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

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

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

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

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

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

Customer Assistance Center
Having trouble finding service? Call the Customer Assistance Center at 1-800-385-4357 or 1-800-FTL-HELP. Call night or day, weekdays or weekends, for dealer referral, vehicle information, breakdown coordination, or Fleetpack assistance. Our people are knowledgeable, professional, and committed to following through to help you keep your truck moving.

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

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

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

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

For additional road safety information, please visit the Road Safety website at: www.tc.gc.ca/roadsafety.
Foreword
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Vehicle Specification Decal

The vehicle specification decal lists the vehicle model, identification number, and major component models. It also lists the major assemblies and installations shown on the chassis specification sheet. One copy of the vehicle specification decal is attached to the inside of the sliding storage/waste drawer; another copy is inside the rear cover of the Owner's Warranty Information for North America booklet. 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.

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 and the tire and rim labels. See Fig. 1.2. 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 attached to the left rear door post. See Fig. 1.4. 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 with the
Canadian National Safety Mark attached to the left rear door post. See Fig. 1.5.

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

**Tire and Rim Labels**

Tire and rim labels 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 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.

See Fig. 1.6 for U.S. and Canadian tire and rim labels that are attached to the left door rear post.

**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 front wall between the dash and the windshield.

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

**EPA07 and EPA10 Emission Control**

To meet EPA07 and EPA10 emissions regulations for vehicles domiciled in the USA or Canada, engines manufactured after December 31, 2006 (EPA07) or
December 31, 2009 (EPA10) are equipped with an emission aftertreatment system. Vehicles domiciled outside of the USA and Canada may not have after-treatment equipment, depending upon local statutory emissions guidelines. There is a warning label (placement will vary), for important new warning indicators in the driver’s message display, that pertain to the aftertreatment system.

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

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Cab Door Locks and Handles

One common key operates the ignition switch and all of the door locks.

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

To unlock the driver’s door from outside the cab, insert the key in the lockset and turn it one-quarter turn clockwise. See Fig. 2.1. To remove the key, turn it counterclockwise to the original position. Pull out on the door pull handle to open the door.

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

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

To lock a door from outside the cab, insert the key in the lockset and turn it in the direction opposite to the unlocking direction (counterclockwise for the driver’s door, clockwise for the passenger’s door). Close the door if it is open.

To lock either door from inside the cab, push the lock button downwards. See Fig. 2.2.

To open the door from the inside, lift up on the door lever. This will unlatch the door whether or not it is locked.

Grab Handles and Access Steps

![Fig. 2.1, Exterior Door Handle](image1.png)

1. Key
2. Lockset
3. Door Pull Handle

![Fig. 2.2, Door Interior](image2.png)

1. Lock Button
2. Integral Door Upper Grab Handle
3. Door Lever

**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 climbing onto, or down from, the back-of-cab area.

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

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

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

1. Open the driver side door, and place anything that you are carrying in the cab.
2. Using both hands, grasp the grab handle that is on the B-pillar, or use your left hand on the integral door lower grab handle. See Fig. 2.3. Reach up as far as is comfortable.

3. Place your right foot on the bottom step, and pull yourself up. Move your left hand to the integral door upper grab handle.
4. Place your left foot on the top step.
5. Grasp the steering wheel with your left hand, and step up.
6. Step into the cab with your right foot first, and grasp the steering wheel with your right hand.

Exiting the Driver Side

Exit the cab from the driver side as follows:

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

1. Grasp the steering wheel with both hands, place your left foot on the top step, then stand on the threshold facing into the cab.
2. Using your right hand, grasp the grab handle located on the B-pillar.
3. Move your right foot to the bottom step.
4. Move your left hand to the integral door lower grab handle.
5. Step to the ground with your left foot first.

Entering the Passenger Side

When entering the cab from the passenger side, use the grab handles and access steps as follows:

1. Open the passenger-side door, and place anything that you are carrying in the cab.
2. Using your left hand, grasp the grab handle that's on the rear of the door opening. See Fig. 2.4.
3. Using your right hand, grasp the integral door lower grab handle.
4. Place your right foot on the bottom step, and step up to the upper step with your left foot.
5. Place your right foot on the top step, and step up.
6. Move your right hand to the upper grab handle on the windshield post.
7. Step into the cab with your left foot first.

Exiting the Passenger Side

Exit the cab from the passenger side as follows:

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

1. Grasp the steering wheel with your left hand, and step up.
2. Place your right foot on the bottom step, and step up to the upper step with your left foot.
3. Move your right hand to the upper grab handle on the windshield post.
4. Step into the cab with your left foot first.
Vehicle Access

Cab-to-Sleeper Access

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

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

Sleeper Door

The sleeper door (Fig. 2.5, Ref. 1) is not intended for entry or exit. The door is intended only as a convenient means to stow or remove personal belongings in and from the sleeper area. To open the sleeper door from the inside, push down on the lever handle located inside the sleeper compartment aft of the door, or pull out on the upper lever located inside the cab door opening; see Fig. 2.6. To open the sleeper door from outside, open the cab door, then pull out on the upper lever located inside the cab door opening. To close the door, pull on the strap attached to the inside of the door, or push it closed from the outside, until it latches.

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

1. Using both hands, grasp the grab handle that's on the windshield post, and place your right foot on the top step while standing up from the seat facing inward.
2. Place your left foot on the bottom step.
3. Move your left hand to the lower grab handle located at the rear edge of the door opening. See Fig. 2.4.
4. Move your right hand to the integral door lower grab handle.
5. Step to the ground with your right foot first.

Fig. 2.4, Passenger-Side Steps and Grab Handles

1. Lower Grab Handle
2. Upper Grab Handle
3. Integral Door Lower Grab Handle
4. Top Step

Fig. 2.5, Sleeper Doors

1. Sleeper Door
2. Luggage Compartment Door
Sleeper Luggage Door

To open the sleeper luggage door, pull out on the lower lever located inside the cab door opening. See Fig. 2.6. To close the door, push it closed until it latches.

Back-of-Cab Access

**WARNING**

External surfaces of the exhaust system remain hot after the engine has been shut down. When accessing the back of the cab or sleeper, do not touch any part of the exhaust system, or severe burns could occur.

When trailer air and electrical connections cannot be reached conveniently from the ground, Federal Motor Carrier Safety Regulations require commercial carriers to provide back-of-cab access.

Optional grab handles are mounted either on both cab sidewalls, or on the left sidewall only. See Fig. 2.7. Steps are mounted either on the fuel tank(s) or on metal brackets. When a deck plate is necessary, it is mounted across the top of the frame rails.

**IMPORTANT:** Climb onto, and down from, back-of-cab access facing in toward the vehicle, as you would on a ladder. Do not climb up or down facing out away from the vehicle.

**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 climbing onto, or leaving, the back-of-cab area.

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

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

Entering Back-of-Cab
When climbing onto the deck plate, do the following:
1. Grasp the sidewall grab handle with both hands. Reach up as far as is comfortable.
2. Place one foot on the bottom step and pull yourself up.
3. Place your other foot on the top step.
4. Move your lower hand to a higher position on the grab handle.
5. Step onto the deck plate.

Climbing Down from Back-of-Cab
To climb down from the back-of-cab area:
1. Grasp the sidewall grab handle with both hands.
2. Step one foot at a time onto the top step.
3. Move your upper hand to a lower position on the grab handle.
4. Move one foot to the bottom step.
5. Move your upper hand to a lower position on the grab handle.
6. Step to the ground with your upper foot first.

Hood Opening and Closing
A grab handle at the front of the hood provides a hand-hold for hood tilting. Two tilt-assist struts help to tilt the hood open, and to return it to the operating position. A damper controls the closing rate of the hood and hood straps prevent the hood from over-travel. In the operating position, the hood is secured by a hold-down latch on each side of the hood.

To Tilt the Hood
1. Apply the parking brakes.
2. Release both hood hold-down latches by pulling the ends outward.

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

3. Using the bumper step and grab handle, slowly tilt the hood until the straps support it. See Fig. 2.8.

To Return the Hood
1. Grasp the grab handle, and lift the hood a just-over-center position.
2. As the hood goes over center, the hood damper controls the rate of descent to the operating position.
3. Make sure the hood is flush with the cowl, then secure the hood by engaging both hood hold-down latches.

IMPORTANT: Make sure that both hold-down latches are fully engaged before operating the vehicle.
3

Electrical System

Electrical System Overview .......................................................... 3.1
Electrical System Overview

**WARNING**

Do not attempt to modify, add, splice, or remove electrical wiring on this vehicle. Doing so could damage the electrical system and result in a fire that could cause serious personal injury or property damage.

The Cascadia™ electrical system is a multiplexed design. Multiplexing allows the electrical system to simultaneously perform tasks and monitor components. The multiplexing system sharply reduces the number of wires on the vehicle by sharing wires for multiple components. Multiple electronic messages are sent simultaneously through the same signal path, called the datalink.

The multiplexed electrical system on Cascadia™ vehicles combines electronic devices called SAMs, with traditional power distribution modules (PDMs) that house fuses and relays. The SAM Cab and SAM Chassis monitor inputs from sensors and switches, and control power distribution to the electrical loads on the vehicle.

Electronic Power Distribution

The SAM Cab and SAM Chassis modules are electronic control units that have power distribution components (fuses and relays) physically on them. Refer to Chapter 25 for fuse and relay locations. The SAM Cab is located behind the glovebox, on the passenger side. See Fig. 3.1.

The SAM Chassis is located on the frontwall, on the driver side. See Fig. 3.2.

Electrical Power Distribution

Electronic Power Distribution provides battery power to the electronics system. The electrical power distribution components on the Cascadia™ vehicle are:

- Powertrain PDM
- Trailer PDM
- Auxiliary PDM
- MEGA® Fuse junction block
- Main ground junction block
- Load disconnect switch

**Powertrain PDM**

The powertrain PDM provides battery and ignition power to the engine ECM, the exhaust aftertreatment device (ATD), transmission (TCU), as well as other powertrain-related circuits. It is mounted in the engine compartment, above the quarter fender on the driver side. See Fig. 3.2.

**Trailer PDM**

The optional trailer PDM mounted on the frame rail is used to supply trailer power to the chassis-mounted trailer receptacles. The SAM Chassis supplies control outputs to the remote trailer PDM. The trailer PDM is powered through the vehicle battery system.

**Auxiliary PDM**

This optional PDM is used when additional circuit protection is needed for optional features. For example, if a beacon light is added to the Cascadia, it may require an auxiliary PDM.

**MEGA® Fuse Junction Block (MFJB)**

The MEGA Fuse junction block houses up to five MEGA Fuses. One fuse is used to provide power to the engine and transmission, one to the SAM Cab, and one to the SAM Chassis. The remaining MEGA Fuses may be used to power an optional trailer PDM and/or inverter. The MFJB is located on the left frame rail in front of the batteries. The cab electrical system is fed from the battery through the MFJB regardless of the ignition switch position. This routing provides the best power distribution to the vehicle. See Fig. 3.3.

**Main Ground Junction Block (MGJB)**

The MGJB is the main node for connecting ground returns to the battery. It is located on the left frame rail, ahead of the MEGA Fuse junction block. See Fig. 3.3.
Fig. 3.1, SAM Cab Location

Fig. 3.2, SAM Chassis and Powertrain PDM Locations

1. Powertrain PDM
2. SAM Chassis

Fig. 3.3, Junction Blocks Locations

1. MEGA Fuse Junction Block
2. Main Ground Junction Block
Load Disconnect Switch

The load disconnect switch is mounted in one of three locations:

- inside the cab on the left side of the driver’s seat (left-hand-drive vehicle);
- on the battery box;
- outboard mounted on the left frame rail.

The load disconnect switch is used to avoid excessive draw on the battery when the vehicle is parked for an extended period of time. When the load disconnect switch is set to OFF, it interrupts the connection between the battery and the MEGA Fuse junction block, and disconnects circuit power at the positive battery cable. See Fig. 3.4.

**WARNING**

Turning the load disconnect switch to the OFF position does not disconnect the connection between the battery and the starter. To work on the vehicle safely, the negative leads must be disconnected from the battery.

**IMPORTANT:** The ignition should be turned OFF before turning the load disconnect switch.

If the load disconnect switch is turned to the OFF position while the vehicle is running, the emergency power system will activate. The powertrain PDM will receive power from the emergency power feed on the SAM system, but the batteries will not be charging. See *Emergency Power Supply*, for details.

---

Emergency Power Supply

The emergency power supply feature ensures that in the event of a SAM Cab or SAM Chassis failure, the vehicle can be driven off the highway, and kept conspicuous until help arrives. The emergency power supply will cause certain exterior lamps to flash (depending on if it is the SAM Cab, or SAM Chassis that failed), indicating that the vehicle is disabled. See *Fig. 3.5* for identification of the exterior lights.

If the SAM Cab fails, all gauges in the instrument control unit (ICU) drop to zero because power to the ICU is lost. Do not shut off the engine until the vehicle is safely off the highway; the engine cannot be restarted when the SAM Cab fails.

When the ignition is in the ON position, the emergency power will cause the following lamps to flash:

- dash panel lights
- clearance lights
- front marker lights
- side marker lights
- trailer taillights
- rear stop lights

If the SAM Chassis fails, the turn signal indicators will flash alternately. The engine can be restarted when the SAM Chassis fails.

When the ignition is in the ON position, the emergency power outputs will cause the following lamps to flash:

- dash panel lights
- clearance lights
- identification lights
- front marker lights
- turn-signal indicators in the ICU (alternately)
- side marker lights
- rear turn-signal lights
- trailer taillights
If the ignition switch is turned ON while the load disconnect switch is in the OFF position, the emergency power supply feature will activate the following lamps:

- clearance lights (flashing)
- side marker lamps (flashing)
- low beam headlights

**Powernet Management**

The powernet management feature protects the batteries from discharging too much by temporarily shutting down loads from the power supply. This ensures that in the event of a drop in voltage, the battery draining process is slowed.

Progressive low voltage disconnect (PLVD) is used to implement the powernet management feature.
When the battery voltage drops below a predetermined value, loads designated as comfort loads (priority level I) are shut down first. Then loads designated as house loads (priority level II) are shut down. If necessary, basic loads (priority level III) are shut down last.

The progressive shutdown of loads from comfort loads, to house loads, to basic loads allows the driver to continue using critical loads, while non-critical loads are temporarily unavailable. Calculations for disconnecting loads are based on battery voltage, ignition switch status, and engine RPM. Also, a time delay is implemented for the shutdown and reactivation of loads to avoid unnecessary cycling of loads when battery voltage is close to the shutdown thresholds.

The SAM Cab reads the battery voltage via a dedicated sense pin that is fused in the powertrain PDM and not at the MFJB.

One minute before the comfort loads and house loads are shut down, an alarm sounds for 10 seconds. No alarm sounds before the basic loads shut down.

If the interior lights have been shut down by PLVD, pressing one of the interior light switches (if equipped) brings the interior lights back on.

See Table 3.1 for the type of loads shut down under specific conditions.

See Table 3.2 for the loads that are designated comfort, house, and basic load status.

<table>
<thead>
<tr>
<th>Type of Loads Shut Down Under Specific Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Switch Position</strong></td>
</tr>
<tr>
<td>Off</td>
</tr>
<tr>
<td>Accessory</td>
</tr>
<tr>
<td>On</td>
</tr>
<tr>
<td>Crank</td>
</tr>
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</table>

**Table 3.1, Type of Loads Shut Down Under Specific Conditions**

<table>
<thead>
<tr>
<th>Designated Loads</th>
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</thead>
<tbody>
<tr>
<td><strong>Type of Load</strong></td>
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<tr>
<td>Priority Level I Loads</td>
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### DesignatedLoads

<table>
<thead>
<tr>
<th>Type of Load</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Priority Level II Loads</strong></td>
<td>Heated seats, ignition*</td>
</tr>
<tr>
<td></td>
<td>Sleeper HVAC controller, accessory*</td>
</tr>
<tr>
<td></td>
<td>Cabin HVAC controller, accessory*</td>
</tr>
<tr>
<td></td>
<td>Radio, accessory (clamp 15R)</td>
</tr>
<tr>
<td></td>
<td>Power feed spare output I, battery</td>
</tr>
<tr>
<td></td>
<td>Power feed spare output III, battery</td>
</tr>
<tr>
<td></td>
<td>Mirror heating, passenger*</td>
</tr>
<tr>
<td></td>
<td>Mirror heating, driver*</td>
</tr>
<tr>
<td></td>
<td>Power feed spare output IV, battery</td>
</tr>
<tr>
<td></td>
<td>Power feed spare output II, battery</td>
</tr>
<tr>
<td></td>
<td>Fuel water separator heater element, ignition*</td>
</tr>
<tr>
<td></td>
<td>Air dryer (pneumatic, electrically heated), accessory*</td>
</tr>
<tr>
<td></td>
<td>Auxiliary circulation fan-windshield, accessory*</td>
</tr>
<tr>
<td></td>
<td>Auxiliary heater (ESPAR) power</td>
</tr>
<tr>
<td></td>
<td>Utility light</td>
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<tr>
<td></td>
<td>Utility light</td>
</tr>
<tr>
<td></td>
<td>Dome light rear</td>
</tr>
<tr>
<td></td>
<td>Area lighting (lower bunk and sleeper work surface), battery</td>
</tr>
<tr>
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<td>Dome light cab, battery</td>
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<td></td>
<td>Overhead compartment lights, battery</td>
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<td>12V power receptacle 3 (sleeper, cigar), battery</td>
</tr>
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<td>Stand-alone HVAC, battery</td>
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<td>Advertising light, accessory*</td>
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<td>Dome light passenger</td>
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<tr>
<td></td>
<td>Dome light driver/forward overhead</td>
</tr>
<tr>
<td><strong>Priority Level III Loads</strong></td>
<td>CB radio, battery†</td>
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<td>Fleet management system, battery†</td>
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<td></td>
<td>Trailer power, battery or ignition</td>
</tr>
<tr>
<td></td>
<td>12V power receptacle 2 (dash, phone), battery</td>
</tr>
<tr>
<td></td>
<td>12V power receptacle 1 (dash, cigar), battery</td>
</tr>
</tbody>
</table>

* When the vehicle has Optimized Idle, these functions will not operate with the key in accessory mode. Optimized Idle may also turn these functions off to reduce stress on the batteries. Refer to the Optimized Idle section in Chapter 10 for more information.

† May or may not shut down depending on how an additional parameter is set at the factory or dealership.

**Table 3.2, Designated Loads**
4 Instruments

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ICU3-P3 (Instrumentation Control Unit)

See Fig. 4.1 for a typical layout of the ICU3-P3.

The ICU3-P3 receives information from various sensors installed on the vehicle, and feeds it to electronic gauges. Only air gauges operate mechanically.

There are eight standard gauges on the main instrument panel, and space for six optional gauges in the auxiliary gauge panel. See Fig. 4.1.

The lightbar is the heart of the ICU3-P3. It houses a set of warning and indicator lights, and the driver display screen.

There are four rows of warning and indicator lights in the lightbar. Lights installed in the top row are optional and their positions may vary. The lights in the bottom three rows are installed in fixed positions on all vehicles. Most are standard, but a few are optional. See "Warning and Indicator Lights", later in this chapter, for details.

The driver message display is a one-line by seven-character liquid crystal screen (LCD) that normally shows odometer readings, or messages that alert the driver of situations that must be acknowledged. It also displays features and options when programming the ICU.

Buzzer

A buzzer sounds for 3 seconds during the self-test at start-up, and when the following conditions exist:

- low air pressure
• low oil pressure
• high coolant temperature
• the parking brake is applied and the vehicle is moving at a speed of at least 2 mph (3 km/h)

While the vehicle is being driven, if the outside air temperature drops to 34°F (1°C) or less, the message display will flash the temperature, and a warning chime will sound for 5 seconds if the ambient temperature alarm is enabled.

ICU3-P3 Ignition Sequence

If the headlights are turned on, the driver message display shows the odometer reading until the ignition is turned on.

When the ignition is turned on, the electronic gauges complete a full sweep of their dials, the warning and indicator lights illuminate, and the buzzer sounds for 3 seconds.

NOTE: The air gauges do not sweep.

The following lights illuminate during the ignition sequence:

- Fasten Seat Belt Warning
- Low Battery Voltage Warning
- High Coolant Temperature Warning
- Low Engine Oil Pressure Warning
- Low Air Pressure Warning
- Parking Brake On Indicator
- All engine warning lights, including engine protection, check engine, and (Cummins only) stop engine
- All ABS warning lights, including wheel spin, tractor ABS, and (if installed) trailer ABS

See Fig. 4.2 for the ICU3-P3 ignition sequence.

NOTE: The engine and ABS warning lights illuminate during the ignition sequence, but they are controlled by an independent ECU (electronic control unit), not by the ICU3-P3.

When the ignition switch is turned on, the ICU3-P3 performs a self-test, and looks for active faults. During the first half of the self-test, all segments of the display illuminate as follows: "888888.8." The ICU3-P3 voltmeter display illuminates with the value "8.8." During the second half of the self-test, the software revision level is displayed.

If there are no active faults, the ICU3-P3 displays the odometer reading. However, if the ICU3-P3 has received active fault codes from other devices, it displays them one after the other until the parking brake is released or the ignition switch is turned off. Once the parking brake is released, the ICU3-P3 displays the odometer reading again.

Mode/Reset Switch

A MODE/RESET switch is located on the right side of the ICU3-P3 instrument cluster. See Fig. 4.1. The MODE/RESET switch is used to scroll through the screens on the driver message display, and to reset features such as trip counters, miles or kilometers units, and the ambient temperature alarm. Pressing the MODE/RESET button advances the display to the next feature. Holding the button scrolls to a menu choice, then releasing it at the preferred choice and pressing the MODE/RESET switch will reset the display. When the display is reset, an audible chirp is heard.

The driver message display screens can also be scrolled through using the switches mounted on the steering wheel. See Fig. 4.3. Use the + button to scroll up, and use the – button to scroll down. The + button can be held to reset or select a menu choice, instead of the MODE/RESET button, for any screen.

When the ignition sequence is completed, if the parking brake is released, the driver message display will cycle through the trip information screens and the ambient air temperature display screen only. The parking brake must be set to access the stationary access screens, i.e. SELECT, ALERT, DIAGNOSTIC, ENGINE, OIL_LVL (if available) and SETUP screens.

See Fig. 4.4 for a diagram of the stationary access screens.

Trip Information Screens

Trip information allows you to view trip mileage and time. Trip information screens will display with the parking brake released, or applied.

When the odometer reading is displayed:

- Press the MODE/RESET switch once for trip distance.
Press the MODE/RESET switch a second time for trip hours.

Hold the MODE/RESET switch, or the + button, to reset trip miles or hours to zero.

NOTE: To change between MI (miles) and KM (kilometers) as preferred units, use the SELECT screen.

**Ambient Air Temperature Screen**

Pushing the mode switch while in the trip hours, will display the ambient air temperature. The ambient air temperature will display with the parking brake released, or applied. See **Fig. 4.4**.

NOTE: When the parking brake is set, the outside ambient air temperature unit display can be changed from °F to °C in the SELECT screen. The ambient temperature warning can be disabled or enabled in the ALERT screen.

NOTE: The ambient air temperature warning is in the disabled state when the vehicle is shipped from the factory. It must be enabled in the ICU setup screen.

**Select Screen**

When the parking brake is set, the SELECT screen allows the driver to choose standard or metric units...
of measure. If MI is selected, all measurements display in standard units. If KM is selected, all measurements display in metric units. See Fig. 4.4.

Alert Screen
When the outside ambient air temperature drops to 34°F (1°C) or less, the ICU displays a caution text at 1-second intervals for 5 seconds, and a friendly chime sounds. The driver can acknowledge the message by pressing the + or − button on the steering wheel, or the MODE/RESET switch. The chime will not sound again unless the temperature cycles above 37°F (4°C) and back to 34°F (1°C) or less. This warning only occurs while the ignition is on and the parking brake is released.

When the parking brake is set, the alert screen allows the driver to disable the ambient temperature warning. Holding the MODE/RESET switch will toggle between an on/off menu choice. Release the mode switch, then press it to select the displayed choice. See Fig. 4.4.

Diagnostic Screens
During vehicle start-up, with the parking brake set, the driver message display will display any active fault codes for 3 seconds each until the parking brake is released. If service cycle screens are enabled, and service distance or time has been exceeded, the text SERVICE HOUR/Mi(KM) will be displayed with the other fault messages. This will inform the driver that the service interval has been exceeded and vehicle service is required.
If the word SERVICE displays in the DIAG message display screen, service cycle screens are enabled. Hold the MODE/RESET switch at the DIAG screen to display MILES (KM), or HOURS, remaining until the next scheduled service. If MI (KM) displays, service MILES (KM) are enabled; if HOURS displays, service hours are enabled. Either service MILES (KM) or HOURS can be enabled, but not both. If service MILES (KM) or HOURS has been exceeded, the number flashes to indicate service is overdue.

The diagnostic screens are used by trained technicians to retrieve fault codes and other diagnostic information pertaining to the vehicle. Active faults are current problems that require attention. If active fault codes display during start-up or at any other time, make a note of the fault code and text message, then call an authorized Freightliner service facility for assistance. Pushing the MODE/RESET button will advance to the engine display screens. See Fig. 4.4.

**Engine Display Screens**

When the parking brake is set, the engine screens display the total engine miles, and the total engine hours.

If the parking brake is set, the first engine screen to display is the total engine miles screen. Pushing the mode switch a second time will display the total engine hours screen.

If the engine oil level is low while in the ENGINE OIL screen, the text "Lo" will be displayed in the lower left-hand corner of the display. If the engine oil level is high while in the ENGINE OIL screen, the text "HI" will be displayed in the left-hand corner of the display. If the oil level is OK while in the ENGINE OIL screen, blank text will be displayed in the lower left-hand corner of the display.

Holding the mode switch while in the OIL screen will display the engine oil level screen. The engine oil level screen will display the oil level quantity that is either high or low. The maximum displayed oil quantity is 9 quarts/liters high, or −9 quarts/liters low. See Fig. 4.4.

**Setup — Service Interval Screens**

With the parking brake set, pressing the MODE/RESET switch while in the total engine hours, or engine oil level screen, will sequence to the setup screen. The setup screens allows you to view or reset the next recurring service interval. Service intervals can be displayed in either miles (KM) or hours. They can also be inactivated, so they do not display at all.

The setup screen will display the active mode enabled for the service interval, MI (KM), or HOURS.

Holding the mode switch while in the setup screen, will display the reset screen. Holding the mode switch while in the reset screen will display the interval select screen. Holding the button while in the interval select screen will toggle between MI (KM) and HOURS for selection of the service interval active mode.

While in the HOURS screen, pushing the mode switch will sequence to the service hours time select screen. Flashing text indicates a menu choice that can be selected by pressing the MODE/RESET switch. Holding the switch for approximately 1-1/2 seconds will display table values. Holding the MODE/RESET switch for 3 seconds will speed up scrolling through the tables. Release the MODE/RESET switch, then push to select the menu choice.

While in the MI (KM) screen, holding the mode switch for approximately 1-1/2 seconds will display table values. Holding the MODE/RESET switch for 3 seconds will speed up scrolling through the tables. Release the MODE/RESET switch, then push to select the menu choice. See Fig. 4.4.

**ICU4-P3 (Instrumentation Control Unit)**

The ICU4-P3 instrument cluster is an individual-gauge cluster, with a lightbar with a driver message display screen and integrated warning and indicator lights. See Fig. 4.5 for a typical layout of the ICU4-P3.

Standard gauges are:
- speedometer
- tachometer
- engine coolant temperature
- engine oil pressure
- voltmeter
- fuel/DEF level
- primary and secondary air-pressure gauges
Gauges with a warning light on them are listed below, with an indication of how the warning light is activated:

- engine coolant temperature (high)
- engine oil pressure (low)
- fuel and DEF level (low)
- transmission oil temperature (high)

Other available gauges include:

- engine oil temperature
- transmission oil temperature
- axle temperature; forward-rear, and rear-rear
- brake application gauge, and air-suspension pressure gauge
- pyrometer
- turbo boost

**Buzzer and Chime**

A buzzer sounds for 3 seconds during the self-test at start-up, and when the following conditions exist:

- low air pressure
- low oil pressure
- high coolant temperature
- the parking brake is applied and the vehicle is moving at a speed of at least 2 mph (3 km/h)
- low voltage (< 12V for more than 40 seconds)

A chime sounds when the parking brake is off and the door is open, or when the headlights are on and the door is open.

While the vehicle is being driven, if the outside air temperature drops to 34°F (1°C) or less, the message display will flash the temperature and a warning message, and a warning chime will sound for 5 seconds if the ambient temperature alarm is enabled.
Ignition Sequence

When the ignition key is turned on, the ICU4-P3 begins a self-test. During this process, all gauges controlled by the cluster sweep to full scale and return, the buzzer sounds for 3 seconds, the fasten seat belt warning light illuminates for 15 seconds, and the battery voltage, low air pressure, and parking brake warning lights illuminate then turn off. Then the software revision level of the ICU4 is displayed, followed by active faults, if any, then the odometer display.

Mode/Reset Switch

The mode/reset switch is located on the lightbar. See Fig. 4.5. It controls the driver message display. Pressing the mode/reset button advances one screen, holding the button selects a menu choice or resets the display. When the display is reset, an audible chirp is heard.

The message display screens can also be scrolled through by using the switches mounted on the steering wheel. See Fig. 4.3. Use the + button to scroll up, and use the – button to scroll down. The + button can be held to reset or select a menu choice, instead of the mode/reset button, for any screen.

With the parking brake released, only the odometer, trip miles, trip hours, and ambient air temperature can be accessed. See Fig. 4.6. The parking brake must be set to access the stationary access screens.

Trip Miles, Trip Hours

Trip information allows you to view trip mileage and time. Trip information screens will display with the parking brake released, or applied.

When the odometer reading is displayed:

- Press the mode/reset switch once for trip distance.
- Press the mode/reset switch a second time for trip hours (engine hours).
- Hold the mode/reset switch, or the + button, to reset trip miles or hours to zero.

See Fig. 4.6.

Ambient Air Temperature

Push the mode switch while in the trip hours to display the outside ambient air temperature. The ambient air temperature will display with the parking brake released, or applied. See Fig. 4.6.

When the ambient air temperature reaches 34°F (1°C) or less, the ICU displays a caution text at 1-second intervals for 5 seconds, and a friendly chime sounds if the ambient temperature alarm is enabled. The driver can acknowledge the message by pressing the + or – button on the steering wheel, or the mode/reset switch. The chime will not sound again unless the temperature cycles above 37°F (4°C) and back to 34°F (1°C) or less. This warning only occurs while the ignition is on and the parking brake is released.

When the parking brake is set, the ambient air temperature display can be changed from °F to °C by changing the MI or KM selection in the SETUP menus. The warning message can be disabled or enabled in the SETUP menus.

NOTE: The ambient air temperature warning is in the disabled state when the vehicle is shipped from the factory. It must be enabled in the ICU setup screen.

Diagnostic Screens

During vehicle start-up, with the parking brake on, the ICU4-P3 will display any active fault codes for 3 seconds each until the parking brake is released. If service cycle screens are enabled, and service distance or time has been exceeded, the text SERVICE HOUR/MI (KM) will be displayed with the other fault messages, to inform the driver that the service interval has been exceeded and vehicle service is required.

See Fig. 4.7 for a diagram of the diagnostic and engine display screens for EPA07.

See Fig. 4.8 for a diagram of the diagnostic and engine display screens for EPA10.

If the word SERVICE appears on the diagnostic message display screen, service cycle screens are enabled. Hold the mode/reset switch to display miles or hours remaining until the next scheduled service. If MI (KM) appears on the DIAG screen, service miles are enabled; if HOURS appears on the screen, service hours are enabled. Either service miles or hours can be enabled, but not both. If service miles or hours has been exceeded, the number flashes to indicate service is overdue.
The diagnostic screens are used by trained technicians to retrieve fault codes and other diagnostic information pertaining to the vehicle. Active faults are current problems that require attention. If active fault codes display during start-up or at any other time, make a note of the fault code and text message, then call an authorized Freightliner service facility for assistance. Pushing the mode/reset button will advance to the engine information screens.

**Engine Screens**

The engine screen displays total engine miles or hours. Push and hold the mode/reset switch to display total engine miles. Push and hold it a second time to display total engine hours.

**Setup Screens**

Once the vehicle is safely parked with the parking brake set, the setup screens can be accessed. See Fig. 4.9 for setup screens.

Press the mode reset switch while in the engine display screen, to sequence to the SETUP screen. Hold the mode switch while in the SETUP screen, to sequence to the SELECT screen. Hold the mode switch while in SELECT, to toggle between MI or KM as a display preference. Release the mode switch at the desired selection, then press again to reset.

**NOTE:** The outside ambient air temperature display will be change between °F to °C by changing the MI or KM selection.
Push the mode switch again to display the temperature warning screen. Hold the mode switch to toggle between ON and OFF. Release the button, then press it again to reset to the desired setting.

Push the mode switch again to sequence to the LCD brightness screen. Hold the mode switch to toggle between ON and OFF. Release the button at the desired setting, then push again to reset.

Push the mode switch again to sequence to the service SETUP screen.

To reset the service intervals, hold the mode switch while in the service SETUP screen, to display the RESET screen. Hold the mode switch while in the RESET screen, to display the interval select screen. Hold the mode switch while in the interval select screen, to toggle between MI (KM), or HOURS for selection of the service interval mode. Release the button at the desired setting, then push again to reset.

If MI (KM) is selected, push the mode switch to sequence to the service miles distance select screen. Holding the mode switch for approximately 1-1/2 seconds will display table values. Holding the mode/reset switch for 3 seconds will speed up scrolling through the tables. Release the mode switch when the desired interval flashes, then push the mode/reset switch to select it. When completed, the display will sequence to the odometer display.

If HOURS is selected, push the mode switch to sequence to the service hours time select screen. Holding the mode switch for approximately 1-1/2 seconds will display table values. Holding the mode/reset switch for 3 seconds will speed up scrolling through the tables. Release the mode switch when the desired interval flashes, then push the mode/reset switch to select it. When completed, the display will sequence to the odometer display.

If NO is selected, the display will sequence to the odometer display.

* If "SERVICE" is displayed Service Cycle screens are enabled and either "MI" or "HOURS" is also displayed.
** On some vehicles "OIL LVL" appears in the top row of the display, if equipped and enabled.
The last screen in the SETUP menu, RESET EE is for resetting certain parameters to the original settings. Hold the mode switch to reset the ABS, SAMS rollcall, AMT display, Transmission heart beat (NO TRANS), sensor fault codes and engine oil level screens. Push the mode switch to sequence the display to the odometer setting.

**ICU4M-P3 (Instrumentation Control Unit)**

**General Information**

The ICU4M-P3 instrument cluster is an individual-gauge cluster, with an intelligent lightbar and integrated warning and indicator lights. See Fig. 4.10.

Some main features of the ICU4M-P3 are:

- Gauges sweep 270 degrees and have pointers lit by an LED (light-emitting diode).
• Service intervals are programmable from the steering wheel switches and from a dash-mounted info switch.

• A warning chime and alert message display warns the driver if the door is opened without first setting the parking brake.

• If low oil pressure or high coolant temperature is detected, a red warning light at the bottom of the gauge illuminates, a warning buzzer sounds, and a flashing alert message appears on the display, along with a text message giving additional information.
If the outside temperature drops to 34°F (1°C) or less, the ICU will flash the temperature with a chime for 5 seconds if the ambient temperature alarm is enabled.

There can be up to 12 removable gauges on the driver’s instrument panel. The ICU4M-P3 can also drive gauges located on the auxiliary instrument panel.

The standard gauges are:

- speedometer
- tachometer
- engine coolant temperature
- engine oil pressure
- battery voltmeter
- fuel/DEF level
- primary and secondary air pressure

Other available gauges include:

- engine oil temperature
- transmission fluid temperature
- rear axle temperature; on vehicles with tandem axles, forward-rear, and rear-rear
- brake application, and air-suspension pressure
- pyrometer
- turbo boost air pressure

Some gauges have a warning light integrated into the gauge. These are listed below, with an indication of how the warning light is activated:

- engine coolant temperature (high)
- engine oil pressure (low)
- fuel and DEF level (low)
- transmission fluid temperature (high)

The ICU4M-P3 settings are controlled with the (+) and (–) buttons located in the steering wheel, and the top of the My Info switch, mounted in the dash.
panel. See Fig. 4.11 and Fig. 4.12. The following tasks can be performed:

- Call up information onto direct access screens while the vehicle is moving, using the steering wheel switches.
- Move from screen to screen.
- Program on-screen service intervals, screen brightness, language, units of measurement, and other display functions, using the info switch.

- low air pressure
- low oil pressure
- low voltage
- high coolant temperature
- the parking brake is applied and the vehicle is moving at a speed of at least 2 mph (3 km/h)
- low voltage (< 12V for more than 40 seconds.)
- some roll stability (RSA) messages

A friendly chime sounds when the parking brake is off and the door is open, or when the headlights are on and the door is open.

While the vehicle is being driven, if the outside air temperature drops to 34°F (1°C) or less, the message display will flash a warning message, and a warning chime will sound for 5 seconds if the ambient temperature alarm is enabled.

**Ignition Sequence**

When the ignition key is turned on, the ICU4M-P3 begins a self-test. During the first half of this process, the following events occur. Observing these events is a good way to make sure the ICU4M-P3 is functioning properly.

- All gauges controlled by the cluster sweep to full scale and return.
- All display segments of the message center turn on and then turn off.
- The buzzer sounds for 3 seconds.
- The battery voltage, low air pressure, and parking brake warning lights come on and then go off.
- The fasten seat belt warning light illuminates for 15 seconds.

In the second half of the self-test, the software revision level of the ICU4M-P3 displays on the message center, followed by the active faults, if any.

When the self-test is complete, the fasten seat belt screen displays if the engine is not running. If the engine is running, the idle hours screen displays (odometer display).

**Buzzer and Chime**

The buzzer sounds for 3 seconds during the self-test at start-up, and when the following conditions exist:
Alert Messages

With the parking brake released, only the odometer and alerts messages can be displayed. Park the vehicle and set the parking brake to display additional screen functions.

The dash message center displays alerts when certain conditions occur. They appear when the parking brake is off, and override the regular screen display. They are warnings, cautions, or other messages that require the driver's attention, but not all of them are critical to the operation of the vehicle. Warning messages always display at full brightness.

More important messages take priority over less important messages. The order of importance, or priority, is:

1. parking brake on (with the vehicle moving)
2. parking brake off (with door open)
3. low oil pressure, high coolant temperature
4. hard brake warnings (if equipped with RSA)
5. low voltage
6. Caution 34°F (1°C) (or less); road may be icy
7. turn signal on
8. incoming instant or Qualcomm messages
9. service warnings
10. no datalink activity

"Incoming Message" Alert

On vehicles with an onboard Qualcomm communications system, this screen activates whenever a message is received. "Incoming Message" appears on the message display screen.

NOTE: The "Incoming Message" screen also displays during the ignition sequence if a message is available.

This message displays for a preset time period and then disappears. It returns after the preset interval until it is dismissed by pressing the +, –, or the MY INFO switch.

"Park Brake On" Warning

This warning message and an alarm tone come on whenever the parking brake is applied and the vehicle is moving faster than 2 miles per hour. The word "Warning" flashes on the message display screen above the message "Park Brake On". The screen and alarm tone go away only when the parking brake is released, or speed is reduced below 2 mph (3 km/h). See Fig. 4.13.

"Low Oil Pressure" Warning

This warning message and an alarm tone come on whenever the oil pressure falls below the minimum oil pressure specified by the engine manufacturer, whether the vehicle is idling or in motion. The word "Warning" flashes on the message display screen above the message "Low Oil Pressure". Dismiss the message by pressing the +, –, or the MY INFO switch.

NOTE: If there is more than one alert message to display, pressing the +, –, or the MY INFO switch takes you to the next message, and so on, until all the messages have been received.

If low oil pressure is detected during the ignition sequence, it displays as an active fault and the alert screen does not appear.

After 30 seconds, this message displays again and can be dismissed as before by pressing the +, –, or MY INFO switch.

"High Coolant Temp" Warning

This message and an alarm tone come on whenever the engine coolant temperature exceeds a preset point specified by the engine manufacturer (see the engine operation manual for this temperature). The word "Warning" flashes on the message display screen above the message "High Coolant Temp".

This message follows the same rules of dismissal and display as "Low Oil Pressure".
"Low Voltage" Warning
On some vehicles, this message and an alarm tone come on whenever a low voltage condition is detected by the instrumentation control unit. The word "Warning" flashes on the message display screen above the message "Low Voltage".

"Turn Signal On" Warning
This warning message and buzzer come on whenever the turn signal remains on for 4 minutes, or 5 miles of travel. The word "Warning" flashes on the display screen above the message "Turn Signal On", and the buzzer sounds.

To dismiss this message, either turn off the turn signal, or press the +, -, or MY INFO switch.

"Air Temperature" Warning
When the outside ambient air temperature drops to 34°F (1°C) or less, the ICU will display a warning text at 1 second intervals for 5 seconds, and a friendly chime will sound. The driver must acknowledge the warning by pressing the steering wheel switch, or the Quick Info switch. The chime will not sound again unless the temperature cycles above 37°F (4°C) and back to 34°F (1°C) or less. This warning only occurs while the ignition is on and the parking brake off. The outside ambient air temperature will display in degrees Fahrenheit if MI is selected in the setup screens, or degrees Celsius if KM is selected.

NOTE: The ambient air temperature warning is in the disabled state when the vehicle is shipped from the factory. It must be enabled in the ICU setup screen.

Service Warnings
Service warning screens display during the ignition sequence and indicate that a service interval has been reached or exceeded and maintenance is required. The messages may indicate the number of miles (KM) or hours until the next service or, once passed, the number of miles (KM) or hours ago that maintenance should have been performed. The messages read "X Miles (KM) To Next Service", "X Hours To Next Service", "Service Was Due X Mi (KM) Ago", and "Service Was Due X Hr Ago". The letter X represents the number of miles (KM) or hours programmed.

"No Datalink Activity" Alert (EPA07 only)
The "No Datalink Activity" screen comes on whenever the datalink is not receiving data.

If the condition persists, take the vehicle in for service as soon as possible to discover the cause of the problem.

Automated Manual Transmissions Display
The ICU4M-P3 can display current gear information for vehicles with automated manual transmissions (AMT). The last 3 digits at the far right on the lower line are reserved for this information.

If there is a recommendation to shift, one digit displays an arrow, either up or down depending on the shift direction. The other two digits display the current gear.

On vehicles with conventional manual or automatic transmissions, these 3 digits do not display. For more information about specific models of automated manual transmissions, see Chapter 15.

Favorite Screen
The driver can access a preset screen using the MY INFO switch. Holding down the bottom of the MY INFO switch for 1.2 seconds will set the current screen as the favorite screen. A chirp will sound to verify the screen has been set. Only screens that can be accessed with the parking brake off, can be selected as the favorite screen.

The favorite screen can be called up by pressing the bottom of the MY INFO switch. The favorite screen can be accessed with the parking brake off or on. There is no time-out for this screen. The screen can be acknowledged with any button except the MY INFO, and it will return to the previous screen.

Direct Access Screens
These are the screens that can be reached when the parking brake is not set. The vehicle can be stationary or moving to reach these screens. Use the steering wheel buttons to scroll through the main menus.

See Fig. 4.14 for the main stationary and direct access screens for EPA07.

See Fig. 4.15 for the main stationary and direct access screens for EPA10.
Stationary Access Screens

While the vehicle is stationary, with the parking brake set, the following screens can be accessed.

- Trip information including trip miles and hours, idle hours and average speed, and leg miles and hours
- Fuel information including fuel used, fuel economy, and idle and PTO fuel usage
- Engine information including engine miles and hours, engine and PTO fuel consumption
- Diagnostic information
- Service information including mileage or time to next service
- Setup information of various kinds
- Vehicle information including Datalink status, ICU serial number, and software version
- Fasten Seat Belts (RPM <100) or Idle hours (RPM >100)
- Outside air temperature

Use the steering wheel buttons to scroll through the main menus, and push the top of the MY INFO switch to advance through the sub-menus. The + button on the steering wheel is pushed and held to reset the counters for trip and fuel information. Briefly pushing the + and – will scroll up or down the menus.
**Trip Information**

When idle hours is displayed, press the steering wheel – button, or the MY INFO switch, to display the main trip information screen. Press the top of the MY INFO switch to advance to trip miles, trip advisories, idle hours, leg miles, and leg advisories, in that order. Press and hold the steering wheel + button to reset any of the screens. This sequence completes the trip information screens. Press the – steering wheel button, or the MY INFO switch, to advance to the main engine information screen.

**Fuel Information**

Press the MY INFO switch to advance through the fuel information screens; fuel used and average miles per gallons, and idle gallons and PTO gallons.

Fuel information allows you to view total fuel usage since the last reset, fuel mileage, and fuel consumed while idling or running the PTO. Press and hold the steering wheel + button to reset any of the screens. See Fig. 4.14. This sequence completes the fuel information screens.

Press the – steering wheel button, or the MY INFO switch, to advance to the main engine information screen.

**Engine Information**

Press the MY INFO switch to advance through the engine information screens; engine mileage and hours, and total fuel consumption for the engine and PTO. See Fig. 4.14.
Press the – steering wheel button, or the MY INFO switch, to advance to the main diagnostic information screen.

**Diagnostic Information**

During vehicle start-up, with the parking brake set, the ICU4M-P3 displays active fault codes, if any, until the parking brake is released. Active faults are current problems that require attention. If active fault codes display during start-up or at any other time, make a note of the fault code and text message, then call an authorized Freightliner service facility for assistance. Press the – steering wheel button, or the MY INFO switch, to advance to the main service information screen.

See Fig. 4.16 for a diagram of the diagnostic information screens for EPA07.

See Fig. 4.17 for a diagram of the diagnostic information screens for EPA10.

**Service Information**

Service information allows you to view the next recurring service interval. Service intervals can be expressed in either miles or hours. They can also be inactivated, so they do not display at all. For programming service intervals, look under the heading "Setup Information".

Press the MY INFO switch to advance through the service information screens; miles/km remaining to next service due, and service interval screen. See Fig. 4.16.

NOTE: If the vehicle has gone past the service interval, the "miles(km)/hours remaining" screen
is replaced by the "service was due" screen, followed by the number of miles(km)/hours since the service was due.

Press the – steering wheel button, or the MY INFO switch, to advance to the main setup information screen.

**Standard Screens**

See **Fig. 4.18** for an overview the standard screens.

See **Fig. 4.19** for a detail of the setup information screens.

See **Fig. 4.20** for a detail of the vehicle information screens for EPA07.

See **Fig. 4.21** for a detail of the vehicle information screens for EPA10.

**Setup Information**

Setup information allows you to program various features of the ICU4M-P3 environment. Some of the features which can be programmed include:

- Service intervals (Off/Miles/Hours);
- Ambient Temperature Warning (On/Off);
- Target MPG;
- LCD Lamp (On/Off);
- Driver message display brightness;
- Language (English, French, Spanish);
- Units of measurement (English/Metric);
- Reset Parameters to their original settings. I.E. ABS rolcall, sensor fault codes, engine oil level screens.
Press the MY INFO switch to advance to the service interval screen. Hold the + button to toggle between "Off", "Miles", "Hours" selections. Release the + at the desired choice, then press it to select the choice. If you select "Off" at the selection screen (meaning you have turned off service interval information), the screen will skip the remaining service screens.

Press the MY INFO switch to go to the service interval screen. Hold the + button to scroll through the
The current selection flashes. Hold the + button to toggle between choices, then release the button and briefly push it to select. To exit the screen, press the top of the MY INFO switch.

Note: If parking brake is released while in stationary screens, the display will return to the bar graph screen.

Fig. 4.19, ICU4M-P3 Setup Information Screens
intervals, then release and press the + button to select the desired interval.

Press the MY INFO switch to advance to the next feature screen, temperature warning.

Press the MY INFO switch to go to the change screen. Use the + button to toggle between "On" and "Off". Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, change target MPG.

Press the MY INFO switch to go to the change screen. Press the + button to increase the target MPG. Press the – to decrease the target MPG. Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, change LCD lamp.

Press the MY INFO switch to go to the change screen. Press the + button to toggle between "On" and "Off". Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, change display brightness.

Press the MY INFO switch to go to the change screen. Press the + button to increase the display brightness. Press the – to decrease the display brightness. Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, change language.

Press the MY INFO switch to go to the change screen. Press the + button to toggle between language selections. Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, change units.

Press the MY INFO switch to go to the change screen. Press the + button to toggle between unit selections. Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to advance to the next feature screen, reset parameters.

Press the MY INFO switch to go to the change screen. Press the + button to toggle between "Yes" and "No". Release the button at the desired setting, then press it briefly to select.

Press the MY INFO switch to return to the beginning of the setup menus.
Vehicle Information Screens

The vehicle information screens display hardware, and software information.

The following screens display under vehicle information:

- Dash#: This screen displays the Freightliner part number of the ICU.
- SW: This screen displays the switch ID of the ICU.

Warning and Indicator Lights

The dash lightbar has three to four rows of warning and indicator lights with icon symbols (also known as telltales), depending on the ICU. The positions of the lights may vary for the different ICUs, but the symbols are standard for all applications.

IMPORTANT: EPA07 emissions regulations apply to vehicles domiciled in Canada and the USA at the time of printing this manual. Vehicles that are domiciled outside of the USA and Canada may not have EPA07-compliant engines with an emission aftertreatment system, depending upon local statutory emissions guidelines. Vehicles that are not EPA07 compliant will not have functioning High Exhaust System Temperature, Diesel Particulate Filter, or Malfunction Indicator lamps as shown in the table that follows.

<table>
<thead>
<tr>
<th>Warning and Indicator Lights</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Check Engine" /></td>
<td>Indicates an undesirable engine condition is detected or recorded. If the condition gets worse, the stop engine or engine protection light will illuminate.</td>
</tr>
<tr>
<td><img src="image" alt="Stop Engine or Engine Protect" /></td>
<td>Indicates a serious fault which requires the engine shut down immediately. The engine ECU will reduce the maximum engine torque and speed, and, if the condition does not improve, will shut down the engine within 30 seconds of the light illuminating. The driver must safely bring the vehicle to a stop on the side of the road and shut down the engine as soon as the red light is seen. If the engine shuts down while the vehicle is in a hazardous location, the engine can be restarted after turning the key to the OFF position for a few seconds.</td>
</tr>
<tr>
<td><img src="image" alt="High Exhaust System Temperature (HEST)" /></td>
<td>Slow (10-second) flash, indicates a regeneration is in progress, and the driver is not controlling the engine idle speed. Solid illumination indicates a regeneration is in progress, with high exhaust temperatures at the outlet of the tail pipe, if the speed is below 5 mph (8 km/h). It does not signify the need for service; it only alerts the vehicle operator of high exhaust temperatures. See the engine operation manual for details.</td>
</tr>
<tr>
<td><img src="image" alt="Diesel Particulate Filter (DPF) Status" /></td>
<td>Solid illuminated indicates a regeneration is required. Change to a more challenging duty cycle, such as highway driving, to raise exhaust temperatures for at least 20 minutes, or perform a parked regeneration. See the engine operation manual for details. Blinking indicates that a parked regeneration is required immediately. An engine derate and shutdown will occur. See the instructions in the engine operation manual to perform a stationary regeneration.</td>
</tr>
<tr>
<td>Lamp Type</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Malfunction Indicator Lamp (MIL) (amber)</td>
<td>Indicates an engine emissions-related fault, including, but not limited to the aftertreatment system. See the engine operation manual for details.</td>
</tr>
<tr>
<td>Tractor ABS (amber)</td>
<td>Indicates a problem with the ABS is detected. Repair the tractor ABS immediately to ensure full antilock braking capability.</td>
</tr>
<tr>
<td>Trailer ABS (amber)</td>
<td>Indicates a fault is detected with the trailer ABS.</td>
</tr>
<tr>
<td>Left-Turn Signal (green)</td>
<td>Flashes on and off whenever the outside turn signal lights are flashing.</td>
</tr>
<tr>
<td>Right-Turn Signal (green)</td>
<td>Flashes on and off whenever the outside turn signal lights are flashing.</td>
</tr>
<tr>
<td>High-Beam Indicator (blue)</td>
<td>Indicates the headlights are on high beam.</td>
</tr>
<tr>
<td>Low Air Pressure Warning (red)</td>
<td>For EPA07, activates with a buzzer when air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa). For EPA10, activates when suspension air is low.</td>
</tr>
<tr>
<td>High Coolant Temperature Warning (red)</td>
<td>Activates with a buzzer when the coolant temperature goes above a maximum level specified by the engine manufacturer (see the engine manual).</td>
</tr>
<tr>
<td>Low Engine Oil Pressure Warning (red)</td>
<td>Activates with a buzzer when engine oil pressure goes below a minimum level specified by the engine manufacturer (see the engine manual).</td>
</tr>
<tr>
<td>Intake Heater (amber) (EPA07)</td>
<td>Indicates the intake air heater is active. Wait to start.</td>
</tr>
<tr>
<td>Parking/Emergency Brake Warning (BRAKE!) (red) (EPA07)</td>
<td>Indicates the parking brake is engaged, or hydraulic brake fluid pressure is low. A buzzer activates when the vehicle is moving over 2 mph (3 km/h) with the parking brake set.</td>
</tr>
<tr>
<td>Parking/Emergency Brake Warning (BRAKE) (red) (EPA10)</td>
<td>Indicates the parking brake is engaged, or hydraulic brake fluid pressure is low. A buzzer activates when the vehicle is moving over 2 mph (3 km/h) with the parking brake set.</td>
</tr>
<tr>
<td>Cruise Control Activated (green)</td>
<td>Indicates the cruise control is active.</td>
</tr>
</tbody>
</table>
## Instruments

### Warning and Indicator Lights

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Seat Belt Icon]</td>
<td>Fasten Seat Belt Warning (red)</td>
<td>Illuminates for 15 seconds when the ignition key is turned to the ON position.</td>
</tr>
<tr>
<td>![Fuel Icon]</td>
<td>Water in Fuel Warning (amber)</td>
<td>Indicates that the fuel could contain water.</td>
</tr>
<tr>
<td>![Battery Icon]</td>
<td>Low Battery Voltage Warning (red)</td>
<td>Indicates battery voltage is 11.9 volts or less.</td>
</tr>
<tr>
<td>![Charge Icon]</td>
<td>No Charge Warning (amber)</td>
<td>Indicates an alternator charge output failure.</td>
</tr>
<tr>
<td>![Transmission Icon]</td>
<td>Check Transmission Temperature</td>
<td>Indicates high transmission temperature.</td>
</tr>
<tr>
<td>![Transmission Icon]</td>
<td>Check Transmission</td>
<td>Indicates a transmission issue.</td>
</tr>
</tbody>
</table>

### Overhead Instrument Panel

The overhead instrument panel holds the C/B radio if installed, and any switches that can not be accommodated on the driver’s or auxiliary dash panels.

The underside of the overhead console also holds the sun visors and the optional dome/reading light assembly. See Chapter 5 for more information on the dome/reading light assembly.

### Speedometer and Tachometer

**Tachometer**

The 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. The green band on the tachometer indicates the best fuel economy range. The yellow band indicates lower fuel economy, the orange band indicates much lower fuel economy, and the red band indicates poor fuel economy.

**Speedometer**

The speedometer registers speed in both miles per hour (mph) and kilometers per hour (km/h).

### Standard Instruments

#### Engine Oil Pressure Gauge

The oil pressure gauge should read as shown in Table 4.1.

<table>
<thead>
<tr>
<th>Engine Model</th>
<th>At Idle Speed: psi (kPa)</th>
<th>At Rated RPM: psi (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detroit Diesel S60</td>
<td>12 (83) min.</td>
<td>50 (345) min.</td>
</tr>
<tr>
<td>Cummins</td>
<td>15 (103)</td>
<td>35 (241) min.</td>
</tr>
<tr>
<td>MBE4000</td>
<td>7 (50)</td>
<td>36 (250) min.</td>
</tr>
</tbody>
</table>

* 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 create a guide for checking engine condition.

#### 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.
Coolant Temperature Gauge

During normal engine operation, the coolant 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 4.2, inspect the cooling system to determine the cause.

<table>
<thead>
<tr>
<th>Engine Make</th>
<th>Temperature: °F (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detroit Diesel</td>
<td>215 (101)</td>
</tr>
<tr>
<td>Cummins</td>
<td>225 (107)</td>
</tr>
<tr>
<td>Mercedes-Benz</td>
<td>221 (105)</td>
</tr>
</tbody>
</table>

Table 4.2, Maximum Coolant Temperature

Transmission Oil Temperature Gauge

During normal operation, the transmission oil temperature gauge reading should not exceed 250°F (121°C) for Eaton® Fuller® 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 engine until the cause has been determined and corrected.

Fuel Gauge

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.

Fuel/Diesel Exhaust Fluid (DEF) Gauge (EPA10)

The fuel and DEF levels are measured in a dual-purpose fuel/DEF gauge. See Fig. 4.22.

The diesel fuel level is indicated at the top of the gauge, with a low-fuel warning lamp that illuminates amber when the diesel fuel level registers 1/8th of capacity. The DEF level is indicated in the lightbar on the lower portion of the gauge. There is a low DEF level warning lamp that illuminates amber when the

DEF level reaches 10% of capacity. See Chapter 11, for details of the DEF gauge functions.

Primary and Secondary Air Pressure Gauges

Air pressure gauges register the 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, activate 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.

Voltmeter

The voltmeter is a digital readout located on the bottom line of the dash message center whenever the ignition switch is turned on. 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.

**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.

**Optional Instruments**

**Engine Oil Temperature Gauge**

During normal operation, the engine oil temperature gauge should read from 200 to 260°F (93 to 126°C). Under heavy loads, such as when climbing steep grades, temperatures that exceed the normal oil temperature 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 determined and corrected.

**Turbocharger Boost Pressure Gauge**

A turbocharger boost pressure gauge measures the pressure in the intake manifold, in excess of atmospheric pressure, being created by the turbocharger.

**Pyrometer**

A pyrometer registers the exhaust temperature near the turbocharger. Normal exhaust temperatures are 700 to 1100°F (370 to 595°C).

Variations in engine load can cause exhaust temperatures to rise as high as 1100°F (600°C). If the pyrometer reading shows that exhaust temperature exceeds normal, reduce fuel to the engine until the exhaust temperature is reduced. Shift to a lower gear if the engine is overloaded.

**Forward and Rear Axle Oil Temperature Gauges**

During normal operation, forward and rear axle oil temperature gauges should read between:

- 160 and 220°F (71 and 104°C) for Meritor™ drive axles;
- 180 and 200°F (82 and 93°C) for Dana Spicer® drive axles.

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

**CAUTION**

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

**Application Air Pressure Gauge**

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.
Intake-Air Restriction Gauge

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 inH₂O (inches of water).

NOTE: Rain or snow, or temporarily running the vehicle above its rated speed, can cause a higher than normal temporary reading.

Intake-Air Restriction Indicator

An intake-air restriction indicator measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. See Fig. 4.23. If the yellow signal stays locked at or above the values shown in Table 4.3 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.

NOTE: Rain or snow, or temporarily running the vehicle above its rated speed, can cause a higher than normal temporary reading.

<table>
<thead>
<tr>
<th>Engine Make</th>
<th>Initial inH₂O</th>
<th>Service inH₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cummins</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Detroit Diesel</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Mercedes-Benz</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

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

Table 4.3, Intake-Air Restriction Vacuum Readings

Vehicles may be equipped with an optional go/no-go restriction indicator without graduations (Fig. 4.24).

Ammeter

An ammeter measures current flowing to and from the battery. When the batteries are being charged, the meter needle moves to the plus side of the gauge; when the batteries are being discharged, the needle moves to the minus side. A consistent negative reading when the engine is running indicates a possible problem with the charging system.

Air-Weigh On-Board Scale

The Air-Weigh on-board scale is an aftermarket option for all truck models with air suspensions. The in-dash LCD scale provides digital weights to within 300 lb (135 kg) of a DOT scale. It is calibrated to the vehicle suspension and weight. See Fig. 4.25.

See the following list for button functions:

- **ESC**—press ESC to go to the menu system when displaying weights, or go to the previous menu selection when within the menu system. Pressing ESC before pressing ENTER during data entry will make the scale revert to its previous entry like an *Undo* function. Pressing ESC a second time will return to the previous menu selection.

- **ARROW UP**—press ARROW UP to select a menu option immediately above the flashing selection and to scroll the display to a higher number. Holding ARROW UP increases the scrolling rate when entering numbers.

- **ARROW DOWN**—press ARROW DOWN to select a menu option immediately below the flashing selection and to scroll the display to a
Collision Warning System, Eaton VORAD VS-400 (Stand Alone)

The Eaton VORAD VS-400 is a computerized collision warning system (CWS) that uses forward-looking radar (FLR) to monitor objects ahead, and optional side-mounted sensors to monitor objects alongside the vehicle.

The system performs in fog, rain, snow, dust, smoke, and darkness. To be detected, objects must be within the radar beam field of view and provide a surface area that can reflect back the radar beam.

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

Optional side sensors also transmit and receive radar signals, for a distance of 2 to 10 feet (0.5 to 3 meters) alongside the vehicle. The side sensor can detect unseen objects, moving or stationary, adjacent to the vehicle.

WARNING

The Eaton VORAD VS–400 Collision Warning System (CWS) is intended solely as an aid for an alert and conscientious professional driver. It is not intended to be used or relied upon to operate a vehicle. Use the system in conjunction with rearview mirrors and other instrumentation to safely operate the vehicle. Operate this vehicle, equipped with the VS–400 Collision Warning System, in the same safe manner as if the VS–400 Collision Warning System were not present.

The VS–400 Collision Warning System is not a substitute for safe, normal driving procedures, nor will it compensate for any driver impairment such as drugs, alcohol, or fatigue.

The VS–400 Collision Warning System may provide little or no warning of hazards such as pedestrians, animals, oncoming vehicles, or cross traffic.

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

Driver Display Unit

The VORAD system controls are located in the driver interface unit (DIU). The DIU provides visual and audio warnings and messages. Menu selections are made by pressing the up, down, and OK buttons. See Fig. 4.26.

The DIU has the following features:

- Internal speaker, for audio warnings
- Graphic display, for visual warnings, menus, and other information
- User interface keypad, for scrolling up, scrolling down, and selection
Ambient light sensor, for auto illumination adjustment for daytime or night-time display

Programmable for driver ID with use of a PIN

The following lights illuminate on the DIU to indicate a message:

- Red LED– illuminates with the collision alert display
- Yellow LED–illuminates with headway alert display
- Orange LED–illuminates when a system failure occurs
- Blue LED–illuminates when information is available

Immediately after each battery power ON cycle, the DIU initializes by executing self-test routines. During the initialization time, the screen shown in Fig. 4.27 is displayed and all the LED lamps are activated (power-on bulb check) for approximately 3 seconds, along with a power-up tone.

When initialization is complete, the DIU displays the VS-400 system configuration screen. Figure 4.28 shows the screens for the VS-400 configured for Collision Warning System (CWS) and SmartCruise™, and for CWS only.

### Menu Selections

**IMPORTANT**: The display of any menu item is overridden whenever conditions require an alert warning, or collision warning, to be displayed.

After initialization, the menu screen is displayed. In this screen, the driver may scroll to the desired item by pressing an arrow button, then pressing the OK button to select the item. See Fig. 4.29. If the driver
System Status Screen

System status is displayed under normal operating conditions by scrolling to the "System Status" item and then pressing the "OK" button. This screen shows the status of each system, indicating if the system can operate normally. If a system cannot operate normally, the system displays "Failed" beside the system name rather than "OK". "Failed" means a fault is preventing the system from operating and it cannot be used until the fault is corrected or acknowledged.

Depending on the VS-400 system installed, one of the following screens will appear unless a system fault is active. Pressing OK exits this menu. See Fig. 4.30.

Demo (vehicle must be stationary)

When the vehicle is stationary, and the Demo mode is selected, the DIU will demonstrate the meaning of all LED and screen displays, including alert messages and sound warnings. The demo screens are scrolled through by pressing the down arrow. Pressing any other key exits the mode.

Volume

For configurations with adjustable volume, the minimum adjustable volume configuration is 50% of the maximum volume. If the DIU volume is not adjustable, the display screen shows a grayed bar graph whenever volume adjustment is selected. After each ignition switch cycle, the volume will default to 100%.

One of the screens in Fig. 4.31 is displayed when volume is selected, if conditions do not require the display of headway alerts or warnings.

NOTE: Headway alert tones (Yellow LED), and collision alert tones (Red LED), may be suppressed when the brake is applied, if the parameter is configured to do so.

Brightness

The up and down arrows are used to change the brightness. This adjustment changes the warning LEDs and graphic display backlight brightness. Pressing the OK button exits this screen. See Fig. 4.32.
The ambient light sensor reading determines if the DIU is in daytime or nighttime mode. Menu-adjusted brightness is applied only to the mode the DIU is in at the time of adjustment. The previous brightness settings are repeated after each ignition cycle. However, the graphic display and the warning LED brightness range are constrained such that they are always visible regardless of how low the brightness is adjusted in all driving conditions. Pressing the OK button exits the menu.

**SmartCruise® Headway Range**

Headway range adjustment is only available in the CWS with SmartCruise version of the VS-400 system, with headway range adjustment enabled. Headway range adjustment is selected from the main menu with the scroll arrow, followed by pressing the OK key to select the screen. Headway range is adjustable between 3.25 and 2.25 seconds, in 0.25 second increments, by pressing the up or down arrows. The headway range setting will default to 3.25 seconds, after each ignition power cycle.

If the headway adjust screen is selected and headway range is not enabled, then only the "3.25 sec" screen is displayed. See Fig. 4.33 for the various headway range screens.

Pressing OK exits the menu.

If the headway range is adjusted to 3 seconds or below, and SmartCruise is active, the 3 second collision warning headway alert will not display. All other alerts are not suppressed.

**KM/H MPH Screen**

The up and down arrows are used to select either km/h or mph units for display of SmartCruise set speed. The previous km/h or mph setting is displayed at the next ignition cycle. See Fig. 4.34.

Pressing OK exits this menu.

**Diagnostics**

The DIU displays fault codes currently active when this screen is selected. See Fig. 4.35. The vehicle must be stationary for the fault codes to display. Contact an authorized Freightliner service center if fault codes display.

**Forward-Looking-Radar (FLR) Warning System**

If the VS-400 reads any vehicle speed before the forward-looking-radar has time to warm up, a single tone will sound, and one of the following screens will display. See Fig. 4.36. The FLR may require a warm-up period of up to 5 minutes in extreme cold outside temperature conditions.

The VS-400 FLR identifies and tracks the nearest object in the lane of travel. This object is classified by the range, and assigned one of the messages shown in Fig. 4.37, Fig. 4.38, Fig. 4.39, Fig. 4.40.
The alerts given by the VS-400 system are based on the “headway” to the object ahead, whenever vehicle speed is 10 mph (8 km/h) or greater.

Object Detected

When an object is in the lane of travel, the VS-400 system displays the following message and tone. See Fig. 4.37.

- Information Message: OBJECT DETECTED
- Tone sequence: None
3-Second Headway Alert
When a moving object is in the lane of travel, and the headway is greater than 2 seconds, up to and including 3 seconds, the DIU displays the following message. See Fig. 4.38.

- Information Message: 3 seconds
- Tone Sequence: None

2-Second Headway Alert
When the vehicle is closing on a moving object in the lane of travel, and the headway is greater than 1 second, up to and including 2 seconds, the DIU displays the following message and tones. See Fig. 4.39.

- Information Message: 2 seconds
- Tone Sequence: "2-Second closing headway alert" tones are sounded. (Note: This tone sequence is not sounded if the brakes are applied.)

1-Second Headway Alert
When the vehicle is closing on a moving object in the lane of travel, and the headway is greater than 0.5 seconds, up to and including 1 second, the DIU displays the following message and tones. See Fig. 4.40.

- Information Message: 1 second
- Tone Sequence: "1-Second closing headway alert" tones are sounded. (Note: This tone sequence is not sounded if the brakes are applied.)

Collision Alert: 1/2-Second Headway
When the vehicle is closing on a moving object in the lane of travel, and the headway is 0.5 second or less, the DIU displays the following message and tones. See Fig. 4.41.

- Information Message: COLLISION ALERT
- Tone sequence "1/2-Second closing alert" tones are sounded continuously.
Collision Alert: Slow Moving Object

See Fig. 4.41. If the headway to a slow moving object is 3 seconds or less and the vehicle turn radius is 750 feet or more, the collision alert message is displayed and the "slow moving object tone" is sounded, provided:

- the vehicle speed is greater than 35 mph (55 km/h);
- the speed of the object is greater than 5 ft (1.5 m) per second;
- the object is in the lane of travel, and within 220 feet (67 meters) of the vehicle;
- the object speed is less than 80% of the host vehicle speed.

Collision Alert: Stationary Object

See Fig. 4.41. If the headway to a stationary object is 3 seconds or less, and the vehicle turn radius is 750 feet (230 meters) or more, the collision alert message is displayed and the "stationary object tone" is sounded, provided the object is in the lane of travel, and within 220 feet (67 meters) of the vehicle.

Side Sensor Display

The side sensor display is mounted on the A-pillar. See Fig. 4.42. The following lights illuminate.

- The red LED illuminates when an object is detected.
- The red LED illuminates and a triple tone is sounded, when objects are detected and the turn signal is activated.
- The ambient light sensor determines if the side sensor display is in daytime or nighttime mode. The display brightness is automatically adjusted for daytime or nighttime operation.
- The yellow LED illuminates when no objects are detected.
- The red and yellow LEDs illuminate together when there is a fault condition.

Special Road Situations

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

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

- When an object is detected in a very sharp right- or left-hand turn, the audible alarm will not sound.
- When approaching a curve, alarms may sound and lights illuminate, because of an object off the road directly in line with your vehicle. This will not occur when the brakes are applied.
• Elevated obstacles such as overpasses and overhead signs may be detected, when approaching a roadway descending to a lower elevation.

• Vehicles cannot be detected on the other side of a hill. An alarm will not sound until the object is within the antenna assembly’s field of view.

• On approaching a steep hill, objects above the beam cannot be detected. Generally, the beam hitting the road surface does not cause an alarm.

• The side sensor only detects objects within its field of view, next to the tractor. A vehicle farther back behind the field of view, will not be detected.

• The side sensor range is set to detect average sized vehicles 2 to 10 feet (0.5 to 3 meters) away in the adjacent lane.

• The radar beam will detect near range cut-ins of approximately 30 feet (9 meters) or less, depending on the angle of entrance into the lane in front of your vehicle.

**WARNING**

Heavy rain or water spray at the side sensor may cause both the yellow and red lights on the side sensor display to illuminate at the same time. Under these conditions the system is temporarily unable to provide adequate warnings.

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

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

**Maintenance**

Keep the antenna assembly and side sensor(s) free of buildup of mud, dirt, ice, or other debris that might reduce the system’s range.

---

**Failure Display Mode/Fault Codes**

The VS-400 performs internal diagnostics at power-up, then continuously monitors system components thereafter.

If a failure is detected, depending on what features are affected, the DIU displays a screen similar to Fig. 4.43, blinks the orange fault light, and sounds a tone. Press the OK button to acknowledge the fault.

![Fig. 4.43, VORAD Fault Display](image1)

After the fault has been acknowledged by the driver pressing the OK button, the DIU will attempt to return to normal operations. The orange LED is continuously illuminated while the fault persists. If the fault disappears, the VS-400 transmits a message to indicate that the fault status has changed to a previously active fault.

In the event the FLR antennae becomes blocked while the vehicle is moving (e.g., snow, mud, ice, tampering, etc.), the system sounds a tone and displays the fault screen shown in Fig. 4.44.

![Fig. 4.44, Antennae Blocked Display](image2)
Previously active fault codes can be reviewed, tested, and cleared using the Eaton Service Ranger diagnostic tool. Contact an authorized Freightliner dealer to review and clear previously active fault codes. See Table 4.4 for common fault codes.

**Roll-Stability Advisor/Control, and Hard-Braking Advisor**

The roll-stability system may entail the roll-stability advisor only, or include the roll-stability control as an option.

A decal (Fig. 4.45) on the auxiliary dash panel, and an amber-colored dash indicator light (Fig. 4.46), indicate that the vehicle is equipped with the roll-stability system components.

**Roll-Stability Advisor**

IMPORTANT: This is not an advance warning system. The roll-stability advisor displays a message only after the driving maneuver is completed.

The roll-stability system uses a lateral-acceleration sensor that monitors rollover risk. Shortly after a curve, lane change, or other driving maneuver that results in a rollover-risk detection, a dash warning light illuminates, an audible tone sounds, and a driver advisory message is displayed in the driver message center. The purpose is to advise the driver that the previous maneuver produced a rollover risk.

The roll-stability advisor displays different text messages depending on the severity of the risk of each occurrence of risky driving. From the highest risk level to the lowest risk level, the system will sound a warning buzzer, and display a message, as shown in Fig. 4.47.

<table>
<thead>
<tr>
<th>Device</th>
<th>SPN</th>
<th>FMI</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIU/FLR</td>
<td>639</td>
<td>2</td>
<td>One or more required messages missing from datalink</td>
<td></td>
</tr>
<tr>
<td>DIU/FLR</td>
<td>639</td>
<td>9</td>
<td>No message being received from datalink</td>
<td></td>
</tr>
<tr>
<td>DIU/FLR</td>
<td>639</td>
<td>13</td>
<td>Device cannot claim source address on datalink</td>
<td></td>
</tr>
<tr>
<td>DIU/FLR</td>
<td>639</td>
<td>19</td>
<td>Messages received with incorrect data or marked as error</td>
<td></td>
</tr>
<tr>
<td>FLR</td>
<td>886</td>
<td>7</td>
<td>FLR misaligned</td>
<td></td>
</tr>
<tr>
<td>FLR</td>
<td>886</td>
<td>12</td>
<td>FLR internally defective</td>
<td></td>
</tr>
<tr>
<td>FLR</td>
<td>886</td>
<td>13</td>
<td>FLR not configured properly</td>
<td></td>
</tr>
<tr>
<td>FLR</td>
<td>886</td>
<td>14</td>
<td>FLR blocked</td>
<td></td>
</tr>
<tr>
<td>DIU</td>
<td>893</td>
<td>12</td>
<td>DIU internally defective</td>
<td></td>
</tr>
<tr>
<td>FLR</td>
<td>898</td>
<td>13</td>
<td>Engine not configured for SmartCruise operation</td>
<td>Tested only if SC configured</td>
</tr>
<tr>
<td>FLR</td>
<td>898</td>
<td>14</td>
<td>Engine not supported for SmartCruise operation</td>
<td>Tested only if SC configured</td>
</tr>
<tr>
<td>DIU/FLR</td>
<td>1563</td>
<td>13</td>
<td>VS-400 component detects incompatibility issue with other VS-400 devices</td>
<td></td>
</tr>
<tr>
<td>DIU</td>
<td>1703</td>
<td>3</td>
<td>External right speaker shorted high</td>
<td>Tested only if external right speaker configured</td>
</tr>
<tr>
<td>DIU</td>
<td>1703</td>
<td>4</td>
<td>External right speaker shorted low</td>
<td>Tested only if external right speaker configured</td>
</tr>
<tr>
<td>DIU</td>
<td>1703</td>
<td>5</td>
<td>External right speaker open</td>
<td>Tested only if external right speaker configured</td>
</tr>
<tr>
<td>DIU</td>
<td>1704</td>
<td>3</td>
<td>External left speaker shorted high</td>
<td>Tested only if external left speaker configured</td>
</tr>
<tr>
<td>DIU</td>
<td>1704</td>
<td>4</td>
<td>External left speaker shorted low</td>
<td>Tested only if external left speaker configured</td>
</tr>
</tbody>
</table>
## Instruments

<table>
<thead>
<tr>
<th>Device</th>
<th>SPN</th>
<th>FMI</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIU</td>
<td>1704</td>
<td>5</td>
<td>External left speaker open</td>
<td>Tested only if external left speaker configured</td>
</tr>
</tbody>
</table>

**Table 4.4, VORAD Fault Codes**

**SAFETY INSTRUCTIONS**

lamp indicates traction OR roll control event. Follow instructions in driver’s manual.

07/11/2003 24-31054-000 1080125

**Fig. 4.45, Roll-Stability Decal**

**WARNING**

The Roll-Stability Control system is intended only as an aid for a conscientious and alert driver. Carefully read the information in this manual to understand this system and its limitations. The Roll-Stability Control system is not a substitute for safe driving procedures. Failure to drive safely, and use the system properly, could result in personal injury and/or death and property damage.

The roll-stability control system automatically reduces engine power, applies the engine brake, and/or applies the tractor and trailer brakes when the acceleration sensor detects that the vehicle is at risk of rolling over. The control can intervene even before an advisory message is displayed.

The dash indicator light illuminates whenever the roll-stability control system intervenes. See **Fig. 4.46**.

**Hard-Braking Advisor**

The hard-braking advisor uses the information from the ABS wheel speed sensors to determine when braking is severe enough to produce lockup at one or more wheels on the tractor, and/or very rapid vehicle deceleration. Shortly after a hard-braking event occurs, an advisory message is displayed in the driver message center, indicating that the braking behavior was too aggressive for the current road surface conditions. This system is not a replacement for a driver’s good judgment. Sometimes it is necessary to brake hard.

From the highest risk level to the lowest risk level, the system will sound a warning buzzer, and display a message, as shown in **Fig. 4.47**.

**Trip/Leg Totals**

The driver message center records the number of messages received, and displays the number of messages as counts. Roll-stability advisor (RSA) and hard-braking event data (HBED) counts can be viewed in the trip advisory screen, and the leg advisory screen.

Counts can be reset using the + key on the steering wheel. Clearing RSA and HBED leg counts will also reset the leg miles and leg hours. Clearing RSA and HBED trip counts will also reset trip miles, trip hours,
In addition, resetting leg miles will clear leg counts. Clearing trip miles will reset miles, hours, and counts in both the leg and trip screens.

The TRIP and LEG advisor screens count both the roll-stability advisories (ROLL) and hard-braking events (BRK). For example, if during a TRIP, the driver message center recorded the events in Table 4.5, the message center would display as shown in Fig. 4.48.

### Table 4.5, RSA/HBED Count

<table>
<thead>
<tr>
<th>Message Received</th>
<th>Message Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSA Level 3</td>
<td>2</td>
</tr>
<tr>
<td>RSA Level 2</td>
<td>3</td>
</tr>
<tr>
<td>RSA Level 1</td>
<td>7</td>
</tr>
<tr>
<td>HBED Level 3</td>
<td>5</td>
</tr>
<tr>
<td>HBED Level 2</td>
<td>1</td>
</tr>
<tr>
<td>HBED Level 1</td>
<td>8</td>
</tr>
</tbody>
</table>

If the count reaches more than 9 occurrences an up-arrow symbol will appear, to indicate to the driver that the count has exceeded 9 counts. See Fig. 4.49.
# Driver Controls

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<td>Exterior Lighting Controls</td>
<td>5.2</td>
</tr>
<tr>
<td>Interior Lighting Controls</td>
<td>5.5</td>
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<td>Dash-Mounted Electrical Switches</td>
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<tr>
<td>Dash-Mounted Brake Controls</td>
<td>5.12</td>
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<tr>
<td>Multifunction Turn Signal Switch</td>
<td>5.12</td>
</tr>
<tr>
<td>Steering-Wheel-Mounted Controls</td>
<td>5.14</td>
</tr>
<tr>
<td>Adjustable Steering Column</td>
<td>5.14</td>
</tr>
</tbody>
</table>
Ignition Switch and Key

The ignition switch is located on the left-hand dash, below the headlight switch. See Fig. 5.1 for an overview of the left-hand dash.

The ignition switch has four positions: ACC, OFF, ON, and START. See Fig. 5.2.

In the OFF position, the key slot is vertical; the key can be inserted and removed only in this position. The following features can be operated in the OFF position, regardless of whether the key is inserted.

- low-beam headlights
- taillights
- brake lights
- road lights
- dome lights
- clearance lights
- hazard warning lights
- utility lights
- baggage compartment lights
- spot lights
- horn
- CB radio
- power mirrors
- power receptacle
- clock
- refrigerator
- fuel heater
- electric oil pan heater
- electric or diesel-fired engine-coolant preheaters

In the ACC (accessory) position, the key is turned counterclockwise. The auxiliary (bunk) fan, windshield fan(s), radio or stereo system, mirror heat, ether start system, air dryer, backup lights, and all of the electrical systems that are operable in the off position are operable.

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

NOTE: Switching on the ignition and releasing the parking brakes automatically activates the daytime running lights. The daytime running lights will operate until the parking brakes are applied, then they will switch off. They can also be turned off with an optional override switch.
The ignition key also locks and unlocks the cab doors, the baggage door(s) and if equipped, the bunk door(s).

**Exterior Lighting Controls**

NOTE: Not all dash electrical switches are fully described in this chapter. This chapter describes how the switch works. See the appropriate chapter of the manual for details of the feature.

There are two styles of electrical rocker switches.

- **Momentary Switch**—activated and deactivated by briefly pushing the top of the switch. The switch returns to a neutral position when released.

- **Latching Switch**—activated by pushing the top of the switch, or deactivated by pushing the bottom of the switch. The switch remains in the position selected.

**Headlamps, Marker Lamps, Fog Lamps**

The headlamp switch is a rotary switch located on the left of the steering column, above the ignition switch. The headlamp switch has the following set positions. See Fig. 5.3.

![Fig. 5.3, Headlamp/Parking Light Switch](https://example.com)

03/20/2007

- **A. Off**
- **B. Clearance/Marker Lamps (Position 1)**
- **C. Headlamps (Position 2)**
- **D. Fog Lamps (optional)**

Turning in a clockwise direction:

- Headlamp switch position 0: OFF.
- Headlamp switch position 1: Marker/clearance/tail/license plate lamps are activated.

Pulling the switch outwards activates the optional fog lamps if the stalk switch is in the low-beam position. The fog lamps turn off when the high-beam lamps are selected.

- Headlamp switch position 2: All position 1 lights, and headlamps are activated.

Pulling the switch outwards activates the fog lamps if the stalk switch is in the low-beam position. The fog lamps turn off when the high-beam lamps are selected.

**Marker Interrupt**

The marker interrupt switch, located on the steering wheel, temporarily turns the marker lights on or off. When the headlights are on and the marker interrupt (MRKR INT) switch is pressed, the marker lights momentarily turn off. When the headlights are off and the marker interrupt switch is pressed, the marker lights momentarily turn on. See *Steering Wheel Controls* in this chapter.

**Follow-Me-Home Feature**

The low-beam headlights will remain on for nine seconds after the vehicle is parked, if the headlights were on prior to engine shutdown. This feature provides temporary lighting in the path of the headlights while walking to a building or other destination. If a vehicle door is opened or closed while this feature is active, the timer will add an additional 10 seconds of lighting. This feature can be temporarily disabled by turning the ignition switch on, or by cycling the headlight switch from the off position to one of the other two positions.

**RH Dash Switches**

Most of the driver controls are located in the right-hand dash. See Fig. 5.4 for an overview of the right-hand dash.

**Hazard Warning Lights**

The hazard warning light switch is located on the dash in what is referred to as the master module.
See Fig. 5.5. The hazard lights can be activated regardless of the ignition switch position.

To activate the hazard lights, push the center of the switch once. The switch will blink at the same rate that the hazard lights flash. Push the switch again to turn them off. All the turn signal lights on the vehicle and trailer, as well as the turn signal indicators in the ICU, flash simultaneously when the hazard lights are activated.

Daytime Running Lights

The front turn signals lights are used for daytime-running lights when the ignition switch is on, and the parking brake is released. Marker lights, taillights, and the licence plate light, may be specified to also illuminate with the daytime-running lights as an option. If the turn signal switch or the hazard light switch is activated, the signal will take precedence over the daytime running lights.
Daytime running lights are mandatory for vehicles domiciled in Canada. Vehicles for U.S. vocations may have an optional override switch. This switch is a momentary switch. Push the top of the switch briefly to activate or deactivate it. An amber LED light in the switch will illuminate when the switch is activated. See Fig. 5.6.

Utility Lamps

Utility lamps can be swivel-mounted on top of the cab, mounted on the exhaust support, or flush-mounted in the back of the cab or sleeper. The utility lamp switch is a latching switch. Press the top of the switch to activate it. Press the bottom of the switch to turn it off. When activated, a red indicator light in the switch illuminates. See Fig. 5.7.

Spot Lamps

The spot lamps switch operates a single spotlight and pivoting handle assembly mounted on the driver’s door, or one on each door. The spot lamp switch is a latching switch. Press the top of the switch to activate it. Press the bottom of the switch to turn it off. When activated, a red indicator light in the switch illuminates. See Fig. 5.8.

Auxiliary High Beam Lamps

Auxiliary high-beam lamps may be located in the front bumper. To activate the auxiliary high beam lamps, press on the upper part of the dash switch. The auxiliary high beam lamps will illuminate only when the high-beam headlights are selected. They will switch off temporarily when the low-beam headlights are selected, until the high beams are selected again. Press the bottom of the switch to deactivate it. See Fig. 5.9.
Interior Lighting Controls

The interior lights include panel lamps, dome lamps, red map lamps, clear reading lamps, and courtesy lamps. Vehicles come preset from the factory with theater lighting, which ramps up lights from low power to full power when activated.

Sleepers have rear dome lamps, bunk reading lights, sleeper floor lamps, and baggage compartment lights.

Panel Lamps Switch

The panel lamps illuminate when the headlamps are turned on. To adjust the brightness of the panel lamps, use the panel lamps switch, usually located in the master module, next to the hazard flasher switch. See Fig. 5.10. The panel lamps brighten in 5-percent increments each time the top of the switch is pushed. The panel lamps dim in 5-percent increments each time the bottom of the switch is pushed. When the headlights are turned on, the panel lamps setting will default to the intensity that was last set.

Footwell Lamps

When the driver or passenger doors are opened, red lamps illuminate both footwells.

These lamps can also be activated with the footwell lamp switch, and the ignition key in the accessory or ON position. This switch is a latching switch; push the top of the switch to activate it, push the bottom of the switch to turn it off. The footwell lights ramp up with the theater lighting. See Fig. 5.11.

Overhead-Console Dome Lamp

Two dome lamp assemblies are installed on the overhead console. They have a clear reading lamp, a clear dome lamp in the center, and a red map lamp. See Fig. 5.12. The overhead-console dome lamps illuminate when a door opens, and stay on for a short time period before they shut off. When activated, the overhead-console dome lamps ramp up theatre-style, from 0 to 100 percent illumination. When deactivated, they ramp down. Pressing the lens of the reading light, dome light, or map light will activate each one independently of the others.

Rear Cab Dome Lamp

A rear cab dome lamp is located on the roof, between the bunk and the cab. See Fig. 5.13. The rear cab dome lamp will activate with the overhead-console dome lamps when a door is opened, and
Shut down after a short period. It ramps up theatre-style to 100 percent illumination when activated, and ramps down when deactivated.

The rear cab dome lamp can be activated by a dash switch, or one in the sleeper panel. See Fig. 5.14 and Fig. 5.15. Pressing the lens of the rear cab dome lamp will not turn it off.

Sleeper Reading Lamps

Clear reading lamps are mounted above the lower bunk in the rear corners of the sleeper. See Fig. 5.16.

The reading lamps can be activated by pressing the lens. There are two switches in the sleeper control panel for the reading lamps. Push the top of the switch to activate it, push the bottom of the switch to turn it off. See Fig. 5.17 and Fig. 5.18.

Sleeper Dome Lamp

Two dome lamps are mounted on the sleeper roof, close to the outside walls. See Fig. 5.19.

There are two switches in the sleeper that control the sleeper dome lamps. The passenger-side switch will activate both sleeper dome lamps. The driver-side switch operates that lamp independently. Push the top of the switch to activate, push the bottom of the switch to turn it off. See Fig. 5.20 and Fig. 5.21.

Sleeper Footwell Lamps

The sleeper footwell switch is located in the lower switch module in the sleeper. It looks identical to the cab footwell switch. When the switch is activated,
Baggage Compartment Lamp

Baggage compartment lamps are located on the underside of the lower bunk, on both sides. Both lamps turn on when either baggage compartment door is opened, and illuminate the baggage compartment.

two lamps, located under the front ledge of the lower bunk, illuminate the sleeper floor.
Dash-Mounted Electrical Switches

NOTE: Not all dash electrical switches are fully described in this chapter. This chapter describes how the switch works. See the appropriate chapter of the manual for details of the feature.

There are two styles of electrical rocker switches in the dash.

- Momentary Switch—activated and deactivated by briefly pushing the top of the switch. The switch returns to a neutral position when released.
- Latching Switch—activated by pushing the top of the switch, or deactivated by pushing the bottom of the switch. The switch remains in the position selected.

Mirror Heat Switch

The outside mirrors can be heated to keep them clear of fog, frost, and ice.

In order for the heated mirrors to operate, the key must be turned to ON. The heated mirror will remain on for 30 minutes, as a default setting. The settings can be changed by an authorized Freightliner service technician. After the defined length of time the heated mirrors will disengage only if the outside air temperature is greater than 60°F (16°C) as a default setting. Outside air temperature is monitored by a sensor.

The heated mirror switch is a momentary switch. Press the upper part of the mirror heat switch to toggle it on or off. When the switch is on, an amber indicator light illuminates in the switch. See Fig. 5.22. If the vehicle has Optimized Idle, mirror heating will not operate with the key in accessory mode. Optimized Idle may also turn mirror heating off to reduce stress on the batteries. Refer to the Optimized Idle section in Chapter 10 for more information.

Trailer Auxiliary Switch

Trailers that are equipped with pneumatic brakes and used in North America or South America are generally equipped with an electrical cable that terminates in a 7-way connector. Power for the trailer lights is passed from the vehicle to the trailer via the primary receptacle, controlled by a dash switch.

The trailer auxiliary switch is a latching switch. Press the top of the switch to activate it. Press the bottom
Driver Controls

of the switch to turn it off. An amber light will illuminate in the center of the switch when it is on. See Fig. 5.23.

**ATC Switch**

The Automatic Traction Control (ATC) switch is a momentary switch. Briefly push the top of the switch to activate or deactivate it. See Fig. 5.24.

The ATC system limits wheel spin when power is applied to the drive axles during reduced-traction situations. When the ATC is active, the ATC will apply gentle braking to the spinning wheel, to force power to the wheel(s) with better traction. If both wheels are spinning, the system will signal the electronic engine to reduce power.

Pressing the ATC switch will temporarily allow more drive wheel spin, to help burn through a thin layer of ice, or to help throw off accumulated mud or snow. When the switch is activated, an ATC or WHEEL SPIN icon located in the driver’s message center will be illuminated. Pressing the switch again will cycle the system back to normal operation.

**Engine Fan Switch**

The engine cooling fan can be turned on by the engine fan switch. The fan will continue to operate for a set amount of time and then turn off unless the coolant temperature is high enough to continue the fan operation. The engine fan switch is a latched switch. To turn the engine fan on, press on the upper part of the rocker (at the fan icon). Press the bottom of the switch to deactivate it. See Fig. 5.25.

When the engine fan switch is activated, an amber LED light is illuminated in the center of the switch.

When the panel lights are on, the ENG FAN legend is backlit in green.

**Engine Brake Switch**

The Hi/Med/Lo engine brake rocker switch on the dash controls the amount of engine braking. See Fig. 5.26. It is a three-position latching switch. Press the switch to the bottom for low, center for medium, and up for high. An amber LED illuminates in the center of the switch when it is activated, and it is backlit in green when the panel lights are on.

**PTO Switch**

The PTO switch is a latched switch. To activate the switch, press on the upper part of the rocker. Press the bottom of the switch to deactivate it. See Fig. 5.27.
When the PTO switch is activated, an amber LED light is illuminated in the center of the switch. When the panel lights are on, the legend is backlit in green. **MY INFO Switch**

On the ICU4M, the driver can access a preset screen using the "MY INFO" switch. Holding down the bottom of the "MY INFO" switch for 1.2 seconds will set the current screen as the favorite screen. A chirp will sound to verify the screen has been set. See Fig. 5.28.

**Guarded Switches**

IMPORTANT: The following switches are guarded to prevent unintentional switch activation.

---

**Exhaust Aftertreatment System Switches**

IMPORTANT: To meet January 2007 EPA emissions regulations for vehicles domiciled in the USA or Canada, engines manufactured after January 1, 2007 are equipped with an exhaust aftertreatment system. Vehicles domiciled outside the USA and Canada may not have the following aftertreatment system switches at the time of printing this manual, depending on local statutory emissions guidelines.

The regen switch, located on the dash, is used to initiate a parked regen of the aftertreatment device. To access the regen switch, the guard needs to be lifted, and the switch will operate as noted in the engine operation manual. See Fig. 5.29. See the engine operation manual for switch operation details.
The inhibit regen switch provides additional control over the aftertreatment regeneration process. When activated, the inhibit switch will stop a regeneration cycle in progress, and prevent the start of a regeneration cycle until the switch is no longer active. See the engine operation manual for switch operation details. See Fig. 5.30.

Interaxle Differential Lock Switch

The interaxle differential lock switch is a two-position guarded paddle switch. See Fig. 5.31. The interaxle lock, standard on all dual-drive vehicles, is driver-actuated by means of a LOCK/UNLOCK control valve switch mounted on the control panel. A red indicator light comes on whenever the interaxle differential is locked out (switch is in the lock position; no differential action between the drive axles). A guard around the switch minimizes accidental activation.

NOTICE

The interaxle lock should only be engaged when the vehicle is moving slowly at low throttle. Engagement at high speed or power can damage the axle(s).

Fifth Wheel Slide Control Switch

The fifth wheel air slide valve allows repositioning of the sliding fifth wheel from inside the cab. Moving the air slide control valve switch to the LOCK position deactivates the control valve and locks the fifth wheel to the baseplate. Moving the switch to the UNLOCK position activates the control valve and unlocks the fifth wheel slide mechanism, allowing changes to the total length of the tractor-trailer and changes to axle loads to comply with varying state or provincial laws. See Fig. 5.31. For detailed operating instructions for fifth wheel slide, coupling and uncoupling procedures, refer to Chapter 18. A red indicator light, if equipped, is illuminated whenever the fifth wheel slide is unlocked. A guard is positioned around the switch to minimize accidental activation.

NOTICE

Do not activate the fifth wheel slide control valve while the vehicle is in motion. To do so could cause damage to the fifth wheel member, the kingpin, the cab or trailer, and ultimately to the drivetrain.

Air-Suspension Height Switch

The air-suspension height switch may be used to aid in connecting or disconnecting from a trailer. When
the switch is set to LOWER, the air-suspension dump valve deflates the air springs to lower the rear of the vehicle. In the AUTO position, the automatic ride-control valves operate for normal driving. See Fig. 5.31. A red LED in the switch is illuminated when the suspension is deflated.

**NOTICE**

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from reinflating.

**NOTICE**

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

**Dash-Mounted Brake Controls**

**Parking Brake Control Valve and Trailer Air Supply Valve**

The yellow diamond-shaped knob operates the parking brake valve. See Fig. 5.32. 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. See Fig. 5.32. 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 12 regarding use of the trailer air supply valve and parking brake valve.

**Trailer Brake Lever**

The trailer brake lever (hand control valve) is used for applying the trailer brakes without applying the truck or tractor brakes. It is usually mounted on the right-hand control panel. See Fig. 5.33. Refer to Chapter 12 for operating instructions.

**Multifunction Turn Signal Switch**

The multifunction turn signal switch is attached to the steering column, just below the steering wheel, on the left-hand side. It controls the following functions:

- turn signals
- windshield wipers and washers
- headlight high/low beam selection

See Fig. 5.34 for the multifunction switch and its component parts.
Turn Signal Controls

Moving the lever down turns on the left turn signal lights; moving it up turns on the right turn signal lights.

When one of the turn-signal lights is on, a green indicator arrow flashes at the far left or far right of the warning and indicator light panel.

To cancel the signal manually, move the lever to the neutral position. If the vehicle has a self-cancelling option, the lever automatically returns to the neutral position (self-cancels the switch) when the steering wheel returns to the straight ahead position after a turn.

Turn-Tip Feature

The turn-tip feature is advantageous in lane change situations when the steering wheel does not travel far enough to cancel a conventional turn signal request. The turn-tip feature is activated by pushing the turn-signal switch half way to the normal turning position. The signal will flash a set number of times then cancel. Activation of the turn-tip feature is immediately canceled when a request for the turn signal in the opposite direction is made.

Windshield Wiper/Washer Controls

--- NOTICE ---

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

The wipers are operated by a rotary switch in the wiper control dial, which is on the end of the turn signal lever. There are five delay settings, marked on the dial by lines of increasing length, and two steady speed settings, LO and HI. See Fig. 5.34.

Rotating the control dial counterclockwise turns the wipers on. Rotating the handle further, increases the speed of the wipers through the various intermittent settings, then to LO, then HI.

Rotating the control dial clockwise causes the wipers to slow down. Rotating the control dial clockwise as far as it will go, turns the wipers off.

The washer button is located at the end of the turn signal lever. The driver can momentarily press the windshield washer button anytime a single wipe is desired, without activating the washer pump. The wipers will swipe one full cycle and return to the parked position.

To operate the washers, press and hold the button in. After a short delay, the washer will pump windshield washer fluid onto the windshield for as long as the washer button is pressed. The windshield wipers will turn on at low speed while the wash button is pressed. After the wash button is released, the wipers will continue to operate for one to several wipe cycles, depending on how long the wash button was pressed initially.

Headlight High Beams

To activate the high-beam headlights, while the headlight switch is in position 2, push the turn signal lever forward towards the windshield. Return the turn-signal lever back to its neutral position to deactivate the high beams, and return to low beam headlights.

When the high-beam headlights are on, a blue light illuminates on the instrument cluster. For vehicles with fog lights, switching on the high beams will switch off the fog lights. The headlight low beams remain on continuously during high-beam operation.

NOTE: The ignition switch must be on for the high beams to work.
Flash-to-Pass
The flash-to-pass feature momentarily illuminates the high-beam headlights. Pulling the multifunction turn signal switch illuminates the high-beam headlights regardless of what position the headlight switch is in. However, if the fog lights are on when the flash-to-pass feature is activated, the fog lights will momentarily turn off.

Steering-Wheel-Mounted Controls
Left-Hand Switch Pod, Cruise Control
The cruise control is operated by four switches mounted in the left-hand switch pod of the steering wheel. See Fig. 5.35.

- ON/OFF Switch—Press to toggle cruise control on/off. When cruise control is on, an amber telltale lens illuminates in the ICU lightbar. The cruise control speed memory will be retained until the cruise control is disenabled with the ON/OFF switch, or the ignition is shut off.
- DEC/SET Switch—Press to set the cruise speed while the vehicle is traveling at the desired speed. Press and hold to decrease the set cruise speed.
- CANCEL Switch—Press to pause the cruise control, while retaining the speed setting in memory. The cruise control can also be disengaged, while retaining the speed setting in memory, by stepping on the brake pedal, or the clutch pedal.
- ACC/RES Switch—Press to resume the set speed. Press and hold to accelerate the set cruise speed.

See Chapter 10 for further instructions on using cruise control.

Right-Hand Switch Pod, Convenience Functions
There are four driver convenience functions on the right-hand switch pod of the steering wheel, +, −, MRKR INT, and ENG BRK that allow the driver to perform common functions without taking their hands off the steering wheel. See Fig. 5.35.

Adjustable Steering Column
To adjust the steering column, depress the foot pedal located below the steering column. See Fig. 5.36. Tilt the steering column to the desired angle. Telescope the steering column closer or further away by pushing or pulling it. Release the foot pedal to lock the steering column in place.
Driver Controls

Fig. 5.36, Steering Column and Left Panel Controls

1. Multifunction Turn Signal Switch
2. Headlight Switch
3. Ignition Switch
4. Tilt Steering Column Lever
5. Steering Wheel
Seats and Restraints

General Information ............................................................... 6.1
Cascadia High-Back Seat .......................................................... 6.2
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Seat Belts and Tether Belts ........................................................ 6.3
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General Information

Unless otherwise noted, all seat adjustments should be made while seated and before the engine is started.

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

**WARNING**

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

The following is a description of adjustments that can be made to various Freightliner-installed seats. Not all seats have all of the adjustments listed below. See **Fig. 6.1**.

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. This adjustment is either mechanical or air controlled, depending on make and model of the seat.
3. **Isolator**: This feature reduces the amount of road shock by isolating the occupant from the motion of the vehicle, 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. **Bottom Cushion Angle, or Fore and Aft Bottom Cushion Height**: This feature enables the occupant to raise or lower the front or back of the seat.

**Fig. 6.1, Seat Adjustments**
bottom cushion. This adjustment is easier to perform when all weight is removed from the seat.

6. Fore and Aft Seat (seat track adjustment): The entire seat moves forward or backward when this adjustment is made.

7. Seat Tilt: When this adjustment is made, the seat assembly (back and bottom cushions) tilts forward or backward.

8. Upper Back Cushion Adjustment: When this adjustment is made, the upper back cushion changes angle to provide upper back support.

9. Weight Adjustment: On those seats with weight adjustment, the feature is fully automatic. When you sit 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.

### Cascadia High-Back Seat

See **Fig. 6.2** for seat adjustment controls.

1. Rear Cushion Adjustment Knob—To adjust the height of the rear of the seat cushion, remove your weight from the seat and turn the rear cushion adjustment knob to one of three positions.

2. Fore and Aft Isolator—The isolator reduces the amount of road shock, by isolating the occupant from the motion of the vehicle, and allowing the seat to move in a simple pendulum motion. To use the isolator feature, turn the isolator knob rearward to the unlocked position. Turn the isolator knob forward to the locked position when the isolator feature is not desired.

3. Front Cushion Adjustment Knob—To adjust the height of the front of the cushion, remove your weight from the seat, then turn the adjustment knob toward the front of the seat (clockwise) to increase cushion height. To lower the cushion height, turn the adjustment knob toward the rear of the seat (counterclockwise).

4. Fore and Aft Cushion Adjustment Handle—To adjust the fore and aft position of the seat cushion, remove your weight from the seat, then lift up and pull forward on the cushion adjustment handle. To return the cushion to the aft position, lift up and push rearward.

5. Fore and Aft Seat Adjustment Lever—To adjust the fore and aft position of the entire seat, move the fore and aft seat adjustment lever to the left and slide the seat forward or backward to the desired position. Move the lever back to its original position to lock the seat in place.

6. Back Cushion Tilt Knob—To tilt the back cushion, lean forward slightly to remove pressure from the cushion, then turn the knob forward or rearward to achieve the desired position.

7. Heater Button—To turn on the heat option, press the button. To turn off the heat option, press the button again. If the vehicle has Optimized Idle, seat heating will not operate with the key in accessory mode. Optimized Idle may also turn seat heating off to reduce stress on the batteries. Refer to the Optimized Idle section in Chapter 10 for more information.

8. Shock Absorber Adjustment Lever—To adjust the amount of damping the shock absorber provides, move the lever up to increase damping; move the lever down to decrease damping.

9. Height Adjustment Switch—To raise or lower the height of the seat, use the height adjustment switch on the side of the seat.

10. Lumbar Support Switches—To adjust the lumbar support, use the lumbar support switches on the side of the seat to give more or less support to your lower back.

### Sears Atlas Seat

See **Fig. 6.3** for seat adjustment controls.

1. Isolation Adjustment—Position the handle to the left to allow isolation movement. Position the handle to the right to lock-out isolation movement.

2. Fore and Aft Slide Adjustment—To adjust the fore and aft position of the entire seat, squeeze the fore/aft slide lock against the adjustment bail, and lift the bail up; see **Fig. 6.4**. Slide the seat forward or backward to the desired position. Release the bail and fore/aft slide lock, to its original position, to lock the seat in place.

3. Seat Tilt Adjustment—Lift the handle upward and move the seat cushion to the desired position. Three positions are available.
Seats and Restraints

4. Seat Extension Adjustment—Rotate the handle upward to disengage, then move the seat cushion to the desired position and release the lever. Three positions are available.

5. Backrest Adjustment—Pull upward on the recliner handle, move the backrest to the desired position and release the handle.

6. Lumbar Adjustment—Rear rocker switch: push forward to inflate the lower lumbar bag; push rearward to deflate the bag. Center rocker switch: push forward to inflate the upper lumbar bag; push rearward to deflate the bag.

7. Suspension (Ride) Adjustment—Push forward on the gray rocker switch to inflate and raise the suspension; push rearward to deflate and lower the suspension.

8. Armrest Adjustment (not shown)—Rotate the control knob, located on the underside of the armrest, to set the desired angle of the armrest.

Seat Belts and Tether Belts

General Information

Seat belt assemblies are designed to secure persons in the vehicle to help reduce the chance of injury, or the amount of injury, resulting from accidents or sudden stops. For this reason, Daimler Trucks North
America LLC urges that the driver and all passengers, regardless of age or physical condition, use seat belts when riding in the vehicle.

**WARNING**

Always use the vehicle’s seat belt system when operating the vehicle. Failure to do so can result in severe personal injury or death.

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Seat belt assemblies in Daimler Trucks North America (DTNA) vehicles meet Federal Motor Vehicle Safety Standard 209, "Type 1" and "Type 2" requirements.

When transporting a child, always use a child restraint system or the vehicle seat belts as appropriate. To determine whether a child restraint system is required, review and comply with applicable state and local laws. Any child restraint used must comply with Federal Motor Vehicle Safety Standard 213, "Child Restraint Systems." When providing a child restraint system, always 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 provide a flexible extension of the cab structure. They 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 and tethers 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.
Seat Belt Inspection

**WARNING**

Inspect and maintain seat belts and tethers as instructed below. Seat belts and tethers that were damaged or stressed in an accident must be replaced, and their anchoring points must be checked. When any part of a seat belt system needs replacement, the entire seat belt must be replaced, both the retractor and the buckle side. Do not attempt to modify the seat belt system; doing so could change the effectiveness of the system. Failure to replace damaged or stressed seat belts or any modifications to the system may result in personal injury or death.

**WARNING**

The RollTek seat belt buckle, latch, and tethers are unique and are NOT interchangeable with non-RollTek seat belt components. The use of incompatible seat belt components may result in severe injury or death.

Inspect the seat belts and tether belts (if so equipped).

1. Check the web for fraying, cuts, or extreme or unusual wear, especially near the buckle latch plate and in the D-loop guide area.
2. Check the web for extreme or unusual dirt or dust, and for severe fading from exposure to sunlight.
3. Check the buckle and latch for operation and for wear or damage.
4. Check the Komfort Latch or the Sliding Komfort Latch (if equipped) for function and cracks or other damage.
5. Check the upper seat belt mount on the door pillar for damage.
6. Check the web retractor for function and damage.
7. Check the mounting bolts for tightness, and tighten any that are loose.

Seat Belt Operation

**WARNING**

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

Fasten the seat belts before driving. Fastening a three-point seat belt while driving creates a hazard.

When engaged and used properly, the Komfort Latch (Fig. 6.5) and the Sliding Komfort Latch (Fig. 6.6) introduce a small amount of slack into the seat belt, resulting in a more comfortable ride.

![Fig. 6.5, Komfort Latch](image)

1. Slowly pull the latch 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. See Fig. 6.7.
2. Fasten the three-point seat belt by pushing the latch into the buckle. Listen for an audible click.

3. Tug on the seat belt to make sure it is securely fastened. If the buckle unlatches, repeat this step. If the problem continues, replace the three-point seat belt.

4. Snug the seat belt to your waist.

5. Position the shoulder strap diagonally across your chest with the adjustable D-loop bracket (if equipped). The shoulder strap must be centered on your shoulder and chest, away from your face and neck. See Fig. 6.8. If desired, engage the Komfort Latch or Sliding Komfort Latch as follows.

If equipped with a Sliding Komfort Latch, make sure that the shoulder strap is snug against your chest. Without loosening the shoulder strap, push the Sliding Komfort Latch switch to the "ON" position. See Fig. 6.6. To activate the latch lean forward until you hear a click. This will allow for approximately 1 inch (2.5 cm) of slack between your chest and the shoulder harness. Once engaged, the latch will allow you to lean forward about 5 inches (13 cm) without having to reset the latch. Leaning forward more than 5 inches (13 cm) will disengage the Sliding Komfort Latch, requiring it to be reset.

If equipped with a Komfort Latch, pull on the shoulder strap to lessen the pressure of the strap on your shoulder and chest. Allow no more than
1 inch (2.5 cm) of slack between your chest and the shoulder harness. More slack can significantly reduce the seat belt effectiveness in an accident or a sudden stop. While holding the belt slack, press the Komfort Latch lever up, clamping the seat belt webbing (Fig. 6.9 and Fig. 6.10).

If equipped with a Komfort Latch, un buckle the seat belt, then release the Komfort Latch 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: Neither the Komfort Latch nor the Sliding Komfort Latch need to be manually released in an emergency situation. Each 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.

**Steering Wheel Air Bag**

NOTE: Only vehicles with the letters "SRS" molded into the steering wheel center pad are equipped with a steering wheel air bag.

Steering wheel air bags are designed to inflate only in severe frontal collisions. The driver and the passenger should always wear seat belts. The steering wheel air bag will activate during a collision even if the seat belts are not fastened, but the system is designed to provide protection to the occupant only when the seat belts are fastened. For maximum protection in a collision, always be in a normal seated position with your back against the seat back and your head upright. Fasten your seat belt and ensure that it is properly positioned on your body as described under the “Seat Belt Operation” heading.

Since the air bag inflates with considerable speed and force, a proper seat position will help keep you a safe distance from the inflating air bag.

Do not place objects on the steering wheel or between you and the steering wheel. Any such objects may cause harm during an accident. Keep your hands on the sides and lower portion of the steering wheel. Failure to follow these instructions may result in death or personal injury.

The air bag, when used with seat belts, provides additional protection to the driver in severe frontal collisions. The operational readiness of the air bag system is indicated by the supplemental restraint system (SRS) indicator on the dash. The SRS indicator comes on when the engine is started and then goes off. The indicator will remain on if there is a problem with the air bag system. The vehicle should be serviced if the SRS indicator does not come on when
the engine is started or if the SRS indicator remains on.

The air bag system contains components that use combustible chemicals. Because these chemicals are combustible, care must be taken when replacing or handling system components.

**WARNING**

Consider undeployed air bags to be dangerous and capable of deploying at any time. Do not attempt to service the air bag system unless trained to do so. Damaged air bag systems should be examined by qualified personnel before any attempt is made to remove or to deploy the air bag. All intentional deployments and testing of the system should be performed by trained personnel. Unintentional or improper air bag deployment could cause severe bodily injury or death.

Do not attempt to disassemble the air bag inflator unit or breach the integrity of the sealed metallic inflator case. Doing so could cause severe bodily injury or death.

Do not allow system chemicals to contact other liquids, combustibles, and flammable materials. Doing so could cause chemical burns or personal injury.

The surface of the deployed air bag may contain small amounts of sodium hydroxide (which is a by-product of the gas generator combustion) and metallic sodium. Sodium hydroxide may be irritating to the skin and eyes. Always wear rubber gloves and safety glasses when handling a deployed air bag. Immediately wash your hands and exposed skin areas with a mild soap and water. Flush your eyes immediately if exposed to sodium hydroxide.

Review and comply with the following list of warnings. Failure to do so could result in severe injury or death.

- Keep all liquids, acids, halogens, heavy metals, and heavy salts away from the air bag system.
- Do not cut, drill, braze, solder, weld, strike, or probe any part of the air bag system.
- Do not expose the air bag module to electricity. Never probe a circuit.
- Do not attempt to adapt, reuse, or install an air bag system in any vehicle other than the specific vehicle for which it is designed.
- Do not cut wires or tamper with the connector between the vehicle wiring harness and the air bag module. Cutting or removing the connector from the system will disable the safety shunt and could cause unintentional deployment.
- Allow deployed air bag systems to cool after deployment.
- Wear rubber gloves and safety glasses when handling a deployed air bag.
- Wash your hands and exposed skin surface areas immediately after handling a deployed system.
- Store, transport, dispose of, and recycle deployed air bag system components in accordance with all applicable federal, state, and local regulations.
- The air bag module may contain perchlorate material: special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate.
- Keep all heavy objects in the cab secured.

**RollTek Rollover Protection System**

**Identification**

Only seats with the RollTek module under the seat and the molded side-roll air bag cover on the upper side of the seat back are equipped with the RollTek rollover protection system; see Fig. 6.11. RollTek may be installed in one of the following configurations:

- driver seat only
- driver and passenger seats
- driver seat only, with an optional steering wheel frontal air bag
- driver and passenger seats, with an optional steering wheel frontal air bag
Operation

The RollTek system, when used with seat belts, provides additional protection to the driver and passenger (if equipped with a passenger-side system) in rollover accidents. The RollTek system provides a significant increase in seat stability during a rollover. Vehicles equipped with RollTek rollover protection have a sensor mounted in the seat base that activates the side-roll air bag and seat pull-down device during a rollover. When the RollTek module senses a rollover, the module triggers gas cylinders mounted in the base of the seat. The gas cylinders activate the power cinches that then tighten the lap and shoulder belts against the occupant of the seat and lower the seat suspension, moving the occupant down and away from the steering wheel and ceiling. The side-roll air bag deploys from the outboard side of the seat as the seat is pulled down to its lowest position. See Fig. 6.12.

WARNING

Always use the seat belts when operating the vehicle. Failure to do so can result in severe personal injury or death.

The RollTek system will activate during a rollover even if the seat belts are not fastened, but the
RollTek system is only designed to provide protection to the occupant when the seat belts are fastened.

For vehicles with the RollTek system(s) only, device(s) deploy as follows:

- Rollover Crash—occupant seat belt pretensioning, seat pretensioning, and side-roll air bag at the proper time
- Frontal Crash—no devices deployed

For vehicles with the RollTek system(s) and frontal steering wheel air bag, device(s) deploy as follows:

- Rollover Crash—occupant seat belt pretensioning, seat pretensioning, and side-roll air bag at the proper time
- Frontal Crash—steering wheel air bag, occupant seat belt pretensioning, seat pretensioning, and the side-roll air bag at the proper time

**DANGER**

Do not place objects on the seat back or block the side-roll air bag. Objects that block the side-roll air bag may prevent proper inflation and could cause serious injury or death.

**Inspection and Service**

**WARNING**

Do not attempt to modify the RollTek system. Doing so could change the effectiveness of the system. The RollTek system must be replaced after being activated. Failure to do so may result in personal injury or death. Infants and children must not be placed in seats equipped with the RollTek system. The RollTek system is designed for adults only. Failure to follow these instructions may result in personal injury or death.

Damaged seat belts and tethers, or seat belts and tethers that were worn in an accident, must be replaced, and their anchoring points must be checked.

The operational readiness of the RollTek system is indicated by the supplemental restraint system (SRS) indicator on the dash. The SRS indicator comes on for approximately 10 seconds when the engine is started and then goes off. The indicator will remain on if there is a problem with the air bag or RollTek system. The vehicle must be serviced if the SRS indicator does not come on when the engine is started or if the SRS indicator remains on.

The RollTek system contains components that use combustible chemicals. Because these chemicals are combustible, care must be taken when replacing or handling system components.

Although the RollTek system components will not likely explode, self-deploy, or produce shrapnel, care must be taken when it is necessary to replace or perform work around the components.

**WARNING**

Do not attempt to service the RollTek system. Damaged or deployed systems must be examined only by qualified personnel before any attempt is made to remove, replace, or handle the components. All intentional deployments and testing of the system should be performed by trained personnel. Unintentional or improper deployment of the RollTek system could cause severe bodily injury or death.

Do not attempt to service or to disassemble the RollTek module. The RollTek module cannot be serviced. Doing so could result in severe bodily injury or death.

Review and comply with the following list of warnings. Failure to do so could result in severe injury or death.

- Do not cut, drill, braze, solder, weld, strike, or probe any part of the RollTek system.
- Keep all liquids, acids, halogens, heavy metals, and heavy salts away from the RollTek system.
- Do not attempt to adapt, reuse, or install a RollTek system in any vehicle other than the specific vehicle for which it is designed.
- Keep hands and tools away from the scissor points under the seats.
- Do not cut wires or tamper with the connectors between the vehicle wiring harness and the RollTek system. Cutting or removing the electrical connectors could cause unintentional deployment.
- Do not expose the RollTek system to electricity. Never probe a circuit.
• Store, transport, dispose of, and recycle deployed RollTek system components in accordance with all applicable federal, state, and local regulations.

• Replace damaged seat belts or seat belts that were worn in an accident, and check all anchoring points. Only qualified personnel familiar with RollTek systems should replace the seat belts used in a vehicle with a RollTek system.

• The RollTek system requires a special seat belt. Care must be taken to be sure the correct seat belt is used.

• Keep all heavy objects in the cab secured.

The frontal air bag (crash) sensor, included with the steering wheel air bag system, will only deploy device(s) in the event of a significant impact from a frontal crash.
Climate Control

Cab Climate Control ............................................................ 7.1
Sleeper Climate Control ........................................................ 7.3
ParkSmart Auxiliary HVAC .................................................... 7.4
Climate Control

Cab Climate Control

The cab climate control panel has three switches to control the functions of the cab HVAC system; see Fig. 7.1:

- fan switch with recirculation button;
- temperature control switch with A/C button;
- air selection switch (with bunk-override button on sleeper cab only).

![Fig. 7.1, Cab Climate Control Panel](image)

Fan Switch with Recirculation Button

The fan switch controls the fan speed, and forces fresh or recirculated air through the air outlets. The fan switch has eight fan speeds and an OFF position. See Fig. 7.2.

To increase airflow, turn the switch (outer ring) clockwise to a higher number. To decrease the airflow, turn the switch counterclockwise to a lower number. Turning the fan switch to the OFF position, disables the air conditioner, and sets the air source to recirculated air mode.

There is a two-second delay between the time the engine is started, and the blower is operational. It can take an additional four seconds for the blower to reach high speed. The blower motor performs a self-test immediately after the engine is started, which causes the delay. If the vehicle has Optimized Idle, the fan will not operate with the key in accessory mode. Optimized Idle may also turn the fan off to reduce stress on the batteries. Refer to the Optimized Idle section in Chapter 10 for more information.

![Fig. 7.2, Fan Switch](image)

Recirculation

The recirculation mode limits the amount of outside air entering the cab. Press the recirculation button to prevent dusty or smoky air from entering the cab. See Fig. 7.2. The recirculation mode can also decrease the time required to cool, or heat, the cab interior during extreme outside temperature conditions. When the recirculation mode is ON, the amber indicator on the recirculation button will be illuminated.

The recirculation button will not work when the air selection switch is in one of the following modes:

- the selection between floor mode and defog mode;
- defog mode;
- the selection between defog mode and defrost mode;
- defrost mode.

NOTE: To prevent the buildup of odors, and to prevent oxygen depletion inside the cab, the system switches from full recirculation mode to partial recirculation mode after 20 minutes. In extremely dusty or smoky conditions, the partial recirculation mode can be overridden by pressing the recirculation button twice to obtain full...
recirculation mode. This resets the 20-minute timer.

**Temperature Control Switch with Air Conditioning**

The temperature control switch is used to select the desired temperature. Turn the switch (outer ring) clockwise to the red area for warm air. Turn the switch counterclockwise to the blue area for cool air. See *Fig. 7.3.*

**Air Conditioning**

The air conditioner cools and dehumidifies the air inside the cab. Press the air conditioning button, located in the center of the temperature control switch, to turn the air conditioner ON and OFF. See *Fig. 7.3.*

The amber indicator on the air conditioning button will be illuminated, whether the request for air conditioning comes from the cab climate control panel, or the sleeper climate control panel. When the instrument panel lights are on, the snowflake indicator on the air conditioning button will be illuminated.

The air conditioner will be automatically disabled when:

- outside air temperature is low enough to make air conditioning ineffective;
- engine is running at extremely low rpm;
- conditions exist that result in the heater and air conditioner system going into protection mode.

**Air Selection Switch with Bunk-Override Button**

The air selection switch allows you to control the flow of air through the face outlets, the floor outlets, the defrost (windshield) outlets, or a combination of these outlets. See *Fig. 7.4.*

![Air Selection Switch with Bunk-Override Button](06/08/2007 f610948)

1. **Face Mode**
2. **Selection between Face Mode and Bi-Level Mode**
3. **Bi-Level Mode**
4. **Selection between Bi-Level Mode and Floor Mode**
5. **Floor Mode**
6. **Selection between Floor Mode and Defog Mode**
7. **Defog Mode**
8. **Selection between Defog Mode and Defrost Mode**
9. **Defrost Mode**
10. **Bunk-Override Button (on sleeper-cabs only)**

![Air Selection Switch With Bunk-Override Button](06/08/2007 f610948)

1. **Face Mode**: Directs all airflow through the face or instrument panel outlets.
2. **Selection between Face Mode and Bi-Level Mode**: Directs 75 percent of the airflow through the face outlets and 25 percent through the floor outlets.
3. **Bi-Level Mode**: Directs the airflow equally to the face outlets and floor outlets.
4. **Selection between Bi-Level Mode and Floor Mode**: Directs 25 percent of the airflow through the face outlets and 75 percent through the floor outlets.
5. **Floor Mode**: Directs all airflow through the floor outlets.
Climate Control

6. **Selection between Floor Mode and Defog Mode:** Directs 75 percent of the airflow through the floor outlets and 25 percent through the defrost outlets.

7. **Defog Mode:** Directs the airflow equally to the floor outlets and the defrost outlets. The air conditioner automatically turns on in this mode. The recirculation button will not work in this mode.

8. **Selection between Defog Mode and Defrost Mode:** Directs 75 percent of the airflow through the defrost outlets and 25 percent through the floor outlets. The air conditioner automatically turns on in this mode. The recirculation button will not work in this mode.

9. **Defrost Mode:** Directs all airflow through the defrost outlets. The air conditioner automatically turns on in this mode. The recirculation button will not work in this mode.

**Bunk-Override Button**

The bunk-override button is located in the center of the cab air-selection switch, on sleeper-cabs only. See **Fig. 7.4**.

Push the bunk-override button to make the cab controls override the settings on the sleeper HVAC control panel; the sleeper HVAC will mimic the cab settings. An amber LED in the button is illuminated when the bunk-override mode is activated. When the bunk-override button is deactivated, the LED turns off, and the sleeper HVAC will return to the sleeper controls. Adjusting the sleeper HVAC controls at any time will also cause the override mode to cancel. Changes to the cab setting will not affect the bunk settings, without deactivating, and reactivating, the override.

When the override switch is not activated, the cab climate control panel can be adjusted without affecting the sleeper settings.

**Sleeper Climate Control**

The sleeper HVAC can be controlled from the sleeper climate control panel, or from the cab climate control panel if the bunk-override button is activated. See “Cab Climate Control” for details of the bunk-override button. If any of the sleeper HVAC controls are adjusted while the bunk-override button is activated, the override is cancelled, and sleeper HVAC control returns to the sleeper controls.

**Fan Switch**

The fan switch controls the sleeper HVAC fan speed. The sleeper climate control panel has eight fan speeds and an off position. To increase airflow, turn the switch (outer ring) clockwise to a higher number. To decrease the airflow, turn the switch counterclockwise to a lower number. See **Fig. 7.5**. If the vehicle has Optimized Idle, the fan will not operate with the key in accessory mode. Optimized Idle may also turn the fan off to reduce stress on the batteries. Refer to the Optimized Idle section in **Chapter 10** for more information.

**Temperature Control Switch with Air Conditioning**

The temperature control switch is used to select the desired temperature in the sleeper. Turn the switch (outer ring) clockwise to the red area for warm air. Turn the switch counterclockwise to the blue area for cool air.
Push the button in the center of the temperature control switch to activate the air conditioning.

If the bunk-override button has been activated, the override mode can be cancelled by changing the sleeper fan speed or temperature setting. The sleeper HVAC system will then operate from the sleeper controls, and the amber indicator on the bunk-override button will be off.

**Cab-Override Operation**

While the parking brake is applied, the cab control will apply the bunk switch setting for blower and temperature, when either of these switches is adjusted. If the cab blower is activated in this manner, the A/C mode can then be activated by the bunk control, even if the cab blower switch is physically set to the OFF position. Any change to the cab control switches will deactivate the cab-override control.

**ParkSmart Auxiliary HVAC**

The ParkSmart Auxiliary HVAC unit replaces the normal auxiliary unit in the compartment behind the driver’s seat. The unit is designed to maintain an established comfortable temperature inside the cabin. It has a 12-volt electric compressor and condenser fan, and a fuel-operated coolant heater. It can operate in combination with the main cab HVAC while the vehicle is running, or independently when the vehicle is parked. In PARK mode it uses a set of four absorbed glass mat (AGM) batteries, mounted aft of the starting batteries, either between the frame rails behind the cab, or outside the frame rail.

The ParkSmart Auxiliary HVAC unit controls the temperature in the sleeper area with a sensor mounted in the sleeper control panel. The temperature settings are from 60°F (15°C) to 85°F (29°C), with the center setting being 74°F (23°C). The fan speed is manually selected; 0 is off, and 8 is maximum. See Fig. 7.6.

The ParkSmart Auxiliary HVAC unit operates in several modes, with the engine running, with the engine off and the ignition key in the ON/ACC position, or with the engine off and the ignition key OFF.

When the engine is running, the air conditioning is powered by the vehicle electrical system, and the auxiliary heater core is supplied conventionally using the engine coolant, and the ParkSmart AGM batter-

![Fig. 7.6, ParkSmart Auxiliary HVAC Control Panel](image.png)

ies are connected to the electrical system so they will be recharged by the alternator.

When the engine is off, if the key is in ACC/ON, the ParkSmart auxiliary unit can run in A/C mode, and power will be sourced from the ParkSmart AGM batteries. The main cab HVAC fan will also circulate air in the cab using power from the main vehicle batteries. The available power for other vehicle supplied accessories (house loads) will be affected when running in this mode. If there is no Low Voltage Disconnect (LVD) control on the main electrical system, the ability to start the vehicle could also be compromised if this mode is activated for an extended time period. When the engine is off, and the key is off, the ParkSmart system runs the battery operated A/C or diesel fired water heater, depending on the temperature requested. In PARK mode, air-conditioning power is drawn from the batteries. If heat is requested, the heater is fuel-operated, and the coolant pump is powered by the batteries. The main batteries and the ParkSmart AGM batteries will both be used until the system voltage drops to 12.5 volts, then the unit will switch to the ParkSmart AGM batteries only. The ParkSmart auxiliary unit will run until the dedicated batteries reach 11.3 volts.

Before operating the parked HVAC unit, the sleeper interior temperature should first be brought to the desired temperature with the engine running, and the bunk curtain open. The parked HVAC unit is designed to maintain an established comfortable bunk temperature, in key-off parked mode, for up to 12 hours with the bunk curtain closed. See Table 7.1,
for recommended settings for comfort while the vehicle is parked. Table 7.2 shows the temperature know setting for desired temperatures.

To use the ParkSmart Auxiliary unit, turn the fan knob to any position, other than 0, and then push the "Park" button. Adjust the temperature control knob to the desired temperature. Refer to Table 7.1, or Table 7.2, depending what mode is being used.

<table>
<thead>
<tr>
<th>Rest Hours Desired</th>
<th>Outdoor Temperature less than or equal to: °F (°C)</th>
<th>Sunshine less than or equal to</th>
<th>Maximum Blower Speed</th>
<th>Minimum Temperature Knob Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>105 (40)</td>
<td>Light Sun</td>
<td>8</td>
<td>Full Cold</td>
</tr>
<tr>
<td>6</td>
<td>95 (35)</td>
<td>Full Sun</td>
<td>8</td>
<td>Mid</td>
</tr>
<tr>
<td></td>
<td>90 (32)</td>
<td>Light Sun</td>
<td>8</td>
<td>Full Cold</td>
</tr>
<tr>
<td></td>
<td>100 (38)</td>
<td>Night Time</td>
<td>8</td>
<td>Full Cold</td>
</tr>
<tr>
<td></td>
<td>110 (43)</td>
<td>Full Sun</td>
<td>6</td>
<td>3 O’Clock</td>
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<tr>
<td>8</td>
<td>75 (24)</td>
<td>Night Time</td>
<td>6-8</td>
<td>Full Cold</td>
</tr>
<tr>
<td></td>
<td>95 (35)</td>
<td>Light Sun</td>
<td>6</td>
<td>10 O’Clock</td>
</tr>
<tr>
<td></td>
<td>85 (30)</td>
<td>Light Sun</td>
<td>6</td>
<td>10 O’Clock</td>
</tr>
<tr>
<td></td>
<td>100 (38)</td>
<td>Light Sun</td>
<td>6</td>
<td>Mid</td>
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<tr>
<td></td>
<td>95 (35)</td>
<td>Night Time</td>
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<td>10 O’Clock</td>
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<td></td>
<td>105 (40)</td>
<td>Night Time</td>
<td>6</td>
<td>Mid</td>
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<tr>
<td>10</td>
<td>90 (32)</td>
<td>Night Time</td>
<td>6</td>
<td>10 O’Clock</td>
</tr>
<tr>
<td></td>
<td>100 (38)</td>
<td>Night Time</td>
<td>6</td>
<td>Mid</td>
</tr>
</tbody>
</table>

Table 7.1, Parked HVAC Comfort Guide

<table>
<thead>
<tr>
<th>Temperature Control Knob Position to Requested Output Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Control Knob Position (Clicks)</td>
</tr>
<tr>
<td>1</td>
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<tr>
<td>2</td>
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<td>3</td>
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<td>16</td>
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<td>17</td>
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</tbody>
</table>

Table 7.2, Temperature Control Knob Position to Requested Output Temperature

<table>
<thead>
<tr>
<th>Temperature Control Knob Position to Requested Output Temperature</th>
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<tbody>
<tr>
<td>18</td>
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<tr>
<td>19</td>
</tr>
<tr>
<td>20</td>
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<tr>
<td>21</td>
</tr>
</tbody>
</table>
Cab Features

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Mirrors ..................................................................... 8.1
Cab Amenities .......................................................... 8.1
Windshield Washer Reservoir ................................. 8.2
Horn Controls .......................................................... 8.2
**Windows**

Power windows are standard on Cascadia™ vehicles. The passenger door has a switch mounted in the top of the door, that controls the passenger-side power window. The driver’s door has two switches mounted in the top of the door, that control the driver and passenger windows separately. See Fig. 8.1.

- **WARNING**

There is no anti-pinch protection when the window is almost closed. Be sure to clear all objects from the window before closing.

The window switches have three positions: lower window, neutral, and raise window. Press forward on the switch to lower the window. Hold the switch down in the forward position for approximately one second to activate the express function; the window will continue to roll down after the switch is released. Press the switch in the rearward position (bump) to raise the window.

**Mirrors**

The standard outside mirrors are mounted on the door frame. There is a primary rear view mirror and a convex mirror.

**Mirror Heat Switch**

The outside door mirrors can be heated to keep them clear of fog, frost, and ice. To heat the mirrors, press the upper part of the mirror heat switch on the dash. See Fig. 8.2. When the mirror heat switch is on, an amber indicator light illuminates inside the switch. If the vehicle has Optimized Idle, mirror heating will not operate with the key in accessory mode, or if the Optimized Idle feature turns mirror heating off to reduce stress on the batteries. Refer to the Optimized Idle chapter for more information.

**Power Mirrors**

The power mirrors are controlled with a left-hand or right-hand mirror selector switch, and a directional switch.

Select the left (driver) mirror, or the right (passenger) mirror using the selector switch. The mirror can then be adjusted by pressing the directional switch arrow for the direction the mirror should be adjusted.

**Cab Amenities**

**Center Dash**

Two cup holders and a storage tray are molded into the center dash. See Fig. 8.3.

Power receptacles, to supply 12V power for accessories, are located on either side of the cup holders. An optional ashtray/coin holder may be located in the center dash.
Overhead Storage

Storage pockets are located in the overhead console, above the driver and passenger seats. A glove box is located in the center of the overhead console. In sleeper cabs, there is an overhead storage compartment above the overhead console, and cargo compartments with netting above the seats. See Fig. 8.4.

Glove Box

A glove box is located in front of the passenger seat.

Door Compartments

Map holder/storage compartments are molded into the lower portion of the driver and passenger doors.

Radio and CB

The radio and CB are installed in the overhead console. Optionally there is a hot mount on the dash for fleet CB radios.

Windshield Washer Reservoir

The windshield washer reservoir is mounted under the passenger-side floor. The filler neck is located inside the hood compartment, on the right-hand side, close to the frame rail. Remove the cap from the filler neck to add windshield washer fluid. See Fig. 8.5.

Horn Controls

Air Horn

Air horns may be mounted on the roof of day cabs, or under the driver-side floor for sleeper cabs. The air horn is controlled by a wire lanyard that hangs down inboard by the driver’s door. See Fig. 8.6. Pull downward on the lanyard to sound the air horn.

Electric Horn

The button for the electric horn is located in the center of the steering wheel. See Fig. 8.7. To sound the
horn, press down on the button. The horn will sound for the duration that the button is pressed, up to 60 seconds. The electric horn will operate regardless of the position of the ignition key.
Engine Starting, Operation, and Shutdown

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Engine Starting, Operation, and Shutdown

Engine Starting

This engine chapter is to serve as a guide for best practices only. Each make and model engine may have operating characteristics that are unique to that particular engine, and will be documented in the engine manufacturer’s literature. Always refer to specific instructions and recommendations from the engine manufacturer.

NOTE: Before starting the engine, read Chapter 4 for detailed information on how to read the instruments and see Chapter 5 for detailed information on how to operate the controls. Read the operating instructions in the manufacturer’s engine operation manual before starting the engine.

WARNING

Never pour fuel or other flammable liquid into the air inlet opening in the air intake in an attempt to start the vehicle. This could result in a flash fire causing serious personal injury or property damage.

IMPORTANT: The Cascadia is equipped with starter interlocks to enhance reliability and safety. Antigrinding, starter pinion, and thermal protection logic, limit the amount of time and conditions for starter engagement. Cranking may be limited from 5 to 15 seconds, with a 30 second cool-down period, as determined by the protection logic. If the engine is turning, the starter will not re-engage. Depending on the transmission option, the starter will not engage if the clutch is not fully depressed, or if the transmission is not in neutral.

IMPORTANT: The starter can not be used for priming the fuel system. If the fuel/water separator filter is replaced, and the fuel system needs to be primed, see the engine manufacturer for instructions.

1. Before engine start-up, complete the engine pre-trip and post-trip inspections and maintenance procedures in Chapter 20 and Chapter 21.
2. Set the parking brake.
3. For manual transmissions, place the transmission in neutral and fully depress the clutch pedal. For automatic transmissions, put the transmission in neutral. Do not push the accelerator pedal.
4. Turn the ignition switch to the ON position. See Fig. 9.1. All the electronic gauges on the ICU (instrumentation control unit) complete a full sweep of their dials, the warning and indicator lights light up, and the buzzer sounds for three seconds.

NOTE: The engine electronics supply the correct amount of fuel for starting the engine. Accelerator pedal pressure is unnecessary, and could interfere with engine starting.

5. Turn the ignition key to the START position. Do not press down on the accelerator pedal. Release the key the moment the engine starts.

NOTICE

Do not rev the engine if the oil pressure gauge indicates no oil pressure. Shut down the engine if no oil pressure appears within approximately ten seconds. Check to determine the cause of the problem. Operating the engine with no oil pressure will damage the engine.

6. It is not necessary to idle the engine before engaging or starting the operation, but load should be applied gradually during the warm-up period until the oil temperature reaches 140°F (60°C).
7. Check the oil pressure gauge for any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system. Minimum oil pressure at idle is 7 psi (50 kPa).

Cold-Weather Starting

Turn the ignition switch to the ON position, to activate the intake air preheater. See Fig. 9.1.

If the engine is at normal temperature, the INTAKE HEATER indicator goes out after two seconds.

If the temperature is low enough to require the heater, the INTAKE HEATER indicator stays on while the intake air preheater warms up. After the indicator goes out, follow the instructions under "Engine Starting".

IMPORTANT: If the engine doesn’t start on the second try, wait at least five minutes before using the intake air preheater again.

Starting After Extended Shutdown

An engine in storage for an extended period of time (over winter, for example) may accumulate water in the oil pan. Oil diluted by water cannot provide adequate bearing protection at start-up. For this reason, change the engine oil and filters after extended storage.

Engine Operation

Safety and Environmental Considerations

**WARNING**

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

All Freightliner diesel engines comply with the requirements of the Federal (U.S.) Clean Air Act. Once an engine is placed in service, the responsibility for meeting both state and local regulations is with the owner/operator.

IMPORTANT: EPA10 emissions regulations apply to vehicles domiciled in Canada and the USA at the time of printing this manual. Vehicles that are domiciled outside of the USA and Canada may not have EPA10-compliant engines with an emission aftertreatment system, depending upon local statutory emissions guidelines.

**NOTICE**

It is extremely important that the following guidelines be followed for vehicles with EPA10-compliant engines, or damage may occur to the aftertreatment device, and the warranty may be compromised.

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

Adequate maintenance of the engine and the diesel-particulate filter are the responsibility of the owner/operator, and are essential to keep the emission levels low. Good operating practices, regular maintenance, and correct adjustments are factors that will help to stay within the regulations.

The driver should be familiar with the vehicle 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 occur, causing a safety hazard. See Chapter 4 for information.

Engine Break-In

Each engine must pass a full-load operating test on a dynamometer before shipment, thereby eliminating the need for a break-in. Before running the engine for the first time, follow the instructions in the manufacturer’s engine operation manual.

Normal Operation

**WARNING**

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

All engines have an operating range specific to that engine 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. Most 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. For specifics for any engine, refer to the engine manufacturer’s operation manual.

Prolonged idling of engines is not recommended, and is illegal in some states. The belief that idling a diesel engine causes no engine damage is wrong. Idling produces sulfuric acid, that is absorbed by the lubricating oil, and eats into bearings, rings, valve stems, and engine surfaces. If you must idle the engine for cab heat or cooling, the high idle function of the cruise control switches should be used. An idle speed of 900 rpm should be enough to provide cab heat in above freezing ambient temperatures.

If the engine is programmed with the idle shutdown timer, ninety seconds before the preset shutdown time, the CHECK ENGINE light will begin to flash at a rapid rate. If the position of the clutch pedal or service brake changes during this final ninety seconds (CHECK ENGINE lamp flashing) the idle shutdown timer will be disabled until reset.

Cold-Weather Operation

Special precautions must be taken during cold weather. For service products to use in cold weather, see the engine operator’s manual.

Satisfactory performance of a diesel engine operating in low ambient temperatures requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The lower the temperature, the greater the amount of modification required.

If satisfactory engine temperature is not maintained, maintenance costs will increase due to greater engine wear. If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil, causing all moving parts of the engine to suffer from poor lubrication.

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.

A modified engine must still be capable of operation in warmer climates without extensive changes. Accessories, such as block heaters, or oil pan heaters, should be designed so that they can be disconnected when not needed with little effect on the engine.

There are three basic objectives:

1. Reasonable starting characteristics followed by practical and dependable warm up of the engine and equipment.
2. A unit or installation that is as independent as possible from external influences.
3. Modifications that maintain satisfactory operating temperatures with a minimum increase in maintenance of the equipment and accessories.

The following points are important to observe when operating in cold weather.

- Check for cracks in the battery cases, for corrosion of the terminals, and for tightness of the cable clamps at the terminals.
- Charge the batteries to full capacity. Replace any battery that is unable to hold full charge or is physically damaged.
- If so equipped, turn off the load disconnect switch after the engine is shut down, to prevent battery discharge.
- Have the alternator output checked at an authorized Freightliner service provider.
- Check the condition and tension of the drive belts.
- Use low-viscosity lubricating oils for adequate lubrication.
- Periodically check the coolant mixing ratio (concentration of antifreeze in the coolant). Add more if necessary.
- At outside temperatures below –4°F (–20°C), a coolant preheater is recommended.
- At temperatures below 32°F (0°C), use winter-grade (1-D or winterized 2-D) diesel fuel to avoid fuel problems due to paraffin separation.
• If the use of unblended summer-grade diesel fuel in winter cannot be avoided, install a thermostatically controlled fuel heater to prevent wax from clogging the fuel filters, and formation of ice crystals from water in the fuel. If a fuel heater is used, make sure it has thermostatic controls to prevent excessive heating of the fuel in warm weather. Excessive heating of fuel can cause a loss of engine power.

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

High-Altitude Operation

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.

All engines used on Freightliner vehicles are altitude-compensated by the use of a turbocharger. This reduces smoky exhaust at high altitudes, requires less downshifting, and allows the engine to make better use of its fuel. Nevertheless, shift gears as needed to avoid excessive exhaust smoke.

Engine Shutdown

1. With the vehicle stopped, apply the parking brakes and place the transmission in neutral.

**NOTICE**

Idle the engine one to two minutes before shutting it down, if this can be done without damage to the engine. After hard operation, shutting down the engine without idling may cause damage to the turbocharger.

2. Allow the engine to idle one to two minutes before shutting it down. This allows the lubricating oil and the coolant to carry heat away from the combustion chambers, bearings, shafts, and seals. The extreme heat may cause bearings to seize or oil seals to leak.

IMPORTANT: 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 115°F (46°C).

**NOTICE**

Except in an emergency, do not shut down the engine when the coolant temperature is above 194°F (90°C). To do so could damage the engine.

3. Turn off the ignition switch and shut down the engine.
Optional Engine Systems

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Engine Idle Limiting ............................................................................................... 10.1
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Optional Engine Systems

Engine Protection—Warning and Shutdown

The driver should be familiar with the vehicle 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 occur, causing a safety hazard.

If the engine coolant temperature, the coolant level, the engine oil pressure, or exhaust aftertreatment system (on some engines, the engine oil temperature, or the intake air temperature) reach preset levels, the engine will begin a warning and shutdown process. See the engine manufacturer’s operation manual for specific details for your vehicle. See Chapter 11 in this manual, for the warning and shutdown modes associated with the exhaust aftertreatment system.

Electronic engine protection is programable as an option, and can be specified as the following: DERATE, and SHUTDOWN mode (factory default), WARNING mode, or OFF mode.

In the DERATE and SHUTDOWN mode, the red stop-engine light will illuminate when the problem is serious enough to reduce the power or speed. The engine power will ramp down, then shut down, if the problem continues. The driver has 30 seconds after the stop-engine light illuminates, to move the vehicle safely off the road. If the vehicle cannot be moved to a safe location within that time, the engine can be restarted by turning the ignition switch to the OFF position for at least 5 seconds, then back ON. This action can be repeated until the vehicle is safely off the road. See Fig. 10.1.

Some vehicles may have a shutdown-override switch, which may be used to override the shutdown sequence. This switch resets the shutdown timer, restoring power to the the level before the derate was initiated. The switch must be pressed again after 5 seconds to obtain a subsequent override. It can be used to move the vehicle to a safe stopping area. Do not operate the vehicle until the problem has been corrected. See Fig. 10.2.

If the engine protection parameters are set to WARNING, it warns the driver; the amber, check-engine light will flash, and a buzzer will sound. The engine electronics log the event for diagnostic purposes. The check-engine light will go out if the problem stops.

If the engine protection parameters are set to OFF mode, the individual sensor indicator lights will illuminate if a problem exists, but no shutdown action will be started, and the event will not be recorded.

Engine Idle Limiting

Idle Shutdown Timer

This feature is an optional 1-to-100 minute idle shutdown system. Its purpose is to conserve fuel by eliminating excessive idling, and allowing a turbocharger cool-down period. To activate the shutdown, the transmission must be in neutral with the vehicle parking brakes set and the engine in idle or fast-idle mode.

California Engine Idle Limiting

In order to meet the California Air Resources Board (CARB) engine idle limiting standard, an engine idle shutdown feature has been included in engine control strategy. When the CARB engine idle limiting feature is enabled, the engine will generally shut down after five minutes of continuous idling when the
transmission is in neutral or park, and the parking brake is set, or after fifteen minutes when the transmission is in neutral or park, and the parking brake is not set.

Activating or momentarily changing the position of the service-brake pedal, the clutch pedal, stop-engine override switch, the accelerator pedal, or parking brake, during the final 30 seconds before a shutdown would otherwise occur, will prevent the engine from shutting down, and will reset the shutdown timer. After an automatic shutdown, the engine may be restarted and operated normally.

The automatic shutdown feature is generally disabled on engines certified by the U.S. EPA for use outside California, but is required to be enabled for all California-certified engines (with the exception of engines used in specific vehicle types that the state of California has determined to be exempt from the idle shutdown requirement). Owners that wish to have the shutdown feature disabled should consult with California authorities to determine if their vehicle qualifies for the exemption.

Cruise Control

**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.

IMPORTANT: On vehicles with Eaton VORAD Collision Warning System with SmartCruise, see Chapter 4 before operating the cruise control.

The cruise control is operated by four switches mounted in the left-hand switch pod of the steering wheel. See Fig. 10.3.

- **ON/OFF switch**—Press to toggle cruise control on/off. When cruise control is on, an amber telltale lens illuminates in the ICU lightbar. The cruise control speed memory will be retained until the cruise control is disengaged with the ON/OFF switch, or the ignition is shut off.
- **DEC/SET switch**—Press to set the cruise speed while the vehicle is traveling at the desired speed. Press and hold to decrease the set cruise speed.
- **CANCEL switch**—Press to pause the cruise control, while retaining the speed setting in memory. The cruise control can also be disengaged, while retaining the speed setting in memory, by stepping on the brake pedal, or the clutch pedal.
- **ACC/RES Switch**—Press to resume the set speed. Press and hold to accelerate the set cruise speed.

**NOTICE**

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.

Cruise Control Disengage

The cruise control disengage feature is an optional safety feature that disengages the cruise control when one of the following conditions occurs:

- hazard lights, headlights, or windshield wipers are on
- hazard lights or windshield wipers ar on
- hazard lights or headlights are on.
Predictive Cruise Control

Run Smart Predictive Cruise Control™ is an optional fuel savings application that adjusts the vehicle speed predictively, based on the approaching road profile. Using 3D digital map technology and GPS, Predictive Cruise Control evaluates the upcoming road grade about a mile in advance to determine the most fuel efficient vehicle speed. Vehicles equipped with Predictive Cruise Control have a sticker on the dash indicating that the system is installed in the vehicle. See Fig. 10.4.

Predictive Cruise Control will vary the vehicle set cruise speed by up to 6% depending on the approaching road grade. If the engine brake is enabled, Predictive Cruise will automatically engage the engine brakes when the actual vehicle speed exceeds the cruise set speed by 6%.

When Predictive Cruise Control is active, the driver may experience variability in the set speed of the vehicle. This is different from conventional cruise control, which maintains the speed set by the driver.

**WARNING**

Apply brakes and downshift as necessary when driving on downhill grades. Predictive Cruise Control does not adequately control vehicle speed on steep downhill grades. Failure to use normal braking techniques when Predictive Cruise Control is active could result in personal injury and vehicle damage.

The 3D digital map database contains road profile information for over 200,000 highway miles (322,000 km) in the 48 contiguous United States, including all Interstate and many major highways.

**IMPORTANT:** Predictive Cruise Control adjusts the vehicle set speed to achieve maximum fuel economy, but it does not account for traffic flows or surrounding vehicles. Predictive Cruise Control is compatible with SmartCruise, but it does not perform the same function. SmartCruise maintains the vehicle’s headway distance by de-fueling and applying the engine brake.

If there is a problem with the normal operation of Predictive Cruise Control, the system reverts to conventional cruise control.

Driver interaction with Predictive Cruise Control is the same as conventional cruise control, using existing cruise control switches. In the event of a problem with Predictive Cruise Control, or when driving on a road with no profile information available in the 3D digital map database, the system reverts to conventional cruise control.

**Power Takeoff (PTO) Governor**

Front Engine Power Take Offs (PTO) are devices used to tap into engine power to run auxiliary devices. Common uses are vehicles with hydraulic pumps which power additional equipment. The following instructions are general guidelines for operating a PTO.

1. **Set the parking brake. Shift the transmission to neutral.**
2. **Press the dash PTO switch. Release the switch when the light begins to blink.**
   
   When the light comes on steadily, the PTO is engaged and ready to operate. In stationary mode, the vehicle must remain in neutral with the parking brake set.
3. **To activate the mobile mode, shift from neutral to reverse, 1st, or 2nd gear. The clutch will open and the PTO will disengage for a moment.**
4. **Touch the throttle pedal to close the clutch and engage the PTO in mobile mode. The PTO may be operated with the transmission in the following gears only: R-N-1-2.**

**NOTE:** Do not attempt to change gears while the vehicle is moving. The transmission will ignore the request.

5. **To end the mobile mode, bring the vehicle to a stop. The clutch will open and shut off power to the PTO.**
6. To resume stationary mode, shift to neutral. The PTO will engage.

7. To end stationary mode, press the dash switch. When the light in the switch goes out, power to the PTO is shut off. Shut down the engine.

**Optimized Idle®**

The optimized idle option with Detroit Diesel engines is a system that automatically stops and restarts the engine to accomplish the following:

- Keep the engine oil temperature between 60 and 104°F (16 to 40°C)
- Keep the battery charged
- Keep the cab or sleeper at a constant, desired temperature (if equipped with a thermostat)

The benefits of the system include reduced engine idle time, fuel savings, reduction of exhaust emissions and noise, increased starter and engine life, and less chance of dead batteries due to electrical loads.

Optimized Idle operates in two modes; the engine mode or the thermostat mode. The engine mode keeps the battery charged and the engine oil temperature within factory set limits. The thermostat mode is the same as the engine mode, but also keeps the cab and sleeper at a constant preset temperature.

The engine mode is always activated when the system is operated. The thermostat mode is activated when the thermostat is turned on.

The thermostat mode controls the set point, which is the desired temperature of the cab and sleeper, and the comfort zone, which is the number of degrees from the set point before the engine needs to heat or cool the cab. There are three comfort zones: 4°F (2°C), 7°F (4°C), or 10°F (6°C).

Vehicles equipped with Optimized Idle have a label on the dash, and a telltale lens in the dash message center. See Fig. 10.5 for the dash label detail. See Chapter 4 for the appropriate dash message center. If equipped with the thermostat mode, a thermostat is located in the sleeper, above the bunk. See Fig. 10.6.

The thermostat consists of an LCD readout and four buttons.

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**Fig. 10.5, Optimized Idle Dash Label**

**Fig. 10.6, Optimized Idle Thermostat**

The display normally shows the temperature of the sleeper, but changes accordingly as the buttons are pressed.

The button functions are as follows:

- Up Button: increases the set point and comfort zone.
- Down Button: decreases the set point and comfort zone.
- Cool/Heat Button: detects either cooling or heating operation.
Optional Engine Systems

• Mode Button: scrolls through the various functions. It can also be used to set desired temperature values.

1. Activate Optimized Idle (engine mode).
   1.1 Set the parking brake.
   1.2 If it is tilted, close and secure the hood.
   1.3 Start the engine and let it idle.
   1.4 Put the transmission in neutral.
   1.5 Turn on the cruise control.
      The dash light will begin blinking, indicating that Optimized Idle is active. The system is now in the engine mode and after an initial phase, in which the idle speeds up to 1000 or 1500 rpm (depending on the outside temperature), the engine will stop and start automatically to keep the battery charged and the engine oil warm. The dash light stays on and shines steadily at this point.

   IMPORTANT: The cruise control must be turned on after the engine is idling. If it was previously turned on, turn off the cruise control, then turn it on again.

2. Activate the thermostat mode (if so equipped).
   NOTE: When the system is in the thermostat mode, it is also in the engine mode. It will continue to operate in the engine mode even if the thermostat mode is turned off.
   2.1 With the system in the engine mode, set the cab and sleeper heater or air conditioner controls to the highest setting.
   2.2 Turn on the thermostat by touching any of the four buttons. See Fig. 10.6.
      The display will flash the current sleeper temperature and the previous mode (cooling or heating) selected. If the cab needs to be cooled or heated, the cool/heat icon will flash.

   2.3 Choose either cool or heat by pressing the Cool/Heat button. Make sure the selection matches that of the cab controls.

   IMPORTANT: If the heat or cool selection of the thermostat does not match that of the cab, the system will idle and cycle excessively.

   2.4 Select Fahrenheit or Celsius by pressing and holding the Mode button until either the "F" or "C" is displayed.

   2.5 Select the temperature set point by pressing either the Up button or the Down button, as applicable. Holding the button will cause the display to count up or down rapidly. When the desired set point is displayed, release the button. The set point is stored in memory.

   2.6 Select the temperature comfort zone by pressing the Mode button until the upper and lower temperature limit icon is displayed. Then use the Up or Down button to select one of the three comfort zones of 4°F (2°C), 7°F (4°C), or 10°F (6°C).

3. To change the display to either Fahrenheit or Celsius, press the Mode button until only the F° or C° icon is flashing. Press the Up or Down button to change to the desired value. The main display will appear five seconds after the button is released.

4. To deactivate the thermostat mode and return to just the engine mode, press the Mode button and hold it for three seconds.

5. To shut down Optimized Idle completely, either turn off the ignition or use the drive away feature.
   The drive away feature allows the use of all the engine features. Use the drive away feature as follows:
   5.1 If the engine is running: Release the parking brakes or put the transmission in gear.
      If the engine is not running: Start the engine.

   5.2 Let the engine return to base idle. The active light will turn off. Optimized Idle is now disabled.

   When the vehicle has Optimized Idle, the following functions will not operate with the key in accessory mode. Optimized Idle may also turn these functions off to reduce stress on the batteries.

   • Cab climate control fan
Optional Engine Systems

- Sleeper climate control fan
- Mirror heating (driver and passenger)
- Fuel/water separator heating element
- Seat heating
- Advertising light
- Auxiliary circulation fan (windshield)
- Air dryer
11

Aftertreatment Systems (ATS)

Exhaust Aftertreatment Systems .................................................... 11.1
Diesel Exhaust Fluid and Tank (EPA10) .............................................. 11.6
Exhaust Aftertreatment Systems

IMPORTANT: EPA07 and EPA10 emissions regulations apply to vehicles domiciled in Canada and the USA at the time of printing this manual. Vehicles that are domiciled outside of the USA and Canada may not have EPA07- or EPA10-compliant engines with an emission aftertreatment system, depending upon local statutory emissions guidelines.

EPA07 ATS

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

NOTICE

It is extremely important that the following guidelines be followed for vehicles with EPA07-compliant engines, or damage may occur to the aftertreatment device, and the warranty may be compromised.

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

IMPORTANT: Using non-specification fuels or oils can lead to shortened Diesel Particulate Filter (DPF) cleaning or exchange intervals. For example, using CI-4+ oil with 1.3% sulfated ash (30% more ash content) may result in the need for DPF cleaning or exchange 20 to 30% sooner than would normally be required.

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

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

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

In active regeneration, extra fuel is injected into the exhaust stream to superheat the soot trapped in the DPF and turn it to ash. Active regeneration happens only when the vehicle is moving above a certain speed, determined by the engine manufacturer. Consult manufacturers’ documentation for details. Both active and passive regeneration happen automatically, without driver input.

Only when operating conditions do not allow for ATD filter cleaning by at-speed active or passive regeneration, the vehicle may require a driver-activated parked regeneration. The vehicle must be standing still, and the driver must initiate a parked regen. Completing a parked regen takes 20 minutes to an hour, depending on ambient conditions.

DANGER

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

Before initiating a parked regeneration, make certain the exhaust outlets are directed away from structures, trees, vegetation, flammable materials, and anything else that may be damaged or injured by prolonged exposure to high heat.
The warning lamps in the driver message center alert the driver of a regen in progress, high exhaust temperatures, the need to perform a parked regen either soon or immediately, and of an engine fault that affects the emissions.

A slow (10-second) flashing of the high exhaust system temperature (HEST) lamp indicates that a parked regen is in progress, and the engine’s high idle speed is being controlled by the engine software, not the vehicle operator.

A steadily illuminated high exhaust system temperature (HEST) lamp, alerts the operator of high exhaust temperature during the regen process if the vehicle speed is below 5 mph (8 km/h), or during a parked regen. See Fig. 11.1.

The HEST lamp does not signify the need for any kind of vehicle or engine service; it only alerts the vehicle operator of high exhaust temperatures. Make sure the engine exhaust pipe outlet is not directed at any person, or at any surface or material that will melt, burn, or explode.

**WARNING**

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

A steadily illuminated yellow diesel particulate filter (DPF) lamp indicates that the engine has been unable to efficiently perform an at-speed regeneration. The vehicle should be operated at highway speeds to encourage automatic regeneration conditions, or a parked regen will be required soon, and should be scheduled for the earliest convenient time. See Fig. 11.2.

**Fig. 11.2, Diesel Particulate Filter (DPF) Status Lamp**

A steadily illuminated yellow malfunction indicator lamp (MIL) indicates an engine fault that affects the emissions. See Fig. 11.3.

**Fig. 11.3, Engine Lamps**

A DPF lamp blinking at the same time as a steadily illuminated yellow Check Engine lamp, indicates that a parked regen must be performed immediately, or an engine derate will occur.

If the red Stop Engine lamp illuminates with the blinking DPF lamp and the Check Engine lamp, a parked regen must occur or an engine shutdown will occur. Park the vehicle and perform a parked regen. See Fig. 11.3.

The regen switch, located on the dash, is used to initiate a parked regen of the aftertreatment device. To access the regen switch, the guard needs to be lifted, and the switch will operate as noted in the engine operation manual. See Fig. 11.4.
NOTE: The regen switch can start a parked regen only when at least one of two conditions exists: either the DPF light is lit, or the engine software calls for it. If neither of those conditions exist, the regen switch cannot cause a regeneration to happen.

The inhibit regen switch provides additional control over the aftertreatment regeneration process. When activated, the inhibit switch will stop a regeneration cycle in progress, and prevent the start of a regeneration cycle until the switch is no longer active. See Fig. 11.5.

**Maintenance**

When diesel particulate filter servicing is needed, it must be performed by an authorized technician, and a record must be maintained for warranty purposes. The record must include:

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

**EPA10 ATS**

IMPORTANT: EPA10 emissions regulations apply to vehicles domiciled in Canada and the USA at the time of printing this manual. Vehicles that are domiciled outside of the USA and Canada may not have EPA10-compliant engines with an emission aftertreatment system, depending upon local statutory emissions guidelines.

The EPA mandates that all engines built after December 31, 2009 must reduce the level of emissions exhausted by the engine to the following levels:

- Nitrogen Oxides (NOx) – 0.2 g/bhp-hr
- Particulate Matter (PM) – .01 g/bhp-hr

To meet EPA guidelines, diesel engines installed in Daimler Trucks North America (DTNA) chassis for domicile in Canada and the USA use an aftertreatment system (ATS) with an aftertreatment device (ATD) and Selective Catalytic Reduction (SCR) technology to reduce NOx downstream of the engine.

**NOTICE**

Using non-specification fluids can result in serious damage to the ATS. It is extremely important that the following guidelines be followed for vehicles with EPA10-compliant engines, or damage may occur to the ATD, and the warranty may be compromised.

- Use ultralow-sulfur diesel with 15 ppm sulfur content or less.
- Do not use fuel blended with used engine lube oil or kerosene.
- Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.
- Use only certified diesel exhaust fluid (DEF) in the DEF tank.

After exhaust gasses leave the engine, they flow into the ATS. First they flow into a two-part ATD, comprised of a diesel oxidation catalyst (DOC), and a diesel particulate filter (DPF). The DPF traps soot...
particles, then exhaust heat converts the soot to ash in the DPF, in a process called regeneration (regen). The harder an engine works, the better it disposes of soot. When the engine is running under load and regen occurs without input, it is called passive regen. If the engine isn’t running hot enough, the electronic controls may initiate an active regen, whereby extra fuel is injected into the exhaust stream before the diesel particulate filter, to superheat the soot trapped in the filter and burn it to ash. Both types of regen occur without driver input.

⚠️ WARNING

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

Operating at reduced engine load will allow soot to accumulate in the DPF. When this occurs, the DPF lamp illuminates, indicating that a regen must be performed, and the driver must either bring the vehicle up to highway speed to increase the load, or park the vehicle and initiate a parked regen. See Parked Regen, later in this chapter for instructions.

After the exhaust stream passes through the ATD, it flows through another canister housing the SCR device. A controlled quantity of diesel exhaust fluid (DEF) is injected into the exhaust stream, where heat converts it to ammonia (NH₃) gas. This mixture flows through the SCR device, where the ammonia gas reacts with the NOx in the exhaust, to produce harmless nitrogen (N₂) and water vapor (H₂O), which then exits out of the tailpipe.

ATS Warning Lamps

The malfunction indicator lamp (MIL) illuminates to indicate a fault that affects the emissions. See Fig. 11.6.

Warning lamps in the driver’s message center alert the driver of situations with the aftertreatment system. A decal attached to the driver’s sun visor explains the aftertreatment system DPF, HEST, and DEF warning lamps. See Fig. 11.7.

- An illuminated DPF lamp indicates a regen is needed.

⚠️ DANGER

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

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

See Fig. 11.8 for an explanation of the ATS warnings, and actions required to avoid further engine protection sequences.

The regen switch, located on the dash, is used to initiate a parked regen of the aftertreatment device. To access the regen switch, the guard needs to be lifted. See Fig. 11.4.
NOTE: The regen switch can initiate a parked regen only when the DPF lamp is illuminated (because the engine software is signaling for a parked regen.)

The regen-inhibit switch provides additional control over the aftertreatment regeneration process. A driver may decide to use this feature if they are hauling cargo that should not be exposed to possible high exhaust temperatures from an automatic regen. When activated, the inhibit switch will stop a regeneration cycle in progress, and prevent the start of a regeneration cycle until the switch is no longer active. See Fig. 11.5.

To initiate a parked regeneration, perform the following steps.

1. Park the vehicle away from all combustible and flammable materials. Chock the tires. Start and warm the engine until the coolant temperature is at least 150°F (66°C).

2. Set the parking brake. If the parking brake was already set, you must release it, then set it again.

   For manual transmissions, fully depress the clutch pedal, put the transmission in neutral, then release the pedal.

   If the vehicle has a two-pedal automated transmission, shift it into gear, then back to neutral.

   **IMPORTANT:** The driver must remain with the vehicle during the entire regen cycle.

3. Press and hold the regen switch for 4 seconds. The engine will increase rpm and initiate the regen process.

4. After the parked regen has run for 20 to 40 minutes, the regen cycle is completed. The engine
idle speed will drop to normal, and the vehicle may be driven normally. The HEST lamp may be illuminated, but will go out when the vehicle speed exceeds 5 mph (8 km/h), or the system has cooled to normal operating temperature.

5. To stop a parked regen at any time during the process, engage the clutch, brake, or throttle pedal, or turn off the engine.

DPF Maintenance

Eventually ash will accumulate in the DPF and the filter will require servicing. DPF servicing must be performed by an authorized technician, following the engine manufacturer’s instructions. A record must be maintained for warranty purposes, that includes:

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

Diesel Exhaust Fluid and Tank (EPA10)

Diesel Exhaust Fluid

Diesel exhaust fluid (DEF) is used in the aftertreatment system to lower NOx in the exhaust stream. DEF is colorless and close to odorless. (It may have a slightly pungent odor similar to ammonia.) It is nontoxic, non-flammable and biodegradable. It is mildly corrosive to aluminum, but it will not affect the strength or structure of the aluminum. A white powder may be noticeable around components that the DEF comes in contact with. Around 12°F (-11°C) DEF freezes to slush, but is not damaged or destroyed if frozen, and is fully usable when thawed. The DEF supply lines are electrically heated and are purged when the engine is shut down. The DEF in the tank is allowed to freeze while the vehicle is non-operational. At start up, normal operation of the vehicle is not inhibited if the DEF is frozen; an immersion heater with engine coolant flowing through it will warm the DEF once the engine is running, to allow the SCR system to operate.
DEF Tank

EPA10-compliant vehicles are equipped with a DEF tank located on the driver’s side of the vehicle, usually behind the battery box, or an optional location forward of the fuel tank for day cab configurations. See Fig. 11.9, and Fig. 11.10. The DEF tank has a 19 mm filler neck inlet that prevents the hose from a diesel outlet from being inserted, and has a blue cap for easy identification.

DEF consumption will vary depending on ambient conditions and vehicle application.

Fuel/DEF Gauge

The diesel fuel and DEF levels are measured in a dual purpose gauge. See Fig. 11.11.

The diesel-fuel level is indicated at the top of the gauge. Below the fuel level, a diesel-fuel warning lamp illuminates amber when the diesel fuel level drops below 1/8th of the capacity.

The lower portion of the gauge has a DEF warning lamp that illuminates amber when the DEF tank is near empty, and a lightbar that indicates the level of DEF in the tank. The DEF light bar illuminates as follows.

- Four bars illuminated green—Between 75% and 100% full.
- Three bars illuminated green—Between 50% and 75% full.
- Two bars illuminated green—Between 25% and 50% full.
- One bar illuminated green—Between approximately 10% and 25% full.
- One bar illuminated amber—DEF very low, refill DEF.
- One bar flashing red—DEF empty, refill DEF.

DEF Warnings and Engine Limits

IMPORTANT: Ignoring the DEF warning lights will result in limited engine power, with a speed limit of 5 mph (8 km/h) eventually being applied.

DEF Level Low—Initial Warning

When the DEF level reads low the following warnings strongly encourage the driver to refill the DEF tank:

- One bar of the DEF level indicator illuminates amber—DEF very low, refill DEF
- DEF warning lamp illuminates solid amber

See Fig. 11.12.

The DEF tank must be filled to cancel the warning sequence.
When the DEF level reads empty, the following warnings are activated:

- One bar of the DEF level indicator flashes red—DEF empty, refill DEF
- DEF warning lamp flashes amber
- MIL lamp illuminates

Detroit Diesel engines: Power is limited, with a 55 mph (90 km/h) speed limit.

Cummins engines: Power is limited with progressively harsher engine power limits applied.

The DEF tank must be filled to cancel the warning sequence.

### DEF Level Empty and Ignored

If the empty warning is ignored and the DEF is not refilled, the red STOP engine lamp illuminates in addition to the DEF warning lamp and MIL illumination. See Fig. 11.14.

If the DEF is not refilled, a 5 mph (8 km/h) speed limit will be applied after the next engine shut down or while parked and idling.

### DEF Quality or SCR Tampering

**NOTICE**

Once contaminated DEF or tampering has been detected in the SCR system, the vehicle must be taken to an authorized service center to check the SCR system for damage, and to deactivate the warning lights and engine limits.

If contaminated DEF or tampering is detected the DEF warning light flashes, and the MIL illuminates to warn the driver. See Fig. 11.14.
Detroit Diesel engines: Power is limited, with a 55 mph (90 km/h) speed limit. If the fault is not corrected the STOP engine light illuminates, and a 5 mph (8 km/h) speed limit will be applied after the next engine shut down or while parked and idling.

Cummins engines: Power is limited with progressively harsher engine power limits applied. If the fault is not corrected the STOP engine light illuminates, and a 5 mph (8 km/h) speed limit will be applied after the next engine shut down, or while parked and idling.
Air Brake System

Air Brake System ................................................................. 12.1
Meritor WABCO® Antilock Braking System (ABS) .......................... 12.3
Air Brake System

General Information

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

**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.

**IMPORTANT**: On TRACTORS, loss of air pressure in the primary system causes the rear service brakes to become inoperative; front brakes will continue to be operated by secondary system air pressure. On TRUCKS, loss of air pressure in the primary system causes the rear spring brakes to get modulated, controlled by a secondary air signal. In addition, on TRACTORS and TRUCKS, trailer brakes will be operated by the secondary system.

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. Monitor the air pressure system by observing the dual system air pressure gauge and the low-air-pressure warning light and buzzer. The warning light and buzzer shut off when air pressure in both systems reaches 64 to 76 psi (441 to 524 kPa).

The warning light and buzzer come on if air pressure drops below 64 to 76 psi (441 to 524 kPa) in either system. If this happens, check the dual system air pressure gauge to determine which system has low air pressure. Although the vehicle’s speed can be reduced using the foot brake control pedal, either the front or rear service brakes will not be operating at full capacity, causing a longer stopping distance. Bring the vehicle to a safe stop, and have the air system repaired before continuing.

**WARNING**

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

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

Brake System Operation

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

During normal brake stops, depress the foot brake control pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. Apply the spring parking brakes if the vehicle is to be parked.

**IMPORTANT**: An air brake proportioning system is used in tractor air brake systems when the vehicle is not equipped with ABS. 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.

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

The trailer brake lever (hand control valve) is used for applying the trailer brakes without applying the truck or tractor service brakes. It is usually mounted on the right-hand control panel. See Fig. 12.1. The valve can be partially or fully applied, but in any partially on position it will be overridden by a full application of the service brake pedal. Moving the lever down applies the trailer brakes, while moving it up releases the trailer brakes. The lever will automatically return to the up position when it is released.

WARNING

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

The red octagonal-shaped knob in the control panel actuates the trailer air supply valve. See Fig. 12.2. After the vehicle’s air hoses are connected to a trailer, and the pressure in both air systems is at least 65 psi (448 kPa), the red knob must be pushed in. It should stay in, to charge the trailer air supply system and to release the trailer spring parking brakes. It must be pulled out before disconnecting a trailer. It must also be pulled out when operating a vehicle without a trailer. If pressure in both air systems drops to 35 to 45 psi (242 to 310 kPa), the red knob automatically pops out, exhausting the trailer air supply, and applying the trailer service or spring parking brakes.

CAUTION

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

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

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

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

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

**WARNING**

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

**CAUTION**

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

**Automatic Slack Adjusters**

Automatic slack adjusters should never be manually adjusted except during routine maintenance of the foundation brakes (e.g., replacing shoes), during slack adjuster installation, or in an emergency situation.

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

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

**WARNING**

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

**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, and *controls* wheel speed during emergency stops. If equipped with Automatic Traction Control, wheel spin is controlled during reduced-traction situations. 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 wheel. The sensors transmit vehicle wheel speed information to an electronic control unit (located behind the center dash). 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 modulator valve to reduce braking pressure. During emergency braking, the modulator valve alternately reduces, increases, or maintains air pressure supply in the brake chamber to prevent front and rear wheel lockup.

If equipped with automatic traction control (ATC), an additional solenoid valve is installed. During reduced-traction situations, the ATC solenoid valve controls air pressure to the modulator valves, and they in turn increase, hold, or reduce pressure to the appropriate brake chambers to provide better traction whenever wheel spin occurs.

The electronic control unit also has a safety circuit that constantly monitors the wheel sensors, traction control valve (if equipped), modulator valves, and the electrical circuitry.
After the ignition switch is turned on, the tractor warning light (TRACTOR ABS) and, if equipped with automatic traction control, the wheel spin indicator light come on for about three seconds. After three seconds, the warning lights go out only if all of the tractor’s ABS components are working.

Vehicles with electronic engines and ABS may have ATC. On these vehicles, the ATC system automatically limits wheel spin during reduced-traction situations.

If the vehicle has ATC, there will be a momentary contact rocker switch on the dash labeled ATC.

When the ATC system is in the NORMAL mode, it will apply gentle braking to the spinning wheel, to feed power to the wheel(s) with better traction. If both wheels are spinning, the system will signal the electronic engine to reduce power.

Pressing the switch will temporarily allow more drive wheel spin to help burn through a thin layer of ice, or to help throw off accumulated mud or snow. SPIN mode is indicated by a flashing WHEEL SPIN light. Pressing the switch again will cycle the system back to normal operation.

The Meritor WABCO ABS system combines one front-axle control channel with one rear axle to form one control circuit. For example, the sensor and modulator valve on the left-front axle form a control circuit with the sensor and modulator valve on the right rear axle. If, during vehicle operation, the safety circuit senses a failure in any part of the ABS system (a sensor, modulator valve, wiring connection, short circuit, etc.), the tractor warning light (TRACTOR 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 completely inoperative, normal braking ability is maintained. An exception would be if a modulator valve (or combination modulator valve) is damaged and inoperative. As these components are an integral part of the air brake system, normal braking may be impaired or inoperative.

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.

Trailer ABS Lamp Operation

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

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

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

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

IMPORTANT: If a compatible trailer is connected, and the lamp is not illuminating momentarily when the ignition key is turned to the ON position, it is possible that the lamp is burnt out.
13

Engine Brakes

Engine Brake ................................................................. 13.1
**Engine Brake**

**WARNING**

To avoid injury from loss of vehicle control, do not activate the engine brake system under the following conditions:

- on wet or slippery pavement, unless the vehicle is equipped with ABS (antilock braking system) and you have had prior experience driving under these conditions;
- when driving without a trailer (bobtailing) or pulling an empty trailer;
- if the tractor drive wheels begin to lock, or there is fishtail motion after the engine brake is activated.

Whenever vehicle braking is required on good road conditions, the engine brake may be used in conjunction with the service brakes. There is no time limit for operation of the engine brake. However, an engine brake is not a substitute for a service braking system, except in emergencies, because it does not provide the precise control available from the service brakes.

**WARNING**

Usage of the engine brake as the primary braking system can cause unpredictable stopping distances, that could result in personal injury or property damage. Service brakes are the primary vehicle braking system.

There are two switches that control the engine brake.

- The steering-wheel-mounted switch (ENG BRK), located in the right-hand control pod, is used to turn the engine brake ON and OFF. See **Fig. 13.1**.
- The HI/MED/LO engine brake rocker switch on the dash, controls the amount of engine braking. See **Fig. 13.2**. An amber LED illuminates in the center of the switch when it is activated, and it is backlit in green when the panel lights are on.

The dash switch controls the amount of braking to the vehicle. It has three positions that provide approximately the following amounts of braking.

- LO: 33 percent
- Medium: 66 percent
- HI: 100 percent

When the ENG BRK switch on the steering wheel is enabled, the amount of braking applied to the vehicle is determined by the position that the level selection switch is set at—LO, Medium, or HI. After the ENG BRK switch is enabled, the level of braking can be changed by pressing the level selection switch. Pressing the ENG BRK switch a second time turns the engine brake off. The illuminated indicator on the level selection switch turns off when the engine brake is off.

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**Fig. 13.1, Steering Wheel Switches**

**Fig. 13.2, Engine Brake Level Switch**
WARNING
The engine brake must be disengaged when shifting gears, by using the clutch. If the engine brake is engaged when the transmission is in neutral, the braking power of the engine brake can stall the engine, which could result in loss of vehicle control, possibly causing personal injury and property damage.

On a cold engine, below a set engine temperature, the brake may be disabled, depending on the brake type. The engine brake may be activated after the engine is warmed up and the vehicle is in motion, using the following procedures.

- Remove your feet from both the clutch and throttle pedals. Press the steering-wheel-mounted switch to toggle the engine brake ON. See Fig. 13.1.
  The engine brake will engage at the rate last set on the dash switch (HI/MED/LO). See Fig. 13.2.
- Move the dash switch to the desired rate, HI for 100% braking capacity, MED for 66% braking capacity, or LO for 32% braking capacity.
  Use the dash-mounted switch set at the LO position when driving on flat, open stretches of road. If the service brakes are still required to slow down on a grade, switch to a higher setting on the dash switch, until there is no need for the service brakes. Grade descent speed should be such that the service brakes are used infrequently and that they remain cool, thus retaining their effectiveness.
- To obtain maximum retarding, maintain the top governed speed of the engine through the appropriate selection of gears. When shifting gears, the engine brake will disengage when the clutch pedal is depressed, then engage when the clutch pedal is released.
- To cancel the engine brake application, press the steering-wheel-mounted switch to toggle it to OFF.
- If the engine brake fails to activate, take the vehicle to an authorized Freightliner dealer for service.

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. Recommended engine braking speed is above 1800 rpm and below the rated speed.

NOTICE
Do not allow the engine to exceed 2500 rpm. Serious engine damage could result.

"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. A driver may descend slower than control speed by selecting a lower gear, being careful not to overspeed the engine. Occasional deactivation of the engine brake may be necessary to maintain the designated road speed under these conditions.

If the engine is equipped with both cruise control and an engine brake, the engine brake can operate automatically while in cruise control mode. If the cruise control/engine brake function is turned on in the DDEC VI system programming, the engine brake will come on "low" when the set road speed increases a few miles-per-hour (kilometers-per-hour) above the cruise set speed. The maximum amount of braking (low, medium, high) is selected with the dash switches. When the vehicle returns to the set cruise speed, the engine brake will turn off.

The engine brake will only operate when the accelerator pedal is fully released. Disengaging the clutch will prevent the engine brake from operating.

Vehicles equipped with antilock braking systems (ABS) have the ability to turn the engine brake off if a wheel-slip condition is detected. The engine brake will automatically turn itself back on once the wheel slip is no longer detected. The DDEC VI system will deactivate the engine brake system when the engine speed falls below 1000 rpm or when the vehicle slows down to a preset speed, depending on DDEC programming. This prevents stalling the engine.
Manual Transmissions and Hydraulic Clutch

Eaton Fuller 13-Speed and 18-Speed Splitter and Range-Shift Transmissions ........................................ 14.1
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Eaton Fuller 13-Speed and 18-Speed Splitter and Range-Shift Transmissions


General Information, Eaton Fuller Splitter and Range-Shift

Combination splitter and range-shift transmissions allow the choice of two splitter ratios in each lever position as well as the additional ratio provided in each lever position after shifting to the other range.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

13-Speed RTLO Models

Eaton Fuller 13-speed transmissions have thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus an overdrive splitter gear. See Fig. 14.1 for the shift pattern.

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 RTLO Splitter and Range-Shift Models

Eaton Fuller 18-speed transmissions have 18 forward speeds and four reverse speeds. These transmissions consisting of a 5-speed front section and a 3-speed auxiliary section. The auxiliary section contains low and high range ratios, plus an overdrive splitter gear.

One ratio in the front section (low) is used as a starting ratio; it is never used when the transmission is in high range. Low gear can be split to provide both a direct and an overdrive ratio.

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 18 speeds are controlled with one shift lever. A range preselection lever and a splitter control button are built into the shift knob. The range preselection lever controls range selection and the splitter control button (located on the side of the shift knob) controls gear splits.

Operation, Eaton Fuller Splitter and Range-Shift

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. 14.2.

3. Make sure the splitter control button is in the direct (rearward) position. See Fig. 14.2.

4. For 13-speed transmissions:

   Press 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:

   Press 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 into the overdrive (forward) position, then immediately release the accelerator. 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. 14.1.

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. 14.2). 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. 14.1) 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. 14.2) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

**Downshifting**

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button to the direct (rearward) position, then immediately release the accelerator, and disengage the clutch. Engage the clutch, and accelerate the engine only after the transmission has shifted.

2. Start the downshift from 8th direct to 7th overdrive by flipping the splitter control button to the overdrive (forward) position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.

3. Shift downward through each of the high range gears, alternating the procedures in steps 1 and 2, above, until reaching 5th direct.

4. While in 5th direct and ready for the downshift to 4th (13-speed transmissions) or 4th overdrive (18-speed transmissions), push the range preselection lever down. Then, double-clutch through neutral and move the shift lever to the 4th gear position. On 18-speed transmissions, move the splitter control button to the overdrive (forward) position **before** engaging the clutch. Do not move the control button while the shift lever is in neutral.

5. Continue downshifting from 4th to 1st as follows:

For 13-speed transmissions:

Downshift through the low range gears as conditions require.

For 18-speed transmissions:
Continue downshifting from 4th overdrive to 4th direct, then 4th direct to 3rd overdrive, 3rd overdrive to 3rd direct, etc. Single-clutch when split shifting (direct to overdrive, overdrive to direct). Double-clutch when making lever shifts (4th to 3rd, 3rd to 2nd, etc.). IMPORTANT: Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

**Eaton Fuller 10-Speed Range-Shift Transmissions**


**General Information, Eaton Fuller Range-Shift**

To operate a range-shift transmission, move the shift lever through all the low gear positions and then activate a range switch to provide an additional set of ratios in the high range. Using the same shift lever positions as in low range, move the shift lever through each position as before. On some models, the initial low gear is often used only in low range.

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

**10-Speed FR/FRO and RT/RTO/RTX Models**

Eaton Fuller 10-speed transmissions have 10 selective, evenly spaced forward ratios. Each transmission has a 5-speed front section and a 2-speed rear range section. The 10 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. 14.3 for the shift patterns.

NOTE: The 4th/9th and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

**Operation, Eaton Fuller Range-Shift**

1. When operating off-highway, or under adverse conditions, always use low gear (if so equipped) when starting to move the vehicle.

   When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle (except when equipped with a 9-speed RTO transmission, then always start in low gear).

   For all conditions, use the highest gear that is still low enough to start the vehicle moving with engine idling, and without slipping the clutch excessively.

2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

   For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Do not make range shifts with the vehicle moving in reverse gear.

4. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.

5. Do not shift from high range to low range at high vehicle speeds.
6. Double-clutch 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. Press the clutch pedal to the floor; shift into low or 1st gear (Table 14.1), 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 14.1), 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 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.

6. With the transmission in high range, shift progressively upward through each of the high range gears (Table 14.1), double-clutching between shifts.

**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.

**IMPORTANT:** Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

**Clutch**

**General Information**

The hydraulic clutch control system consists of a pedal unit and a slave cylinder, connected by a hydraulic hose and fastened with quickdisconnect clamps. The components of the system have been specially designed to use DOT 4 brake fluid. The pedal unit includes a hydraulic subassembly, composed of the master cylinder and reservoir, which can be removed from the pedal unit for service purposes. When the clutch pedal is depressed, the fluid in the master cylinder is forced through a hydraulic line to the slave cylinder. The fluid pressure moves the slave cylinder piston, pushing the plunger rod and clutch release lever, which disengages the clutch. The hydraulic system is self-adjusting.

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.

To ensure long service life of the clutch; start in the right gear, be alert to clutch malfunctions, and know when to adjust the clutch.

Clutch Operation

Clutch Break-In

With a new or newly installed 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.

Moving the Vehicle in the Proper Gear

An empty truck can be started in a higher transmission gear than can a partially or fully loaded truck. A good rule of thumb for the driver to follow is to select the gear combination that allows the vehicle 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 can be accelerated to the correct rpm for the upshift into the next higher gear.

Gear Shifting Techniques

Shift into the next higher gear when the vehicle speed allows the transmission input shaft speed to match the flywheel speed when engaging the clutch. This technique results in the smallest speed difference between the clutch disc and the flywheel and causes the least heat and wear on the clutch assembly. When downshifting, the input shaft speed must be increased by slightly revving the engine to match the flywheel speed for smooth clutch engagement. For transmission operating instructions, refer to the transmission headings in this manual.

Vehicle Loading

Clutches are designed for specific vehicle applications and loads. These weight limitations should not be exceeded.

CAUTION
Exceeding vehicle load limits can not only result in damage to the clutch, but can also damage the entire powertrain.

Using the Clutch

The clutch pedal must be used only to start the vehicle moving or while shifting. To start the vehicle moving, depress the clutch pedal all the way to the floor plate (see "Using the Clutch Brake") and shift from neutral to a low gear. Slowly raise your foot until the clutch starts to engage. In this position the clutch is starting to connect the transmission input shaft to the flywheel and is causing the most heat and wear. Slightly increase the engine speed and smoothly allow the clutch pedal to return to its at rest position. Do not allow the clutch to remain in the partially engaged position any longer than necessary to obtain a smooth start.

To shift gears while the vehicle is moving, push the clutch pedal most of the way (but not all of the way) to the floor plate. Shift the transmission into neutral and fully release the clutch pedal. If upshifting, wait long enough for the engine speed to decrease to the road speed. If downshifting, increase the engine speed to match the road speed. Again, push down the clutch pedal part way and then move the shift lever to the next gear position. Fully release the clutch pedal after completing the shift.

Slightly depressing the clutch pedal while driving is damaging to the clutch, because partial clutch engagement causes slippage and heat. Resting your foot on the clutch pedal will also put a constant thrust load on the release bearing, thinning the bearing lubricant and increasing the wear on the bearing.
Using the Clutch Brake

The clutch brake is applied by depressing the clutch pedal past the fully released clutch position, almost to the floor plate. The last part of the clutch pedal travel will compress the clutch brake plates together, stopping the transmission input shaft. The purpose of the clutch brake is to stop the transmission gears from rotating in order to quickly engage a transmission gear after idling in neutral.

**CAUTION**

Never apply the clutch brake when the vehicle is moving. If the clutch brake is applied when the vehicle is moving, the clutch brake will try to stop or decelerate the vehicle, causing rapid wear of the clutch brake friction discs. Considerable heat will be generated, causing damage to the release bearings and the transmission front bearings.

Holding the Vehicle on an Incline

Always use the vehicle service brakes to prevent the vehicle from rolling backwards while stopped on a hill. Slipping the clutch on a hill to maintain the vehicle position will quickly damage the clutch assembly.

Coasting

Coasting with the clutch pedal depressed and the transmission in a low gear can cause high driven disc speed. The clutch speed can be much higher under these conditions than when the engine is driving the clutch. This condition creates a hazardous situation due to the lack of vehicle control and due to the high clutch disc speed. Engaging the clutch under these conditions can cause component damage because of the shock loads to the clutch and drivetrain.

**WARNING**

Always shift into the gear that is correct for the traveling speed of the vehicle and engage the clutch. Coasting with the clutch disengaged can prevent engagement of the correct transmission gear which can cause loss of vehicle control, possibly resulting in personal injury or property damage.

High clutch disc speeds while coasting can also cause the clutch facing to be thrown off the disc. Flying debris from the clutch can cause injury to persons in the cab.

Clutch Maintenance

**Clutch Adjustment**

Eaton Fuller Solo clutches are adjustment-free. As the clutch wears, its wear-adjusting technology monitors clutch components and makes any necessary adjustments. The wear adjusting technology comes from two sliding cams, which rotate to maintain the proper adjustment. Atop the upper cam, a wear indicating tab mirrors the cam’s movement, letting you know when it’s time to replace the clutch.

**CAUTION**

Operating the vehicle with incorrect free pedal could result in clutch damage.

**Hydraulic Clutch Fluid Reservoir Checking**

Make sure that the clutch fluid reservoir is full. See Fig. 14.4. The reservoir is full when the fluid level is up to the “max” mark. The fluid level must always be above the “min” mark. Use only heavy-duty brake fluid, DOT 4, in the clutch hydraulic system.
Automated Transmissions

Freightliner SmartShift Shift Control .................................................. 15.1
Eaton Fuller UltraShift ................................................................. 15.1
Eaton Fuller AutoShift Automated Transmissions .................................. 15.7
Freightliner SmartShift Shift Control

General Information, SmartShift

The SmartShift transmission control is an electronic transmission control device. It is installed with the following transmissions:

- Eaton Fuller UltraShift™
- Eaton Fuller AutoShift™

It replaces the typical floor-mounted shift lever or dash-mounted push button control.

SmartShift accepts driver requests for transmission functions and transmits them through hard wiring to the transmission control unit (TCU). SmartShift is a true shift-by-wire system.

SmartShift offers two main advantages over conventional transmission control devices. Without a floor-mounted shift control, usable cab space is increased. The SmartShift control mounts to the right-hand side of the steering column and is operated by the fingers of the driver’s right hand, allowing both hands to remain on the steering wheel.

A two-position slide switch (Fig. 15.1) is mounted on the body of the control lever just before the paddle widens out. The slide switch allows the driver to choose automatic (AUTO) or manual (MAN) mode.

In AUTO mode, gears shift automatically, without driver interaction. Manual gearshifts are accomplished by a momentary pull or push on the control in the plane perpendicular to the steering wheel. Pull upward (toward you) on the control to upshift and push downward (away from you) to downshift. The control is spring-loaded and returns to mid-position when released after an upshift or downshift.

For Eaton Fuller UltraShift and AutoShift transmissions (Fig. 15.1), a four-position (R, N, D, L) selector switch is located at the end of the lever.

Embedded in the selector switch is a small neutral lock button to prevent accidental shifts into gear from neutral. Any time you shift through N, press down on the neutral lock button to move the switch from neutral (N) to another gear, such as drive (D), low (L), or reverse (R). When shifting to N, it is not necessary to press the neutral lock button.

Eaton Fuller UltraShift

General Information, UltraShift DM

Eaton® Fuller® UltraShift™ DM is a ten-speed heavy-duty fully automated transmission. No clutch pedal is required to operate the vehicle.

UltraShift DM uses a dry clutch system which is offered only on this automated transmission system.

The UltraShift transmission uses the four-position SmartShift lever on the steering column to select gears. To know what gear the transmission is in, look at the round current gear indicator on the right-hand control panel as shown in Fig. 15.2. All forward shifts can be made either manually or automatically, at the driver’s choice.

Operation, UltraShift DM

Power Up

1. With the parking brake set, select neutral (N) by moving the selector switch to the N position.
2. With the transmission in neutral, turn on the ignition switch. The CHECK TRANS and TRANS TEMP telltale lights come on and go out again (bulb check).

3. After the ignition is turned on, the current gear indicator shows the dot display, arranged in a square pattern. All dots in the pattern should light up, without gaps or spaces. See Fig. 15.3.

4. Wait for the current gear indicator to show a solid N. When the N is solid, rather than flashing, the UltraShift DM TCU is powered up. Apply the service brake and start the engine.

5. Select drive (D) by pressing in the neutral lock button and moving the selector switch downward to the position below neutral. Release the parking brake. The gear is displayed on the current gear indicator.

NOTE: When D is selected, the transmission controller starts up in second gear. If desired, the driver can select to start up in first. No other start gear is available.

6. On a level grade, release the service brake and press down on the throttle pedal to allow the vehicle to move forward. The vehicle will not move until the pedal is depressed.

7. Prevent the vehicle from rolling backwards when stopped on a hill or grade, or when the vehicle is starting from a stop on a hill or grade.

7.1 To start from a full stop on a hill or grade, quickly move your foot from the brake pedal and press firmly on the throttle pedal.

On steep hills, set the parking brake, and release it only when there is enough engine power to prevent rollback.

7.2 To stop on a hill or grade, press and hold the brake pedal to keep the vehicle from moving.

On steep hills, set the parking brake. When parking, chock the tires, front and/or rear. Never hold a hill with the throttle pedal. This will cause the clutch to overheat.

Fig. 15.2, Shift Controls and Indicators, UltraShift Transmissions

Fig. 15.3, Power-Up Dot Display

WARNING

When starting or stopping on hills and grades, use extra care to prevent the vehicle from rolling back. A rollback accident could cause death, serious personal injury, or property damage.
Power Down

1. Apply the service brakes.
2. Select neutral (N) by pressing in the neutral lock button and moving the selector switch to N. When the N on the current gear indicator is solid, rather than flashing, the UltraShift DM TCU is ready to power down.
3. With the transmission in neutral, set the parking brake.
4. Turn off the ignition key and shut down the engine.

Automatic and Manual Modes

The SmartShift control has a slide switch located on the body of the control lever just before the paddle widens out. See Fig. 15.4. The slide switch controls the forward driving mode, automatic or manual.

To change mode at any time, move the slide switch in the desired direction. This allows the driver to respond to a wide range of driving conditions, such as blind corners, tight curves, and steep hills.

IMPORTANT: Whatever the mode, it is always possible to shift manually by moving the lever up or down as needed. When the engine speed is within 75 revolutions per minute (rpm) of the load-based shift point for an automatic shift, the UltraShift DM TCU will advance the shift.

In either mode, the gear indicator displays the current gear. See Fig. 15.5.

At the start of a shift, the current gear continues to display until the transmission has been pulled into neutral. At this point, as the transmission is synchronizing for the new (target) gear, the gear indicator flashes the number of the new gear.

When the shift is complete, the new gear displays solid, without flashing.

Automatic Mode (AUTO)

In automatic drive mode (AUTO), upshifts and downshifts are made by the transmission without driver intervention. Press in the neutral lock button, move the selector switch to drive (D), and press down on the throttle pedal. The transmission will shift automatically.

If driving conditions require, it is still possible to request a manual shift. The transmission will make the shift if the engine speed is within 75 rpm of the load-based shift point for that gear.

If the driver presses down on the throttle pedal after a manual downshift in automatic mode, the transmission will upshift again if the UltraShift DM TCU requires it.
Manual Mode (MAN)
In manual drive mode (MAN), upshifts and downshifts are made by the driver:

• To shift up, pull the lever up (towards you).
• To shift down, push the lever down (away from you).

The system will hold the current gear until the driver requests a shift. In downhill situations in particular, the driver must be alert to vehicle speed by downshifting and/or using the service brakes as needed. A shift request will still be refused if the selected gear would cause engine overspeed or excessive lugging.

Selecting Gears
Reverse
Reverse (R) is at the upper end of the four-position selector switch located at the end of the SmartShift control lever. To select R, press in the neutral lock button and move the selector switch upward to the position above neutral.

UltraShift DM has two reverse gears, reverse low and reverse high. To shift manually between them, use the shift lever as described for MAN mode. There is no AUTO mode for reverse.

When reverse low is selected, the letter R displays on the current gear indicator. When reverse high is selected, the letter H displays on the current gear indicator. See Fig. 15.6.

IMPORTANT: Under normal conditions, do not select reverse with the vehicle moving forward. The vehicle must be moving at less than two miles per hour (3 km/h) before selecting reverse. If reverse is selected when the vehicle is moving faster, an audible alert will sound and continue sounding at three-second intervals until the control lever is returned to the D position or the vehicle slows to the proper speed.

If necessary to rock the vehicle, use the selector switch to shift back and forth at low speed between reverse and drive.

Neutral
IMPORTANT: Always start the engine with the transmission in neutral, the parking brake set, and the service brakes applied.

Neutral (N) is directly below R on the four-position selector switch located at the end of the SmartShift control lever. To select N, press in the neutral lock button and move the selector switch to the position below R. When neutral is selected, the letter N displays on the current gear indicator. See Fig. 15.7.

WARNING
Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Neutral is always available during operation, whatever the vehicle speed. When in neutral, requests to
upshift or downshift are ignored. If the selector switch is moved from neutral to drive while the vehicle is moving, the transmission will shift into a gear within the engine's operating speed range.

When shifting from neutral, always press on the brake pedal. If the brake pedal is not pressed, the transmission will not shift, the current gear display will flash N, and an audible alert will sound.

NOTE: To reset the transmission, return the selector switch on the SmartShift lever to N and attempt the shift again, this time with the brake pedal pressed.

Before shutting down the engine, return the selector switch to N. When the ignition is turned off, the transmission will reset to neutral in a few minutes regardless of the position of the shift lever.

Drive

Drive (D) is directly below N on the four-position selector switch located at the end of the SmartShift control lever. To select D, press in the neutral lock button and move the selector switch to the position below N. When drive is selected, the number of the currently selected forward gear (1 through 10) displays on the gear indicator. See Fig. 15.5.

When in drive, requests to upshift or downshift are enabled. Either manual or automatic mode can be selected on the slide switch.

Two starting gears are available, first and second. The default starting gear is second, but first can be selected by the driver, if desired. To change the starting gear, press the brake pedal and select D with the vehicle stopped. The current gear indicator will display the starting gear. Move the shift lever up or down until the desired starting gear is displayed.

The UltraShift DM TCU adapts to the working conditions of each vehicle and its driver. After power up or a load change, it needs to learn the new conditions. While learning, it may hold a gear too long before upshifting. Start the upshift manually. It may take three or four shifts before UltraShift succeeds in learning the new load-based shift points, but after that it will handle the shifting automatically.

Low

Low (L) is at the lower end of the four-position selector switch located at the end of the SmartShift control lever. To select L, press in the neutral lock button and move the selector switch to the position below D.

When in low, the current gear is maintained. Requests to upshift are not enabled.

IMPORTANT: If the engine is approaching overspeed, the UltraShift DM TCU will override the current gear setting and upshift to prevent engine damage.

To enhance engine braking, downshifts are performed at higher rpm than normal.

If L is selected from neutral while stopped, the vehicle starts up in first gear and stays there until the engine approaches overspeed.

Upshifting

To request an upshift with the transmission in drive, pull the control lever up (towards you). If the gear is available, the transmission upshifts and the new gear displays on the gear indicator. No skip shifts are available while upshifting.

No upshifts are available in low, except to prevent engine overspeed.

If the transmission does not upshift quickly enough after power-up or a load change, begin the shift manually. The UltraShift DM TCU will learn the new load-based shift conditions after three or four shifts.

If the gear requested is unavailable, a tone will sound. An unavailable request to upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: The driver can manually downshift at any time, even when the slide switch is set to AUTO mode.

To request a downshift with the transmission in drive or low, push the control lever down (away from you). If the gear is available, the transmission downshifts and the new gear displays on the gear indicator. Skip shifts are available while downshifting.

For best engine braking, select low while moving. In low, downshifts are performed at higher rpm than in drive.

IMPORTANT: If the engine is approaching overspeed, the UltraShift DM TCU will override the
current gear setting and upshift to prevent engine damage.

If the gear requested is unavailable, a tone will sound. An unavailable request to downshift is not stored in memory. The downshift must be requested again.

When coasting to a stop, the UltraShift DM TCU may not finish the downshift until the driver presses down on the throttle pedal again.

IMPORTANT: A downshift request can never result in a shift into neutral, even if the vehicle is in the drive position in the lowest possible gear.

Before starting down a hill, slow down. Downshift to a speed that you can control without hard pressure on the service brakes.

Before entering a curve, slow down to a safe speed. Downshift if necessary. This lets you use some power through the curve to help the vehicle be more stable on the turn. It also allows you to regain speed faster as you come out of the curve.

Ultrashift Diagnostics

Clutch Protection Fault

Excessive clutch slippage creates heat and reduces the life of the clutch. These are some conditions which lead to clutch abuse:

• Using the throttle to hold the vehicle on a grade
• Starting the vehicle in too high a gear
• Overloading the vehicle
• Using high idle with the vehicle in gear

The UltraShift DM TCU is programmed to prevent clutch abuse. When the clutch overheats, the following alerts take place:

• The TRANS TEMP light comes on
• The current gear indicator displays CA
• A warning tone sounds at one-second intervals

The alerts continue until the clutch cools, the throttle is released, or the clutch is fully engaged.

System Problem

In the event of a problem, do the following steps.

1. Note the driving conditions at the time the problem occurred.
2. Record the status of the transmission at the time of the problem (AUTO or MAN mode, gear setting R, N, D, or L, current gear, engine speed, etc.)
3. Reset the system, using the procedure below.

Reset Procedure

Transmission operation can sometimes be restored by doing the following reset procedure:

1. Stop the vehicle when it is safe to do so. Set the parking brake.
2. Place the selector switch in neutral and turn off the ignition.
3. Check all harness connectors as described in Chapter 21.
4. Wait at least two minutes with the engine shut down.
5. Restart the engine.

If the problem continues, contact an authorized Freightliner or Eaton service facility.

Locked In Gear

If the transmission becomes locked in gear, a dash (–) will appear on the current gear indicator when the vehicle is restarted during the reset procedure.

NOTE: If the transmission becomes locked in gear while the vehicle is moving, increased braking effort may be required to stop the vehicle.

If the current gear indicator displays a dash during power-up with the selector switch in neutral, do the following steps.

1. Make sure the parking brake is set.
2. Turn off the ignition and wait at least two minutes.
3. Apply the service brakes.
4. With the service brakes applied, release the parking brake.
5. Make sure the selector switch is in neutral and turn on the ignition key. Do not attempt to start the engine at this time.

6. If necessary to get the transmission to shift into neutral, release the pressure on the brake pedal slightly.

7. Once the UltraShift DM TCU reaches neutral, a solid N will appear on the current gear indicator and the vehicle will start. Make sure the service brakes are applied and the parking brake is set.

If the current gear indicator continues to display a dash, contact an authorized Freightliner or Eaton service facility.

Eaton Fuller AutoShift Automated Transmissions


General Information, AutoShift

10-Speed RT/RTO Models

Eaton Fuller 10-speed AutoShift transmissions have 10 forward speeds and two reverse speeds. The transmission consists of a 5-speed front section and a 2-speed rear section. The driver must use the clutch to start and stop the vehicle.

The driver does not need to break torque or increase or decrease engine speed to synchronize the shift. The transmission signals the engine controller when to break torque and the engine controller automatically increases or decreases engine speed. When engine speed is correct, the transmission engages the next gear and signals the engine controller to resume operation.

**WARNING**

When starting or stopping on hills and grades, use extra care to prevent the vehicle from rolling back. A rollback accident could cause death, serious personal injury, or property damage.

The AutoShift system consists of the following components:

- The SmartShift control paddle on the steering column. See Fig. 15.1.

- The gear display module (Fig. 15.8) mounted on the dashboard indicates the current gear position or transmission status. The display also flashes the next gear to be engaged while the transmission is in neutral during a gear change.

- The shifter mechanism performs shifts at the front portion of the transmission. It preselects the shift to neutral and completes the gear change after driver input.

- The Electronic Control Unit (ECU) includes two controllers: a transmission ECU and a system ECU. The transmission ECU controls all transmission shift functions and the system ECU manages all vehicle interfaces for transmission shift functions.

- An electronic range valve, controlled by the transmission ECU, is used to perform range shifts.

**Operation, AutoShift with SmartShift Automatic and Manual Modes**

A two-position slide switch (forward driving mode switch) is located near the end of the control (Fig. 15.1). The switch positions are labelled MAN (manual shift mode) and AUTO (automatic drive mode).

**NOTE:** In automatic drive mode, upshifts and downshifts require no driver interaction. Move
the selector switch to the drive (D) position, disengage the clutch to engage the gear selected, engage the clutch and drive the vehicle. In manual shift mode, upshifts and downshifts require either a pull upward or push downward on the control.

**Driver Message Center**

Gear information is presented to the driver on the dash display. In automatic drive mode, the number of the forward gear currently engaged appears continually on the message display screen when in drive (D). In manual shift mode, the current gear is displayed until a new gear is requested. When neutral (N) is engaged, “N” will appear on the message display screen. When reverse (R) is engaged, either “RL” or “RH” will appear on the message display screen.

**IMPORTANT:** The information shown on the message display screen indicates the state of the transmission only, not the state of the SmartShift control.

**Neutral Position**

Select neutral by sliding the selector switch to the “N” position.

**NOTE:** Neutral is always available during operation. When in neutral, upshift and downshift requests are ignored. If the mode selector switch is moved from neutral (N) to drive (D) while the vehicle is moving, the transmission will shift into a gear causing the engine to go to a high torque level, under the engine’s rated torque.

**WARNING**

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

**Selecting a Starting Gear**

1. In automatic mode, select drive (D) by sliding the selector switch downward to the next position below the neutral position.
2. Disengage the clutch to engage the gear selected. Engage the clutch and drive the vehicle.

**Changing the Default Starting Gear**

To select a starting gear other than the default starting gear, follow the instructions below.

1. Make sure the vehicle is stopped and in drive.
2. In either automatic or manual mode, pull upward on the control (to increase), or push downward (to decrease). Each pull upward on the control increases the starting gear by one gear, but no higher than fourth gear.
3. The number of the gear selected will flash on the message display screen until the driver engages the clutch. This gear will be stored in memory as the default starting gear until either a different starting gear is selected by the driver or the engine is shut down.

**NOTE:** The transmission may also be programmed so that it is not possible to select a starting gear other than the preprogrammed default starting gear.

**Upshifting**

**NOTE:** With the transmission in drive (D) in the automatic mode, upshifts require no driver interaction.

1. With the transmission in drive in the manual mode, request an upshift by pulling upward on the control. If the requested gear is available, the transmission will upshift.

**NOTE:** A single, momentary pull upward on the control selects the next higher gear when it is available. Two consecutive, momentary upward pulls will cause a skip shift when the next two higher gears are available and conditions are right.

2. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

**NOTE:** The Eaton Fuller AutoShift 18-speed transmission is able to perform triple upshifts when the next three higher gears are available and conditions are right. To triple-shift this transmission, move the control three times in less than 1/2 second.
Automated Transmissions

If a requested gear is not available, an audible warning will sound and the gear display module will indicate that the gear is not available. An unavailable requested upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: With the transmission in drive (D) in the automatic mode, downshifts require no driver interaction.
1. With the transmission in drive in the manual mode, request a downshift by pushing downward on the control. If the requested gear is available, the transmission will downshift.

NOTE: A single, momentary push downward on the control selects the next lower gear when it is available. Two consecutive, momentary downward pushes will cause a skip shift, when the next two lower gears are available and conditions are right.
2. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

NOTE: The Eaton Fuller AutoShift 18-speed transmission is able to perform triple downshifts when the next three lower gears are available and conditions are right. To triple shift this transmission, move the control three times in less than 1/2 second.

If a requested gear is not available, an audible warning will sound and the gear display module will indicate that the requested gear is not available. Unlike upshifting, an unavailable requested downshift is stored in memory and the shift will be made when the gear is available. The time limit for this memory is a programmable parameter.

Start-Up

1. With the parking brake applied, press the clutch all the way down to the floor.
2. Start the engine.
3. Check to make sure the transmission is in neutral.
4. With the transmission in neutral, release the clutch.

NOTE: This allows the speed sensor on the input shaft to get a reading.
5. Press down on the clutch again and release the parking brake.
6. Select the desired starting gear.
7. Release the clutch.

Reverse

1. To engage reverse (R), slide the selector switch upward to the next position above the neutral position and disengage the clutch.

NOTE: AutoShift 10- and 18-speed transmissions have a dual-range reverse. Reverse low (RL) is the default reverse gear.
2. Select reverse high (RH) by pulling upward on the control.

NOTE: Reverse may be engaged below a programmable forward speed in order to rock the vehicle. If reverse is selected above the programmed forward speed, an audible warning will sound and a message indicating that the gear is not available will appear on the message display screen.

Low Gear Operation

Use low (L) when descending steep hills and using compression braking. Engine speed will be increased by 200 rpm and shift points will be offset by 200 rpm. The efficiency of the exhaust brake will be maximized.

Using the Clutch

Use the clutch to start and stop the vehicle.
Drive Axles

Drive Axles with Differential Lock .................................................... 16.1
Two-Speed Drive Axles .............................................................. 16.2
Drive Axles with Differential Lock

Drive Axles with Main Differential Lock

The main differential lock is a driver-controlled traction device operated from the vehicle cab. A dash switch controls the side to side lock-up of the rear axle, supplying equal traction to both sides. On tandem axles there are three possible differential lock options:

- Forward-rear carrier only
- Rear-rear carrier only
- Both rear carriers.

An indicator light 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.

Main Differential Lock Operation

To lock the main differential and obtain maximum traction under slippery conditions, move the control switch to the lock position.

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. 16.1. Drive cautiously and do not exceed 25 mph (40 km/h).

![Fig. 16.1, Turning Radius](image)

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.

When the differential lock disengages, the indicator light will go off and the buzzer will stop.

Tandem Drive Axles with Interaxle Differential

Tandem drive axles with an interaxle differential have a lockout feature. Differential lockout is controlled by a switch (Fig. 16.2) on the control 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.

Interaxle Differential Lockout Operation

To lock the interaxle differential and achieve maximum pulling power when approaching slippery or poor road conditions, move the lockout control valve to LOCK while maintaining vehicle speed, before encountering the poor road conditions. Let up momentarily on the accelerator to engage the differential lock. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before locking the interaxle differential.

CAUTION

Do not actuate the interaxle differential control valve while the tires are slipping. Do not operate the vehicle continuously with the interaxle differential locked during extended good road conditions. To do so could result in damage to the axle gearing and excessive tire wear.

To unlock the interaxle differential, move the lockout control valve to UNLOCK while maintaining vehicle speed, after leaving the poor road conditions. Let up momentarily on the accelerator to allow the shift, then resume driving at normal speed.

Single Drive Axles with Traction Equalizer

Some single drive axles are equipped with a traction equalizer that 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 is corrected by adding a friction modifier to the axle lubricant. This additive tends to reduce the static coefficient of friction to a value equal to, or lower than, the sliding coefficient.

See Group 35 of the Cascadia™ 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.

Two-Speed Drive Axles

Axle Shift

CAUTION

To prevent transmission and axle damage, make sure the automatic transmission is in high range when performing an axle shift with the vehicle moving.

Axle shift is a function installed on vehicles with two-speed axles to allow the use of the low speed range when greater traction and maximum pulling power is needed at low engine speed (rpm).

Under normal operating conditions, the vehicle is operated using the high-speed gear ratios of the axle. Under extreme weather or off-road conditions, at low speed and rpm and/or to pull heavy loads, the vehicle must be operated using the low-speed, or reduction, gear ratios of the axle.
Axle Shift Switch

The axle shift switch is a two-position rocker switch (Fig. 16.3) installed on vehicles with two-speed axles.

To shift the axle from low speed to high speed, press the top of the switch. To turn the axle shift off (switch from high speed back to low speed), press the bottom of the switch. When the axle has shifted speed, the LED turns off.

When the panel lights are on, the AXLE SHIFT legend is backlit in green.

IMPORTANT: If the LED in the switch begins to blink during normal operation, when the switch has not been activated, this indicates an error condition. Bring the vehicle to an authorized Freightliner service facility as soon as possible.

When the axle shift switch is pressed, three responses are possible: a normal response, a slow response, and an abnormal response.

Normal Response: The LED in the switch blinks until the axle shifts speed. At this point, the LED comes on steady and stays illuminated. In normal operation, the axle may shift so quickly that the blinking of the switch is barely noticeable.

If operation of the switch is not possible for any reason (interaxle lock is on, ignition is turned off, etc.), the LED will stop blinking and turn off.

Slow Response: If operation of the switch is slowed for any reason (by cold weather, low air pressure, etc.), the switch will continue to blink until the axle shifts. As in the normal response, the LED comes on steady and stays illuminated.

Abnormal Response: If the LED blinks for more than 30 seconds, the axle shift function/mechanism may not be operating correctly. Bring the vehicle to an authorized Freightliner service facility for testing.

Axle Switch Interlock

NOTE: On vehicles with tandem drive axles, there is an interlock that prevents an axle from shifting speed whenever the interaxle lock is on.

If the axle shift switch is pressed when the interaxle lock is on, the axle shift will not be completed. The LED does the following:

- If the LED is off, the LED comes on briefly and turns off again.
- If the LED is on, it stays on.

To complete the axle shift, turn off the interaxle lock and press the axle shift switch again. If still needed, the interaxle lock can then be reactivated.
Steering System

Power Steering System General Information ........................................ 17.1
Power Steering Systems ................................................................. 17.1
Power 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 centered, ±10 degrees, as shown in Fig. 17.1. See Group 46 of the Cascadia™ Workshop Manual for steering adjustment procedures.

CAUTION

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

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.

Power Steering Systems

Steering Gear System

The steering gear system includes the power steering gear, 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, or a right-hand slave gear (such as the TRW RCH-45). 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.

Rack and Pinion Steering System

The rack and pinion steering gear is mounted to the front axle with two brackets, and connected by tie-rod ends to the axle steering arms. When the steering wheel is turned, the intermediate steering shaft turns the input shaft, rotating the torsion bar and the valve. When the valve turns, power steering fluid is redirected and provides power assist to turn the pinion gear meshed with the rack teeth, moving the rack left or right. The rack, with a tie-rod at each end, then moves the steering arms on the axle, and pivots the wheels.

This design provides drivers with more responsive steering, with increased performance and “road feel.” It virtually eliminates steering issues when the driver hits a bump (bumpsteer), and significantly reduces roll steer when a vehicle goes into a curve. Wandering is significantly reduced as well, so the vehicle tends to drive straight on the highway. It has a lower steering ratio, which means drivers don’t have to turn the steering wheel as much to get the wheels to turn a given distance. Overall, rack and pinion steering greatly improves steering response, and reduces driver effort and fatigue.
Fifth Wheels

Fifth Wheels, General Information ................................................... 18.1
Fifth Wheel Coupling ............................................................... 18.1
Fifth Wheel Uncoupling ............................................................ 18.4
Fifth Wheel Slide .................................................................. 18.7
Fifth Wheels, General Information

⚠️ WARNING

Do not use any fifth wheel that fails to operate properly. Doing so may cause loss of vehicle control, possibly resulting in severe personal injury or death.

Air-Suspension Dump Valve

The air-suspension dump valve may be used to adjust the tractor height to aid with coupling to or uncoupling from a trailer. See Fig. 18.1. When the switch is set to LOWER, the air-suspension dump valve deflates the air springs to lower the rear of the vehicle. In the AUTO position, the automatic ride-control valves operate for normal driving.

⚠️ WARNING

Never exhaust air from the suspension while driving. The suspension will not absorb road shocks, possibly damaging components, and vehicle handling may be compromised. This could result in loss of vehicle control, possibly resulting in severe personal injury or death.

NOTICE

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from inflating.

Fifth Wheel Lubrication

⚠️ WARNING

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

The standard 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 a low-lube fifth wheel plate, inspect the condition of the low-lube pads. There should be no damaged or missing pieces. Slight puckering at the outside edges is normal.

For lubrication instructions, see Group 31 of the Cascadia® Maintenance Manual.

Fifth Wheel Coupling

Fifth wheel coupling is activated with the lock control handle located on either the right side or left side of the fifth wheel. Coupling has successfully occurred when the kingpin has been forced into the jaws and the lock control handle has moved to the locked position.

NOTICE

Some fifth wheels may be mounted on sliding rails. Before attempting to couple a trailer to a sliding fifth wheel, the slide feature must be locked to prevent the top plate from sliding rapidly forward or rearward, causing damage to the fifth wheel or kingpin.

Fontaine and Holland Fifth Wheels Coupling

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. Ensure the fifth wheel jaw is fully open and the operating rod is in the unlocked position. See Fig. 18.2 or Fig. 18.3.
3. Make sure the fifth wheel top plate is tilted so the ramps are as low as possible.
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.

**NOTICE**

Attempting to couple at the wrong height may cause improper coupling, which could result in damage to the fifth wheel or kingpin.

Adjust the trailer height if required.

For a standard fifth wheel plate, the trailer should contact the fifth wheel approximately 4 to 8 inches (10 to 20 cm) behind the fifth wheel pivot. See Fig. 18.4.

For a low-lube fifth wheel plate, the fifth wheel must slide freely under the trailer, and the trailer should contact the fifth wheel at the pivot. See Fig. 18.5.

With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer. After sliding under the trailer, STOP to prevent from hitting the kingpin too hard, then resume backing slowly until the fifth wheel locks.

On a standard fifth wheel, the fifth wheel must lift the trailer.

On a low-lube fifth wheel, do not lift the trailer as this may damage the fifth wheel plate.
7. Apply the tractor parking brakes.

**WARNING**

A visual inspection is required by law. Some improper couplings can pass a pull test. Sound is not reliable. Get out of the cab and look. Incorrect coupling could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

8. Perform a coupling inspection, checking that there is no gap between the bottom of the trailer and the fifth wheel, and that the kingpin is securely locked. See Fig. 18.6

When lockup has occurred, the fifth wheel control handle moves to the locked position. Make sure that the safety latch is down over the lock control handle to hold the control handle in the locked position. (The safety latch will only rotate down if the operating rod is fully retracted in the locked position.) See Fig. 18.2 for Fontaine fifth wheels. See Fig. 18.3 for Holland fifth wheels.

9. Release the tractor parking brakes. Test for kingpin lockup slowly inching the tractor forward, pulling on the trailer against the chocks.

10. 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.

**NOTICE**

Always make sure the connection hanger keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

11. Charge the air brake system with air, checking that the air connections do not leak.

**WARNING**

Incorrect fifth wheel lock adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

12. 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. If slack is present, uncouple the trailer and have the fifth wheel inspected and adjusted by a certified technician.

**Jost Fifth Wheel Coupling**

1. Tilt the ramp down.
2. Open the kingpin locks. See Fig. 18.7.
3. Back the vehicle close to the trailer, centering the kingpin on the fifth wheel.
4. Chock the trailer wheels.
5. Connect the air lines and electrical cable.
6. Ensure that the red trailer air supply valve (trailer brake) is pulled out, and that the trailer parking

---

**Fig. 18.5, Trailer Connection Point, Low-Lube Fifth Wheel**

- A. Adjust trailer height
- B. Ramps tilted down

**Fig. 18.6, Coupling Inspection**

- A. No gap between trailer and fifth wheel
- B. Kingpin inside lock

**Fig. 18.7, Jost Fifth Wheel Coupling**

- A. No gap between trailer and fifth wheel
- B. Kingpin inside lock
brakes are set. See Chapter 5 in this manual for operation of the dash-mounted brake controls.

**NOTICE**

Attempting to couple at the wrong height may cause improper coupling, which could result in damage to the fifth wheel or kingpin.

7. Adjust the trailer height (if required).

For a standard fifth wheel plate, the trailer should contact the fifth wheel approximately 4 to 8 inches (10 to 20 cm) behind the pivot. See Fig. 18.4.

For a low-lube fifth wheel plate, the fifth wheel must slide freely under the trailer, and the trailer should contact the fifth wheel at the pivot. See Fig. 18.5.

8. Back the tractor under the trailer.

On a standard fifth wheel, the fifth wheel must lift the trailer.

On a low-lube fifth wheel, do not lift the trailer as this may damage the fifth wheel plate.

9. After sliding under the trailer, STOP to prevent from hitting the kingpin too hard, then resume backing slowly until the fifth wheel locks.

**WARNING**

A visual inspection is required by law. Some improper couplings can pass a pull test. Sound is not reliable. Get out of the cab and look. Incorrect coupling could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

10. Apply the tractor parking brake, then perform a physical check for positive kingpin lockup, and that there is no gap between the trailer and the fifth wheel. See Fig. 18.6.

11. Ensure that the release handle is in the locked position adjacent to the casting. See Fig. 18.8.

12. Release the tractor parking brakes and test for kingpin lockup by slowly moving the tractor forward, pulling on the trailer against the chocks.

**Fifth Wheel Uncoupling**

**Manual Uncoupling**

1. Apply the tractor and trailer parking brakes.

2. Chock the trailer rear wheels.

3. Lower the trailer landing gear until the weight is removed from the fifth wheel.

4. 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.

5. Verify that both the yellow parking-brake and red trailer-air-supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.

6. Release the kingpin locking mechanism following the instructions for each manufacturer below.

6.1 Fontaine: Lift the safety latch and pull the lock control handle to the unlocked position. See Fig. 18.2.

6.2 Holland: In the locked position the safety indicator swings freely over the operating rod. See Fig. 18.9, View A.

To unlock the mechanism, manually rotate the safety indicator toward the rear of the fifth wheel. See Fig. 18.9, View B.

Pull the operating rod out. When the upper operating rod shoulder is outside the slot, raise the handle and place the shoulder of the upper rod against the plate casting, above the slot. See Fig. 18.9, View C.
The fifth wheel is now in the lockset position and is ready for uncoupling. As the tractor pulls away from the trailer the kingpin forces the jaw to rotate, contacting the lock. Continued rotation of the jaw forces the lock to move outward, and drops the upper rod back into the slot. See Fig. 18.9 View D. The wheel is now ready for coupling.

6.3 **Jost:** Pull the retractable handle out, then secure it in the open position with the catch. See Fig. 18.7.

7. Release the tractor parking brake then drive out slowly, allowing the trailer to slide down the fifth wheel and pick-up ramps.

**Air-Actuated Uncoupling**

An air-actuated kingpin release valve is optional with all fifth wheels. See Fig. 18.10.

NOTE: In the event of an air system failure, air-actuated kingpins can be manually released following the instructions for manual unlocking.

---

**WARNING**

Once the kingpin release valve has been pulled the kingpin lock is released. The vehicle MUST NOT be driven with the trailer until the trailer has been uncoupled and coupled again. Failure to do so may result in separation of the trailer from the tractor, possibly causing serious personal injury or death.

**Preparing the Trailer for Uncoupling**

Before using the air valve to unlock a fifth wheel kingpin, prepare the trailer as follows.

1. Apply the tractor and trailer parking brakes.
2. Chock the trailer rear wheels.
3. Lower the trailer landing gear until the weight is removed from the fifth wheel.
4. Disconnect the tractor-to-trailer air lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.

**Fontaine and Holland Fifth Wheels Air-Activated Kingpin Unlock**

1. Verify that both the yellow parking-brake and red trailer-air supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.

NOTE: On Fontaine and Holland fifth wheels, if the tractor parking brake is not set, the air-actuated kingpin-release valve will not activate.
2. Pull and hold the kingpin release valve (Fig. 18.10) until the kingpin lock mechanism opens and locks in place.

3. Release the pull valve.

4. Release the tractor parking brake.

5. Drive out from under the trailer.

**Jost Fifth Wheels Air-Activated Kingpin Unlock**

1. Verify that both the yellow parking-brake and red trailer-air-supply knobs are out, the tractor and trailer parking brakes are set, and that the trailer is prepared for uncoupling.
Fifth Wheels

WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

On sliding fifth wheel assemblies, the fifth-wheel plate is attached to rails that allow forward and rearward movement of the fifth wheel to optimally distribute the load across the axles. Slots are evenly spaced along the slide rails, and retractable wedges are positioned through the slots to hold the fifth wheel in the desired position.

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.

Manual Slide Operation

The manual slide feature is operated from the fifth wheel plate with a manual release handle using the following procedure. See Fig. 18.11.

1. Stop the tractor and trailer in a straight line on level ground. Pull the red trailer air supply knob to apply the trailer parking brakes.

2. Apply the tractor parking brake, then release the sliding mechanism using the appropriate method for the fifth wheel manufacturer.

2.1 Fontaine: Lift the slide release pull handle to disengage it from the guide plate. Then, pull out the handle until it is in the unlocked position and can be positioned against the guide plate to hold it out. The
handle will stay in the unlocked position until it is manually disengaged from the guide plate. See Fig. 18.12.

2.2 **Holland**: Pull the operating rod out. Make sure both side plungers have released. See Fig. 18.13.

5. Release the tractor parking brakes, then slowly move the tractor forward or backward until the fifth wheel is in the desired location.

---

**NOTICE**

When 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.

---

**WARNING**

Check that the locking wedges have seated in the slots. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

6. Apply the tractor parking brakes, then lock the sliding member in position using one of the following methods:

6.1 **Fontaine**: Disengage the slide release pull handle from the guide plate. The slide release pull handle is spring-loaded in the locked position and will seek the locked position when disengaged from the guide plate. After the slide release pull handle returns to the fully locked position, visually and physically check the locking wedges to make sure they are fully inserted into the slots in the slide rails. Make sure the handle is locked in position against the guide plate.

6.2 **Holland**: Raise the operating rod so that it is free to move inward. Make sure that the lock pins have seated in the base plate rail holes and the operating rod moves into the locked position.

NOTE: The fifth wheel may need to be moved slightly to enable the locking wedges to enter the fully locked position.
Air Slide Operation

The slide feature may be operated with an air switch mounted in the dash, that operates an air cylinder that locks and unlocks the slide. See Fig. 18.14.

1. Set the air-slide switch (Fig. 18.14) to UNLOCK. Ensure the locking plungers have released. See Fig. 18.15.

For Jost fifth wheels, the mechanism activates as shown in Fig. 18.16.

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

3. Pull the red trailer-air-supply knob to set the trailer-parking brakes.

4. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.

**NOTICE**

Ensure the trailer landing gear does not come in contact with the tractor frame or other components, and that the front of the trailer will not come in contact with the rear of the cab or other components if they extend beyond the rear of the cab.

5. Apply the tractor parking brakes.

**WARNING**

Check that the locking wedges have seated in the slots. Failure to achieve complete lockup may
allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

6. Set the air-slide switch to LOCK. Visually inspect the locking wedges or plungers to make sure that they are fully inserted in the slide rail slots. Verify that the plungers have engaged by tugging the tractor forward while the trailer brakes are locked and the wheels are chocked.

NOTE: The fifth wheel may need to be moved slightly to enable the locking wedges to fully lock.
Trailer Couplings

Air-Suspension Dump Valve ................................................................. 19.1
Holland Trailer Coupling ................................................................. 19.1
Air-Suspension Dump Valve

The air-suspension height switch may be used to aid in connecting or disconnecting from a trailer. When the switch is set to LOWER, the air-suspension dump valve deflates the air springs to lower the rear of the vehicle. In the AUTO position, the automatic ride-control valves operate for normal driving.

**NOTICE**

Do not operate the vehicle over uneven ground such as ramps, speed bumps, curbs, etc. with the air springs deflated. Doing this may lead to air bag separation from the piston, preventing the suspension air springs from reinflating.

**NOTICE**

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

Holland Trailer Coupling

General Information

The Holland PH-T-60-AL trailer coupling is designed for use with trailers having a maximum gross weight of 10,000 lb. See Fig. 19.1. It is a rigid-type pintle hook, used only on tractor 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.
5. Close the latch, then insert the cotter pin.
6. Hook up the trailer electrical and air lines.
7. Remove the chocks from the trailer’s tires.

**Trailer Release**

1. Apply the tractor 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.

Fig. 19.1, Holland PH-T-60-AL Trailer Coupling
20

Pre- and Post-Trip Checklists

Daily Pretrip Checklist ............................................................ 20.1
Weekly Post-Trip Checklist ......................................................... 20.3
Monthly Post-Trip Checklist ....................................................... 20.3
Daily Pretrip Checklist

Regulations in both Canada and the United States clearly indicate that it is the driver’s responsibility to perform an inspection, and ensure the complete road-worthiness of a vehicle, before placing it into service for the day. Commercial vehicles may be subject to inspection by authorized inspectors, and an unsafe vehicle can be put "out of service" until the driver or owner repairs it.

IMPORTANT: The pre- and post-trip checklists, and inspections and maintenance procedures detailed in this chapter, are not all-inclusive. Also refer to other component and body manufacturers’ instructions for specific inspection and maintenance instructions.

Careful inspections save time by eliminating stops later to adjust items overlooked or forgotten. Use the inspection checklists to ensure that vehicle components are in good working condition before each trip. A driver that is familiar with the vehicle, and drives it regularly, can perform the daily inspections, then add the weekly and monthly post-trip inspections as scheduled. If the driver does not operate the vehicle on a consistent basis, all three of the inspection procedures should be performed before the trip.

The checklists in this chapter can be copied and the first column marked with a check mark to indicate the procedure has been performed. The checklist can then be kept as a record that the procedures have been completed. For details on how to perform each procedure, see the procedure reference number in Chapter 22 of this manual.

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the Cascadia™ Workshop Manual for procedures and specifications. See the Cascadia™ Maintenance Manual for lubricant recommendations, specifications, and maintenance intervals.

See Table 20.1 for a list of procedures that should be performed daily, before the first trip.

IMPORTANT: Before performing any of these checks, apply the parking brake and chock the tires.
<table>
<thead>
<tr>
<th>Procedure Performed (check off)</th>
<th>Daily Pretrip Inspections/Checks</th>
<th>Procedure Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>Manually drain air reservoirs (if not equipped with automatic drain valves)</td>
<td>D1</td>
</tr>
<tr>
<td>Check</td>
<td>windshield washer reservoir fluid</td>
<td>D2</td>
</tr>
<tr>
<td>Inspect</td>
<td>wheel seal and hub cap (for leakage)</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>surge tank coolant level</td>
<td>D3</td>
</tr>
<tr>
<td>Inspect</td>
<td>radiator and charge air cooler</td>
<td>D4</td>
</tr>
<tr>
<td>Check</td>
<td>engine for fuel, oil, or coolant leaks</td>
<td>—</td>
</tr>
<tr>
<td>Inspect</td>
<td>engine and chassis wiring</td>
<td>D5</td>
</tr>
<tr>
<td>Inspect</td>
<td>air intake system</td>
<td>D6</td>
</tr>
<tr>
<td>Check</td>
<td>engine oil level</td>
<td>D7</td>
</tr>
<tr>
<td>Check</td>
<td>power steering fluid level</td>
<td>D7</td>
</tr>
<tr>
<td>Inspect</td>
<td>fuel tank(s), fuel lines, and connections</td>
<td>D8</td>
</tr>
<tr>
<td>Check</td>
<td>fuel level</td>
<td>D9</td>
</tr>
<tr>
<td>Check</td>
<td>fuel/water separator</td>
<td>D10</td>
</tr>
<tr>
<td>Inspect</td>
<td>front and rear suspension components</td>
<td>D11</td>
</tr>
<tr>
<td>Inspect</td>
<td>headlights, mirrors, window glass, and windshield wipers</td>
<td>D12</td>
</tr>
<tr>
<td>Check</td>
<td>doors (open without difficulty and close securely)</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Adjust driver’s seat, then align rearview and downview mirrors</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>dash-mounted intake-air restriction indicator</td>
<td>D6</td>
</tr>
<tr>
<td>Check</td>
<td>oil- and air-pressure warning systems</td>
<td>D13</td>
</tr>
<tr>
<td>Check</td>
<td>ICU fault codes</td>
<td>D14</td>
</tr>
<tr>
<td>Check</td>
<td>horn, windshield wipers, and windshield washer</td>
<td>D15</td>
</tr>
<tr>
<td>Check</td>
<td>heater, defroster, and optional mirror heat controls</td>
<td>D16</td>
</tr>
<tr>
<td>Check</td>
<td>backup alarm</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>panel lights and interior lights</td>
<td>D17</td>
</tr>
<tr>
<td>Check</td>
<td>exterior lights and reflectors</td>
<td>D18</td>
</tr>
<tr>
<td>Check</td>
<td>tire pressure</td>
<td>D19</td>
</tr>
<tr>
<td>Inspect</td>
<td>tire condition</td>
<td>D20</td>
</tr>
<tr>
<td>Inspect</td>
<td>wheels</td>
<td>D21</td>
</tr>
<tr>
<td>Check</td>
<td>transmission fluid level</td>
<td>—</td>
</tr>
<tr>
<td>Inspect</td>
<td>air brake chambers and pushrods</td>
<td>D22</td>
</tr>
<tr>
<td>Inspect</td>
<td>air brake lines</td>
<td>D23</td>
</tr>
<tr>
<td>Inspect</td>
<td>slack adjusters</td>
<td>D24</td>
</tr>
<tr>
<td>Check</td>
<td>air brake system operation</td>
<td>D25</td>
</tr>
<tr>
<td>Inspect</td>
<td>frame rails (for missing bolts), and crossmembers (damaged or loose)</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>mud flaps not damaged, and brackets are secure</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>exhaust system (mounted securely and connected tightly, no signs of leaks such as soot trails)</td>
<td>—</td>
</tr>
<tr>
<td>_______</td>
<td>Remove chocks and test service brakes</td>
<td>D26</td>
</tr>
</tbody>
</table>

Inspector ___________________________ Date ________________

Table 20.1, Daily Pretrip Inspection and Maintenance Checklist
Weekly Post-Trip Checklist

See Table 20.2 for a list of procedures that should be performed weekly, post-trip.

<table>
<thead>
<tr>
<th>Procedure Performed (check off)</th>
<th>Weekly Post-Trip Inspections/Checks</th>
<th>Procedure Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>_______</td>
<td>Manually drain air reservoirs that are equipped with automatic drain valves</td>
<td>—</td>
</tr>
<tr>
<td>Inspect</td>
<td>batteries and battery cables</td>
<td>W1</td>
</tr>
<tr>
<td>Check</td>
<td>wheel bearing lubricant level</td>
<td>W2</td>
</tr>
<tr>
<td>Inspect</td>
<td>steering components</td>
<td>W3</td>
</tr>
<tr>
<td>Check</td>
<td>intake-air restriction indicator</td>
<td>W4</td>
</tr>
<tr>
<td>Inspect</td>
<td>serpentine drive belt condition</td>
<td>W5</td>
</tr>
<tr>
<td>Check</td>
<td>V-belt tension</td>
<td>W6</td>
</tr>
<tr>
<td>Inspect</td>
<td>seat belts and tether belts</td>
<td>W7</td>
</tr>
</tbody>
</table>

Inspector _________________________________ Date ____________________

Table 20.2, Weekly Post-Trip Inspection and Maintenance Checklist

Monthly Post-Trip Checklist

See Table 20.3 for a list of procedures that should be performed monthly, post-trip.

<table>
<thead>
<tr>
<th>Procedure Performed (check off)</th>
<th>Monthly Post-Trip Inspections/Checks</th>
<th>Procedure Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inspect</td>
<td>batteries</td>
<td>M1</td>
</tr>
<tr>
<td>Inspect</td>
<td>radiator hoses and heater hoses</td>
<td>M2</td>
</tr>
<tr>
<td>Check</td>
<td>fluid level in the hydraulic clutch reservoir (if applicable, and if necessary, fill with DOT 4 brake fluid)</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>steering wheel play</td>
<td>M3</td>
</tr>
<tr>
<td>Check</td>
<td>outer surfaces of the hood and body (for visible surface breaks and damage)</td>
<td>—</td>
</tr>
<tr>
<td>Check</td>
<td>hood tilt damper (is attached at both ends)</td>
<td>—</td>
</tr>
<tr>
<td>Inspect</td>
<td>brake lining wear</td>
<td>M4</td>
</tr>
<tr>
<td>Check</td>
<td>driveshaft lubrication, mounting (not bent or cracked)</td>
<td>—</td>
</tr>
</tbody>
</table>

Inspector _________________________________ Date ____________________

Table 20.3, Monthly Post-Trip Inspection and Maintenance Checklist
Pre- and Post-Trip Inspections and Maintenance

Daily Pretrip Inspection and Maintenance ............................................. 21.1
Weekly Post-Trip Inspection and Maintenance ....................................... 21.11
Monthly Post-Trip Inspection and Maintenance .................................... 21.13
Daily Pretrip Inspection and Maintenance

Whenever equipment requires adjustment, replacement, and/or repair, see the Cascadia™ Workshop Manual for procedures and specifications. Specific references to the manual will be found where appropriate.

1. Drain the brake system air reservoirs.

   Water and oil normally enter the air reservoir in the form of vapor because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows:

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

   ![Fig. 21.1, Windshield Washer Reservoir](image)

   **WARNING**

   When draining the air reservoir, do not look into the air jets or direct them toward anyone. Dirt or sludge particles may be in the airstream and could cause injury.

   1.2 Exhaust the remaining air and moisture from the system by opening the drain cocks on the bottoms of the remaining air reservoirs. Block the valves open.

   1.3 Water and oil emulsion often form pockets that will not drain while compressed air is in the reservoirs. Because of these pockets, leave the valves blocked open during the first part of the pretrip inspection.

   1.4 If the drained water is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.

2. Check the fluid level in the windshield washer reservoir, usually located under the hood by the right-hand frame rail.

   Unscrew the cap to add fluid as needed. See Fig. 21.1.

   ![Washer Fluid Filler Cap](image)

   **WARNING**

   Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

3. While the surge tank is cool, check the coolant level.

   In hot operation, the upper chamber will be completely full, and there will be some coolant in the bottom chamber. When the tank has cooled, there will be no coolant in the bottom chamber, and an air gap in the upper chamber.

   If the coolant is low, fill the surge tank to the MAX line, with a 50/50 mixture of water and the type of antifreeze currently installed in your vehicle. See Chapter 25 in this manual for approved coolants. See Fig. 21.2.

   **NOTICE**

   Coolant must be filled to the full line of the surge tank. Low coolant could result in engine overheating, which could cause engine damage.

   IMPORTANT: The surge tank must be cool to check the coolant level.
4. Inspect the radiator and charge air cooler.
   4.1 Inspect the radiator and charge air cooler for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.
   4.2 Inspect the radiator and charge air cooler for damage and accumulated debris. Straighten bent or damaged fins to permit airflow across all areas of the cores.

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

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

   4.4 Check the radiator for leaks. If leaks are found, have the radiator repaired or replaced. See Group 20 of the Cascadia™ Workshop Manual for instructions, or take the vehicle to an authorized Freightliner dealer.

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

6. Inspect the air intake system for leaks or damage.

   NOTICE

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

   6.1 Check the intake-air restriction indicator at the air cleaner or in the cab if the vehicle is equipped with a dash-mounted restriction gauge. Push the reset button on the indicator.

   6.2 Check the engine air intake piping from the air cleaner to the engine intake. Inspect the piping for loose connections, cracks, torn or collapsed hoses, punctures, and other damage. Tighten loose connections, and have damaged components replaced. Make sure the piping system is airtight so that all intake air passes through the air cleaner.

   6.3 Check the vacuator valve for damage, and make sure the lips of the valve are pliable, free of debris, and stay shut.

7. Check the engine oil level and the power steering reservoir level.

   7.1 Check the oil level with the vehicle parked on a level surface, and turned off for at least 20 minutes, for most engines. For the DD15 engine, the engine must be shutdown for 60 minutes and on a level surface for an accurate oil level reading. Otherwise the engine must be brought up to an operating temperature of 176°F (80°C), shutdown, and allowed to sit for 5 minutes on a level surface. Failure to allow the oil to drain back properly as just described, can result in a low oil level reading.

   If the engine oil level is at or below the minimum fill (or "add") mark on the dipstick, add enough oil to maintain the level between the minimum fill (or "add") and...
Pre- and Post-Trip Inspections and Maintenance

the maximum fill (or “full”) marks on the dipstick. Use the proper SAE viscosity rating for the temperature and time of year. See the engine operation manual for recommended lubricants.

---

**NOTICE**

Operating the engine with the oil level below the minimum fill (or “add”) mark or above the maximum fill (or “full”) mark could result in engine damage.

**IMPORTANT:** Vehicles domiciled in the USA or Canada, with engines built after December 31, 2006 have EPA07- or EPA10-compliant engines that require engine lube oil with a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil. Failure to use low CJ-4 oil may void the warranty on emission aftertreatment components.

7.2 The power steering fluid level should be between the MIN COLD mark and the middle mark just above it. See Fig. 21.3. Add power steering fluid, TES 389, as necessary.

---

8. Inspect the fuel tanks, fuel lines, and connections for leaks.

8.1 Check that the fuel tanks are secured to their mounting brackets and that the mounting brackets are secured to the frame.

8.2 Replace leaking fuel tanks.

8.3 If lines or connections are leaking, have them repaired or replaced.

For repair and/or replacement procedures, see Group 47 of the Cascadia™ Workshop Manual, or take the vehicle to an authorized Freightliner dealer.

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

---

**WARNING**

Never operate the engine with the fuel tank 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.

9. Check the fuel level in the fuel tank(s).

To keep condensation to a minimum, fuel tanks should be filled at the end of each day. Federal regulations prohibit filling a fuel tank to more than 95 percent of its liquid capacity.

---

**WARNING**

Never fill fuel tanks to more than 95 percent of their liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, possibly resulting in serious personal injury or death. Do not fill the fuel tanks in the presence of sparks, open flames, or intense heat. These could ignite the fuel, possibly causing severe burns.

**IMPORTANT:** Vehicles domiciled in the USA or Canada, with engines built after December 31, 2006 have EPA07- or EPA10-compliant engines that require ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less, based on ASTM D2622 test procedure. Failure to use ultralow-sulfur diesel fuels may void the warranty on emission after-treatment components.
9.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter and reduce the chances of dirt getting into the engine.

9.2 Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.

9.3 If needed, prime the fuel system. For priming procedures, see the applicable engine manufacturer’s manual.

10. If equipped with a fuel/water separator, check for water.

If the engine is equipped with a built-in water separator, place a suitable container under the drainhose, loosen the drain valve, and allow the water to run out. Close the drain valve, taking care not to overtighten it.

For an Alliance Model, see Fig. 21.4. Place a suitable container under the fuel/water separator. Check the water level in the sight bowl, if so 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.

For a Davco Model, see Fig. 21.5. Place a suitable container under the fuel/water separator. Open the filter vent at the top of the assembly, loosen the drain valve at the bottom and allow the water to run out. Close and tighten the drain valve, and filter vent, finger-tight. See Chapter 24 in this manual for Emergency Filter Replacement if the filter cover is broken.

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.

11. Inspect the front and rear suspension components, including springs, spring hangers, shocks, and suspension brackets.

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

11.2 Inspect the shock absorbers for loose fasteners and leaks.

11.3 Tighten all loose fasteners and have any component(s) replaced that are worn, cracked, or otherwise damaged.

11.4 On vehicles with air suspensions, check for leaks. Check air suspension components for cuts and bulges.

12. Clean the windshield, side, and rear windows with a long-handled or telescoping window cleaning device and standard cleaning solutions. Stand only on the ground, on a stepladder, or an elevated walkway. The entry/exit steps and handholds are not designed for this purpose. The tires, fenders, engine, and other under-hood components do not have adequate gripping surfaces and handholds.

Check the condition of the windshield wiper arms and blades.

Be sure the windshield wiper blades are tensioned against the windshield. Replace the wiper.
arms if the wiper blades are not tensioned against the windshield.

Inspect the wiper blades for damage and deteriorated rubber, and replace if necessary.

**WARNING**

When cleaning windshields and windows, always stand on the ground or on a secure ladder or platform. Use a long-handled window cleaner. Do not use the cab steps, tires, fenders, fuel tanks, engine, or under-hood components to access the windshield or windows. Doing so could cause a fall and result in an injury.

13. After starting the engine, make sure the oil- and air-pressure warning systems are operating and that the buzzer stops sounding when the preset minimums are reached.

If the warning systems do not come on when the ignition is turned on, have the systems repaired.

The air pressure in both the primary and secondary air reservoir systems must be above 65 psi (448 kPa) on most vehicles. For vehicles with an optional Bendix dryer reservoir module (DRM), the cut-out pressure is 130 psi (896 kPa).

**NOTE:** If the air pressure in both systems is above the preset minimum when the engine is started, test the low-air-pressure warning system by lowering the pressure to below this range, or until the warning system comes on.

14. **Check the instrumentation control unit (ICU) for fault codes.**

During the ignition sequence, if an active fault is detected in any device that is connected to the datalink, the message display screen will show the active fault codes, one after the other, until the parking brake is released or the ignition switch is turned off. See Chapter 4 for detailed operating instructions for the ICUs.

15. **Make sure that the horn, windshield wipers, and windshield washers are operating properly.**

*These devices must be in good working order for safe vehicle operation.*

**15.1** Make sure that the horn works. If a horn is not working, have it repaired before trip departure.

**15.2** Check the wiper and washer control on the multifunction turn signal switch. If the wipers and/or washers are not working, have them repaired before trip departure.

16. **During cold weather, make sure the heater, defroster, and optional mirror-heat controls are operating properly.**

If so equipped, turn on the mirror heat switch and make sure the system is working.

17. **Check the operation of all the panel lights and interior lights.**

Turn on the headlights, dash lights, and four-way flashers and leave them on. If any of the gauge bulbs, the dome light bulbs, or the right- and left-turn indicator bulbs are not working, replace them. See Chapter 25 for replacement bulb identification.

18. **Make sure all the exterior lights are working properly.**
Check that all the lights and reflectors are clean. See Fig. 21.6.

18.1 Check that the brake lights, taillights, headlights, parking lights, turn signals, marker lights, identification lights, road lights (if so equipped), and front clearance lights are working properly and are clean.

18.2 Test the high and low beams of the headlights.

18.3 Replace light bulbs or sealed beam units that are not working. See Chapter 25 for replacement bulb identification.

18.4 Be sure all reflectors and lenses are in good condition and are clean. Replace any broken reflectors or lenses.

19. Check tire inflation pressures using an accurate tire pressure gauge.

---

1. High-Beam Headlight
2. Fog Lamp, or Auxiliary High-Beam Lamp
3. Low-Beam Headlight
4. Front Turn Signal Light and Marker Light
5. Side Turn Signal Light and Marker Light
6. Clearance Light
7. Stop Light, Taillight, and Turn Signal Light
8. Back-Up Light
9. Identification Light

Fig. 21.6, Exterior Lights
Tires should be checked when cool. For inflation pressures and maximum loads (per tire) see the tire manufacturer’s guidelines.

19.1 Be sure valve stem caps are on every tire and that they are screwed on finger-tight.

19.2 Inflate the tires to the applicable pressures if needed.

19.3 If a tire has been run flat or underinflated, check the wheel and tire for damage before adding air.

Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-maintained inline moisture traps and service them regularly.

**WARNING**

Do not operate the vehicle with underinflated or overinflated tires. Incorrect inflation can stress the tires and make the tires and rims more susceptible to damage, possibly leading to rim or tire failure and loss of vehicle control, resulting in serious personal injury or death.

**IMPORTANT:** The load and cold inflation pressure must not exceed the wheel manufacturer’s recommendations, even though the tire may be approved for a higher load inflation. Some wheels are stamped with a maximum load and maximum cold inflation rating. If they are not stamped, consult the manufacturer for the correct tire inflation pressure for the vehicle load. If the load exceeds the maximum rim capacity, the load must be adjusted or reduced.

**CAUTION**

A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage. The tire should be inspected and, if necessary, repaired or replaced.

20. Inspect each tire for bulges, cracks, cuts, penetrations, and oil contamination.

20.1 Check the tire tread depth. If tread is less than 4/32 inch (3 mm) on any front tire, or less than 2/32 inch (1.5 mm) on any rear tire, replace the tire.

20.2 Inspect each tire for bulges, cracks, cuts, and penetrations.

20.3 Inspect each tire for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if allowed to contact the tires, will soften the rubber and destroy the tire.

21. Check the wheel nuts for indications of looseness. Examine each rim and wheel component.

21.1 Remove all dirt and foreign material from the assembly.

21.2 Examine the wheel assembly components for cracks, or other damage.

See Group 33 or Group 35 of the Cascadia™ Workshop Manual for service procedures on the studs and hubs, and see Group 40 in the same manual for wheel and tire servicing, or take the vehicle to an authorized Freightliner dealer.

**WARNING**

Have any worn or damaged wheel components replaced by a qualified person using the wheel manufacturer’s instructions and the wheel industry’s standard safety precautions and equipment. Otherwise a vehicle or workshop accident could occur, possibly resulting in serious personal injury or death.

**NOTICE**

Insufficient wheel nut torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values and follow the proper tightening sequence.

21.3 Make sure all wheel nuts are tightened 450 to 500 lbf-ft (610 to 678 N·m) for Accuride wheels with unlubricated threads.

Use the tightening pattern in Fig. 21.7 for 10-hole wheels. See Group 40 of the Cascadia™ Workshop Manual for more information.

22. Inspect the air brake chamber and the air brake chamber pushrods.
Pre- and Post-Trip Inspections and Maintenance

**DANGER**

Do not loosen or remove the parking brake clamp ring for any purpose. See Fig. 21.8. The parking/emergency brake section of the brake chamber is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in Group 42 of the Cascadia™ Workshop Manual.

**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.

22.1 Check that the air brake chamber is mounted securely on its mounting bracket, and that there are no loose or missing bolts.

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

**NOTICE**

If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside of the chamber, dirt and debris can cause the internal parts of the chamber to deteriorate faster.

22.4 Inspect the exterior surfaces of the chamber for damage. Make sure that breather holes in the non-pressure section(s) are open and free of debris. See Group 42 of the Cascadia™ Workshop Manual to replace any damaged parts.

22.5 On all parking brake installations, make sure the end cover cap or dust plug is securely snapped into place.

NOTE: On most MGM parking brake chambers equipped with an integral release bolt,
an end cover cap is installed over the release bolt.

22.6 Check for rusted connections, missing snap rings, and damaged camshaft grease seals. Have damaged or missing parts repaired or replaced.

23. **Inspect the air brake lines.**

23.1 Check the clearance between the hoses and the exhaust manifold or other hot spots. Excessive heat will cause material in the hoses to deteriorate rapidly or become brittle. Provide at least 6 inches (150 mm) of clearance. More clearance is recommended if the hose is located above the heat source.

23.2 Check for kinks, dents, or swelling of the hoses. If damaged, have the hose replaced with the same size and type.

**NOTE:** Do not route the hose on top of anything likely to be stepped on.

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

23.4 Check for hose damage caused by abrasion. If abraded, have the hose replaced. Check for the cause of abrasion, such as loose or damaged hose clamps. Have the clamps repaired or replaced as needed.

23.5 Observe the hose cover condition, especially hoses exposed to water splash and ice. If dried out or ragged (the wire or liner is showing through the cover), have the hose(s) replaced.

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

23.7 Check for kinked or twisted hoses. A seven-percent twist in the hose can reduce its life by up to 90 percent. A twisted hose under pressure tends to untwist, which may loosen the fitting. Reconnect hoses that are twisted.

**NOTE:** The front brake lines flex continuously in vehicle operation, so they require special examination. Give particular attention to the areas near where they connect to the front air brake chambers. This inspection requires two people, one in the driver seat and another to inspect the brake line connections at the wheels.

23.8 Both wheel air lines must be inspected with the emergency brake set, engine idling, air pressure at 80 to 90 psi (550 to 620 kPa), and the brake pedal held down.

23.9 Turn the wheels to full lock in one direction and inspect both air lines where they connect to the air chambers, then turn the wheels to full lock in the other direction and inspect both lines. If a hose is leaking, have it replaced.

**IMPORTANT:** ABS-equipped vehicles operating in regions where especially corrosive ice-removal chemicals are used may experience higher than normal rotor corrosion. Tone rings should be routinely inspected for corrosion. Severe corrosion of the integral ABS tone ring may cause the ABS warning lamp in the dash to illuminate due to false wheel speed readings. If the ABS warning lamp illuminates at any time other than at vehicle start-up, have the problem repaired immediately.

24. **Inspect the slack adjusters.**

24.1 **Meritor Slack Adjusters:** Check the boot for cuts, tears, or other damage. Have it replaced if necessary.

24.2 **Gunité Slack Adjusters:** Inspect the slack adjuster for any signs of damage. If damaged, have the slack adjuster replaced. Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, have it replaced. See **Fig. 21.9**.

24.3 **Haldex Slack Adjusters:** Inspect each slack adjuster and anchor strap for damage. Replace any damaged components.

25. **Check the air brake system for proper operation.**
25.1 Check the air governor cut-in and cut-out pressures as follows:
Run the engine at fast idle. The air governor should cut out the air compressor at approximately 120 psi (827 kPa). With the engine idling, apply the brake pedal several times. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not 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.

25.2 Check the air pressure buildup time as follows:
With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

25.3 Check the air pressure reserve as follows:
With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

25.4 Check the air leakage in the system as follows:
With the parking brake (spring brake) applied, the transmission out of gear, and the tires chocked, charge the air system until cut-out pressure of 120 psi (827 kPa) is reached.

With the service brakes released, shut down the engine, wait 1 minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

Charge the air system until cut-out pressure of 120 psi (827 kPa) is reached. With the parking brakes released and the service brake applied, shut down the engine, wait 1 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 21.1, repair all areas of leakage before driving the vehicle.

<table>
<thead>
<tr>
<th>Maximum Allowable Service Brake Air Leakage</th>
<th>Description</th>
<th>Air Leakage in psi (kPa) Per Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Released</td>
<td>Applied</td>
</tr>
<tr>
<td>Truck or Tractor Only</td>
<td>2 (14)</td>
<td>3 (21)</td>
</tr>
<tr>
<td>Truck or Tractor w/Single Trailer</td>
<td>3 (21)</td>
<td>4 (28)</td>
</tr>
<tr>
<td>Truck or Tractor w/Two Trailers</td>
<td>5 (35)</td>
<td>6 (42)</td>
</tr>
</tbody>
</table>

Table 21.1, Maximum Allowable Service Brake Air Leakage
26. **Test the service brakes.**

When starting to move the vehicle and before picking up speed, test the brakes with the foot pedal and parking brake control valve (yellow knob) to be sure they will bring the vehicle to a safe stop.

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**Weekly Post-Trip Inspection and Maintenance**

**WARNING**

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. **Inspect the batteries and battery cables.** Check the battery cables for chafing, and proper routing. Replace the battery cable if damaged. Check that the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.

2. **Check the level of the wheel bearing lubricant in the hub cap at each end of the front axle.**

   If needed, fill the hubs to the level indicated on the hub cap. See Chapter 25 for recommended lubricants.

**IMPORTANT:** Before removing the fill plug, always clean the hub cap and plug.

3. **Examine the steering components.**

   See Fig. 21.10. If repairs are needed, see Group 46 of the Cascadia™ Workshop Manual for instructions, or take the vehicle to an authorized Freightliner dealer.

   3.1 Check the rack-and-pinion mounting bolts for tightness.

   3.2 Check the rack and pinion gear for signs of damage. Carefully inspect each of the bellows for any rips or splitting.

**IMPORTANT:** If a compromised bellows is caught early, it may be replaced. Otherwise, the entire rack and pinion steering gear will need to be replaced.

3.3 **Tighten loose nuts and have damaged parts replaced as needed.** Refer to Group 46 of the Cascadia™ Workshop Manual, or take the vehicle to an authorized Freightliner dealer.

4. **Check the intake-air restriction indicator.**

---

**NOTICE**

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

4.1 For vehicles equipped with a manual-reset indicator with graduations, check the indicator with the engine off to see if air restriction equals or exceeds the value shown in Table 21.2 for maximum air restriction.

For vehicles equipped with a go/no-go restriction indicator without graduations, check the indicator with the engine off to see if the colored bar shows through the clear window.
### Intake-Air Restriction Vacuum Readings

<table>
<thead>
<tr>
<th>Engine Make</th>
<th>Initial inH₂O</th>
<th>Service inH₂O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cummins</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Detroit Diesel</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Mercedes-Benz</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

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

**Table 21.2, Intake-Air Restriction Vacuum Readings**

4.2 If air restriction is at or above the maximum, push the reset button on the indicator.

4.3 Operate the engine to see if air restriction exceeds recommended values again. This can be done by running the vehicle on a dynamometer at full-load and rated rpm, or by driving the vehicle for one day in the vehicle’s typical operating environment while not exceeding the rated rpm (typically 1800 rpm). Refer to the engine operation manual for more information on rated rpm for your engine.

4.4 Check the indicator again. If air restriction continues to equal or exceed the maximum air restriction value, the air cleaner requires replacement. For air cleaner replacement instructions, refer to Group 09 of the Cascadia™ Workshop Manual, or take the vehicle to an authorized Freightliner dealer.

5. **Check the condition of the serpentine drive belt.**

   Look for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, have the belt replaced, following the instructions in Group 01 of the Cascadia™ Workshop Manual.

**NOTICE**

Do not drive with a serpentine belt that is visibly worn or damaged. If it fails, the lack of coolant flow could rapidly cause damage to engine components.

6. **Check the drive belt for proper tension.**

   Use your index finger to apply force at the center of the belt free-span. See Fig. 21.11. There is no adjustment for belt tension on engines with automatic belt tensioners. If there is not proper tension, have the belt tensioner replaced. See Group 01 of the Cascadia™ Workshop Manual for instructions, or take the vehicle to an authorized Freightliner dealer.

7. **Inspect the seat belts and tether belts.**

   **WARNING**

   Inspect and maintain seat belts as instructed below. Worn or damaged seat belts could fail during a sudden stop or crash, possibly resulting in serious injury or death.

   **IMPORTANT:** Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

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

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

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

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

   7.4 Check the Komfort Latch or Sliding Komfort Latch (if equipped) for function and cracks or other damage.

---

**Fig. 21.11, Checking Belt Tension**

A. Deflection B. Belt Free-Span

**10/31/94 I200036a**
Monthly Post-Trip Inspection and Maintenance

**WARNING**
Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

1. **Clean the batteries.**
   1.1 Remove any corrosion from the hold-down and the top of the battery.

**NOTICE**
Take care to keep the vent plugs tight so that the neutralizing solution does not enter any of the battery cells and damage the battery.

1.2 Use a soda solution to neutralize the acid present, then rinse off the soda solution with clean water.

1.3 If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of dielectric grease to the posts and terminals to help retard corrosion.

2. **Inspect the radiator and heater hoses, including the clamps and support brackets.**

2.1 Make sure the radiator inlet and outlet hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.

2.2 Make sure the heater hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.

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

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

**IMPORTANT:** Replace all hoses, including heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. Silicone hoses having an extended service life can be substituted for the reinforced neoprene type. See the Alliance Parts Catalog at [www.alliancebrandparts.com](http://www.alliancebrandparts.com), or contact your Freightliner Dealer.

3. **Check the steering wheel for excessive play.**
   3.1 With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels.

   3.2 Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction until motion is again detected at the wheels.

   3.3 Measure the lash (free play) at the rim of the steering wheel. Excessive lash exists if steering wheel movement exceeds 2-1/4 inches (57 mm) with an 18-inch (450-mm) steering wheel.

   If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear before operating the vehicle.

4. **Check the brake lining wear on all vehicles, including those with automatic slack adjusters.**
   Proper brake operation is dependent on periodic maintenance and inspection of the brake linings.

   4.1 Check that brake linings are free of oil and grease.

   4.2 Inspect the thickness of the brake linings. If the axle assembly is equipped with a dust shield or backing plate, remove the inspection plugs. If any brake linings are...
worn to less than approximately 1/4 inch (6.4 mm) at the thinnest point, have the linings replaced on all brake assemblies on that axle. See Group 42 of the Cascadia™ Workshop Manual for lining replacement instructions and camshaft end-play inspection.

4.3 Check the brake drums for wear and cracks.

4.4 Check that the inspection plugs in the dust shields or backing plates, if so equipped, are installed.
## Cab Appearance

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Cab Washing and Polishing

Cab Washing and Polishing

**IMPORTANT:** Carefully read all instructions before using or applying any cleaner or product on the vehicle or components. Failure to follow manufacturers’ recommendations can result in damage to the finish.

To protect the finish of your new vehicle, follow these guidelines carefully.

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle’s finish, follow these guidelines.

- Avoid washing your vehicle in the hot sun.
- Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. Before waxing, if the finish has become dull, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Freightliner recommends that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface off with water.
- To prevent rust, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

Care of Fiberglass Parts

Wash unpainted fiberglass air fairings and shields monthly with a mild detergent, such as dishwashing liquid. Avoid strong alkaline cleansers.

Apply a wax specifically designed for fiberglass.

Care of Chrome Parts

To prevent rust, keep chrome parts clean and protected at all times. This is especially important during winter driving and in coastal areas where there is exposure to salt air.

When cleaning chrome parts, use clean water and a soft cloth or sponge. A mild detergent may also be used.

Sponge gently, then rinse. If necessary, use a non-abrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

Care of Exterior Lights

Clean the headlight lenses by hand only, using a flannel cloth with mild, non-caustic soap or detergent, and water.

**CAUTION**

Do not use a power buffer, paper towels, chemical solvents, or abrasive cleaners on the headlight lens, all of which can remove the UV coating from the surface, and result in yellowing of the lens.

Dashboard Care

Periodically wipe the dashboard with a water-dampened cloth. A mild detergent can be used, but avoid using strong detergents.

**CAUTION**

Do not use Armor-All Protectant®, STP Son-of-a-Gun®, or other equivalent treatments. These cleaners contain vinyl plasticizers that can cause
stress crazing in the interior plastic panels, which can result in cracking of the panels.

**Vinyl Upholstery Cleaning**

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

**Ordinary Dirt**
Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times, as necessary.

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 it 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 procedure used for 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 for 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 an upholstery shampoo,
or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow the 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 the cloth carefully to the spot from the outer edge to the center. Pat and blot the spot with a clean, dry cloth. Repeat several times, as necessary, turning the 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 it 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 procedure for 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.
23

Headlight Aiming

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Checking Headlight Aim ........................................................ 23.1
Adjusting Headlight Aim ...................................................... 23.2
Preliminary Checks
Before checking or adjusting the headlight aim, do the following.

- Check that the hood is completely closed, and latched.
- Remove large amounts of mud or ice from the underside of the fenders.
- Check the springs for sagging or broken leaves.
- Check the suspension for proper functioning of the leveling mechanism. On cabs with air suspensions, make sure that the height is properly adjusted.
- Check for damage to the hood and hinge assembly. Repair as necessary.
- With the vehicle unloaded, check that the tires are inflated to the recommended air pressure.
- Clean the headlight lenses. Clean by hand only, using a flannel cloth with mild, non-caustic soap or detergent, and water.

Checking Headlight Aim
1. Park the vehicle on a level surface, 25 ft (7.6 m) from a screen or wall that can be used for aiming the headlights. Shut down the engine, apply the parking brake, and chock the front tires. See Fig. 23.1.
2. On each headlight, find the low beam bulb center. See Fig. 23.2.
3. Measure the distance from the ground to the center of each low beam bulb. Note those distances.
4. On the screen or wall, 25 ft (7.6 m) away, make the appropriate markings directly across from each headlight and at the same height as measured for the headlight.

---

Fig. 23.1, Headlight Aiming Screen or Wall
5. Turn on the headlights to the low-beam setting. See Fig. 23.3 for the ideal and acceptable patterns for both headlights.

- If either or both headlights do not aim into the inner edges of the centerline, follow the adjusting procedure.
- If both headlights come close to the inside of each headlight centerline (as shown), no further work is needed. Turn off the headlights and remove the chocks from the front tires.

Adjusting Headlight Aim

The adjusting screw is located on the lower outside corner of the headlight assembly. See Fig. 23.4. Turn the adjusting screw clockwise to raise the beam and counterclockwise to lower it, until the beam pattern meets the acceptable standard in Fig. 23.3.
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Hazard Warning Lights

The hazard warning light switch is located on the dash in what is referred to as the master module. See Fig. 24.1. The hazard lights can be activated regardless of the ignition switch position.

To activate the hazard lights, push the center of the switch once. The switch will blink at the same rate that the hazard lights flash. Push the switch again to turn them off. All the turn signal lights on the vehicle and trailer, as well as the turn signal indicators in the ICU, flash simultaneously when the hazard lights are activated.

![Fig. 24.1, Master Module](image)

**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.

Emergency Filter Replacement, Davco

If the filter cover on the Davco fuel/water separator is broken, it will not be possible to operate the vehicle. A standard spin-on filter will correct this problem.

Refer to the Davco web site (www.davcotec.com) for additional information.

To replace the filter on all Davco fuel/water separators, follow this procedure:

1. Drain the fuel until it is below the level of the collar. See Fig. 24.2 for the model 232/233 fuel/water separator and Fig. 24.3 for the model 382 fuel/water separator.

2. Remove the vent and seal.

   **NOTE:** The vent and seal are not needed in the emergency replacement. They should be retained for later installation at the time when the cover is replaced.

3. Remove the collar using the DAVCO fuel-water separator wrench. Do not use pliers or channel-lock pliers.

4. Remove the cover, cover seal, and spring. Retain them for later assembly.

5. Remove the filter element and dispose of it properly.

   **NOTE:** Remove the rubber grommet from the stud.

6. Install the standard engine spin-on filter (included in the emergency kit) on the threaded stud.

7. Install the cover, cover seal, and spring, as removed.

8. Install the collar over the cover. Tighten the collar finger-tight.

9. Start the engine and run it at increased rpm for one minute to purge air from the fuel lines.

Fire Extinguisher

A fire extinguisher is located either in the cab by the driver’s door, or in the baggage compartment.

Emergency Kit, Optional

An optional emergency kit is located in the cab. The kit includes one or more of the following: a first aid kit, a reflective vest, a triangular reflector, a flare kit, and (on vehicles with a Davco fuel/water separator) a spin-on fuel filter element.

If there is an emergency while driving, cautiously pull off the road. 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.
Emergency Starting With Jumper Cables

When using jumper cables, follow the instructions below.

**WARNING**
Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.

**CAUTION**
Make sure both electrical systems are the same voltage. Electronic devices on both vehicles can

---

**Fig. 24.2, Davco Model 232 and 233 Fuel/Water Separator**

1. Vent  
2. Seal  
3. Collar  
4. Cover  
5. Cover Seal  
6. Spring  
7. Filter Element  
8. Threaded Stud  
9. Fuel Port  
10. Drain

---
be damaged when connected to a vehicle with a different operating voltage.

NOTE: On vehicles equipped with optional underhood jump start posts, connect to these posts instead of the batteries.

1. Apply the parking brakes and turn off the lights and all other electrical devices.

2. Remove the battery box cover by pulling on the end of each hold-down latch until the end clears the catch, then pivoting the latches out of the way, and lifting off the cover. See Fig. 24.4.

**CAUTION**

Always connect the battery, jumper cables, and charger correctly (positive-to-positive and negative-to-negative). Connecting a charging device backwards (positive-to-negative) can severely damage the vehicle electrical content and cause non-warrantable failures.

3. Connect the positive (+) jumper cable to the positive battery post on the Cascadia needing the jump start, then connect the other end of the positive jumper cable to the positive battery or
jump start post of the vehicle providing the jump. See Fig. 24.5.

**WARNING**

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

4. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to the negative battery post of the Cascadia needing the jump start.

5. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.

6. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.

7. When the engine starts, let it idle a few minutes.

**WARNING**

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

8. Disconnect the grounded cable from the frame or other non-battery location, then disconnect the other end of the cable.

9. Disconnect the remaining cable from the newly charged battery (or jump-start post if equipped) first, then disconnect the other end.

10. Install the cover; be sure it is positioned properly before fastening the latches.

**Towing**

When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.

**WARNING**

Do not tow an unbraked vehicle if the combined weight of both vehicles is more than the sum of
the gross axle weight ratings (GAWR) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

**Front Towing Hookup**

1. Disconnect the battery ground cables.

--- **NOTICE** ---

Failure to remove the axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

2. Remove both drive axle shafts. On dual drive axles, if the vehicle is to be lifted and towed, remove only the rearmost drive axle shafts.

   On vehicles equipped with an air fairing, remove both the forward and rearmost drive axle shafts if there is insufficient towing clearance.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out and will keep contaminants from getting into and damaging the wheel bearings and axle lubricant.

--- **NOTICE** ---

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 end caps and chrome bumper (if equipped).

6. Attach the towing device. Do not pass a sling (for example, a rope or chain) from one tow hook to another to fasten for towing. Known as reeving, this practice is not permissible in most industrial applications of towing and hoisting. Reeving can overload the hooks and result in damage to the vehicle. See Fig. 24.6.

7. Lift the vehicle and secure the safety chains. If extra towing clearance is needed, remove the front wheels.

--- **WARNING** ---

Failure to chock the tires or connect the tow truck’s air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

9. Chock the tires on the disabled vehicle 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**

--- **NOTICE** ---

Using a rear towing hookup on a vehicle equipped with a roof fairing could cause damage to the cab structure.

--- **NOTICE** ---

Note the following precautions when reverse towing a vehicle equipped with side extenders, at speeds above 45 mph (70 kph):

- **If middle brackets are installed**, as shown in Fig. 24.7, just remove the rubber flex extenders. Not doing so could cause the flex extenders to come loose and fall off.

- **If middle brackets are not installed**, remove the side extenders. Not doing so could cause damage to the side extenders.

1. If reverse towing at speeds above 45 mph (70 kph) necessary, remove the side extenders or the rubber flex extenders, as necessary (see above).
2. Place the front tires straight forward and secure the steering wheel in this position.
3. Disconnect the battery ground cables.

**NOTICE**

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

4. On dual drive axles, using protection to keep the chains from damaging the vehicle frame, chain the forward-rear drive axle to the frame.
5. Attach the towing device.

**NOTE:** Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.

6. Lift the vehicle and secure the safety chains. If extra clearance is needed, remove the bumper extension if equipped.

7. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.

**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 an Emergency

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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### Fuses and Relays

#### SAM Cab Fuses

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<td>F23</td>
<td>Driver Info/Gauges</td>
<td>15</td>
</tr>
<tr>
<td>F24</td>
<td>ICU-Ignition</td>
<td>15</td>
</tr>
<tr>
<td>F25</td>
<td>Dash Splice Pack</td>
<td>7.5</td>
</tr>
<tr>
<td>F26</td>
<td>SRS-Airbag</td>
<td>5</td>
</tr>
<tr>
<td>F27</td>
<td>Mirror Heat L</td>
<td>10</td>
</tr>
<tr>
<td>F28</td>
<td>Mirror Heat R</td>
<td>10</td>
</tr>
<tr>
<td>F29</td>
<td>SAM Relay Coils</td>
<td>3</td>
</tr>
<tr>
<td>F30</td>
<td>Pwr Recp 6 &amp; Refrigerator</td>
<td>20</td>
</tr>
<tr>
<td>F31</td>
<td>Sleeper Power Recp 5</td>
<td>20</td>
</tr>
<tr>
<td>F32</td>
<td>PWR FD Spare 5&amp;6</td>
<td>25</td>
</tr>
<tr>
<td>F33</td>
<td>Spotlight</td>
<td>20</td>
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<td>F34</td>
<td>Baggage Comp Lamp</td>
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<td>F35</td>
<td>Dome Lamp Cab</td>
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<td>F36</td>
<td>Aux Cir Fan/Rd Lamp</td>
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<td>F37</td>
<td>Clk/Drv Info/CD/Keyless</td>
<td>15</td>
</tr>
<tr>
<td>F38</td>
<td>Door Controls R</td>
<td>20</td>
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<tr>
<td>F39</td>
<td>Power Window R</td>
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<tr>
<td>F40</td>
<td>Power Window L</td>
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Table 25.1, SAM Cab, Fuses

#### SAM Cab Relays

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<tr>
<th>Position</th>
<th>Function</th>
<th>Source</th>
</tr>
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<tbody>
<tr>
<td>R1</td>
<td>PWR FD Spare 1&amp;3</td>
<td>BAT</td>
</tr>
<tr>
<td>R2</td>
<td>PWR FD Spare 2&amp;4</td>
<td>BAT</td>
</tr>
<tr>
<td>R3</td>
<td>Heated Seat</td>
<td>IGN</td>
</tr>
<tr>
<td>R4</td>
<td>Dash Pwr Recp 1&amp;2</td>
<td>BAT</td>
</tr>
<tr>
<td>R5</td>
<td>Fleet Mgm Sys &amp; CB</td>
<td>BAT</td>
</tr>
<tr>
<td>R6</td>
<td>Pwr Recp 3 &amp; Std HVAC</td>
<td>BAT</td>
</tr>
<tr>
<td>R7</td>
<td>Driver Info/Gauges</td>
<td>IGN</td>
</tr>
<tr>
<td>R8</td>
<td>ICU/Vehicle System</td>
<td>IGN</td>
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<tr>
<td>R9</td>
<td>Amplifier Power</td>
<td>ACC</td>
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<tr>
<td>R10</td>
<td>Mirror Heat</td>
<td>BAT</td>
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<tr>
<td>R11</td>
<td>Power Recp 6/Refrig</td>
<td>BAT</td>
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<tr>
<td>R12</td>
<td>Pwr Recp 5</td>
<td>BAT</td>
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<tr>
<td>R13</td>
<td>Cab Lighting</td>
<td>BAT</td>
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<tr>
<td>R14</td>
<td>Pwr Recp 4/Cir Fan/Lamp</td>
<td>BAT</td>
</tr>
<tr>
<td>R15</td>
<td>Pwr Window</td>
<td>ACC</td>
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Table 25.2, SAM Cab, Relays

#### SAM Chassis Fuses

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<thead>
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<th>Part</th>
<th>Name</th>
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<tr>
<td>F1</td>
<td>EAPU</td>
<td>20</td>
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<tr>
<td>F2</td>
<td>Fuel/Water Separator Heat</td>
<td>20</td>
</tr>
<tr>
<td>F3</td>
<td>ABS Bat 1</td>
<td>20</td>
</tr>
<tr>
<td>F4</td>
<td>ABS Bat 2</td>
<td>10</td>
</tr>
<tr>
<td>F5</td>
<td>Trailer Turn L</td>
<td>20</td>
</tr>
<tr>
<td>F6</td>
<td>ABS-Ignition</td>
<td>15</td>
</tr>
<tr>
<td>F7</td>
<td>WIF/Camera</td>
<td>10</td>
</tr>
<tr>
<td>F8</td>
<td>Trailer Turn R</td>
<td>20</td>
</tr>
<tr>
<td>F9</td>
<td>Trailer Marker</td>
<td>30</td>
</tr>
<tr>
<td>F10</td>
<td>SAM Relay Coils</td>
<td>5</td>
</tr>
<tr>
<td>F11</td>
<td>Trailer ABS-Ign</td>
<td>30</td>
</tr>
<tr>
<td>F12</td>
<td>Trailer Stop</td>
<td>30</td>
</tr>
<tr>
<td>F13</td>
<td>Trailer Tail</td>
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<td>F14</td>
<td>Trailer Pwr</td>
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Table 25.3, SAM Chassis, Fuses

#### SAM Chassis Relays

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<th>Function</th>
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<td>Fuel/Water Separator Heat</td>
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<td>R2</td>
<td>Trailer Turn L</td>
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<tr>
<td>R3</td>
<td>ABS/WIF/Camera</td>
</tr>
<tr>
<td>R4</td>
<td>Trailer Turn R</td>
</tr>
<tr>
<td>R5</td>
<td>Trailer Marker</td>
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### Specifications

#### SAM Chassis Relays

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<td>R6</td>
<td>Trailer ABS</td>
</tr>
<tr>
<td>R7</td>
<td>Trailer Stop Lamps</td>
</tr>
<tr>
<td>R8</td>
<td>Trailer Power</td>
</tr>
<tr>
<td>R9</td>
<td>Trailer Tail Lamps</td>
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**Table 25.4, SAM Chassis, Relays**

#### MEGA Fuse Junction Block (MFJB) Fuses

<table>
<thead>
<tr>
<th>Part</th>
<th>Name</th>
<th>AMP</th>
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<tr>
<td>F1</td>
<td>Engine Harness</td>
<td>175</td>
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<tr>
<td>F2</td>
<td>SAM Cab</td>
<td>175</td>
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<tr>
<td>F3</td>
<td>SAM Chassis</td>
<td>125</td>
</tr>
<tr>
<td>F4</td>
<td>Chassis Mounted Trailer</td>
<td>125</td>
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<tr>
<td>F5</td>
<td>Inverter</td>
<td>200</td>
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**Table 25.5, MEGA Fuse Junction Block (MFJB) Fuses**

#### Powertrain PDM Fuses and Relays

<table>
<thead>
<tr>
<th>Position</th>
<th>Function</th>
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<tbody>
<tr>
<td>F1</td>
<td>Spare Fuse</td>
</tr>
<tr>
<td>F2</td>
<td>Transmission ECU Ign</td>
</tr>
<tr>
<td>F3</td>
<td>Fuel Heater</td>
</tr>
<tr>
<td>F4</td>
<td>Fuel Heater</td>
</tr>
<tr>
<td>F5</td>
<td>Engine Ignition</td>
</tr>
<tr>
<td>F6</td>
<td>SAM Chassis</td>
</tr>
<tr>
<td>F7</td>
<td>LVD/Remote Sense</td>
</tr>
<tr>
<td>F8</td>
<td>Engine ECU Batt</td>
</tr>
<tr>
<td>F9</td>
<td>CPC/Eng ECU Batt</td>
</tr>
<tr>
<td>F10</td>
<td>Transmission Batt</td>
</tr>
<tr>
<td>F11</td>
<td>Transmission Batt</td>
</tr>
<tr>
<td>F12</td>
<td>Transmission Batt</td>
</tr>
<tr>
<td>R1</td>
<td>Transmission Backup Relay</td>
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<tr>
<td>R2</td>
<td>MEIIR Relay</td>
</tr>
<tr>
<td>R3</td>
<td>Neutral Relay/Start Enable</td>
</tr>
<tr>
<td>R4</td>
<td>Spare Relay/Het Relay</td>
</tr>
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<td>R5</td>
<td>Starter Relay</td>
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<tr>
<td>R6</td>
<td>73 A Ign Relay</td>
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**Table 25.6, Powertrain PDM Fuses and Relays**

#### Trailer PDM Fuses and Relays

<table>
<thead>
<tr>
<th>Position</th>
<th>Function</th>
<th>AMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Trailer Power Fuse</td>
<td>30</td>
</tr>
<tr>
<td>F2</td>
<td>Tail Lamp Fuse</td>
<td>30</td>
</tr>
<tr>
<td>F3</td>
<td>Left Turn Lamp Fuse</td>
<td>20</td>
</tr>
<tr>
<td>F4</td>
<td>Right Turn Lamp Fuse</td>
<td>20</td>
</tr>
<tr>
<td>F5</td>
<td>Marker Lamp Fuse</td>
<td>30</td>
</tr>
<tr>
<td>F6</td>
<td>Stop Lamp Fuse</td>
<td>30</td>
</tr>
<tr>
<td>R1</td>
<td>Tail Lamp Relay</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>Right Turn Relay</td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>Stop Lamp Relay</td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>Trailer Power Relay</td>
<td></td>
</tr>
<tr>
<td>R5</td>
<td>Left Turn Relay</td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>Marker Lamp Relay</td>
<td></td>
</tr>
</tbody>
</table>

**Table 25.7, Trailer PDM Fuses and Relays**

#### Replacement Bulbs

<table>
<thead>
<tr>
<th>Lamp Assembly</th>
<th>Replacement Bulb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlight Hi/Low Beam, Fog light, Driving Light</td>
<td>WEE 12362LLBA (H11)</td>
</tr>
<tr>
<td>Turn/Marker Lamp (in headlight assy)</td>
<td>GE 3457</td>
</tr>
<tr>
<td>Incandescent Auxiliary Turn (on fender)</td>
<td>GE 2058U</td>
</tr>
<tr>
<td>Integral Stop/Tail/Backup Lights</td>
<td>GE 1157/GE 1156</td>
</tr>
<tr>
<td>Utility Light</td>
<td>WEE 199</td>
</tr>
<tr>
<td>Cab Dome Lamp, Clear, Outboard</td>
<td>GN12 BUL 050 R5WC</td>
</tr>
<tr>
<td>Cab Dome Lamp, Clear, Inboard</td>
<td>GN12 BUL 049 R10W</td>
</tr>
<tr>
<td>Cab Dome Lamp (Red)</td>
<td>GN12 BUL 050 R5WR</td>
</tr>
<tr>
<td>Sleeper Reading Lamp</td>
<td>GRLSAP270</td>
</tr>
<tr>
<td>Sleeper Dome Lamp</td>
<td>GRLBUL049R10W</td>
</tr>
<tr>
<td>Sleeper Writing Desk Lamp</td>
<td>GRLBUL027578</td>
</tr>
<tr>
<td>Sleeper Bunk Lamp</td>
<td>GRLBUL0142112</td>
</tr>
<tr>
<td>Footwell Lamp (Red)</td>
<td>GRLBUL042W5W</td>
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**Table 25.8, Replacement Bulbs**

25.2
## Fluids and Lubricants

<table>
<thead>
<tr>
<th>Type</th>
<th>Approved Fluid or Lubricant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engine Oil*</td>
<td>EPA07- and EPA10-compliant engines: Engine lube oil with a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil.</td>
</tr>
<tr>
<td>Fuel†</td>
<td>EPA07- and EPA10-compliant engines: Ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less, based on ASTM D2622 test procedure.</td>
</tr>
<tr>
<td>Power Steering Fluid</td>
<td>TES 389</td>
</tr>
<tr>
<td>Hydraulic Clutch Fluid</td>
<td>DOT 4</td>
</tr>
</tbody>
</table>
| Manual Transmission Lubricant‡§ | MobilTrans SHC 50 (RN 2952 E-5), SAE 50W  
Synthetic transmission lubricant approved by Eaton, SAE 50W |
|                       | Detroit Diesel Power Cool, premixed solution with supplement additives.                                                                                   |
|                       | Old World Industries, Fleet Charge™, with supplement additives.                                                                                           |

<table>
<thead>
<tr>
<th>Drive Axle Lubricant</th>
<th><strong>Recommended SAE Viscosity Grade</strong></th>
<th><strong>Ambient Temperature Range</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>75W</td>
<td>–40°F to –15°F (–40°C to –26°C)</td>
<td></td>
</tr>
<tr>
<td>75W—80</td>
<td>–40°F to 80°F (–40°C to 21°C)</td>
<td></td>
</tr>
<tr>
<td>75W—90</td>
<td>–40°F to 100°F (–40°C to 38°C)</td>
<td></td>
</tr>
<tr>
<td>75W—140</td>
<td>–40°F and above (–40°C and above)</td>
<td></td>
</tr>
<tr>
<td>80W—90</td>
<td>–15°F to –100°F (–26°C to 38°C)</td>
<td></td>
</tr>
<tr>
<td>80W—140</td>
<td>10°F and above (–12°C and above)</td>
<td></td>
</tr>
</tbody>
</table>

* See the engine manufacturer’s manual for specifications.  
† See the engine manufacturer’s manual for specifications.  
‡ Do not mix types or brands of fluid. Multi-weight and extreme-pressure gear fluids are not recommended.  
§ Call 1-800-826-4357 for a complete list of Eaton approved lubricants.

Table 25.9, Approved Fluids and Lubricants
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