes apply, correct the hand control valve plumbing before operating the vehicle.

NOTE: For trailers not equipped with spring parking brakes, the trailer service brakes automatically apply when the trailer air supply valve knob pops out.

34.6 On vehicles with a trailer air brake hookup, check the spring parking brake system by pushing in the trailer air supply valve knob and releasing the trailer parking brakes. Pull the parking brake control valve knob out. The trailer air supply valve knob must pop out immediately and the tractor and trailer spring parking brakes must both apply.

With a fully charged air system of 120 psi (827 kPa), push in the parking brake control valve knob. The tractor spring parking brakes should release. Push the trailer air supply valve knob in. With the trailer air system charged to 120 psi (827 kPa), the trailer brakes (spring parking brakes, if so equipped, or service brakes) should release. Pull the trailer air supply valve knob out; the trailer brakes should apply.

⚠ WARNING

Before operating the vehicle, be sure the spring parking brakes on the tractor and the spring parking (or service) brakes on the trailer pass the above tests. Otherwise an unexpected parking brake application could occur, causing some loss of vehicle control and possibly resulting in serious personal injury.

35. When starting to move the vehicle and before picking up speed, test the brakes with the foot valve, hand valve, and parking brake valve to be sure they will bring the vehicle to a safe stop.

36. Pull the parking brake control valve knob (**Fig. 11.22**) with the vehicle on a 20 percent grade (the ramp surface should be made of Portland cement or equivalent). If the parking brakes do not hold the vehicle, repair the parking brake system.

12

Cab Appearance

Cab Washing and Polishing **12.1**
Care of Fiberglass Parts **12.1**
Care of Chrome Parts and Stainless-Steel Clad Parts **12.1**
Dashboard Care **12.2**
Vinyl Upholstery Cleaning **12.2**
Velour 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 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 and Stainless-Steel Clad Parts

To prevent rust, keep chrome and stainless-steel clad 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 or stainless-steel clad 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 nonabrasive 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.

IMPORTANT: Use only nonabrasive chrome cleaners on stainless-steel clad parts. This prevents scratching and marring of the polished surface.

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 which 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.

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.

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.

13

In an Emergency

Hazard Warning Lights **13.1**
Emergency Kit, Optional **13.1**
Towing **13.1**
Emergency Starting With Jumper Cables **13.4**
Fire in the Cab **13.5**

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.

To cancel the hazard warning lights, push the turn signal control lever either up or down, then return the lever to its neutral position.

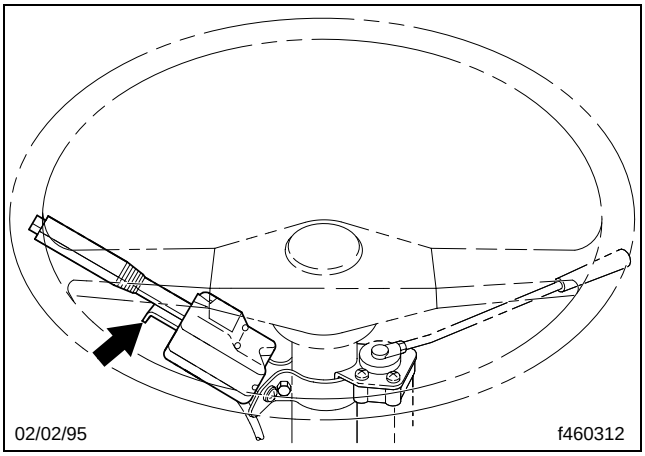


Fig. 13.1, Hazard Warning Light Tab Location

Emergency Kit, Optional

An optional emergency kit package is located between the seats. See **Fig. 13.2**. 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.

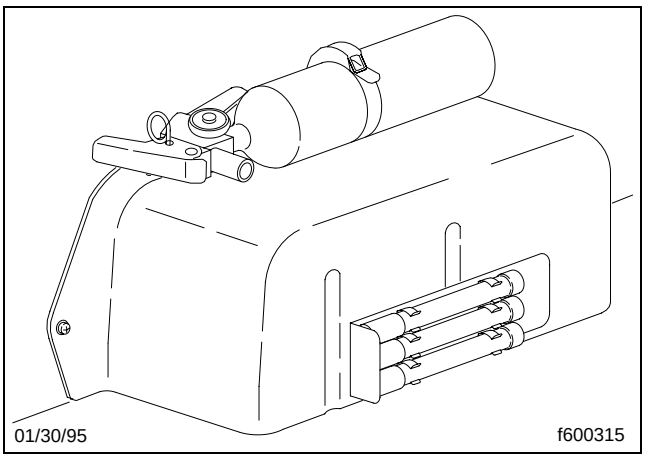


Fig. 13.2, Emergency Kit

⚠ WARNING

Do not tow unbraked vehicles if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWRs) 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 cable.

⚠ 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.
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.
5. Remove the bumper extension and chrome bumper, if so equipped.

6. 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.
7. Lift the vehicle and secure the safety chains. If extra towing clearance is needed, remove the front wheels.
8. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.

⚠ WARNING

Failure to chock the tires or connect the towing vehicle'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.

9. 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.

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 cable.

⚠ 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

Both charged and discharged batteries should be treated carefully when using jumper cables. Follow the procedure below, being careful not to cause sparks.

⚠ WARNING

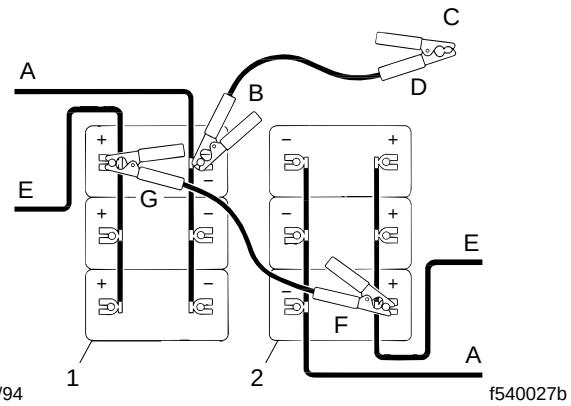
Do not connect (jump) a vehicle starting system to a starting system of a different voltage. To do so could result in serious personal injury from an explosion or flying battery acid.

⚠ CAUTION

If equipped with the Meritor WABCO® Antilock Braking System (ABS), disconnect the electronic control unit before starting the vehicle with jumper cables. Failure to do so could cause power surges and possible component damage in the electronic control unit.

IMPORTANT: At no time during this operation should the vehicles touch each other, as this could establish a ground connection and offset the benefits of this procedure.

1. Apply the parking brakes. Turn off the lights, heater, and all other electrical loads.
2. Find the positive terminal of the discharged battery.
3. Attach an end of one jumper cable to the positive terminal of the booster battery and the opposite end of the cable to the positive terminal of the discharged battery. See **Fig. 13.3**.
4. Attach one end of the other jumper cable to the negative terminal of the booster battery, and the opposite end to a ground at least 12 inches (300 mm) from the battery of the vehicle being started. See **Fig. 13.3**. The vehicle frame is usually a good ground.



A. To Ground
B. 3rd
C. To Frame (ground)
D. 4th
E. To Starter
F. 2nd
G. 1st
1. Booster Battery
2. Discharged Battery

Fig. 13.3, Jumper Connections

IMPORTANT: The final ground connection must provide good electrical conductivity and current-carrying capacity. Do not connect directly to the negative post of the discharged battery.

5. Make sure that the clamps from one cable do not touch the clamps on the other cable. Do not lean over the batteries when making connections.

6. Be sure everyone is standing away from the vehicles. Start the engine of the vehicle with the booster batteries. Wait a few minutes, then attempt to start the engine of the vehicle with the newly charged batteries.

   Do not operate the starter longer than 30 seconds. Wait at least two minutes between starting attempts to allow the starter to cool. If the engine does not start after several attempts, check for the cause.

7. After starting, allow the engine to idle. Remove the ground connection from the vehicle with the newly charge battery. Then disconnect the opposite end of the cable.

8. Disconnect the other cable from the newly charge battery first, then disconnect the opposite 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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