



CENTURY CLASS TRUCKS

DRIVER'S MANUAL

Foreword

Customer Assistance Center

Having trouble finding service? Call the Freightliner Customer Assistance Center at 1-800-385-4357 or 1-800-FTL-HELP. Call night or day, weekdays or week-

ends, 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.

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Foreword

Introduction

This manual provides information needed to operate and understand the vehicle and its components; more detailed information is contained in the *Owner's Warranty Information Book*, and the vehicle's workshop and maintenance manuals.

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

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

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Freightliner Corporation reserves the right to discontinue models at any time, or change specifications and design without notice and without incurring obligation.

Environmental Concerns and Recommendations

In this manual, whenever you see instructions to discard materials, you should first attempt to reclaim and recycle them. To preserve our environment, follow appropriate

environmental rules and regulations when disposing of materials.

National Highway Traffic Safety Administration Reporting Procedure

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

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

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

Contents

Chapter		Page
	Introduction, Environmental Concerns, and National Highway Traffic Safety Administration Reporting Procedure	Foreword
1	Vehicle Identification	1.1
2	Instruments and Controls Identification	2.1
3	Vehicle Access	3.1
4	Heater and Air Conditioner	4.1
5	Seats and Seat Belts	5.1
6	Steering and Brake Systems	6.1
7	Engines and Clutches	7.1
8	Transmissions	8.1
9	Rear Axles	9.1
10	Fifth Wheels and Trailer Couplings	10.1
11	Pretrip Inspection and Daily Maintenance	11.1
12	Cab Appearance	12.1
13	In an Emergency	13.1
	Index	I.1

Vehicle Identification

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

Vehicle Identification

Vehicle Specification Decal

The vehicle specification decal lists the vehicle model, identification number, and major component models. It also recaps the major assemblies and installations shown on the chassis specification sheet. One copy of the specification decal is attached to the inside of the sliding storage/waste drawer; another copy is inside the rear cover of the *Owner's Warranty Book*. An illustration of the decal is shown in **Fig. 1.1**.

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

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

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

Federal Motor Vehicle Safety Standard (FMVSS) Labels

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

Tractors with or without fifth wheels purchased in the U.S. are certified by means of a certification label (**Fig. 1.2**) and the tire and rim labels (**Fig. 1.6**). These labels are attached to the left rear door post, as shown in **Fig. 1.3**.

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

Canadian Motor Vehicle Safety Standard (CMVSS) Labels

In Canada, tractors with fifth wheels are certified by means of a "Statement of Compliance" label (**Fig. 1.2**) and the Canadian National Safety Mark (**Fig. 1.5**), which are attached to the left rear door post. In addition, tire

Vehicle Identification

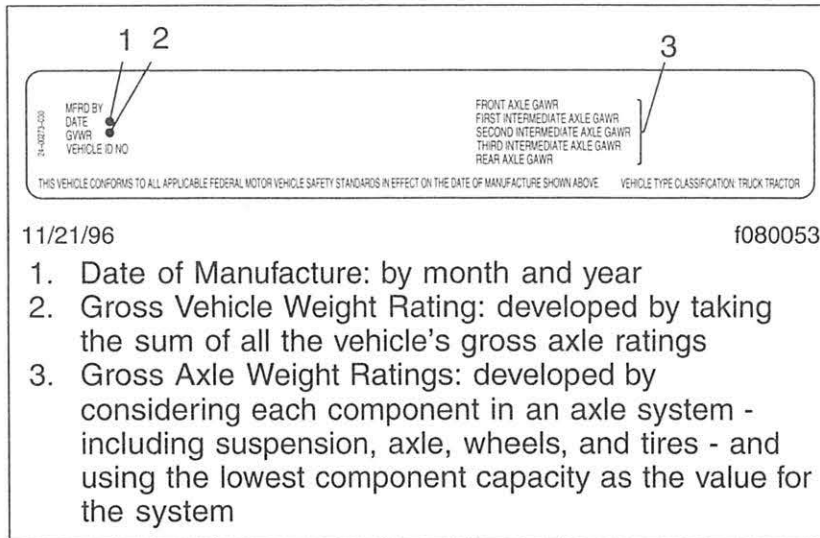


Fig. 1.2, Certification Label, U.S.

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

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

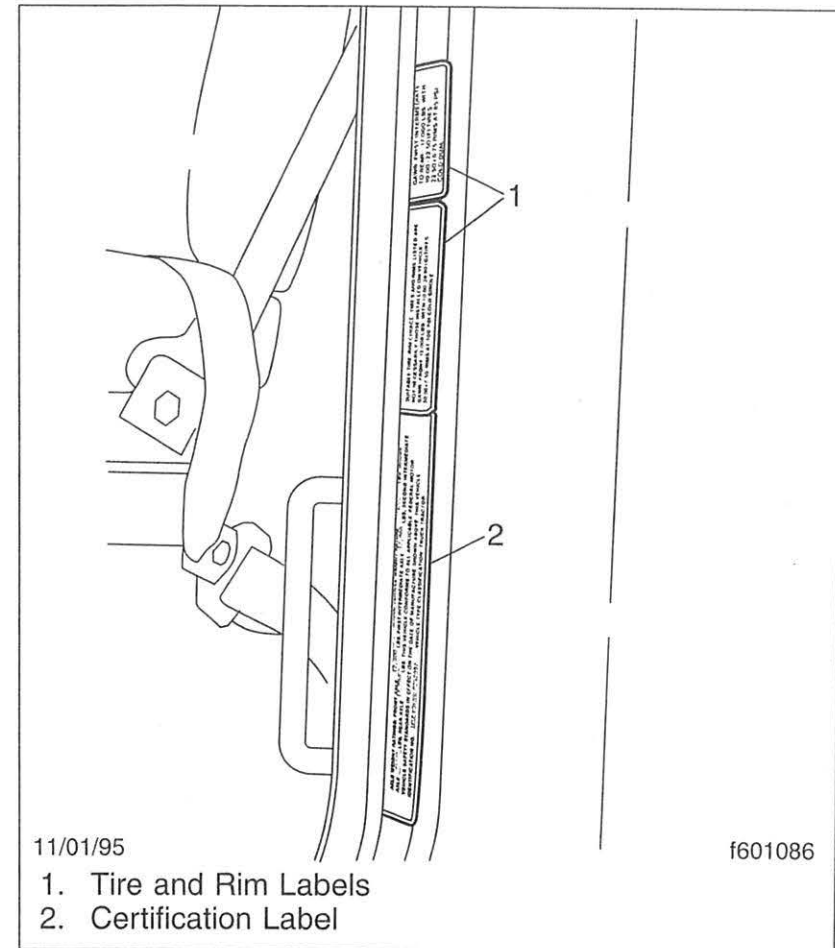


Fig. 1.3, Labels Location

Vehicle Identification

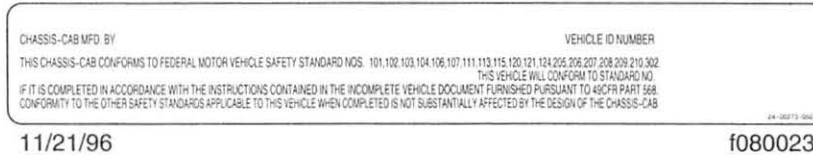


Fig. 1.4, Incomplete Vehicle Certification Label, U.S.



Fig. 1.5, Canadian National Safety Mark

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.

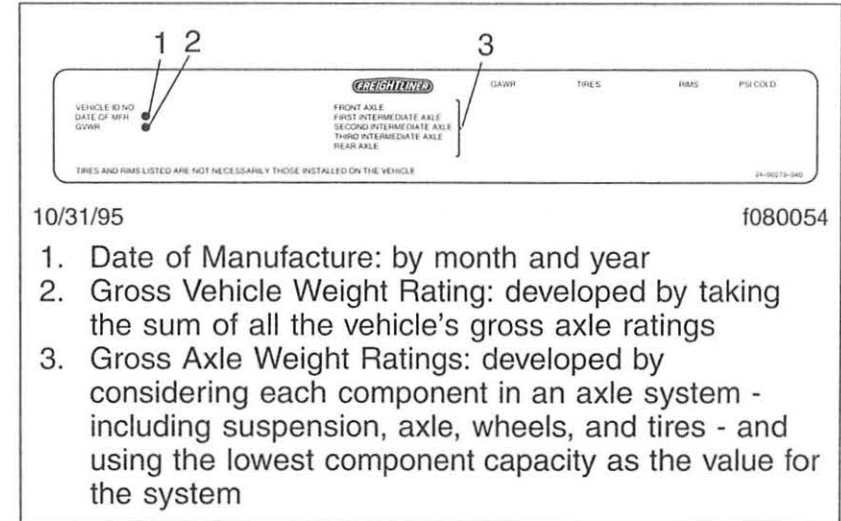


Fig. 1.6, Tire and Rim Label

See **Fig. 1.6** for U.S. and Canadian tire and rim labels.

EPA Vehicle Noise Emission Control Label

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

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

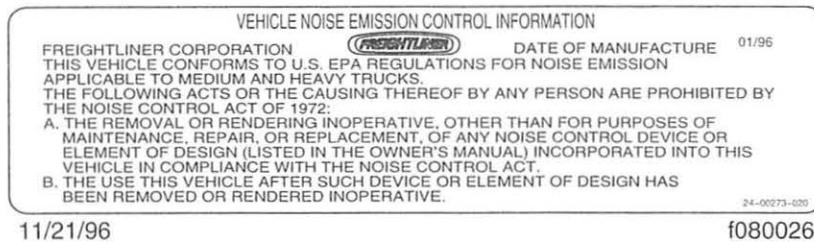


Fig. 1.7, Vehicle Noise Emission Control Label

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

Instruments and Controls Identification

Instrument and Control Panel	2.1
Controls	2.1
Instrumentation Control Unit, Level II	2.27
Instrumentation Control Unit, Level III (optional)	2.32
Meritor (Rockwell) WABCO® Antilock Braking System (ABS)	2.47
Collision Warning System, Optional	2.48
Instruments	2.55
Exterior Switches	2.63

Instruments and Controls Identification

Instrument and Control Panel

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

An instrumentation control unit (Ref. 7) houses all of the standard and optional warning and indicator lights. Warning messages and diagnostic fault codes will appear in the dash driver display screen. For more information on this system, see "Instrumentation Control Unit, Level II" or "Instrumentation Control Unit, Level III (optional)" in this chapter (depending on the type of unit installed in your vehicle). Some of the controls discussed in this chapter are not dash-mounted.

Controls

Ignition Switch and Key (Fig. 2.2)

The ignition switch has three positions: accessory, off, and on. In addition, the same key locks and unlocks the cab doors, baggage door(s), and, if equipped, the bunk door(s).

In the off position, the key slot is vertical; the key can be inserted and removed only in this position. The low-beam headlights, taillights, brake lights, road lights, dome lights, clearance lights, turn signals, hazard warn-

ing lights, utility and baggage lights, spotlights, horn, CB radio, power mirrors, cigarette lighter, clock, refrigerator, fuel heater, electric oil pan heater, and electric or diesel-fired engine-coolant preheaters can be operated in the off position (regardless of whether the key is inserted).

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

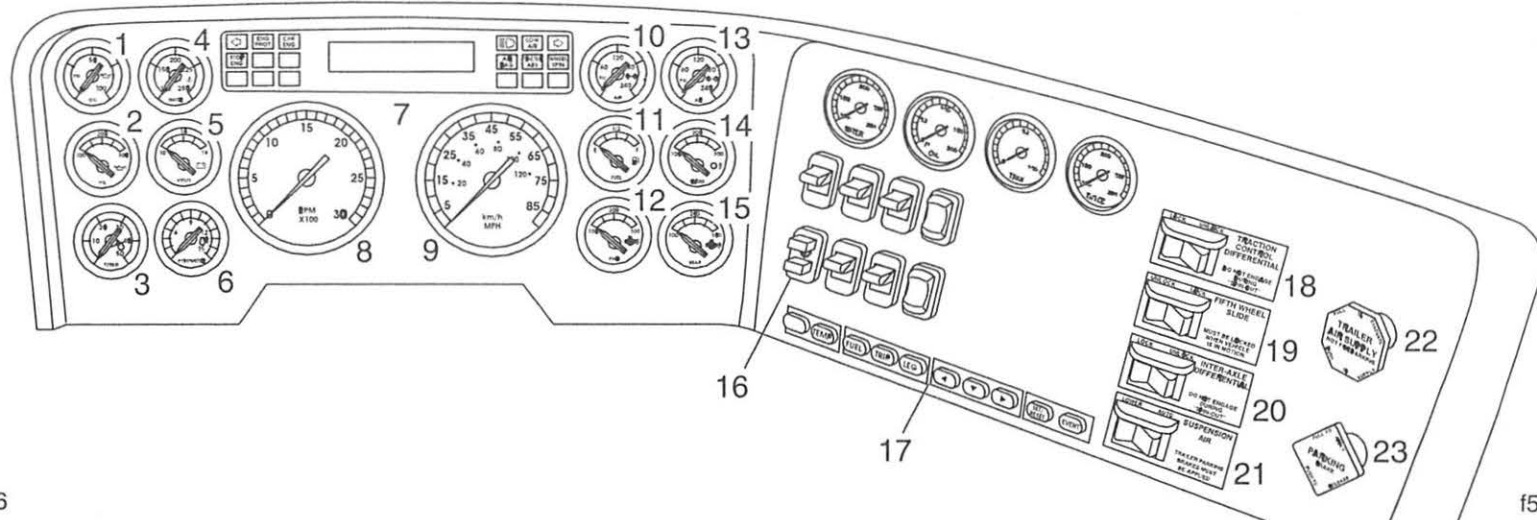
In the on position, the key is turned clockwise. All electrical systems are operable. Low air- and oil-pressure warning lights (or messages) and buzzer operate until the engine is started and pressure is built up. The engine can be started and operated only when the ignition switch is on.

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. The vehicle must not be driven unless the daytime running lights are activated.

Mirror Heat Switch, Optional

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

Instruments and Controls Identification



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

- | | | |
|---|---|--|
| 1. Oil Pressure Gauge | 9. Speedometer | 17. 10-Key Keypad |
| 2. Engine Oil Temperature Gauge (optional) | 10. Primary Air Pressure Gauge | 18. Controlled Traction Differential Control Valve Switch (optional) |
| 3. Turbocharger Boost Pressure Gauge (optional) | 11. Fuel Gauge | 19. Fifth Wheel Air Slide Control Valve Switch (optional) |
| 4. Coolant Temperature Gauge | 12. Forward Axle Oil Temperature Gauge (optional) | 20. Interaxle Differential Lockout Control Switch (optional) |
| 5. Voltmeter | 13. Secondary Air Pressure Gauge | 21. Air Suspension Dump Valve (optional) |
| 6. Pyrometer (optional) | 14. Transmission Oil Temperature Gauge (optional) | 22. Trailer Air Supply Valve |
| 7. Dash Message Center | 15. Rear Axle Oil Temperature Gauge (optional) | 23. Parking Brake Control Valve |
| 8. Tachometer | 16. Windshield Wiper/Washer Controls | |

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

Instruments and Controls Identification

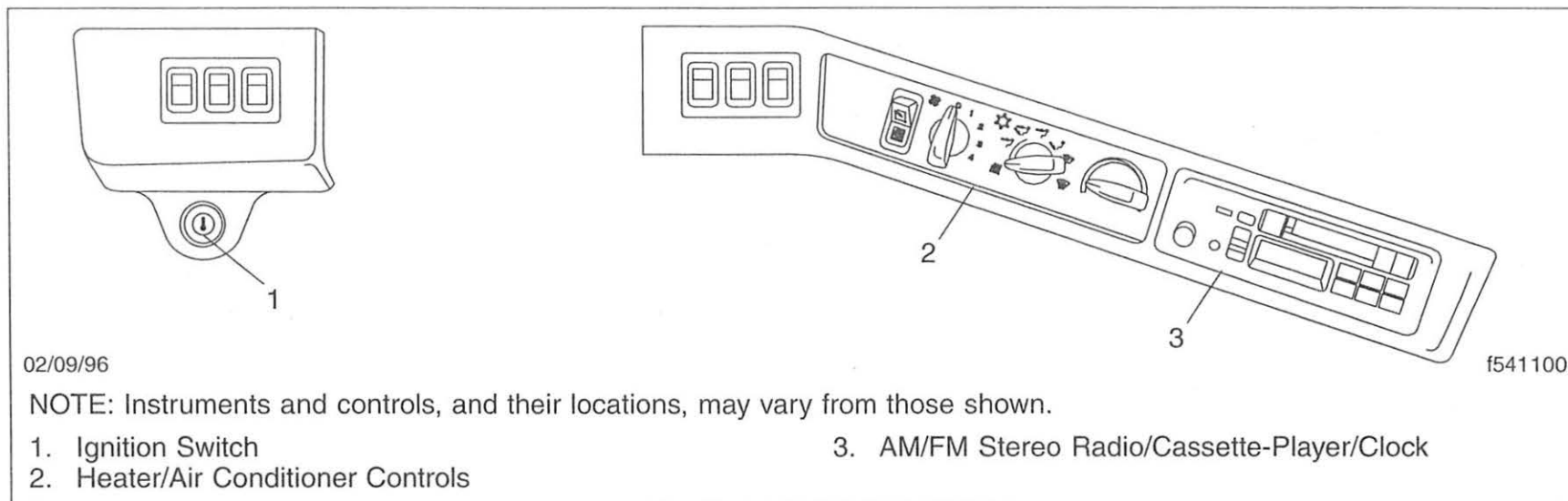


Fig. 2.2, Instrument and Control Panel Layout (lower dash shown)

Power Mirrors

Both outside mirrors can be equipped with an electrical remote control. Operate the driver door-mounted switch to adjust the mirror.

Detroit Diesel Electronic Engine Control (DDEC III[®]) Operator Control

IMPORTANT: This vehicle is equipped with an Instrumentation Control Unit (ICU) that provides warning messages and diagnostic fault codes. See "Instrumentation Control Unit, Level II" or "Instrumentation Control

Unit, Level III (optional)" in this chapter (depending on the type of unit installed in your vehicle).

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

DDEC III systems will shut down the engine if sensors indicate an emergency engine condition such as low coolant level, high coolant temperature, or high oil temperature. If such a condition occurs, the yellow "Check Engine" light on the dash will illuminate. If the problem

Instruments and Controls Identification

gets bad enough to cause possible engine damage, the DDEC III will gradually cut engine power down to 70 percent of original power. At that point, the red "Engine Protection" (ENG PROT) light will turn on, and thirty seconds later, DDEC III will shut down the engine (if programmed).

If DDEC III detects low oil pressure, both the "Check Engine" and "Engine Protection" lights will go on, and the engine will shut down in thirty seconds (if programmed).

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

By two switches on the instrument control panel (Fig. 2.3). The "Speed Control" (SPD CNTL) switch turns on the cruise control option, and the spring loaded "Resume/Accelerate-Set/Coast" (RSM/ACC-SET/CST) switch is used to select the cruise speed, or to resume cruise control after slowing down. For PTO operation, the "Spd Cntl" switch turns on the PTO and the "Rsm/Acc-Set/Cst" switch is used to either select or resume the engine operating speed.

or

By three optional buttons on the transmission shift knob (Fig. 2.4). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button

temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set" button is used to select the engine operating speed. See **Chapter 7** for complete instructions.

If the vehicle is equipped with Optimized Idle®, (Fig. 2.5), the cruise control "Spd Cntl" switch is also used to control this option. Optimized Idle can be used to keep the engine oil warm, recharge the battery, and maintain sleeper temperature when the vehicle is parked for long periods. See **Chapter 7** for more information and complete operating instructions.

Caterpillar C-10, C-12, and 3406E Electronic Engine Operator Control

IMPORTANT: This vehicle is equipped with an Instrumentation Control Unit (ICU) that provides warning messages and diagnostic fault codes. See "Instrumentation Control Unit, Level II" or "Instrumentation Control Unit, Level III (optional)" in this chapter (depending on the type of unit installed in your vehicle).

The Caterpillar C-10, C-12, and 3406E electronic engines use a computer (electronic control module) to automatically control engine timing and fuel injection. The electronic features of these engines include an electronic governor, fuel-to-air ratio control, programmable engine ratings, injection timing control, fault

Instruments and Controls Identification

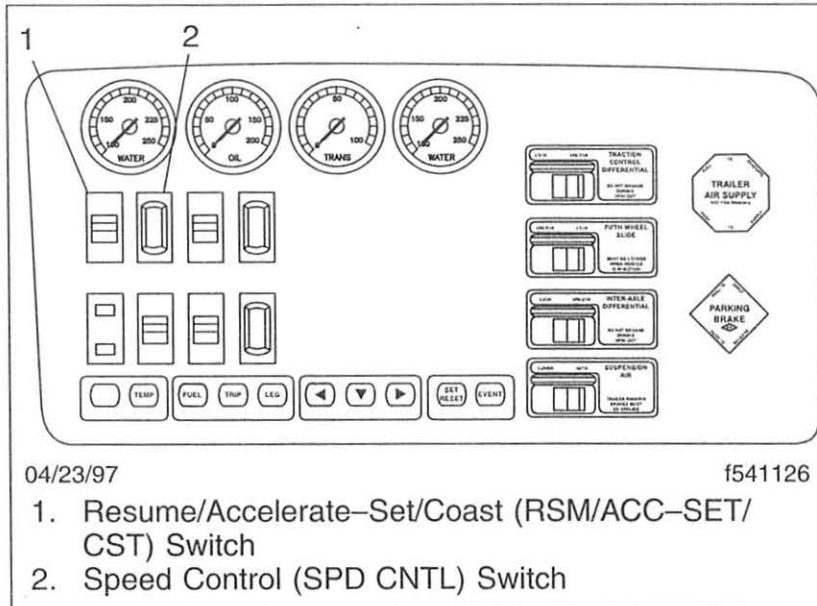


Fig. 2.3, Cruise Control Switches

analysis and recording, and a data link used for programming the electronic control module and troubleshooting the system.

All Caterpillar electronic engines have an engine check light located above the speedometer and tachometer. This warning light comes on or flashes if the engine oil pressure is low, the coolant temperature is high, the intake manifold air temperature is high, the coolant is low (optional), or whenever there is a problem within the electronic engine system. Some vehicles equipped with

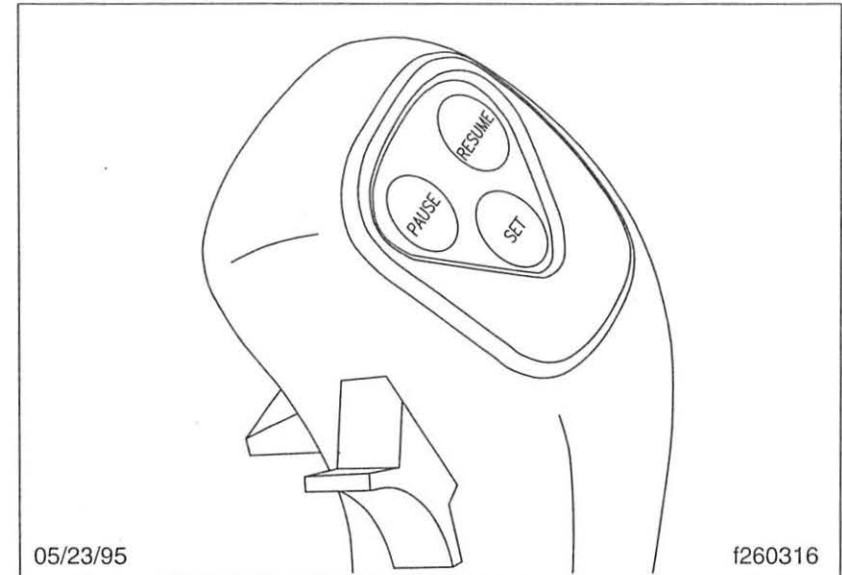


Fig. 2.4, Transmission Shift Knob Buttons

Caterpillar electronic engines have an automatic engine shutdown option. This option will shut off fuel to the engine if potentially damaging conditions are detected. Refer to the Caterpillar electronic engine troubleshooting manual for troubleshooting procedures.

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

By two switches on the instrument control panel (Fig. 2.3). The "Speed Control" (SPD CNTL) switch turns on the cruise control option, and the spring loaded

Instruments and Controls Identification

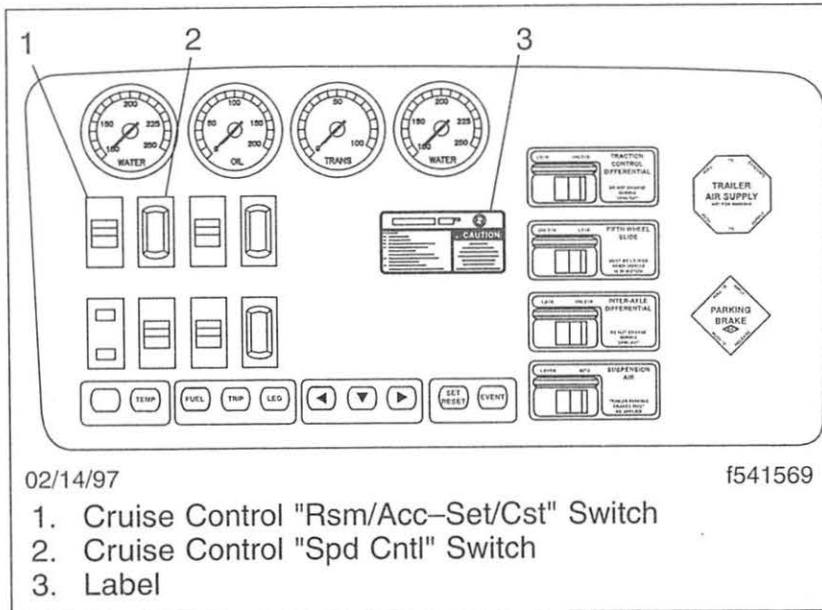


Fig. 2.5, DDEC III Optimized Idle Dash Label

"Resume/Accelerate-Set/Coast" (RSM/ACC-SET/CST) switch is used to select the cruise speed, or to resume cruise control after slowing down. For PTO operation, the "Spd Cntl" switch turns on the PTO and the "Rsm/Acc-Set/Cst" switch is used to either select or resume the engine operating speed. The dash-mounted cruise control switches are also used to check the electronic control module (ECM) for system faults when the engine is not running.

or

By three optional buttons on the transmission shift knob (Fig. 2.4). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set" button is used to select the engine operating speed. See **Chapter 7** for complete instructions.

BrakeSaver Control, Optional

The BrakeSaver (optional on Caterpillar 3406E engines) is operated by a lever mounted in the cab. The lever controls the amount of oil being directed through the BrakeSaver. The time required to fill the BrakeSaver with pressure oil to the point of maximum braking in the BrakeSaver is approximately 1.8 seconds.

Cummins CELECT™ Plus Electronic Engines Operator Control

IMPORTANT: This vehicle is equipped with an Instrumentation Control Unit (ICU) that provides warning messages and diagnostic fault codes. See "Instrumentation Control Unit, Level II" or "Instrumentation Control Unit, Level III (optional)" in this chapter (depending on the type of unit installed in your vehicle).

Instruments and Controls Identification

Cummins CELECT Plus is an electronic fuel control system. These electronic engines are controlled by a microprocessor-based computer. This computer controls specific engine and vehicle speed modes of operation to maximize vehicle fuel economy and performance.

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

The yellow check engine light and the red stop engine light warn the driver of a system fault during vehicle operation. If the yellow check engine light comes on while driving, some features will not work, but the vehicle can still be driven. If the red stop engine light comes on while driving, and if the engine will not accelerate, pull off the road and shut down the engine. The engine protection light alerts the driver of a possible engine fluid out of range condition. These conditions consist of: below normal engine oil pressure; above normal engine oil temperature; above normal engine coolant temperature; below normal coolant level; and above normal intake manifold air temperature. In any of these situations, have the problem repaired as soon as possible.

If the system is programmed to shut down, the engine will shut down 30 seconds after the red engine stop light comes on. The ignition switch will restart the engine after shutdown, but if the potentially damaging problem still exists, the engine will operate at the reduced speed or torque level allowed just prior to shutdown.

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

By two switches on the instrument control panel (Fig. 2.3). The "Speed Control" (SPD CNTL) switch turns on the cruise control option, and the spring loaded "Resume/Accelerate-Set/Coast" (RSM/ACC-SET/CST) switch is used to select the cruise speed, or to resume cruise control after slowing down. For PTO operation, the "Spd Cntl" switch turns on the PTO and the "Rsm/Acc-Set/Cst" switch is used to either select or resume the engine operating speed.

or

By three optional buttons on the transmission shift knob (Fig. 2.4). The "Pause" button allows the driver to temporarily interrupt cruise control. The "Resume" button allows the driver to resume the cruise speed after slowing down. The "Set" button allows the driver to select the cruise speed. For PTO operation, the "Pause" button temporarily interrupts PTO operation, the "Resume" button resumes PTO operation at the previously selected engine speed, and the "Set" button is used to select the

Instruments and Controls Identification

engine operating speed. See **Chapter 7** for complete instructions.

Ether Start, Optional

For cold-weather starting, the vehicle may be equipped with one of several automatic ether start systems. Refer to the engine operating instructions in **Chapter 7** for additional information.

Battery Isolator System, Optional

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

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

When the engine is not running, the gel cell provides all of the vehicle's electrical needs except for turning the starter motor.

The gel cell is longer-lived and cheaper to use than a standard wet cell, but it can take a charge only within an extremely narrow range—13.8 to 14.1 volts.

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



CAUTION

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

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

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

IMPORTANT: To recharge a gel cell, see an authorized Freightliner dealer or the instructions in the Century Class Workshop Manual.

Instruments and Controls Identification

Road Light Switch, Optional

The road light switch operates the road lights, mounted on the bottom edge of the front bumper or recessed in the front bumper.

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

For vehicles built to operate in Canada, the marker lights must be on before the road lights can be turned on.

Utility Light Switch, Optional

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

Panel Lamp Control Switch

The circuit to the panel lamps is activated by the headlight switch. When the headlights are on, the panel lamp switch controls the intensity of the instrument panel lamps. Slide the switch up to brighten them and down to dim them.

Headlight Switch and Daytime Running Lights

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

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. The vehicle must not be driven unless the daytime running lights are activated.

Interrupt Switch

A spring-loaded interrupt switch temporarily deactivates the marker lights and taillights. With the vehicle lights on, raise and release the interrupt switch to briefly turn off the marker lights and taillights. To alert the driver that the switch is functioning, the dash lights will flash with the marker lights when the switch is actuated.

Instruments and Controls Identification

Windshield Wiper/Washer Controls

(Fig. 2.6)

The wipers are operated by a double-paddle switch mounted on the auxiliary instrument panel. The top paddle, when pushed in, turns the wipers on (if they are off) or off (if they are on). When it is pushed up, the top paddle switches the wipers to high speed; when it is pushed down, it switches them to low speed.

The bottom paddle, when pushed in, turns the washers on. When pressed for less than 1/2-second, the wipers will perform a single, low speed dry wipe (mist function).

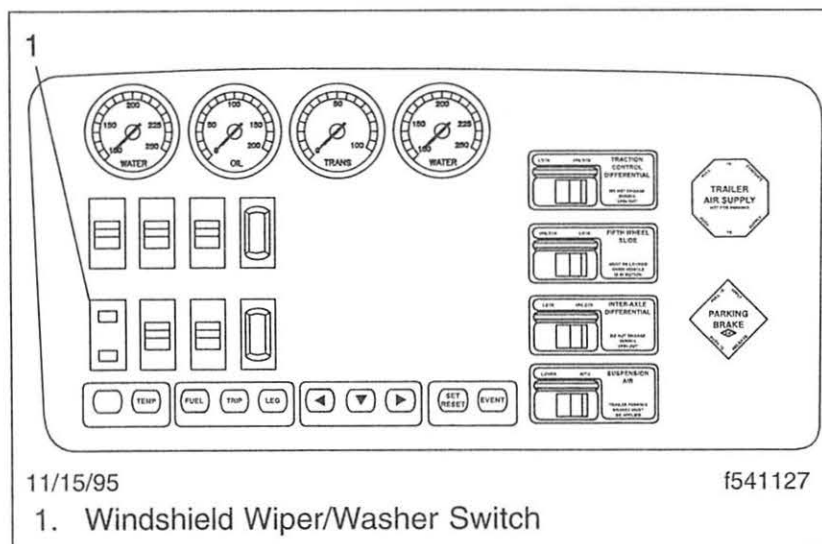


Fig. 2.6, Instrument Panel

When pressed for more than 1/2-second, the wash cycle begins and continues for three cycles or until the paddle is released. When the bottom paddle is pushed up, the wipers operate in fast delay. When the bottom paddle is pushed down, the wipers operate in slow delay. With the wipers in delay mode (fast or slow), push the bottom paddle up to shorten the delay period, or push the paddle down to lengthen it.



CAUTION

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

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

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

Heater/Air-Conditioner Controls (Fig. 2.7)

Heater/air conditioner controls consist of a four-speed fan switch, an air selection switch, a temperature control switch, and a fresh air/recirculation switch. Refer to **Chapter 4** for detailed operating instructions of the heater/air conditioner.

Instruments and Controls Identification

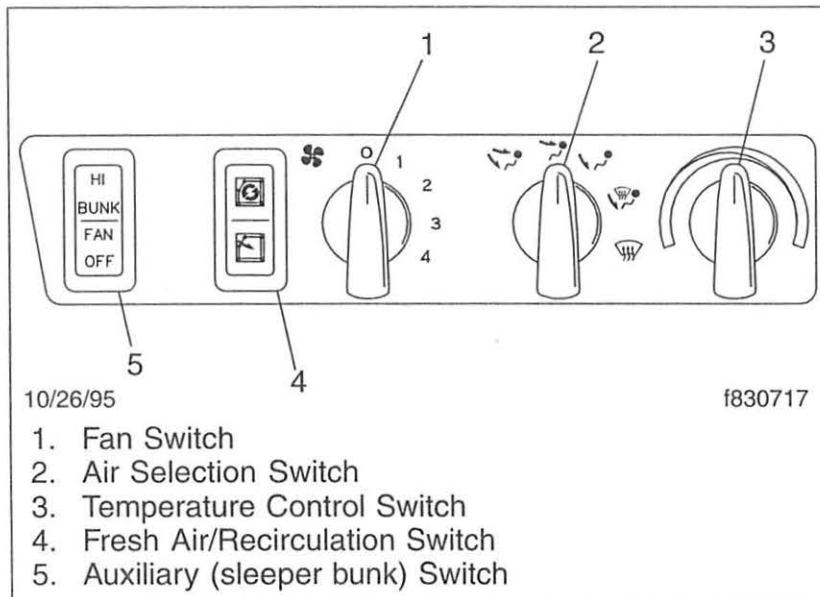


Fig. 2.7, Heater/Air Conditioner Controls

Jacobs Engine Brake Switch, Optional

The Jake Brake is controlled by a dash-mounted paddle switch which controls the degree of engine braking. Refer to **Chapter 7**, under the heading "Engine Braking System, Optional," for additional information.

Interaxle Differential Lockout Control Valve Switch (Fig. 2.8)

Differential lockout, 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.

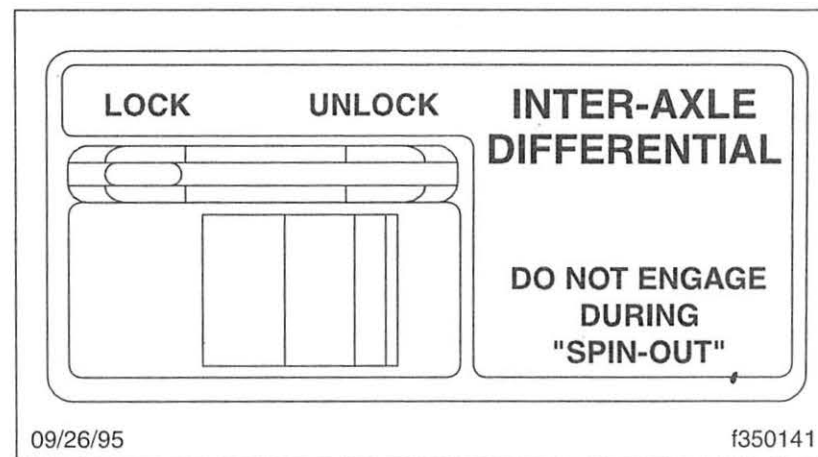


Fig. 2.8, Interaxle Differential Lockout Switch

Instruments and Controls Identification

Fifth Wheel Air Slide Control Valve Switch, Optional Air-Operated Sliding Fifth Wheel (Fig. 2.9)

The fifth wheel air slide valve permits 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 base-plate. Moving the switch to the unlock position activates the control valve and unlocks the fifth wheel slide mechanism, allowing changes to the total length of the tractor-trailer and changes to axle loads, to comply with varying state or provincial laws. A red indicator light, if so equipped, is illuminated whenever the fifth wheel

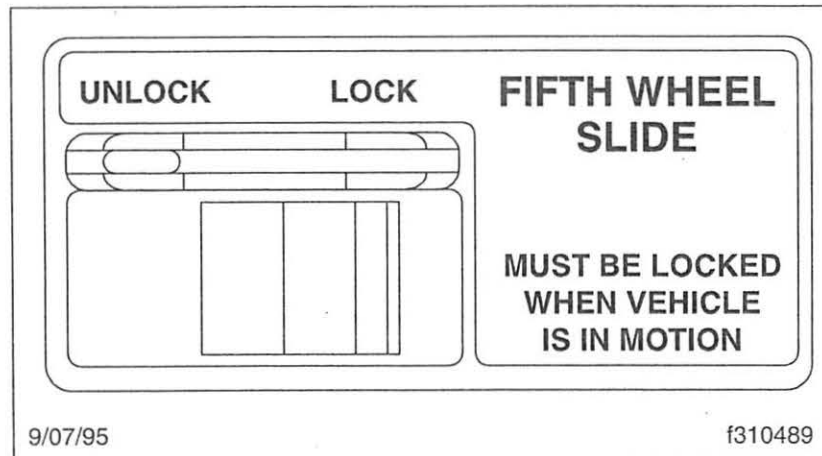


Fig. 2.9, Fifth Wheel Air Slide Switch

slide is unlocked. A guard is positioned around the switch to minimize accidental activation.



CAUTION

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.

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

The yellow diamond-shaped knob (Ref. 2) operates the parking brake valve. Pulling the knob applies both the tractor and the trailer spring parking brakes. Pushing in the knob releases the tractor spring parking brakes. Before the spring parking brakes can be released, the air pressure in either air brake system must be at least 65 psi (447 kPa).

The red octagonal-shaped knob (Ref. 1) operates the trailer air supply valve. After the vehicle and its air hoses are connected to a trailer, and the pressure in the air system is at least 65 psi (447 kPa), the trailer air supply valve knob must be pushed in (and should stay in) to charge the trailer air supply system and release the trailer spring parking brakes. Before disconnecting a trailer, or when operating a vehicle without a trailer, the trailer air supply valve knob must be pulled out.

Instruments and Controls Identification

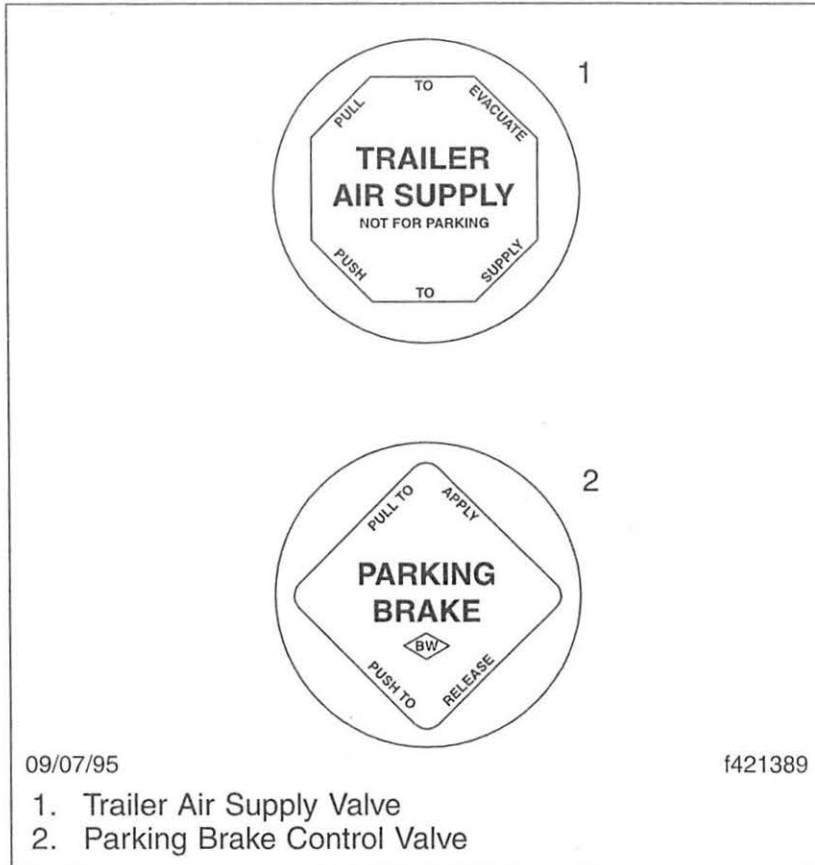


Fig. 2.10, Brake Valves

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

Controlled Traction Differential Control Valve Switch (Fig. 2.11)

A controlled traction differential feature is included or available as an option on some rear axles. A control valve switch engages and disengages the controlled traction feature. A guard is positioned around the switch to minimize accidental activation.

Refer to **Chapter 9** for complete operating instructions.

Air Suspension Dump Valve, Optional (Fig. 2.12)

The air suspension dump valve allows the air in the vehicle air suspension to be quickly exhausted, lowering the rear of the vehicle. This makes it easier to connect to or disconnect from a trailer. A control valve switch exhausts and fills the air suspension. To exhaust air from the suspension, move the switch to "LOWER." A guard is positioned around the switch to minimize accidental activation.



CAUTION

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

Instruments and Controls Identification

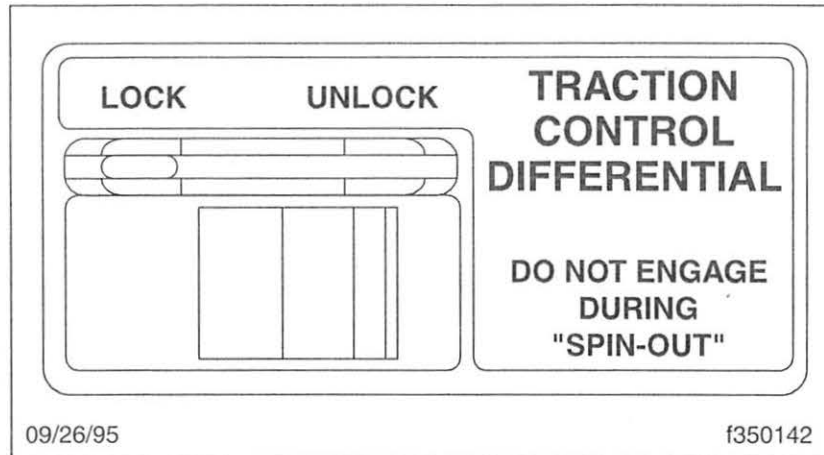


Fig. 2.11, Controlled Traction Differential Switch

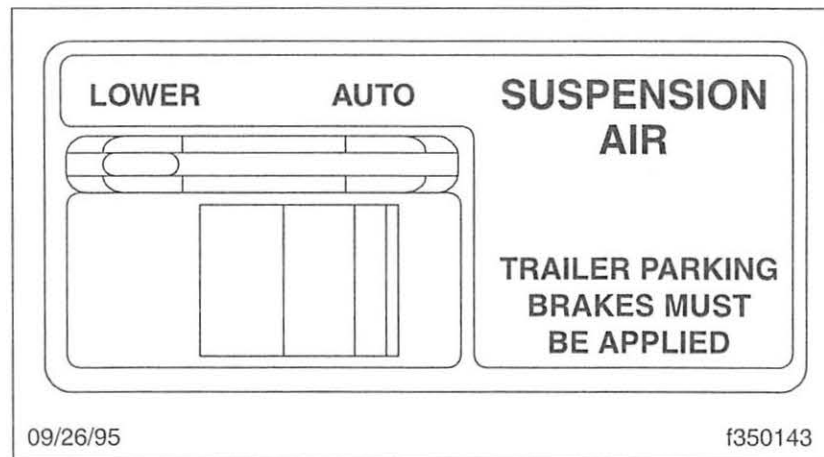


Fig. 2.12, Air Suspension Dump Valve

Automatic Engine Idler/Timer, Optional

A Henke automatic engine idler/timer allows the driver to select the idle time required for engine shutdown. The driver can turn off the ignition, remove the ignition key, lock the vehicle, and leave it with the engine idling; the automatic timer will shut the engine off at the end of the selected time.

Cigarette Lighter

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

CB Radio Connections

An antenna connection and positive (+) and negative (-) power connections are provided for a CB radio.

Turn Signal Lever (Fig. 2.13)

The turn signal lever (Ref. 1) is mounted on the steering column. Pushing the lever counterclockwise turns on the left-hand turn signal lights; pushing it clockwise turns on the right-hand signal lights. When one of the signal lights is on, a green indicator light flashes at the far left or far right of the warning and indicator light panel. To cancel the signal, return the lever to the neutral position.

Instruments and Controls Identification

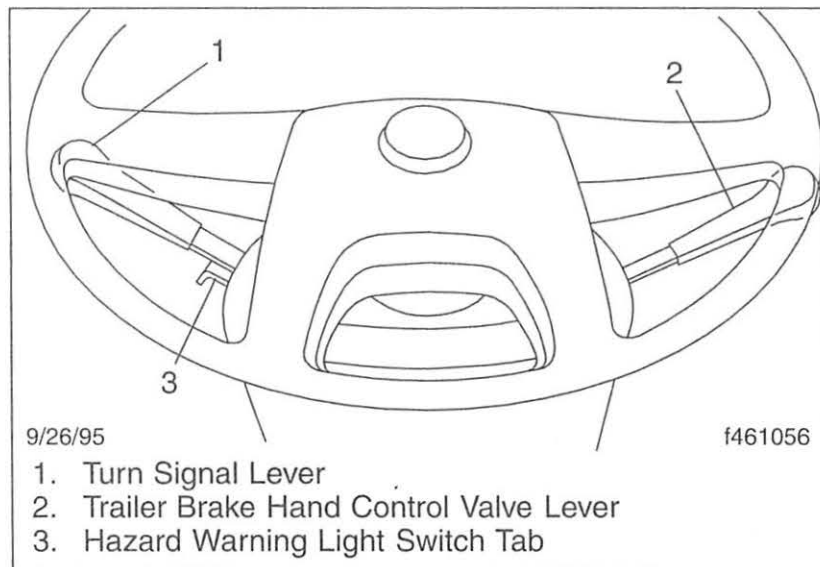


Fig. 2.13, Steering Column-Mounted Controls

Hazard Warning Light Switch Tab (Fig. 2.13)

The hazard warning light switch tab (Ref. 3) is located below the lever on the turn signal switch. Hazard warning lights are operated by pulling the tab out. When the hazard warning light switch tab is pulled out, all of the turn signal lights and both of the indicator lights on the control panel will flash. To cancel the warning lights, move the turn signal lever up or down.

Headlight Dimmer

Pull the turn signal lever toward the steering wheel to change from low-beam to high-beam headlights, or from high beam back to low beam.

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

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

Trailer Brake Hand Control Valve Lever (Fig. 2.13)

This lever (Ref. 2) is used for applying the trailer brakes without applying the truck or tractor brakes and is mounted on the steering column. Refer to **Chapter 6**, under the heading "Brake System," for operating instructions.

Transmission Controls

If so equipped, the transmission range control valve and splitter valve are attached to the gearshift knob. Transmission shift pattern labels are located inside the cab.

Refer to **Chapter 8** for complete transmission operating instructions.

Allison Automatic Transmission Controls

Allison HD-series automatic transmission models are controlled by an electronic control unit (ECU). The ECU processes information from sensors, pressure switches, and the shift selector (**Fig. 2.14**) to automatically control the transmission according to programmed specifications.

Vehicles with these transmissions have a red do-not-shift light in the lens and bezel assembly. Also, there is a service light in the indicator panel on the shift selector. With the ignition switch on, both lights come on for a few seconds; then, if there is no problem with the transmission system, the lights will go out. Whenever there is a problem with the transmission system, the lights will come on and stay on as long as the problem exists.

If "service" is displayed in the indicator panel, some features may not work, but the vehicle can still be driven. If the do-not-shift light comes on while driving (accompanied by eight short beeps from the shift selector), operating limits will be placed on the transmission, such as restricting upshifts and downshifts. However, the vehicle can still be driven to reach service assistance. In either situation, have the problem repaired as soon as possible. Refer to the Allison Transmission Service Manual for troubleshooting procedures.

Refer to **Chapter 8** for complete transmission operating instructions.

Suspension Seat Adjustment Controls

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

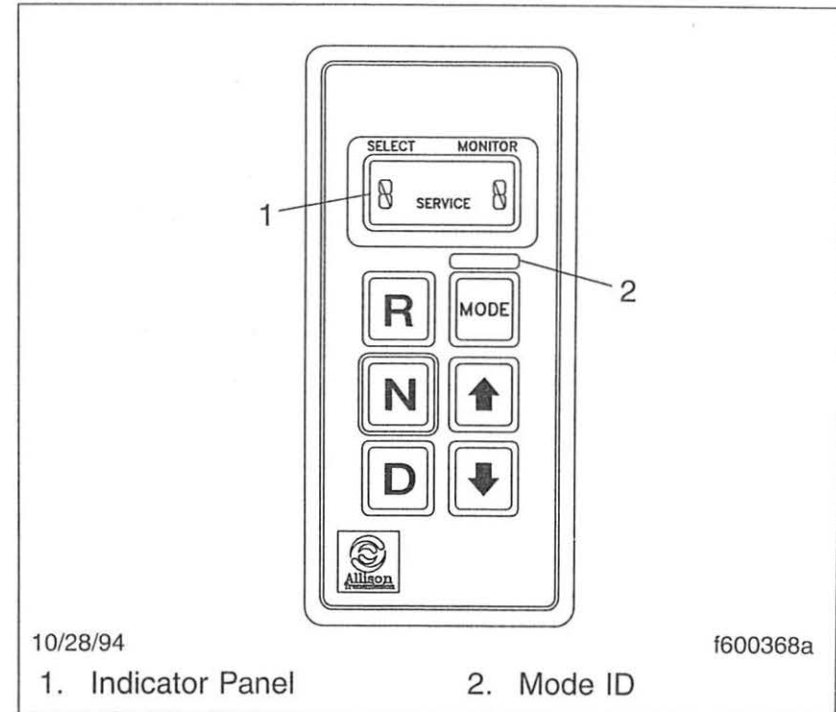


Fig. 2.14, Allison Pushbutton Shift Selector

Instruments and Controls Identification

so that the seat back contacts the backwall. It is the responsibility of the driver to adjust the seat to prevent damage to the seat and the cab interior.

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

Interior Light Controls

The interior lights include dome lights, red map lights, clear reading lights, and courtesy lights.

Day cabs are available with an optional rear wall fluorescent light in the cab.

SleeperCabs have additional lights in the bunk area, including bunk reading lights, under-bunk lights (baggage compartment lights), and fluorescent lights.

Dome Light Switches

Diffuse dome lights are installed on all cabs. See **Fig. 2.15** and **Fig. 2.16**. The dome lights are located either on the overhead console, or on the cab roof (if no overhead console is installed). Both dome lights turn on when either the driver's or passenger's door is opened. The dome lights can also be turned on by pressing in on the light lens.

Red Map Light Switches

Red map lights are available on all cabs. See **Fig. 2.15** and **Fig. 2.16**. They are located next to the dome lights in the same fixture. Like the dome lights, the map lights can be turned on by pressing in on the light lens.

Clear Reading Light Switches (Optional—SleeperCabs Only)

Clear reading lights are available on SleeperCabs only. See **Fig. 2.15**. They are located next to the dome lights in the same fixture. Like the dome lights, the reading lights can be turned on by pressing in on the light lens.

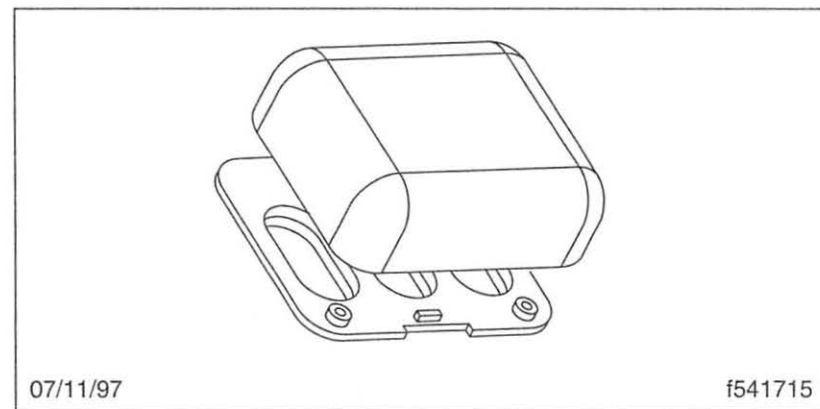


Fig. 2.15, Dome/Tray, Red Map, and Clear Reading Lights (SleeperCab)

Instruments and Controls Identification

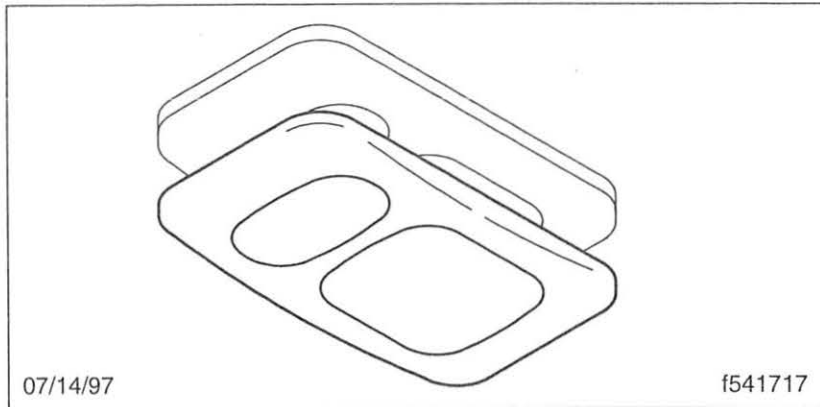


Fig. 2.16, Dome Light with Red Map Light

Courtesy Light Switch (Optional)

Courtesy lights are available on all cabs. They illuminate the footwell area on both sides of the cab. The driver's courtesy light (**Fig. 2.17**) is attached to the steering column and the passenger's footwell light (**Fig. 2.18**) is located on the lower right dash panel. To turn on the courtesy lights, press the rocker switch on the dash. When the lights are on, the switch is illuminated by a light inside it.

Rear-Wall Fluorescent Light Switches (Optional)

A rear-wall fluorescent light (**Fig. 2.19**) is available on all raised roof cabs. It is located on the rear wall where the wall meets the roof. To turn on the rear-wall fluorescent

light, press the rocker switch on either the lower or upper bunk control panels (**Fig. 2.20**).

Mid-Roof Fluorescent Light Switches (SleeperCabs Only)

A mid-roof fluorescent light (curtain bow light) is standard on SleeperCabs only. It is located on the ceiling in the middle of the cab where the curtain is drawn to separate the bunk area from the rest of the cab. See **Fig. 2.19**. To turn on the mid-roof fluorescent light, press the rocker switch on the dash, or on either the lower or upper bunk control panels (**Fig. 2.20**).

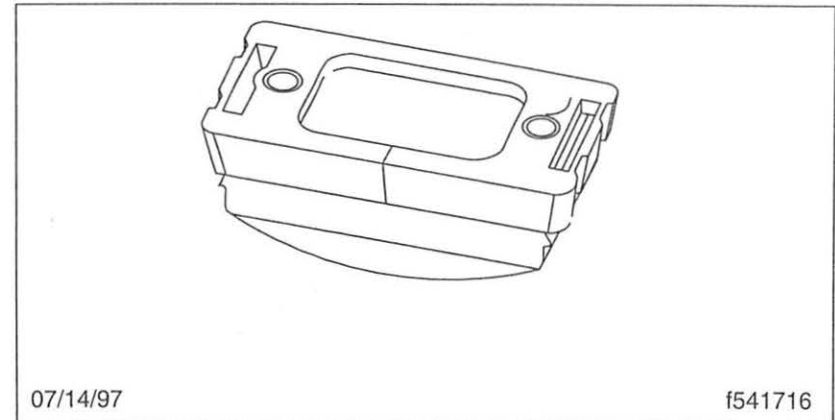


Fig. 2.17, Driver's Floor Courtesy Light

Instruments and Controls Identification

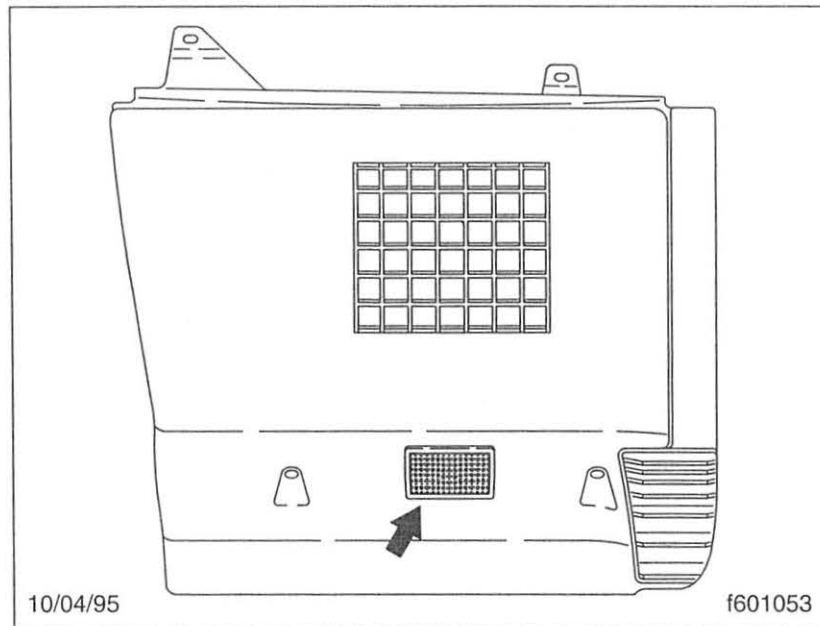


Fig. 2.18, Passenger's Footwell Courtesy Light

Bunk Reading Light Switches (Optional—SleeperCabs Only)

Bunk reading lights are high-intensity reading lights for use when reading in the bunk. They are located on the bunk control panel for each bunk. To turn on the bunk reading lights, press the rocker switch on the bunk control panel that holds the light. See **Fig. 2.20**.

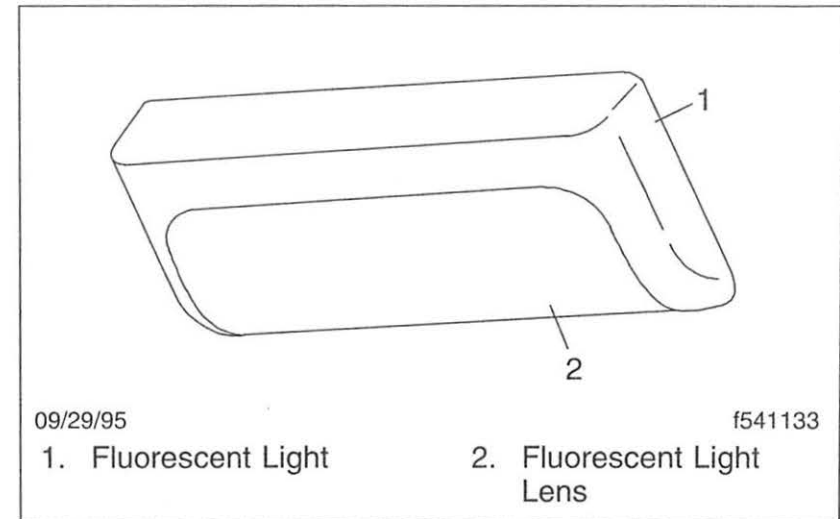


Fig. 2.19, Mid-Roof Fluorescent

Baggage Compartment Light Switches (SleeperCabs Only)

Baggage compartment lights are on all cabs. One light is located on each side of the cab on the underside of the lower bunk and illuminates the baggage compartment; both lights turn on when either baggage compartment door is opened. The lights also come on when the lower bunk is raised See **Fig. 2.21**.

Tilt Steering Wheel, Optional (Fig. 2.22)

The optional tilt steering wheel control pedal is located to the left of the clutch pedal.

Instruments and Controls Identification

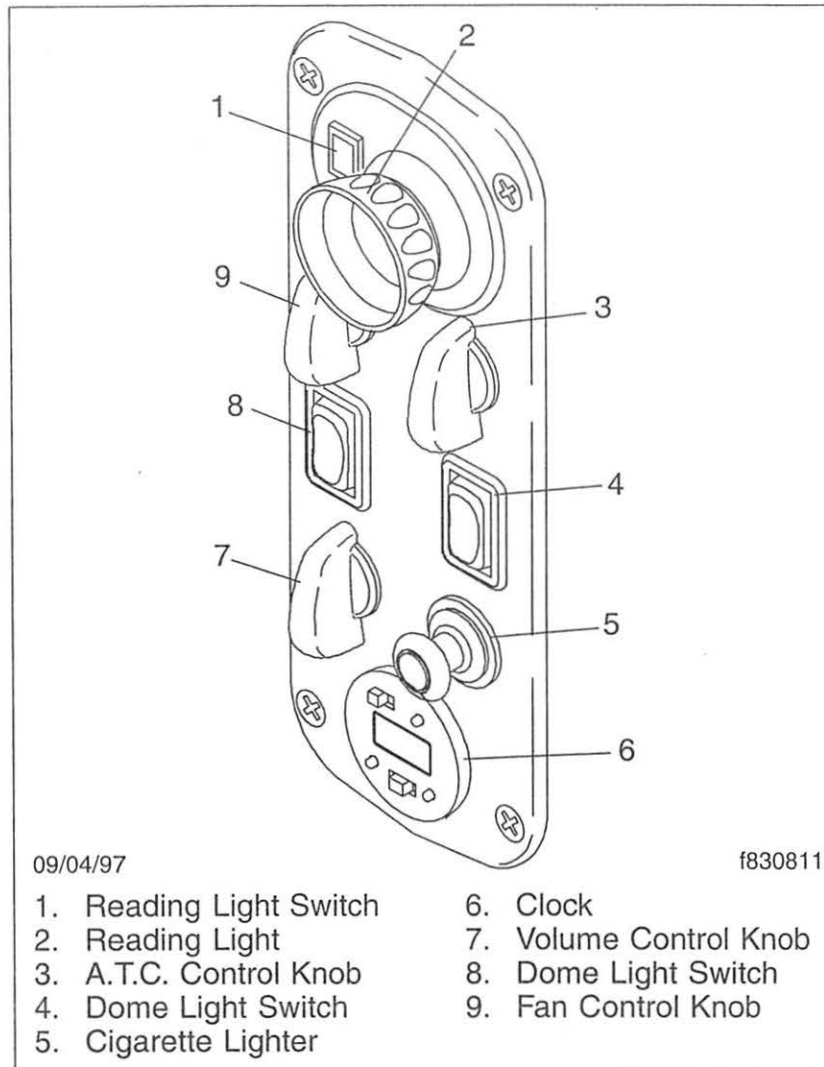


Fig. 2.20, Bunk Reading Light and Control Panel

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

WARNING

Make sure that the control pedal is released and the steering column is locked before driving the vehicle. Never try to tilt the column while driving the vehicle. Doing so could cause loss of vehicle control, personal injury, and property damage.

AM/FM Stereo Radio/Cassette-Player/Clock (Fig. 2.23)

An optional digitally tuned AM/FM stereo radio or radio/cassette player is located on the dash panel or in the overhead console.

The radio controls include a detent volume knob (adjustments are made in fixed increments), a bass and treble control, three preset radio-station rocker buttons, speaker balance control, an LCD (liquid crystal display) frequency/time display, and a built-in clock.

There are three methods of selecting radio stations:

- Preset station selection, which tunes in a preset station on the AM or FM band by using one of the

Instruments and Controls Identification

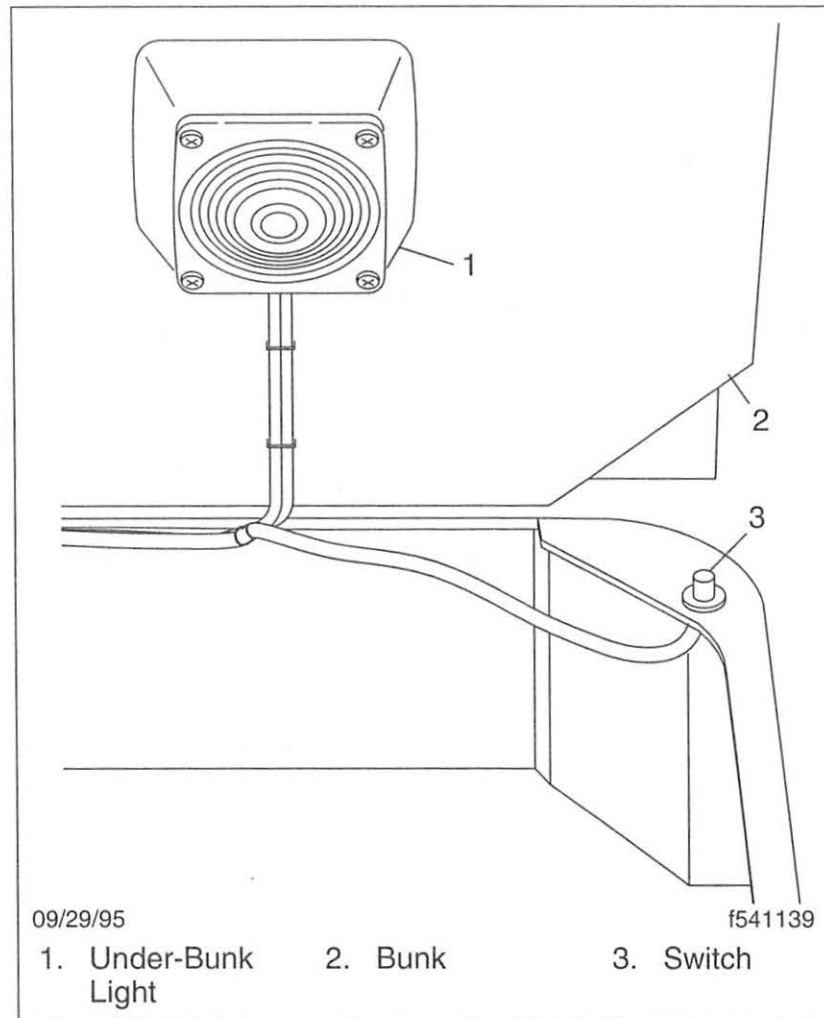


Fig. 2.21, Baggage Compartment Light

three rocker buttons. Each rocker button has two positions—upper and lower—for a total of six numbered positions.

- Manual tuning, which allows you to move up or down the dial, much like a conventional tuning knob.
- Seek tuning, which automatically advances to the next station up or down the dial.

The optional cassette player features the following:

- Automatic reverse, which allows you to listen to each side of a cassette without removing it from the player.
- Reel rotation detector, which senses tape slack in the cassette, and automatically reverses it to take up the slack.
- Tape direction indicator, which shows the direction the tape is moving in the player. An arrow pointing to the right means the tape is playing in the forward mode; an arrow to the left means the tape is playing in the reverse mode.
- Metal tape playing capability.

The radio has a built-in 12-hour clock (it does not distinguish between AM and PM). The time is displayed continuously on the LCD, except when you search for or select a radio station, or use the cassette player.

Instruments and Controls Identification

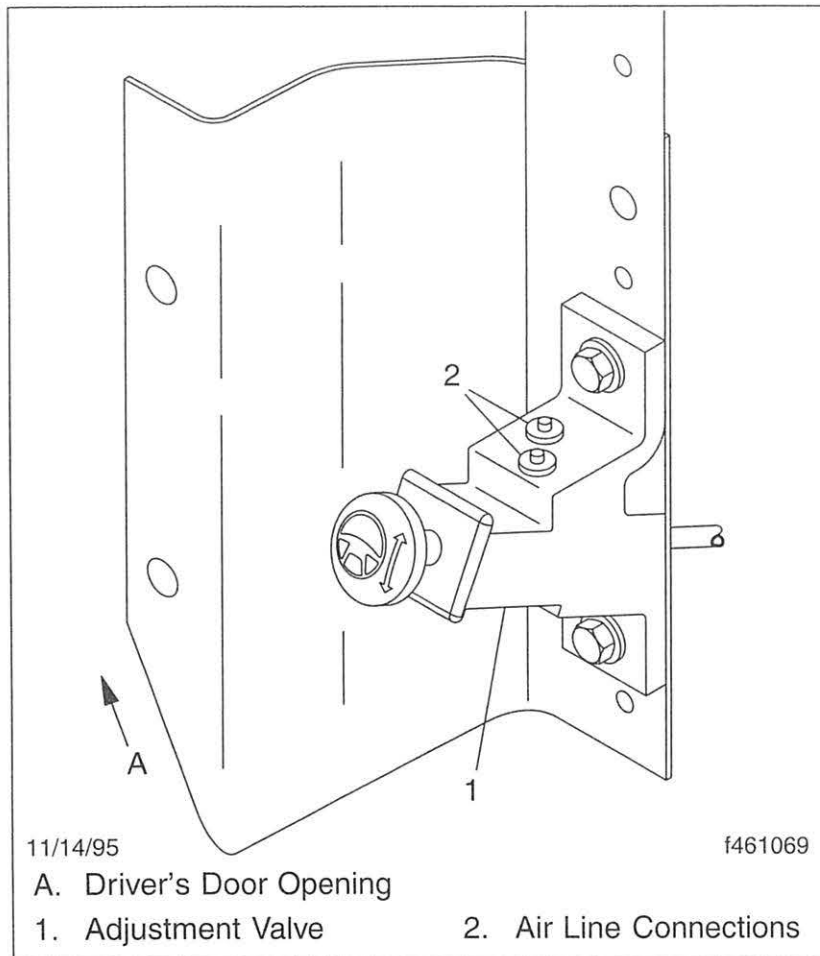


Fig. 2.22, Tilt Steering Wheel Control Pedal

The speakers are located either above and to the rear of each cab door, or at each end of the overhead console (if the vehicle is so equipped). Four-speaker systems have two additional speakers in the sleeper.

Radio Operation (Fig. 2.23)

1. Place the ignition switch in either the "On" or "Acc" (accessories) position. Turn the power/volume/balance control (Ref. 5) knob clockwise until it clicks. Continue turning until you reach the desired volume. To turn off the radio, turn the knob counterclockwise until it clicks.
2. Adjust the sound balance by pulling out on the power/volume/balance knob and turning it in either direction until the desired balance between the right and left speakers is reached. On a four-speaker system, adjust the balance between the front and rear speakers by turning the outer ring, or "fader control" (Ref. 4).
3. Select either AM, FM1, or FM2 using the band selection button (Ref. 3). The band selected is displayed on the clock/frequency LCD (Ref. 7) along with "ST" if the program is being received in FM stereo. Each push of the button will select a different band. "FM 1" and "FM 2" allow each position on the preset station rocker buttons (Ref. 12) to be set for two different FM stations.

Instruments and Controls Identification

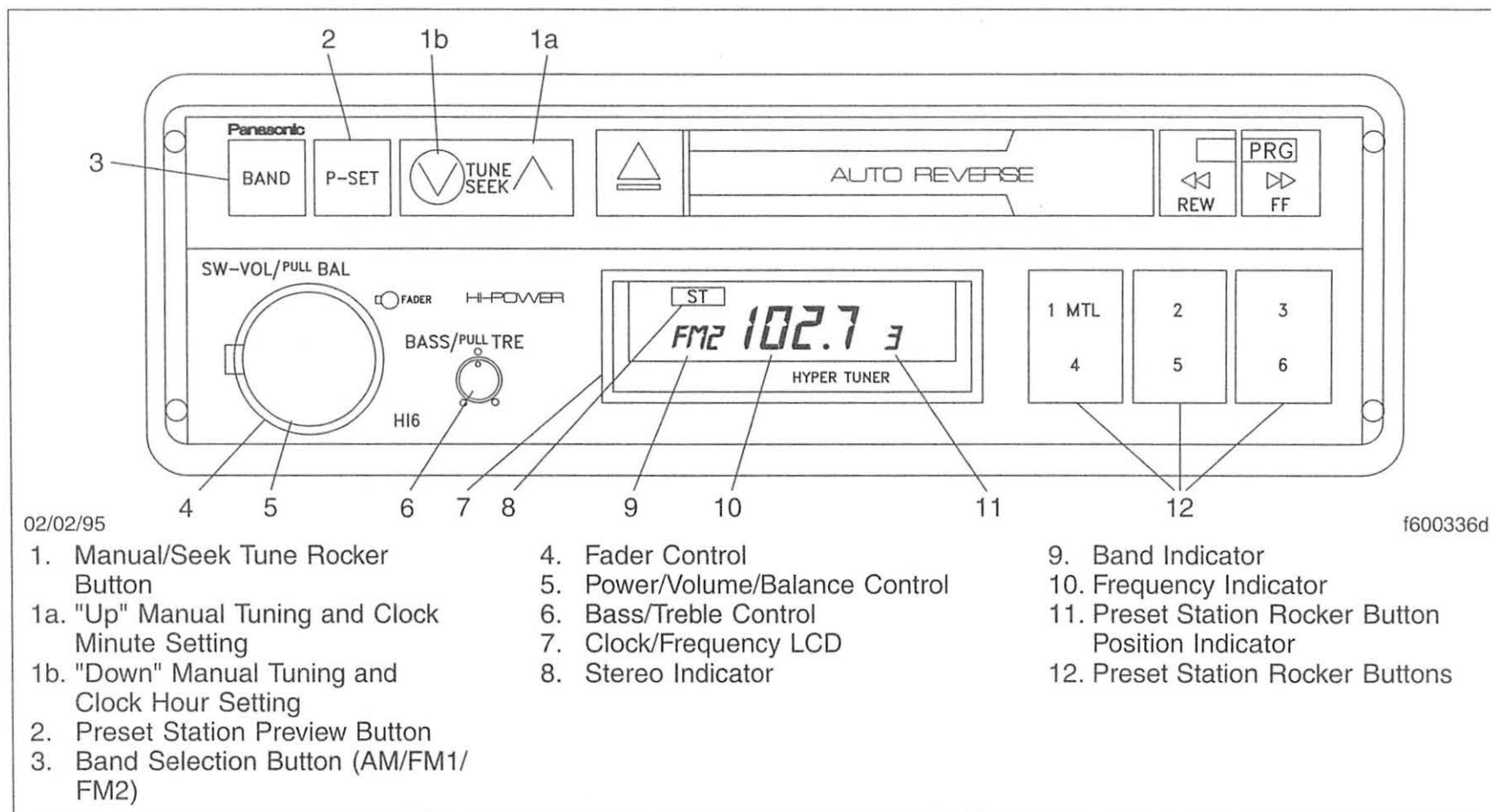


Fig. 2.23, Radio/Clock Controls

4. Adjust the bass/treble control (Ref. 6). Turn the knob in either direction until the desired bass re-

sponse is reached, then pull out on the knob until it

locks, and turn it in either direction until the desired treble response is reached.

Selecting Radio Stations (Fig. 2.23)

Select radio stations using the following instructions.

IMPORTANT: When listening to a station not selected by a preset station rocker button, be careful not to accidentally press any rocker button for longer than two seconds. Otherwise, the previously programmed selection will be replaced by the new selection.

- *Preset station rocker buttons* (Ref. 12): Select the desired band (AM, FM1, or FM2), using the band selection button (Ref. 3). Press a numbered position on one of the preset station rocker buttons, and the station selected is displayed briefly on the LCD.
- *Manual/seek tune rocker button* (Ref. 1): Select the desired band (AM, FM1, or FM2), using the band selection button.

To manually tune, push and release either the left (down) or right (up) side of the rocker button (see Refs. 1a and 1b). The tuner will advance to the next frequency up or down the dial, and stop. Each time the button is pushed, the tuner will advance to the next frequency. This function can be used for fine tuning.

To seek tune, press and hold the left (down) or right (up) side of the rocker button. The tuner will advance up or down the dial to the next station, pause for about two seconds, then advance to the next station, and so on. Release the button to stop at the desired station.

- *Preset station preview button* (Ref. 2): Select the desired band. Press the button marked "P-Set." The tuner will continuously scan the preset stations (up to 12 on the FM dial—six on FM1 and six on FM2—and six on the AM dial). Each station and its band, plus its rocker button position number (1 through 6), will be displayed, and will blink for several seconds. The tuner will then advance to the next preset station on the dial. To choose a particular preset station, press the "P-Set" button again, when the station is displayed.

Presetting Radio Stations (Fig. 2.23)

Each preset station rocker button can "remember" two AM stations and four FM stations. Using all three buttons in both the upper and lower positions, a total of 18 stations (six AM, six FM1, and six FM2) can be preset, as follows:

1. Select the desired band (AM, FM1, or FM2), using the band selection button.
2. Tune in the desired station.

Instruments and Controls Identification

- Press and hold one of the preset station rocker buttons (Ref. 12) in the upper or lower position-the sound will cut out for about three seconds. Hold the button down until the sound comes back, then release it. The station is now entered in the system's memory, and will be displayed on the LCD.

Stereo Cassette Player Operation (Fig. 2.24)

IMPORTANT: Because tape residue and dust on the tape heads reduce sound quality, periodically clean the heads, using a commercially available head cleaning tape. Follow the tape manufacturer's instructions.

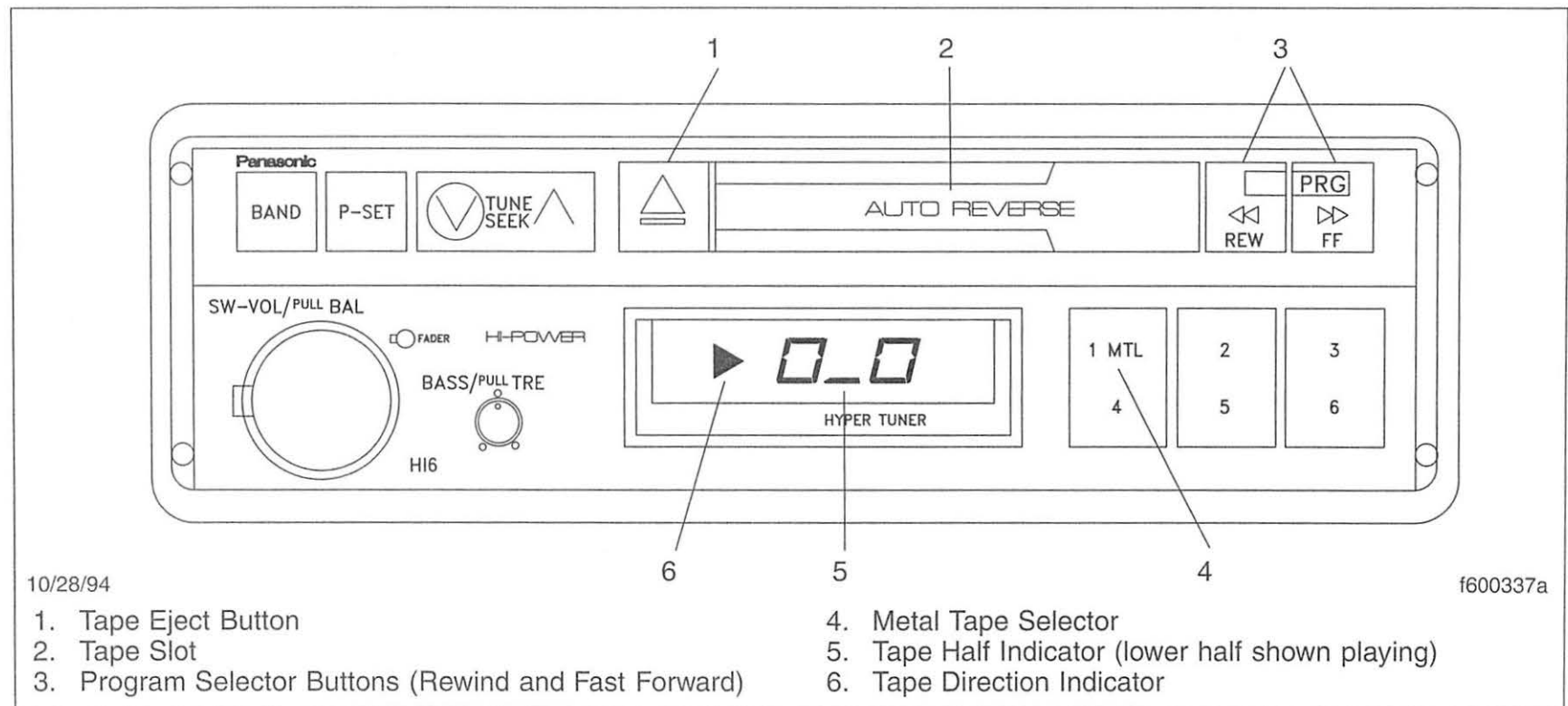


Fig. 2.24, Cassette Player Controls

Instruments and Controls Identification

1. Turn on the radio, and then insert the cassette into the tape slot, with the exposed tape side facing to the right, as shown in **Fig. 2.25**. Push the cassette in until the mechanism catches it. Playback will start immediately, and continue until you eject the cassette.

If you are playing a metal tape, press the left-hand preset station rocker button marked "Mtl" (**Fig. 2.24**, Ref. 4).

NOTE: Repeated reversing of the tape by the automatic reverse feature may indicate a problem with the cassette.

2. Select the direction of the tape play (program) by pressing both the rewind and the fast forward button (Ref. 3) at the same time. The tape direction indicator will display the direction and which side of the tape is playing. See Refs. 5 and 6.
3. To start fast forward or rewind, press one of the program selection buttons (fast forward or rewind) as shown in **Fig. 2.26** (the tape direction indicator will blink during fast forward or rewind):

To stop fast forward or rewind, push the other (opposite) program selection button halfway in.
4. To eject a cassette, push the eject button (**Fig. 2.24**, Ref. 1). The cassette will pop out, and the radio will come back on. To protect the cassette from contamination, always remove it from the slot when it's not being played.

Setting the Time (Fig. 2.27)

NOTE: This unit has a 12-hour clock; it does not distinguish between AM and PM.

Set the time as follows:

1. Turn on the power. The radio frequency (station) is displayed on the LCD.
2. Press and hold the band selection button. The current station will be displayed on the LCD, unless the

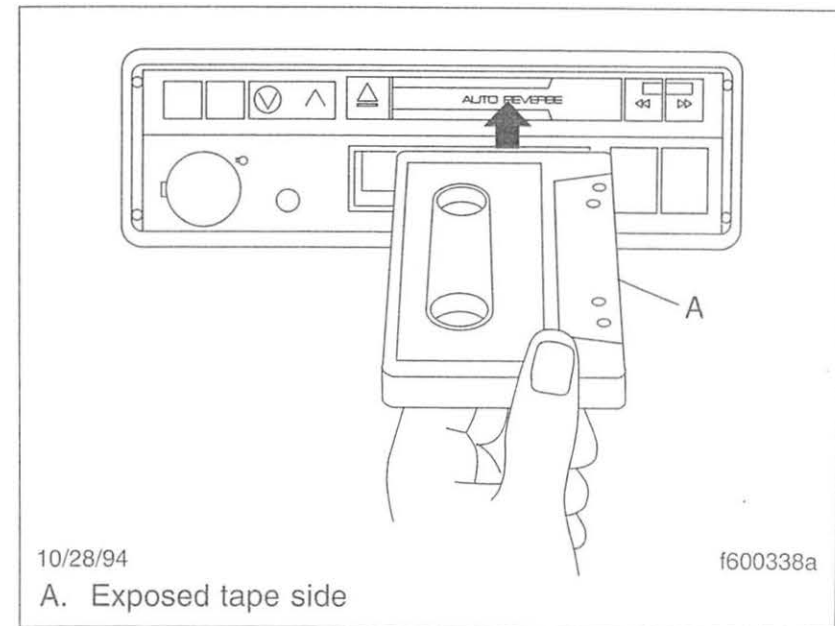


Fig. 2.25, Cassette Player Tape Slot

Instruments and Controls Identification

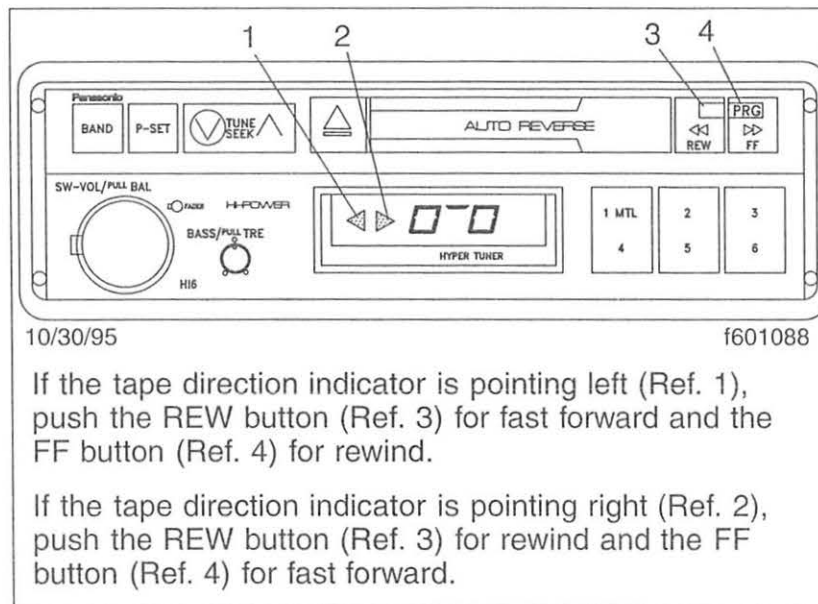


Fig. 2.26, Fast Forward and Rewind

clock has been previously set; if so, the previous time will be displayed.

3. While holding the band selection button, set the time by pushing the left (down) side of the tune/seek button to set the hours, and the right (up) side to set the minutes.

IMPORTANT: Holding either side of the tune/seek button for more than a half a second causes the hours or minutes to advance rapidly. Release the button to stop the advancing.

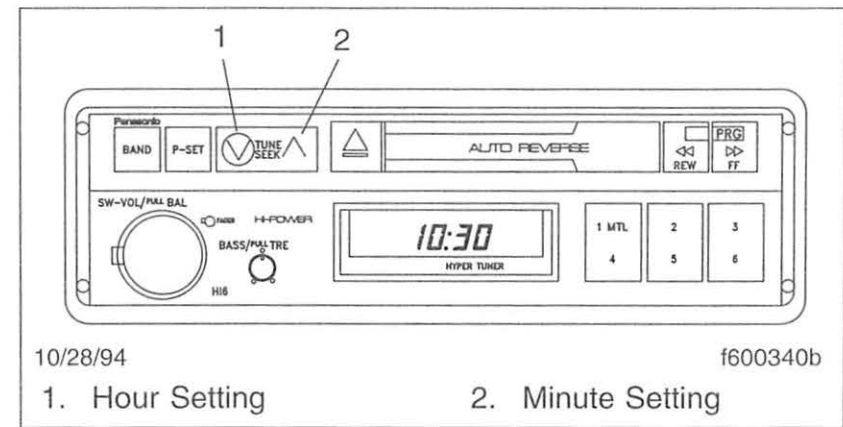


Fig. 2.27, Setting Time

Instrumentation Control Unit, Level II

The instrumentation control unit, level II (level II ICU) is a basic electronic dashboard. It can accept information from the various sensors installed on the vehicle and feed it to electronic gauges. Only air gauges operate mechanically.

There can be up to 14 removable gauges on the driver's instrument panel (11 electronic, one electromechanical, and two mechanical). The level II ICU can not drive gauges located on the auxiliary instrument panel.

The dash message center is the heart of the level II ICU. It has two parts, a set of 18 warning and indicator lights similar to those found on a conventional lightbar,

and a dash driver display screen. The dash driver display screen is a one-line by 6-character vacuum fluorescent display.

Warning and Indicator Lights

There can be up to 18 warning and indicator lights installed in the level II ICU. See **Fig. 2.28**.

- The green right (Ref. 13) and left (Ref. 1) turn signal lights flash on and off whenever the outside turn signal lights are flashing.
- The blue high-beam indicator light (Ref. 11) comes on when the headlights are on high beam.
- The yellow "Check Engine" (ENG CHK) light (Ref. 3) comes on if an engine condition exists such as low coolant level, high coolant temperature, or low oil pressure. It also comes on when a fault is detected or recorded.
- The red "Engine Protection" (ENG PROT) light (Ref. 2) comes on to indicate that the protection system available on the engine has been activated.
- Installed on Cummins engines only, the red "Stop Engine" (STOP ENG) light (Ref. 4) comes on to warn that the engine is not functioning normally. The vehicle should be pulled over to the side of the road and the engine shut down immediately.
- The red low air pressure (LOW AIR) warning light (Ref. 12) and buzzer activate whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).
- The red high coolant temperature (thermometer symbol) warning light (Ref. 5) and buzzer activate whenever the coolant temperature goes above a maximum level specified by the engine manufacturer (see the engine manual).
- The red low oil pressure (oil can symbol) warning light (Ref. 6) and buzzer activate whenever the engine oil pressure goes below a minimum level specified by the engine manufacturer (see the engine manual).
- The parking brake on (PARK BRAKE) warning light (Ref. 17) activates whenever the parking brake is engaged.
- The recirculated air (RECIRC AIR) warning light (Ref. 18) activate whenever the the ventilating system is switched to recirculated air.
- Depending on options installed, other warning and indicator lights can be installed in the spaces marked "OPT." The optional indicator lights that are available include: low voltage warning, alternator no charge warning, automatic transmission overheat warning, trailer ABS

Instruments and Controls Identification

warning, ECAS (electronic suspension) transfer indicator, and ECAS failure warning.

NOTE: The functions of the ABS warning lights are explained under "Meritor (Rockwell) WABCO Antilock Braking System (ABS)" later in this chapter.

Level II ICU Ignition Sequence (Fig. 2.29)

If the headlights are turned on, the screen displays the odometer and waits for the ignition to be turned on.

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

NOTE: The air gauges and voltmeter do not sweep.

The following lights go on during the ignition sequence:

- High Coolant Temperature Warning
- Low Engine Oil Pressure Warning
- Low Air Pressure Warning
- Park Brake On Indicator
- All engine warning lights, including Engine Protection, Check Engine, and Stop Engine (Cummins only)
- All ABS warning lights, including Wheel Spin, Tractor ABS, and Trailer ABS (if installed)

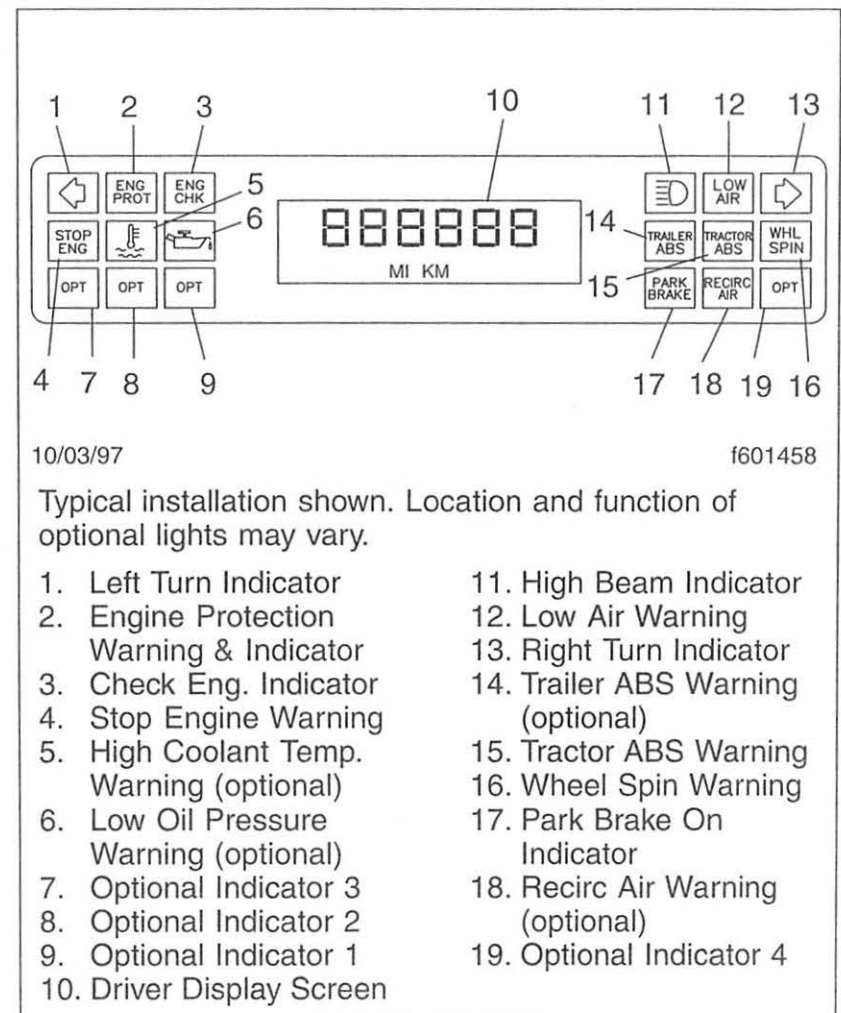


Fig. 2.28, Dash Message Center, Level II ICU

Instruments and Controls Identification

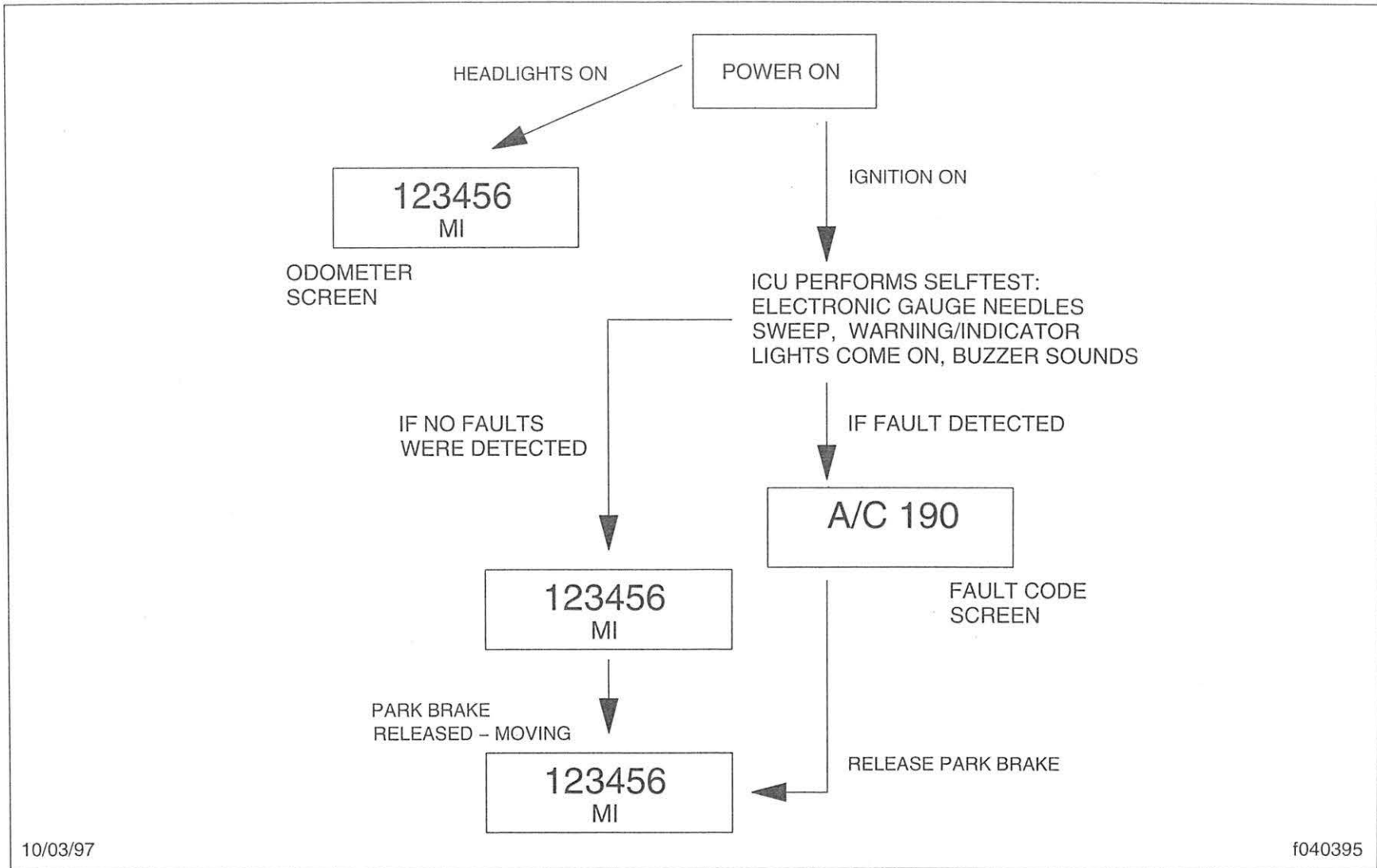


Fig. 2.29, Level II ICU Ignition Sequence

Instruments and Controls Identification

NOTE: While the engine and ABS warning lights go on during the ignition sequence, they are not controlled by the level II ICU, but by their own system ECU (electronic control unit).

Once the ignition keyswitch has been turned on, the level II ICU performs a self-test, looking for active faults. During the first half of the self-test, all segments of the display illuminate. During the second half of the self-test, the software revision level is displayed.

If there are no active faults, the screen displays the odometer.

If, however, the level II ICU has received active fault codes from other devices, it displays them, one after the other, until the parking brake is released, or the ignition keyswitch is turned off.

A list of fault codes and definitions can be found in **Section 54.14** of the vehicle workshop manual. Once the parking brake is released, the level II ICU displays the odometer again.

Setting the Units for the Odometer

The level II ICU odometer is a six-digit display without a decimal point. It can display the distance the vehicle has traveled in either miles or kilometers, but it cannot display tenths of miles (or kilometers). The choice of units is selectable using the cruise control switches.

To change the display, shut down the engine and set the parking brake. Turn the ignition keyswitch to the ON position. Turn the cruise control on (cruise control on/off switch). See **Fig. 2.30**.

With the cruise control on, press and hold down the cruise control set switch until the odometer display begins to blink. After about 5 seconds, the "MI" display at the bottom of the screen will change to "KM" (or "KM"

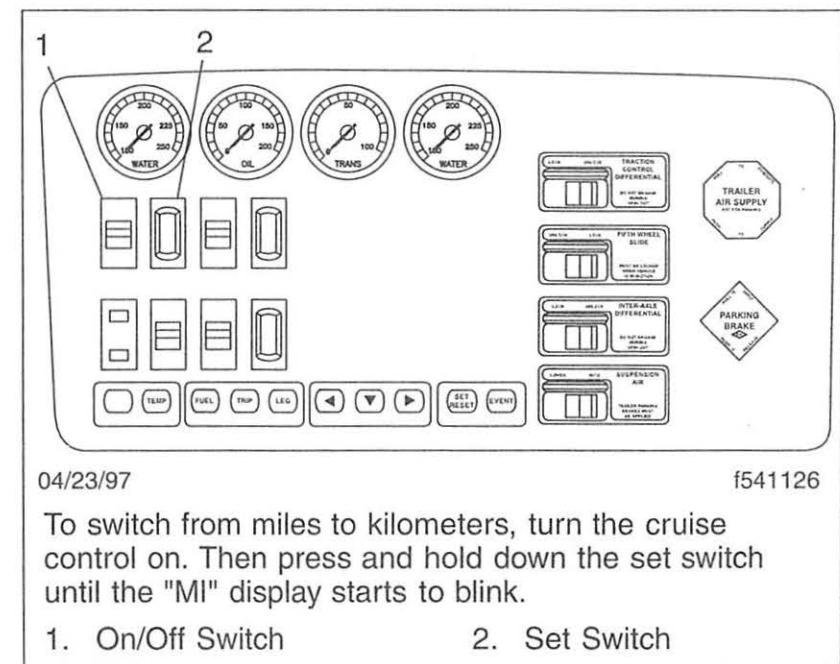


Fig. 2.30, Cruise Control Switches

Instruments and Controls Identification

will change to "MI," depending on what units were previously set). See **Fig. 2.28**.

Alert Screen

The "NODATA" screen comes on whenever the datalink is not receiving data. It appears when the vehicle is moving and overrides the regular screen display.

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

Instrumentation Control Unit, Level III (optional)

The optional instrumentation control unit, level III (level III ICU) is an advanced programmable electronic dashboard. It can accept information from the sensors and electronic control units installed on the vehicle and feed it to electronic gauges. Only air gauges operate mechanically.

There can be up to 14 removable gauges on the driver's instrument panel (11 electronic, one electromechanical, and two mechanical).

The dash message center is the heart of the level III ICU. It has two parts, a set of 18 warning and indicator lights similar to those found on a conventional lightbar, and a dash driver display screen. The dash driver display screen is a 2-line by 20-character vacuum fluo-

rescent display that provides a wide range of information to the driver.

Some of the information that can be provided by the message center includes:

- odometer readings
- outside air temperature
- messages from remote locations such as company docks and offices, shipper's terminals, etc. (if equipped with a communications system, such as Qualcomm)
- trip information, such as trip miles and hours, idle hours, average mph, and leg miles and hours
- fuel information, such as fuel used and miles per gallon, fuel used idling, and PTO fuel used
- engine information, such as miles, hours, gallons of fuel used, and PTO fuel used
- diagnostic information, such as listings of active faults and troubleshooting information
- vehicle information, such as datalink operation and use data, dash part number, and software number

Two advanced features are available in the level III ICU: target miles per gallon (MPG), and brightness control.

Instruments and Controls Identification

Advanced Features of the Level III ICU

Target MPG

The target MPG feature allows quick and easy checking of fuel economy through the "MPG Graph/Target MPG..Odometer" screen. See **Fig. 2.31**.

NOTE: Use the LEFT ARROW key to lower the target MPG, and the RIGHT ARROW key to raise it. For more information on how to set target MPG, see "Setup Information" later in this chapter.

The "Target MPG" area is on the second line of the display, to the left of the odometer. It shows the actual target miles per gallon (TMPG)

Example: A reading of "12.3 TMPG" indicates that the target MPG is 12.3 miles per gallon.

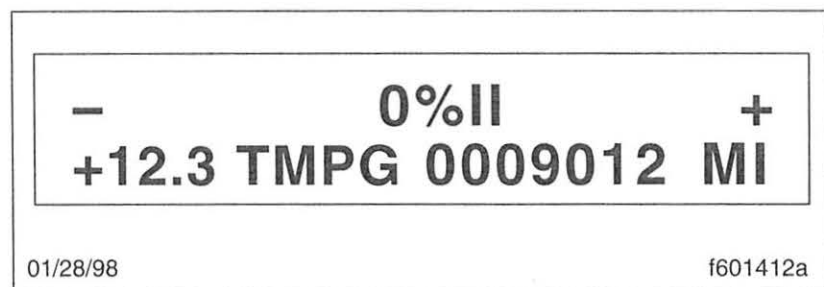


Fig. 2.31, MPG Graph/Target MPG..Odometer Screen

The "MPG Graph" on the first line of the display gives the same information in dynamic form. The "0%" mark in the center of the line gives the target MPG. Bars showing to the right of the display indicate that short term fuel economy is above the target; bars showing to the left of the display indicate that short term fuel economy is below the target.

Brightness Control

The panel light dimmer switch normally controls the brightness of all panel and gauge lights, including the level III ICU dash driver display. With the parking brake set, the ICU keypad can control the brightness of the display independently of the other lights. If the panel lights are set to maximum brightness, the display cannot be brightened any further.

NOTE: Use the LEFT ARROW key to dim the display, and the RIGHT ARROW key to brighten it. For more information on how to set the brightness of the display, see "Setup Information" later in this chapter.

When the parking brake is released, the arrow keys no longer work to change the brightness of the display, but the settings stay in effect unless the headlights are turned on. With the headlights on, the display dims slightly to adjust to night-time conditions.

Warning and Indicator Lights

There can be up to 18 warning and indicator lights installed in the level III ICU (see **Fig. 2.32**).

- The green right (Ref. 9) and left (Ref. 1) turn signal lights flash on and off whenever the outside turn signal lights are flashing.
- The blue high-beam indicator light (Ref. 7) comes on when the headlights are on high beam.
- The yellow "Check Engine" (ENG CHK) light (Ref. 3) comes on to indicate an engine condition such as low coolant level, high coolant temperature, or low oil pressure. It also comes on when a fault is detected or recorded.
- The red "Engine Protection" (ENG PROT) light (Ref. 2) comes on to warn that the protection system available on the engine has been activated.
- Installed on Cummins engines only, the red "Stop Engine" (STOP ENG) light (Ref. 4) comes on to warn that the engine is not functioning normally. The vehicle should be pulled over to the side of the road and the engine shut down immediately.
- The red low air pressure (LOW AIR) warning light (Ref. 8) and buzzer come on whenever air pressure in the primary or secondary air reservoir falls below 64 to 76 psi (440 to 525 kPa).

- Depending on options installed, other warning and indicator lights can be installed in the spaces marked "OPT." The optional indicator lights that are available include: air bag warning, low voltage warning, alternator no charge warning, automatic transmission overheat warning, trailer ABS warning, ECAS (electronic suspension) transfer indicator, and ECAS failure warning.

NOTE: The functions of the ABS warning lights are explained under "Meritor (Rockwell) WABCO Antilock Braking System (ABS)" later in this chapter.

Keypad

The level III ICU is controlled by a keypad located on the auxiliary dash panel. See **Fig. 2.33**. This keypad, which has 10 keys, can be used to do the following things:

- Call up information onto direct access screens by pressing the appropriate key.
- Move about from screen to screen while the vehicle is stationary.
- Set up the display.
- Set a target MPG to monitor fuel economy while driving. Press the LEFT ARROW key to lower the target MPG, and the RIGHT ARROW key to raise it.

Instruments and Controls Identification

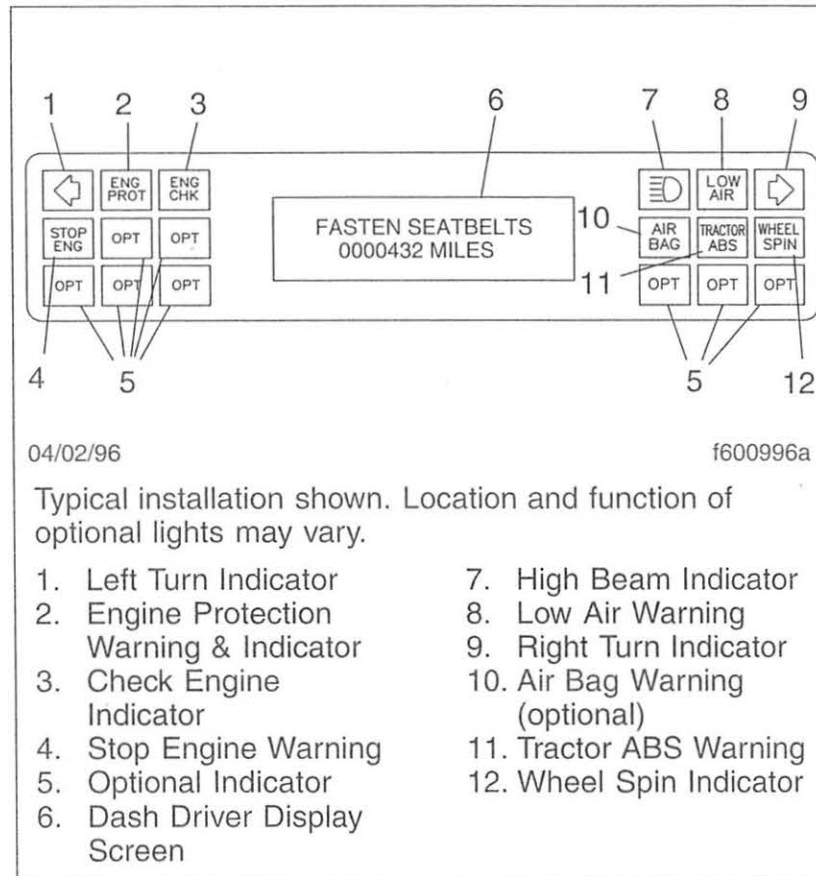


Fig. 2.32, Dash Message Center, Level III ICU

- Set the brightness of the display screen independently of the panel dimmer switch. Use the LEFT

ARROW key to dim the display, and the RIGHT ARROW key to brighten it.

- Record significant data using the EVENT key (optional—if a data logging unit is installed).

NOTE: One key is blank and is not usable at this time.

Level III ICU Ignition Sequence

(Fig. 2.34)

If the headlights are turned on, the screen displays the odometer and waits for the ignition to be turned on.

When the ignition is first turned on, all the electronic gauges complete a full sweep of their dials, the warning and indicator lights light up for five seconds, and the buzzer sounds for two seconds.

NOTE: The air gauges and voltmeter do not sweep.

Once the ignition has been turned on, the screen displays the "Freightliner" message. At the same time, the level III ICU conducts a roll call of all the electronic control units (ECUs) installed on the vehicle, looking for active faults.

If there are no active faults, the screen displays the "Fasten Seat Belts/Odometer" screen.

If, however, the level III ICU has received active fault codes, or an electronic control unit (ECU) fails to respond to the roll call, it shows the "Active Faults" screen

Instruments and Controls Identification

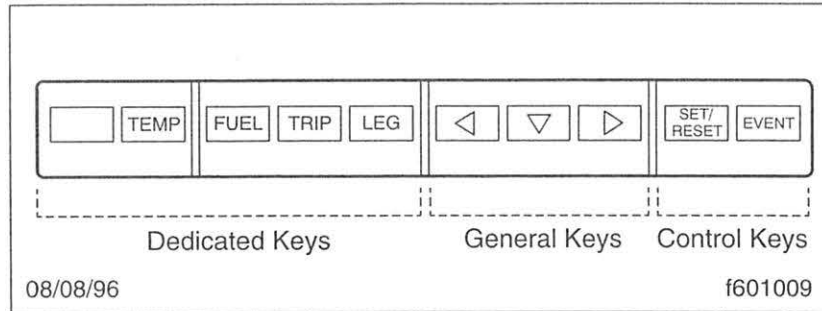


Fig. 2.33, 10-Key Keypad

and displays the number of active faults, up to a total of eight. If desired, press RIGHT ARROW (see **Fig. 2.33**) to see the active fault codes. Continuing to press the right arrow key will display all additional fault codes (if any).

NOTE: A list of fault codes and definitions can be found in **Section 54.03** of the vehicle workshop manual.

To go on, press LEFT ARROW, or, if the engine is on, release the parking brake to go on to the "Fasten Seat Belts/Odometer" screen.

Unless the engine is running, the ignition sequence ends with the "Fasten Seat Belts/Odometer" screen.

IMPORTANT: At this point, if the vehicle has a communications system and an incoming message is available, it will be displayed. To dismiss the incoming message, press any key on the keypad.

With the engine idling (the vehicle not moving), the ignition sequence cycles on, and displays the "Idle Hours/Idle Gallons..Odometer" screen. See **Fig. 2.35**.

The Message Screen

To understand the information displayed on the message screen, here is an example of screen layout. On the "Idle Hours/Idle Gallons..Odometer" screen, idle hours are displayed on the top line with the words "Idle Hours" on the left side of the screen and the number of hours on the right. On the bottom line, the number of idle gallons is on the left and the odometer miles are on the right, with a space in between. See **Fig. 2.36**.

Once the parking brake is released (whether the vehicle is moving or not), the regular message screen display is the "MPG Graph/Target MPG..Odometer" screen. The MPG graph is a dynamic display graph demonstrating how the actions of the driver affect fuel economy. The graph moves to the right as fuel economy improves. See **Fig. 2.31**.

NOTE: Press the LEFT ARROW key to lower the target MPG, and the RIGHT ARROW key to raise it. For more information on how to set the target MPG, see "Setup Information" later in this chapter.

Level III ICU Roll Call

Each time the ignition keyswitch is turned on, the level III ICU roll call function requests data from each ECU on

Instruments and Controls Identification

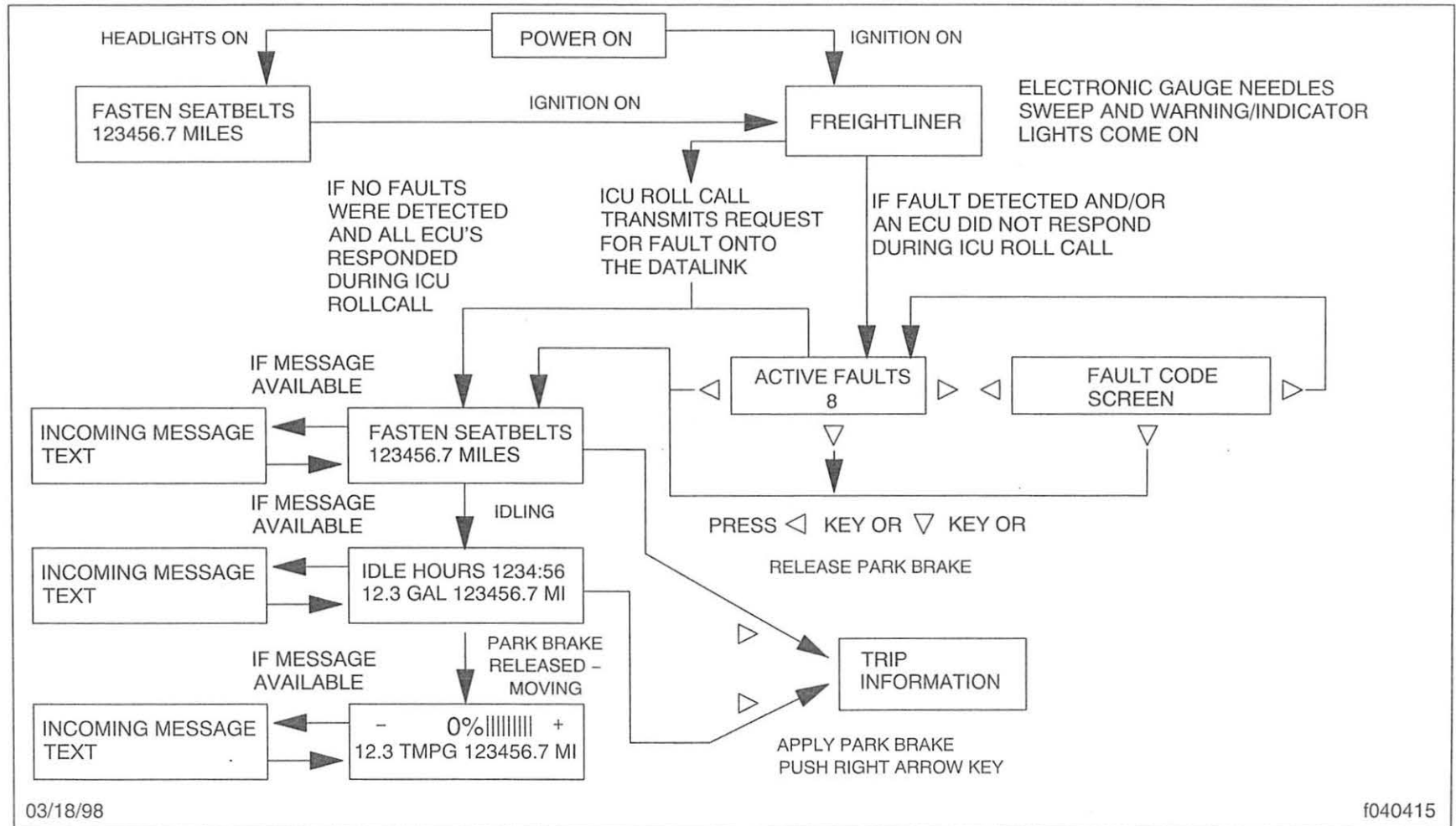


Fig. 2.34, Ignition Sequence, Level III ICU

Instruments and Controls Identification

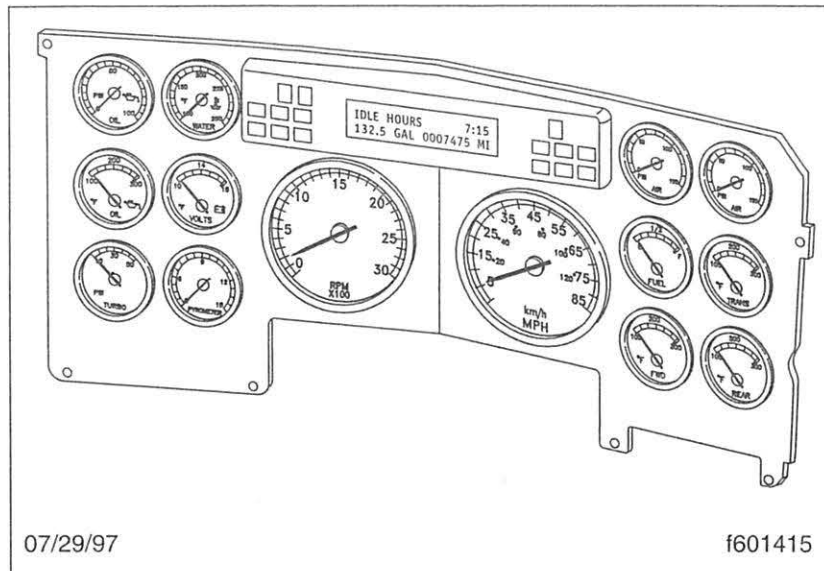


Fig. 2.35, Level III ICU At the End of the Ignition Sequence

the databus. If the ECU does respond to this request, the databus is communicating with that ECU and no fault code is displayed.

NOTE: Each ICU is configured to receive responses from a list of selected ECUs, as installed on that particular vehicle.

If the ECU does not respond to this request, the level III ICU displays an active fault code that indicates the databus is not communicating with that ECU. For a

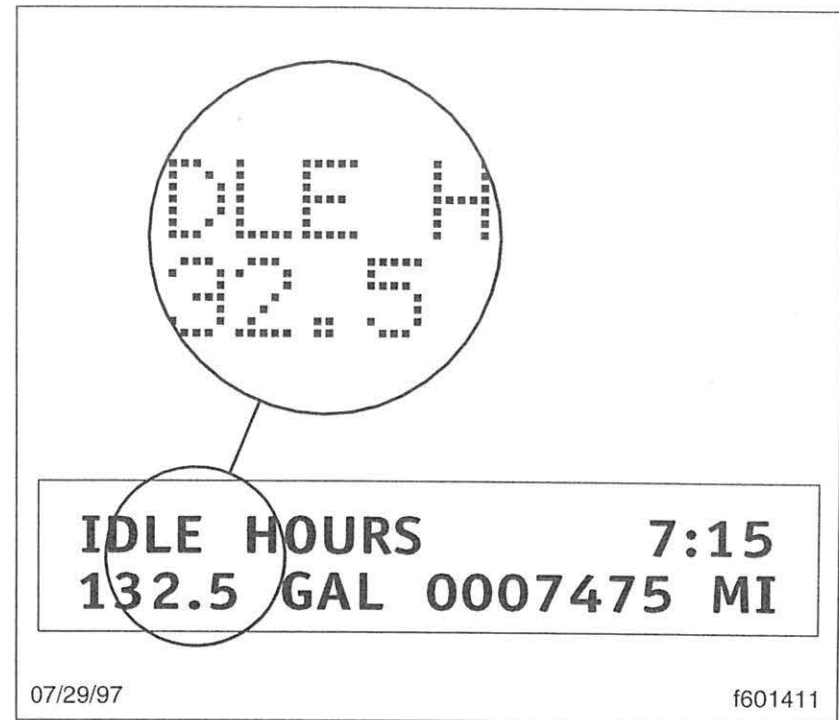


Fig. 2.36, Idle Hours/Idle Gallons..Odometer Screen

sample fault code and message of this type, see **Fig. 2.37**. For a list of roll call faults, see **Section 54.03**.

Level III ICU Odometer

The level III ICU odometer is a seven-digit display with one decimal point after the sixth digit, allowing it to display tenths of miles (or kilometers).

Instruments and Controls Identification

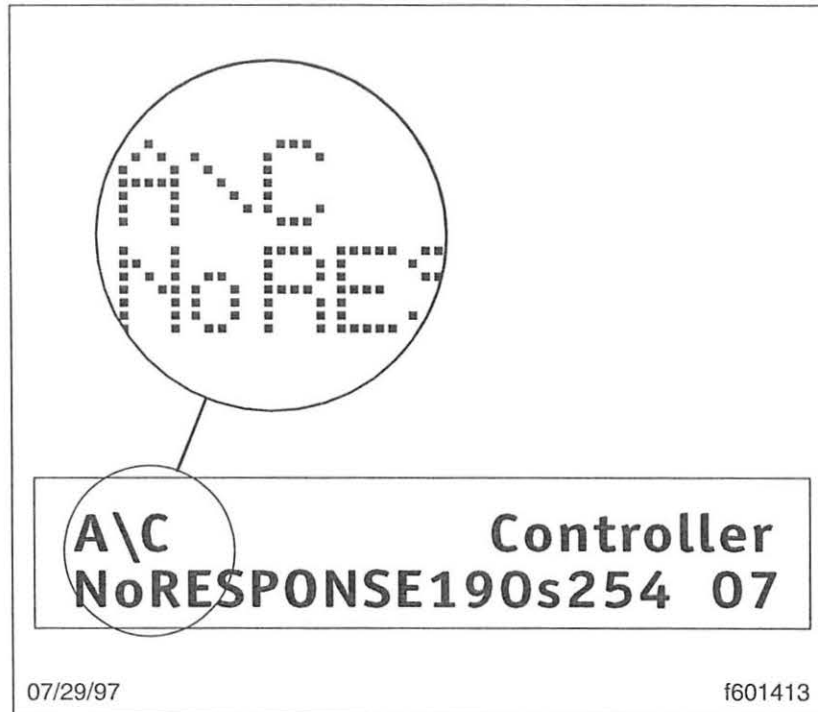


Fig. 2.37, Level III ICU Roll Call Fault Code and Message

When first installed, the odometer starts at 0.0 miles (or kilometers). When replaced, the odometer does not start with the engine miles, but starts again from 0.0 and cannot be changed, either up or down.

IMPORTANT: Although the odometer uses data supplied by the engine ECM to update its count, it keeps its own

mileage starting from the zero point, which marks where it was first installed.

Alert Screens

Alert screens come on whenever the condition occurs. They appear when the vehicle is moving; they 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.

NOTE: Warning messages always display at full brightness.

"Parking Brake On" Screen

This warning message and alarm tone come on whenever the parking brake is applied and the vehicle is moving faster than 2.5 miles per hour, or the clutch has been depressed. The word "Warning" flashes on the display screen above the message "Parking Brake On." The screen and alarm tone go away only when the parking brake is released. See **Fig. 2.38**.

The "Parking Brake On" screen overrides any other screen message.

"Low Oil Pressure" Screen

This warning message and alarm tone come on whenever the oil pressure falls below the minimum oil pressure specified by the engine manufacturer, whether

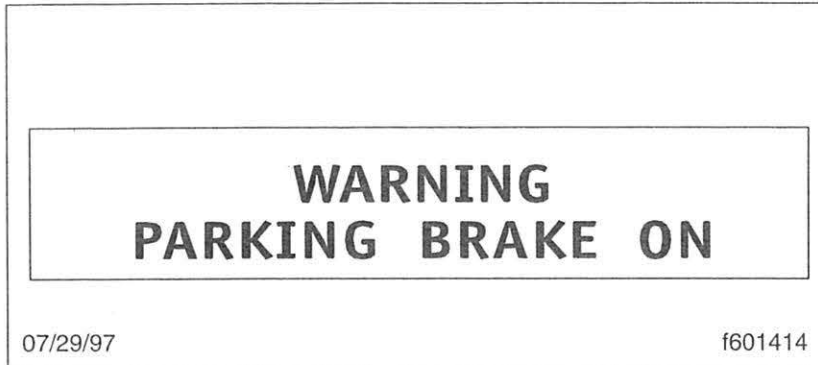


Fig. 2.38, Parking Brake On Screen

the vehicle is idling or in motion. The word "Warning" flashes on the display screen above the message "Low Oil Pressure." To dismiss the message, press any key on the keypad.

NOTE: If there is more than one alert message to display, pressing any key 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 any key.

"High Coolant Temp" Screen

This message and alarm tone come on whenever the engine coolant temperature exceeds a pre-set point

specified by the engine manufacturer (see the engine manual for this temperature). The word "Warning" flashes on the display screen above the message "High Coolant Temp."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Low Coolant Level" Screen

This warning message and alarm tone activate whenever the coolant level falls below a pre-set point. The word "Warning" flashes on the display screen above the message "Low Coolant Level."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Low Voltage" Screen

On some vehicles, this message and alarm tone come on whenever a low voltage condition is detected by the instrumentation control unit. The word "Warning" flashes on the display screen above the message "Low Voltage."

This message follows the same rules of dismissal and display as "Low Oil Pressure."

"Recirc Mode Engaged" and "Provide Fresh Air" Screens

The "Recirc Mode Engaged" screen comes on whenever recirculated air is selected on the fresh/air re-

Instruments and Controls Identification

circulation switch, or the air circulation switch is rotated to the maximum air conditioning position. It displays one time only for seven seconds. It notifies the driver that recirculated air is being used and that fresh air needs to be provided within at least 20 minutes.

If fresh air is not provided within that time span, the "Provide Fresh Air Message" is displayed. It displays for seven seconds every 254 seconds (about every four minutes) until the driver switches to fresh air, either by selecting fresh air on the fresh/air recirculation switch, or by rotating the air circulation switch away from maximum air conditioning and to one of the other positions. See **Chapter 4** for detailed operating instructions for the heater/air conditioner.

"Turn Signal On" Screen

This warning message (the alarm tone is optional) comes on whenever the turn signal remains on, beyond a pre-set time or distance traveled. The word "Warning" flashes on the display screen above the message "Turn Signal On."

To dismiss this message, either turn off the turn signal, or press any key on the keypad.

"Incoming Message" Screen

On vehicles with an inboard communications system like Qualcomm®, this screen activates whenever a message

is received. "Incoming Message" appears on the display screen along with the first characters of the message.

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

This message displays for a pre-set time period and then disappears. It returns after the pre-set interval until it is dismissed by pressing any key on the keypad.

"No Datalink Activity" Screen

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.

Direct Access Screens

The driver can also override the regular screen display at any time by pressing the keypad to display one of the direct access screens.

- Press the TRIP key for the "Trip miles and Trip Hours" screen.
- Press the FUEL key for the "Fuel Used and Average MPG" screen.
- Press the LEG key for the "Leg miles and Leg Hours" screen.

Instruments and Controls Identification

Data for each of the above screens can be reset (cleared). To reset, display the screen and push the Set/Reset key twice within six seconds (a confirmation screen will display after you press the key once).

NOTE: Resetting "Trip Miles and Hours" also resets "Leg Miles and Hours."

Press the "TEMP" key to display the outside air temperature.

If the vehicle has a data logging unit, press the EVENT key to record data about a significant driving event (engine problem, driving problem, unusual vehicle operation, etc.). Normally, the screen displays "Data Being Recorded."

NOTE: If the memory in the data logger is full, the screen instead displays "Memory Full/Data Not Recorded." If the data logger is not connected or not responding, the screen displays "Data Recorder/Not Responding." If the EVENT key was pressed recently (within the last two minutes), the screen displays "Still Recording/Last Event."

Stationary Access Screens—Used With Parking Brake Applied

The stationary access screens are a series of informational displays that give trip, fuel, engine, diagnostic, setup, and vehicle information.

For reasons of safety, stationary access screens can be seen only when the vehicle is not moving and the parking brake is applied.

Each set of stationary access screens has a title screen followed by one or more data screens. To move forward and backward through these screens, use the three arrow keys as shown in **Fig. 2.39**, **Fig. 2.40**, and **Fig. 2.41**.

Trip Information

Trip information provides three data screens: "Trip Miles and Hours," "Idle Hours and Average MPH," and "Leg Miles and Hours." See **Fig. 2.39**.

"Trip Miles and Hours" displays the number of miles and hours driven since the start of the trip. At the start of a trip, press RESET (SET/RESET twice) to set trip miles and hours back to zero.

NOTE: Resetting "Trip Miles and Hours" also resets "Idle Hours and Average MPH."

"Idle Hours and Average MPH" displays the hours spent idling and the average miles per hour.

"Leg Miles and Hours" records the number of miles and hours driven since the start of the leg. At the start of a new leg, press RESET to set leg miles and hours back to zero.

Instruments and Controls Identification

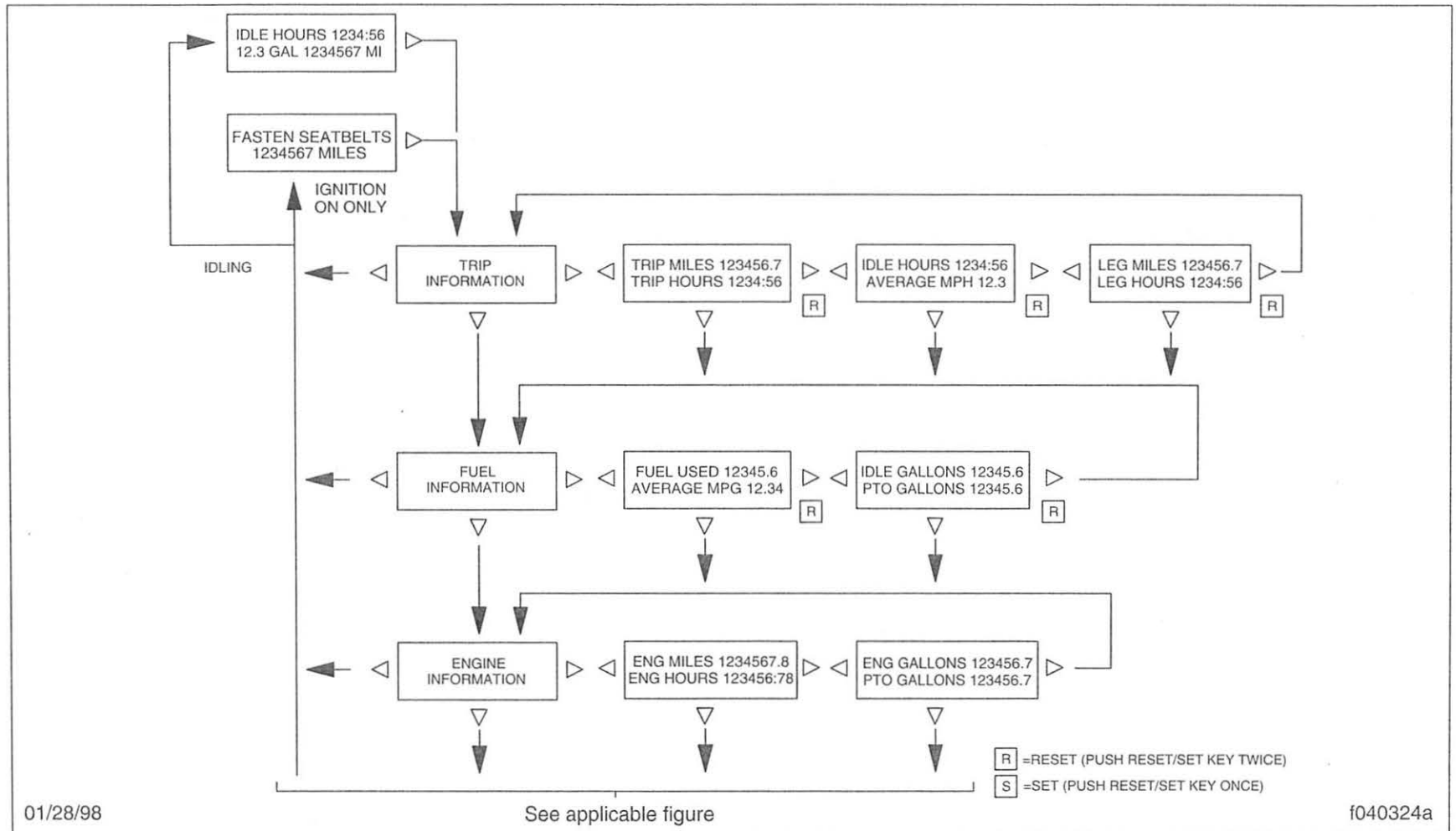


Fig. 2.39, Trip Information, Fuel Information, and Engine Information

Instruments and Controls Identification

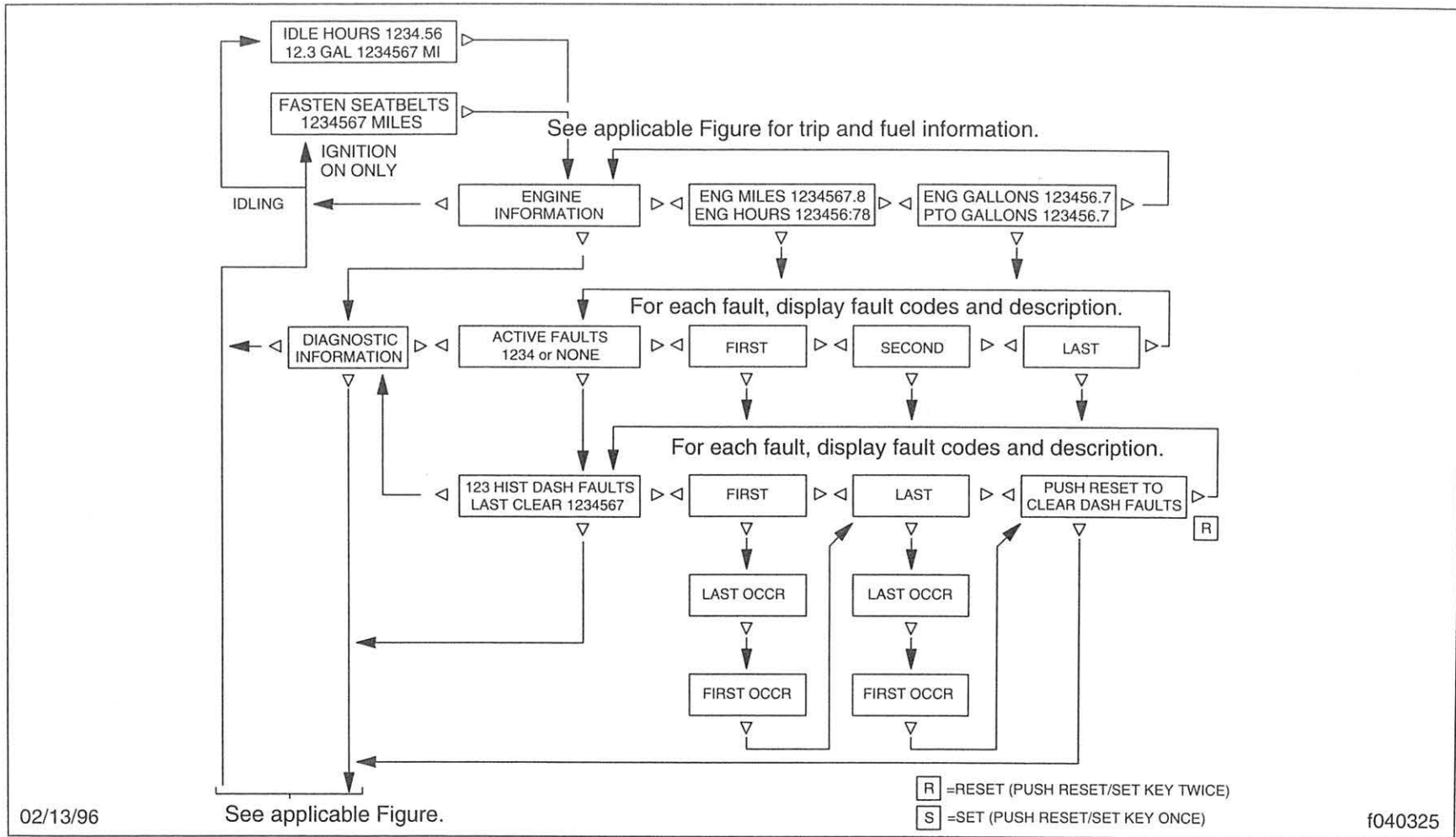


Fig. 2.40, Engine Information and Diagnostic Information

Instruments and Controls Identification

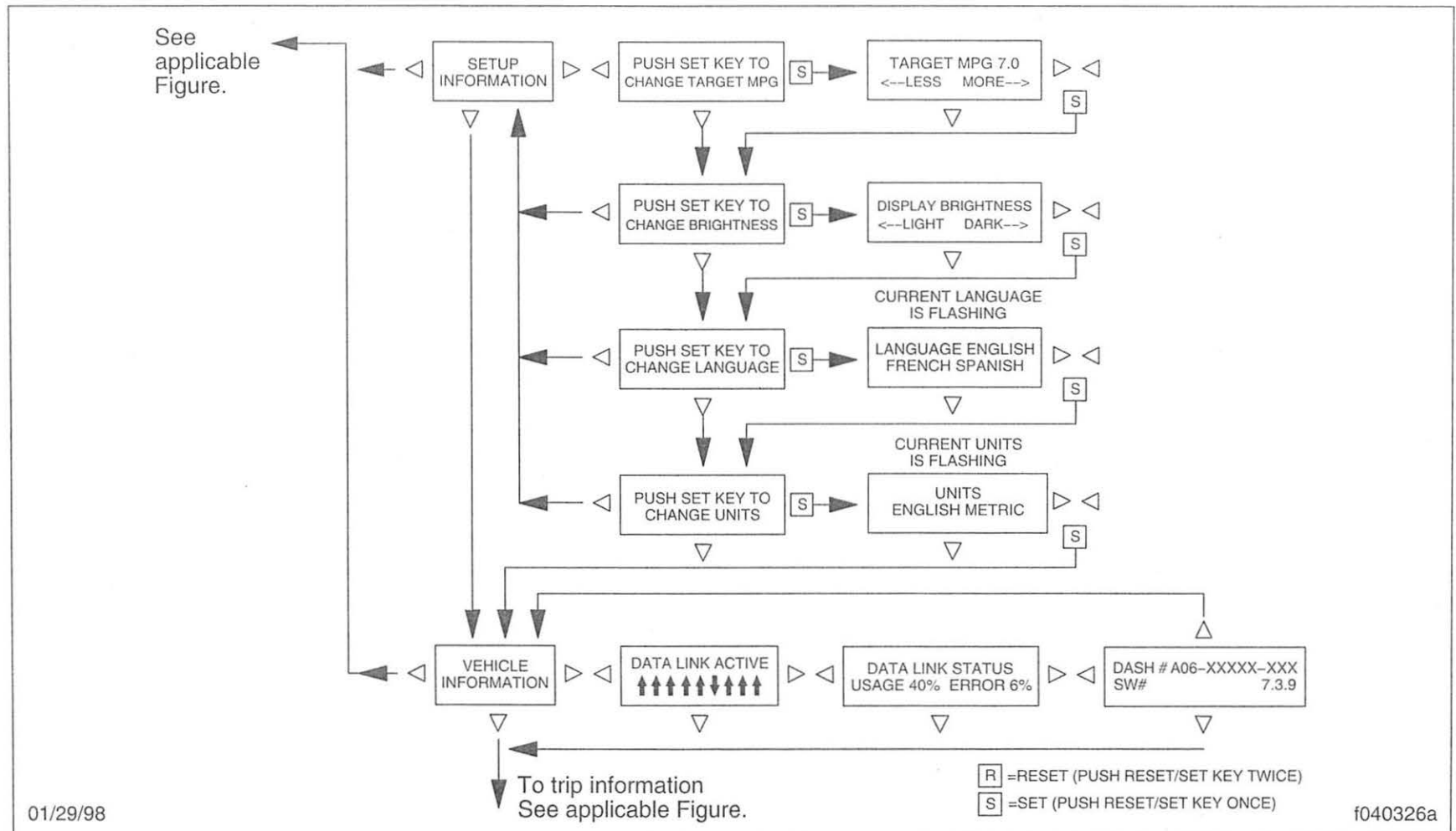


Fig. 2.41, Setup Information and Vehicle Information

Instruments and Controls Identification

NOTE: Resetting "Trip Miles and Hours" also resets "Leg Miles and Hours."

Fuel Information

Fuel information provides two data screens: "Fuel Used and Average MPG," and "Idle Gallons and PTO Gallons." See **Fig. 2.39**.

"Fuel Used and Average MPG" displays the gallons of fuel used since the last reset. At the start of a trip, after refueling, or whenever desired, press RESET (SET/RESET twice) to set fuel used and average miles per gallon back to zero.

NOTE: Resetting "Trip Miles and Hours" does not also reset "Fuel Used and Average MPG" or "Idle Gallons and PTO Gallons." Fuel Information must be reset separately.

"Idle Gallons and PTO Gallons" displays the gallons of fuel used idling and to operate the Power Take Off unit (if installed). At the start of a trip or whenever desired, press RESET to set idle gallons and PTO gallons back to zero.

Engine Information

Engine information provides two data screens: "Engine Miles and Hours," and "Engine Gallons and PTO Gallons." See **Fig. 2.39** or **Fig. 2.40**.

"Engine Miles and Hours" displays the total miles and hours logged by the engine since installation.

NOTE: Engine information is supplied by the engine Electronic Control Module (ECM). It can be reset using engine diagnostic tools. For more information, see the engine manufacturer's manuals.

"Engine Gallons and PTO Gallons" displays the gallons of fuel used by the engine and PTO since installation.

Diagnostic Information

Diagnostic information provides two sets of data screens: "Active Faults," followed by a separate screen for each fault until all have been shown; and "Historical Dash Faults," also followed by a separate screen for each fault until all have been shown. See **Fig. 2.40**.

"Active Faults" cannot be reset. Active faults can be cleared only by correcting the fault.

"Historical Dash Faults" displays all dash faults since the last reset. The second line of the display shows the mileage the last time faults were cleared.

Setup Information

Setup information allows the user to change the target MPG, the brightness of the screen display, the language of the display (English, French, or Spanish), and the units of measurement (English/US conventional or metric).

Instruments and Controls Identification

When prompted by the screen, press SET (push the SET/RESET key once). The units that are settable will be blinking. Use the arrow keys (LEFT, RIGHT, and DOWN) until the display shows the desired setup. Press SET again when finished to save the new settings. See **Fig. 2.41**.

Vehicle Information

Vehicle information displays important information, including datalink activity and status, ICU part number, and software identification number.

The "Datalink Active" screen is a dynamic display that shows if the datalink unit is active at the given time. If all the arrows are pointing down, the level III ICU has not received any information on the datalink since the last time the ignition keyswitch was turned on.

The "Datalink Status" screen is also dynamic, showing current datalink use and error rate. The other screen, which shows the ICU part number and the software identification number, is informational only. See **Fig. 2.41**.

After vehicle information, pressing the DOWN ARROW takes you back to trip information, and so on.

Meritor (Rockwell) WABCO® Antilock Braking System (ABS)

(Fig. 2.42)

The Meritor (Rockwell) WABCO Antilock Braking System (ABS) has a tractor warning light (Ref. 1, TRACTOR ABS) and, if equipped with automatic traction control (ATC), a wheel spin indicator light (Ref. 2, WHEEL SPIN).

After the ignition switch is turned on, the tractor warning light (TRACTOR ABS) and (if equipped) the wheel spin (WHEEL SPN) indicator light come on for about three seconds. After three seconds, the lights go out only if all of the tractor's ABS components are working.

IMPORTANT: If any of the ABS warning lights do not work as described above, or come on while driving, re-

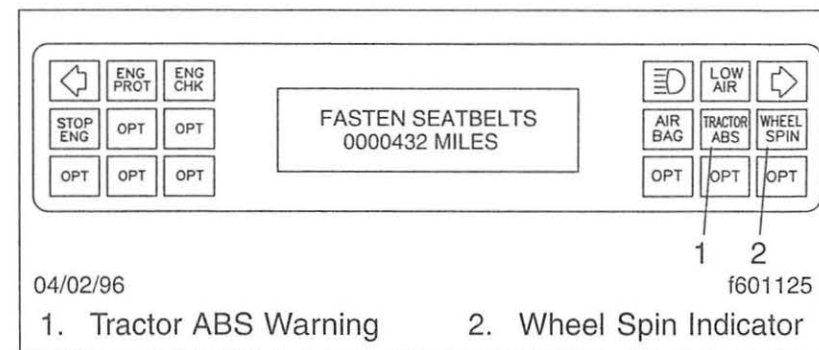


Fig. 2.42, ABS Warning and Indicator Lights (standard)

Instruments and Controls Identification

pair the ABS system immediately to ensure full antilock braking capability.

The wheel spin indicator light (WHEEL SPIN) comes on if one of the drive wheels spins under power. The light goes out when the wheel stops spinning. A label (**Fig. 2.43**) on the dash explains what actions should be taken when the WHEEL SPIN indicator light comes on.



CAUTION

Axle 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).

Vehicles with electronic engines and ABS may have automatic traction control (ATC). On these vehicles, the ATC system automatically limits wheel spin when power

is applied to the drive axles during reduced-traction situations.

If the vehicle has ATC, there will be a momentary contact rocker switch on the dash labeled "NORM/SPIN" and "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 NORM/SPIN 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 NORM/SPIN again will cycle the system back to normal operation.

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

Collision Warning System, Optional

The computerized collision warning system transmits and receives low power, high frequency radar (microwave) signals between the vehicle and objects in front of it. The base system is intended to provide additional warning time of potential rear-ending of other

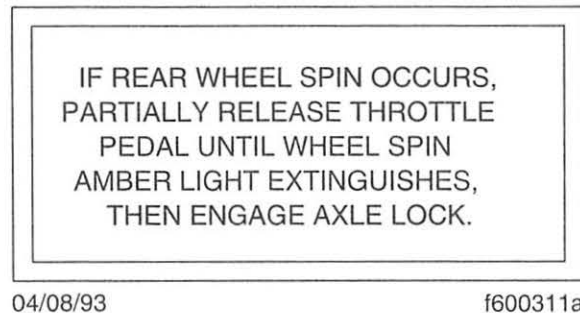


Fig. 2.43, Dash Label

Instruments and Controls Identification

vehicles by alerting the driver to objects in front of the vehicle, stationary or slow moving objects, and objects toward which the vehicle is creeping. An optional right- or left-side sensor can detect objects alongside the vehicle, where they cannot be seen.

Features include visual and audible alerts, an audible alert volume control, automatic indicator and alert light intensity adjustment, a threshold range control to set forward object detection distances at first, second, and third stage distance alerts, a control to save the last ten minutes of data on an optional driver's data card, and the ability to maintain data on up to 20 moving or stationary objects within range.

Inside the cab, the system consists of a driver display unit (DDU), a right-hand A-pillar-mounted side sensor display, turn sensor assembly, and central processing unit (CPU). Components located outside the cab are the antenna assembly and side sensor.



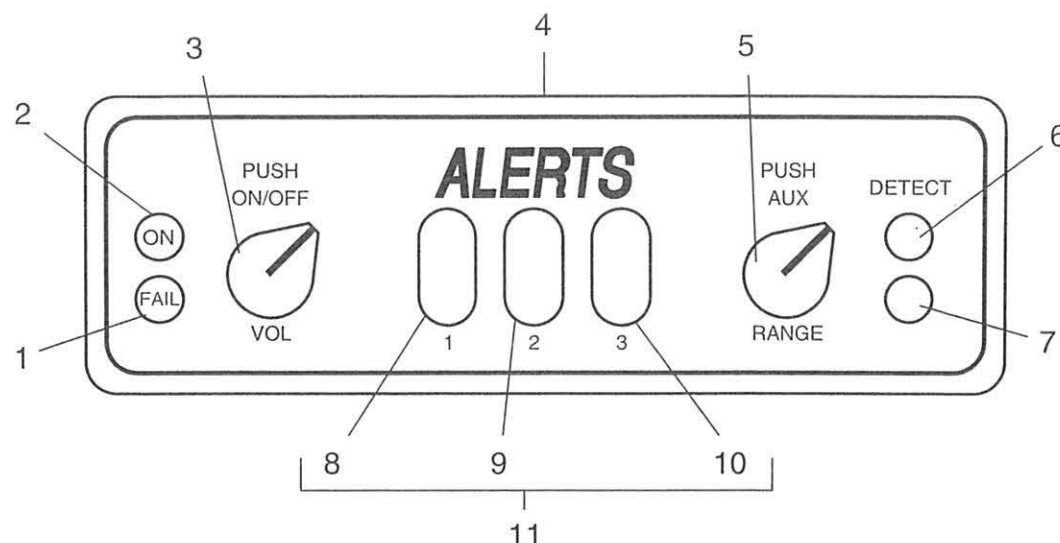
The collision warning system is intended only as an aid to an alert and conscientious driver. The system may provide little or no warning of pedestrians or animals on the road, head-on collisions, or cross traffic at intersections. Do not rely solely on the system to operate the vehicle; always use the system with the rearview mirrors and other instrumentation. The system will not warn of many possible hazards, is not a substitute for safe driving procedures, and will not compensate for driver impairment. Failure to drive safely and use the system properly could result in personal injury and property damage.

Driver Display Unit (Fig. 2.44)

1. The green indicator light (Ref. 2) labeled "ON" on the driver display unit front panel illuminates when the system activates. If the driver's card (optional) is absent or malfunctions the light blinks continuously.

NOTE: When the vehicle is started (activating the collision warning system) and the green "ON" light illuminates, check that the red "FAIL" light does not come on and stay illuminated. If this light does come on during startup or driving, turn the system off and do not use it until a qualified technician performs troubleshooting procedures.

Instruments and Controls Identification



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- 1. Red, Component Failure
- 2. Green, Power On/Driver's Card Status
- 3. Volume Control and Power On/Off
- 4. Speaker
- 5. Range Control and Accident Recorder
- 6. Amber, Vehicle Detection

- 7. Light Sensor
- 8. Yellow
- 9. Orange
- 10. Red
- 11. Distance/Danger Alerts

Fig. 2.44, Driver Display Unit

- 2. The knob (Ref. 3) labeled "PUSH ON/OFF VOL" turns power on or off when pushed in. Turning the knob left or right will increase or decrease speaker volume.

NOTE: The system may be configured to not allow the driver to turn the system off, or decrease the volume level.

Instruments and Controls Identification

3. The speaker (Ref. 4) is located on top of the driver display unit. It sounds audible tones to alert the driver to potential hazards. Its volume cannot be completely turned off.
4. The knob (Ref. 5) labeled "PUSH AUX RANGE" stores accident reconstruction data when pushed in and held for approximately two seconds. Stored data on the driver's card is indicated by eight rapid flashes of the green "ON" light when the system is turned on or after reinserting the driver's card. Turning the knob provides an adjustment range so that the first, second, and third stage alerts can be set for following distances of three to one seconds, two to 2/3 seconds, and one to 1/3 seconds respectively.

NOTE: The system may be configured to not allow the driver to adjust the range levels.

5. The amber alert light (Ref. 6) labeled "DETECT" illuminates when an object is detected up to 350 feet (107 meters) in front of the vehicle.
6. The photo light sensor (Ref. 7) senses external lighting conditions and automatically adjusts the intensity of the indicator and alert lights.
7. The yellow alert light (Ref. 8) labeled "1" (first stage alert) illuminates when a vehicle ahead is within the distance your vehicle will travel in approximately three seconds.

8. The orange alert light (Ref. 9) labeled "2" (second stage alert) illuminates along with the number "1" light when a vehicle ahead is within the distance your vehicle will travel in approximately two seconds.

NOTE: The system may be configured to emit a single tone if the vehicle is getting closer.

9. The red alert light (Ref. 10) labeled "3" (third stage alert) illuminates along with the number "1" and number "2" lights when a vehicle is within the distance your vehicle will travel in approximately one second. If the vehicle is getting closer, a triple tone will also sound.

NOTE: Subject to range settings, detection of a vehicle with a flat bed trailer can affect the accuracy of the distance alerts.

10. If a stationary object or very slow moving vehicle is detected, all three distance alert lights illuminate accompanied by one high pitched single tone. This warning overrides the first, second, and third stage distance alerts. The range of this warning can be adjusted from three to one seconds with the range control but is limited to a maximum of 220 feet (67 meters).
11. If a vehicle is detected within 220 feet (67 meters), moving at least 20 per cent slower, all three alert lights illuminate and a high-pitched triple tone will sound.

Instruments and Controls Identification

NOTE: Application of the brake pedal will cancel all audible alerts.

12. If your vehicle is moving at less than two miles per hour and an object is detected less than 15 feet in front of your vehicle, the yellow first stage alert light will illuminate.

NOTE: The system may be configured to emit an audible tone when the yellow first stage alert light illuminates.

13. The red indicator light (Ref. 1) labeled "FAIL" illuminates and stays on when the system has detected a problem. The light will blink a pattern to indicate the type of failure as shown in **Table 2.1**.
14. A failure of the side sensor will cause the driver display unit "FAIL" light to illuminate continuously (**Fig. 2.44**). A continuous red light on the side sensor display (**Fig. 2.45**) will also appear.

Side Sensor Display (Fig. 2.45)

1. The yellow indicator light (Ref. 3) illuminates continuously when no vehicle is detected by the side sensor.
2. The photo light sensor (Ref. 2) senses external lighting conditions and automatically adjusts the intensity of indicator and alert lights.
3. The red alert light (Ref 1) illuminates when objects are detected by the side sensor. When the red light

is on and the right-hand turn signal is activated, the driver display unit speaker will sound a double tone. The tone sounds only once per operation of the turn signal.

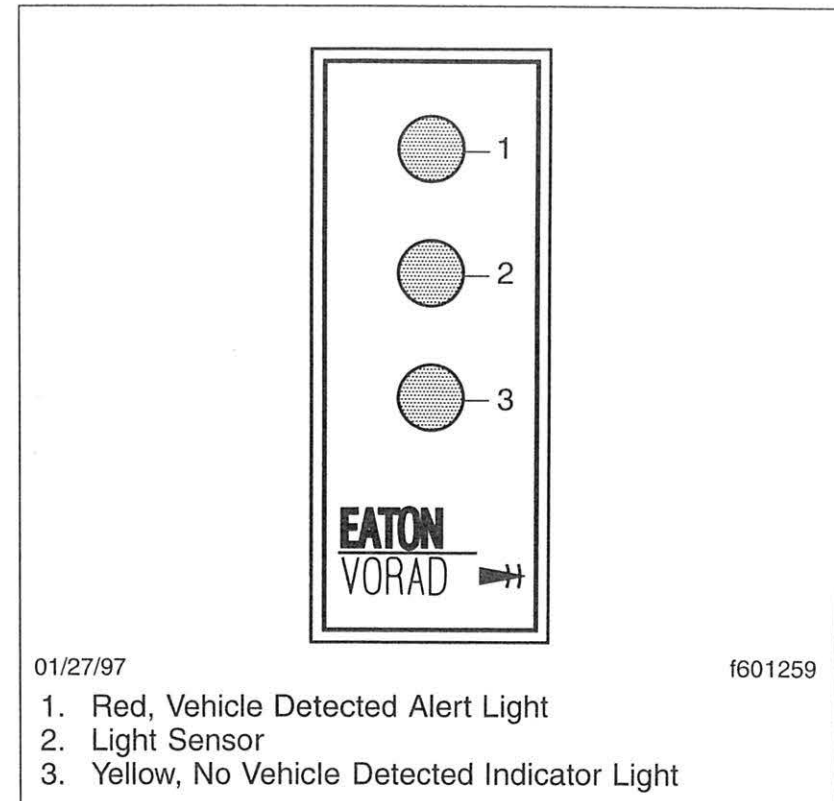


Fig. 2.45, Side Sensor Display

Instruments and Controls Identification

Special Road Situations

1. Certain special road situations must be considered in order to properly interpret the system's warnings. These situations include the effects of curves, dips, and hills. 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.
2. When an object is detected in a turn, the audible alarm will not sound. Inputs from the the turn sensor assembly cause the system to cancel audible alarms while the vehicle is making left- or right-hand turns.
3. In general, oncoming cross traffic in an upcoming curve will not cause an audible alarm because the traffic passes through the radar beam too quickly.
4. When approaching a curve, before turning into it, alarms may sound and lights illuminate because of an object off the road, on the side, in line with your vehicle.
5. Elevated obstacles, such as overpasses and overhead signs, may be detected when approaching a roadway descending to a lower elevation.
6. 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.

7. On approaching a steep hill, objects above the beam cannot be detected. Generally, the beam hitting the road surface does not cause an alarm.
8. 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.
9. The side sensor range is set to detect small cars and motorcycles in the next lane. The sensor may also detect very large vehicles two lanes away.

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. Rain or water spray on the sensor may also cause the red light to stay on when there is no object present.

10. Because the front radar beam is narrow, warnings of a vehicle cutting in closely in front of you may be delayed.

In Case of Accident

The accident recorder can store two ten minute segments of system data on the (optional) driver's card. Store the first of the two segments by pushing and holding the "PUSH AUX RANGE" knob on the driver display unit. Hold for approximately two seconds, until the green "ON" light blinks confirming storage. If the knob is pushed again, the first ten minute segment will not be

Instruments and Controls Identification

overwritten. The second ten minute segment runs continuously and records the last ten minutes of data until the card is removed or the system is turned off. If the "ON" light does not blink after pushing and holding the knob approximately two seconds, remove the driver's card immediately and retain the accident data for safekeeping.

Maintenance and Diagnostics

1. Keep the antenna assembly and side sensor free of a build-up of mud, dirt, ice, or other debris that might reduce the system's range.
2. The system tests itself continuously and evaluates the results every 15 seconds. If a problem is detected, the red "FAIL" light on the driver display unit illuminates continuously and the corresponding fault code is stored in the central processing unit memory.
3. Both active and inactive fault codes can be indicated by the central processing unit when the system is placed in failure display mode. See "Displaying Fault Codes" below. In this mode, specific fault codes are indicated by the pattern of blinks of the driver display unit red "FAIL" light.
4. Each fault code is a two-digit number, as shown in **Table 2.1**. The red "FAIL" light blinks the same number of times as the first digit, a pause of approximately 3/4 of a second follows, then the light blinks the same number of times as the second digit.

5. Additional fault codes are blinked out at intervals of approximately eight seconds. After all the fault

Fault Code	Suspect Failure
11–17	Bad CPU or CPU Connections
21–23	Bad Antenna or Antenna Connections
31	Brake Input Not Connected
41	Speaker Not Connected
42	No Faults Found
51	Steering Sensor Right Input Not Connected
52	Steering Sensor Left Input Not Connected
53	Steering Sensor Misaligned On Column
61	Speedometer Sensor Not Connected
71	Right Turn Signal Input Not Connected
72	Right Side Sensor Not Connected
73	Left Turn Signal Input Not Connected
74	Left Side Sensor Not Connected
91	DDU Volume Knob Bad
92	DDU Range Knob Bad
93	DDU Not Connected

Table 2.1, Fault Codes

Instruments and Controls Identification

codes have been displayed, the sequence repeats. This process continues until the system is turned off.

Displaying Fault Codes

1. To display fault codes, first turn off the system's power with the "PUSH ON/OFF VOL" knob.

NOTE: Disregard this step if the system has no on/off capability. Use the vehicle ignition switch to turn off power to the system.

2. Depress and hold the driver display unit "PUSH ON/OFF VOL" knob. Continue depressing the knob until the "FAIL" light begins to blink in approximately five seconds.
3. Position the driver display unit "RANGE" knob to the left to blink active fault codes and to the right to blink inactive codes.
4. Fault codes can only be cleared by using a Pro-Link® 9000 diagnostic tool. For troubleshooting information, refer to Group 54 in the vehicle workshop manual.

Instruments

Tachometer (Fig. 2.46)

The tachometer (Ref. 1) 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, refer to the engine identification plate. The green color 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.

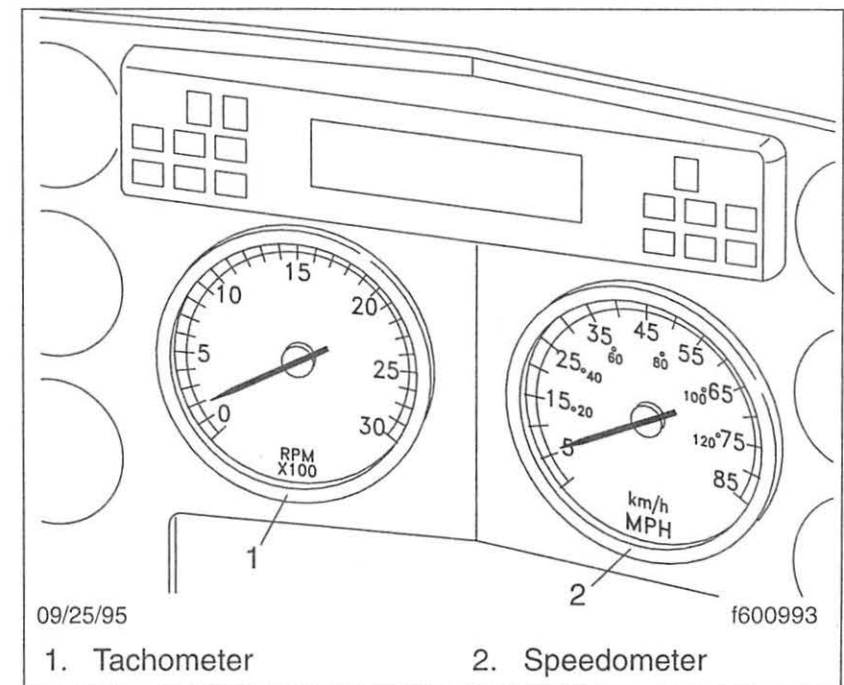


Fig. 2.46, Instrument Panel (center)

Speedometer (Fig. 2.46)

The speedometer (Ref. 2) registers speed in both miles-per-hour (mph) and kilometers-per-hour (km/h).

Engine Oil Pressure Gauge (Fig. 2.47)

The oil pressure gauge (Ref. 1) should read as shown in **Table 2.2**.



CAUTION

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

Coolant Temperature Gauge (Fig. 2.47)

During normal engine operation, the coolant temperature gauge (Ref. 2) should read 175° to 195°F (79° to 91°C). If the temperature remains below 160°F (71°C) or exceeds the maximum temperature shown in **Table 2.3**, inspect the cooling system to determine the cause. Refer to the vehicle workshop manual for troubleshooting and repair procedures.

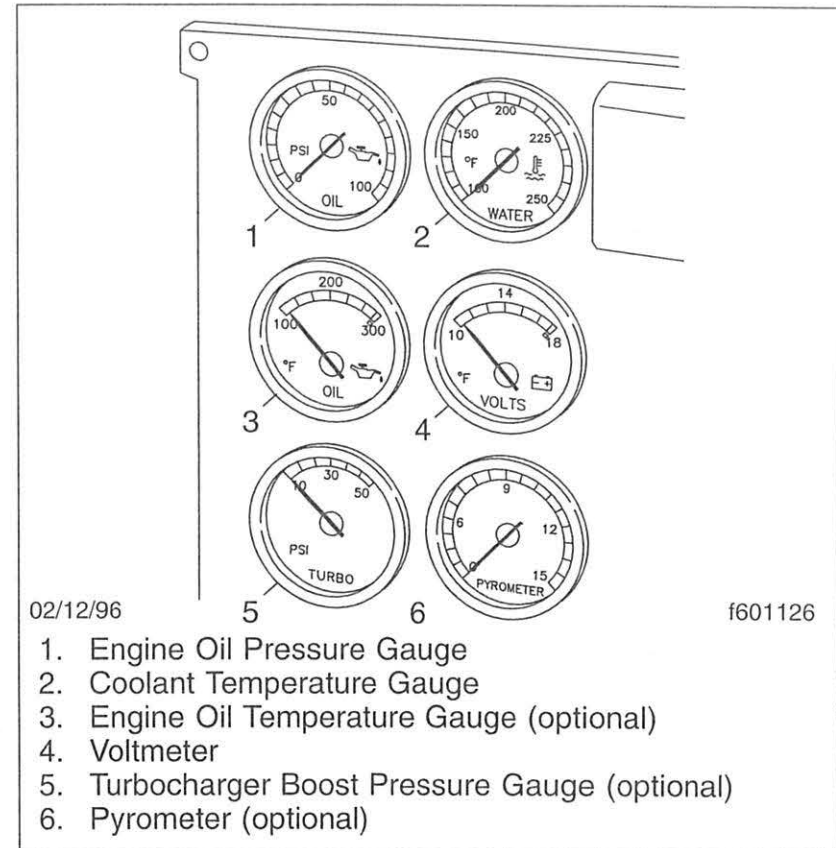


Fig. 2.47, Instrument Panel Gauges (left side)

Instruments and Controls Identification

Engine Model	Oil Pressure at Idle Speed psi (kPa)	Oil Pressure at Rated RPM psi (kPa)
Caterpillar C-10	10-20 (69-138)	30-45 (207-310)
Caterpillar C-12	10-20 (69-138)	30-45 (207-310)
Caterpillar 3406E	15 (100) min.	40 (275) min.
Cummins M11	10 (69) min.	35-45 (241-310)
Cummins N14*	10 (69) min.	35-45 (241-310)
Detroit Diesel	12 (83)	50 (345) min.

* 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.

Table 2.2, Oil Pressure (with the engine at operating temperature: with the engine cold, oil pressure may be higher).

Engine Oil Temperature Gauge, Optional (Fig. 2.47)

During normal operation, the engine oil temperature gauge (Ref. 3) should read:

- 180° to 225°F (82° to 107°C) for Cummins engines;
- 190° to 220°F (88° to 104°C) for Caterpillar engines;

- 200° to 230°F (93° to 110°C) for Detroit Diesel engines.

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



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.

Voltmeter (Fig. 2.47)

A voltmeter (Ref. 4) indicates the voltage in the battery, and should read 13.8 volts nominally when the ignition

Engine Model	Maximum Coolant Temperature °F (°C)
Caterpillar	215 (101)
Cummins	220 (104)
Detroit Diesel	215 (101)

Table 2.3, Maximum Coolant Temperature

Instruments and Controls Identification

is on or off. It will show lower voltage when the vehicle is being started, and higher voltage when the batteries are charging. Whenever the voltmeter shows an undercharging or overcharging condition for an extended period, check the batteries and charging system.

Turbocharger Boost Pressure Gauge, Optional (Fig. 2.47)

A turbocharger boost gauge (Ref. 5) measures the pressure in the intake manifold, in excess of atmospheric pressure, being created by the turbocharger.

Pyrometer, Optional (Fig. 2.47)

A pyrometer (Ref. 6) registers the exhaust temperature near the turbocharger. Normal exhaust temperatures are listed in **Table 2.4**.

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

Primary and Secondary Air Pressure Gauges (Fig. 2.48)

Air pressure gauges register the pressure in the primary (Ref. 1) and secondary (Ref. 2) 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.

Fuel Gauge (Fig. 2.48)

The fuel gauge (Ref. 3) indicates the level of fuel in the fuel tank(s). If equipped with a second (optional) fuel

Engine Model	Exhaust Temperature °F (°C)
Caterpillar C-10, C-12	935-1290 (500-700)
Caterpillar 3406E	900-1100 (480-595)
Cummins M11	800-1000 (430-540)
Cummins N14	750-950 (400-510)
Detroit Diesel	700-950 (370-510)

Table 2.4, Exhaust Temperature

Instruments and Controls Identification

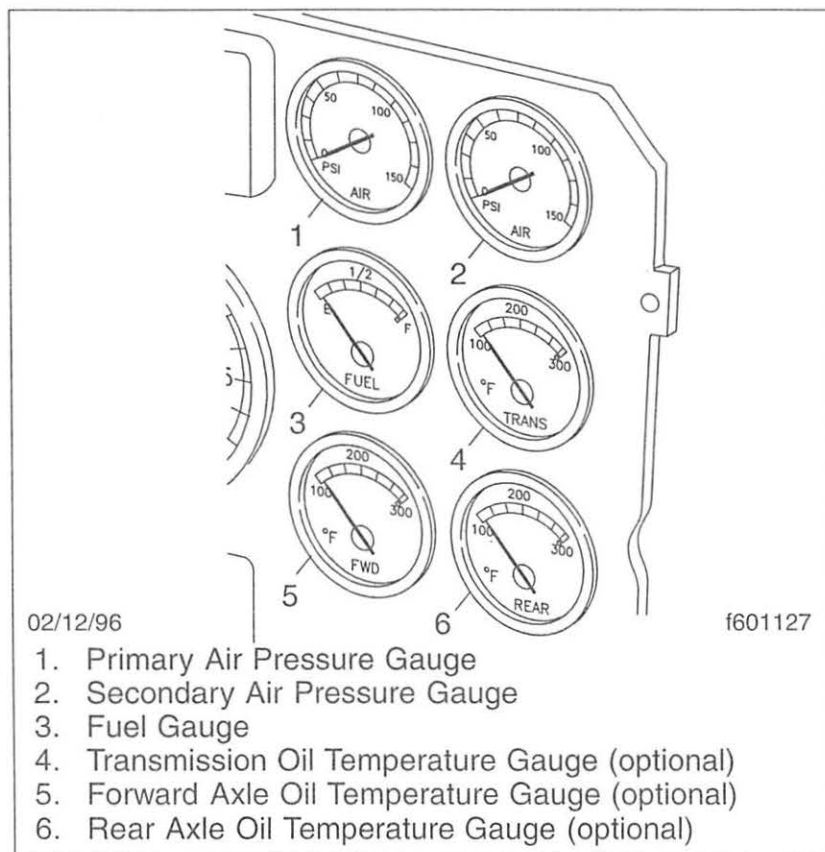


Fig. 2.48, Instrument Panel Gauges (right side)

gauge, each fuel tank level is indicated on a separate gauge.

Transmission Oil Temperature Gauge, Optional (Fig. 2.48)

During normal operation, the transmission oil temperature gauge (Ref. 4) reading should not exceed 250°F (121°C) for 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 vehicle until the cause has been determined and corrected.

Forward and Rear Axle Oil Temperature Gauges, Optional (Fig. 2.48)

During normal operation, forward (Ref. 5) and rear (Ref. 6) axle oil temperature gauges should read between:

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

Instruments and Controls Identification

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 vehicle until the cause has been determined and corrected.

Application Air Pressure Gauge, Optional

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, Optional

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). When the vacuum reading in normal operation equals the applicable level shown under "Service" in **Table 2.5**, the air cleaner needs to be serviced.

NOTE: Rain or snow can wet the filter and cause a higher than normal reading temporarily.

Intake-Air Restriction Indicator (Fig. 2.49)

An intake-air restriction indicator measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the yellow signal stays locked at or above the values shown in **Table 2.5**, after the engine is shut down, the air cleaner needs to be serviced; the indicator then needs to be reset by pressing the yellow button.

NOTE: Rain or snow can wet the filter and cause a higher than normal reading temporarily.

Ammeter, Optional

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

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

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

Table 2.5, Intake-Air Restriction

Instruments and Controls Identification

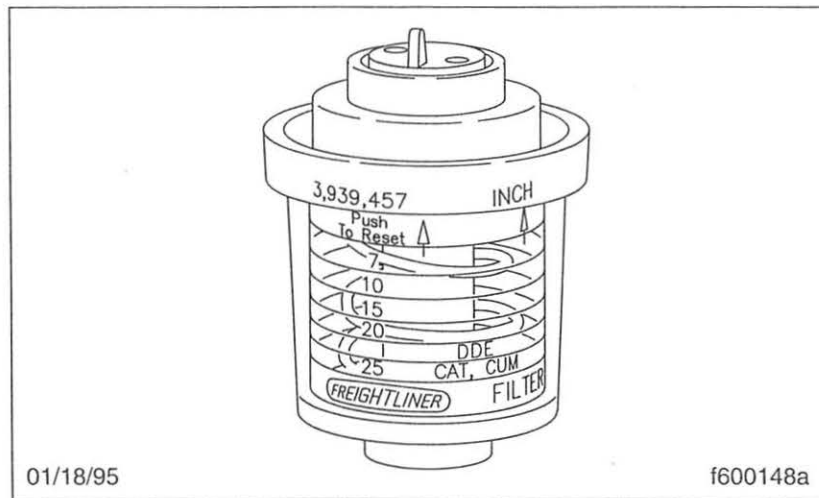


Fig. 2.49, Intake-Air Restriction Indicator

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.

Borg Indak Analog Clock

The analog clock features electronic setting. Do not pull the set knob. The time can be set either forward (turn knob to the right) or backward (turn the knob to the left). A slight turn of the knob either right or left will change the setting of the clock one minute at a time. Holding the knob to either the right or the left will allow accelerated sweeping of the hands for setting the hour.

Pan-Pacific Digital Clock, Optional

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

1. To set the time of day:

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

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

- 1.2 Advance the hour setting to the correct number by pushing and releasing the hour button as many times as needed. Or, if the button is pressed and held in for longer than two seconds, the numbers will continue to advance until the button is released.
- 1.3 Advance the minute setting by repeatedly pushing, or pushing and holding the minute button, as needed.
- 1.4 Push the Run/Set switch to the middle (RUN) position.

2. To set the alarm time:

Instruments and Controls Identification

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

Kysor Digital Clock, Optional

A Kysor digital clock has a constant red display, which automatically adjusts the brightness for day or night. The clock features a 24-hour alarm.

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

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

 - 1.2 Advance to the correct time by pushing either the "Fast" or "Slow" pushbutton.
2. To set the alarm:
 - 2.1 Depress the alarm "Set" pushbutton; observe that a red lamp above the word "Alarm" illuminates.

Instruments and Controls Identification

- 2.2 Set the alarm time by using the same procedure that you used to set the time of day; remember to select either A.M. (no red dot) or P.M. (red dot illuminates) when setting the alarm time.
- 2.3 After the desired alarm time appears, depress the alarm "Set" pushbutton again; the readout will return to the time of day, and the red lamp will go out.
- 2.4 To set the alarm, depress the alarm "On" pushbutton; observe that a red dot on the right side of the time-of-day readout is illuminated. The alarm is now set, and when the displayed time of day coincides with the alarm time, the alarm will sound.
- 2.5 To cancel or shut off the alarm, depress the alarm "On" pushbutton again; the red dot on the face of the clock will go out.

is also used whenever the vehicle is placed out of service for extended periods, to prevent battery discharge.

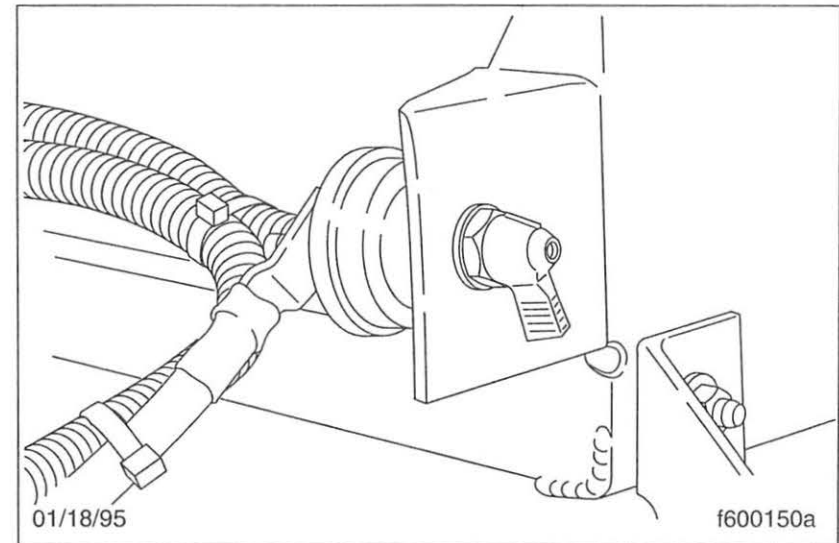


Fig. 2.50, Battery Disconnect Switch

Exterior Switches

Battery Disconnect Switch, Optional (Fig. 2.50)

A battery disconnect switch cuts off all battery power to the vehicle. The switch is used whenever service operations require that the batteries be disconnected; it

Vehicle Access

Ignition and Lock Key	3.1
Cab Door Locks and Handles	3.1
Grab Handles and Access Steps	3.2
Door Windows	3.5
Sleeper Compartment Vents	3.5
Circuit Breaker/Relay Panel	3.5
Cab-to-Sleeper Access	3.6
Sleeper Bunk Latches	3.6
Sleeper Compartment Exit Door	3.6
Baggage Compartment Doors	3.6
Back-of-Cab Grab Handles, Steps, and Deck Plate	3.7
Battery Box Cover	3.8
Hood Tilting	3.9

3.9
3.14
3.17

Keyless Security System (optional)	3
Cab Amenities	3
Windshield Washer Reservoir	3

Vehicle Access

Ignition and Lock Key

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

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

Cab Door Locks and Handles

To unlock the driver's door from outside the cab, insert the key in the lockset and turn it one-quarter turn clockwise (**Fig. 3.1**, Ref. 1). Turn the key counterclockwise to the original position to remove it. Pull out on the paddle handle to open the door (**Fig. 3.1**, Ref. 2).

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

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

To lock a door from outside the cab, insert the key in the lockset and turn it opposite the unlocking direction, then close the door if it is open. Or, push down the inside lock button (**Fig. 3.2**, Ref. 1), then close the door.

To lock either door from inside the cab, push down the lock button (**Fig. 3.2**, Ref. 1), then close the door if it is

open. Pull the integral grab bar (**Fig. 3.2**, Ref. 2) when closing the door.

To open the door from the inside, pull the door handle toward you (**Fig. 3.2**, Ref. 3). This will unlatch the door whether or not it is locked. To unlock the door without unlatching it, pull the lock button up.

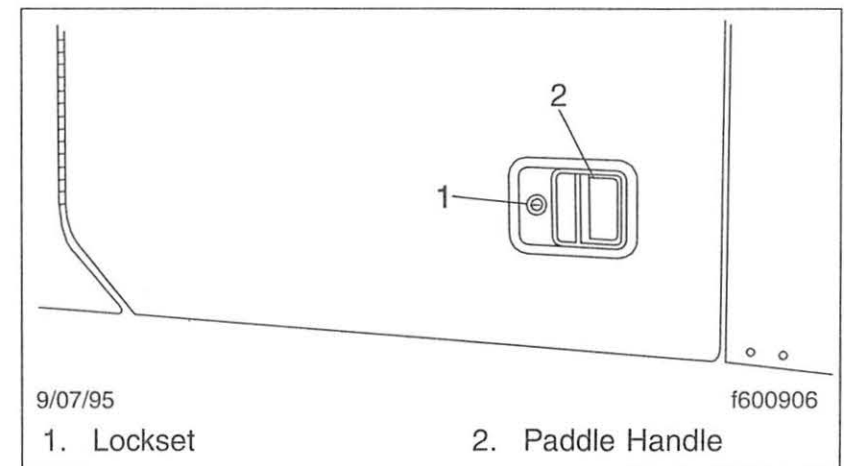


Fig. 3.1, Exterior Door Handle

Grab Handles and Access Steps

WARNING

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

Always maintain three-point contact with the cab access system while entering and exiting the cab. Three-point contact means both feet and one hand, or both hands and one foot.

Entering the Driver's Side (Fig. 3.3)

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

1. Open the driver's door, and place in the cab anything that you are carrying.
2. Grasp the grab handle (Ref. 2) with both hands. Reach up as far as is comfortable.
3. Place your right foot on the bottom step (Ref. 4), and pull yourself up.
4. Place your left foot on the top step (Ref. 3).

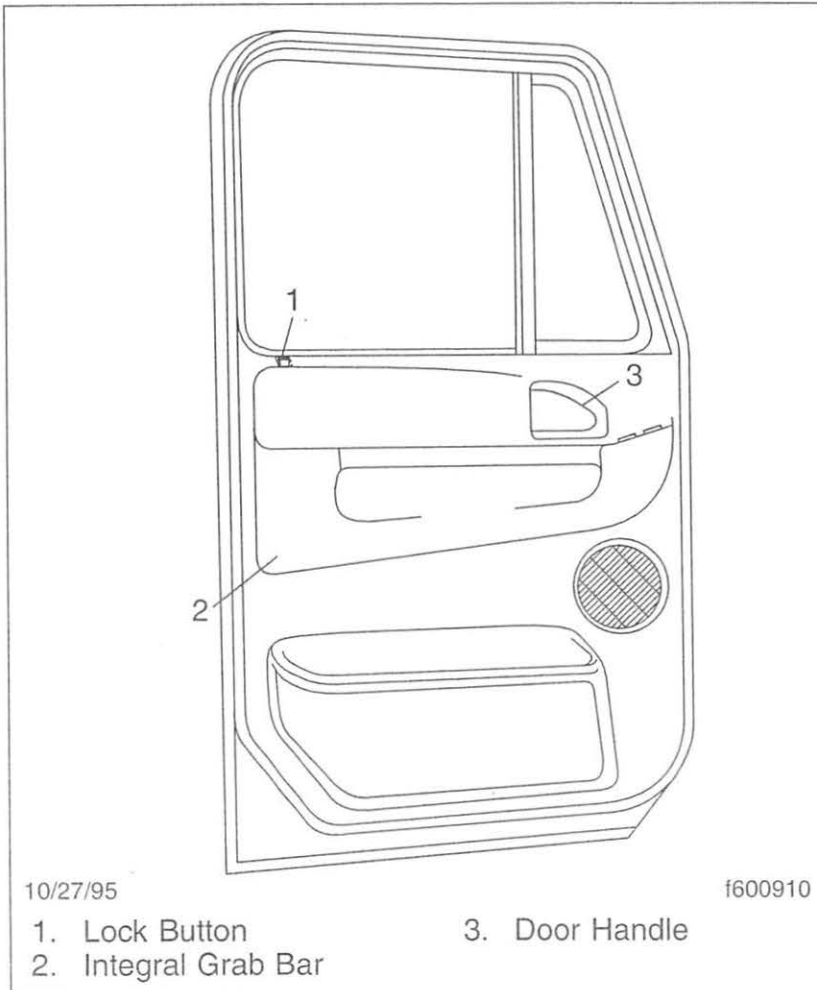


Fig. 3.2, Door Interior

Vehicle Access

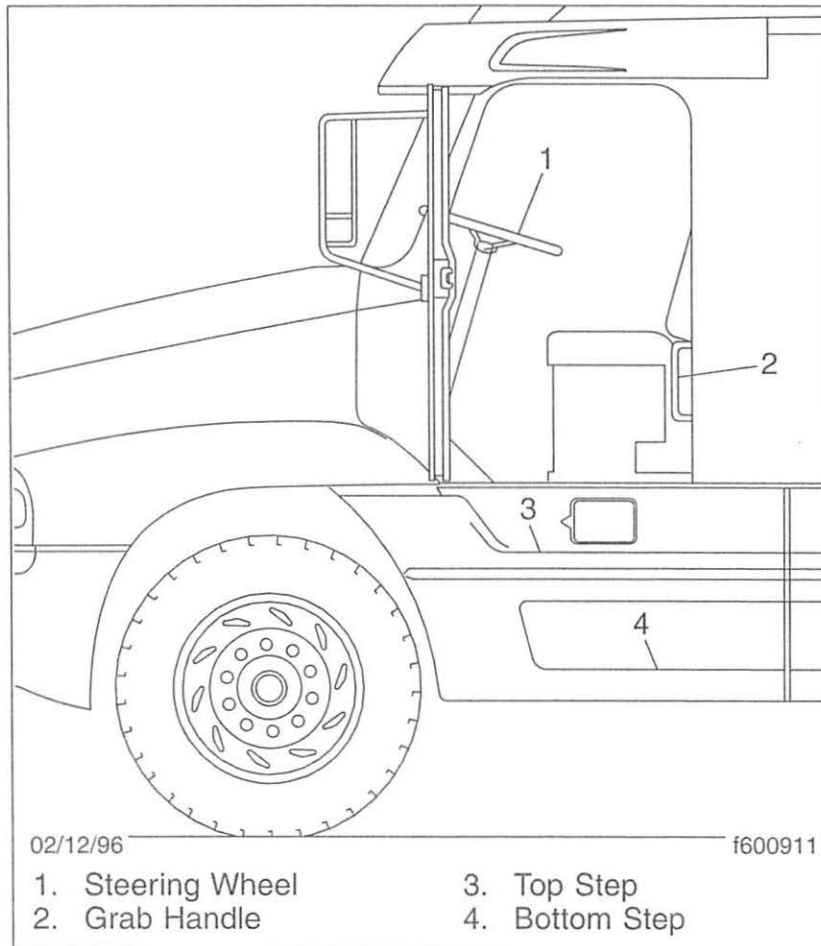


Fig. 3.3, Driver's Side Steps and Grab Handle

5. Grasp the steering wheel (Ref. 1) 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's Side (Fig. 3.3)

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

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

1. Grasp the steering wheel with both hands, place your left foot on the top step (Ref. 3), and stand on the threshold, facing into the cab.
2. Grasp the grab handle at the aft edge of the door opening (Ref. 2) with your right hand.
3. Move your right foot to the bottom step (Ref. 4).
4. Move your left hand to the grab handle (Ref. 2).
5. Step to the ground with your left foot first.

Entering the Passenger's Side (Fig. 3.4)

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

1. Open the passenger's door, and place in the cab anything that you are carrying.

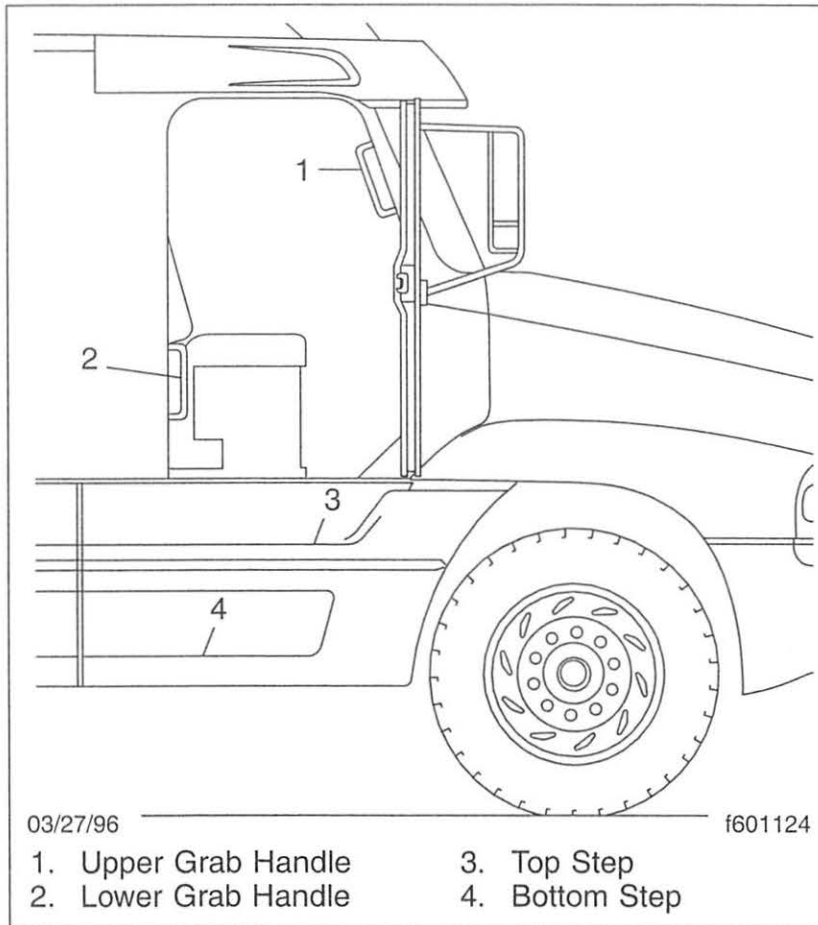


Fig. 3.4, Passenger's Side Steps and Grab Handles

2. Grasp the grab handle at the aft edge of the door opening (Ref. 2) with your left hand.

3. Grasp the handle on the door (**Fig. 3.5**, Ref. 4) with your right hand.
4. Place your right foot on the bottom step (Ref. 4) and step up to the upper step (Ref. 3) with your left foot.
5. With your left hand, grasp the upper grab handle on the windshield post (Ref. 1).
6. Place your right foot on the top step (Ref. 3) and step up.
7. Move your right hand to the upper grab handle on the windshield post (Ref. 1).
8. Step into the cab with your left foot first.

Exiting the Passenger's Side (**Fig. 3.4**)

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

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

1. Grasp the grab handle on the windshield post (Ref. 1) with both hands, and place your right foot on the top step (Ref. 3) while standing up from the seat facing inward.
2. Place your left foot on the bottom step (Ref. 4).
3. Move your left hand to the grab handle at the aft edge of the door opening (Ref. 2).

Vehicle Access

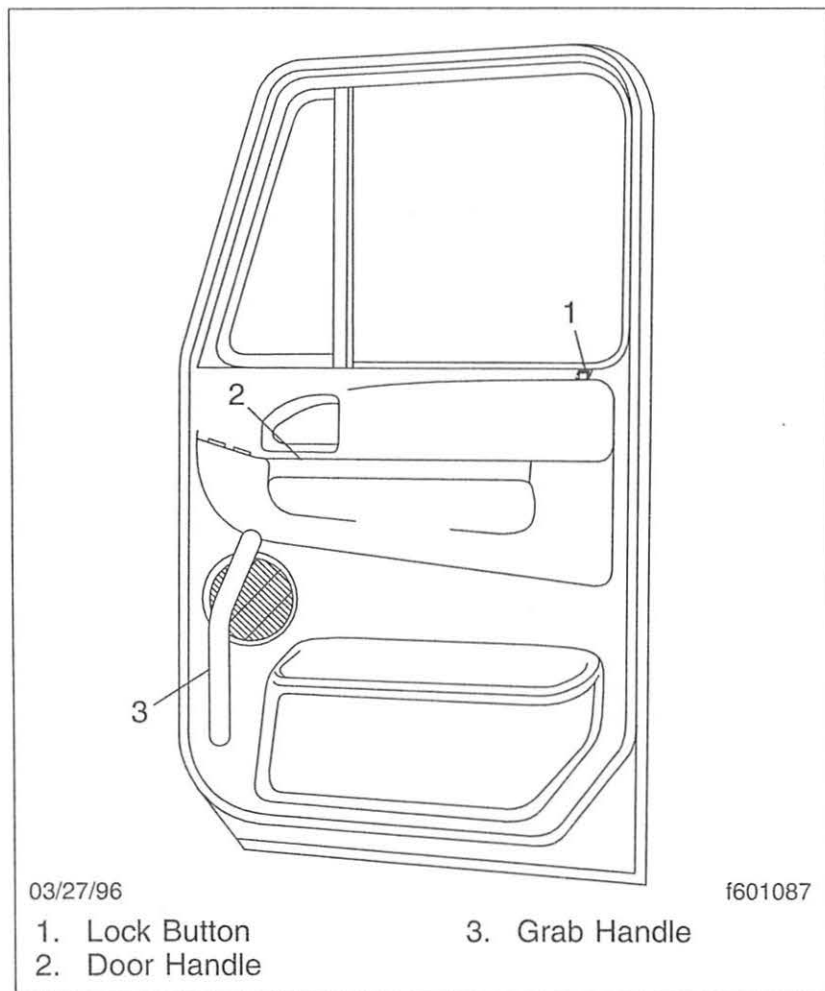


Fig. 3.5, Passenger's Door Interior

4. Move your right hand to the grab handle on the door (**Fig. 3.5, Ref. 4**).
5. Step to the ground with your right foot first.

Door Windows

The windows in both doors operate electrically (if so equipped). Use the appropriate switch to raise or lower a door window.

Sleeper Compartment Vents

To open any sleeper compartment vent, push the vent handle outward and forward with your fingertips. To close the vent, turn your hand so that your fingers are pulling on the handle from the front edge, then pull in and back on the handle. Use care to avoid pinching your fingers.

Circuit Breaker/Relay Panel

The circuit breaker/relay panel is located in front of the passenger's seat under the top cover of the instrument panel. To access the compartment, first remove the vertical panel located immediately below the right hand adjustable louvers. Gently pry up the lower edge by using your fingertips or a flat-bladed screwdriver in the slots provided. Rotate the exposed fastener one-fourth turn and lift off the cover. Removal of the smaller exposed duct might also be required.

Cab-to-Sleeper Access



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

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

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 Bunk Latches

To move the lower or upper sleeper bunk (if equipped), disengage the latch at the front of the lower bunk, or the latches on both sides of the upper bunk. Lock the bunks into operating position, down for the lower bunk and up or down for the upper bunk, by engaging both the primary and secondary latches.

Sleeper Compartment Exit Door (Fig. 3.6)

The sleeper compartment exit door is intended for use as an emergency exit only. The door can not be opened from outside the sleeper.

To open the door from the inside, push down on the lever handle located inside the sleeper compartment to the right of the door. To close the door, push it closed until it latches.

Baggage Compartment Doors (Fig. 3.6)

To unlock the baggage compartment door on the passenger's side, insert the ignition key in the lockset, and turn it one-quarter turn clockwise. Turn the key to the original position to remove it. Pull up and outward on the baggage door handle to open the door. To close the door, push it closed until it latches. To lock the door, insert the ignition key in the lockset and turn it one-quarter turn counterclockwise.

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

Vehicle Access

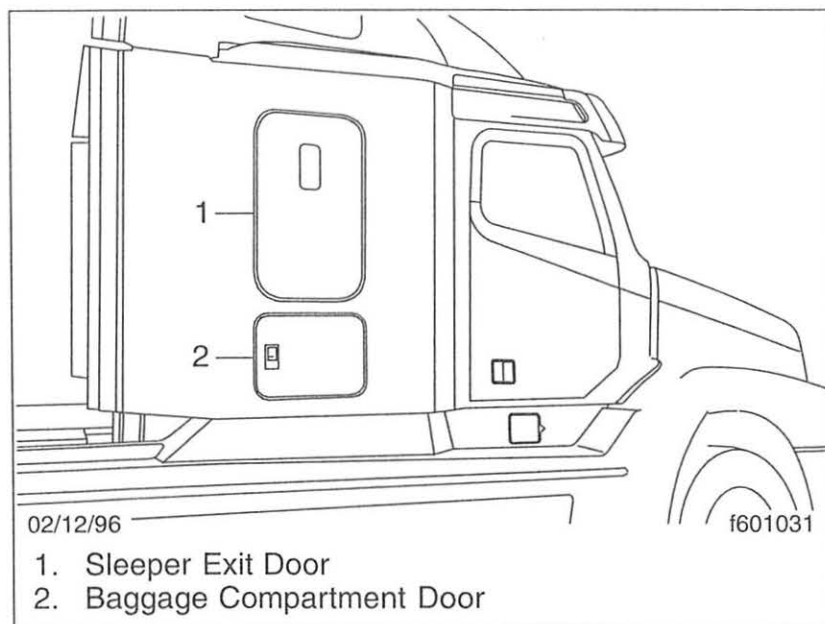


Fig. 3.6, Passenger's Side Doors

Back-of-Cab Grab Handles, Steps, and Deck Plate (Fig. 3.7)

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

A grab handle (Ref. 1) is mounted either on the exhaust shield, the cab, or the sleeper box. Steps (Ref. 3) are

mounted on the fuel tank, battery box, or frame, depending on the available space. When an optional deck plate (Ref. 2) is included, it is mounted across the top of the frame rails.

WARNING

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

Always maintain three-point contact with the cab access system while entering and exiting the cab. Three-point contact means both feet and one hand, or both hands and one foot.

Accessing Back-of-Cab

When climbing onto the frame rails or deck plate, use the grab handle and access steps (Ref. 3) as follows:

1. Grasp the grab handle (Ref. 1) 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.

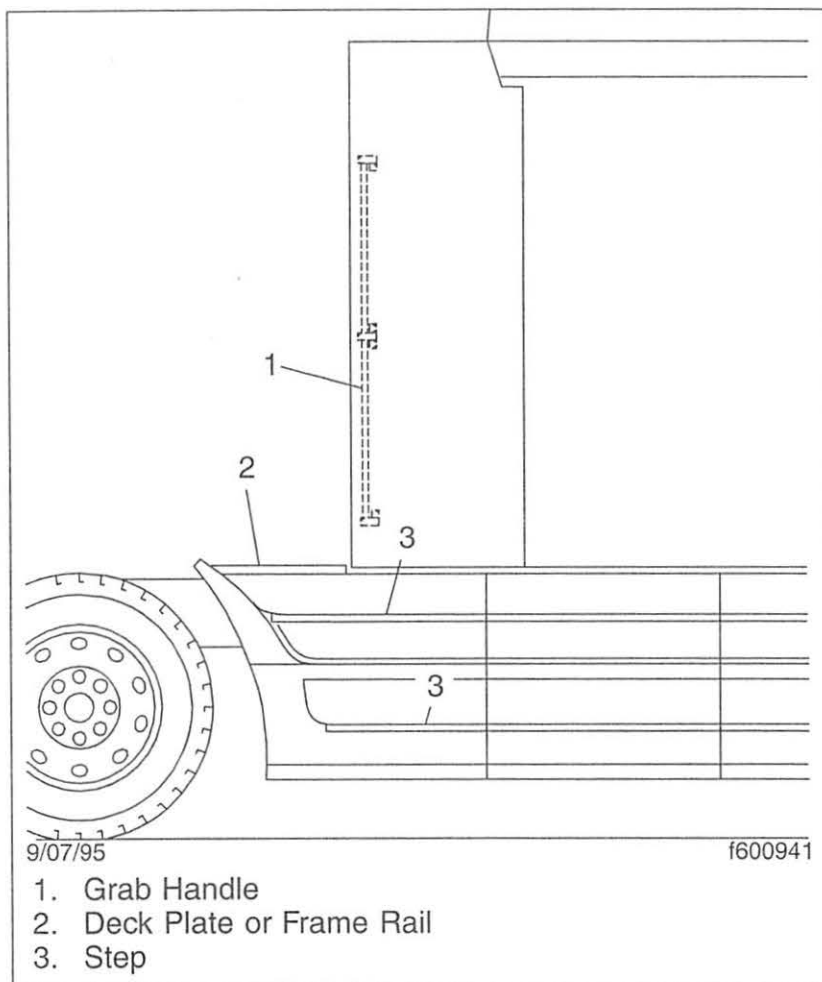


Fig. 3.7, Back-of-Cab Access

5. Step onto the deck plate or frame rail (Ref. 2).

Exiting Back-of-Cab

When climbing down from the frame rails or deck plate, use the grab handle and access steps (Ref. 3) as follows:

1. Grasp the grab handle (Ref. 1) with both hands.
2. Step one foot at a time to the top step.
3. Move your upper hand to a lower position on the grab handle.
4. Move one foot to the bottom step.
5. Move your upper hand to a lower position on the grab handle.
6. Step to the ground with your upper foot first.

Battery Box Cover

To remove the cover from the frame rail-mounted battery box, release the latches that attach the left chassis fairing panel (if equipped) in front of the battery box. Remove the air fairing panel. Refer to **Group 60** in the vehicle workshop manual for instructions. If no air fairing panel is installed, remove the step plate. Pull on the end of each hold-down latch until the end clears the cover-mounted catch. Pivot the latches out of the way, then lift

Vehicle Access

off the cover. When installing the cover, be sure it is positioned properly before fastening the latches.

To remove the cover from the battery box mounted between the frame rails, remove the deck plate and lift the handle on the top of the battery box cover. If equipped, remove the spring pin.

Hood Tilting

The hood can be tilted to a full-open position. A grab handle at the front of the hood provides a hand-hold for hood tilting. A torsion bar helps you to tilt the hood open, and to return it to the operating position. Hood straps prevent the hood from overtravel. In the operating position, the hood is secured to the lower cab side panels by a hold-down latch on each side of the hood.

To Tilt the Hood

1. Apply the parking brakes.
2. Release both hood hold-down latches by pulling the 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. 3.8**.

To Return the Hood

1. Grasp the grab handle, and lift the hood to the 45-degree position.
2. As the hood goes over center, use the bumper step and grab handle to control the rate of descent to the operating position. See **Fig. 3.8**.
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.

Keyless Security System (optional)

General Information

The optional Rockwell keyless security system is a complete vehicle security system. If installed, it locks and unlocks the doors, protects against theft, and provides security for the driver while sleeping or resting inside the vehicle.

The system consists of the following components:

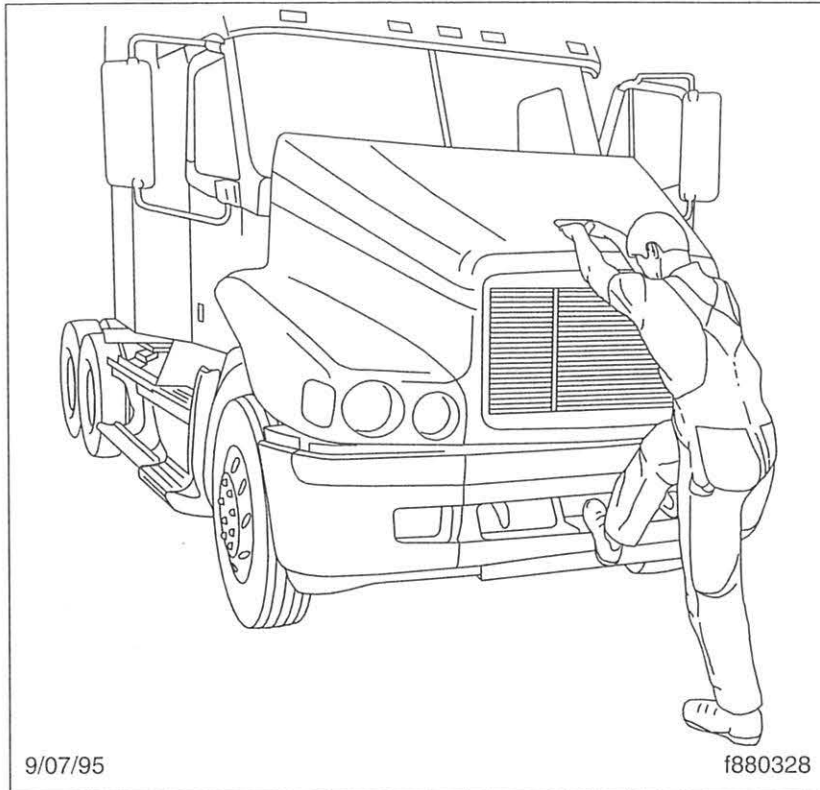


Fig. 3.8, Hood Tilting

- A hand-held radio frequency transmitter that looks like a key chain fob. It acts as a remote control for locking the doors, unlocking the doors, or placing the system on alert. Each system allows as many as four different fobs. See **Fig. 3.9**.

- A red system-status LED (light-emitting diode) mounted on the overhead panel above the clock. The LED flashes slow or fast to indicate what state the system is in: armed, alert, alarmed, or violated. It is off when the system is disarmed. See **Fig. 3.10**.
- A Rockwell relay module mounted behind the right-hand B-pillar electrical compartment door that arms and disarms the system and programs the fobs.
- A program switch on the Rockwell relay module that places the relay module in the learning mode, which is the only state in which the system can learn fob ID codes. The switch is shown in its normal, or OFF, state (toggle pointing up). See **Fig. 3.11**.
- A security system electronic control module (ECM), also mounted behind the right-hand B-pillar electrical compartment door, that monitors all the entry points, controls the door locks, operates the alarm, and interrupts the power to the engine, as necessary. There is also a PDM (power distribution module) relay module mounted on top of the left-hand side of the ECM.

How It Works

The fob has three pushbuttons: LOCK, UNLOCK, and ALERT. When a button is pushed, the fob sends a radio

Vehicle Access

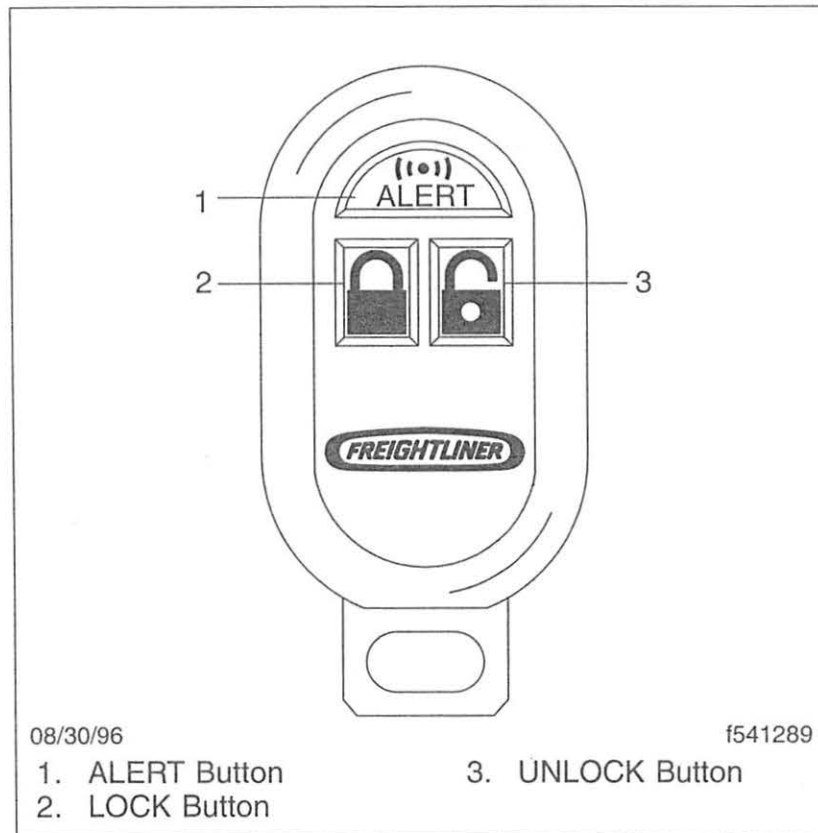


Fig. 3.9, Key Chain Fob (radio transmitter)

frequency signal to the ECM. The signal contains a unique vehicle access code that identifies the individual fob, plus codes that indicate which button has been pushed.

The ECM detects the signal sent by the fob, amplifies it and converts it to a digital sequence.

If the LOCK button is pressed, the ECM arms the system. It locks the two cab doors, begins to monitor all the entry points (the two cab doors, the sleeper cab access door, and the two baggage doors, as installed), and instructs the relay module to start flashing the system LED at the slow rate. If any entry points are open, the ECM sounds the horn and flashes the cab marker lights twice. If the ignition keyswitch is turned off, the ECM interrupts ignition power to the engine.

The driver may be inside or outside the vehicle. However, if the engine is running at the time the LOCK button is pressed, the system still enters the armed state, except that the engine is not immobilized. This improves security for the occupant as well as comfort while sleeping or resting, because the system is armed, and the heating or air conditioning is operating without draining any batteries.

Once the system is armed, the alarm functions activate whenever one of the entry points is opened. In the alarmed state, the ECM does the following:

- Immobilizes the vehicle by cutting off power between the ignition keyswitch and the engine electronic control unit (ECU).
- Sounds the horn in pulses of 0.5 second on, 0.5 second off.

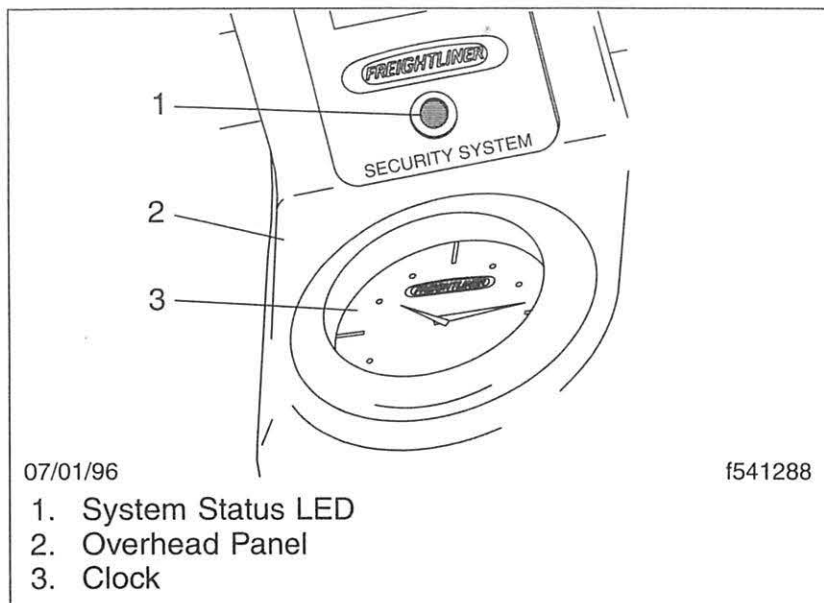


Fig. 3.10, Red System-Status LED

- Flashes the cab marker lights in pulses of 0.5 second on, 0.5 second off.
- Changes the blink rate of the LED from slow to fast.

If the UNLOCK button is pressed, the ECM disarms the system, if armed. It unlocks all the entry points, discontinues its monitoring of the entry points, instructs the relay module to stop flashing the system LED, and restores ignition power to the engine, if interrupted.

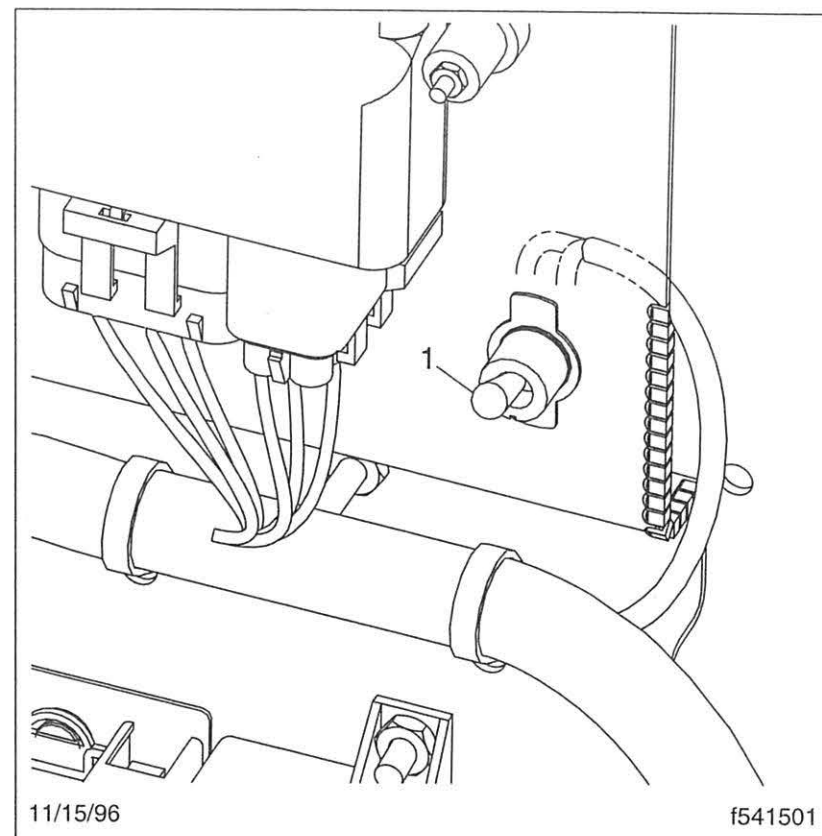


Fig. 3.11, Program Switch

If the ALERT button is pressed, the ECM executes the unlock sequence and also activates the vehicle alarm functions (see above). To cancel an ALERT (to turn off the alarm), press the UNLOCK button.

Vehicle Access

Once activated, the alarm sequence continues for 30 seconds unless deactivated by pressing the UNLOCK button on the fob. After 30 seconds in the alarmed state, the system automatically enters the violated state.

In the violated state, the horn does not sound and the cab marker lights do not flash, but the engine is still immobilized and the LED continues to blink at the fast rate. The vehicle remains in this state until the UNLOCK button is pressed.

Fob Programming

The security system ECM can store up to four fob identification codes. Once the first fob has been programmed, there are never any vacant memory locations.

IMPORTANT: As a security measure, all fobs must be coded during the same programming sequence. The first fob code is stored in all four memory locations. Taken together, these ensure that only the vehicle owner's fobs can be programmed into the system. If additional fobs are programmed, they over-write the original code in locations two, three, and four, in that order.

The ECM provides a 20-second time period to program each fob. If the fob is not programmed within this time span, the system will exit the programming sequence.

After each valid code storage sequence, the system LED will indicate the completion of a learning cycle by

turning off the LED for approximately 0.5 second, and unlocking the doors.

To program a fob, do the following steps:

1. With the ignition keyswitch turned off, turn the program switch ON (flip the toggle DOWN). See **Fig. 3.11**.
2. Now turn the ignition keyswitch on. Note that the system LED illuminates continuously. See **Fig. 3.10**. This indicates that the ECM is ready to begin the learning sequence.

NOTE: If the LED does not illuminate continuously at this point, repeat the first two steps.

3. On the fob, press down both the LOCK and UNLOCK buttons at the same time and hold them down for at least three seconds. See **Fig. 3.9**. If the code was learned, the system LED flashes and the doors unlock.

IMPORTANT: If no valid code was received, the system does not erase any stored data in that memory location. This is a security measure to ensure that a fob ID cannot be erased accidentally.

4. Repeat the above step to program additional fobs, up to a total of four.
5. When the programming sequence is over, return the system to normal operation by turning the program switch OFF (flip the toggle UP).

Fob Battery Replacement

1. Open the battery cover on the back of the fob with a suitable coin or other thin piece of metal. Twist off the cover. See **Fig. 3.12**.
2. Remove the battery and the O-ring installed inside the cover. Save the O-ring for later installation.
3. Install the new battery.

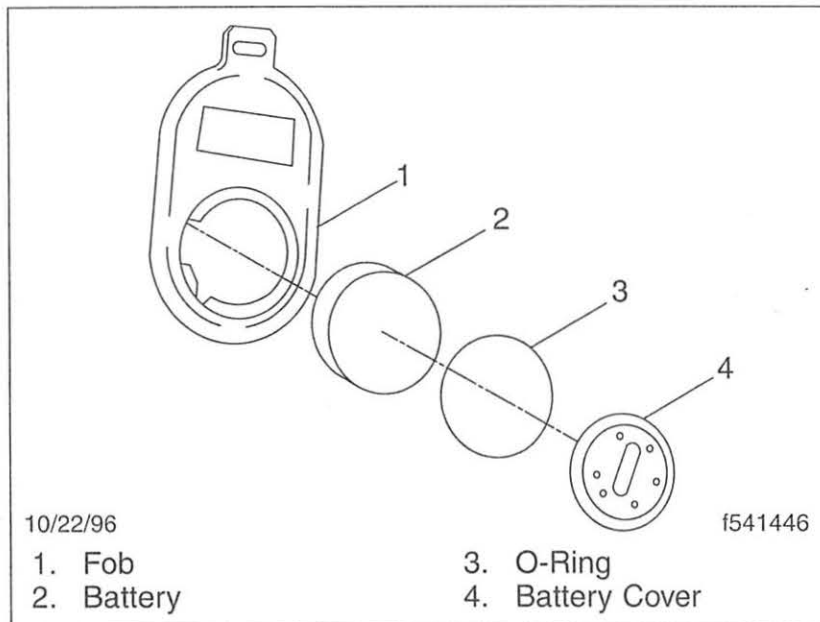


Fig. 3.12, Fob Battery

- 3.1 Insert the new battery into the fob. Make sure the battery is right side up.
 - 3.2 Install the O-ring as removed. If the O-ring is damaged, or there are signs of moisture inside the fob, replace the O-ring.
 - 3.3 Twist on the battery cover and check it to make sure it is tight.
4. Check the fob for correct operation.

Cab Amenities

Waste Bin

To remove the waste bin, slide the waste bin out as far as it will go. Reach in behind the bin and release the bin from the stops on the bin sides. Remove the bin. See **Fig. 3.13**.

To install the bin, insert the bin onto the slides, and then slide the bin into place.

Cup Holders

The Century Class vehicle features two cup holders. The driver's cup holder is located to the right of the ash tray on the lower dash panel. The cup holder flips open for use, and can be pivoted into the dash when not needed. See **Fig. 3.14**. The passenger's cup holder pivots out of the lower dash console. See **Fig. 3.15**. The

Vehicle Access

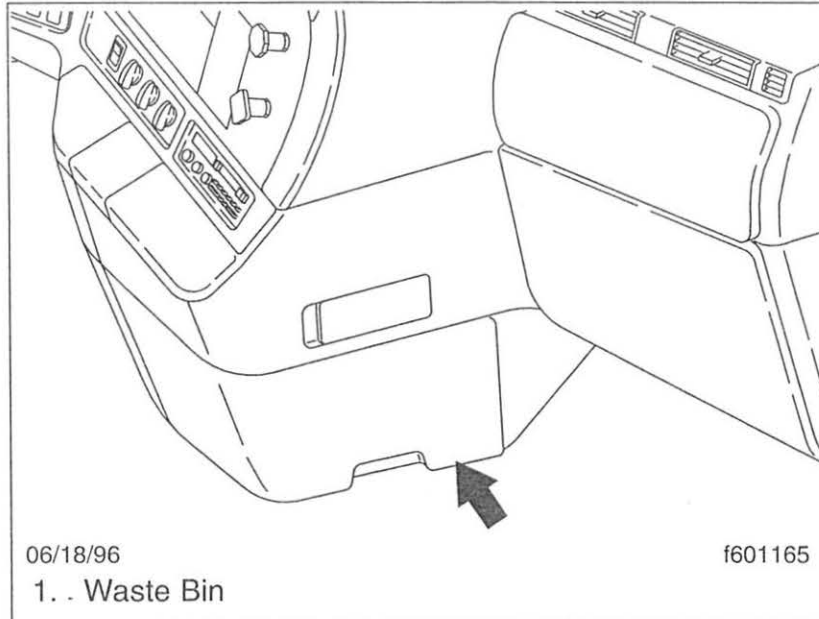


Fig. 3.13, Waste Bin

passenger's cup holder can also be pivoted into the console when not in use.

Ash Tray and Cigar Lighter

The driver's ash tray and cigar lighter assembly is on the left side of the top of the lower dash panel. See **Fig. 3.16**. There is a hinged cover that pivots backward to allow access to the cigar lighter and to the ash tray. The tray is removeable.

Dash Storage Bin

The dash storage bin is located next to the driver's cup holder on the lower dash panel. See **Fig. 3.17**. The bin has a hinged cover, and can be used to store sunglasses.

Map Holder

An elastic-topped pouch is located above each door. These are intended for holding maps and other items.

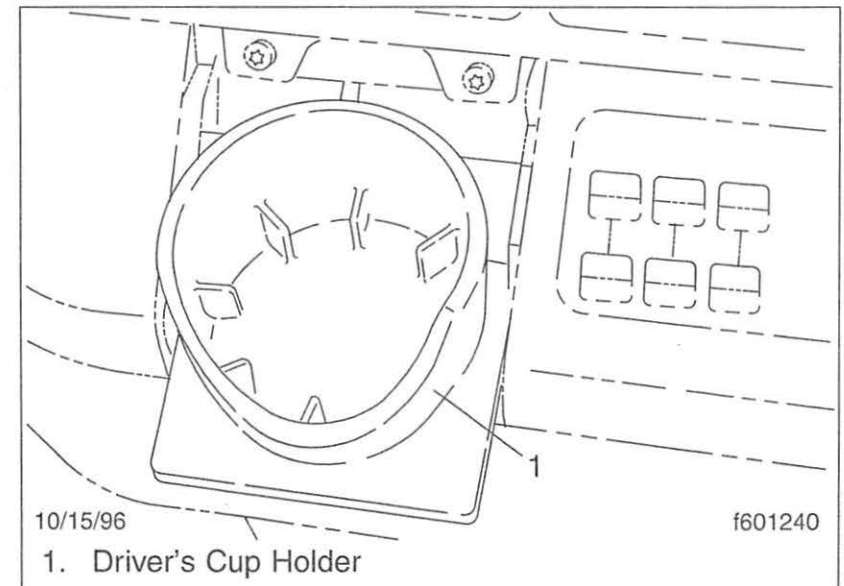


Fig. 3.14, Driver's Cup Holder

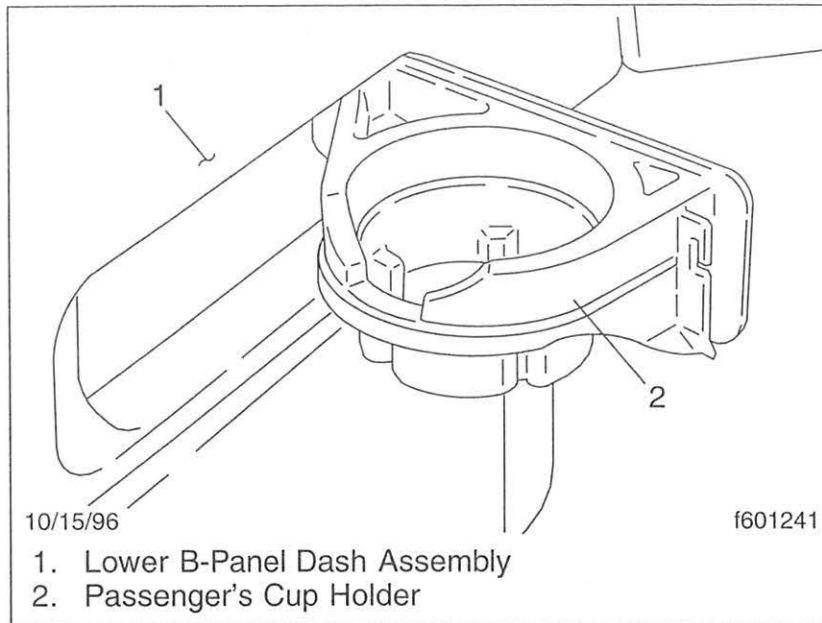


Fig. 3.15, Passenger's Cup Holder

Glove Box

Some vehicles have two glove boxes and two small overhead bins, all located in the overhead console assembly. See **Fig. 3.18**. Above the sun visors on both the driver's and the passenger's sides are the glove boxes with latched doors or netted openings. In the middle section of the console assembly are two small bins. The driver's-side bin is often removed and replaced with a CB radio. The grille underneath this portion of the console allows the radio's speaker to be heard.

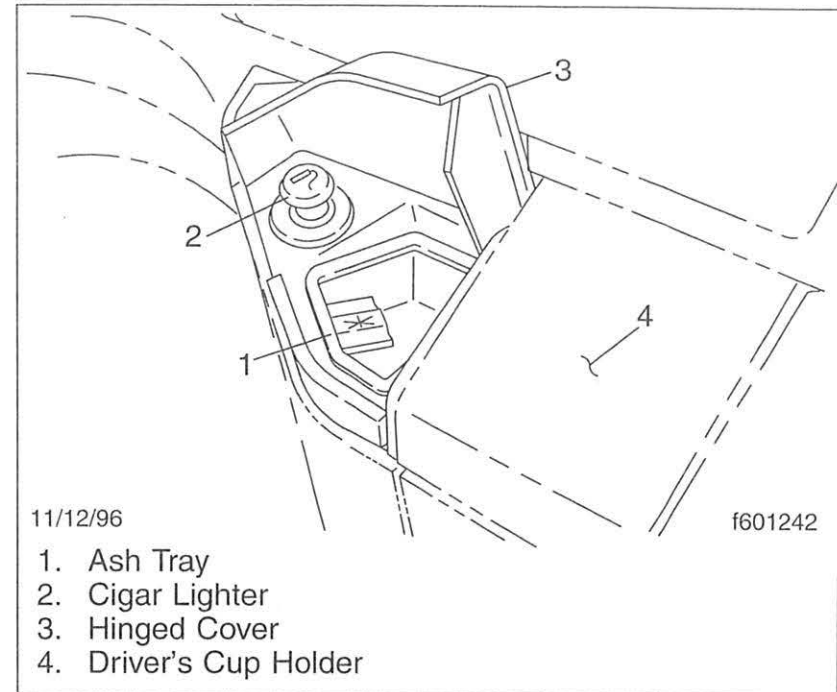


Fig. 3.16, Ash Tray and Cigar Lighter

Overhead Lights

Above both the driver's and the passenger's seats are three oval-shaped lights mounted to the bottom of the overhead console: A red light and two white lights. The red light is mounted nearest to the windshield. Each light is activated by pushing on the lens cover. Also, the center light, a white light, activates when the doors to the vehicle are opened.

Vehicle Access

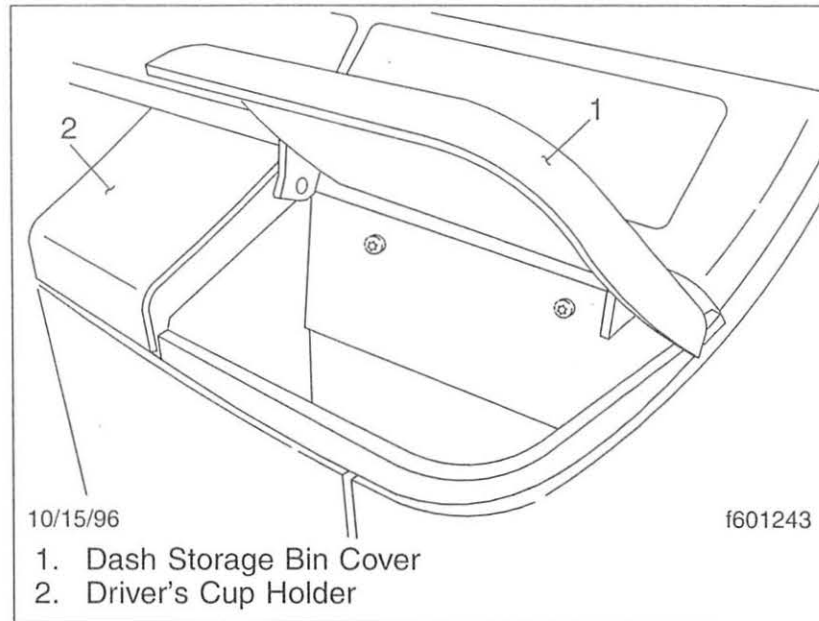


Fig. 3.17, Dash Storage Bin

Footwell Lights

There are optional red lights mounted underneath the dash on the driver's and the passenger's sides of the vehicle. These lights are activated by a rocker switch on the lower dash panel next to the climate control switches.

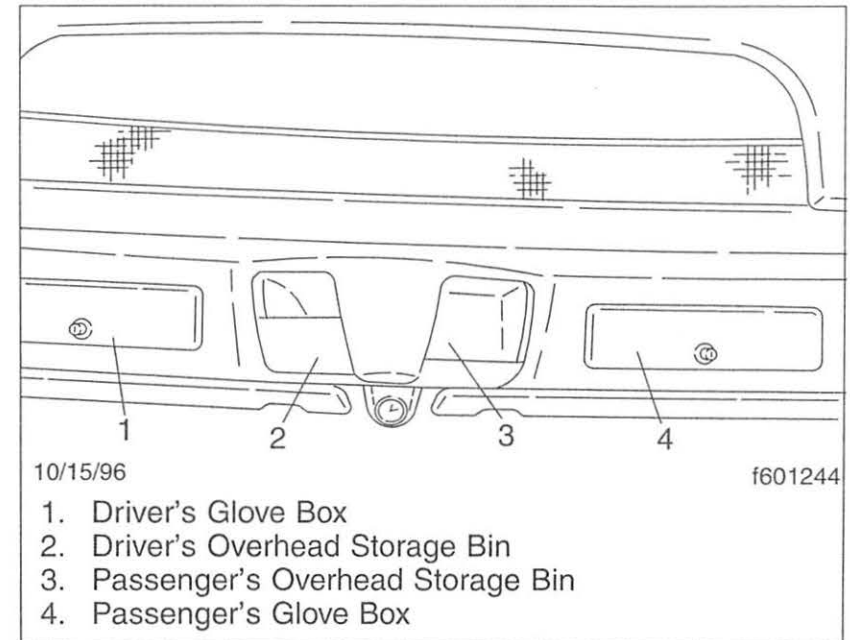


Fig. 3.18, Glove Boxes and Overhead Storage

Windshield Washer Reservoir

The windshield washer reservoir is located on the left-hand side of the frontwall between the surge tank and the hood. See **Fig. 3.19**.

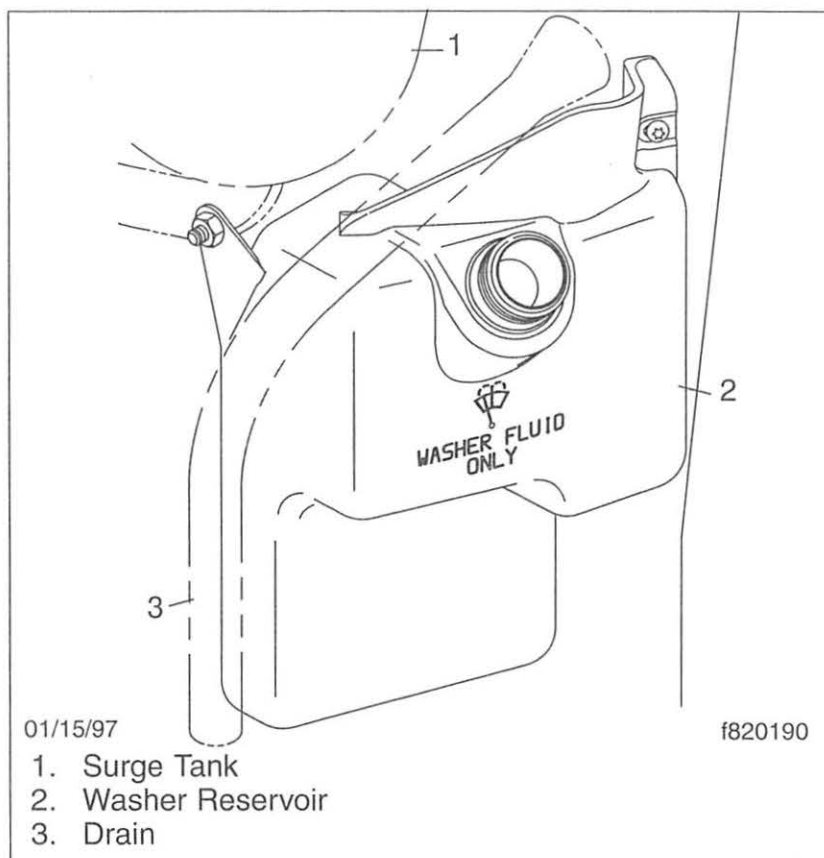


Fig. 3.19, Windshield Washer Reservoir

Heater and Air Conditioner

General Information	4.1
Defogging and Defrosting Using Fresh Air	4.3
Heating	4.4
Air Conditioning	4.5
Fresh Air	4.6
Heating, Auxiliary (Sleeper Bunk) Heater and Air Conditioner	4.6
Air Conditioning, Auxiliary (Sleeper Bunk) Heater and Air Conditioner	4.8

Heater and Air Conditioner

General Information

A dash-mounted climate control panel (**Fig. 4.1** or **Fig. 4.2**) allows you to control all of the heating, air conditioning, defrosting, and ventilating functions.

A four-speed fan (Ref. 1) forces fresh or recirculated air to any selected air outlets at the windshield, door windows, dashboard face, and cab floor.

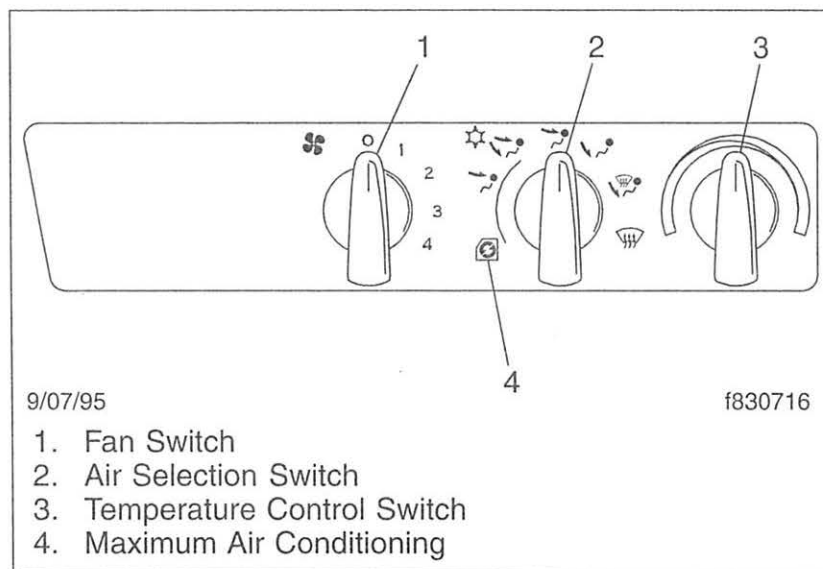


Fig. 4.1, Climate Control Panel, Heater and Air Conditioning

An air selection switch (Ref. 2) controls the direction of warm or cool air to the face and feet, face only, feet only, feet and windshield, or windshield only (defrost).

A temperature control switch (Ref. 3) is used to select the desired temperature. Turn the switch counterclockwise for cool air, or clockwise for warm air.

All of the dash-face outlets have adjustable louvers that pivot right and left, and up and down. The outlets can be closed by moving the louvers all the way down. Windshield defrost outlets and the passenger's door

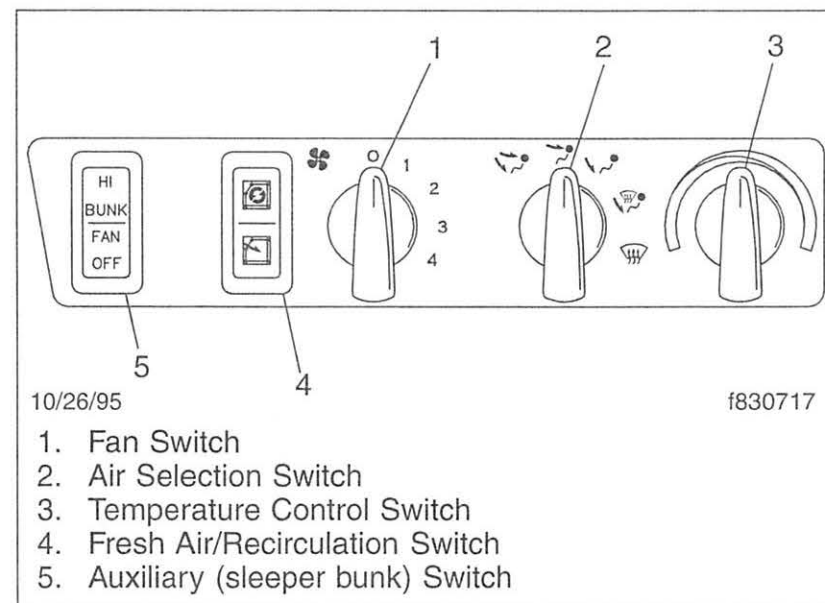


Fig. 4.2, Climate Control Panel, Heater Only

Heater and Air Conditioner

window defrost outlet have nonadjustable louvers. The bunk outlet (at the right-hand rear corner of the bunk) has two sets of vertical louvers that operate like the horizontal dash-face louvers.

An auxiliary heater and air conditioner unit is standard when there is a sleeper compartment. The unit is installed in the right side sleeper baggage compartment and uses the cab's refrigerant liquid system for air conditioner operation. The unit is equipped with a separate evaporator coil, expansion valve, and fan. It is also equipped with its own heater core and water valve, independent of the cab heater. The auxiliary unit's climate control panel (**Fig. 4.3**) is mounted on the right rear wall or the rear overhead storage compartment.

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

A fresh air/recirculation switch (**Fig. 4.2**, Ref. 4) is standard equipment when there is no air conditioning. This control is an option when air conditioning is ordered. It allows the cab to be ventilated with either fresh or recirculated air. When the air selection switch is rotated to the maximum air conditioning position (**Fig. 4.1**, Ref. 4), the system uses *only* recirculated air, regardless of whether fresh or recirculated air has been selected.

When the air selection switch is set to air conditioning and recirculated air has been selected, the system func-

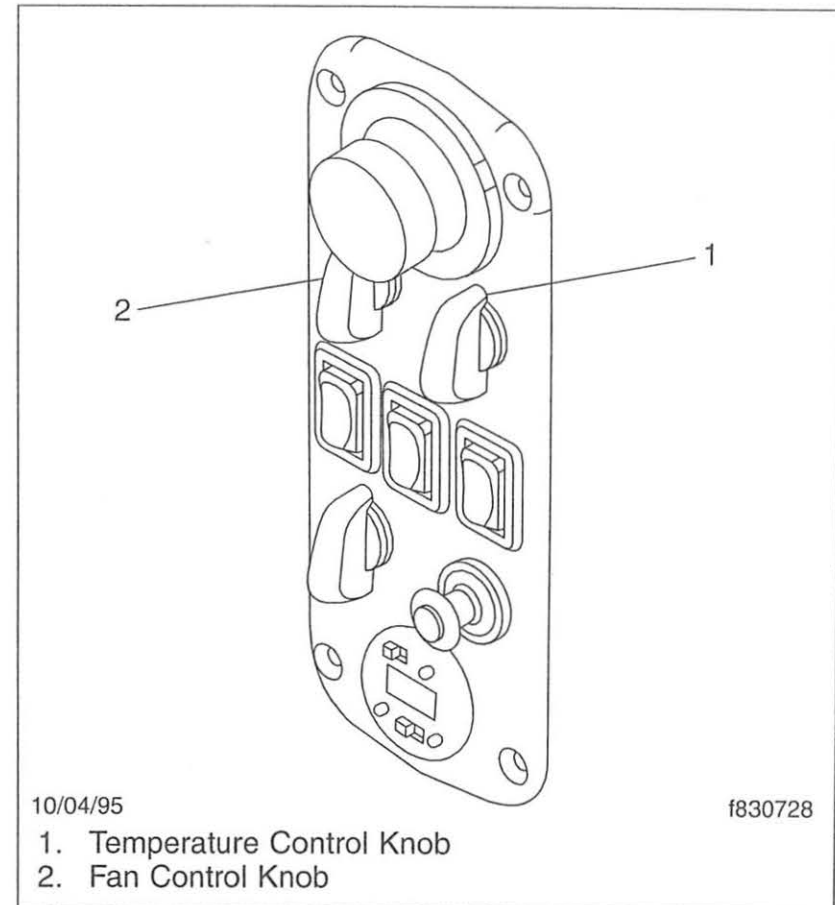


Fig. 4.3, Auxiliary (sleeper bunk) Control Panel

Heater and Air Conditioner

tions the same as when the air selection switch is set at maximum air conditioning.

The dash mounted auxiliary switch (**Fig. 4.2**, Ref. 5) overrides the auxiliary (sleeper) control panel. This switch should be set in the HI (up) position for increased ventilation in the bunk area, the center (middle) position for normal fan and temperature operation, and the OFF (lower) position to cut power to the auxiliary unit.

NOTE: When the auxiliary switch is in the OFF (lower) position, the sleeper temperature control will default to the HEAT mode. The sleeper fan will blow hot air when any air conditioning mode is selected. To operate the temperature controls, move the auxiliary switch to the center (middle) position.

A cab exhaust system is included with sleeper cabs. When the climate control unit is set for fresh air, 300 cubic feet of fresh air per minute is provided to the sleeper cab. In addition, 100 cubic feet of air per minute is exhausted from the sleeper cab through a vent in the left rear area of the sleeper. When the system is activated, fresh air rapidly displaces stale air as the cab pressurizes.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Defogging and Defrosting Using Fresh Air (Fig. 4.4)

1. Turn the temperature control switch all the way clockwise for warm air (Ref. 3), the fan switch to OFF and, if so equipped, the bunk fan switch to OFF before starting the engine.
2. Remove any ice or snow from the outside of the windshield, door windows, and fresh air inlet grille.
3. With the engine at operating temperature, turn the fan switch to 4 (Ref. 1), the highest speed. Leave it

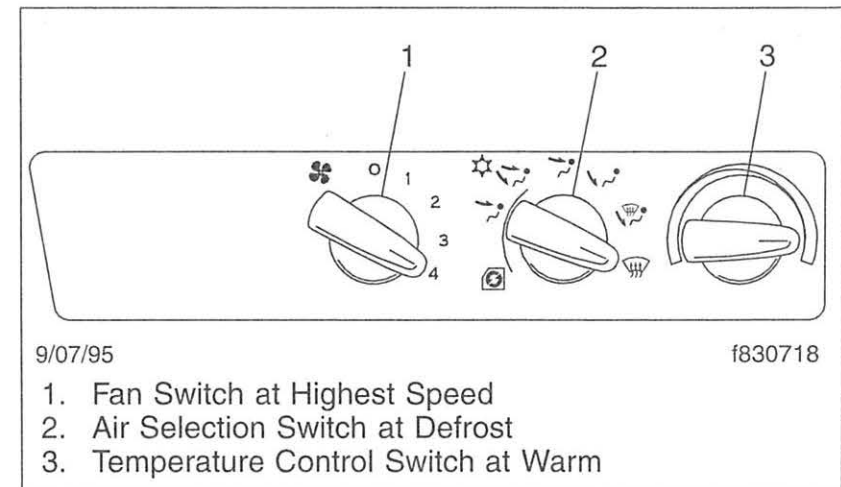


Fig. 4.4, Defogging and Defrosting

Heater and Air Conditioner

in this position for 30 seconds. This will clear the system of moist air.

4. Move the air selection switch to the defrost (windshield) position (Ref. 2). In this position warm, dry air is directed to the windshield.

NOTE: The air conditioner (if equipped) is automatically engaged in the defrost mode. This dries the air.

Heating (Fig. 4.5)

1. With the engine at operating temperature, move the temperature control switch (Ref. 3) all the way clockwise (for heat).
2. Turn on the fan switch (Ref. 1) to the desired speed.
3. Move the air selection switch (Ref. 2) to the desired setting.

IMPORTANT: If the windows start to fog, move the air selection switch to defrost (windshield), and make sure the fan is on. To defog the driver's door window, turn the extreme left dash-face outlet to direct airflow to the upper left.

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

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

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

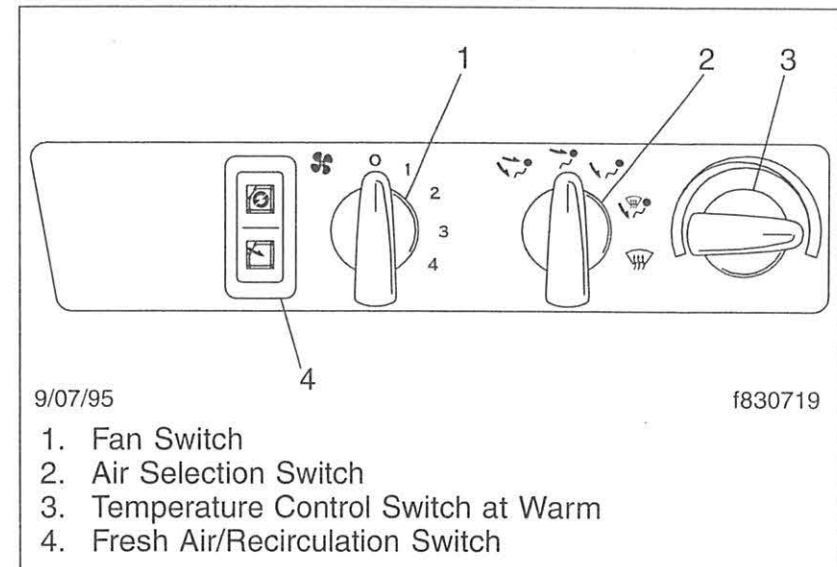


Fig. 4.5, Heating

Heater and Air Conditioner

Air Conditioning (Fig. 4.6)

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

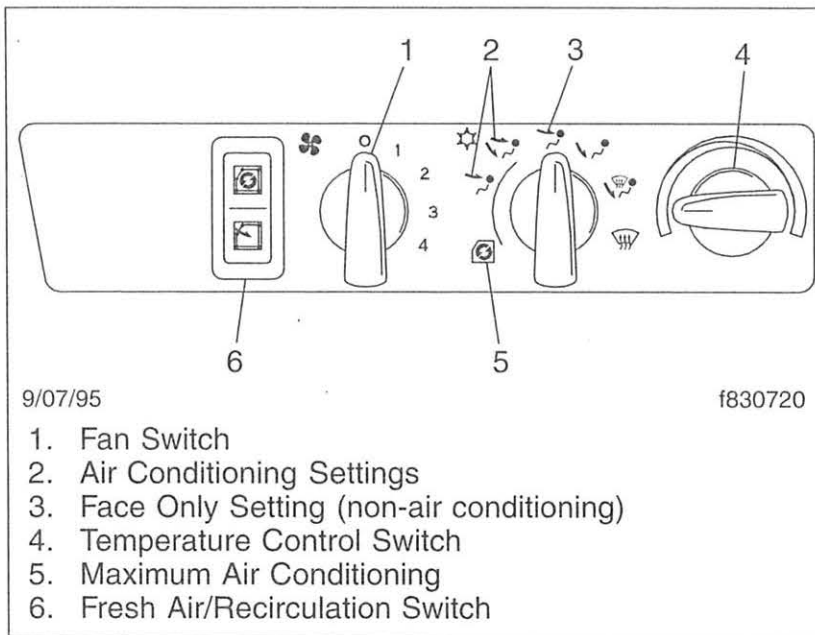


Fig. 4.6, Air Conditioning

1. If the cab is hot inside, temporarily open the windows to let the hot air out.
2. Move the air selection switch to the (non-air conditioning) face only position (Ref. 3) and turn the fan switch (Ref. 1) off before starting the engine.
3. Start the engine.
4. Move the air selection switch to either one of the air conditioning settings (Ref. 2). With the control at either one of the air conditioning settings, fresh air is drawn into the cab. With the control at maximum air conditioning (Ref. 5), the air inside the cab is recirculated.

IMPORTANT: If the outside air is dusty or smoky, set the air selection switch at maximum air conditioning and keep the windows and vent closed, to prevent drawing in dust or smoke. On vehicles with the fresh air/recirculation switch (Ref. 6), recirculated air can be selected either with the switch or by setting the air selection switch to maximum air conditioning.

5. Move the temperature control switch (Ref. 4) counterclockwise for cool air. In this position, no heat is given off by the heater.
6. Turn the fan switch (Ref. 1) to the highest speed, 4.
7. As soon as cool air is flowing from the dashboard outlets, close the windows. Adjust the fan switch setting as desired.

Heater and Air Conditioner

8. If the air from the vents is too cold, move the temperature control switch clockwise for warmer air flow.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Fresh Air (Fig. 4.7)

1. Move the fresh air/recirculation switch (Ref. 4) to the fresh air position. Move the air selection switch (Ref. 2) to the desired position.
2. Move the temperature control switch (Ref. 3) counterclockwise for no heating, or move it clockwise for heat.
3. Set the fan switch (Ref. 1) at the desired speed.

IMPORTANT: To prevent the buildup of fumes or odors inside the cab (for example, from smoking), *do not* operate the heater or ventilation system in a recirculation mode for more than 20 minutes.

Heating, Auxiliary (Sleeper Bunk) Heater and Air Conditioner (Fig. 4.8)

1. With the engine at operating temperature, set the three position switch on the main climate control panel on the dash (Fig. 4.7, Ref. 5) to the middle position.

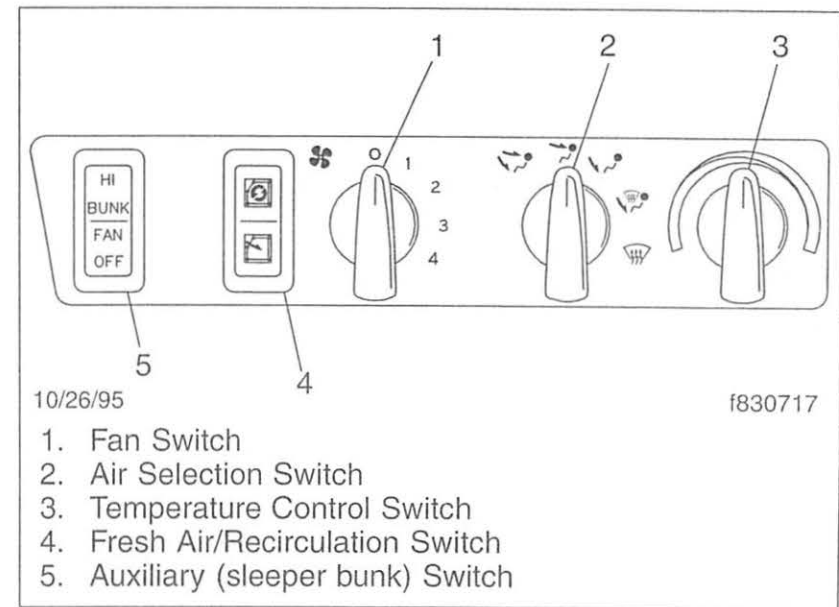


Fig. 4.7, Fresh Air

Heater and Air Conditioner

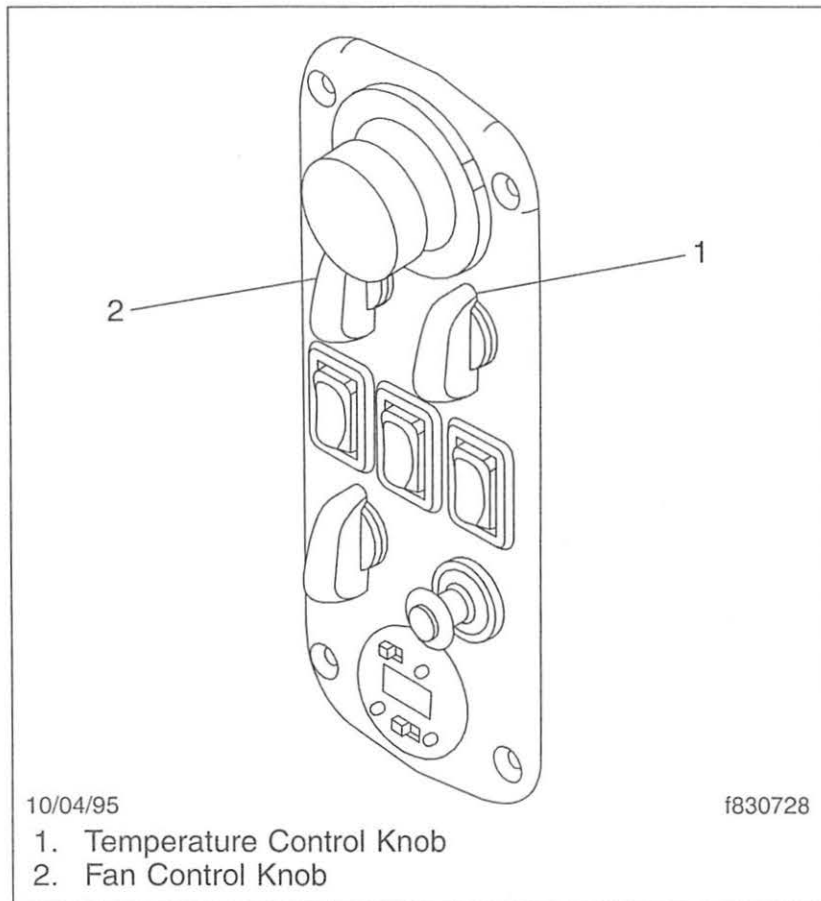


Fig. 4.8, Auxiliary (sleeper bunk) Control Panel

The switch in the middle position gives full control of the auxiliary heater/air conditioner to the sleeper

bunk mounted control panel. The sleeper bunk fan is turned off when the switch is in the bottom position. The sleeper bunk fan is on high when the switch is in the top position.

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

2. Turn the temperature control knob (Ref. 1) all the way clockwise to HEAT. Turn the fan control knob (Ref. 2) to position 3.
3. When the sleeper compartment heats to the desired temperature, turn the temperature control knob counterclockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

The system will automatically maintain the selected outlet air temperature.

4. Whenever heat is not desired, turn the temperature control knob counterclockwise (as needed) and turn off the fan.

IMPORTANT: To prevent the buildup of fumes or odors inside the sleeper (for example, from smoking) *do not* operate the heater and air conditioning system in a recirculation mode for more than 20 minutes.

Air Conditioning, Auxiliary (Sleeper Bunk) Heater and Air Conditioner (Fig. 4.8)

1. Turn on the cab air conditioner (refer to "Air Conditioning") and set the three position switch on the main climate control panel on the dash (**Fig. 4.7**, Ref. 5) to the middle position.

The switch in the middle position gives full control of the auxiliary heater/air conditioner to the sleeper bunk mounted control panel. The sleeper bunk fan is turned off when the switch is in the bottom position. The sleeper bunk fan is on high when the switch is in the top position.

2. Turn the temperature control knob (Ref. 1) all the way counterclockwise to COOL. Turn the fan control knob (Ref. 2) to position 3.
3. When the sleeper compartment cools to the desired temperature, turn the temperature control knob clockwise to adjust outlet air temperature. Then, turn the fan control knob to adjust the air flow level.

The system will automatically maintain the selected outlet air temperature.

4. Whenever air conditioning is not desired, turn the temperature control knob clockwise (as needed) and turn off the fan.

IMPORTANT: To prevent the buildup of fumes or odors inside the sleeper (for example, from smoking) *do not* operate the heater and air conditioning system in a re-circulation mode for more than 20 minutes.

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

Seats and Seat Belts

Seats	5.1
Seat Belts and Tether Belts	5.7
Sleeper Compartment Bunk Restraints	5.11
SPACE Restraint System and Air Bags	5.13

Seats and Seat Belts

Seats

GENERAL INFORMATION

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

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

Seat Adjustment (Fig. 5.1)

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

1. Back Cushion Tilt (Ref. A): This adjustment enables the back cushion to pivot forward or backward.
2. Lumbar Support (Ref. B): 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 seat.
3. Isolator (Ref. C): This feature (also referred to as back-slap isolator, or Chugger-Snubber) reduces the amount of road shock by isolating the occupant from the vehicle's motion, and allowing the upper seat to move in a simple pendulum motion. A lockout feature is used whenever the isolator is not desired.
4. Height Adjustment (Ref. D): The entire seat moves up or down when adjusting the height. The adjustment is either manually or air controlled, depending on the make of the seat.
5. Weight Adjustment: On those seats with weight adjustment, the feature is fully automatic. 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.
6. Bottom Cushion Angle or Fore and Aft Bottom Cushion Height (Ref. E): This feature enables the occupant to raise or lower the front or back of the bottom cushion. This adjustment is easier to perform when all weight is removed from the seat.
7. Fore and Aft Seat or Seat Track Adjustment (Ref. F): The entire seat moves forward or backward when this adjustment is made.
8. Seat Tilt (Ref. G): When this adjustment is made, the seat assembly (back and bottom cushions) tilts forward or backward.
9. Upper Back Cushion Adjustment (Ref. H): When this adjustment is made, the upper back cushion changes angle to provide upper back support.

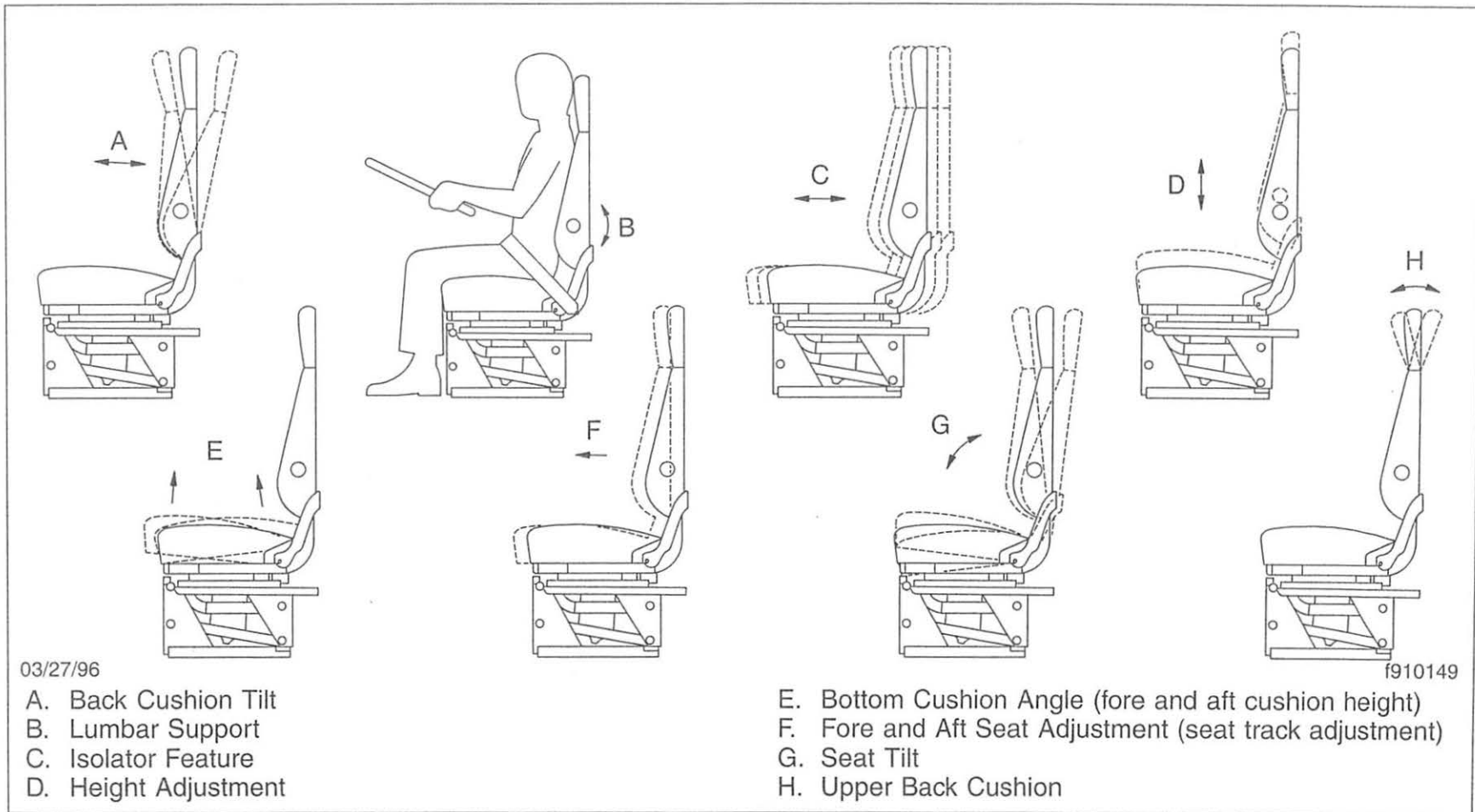


Fig. 5.1, Seat Adjustments

Seats and Seat Belts

FREIGHTLINER/BOSTROM SEAT

(Fig. 5.2)

Back Cushion Tilt

To tilt the back cushion, lean forward slightly to remove pressure from the cushion and hold the lever (Ref. 1) rearward. Lean backward slowly to the desired position and release the lever to lock the cushion in place.

Weight and Height Adjustment

To raise the seat, push the top portion of the switch (Ref. 4). To lower the seat, push the lower portion of the switch.

Isolator

To engage the isolator, put the lever (Ref. 6) in the center position. Lock out the isolator by moving the lever to the right.

Fore and Aft Seat Adjustment

Hold the lever (Ref. 6) to the left and slide the seat forward or backward to the desired position.

Bottom Cushion Tilt Adjustment

Rotate the knob (Ref. 5) to increase or decrease bottom cushion tilt.

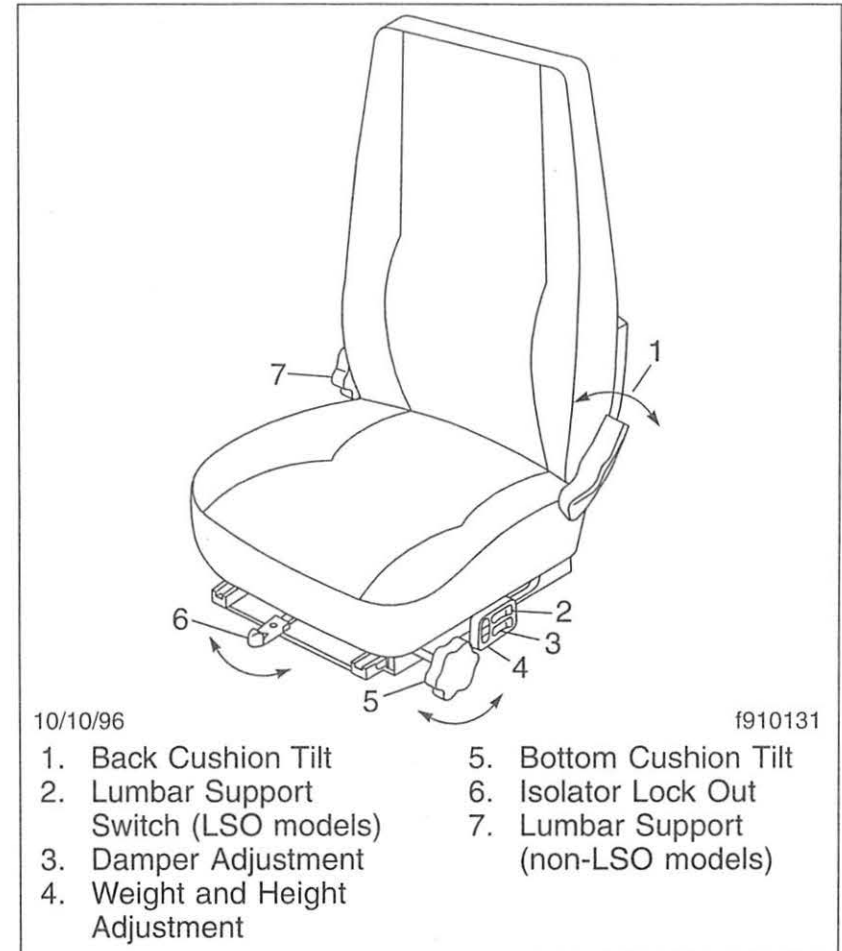


Fig. 5.2, Freightliner/Bostrom Seat

Lumbar Support

To increase lumbar support on LSO models, push the plus sign on the control switch (Ref. 2). To decrease lumbar support on LSO models, push the minus sign on the control switch. To increase lumbar support on non-LSO models, rotate the knob (Ref. 7) forward. To decrease lumbar support on non-LSO models, rotate the knob rearward.

Damper Adjustment

Push the switch (Ref. 3) to adjust the damper.

DURA-FORM FLEETCRUISER SEAT (Fig. 5.3)

Back Cushion Tilt

To tilt the back cushion through a range of 10 degrees, push down on the handle (Ref. 1). Move the back cushion to the desired position and release the lever.

Height Adjustment

Push in the knob (Ref. 2) to inflate the suspension and raise the seat height. Pull out on the knob to deflate the suspension and lower the seat height.

Isolator and Fore-Aft Seat Adjustment

Move the lever (Ref. 3) to the left to adjust the seat to the desired fore-aft position. Move the lever to the cen-

ter position to lock out the isolator feature. Move the lever to the right to engage the isolator.

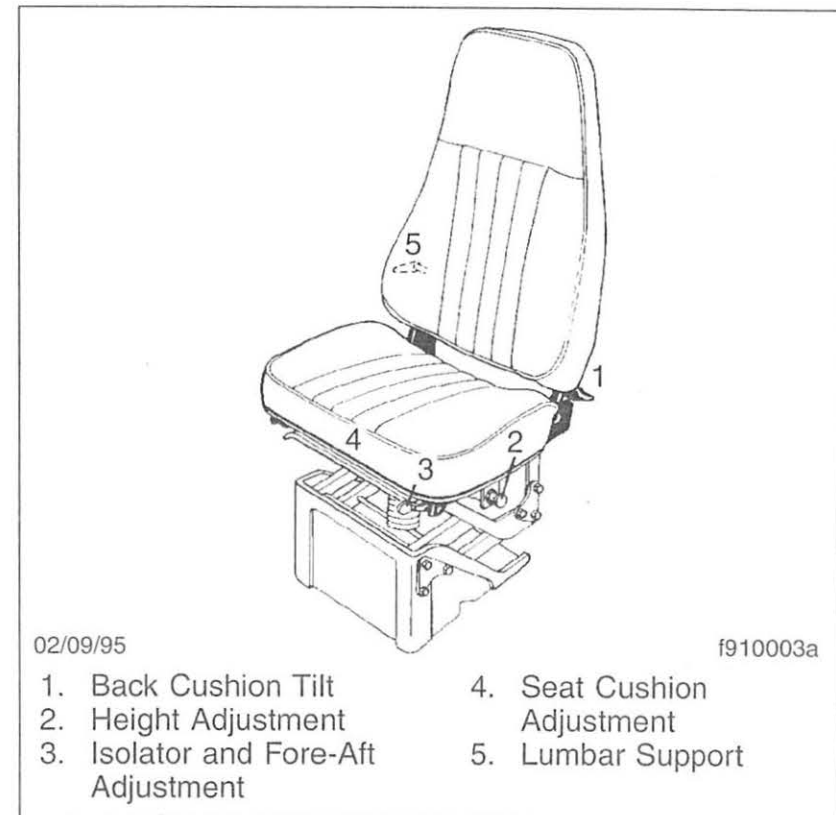


Fig. 5.3, Dura-Form Fleetcruiser Seat

Seats and Seat Belts

Seat Cushion Adjustment

To put the seat cushion in the upper position, lift upward on the front of the cushion (Ref. 4), then push rearward. To put the seat cushion in the lower position, pull forward and then push downward.

Lumbar Support

Move the lever (Ref. 5) on the right side of the back cushion to any of the three positions as desired.

RECARO SEAT (Fig. 5.4)

Back Cushion Adjustment

The back cushion tilt can be adjusted manually with the knob (Ref. 3) or electrically with a switch (Ref. 10). Side bolster is adjusted with the hand wheel (Ref. 2).

The headrest can be raised by pulling up and lowered by pushing down on the headrest. The angle of the headrest is also adjustable. Grasp the headrest on each side and twist it forward or backward.

The seat back can be tilted forward with the lever (Ref. 1) mounted on the side of the back cushion at the top.

Height Adjustment

Seat height is adjusted electrically with a switch (Ref. 5). While moving upwards the seat travels slightly towards the rear. When lowering, the seat travels slightly forward.

Pneumatic Suspension System

The suspension system is electrically controlled by a switch (Ref. 4) and is separate from the height adjustment. The system automatically compensates for the

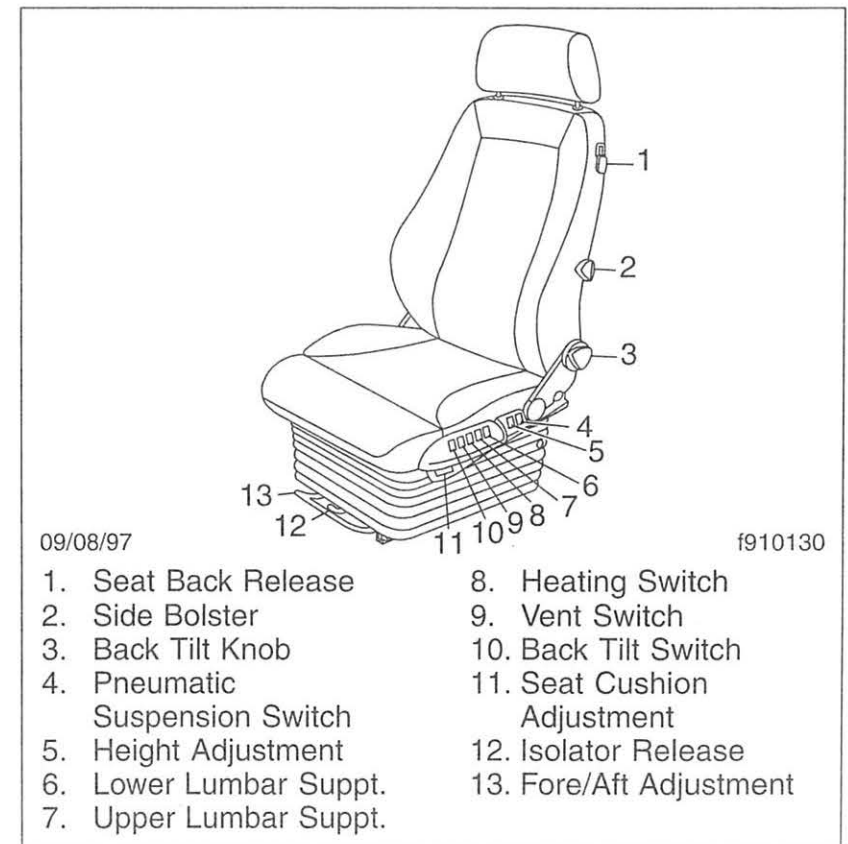


Fig. 5.4, Recaro Seat

driver's weight. The suspension system has a quick release function which is activated with the same switch.

Isolator Release

The horizontal isolation is released with the lever (Ref. 12) located at the front of the seat. Move the lever to the left to activate isolation and to the right to lock the isolator.

Fore and Aft Seat Adjustment

The seat can be adjusted forward and back with the handle (Ref. 13) located at the front of the seat.

Seat Cushion Adjustment

Thigh support/seat cushion rake can be adjusted from – 5 degrees to +10 degrees in a total of six steps with the lever (Ref. 11) mounted on the side of the seat cushion at the front.

The front part of the seat cushion can be extended up to 2 inches (50 mm). The total travel is divided in 10 steps. Pull on the front part of the seat cushion to extend it and push to move it back.

Lumbar Support

Recaro airmatic (pneumatic lumbar support) is controlled by switches. A lower air chamber (Ref. 6) and an upper air chamber (Ref. 7) are provided.

Seat Heating

Seat heating is available with two temperature settings. It is operated with a rocker switch (Ref. 8) and can be set for quick warm-up or continuous use.

Recaro Vent

A ventilation system is available in both the seat cushion and the back cushion. It is operated with a rocker switch (Ref. 9) and can be set for maximum airflow capacity inside the upholstery or 65 percent of maximum capacity.

NATIONAL CUSH-N-AIRE II SEAT

(Fig. 5.5)

Back Cushion Tilt

To tilt the back cushion, turn the knob (Ref. 1) and lean forward or backward.

Height Adjustment

To raise the seat, push the rocker switch on the side of the seat (Ref. 3) up until the seat reaches the desired height. To lower the seat, push the rocker switch down until the seat reaches the desired height.

Fore and Aft Seat Adjustment

Move the lever (Ref. 4) to the left and slide the seat forward or backward to the desired position.

Seats and Seat Belts

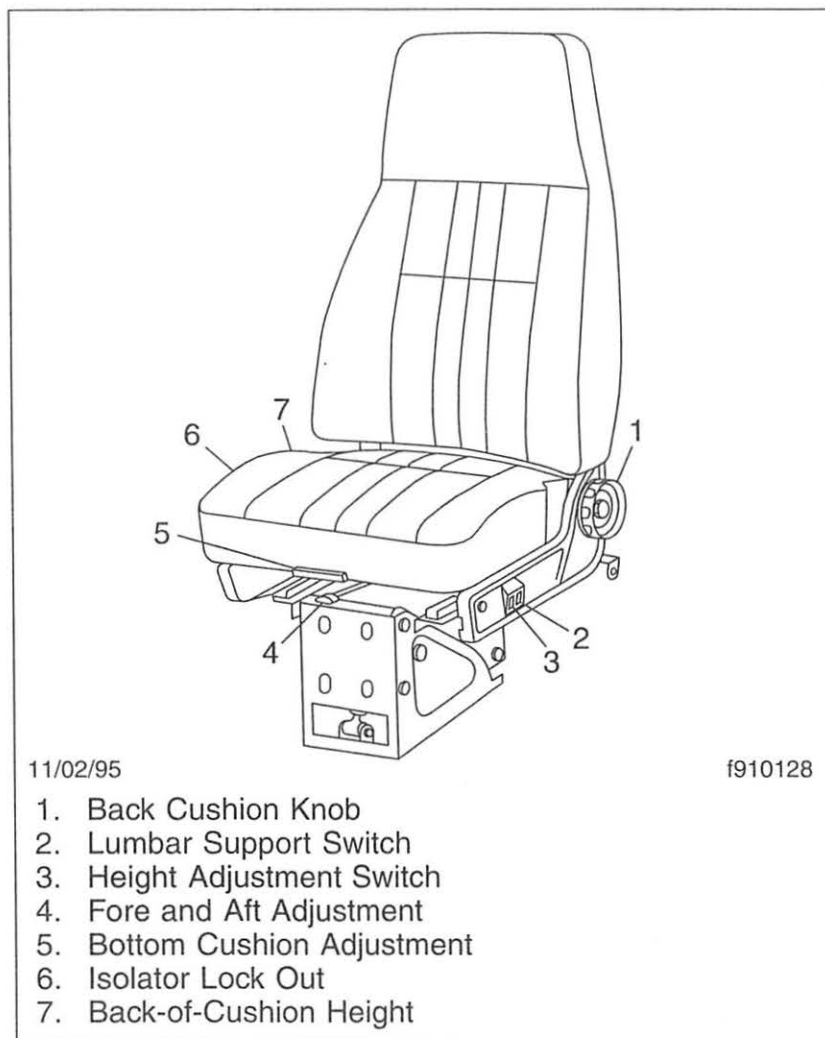


Fig. 5.5, National Cush-N-Aire II Seat

Bottom Cushion Front Height

To adjust the height of the front of the bottom cushion, lift the handle (Ref. 5), and pull forward or push back to the desired setting.

Lumbar Support

Push the rocker switch on the side of the seat (Ref. 2) up to inflate lumbar support. Push the rocker switch down to deflate lumbar support.

Back-of-Cushion Height

To adjust the height at the back of the cushion, move the lever to the desired setting (Ref. 7).

Isolator

Also called a Chugger-Snubber, the isolator is locked out by moving the handle down (Ref. 6).

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, Freightliner Corporation 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.

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

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

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

IMPORTANT: Seat belts have a finite life which may be much shorter than the life of the vehicle. Regular inspections and replacement as needed are the only assurance of adequate seat belt security over the life of the vehicle.

SEAT BELT INSPECTION

WARNING

Inspect and maintain seat belts as instructed below. Damaged seat belts or seat belts that were highly 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 seatbelt system: Doing so could change the effectiveness of the system. Failure to replace damaged or stressed seatbelts or any modifications to the system may result in personal injury or death.

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

1. Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
2. Check the web for extreme 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 for function and cracks or other damage.
5. Check web retractor for function and damage.

Seats and Seat Belts

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

SEAT BELT OPERATION

Three-Point Seat Belt With Komfort Latch



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.



WARNING

Fasten the seat belts before driving off. Trying to fasten a three-point seat belt while driving creates a hazard.

1. Slowly pull the link end of the three-point seat belt out of the retractor and pull it across your lap (from outboard to inboard) far enough to engage the buckle. If the retractor locks too soon, allow the belt to retract slightly, then slowly pull it out again.
2. Fasten the three-point seat belt by pushing the link into the buckle until it latches (**Fig. 5.6**). Give the belt a tug at the buckle. If the buckle unlatches,

repeat this step. If the problem continues, replace the three-point seat belt.

3. Position the shoulder strap diagonally across your chest with the adjustable D-loop bracket. If desired, engage the Komfort Latch as follows:

Pull on the shoulder strap to lessen the pressure of the strap on your shoulder and chest. Allow no more than one inch (2.5 cm) of slack between your

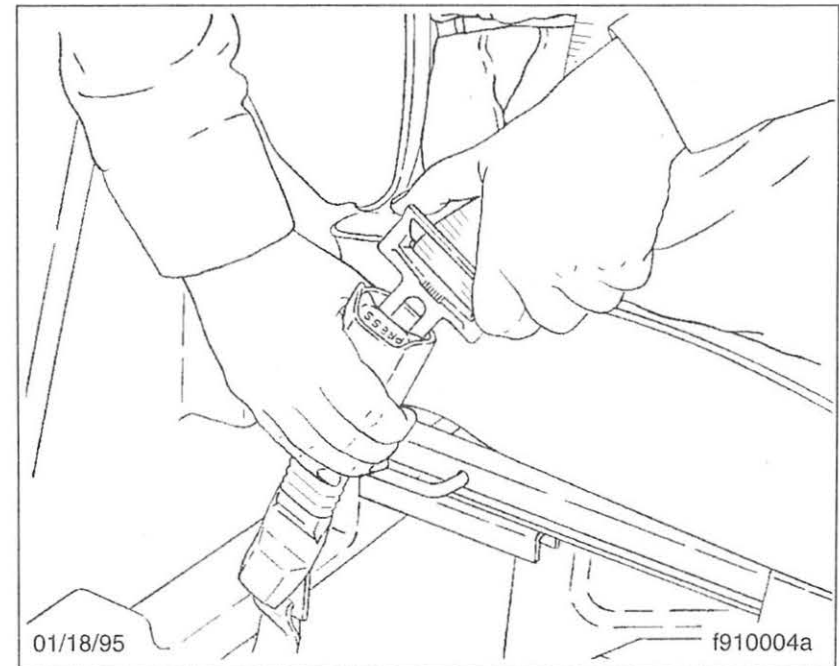


Fig. 5.6, Fastening the Three-Point Belt

Seats and Seat Belts

chest and the shoulder harness. More slack can significantly reduce the seat belt's effectiveness in an accident or a sudden stop. While holding the belt slack, press the Komfort Latch lever up, clamping the belt's webbing (**Fig. 5.7** and **Fig. 5.8**).

4. To unbuckle the three-point seat belt, push the button on the buckle as shown in **Fig. 5.9**. If the Komfort Latch was used, release it by giving the shoulder belt a quick tug. If you lean forward against

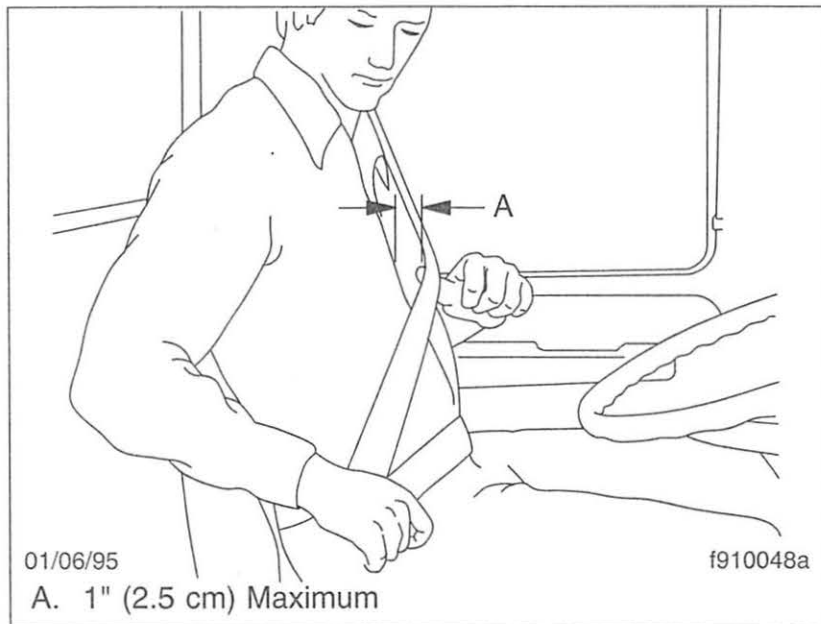


Fig. 5.7, Adjusting Shoulder Harness Clearance

the shoulder belt, the Komfort Latch will automatically release, and will need to be reset.

The Komfort Latch doesn't have to be released in an emergency situation, but it will prevent the three-point seat belt from retracting. The Komfort Latch will release by itself under rough road conditions. Make sure the three-point seat belt is completely retracted when it is not in use.

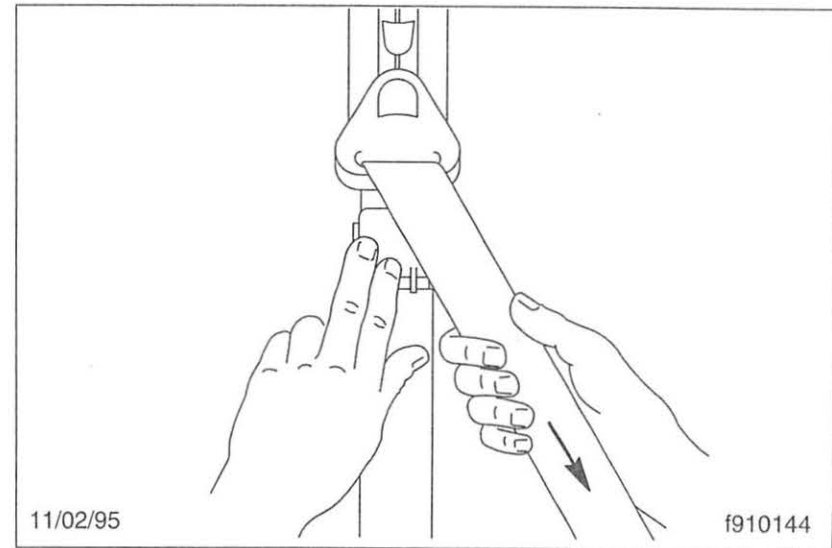


Fig. 5.8, Locking Komfort Latch

Seats and Seat Belts

Sleeper Compartment Restraints

GENERAL INFORMATION

On vehicles equipped with a sleeper compartment, bunk restraints should be used whenever the sleeper compartment is occupied and the vehicle is moving. Restraints are designed to lessen the chance of injury or

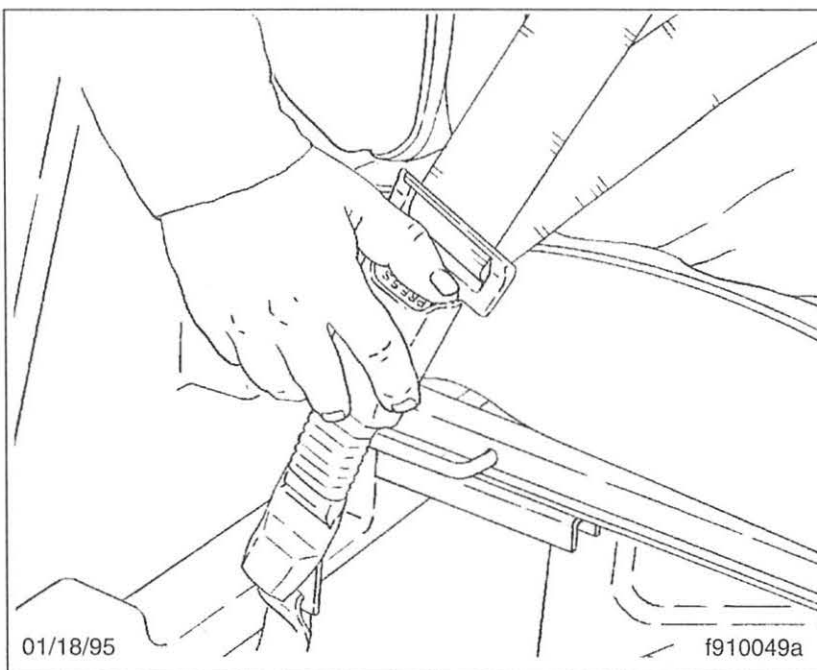


Fig. 5.9, Releasing the Three-Point Seat Belt

the amount of injury resulting from accidents or sudden stops. For this reason, Freightliner Corporation urges the use of bunk restraints when the sleeper compartment is occupied in a moving vehicle.

WARNING

Always use the bunk restraints when the sleeper compartment is occupied in a moving vehicle. Failure to do so increases the chance of injury or the degree of injury from accidents or sudden stops, to all occupants in the vehicle.

BUNK RESTRAINT ADJUSTMENT

(Fig. 5.10)

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

Seats and Seat Belts

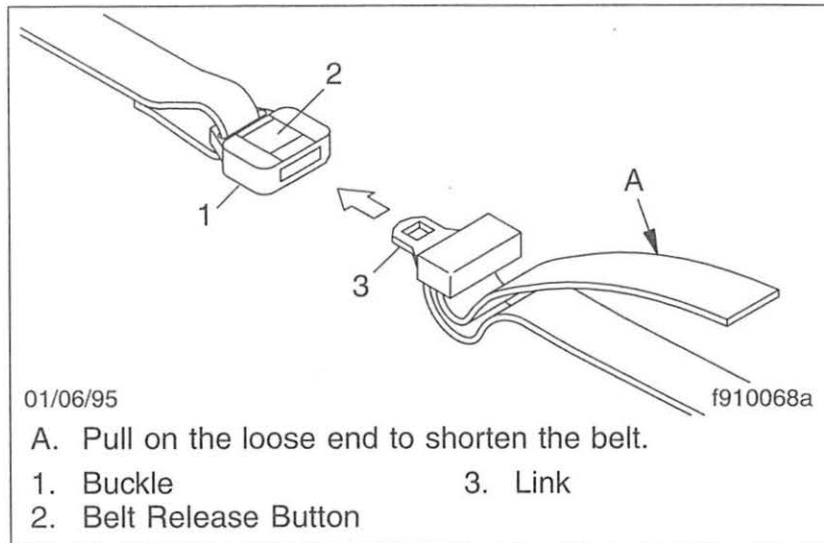


Fig. 5.10, Bunk Restraint Adjustment

Bunk Restraint Operation (Fig. 5.11)

! WARNING

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

1. Starting at the foot of the bunk, pull up the link end of the belt far enough to engage the buckle.

2. Fasten the belt by pushing the link end into the buckle until they latch. Make sure that the belt is not twisted. Check the engagement by trying to pull the link out of the buckle. If they come apart, repeat this step. If the problem continues, replace the belt. Repeat steps 1 and 2 for the other two belts located in

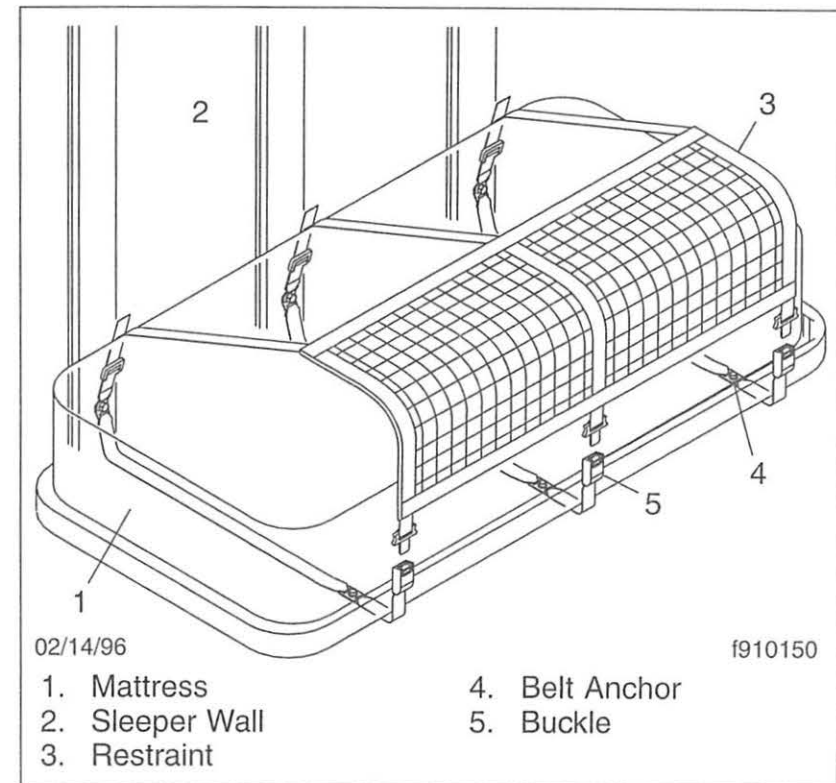


Fig. 5.11, Bunk Restraint

Seats and Seat Belts

the middle and upper portion of the bunk to lock the restraint in place.

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

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

SPACE Restraint System and Air Bags

The vehicle may be equipped with a seat pretensioning system for crash survival enhancement, a system known as SPACE. This vehicle may also be equipped with a driver's-side supplemental restraint system, an air bag.

These systems, in conjunction with the proper use of the vehicle's seat belts, provide additional occupant protection in severe frontal collision situations.



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

The two systems work in this manner: When a crash sensor behind the driver's seat senses a severe, life-threatening frontal impact, the sensor triggers a gas-

powered mechanism mounted at the base of the seat. See **Fig. 5.12**. This mechanism, in turn, tightens the seat belts against the seat and the seat occupant and then lowers the seat suspension, moving the seat occupant downward and away from the steering wheel and roof structure. The air bag is activated and fills a few milliseconds later.

The operational readiness of these systems is continually monitored by a sensor, which indicates the status of the system with a light on the dash. The SRS (Supplemental Restraint System) light comes on for approximately 10 seconds when starting the engine, and then goes off. The light will remain on if there is a problem with either the SPACE or the air bag system. The vehicle should be serviced by qualified personnel if the light does not come on, or if it remains on.

SPACE System

Through the pretensioning of the seat belts, the Seat Pretensioner Activation for Crash survival Enhancement system (SPACE system), provides for a significant increase in stability in the seat during a severe frontal collision. The lap belt and the upper torso belt are pretensioned by a power cinch, which then secondarily pulls the seat downward several inches. This movement, which occurs in less than 0.1 second, is intended to reduce injuries to the head and extremities.

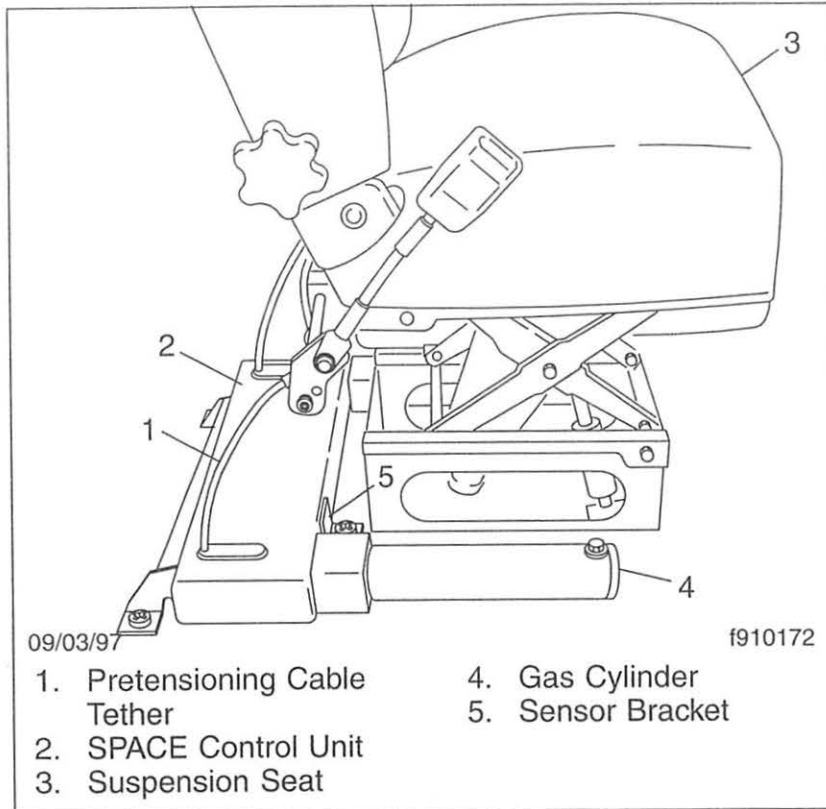


Fig. 5.12, SPACE System Components

The SPACE system includes the SPACE control unit, a crash sensor, the SRS dash indicator light, and may include an air bag in some vehicles.

WARNING

Damaged seat belts or seat belts worn in an accident must be replaced, and their anchoring points must be checked. Do not attempt to modify the SPACE system. Doing so could change the effectiveness of the system. The system must be replaced after being activated. Failure to do so may result in personal injury or death.

Infants or children must not be placed in seats equipped with the SPACE system. The SPACE system is designed for adults only. Failure to follow these instructions may result in personal injury or death.

IMPORTANT: The SPACE system is effective only when the seat belts are fastened. See **Fig. 5.13**. The system will activate even if the seat belts are not fastened.

Air Bags

The driver's side air bag is located in the steering wheel hub. The operational readiness of the air bag system is indicated by the SRS indicator light on the dash. The light comes on when starting the engine, and then goes off. The light will remain on if there is a problem with the system.

The air bag is a supplemental restraint system, and is not intended to comply with federal regulations applica-

Seats and Seat Belts

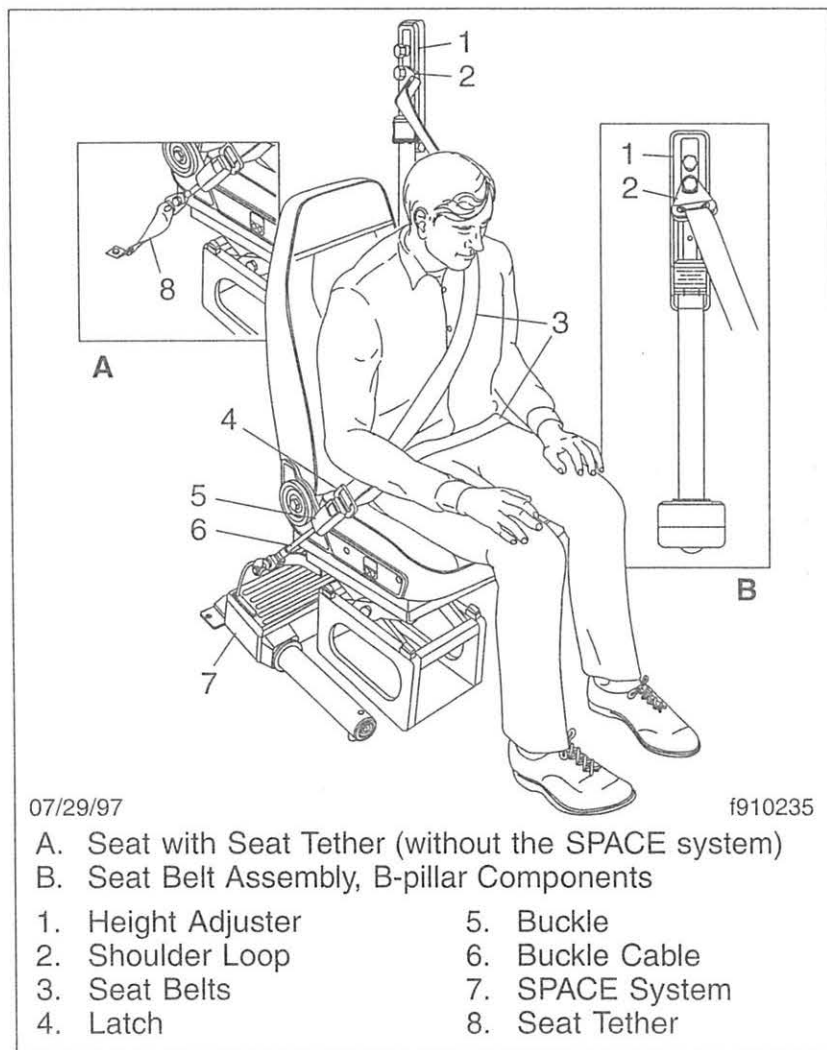


Fig. 5.13, Seat Belt Assembly (SPACE system)

ble to light-duty vehicles regarding its use in a fully passive mode, that is, without the seat belt.

WARNING

Air bags are designed to activate only in severe or life-threatening frontal-impact conditions. Only in these situations will air bags provide supplemental protection. The driver and the passenger should always wear seat belts. For maximum protection in the event of a collision or rollover, 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 the body. Since the air bag inflates with considerable speed and force, a proper seat position will keep you a safe distance from the inflating air bag.

Do not place objects on the steering wheel. Any such objects may cause harm during an accident.

Failure to follow these instructions may result in personal injury or death.

Safety Guidelines

The SPACE and air bag systems feature components that use combustible chemicals to pull the seat downward or to deploy air bags. Because of the combustible nature of these components, care must be taken when working around system components.



WARNING

The components and chemicals used in the SPACE and air bag systems are hazardous. Failure to observe the following safety and handling information could lead to the unintentional deployment of these systems, which could cause serious bodily injury or death.

Do not attempt to service the SPACE system. Damaged or deployed SPACE systems should be examined only by qualified personnel. Unintentional or improper initiation of the SPACE system could cause severe bodily injury or death.

All intentional deployments and testing of the system should be performed by trained personnel. Unintentional or improper initiation of the SPACE system could cause severe bodily injury or death.

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

Although the SPACE system components will not explode, self-deploy or produce shrapnel, care must be taken when it is necessary to perform work around the SPACE system components, review the following list of correct handling procedures and warnings. Failure to do so could result in severe injury or death.

- Do not cut, drill, braze, solder, or weld any part of the SPACE system.
- Do not expose the SPACE system components to electricity.
- Do not attempt to adapt, re-use or install a SPACE system in any vehicle other than the specific vehicle for which it is designed.
- Do not cut wires or tamper with the connectors between the vehicle wiring harness and the SPACE system. Cutting or removing the electrical connectors could cause unplanned deployment.
- Store, transport, dispose, and recycle SPACE 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 SPACE systems should replace seat belts used in a SPACE-equipped vehicle.
- The SPACE system requires a special seat belt. Care must be taken to be sure the correct seat belt is used.

Seats and Seat Belts



WARNING

The surface of a deployed air bag may contain small amounts of sodium hydroxide (which is a by-product of the gas generant 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.

Consider undeployed air bags to be dangerous and capable of deploying at any time. When it is necessary to work around air bag systems, review the following list of correct handling procedures and warnings. Failure to do so could result in severe injury or death.

- Do not cut, drill, braze, solder, or weld any part of the air bag system.
- Do not expose the air bag module to electricity.
- Do not attempt to adapt, re-use or install an air bag system in any vehicle other than the specific vehicle for which it is designed for.

- 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 system's 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, and recycle air bag system components in accordance with all applicable federal, state and local regulations.

Steering and Brake Systems

Steering System.....	6.1
Brake System.....	6.2

Steering and Brake Systems

Steering System

General Information

When there is no load on the vehicle, and the front tires are pointed straight ahead, the steering wheel spokes should be centered, ± 10 degrees, as shown in **Fig. 6.1**. Refer to **Group 46** in the vehicle 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.

Power Steering System

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

drive the vehicle until the cause of the problem has been corrected.

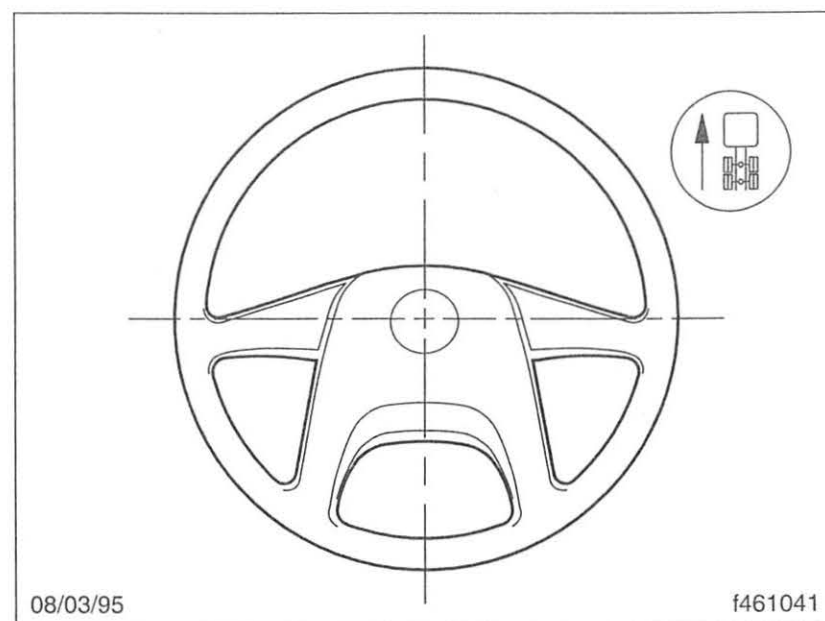


Fig. 6.1, Proper Steering Wheel Position (with tires pointed straight ahead)



WARNING

Do not drive the vehicle without power assisted steering. Driving the vehicle without the power-assist feature of the steering system requires much greater effort, especially in sharp turns or at low speeds, which could result in an accident and possible injury.

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

Brake System

General Information

A dual air brake system consists of two independent air brake systems which 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.

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. In addition, trailer brakes will be operated by the secondary system. Loss of secondary system air pressure causes the front axle brakes to become inoperative; rear service brakes and trailer brakes will be operated by the primary 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

Steering and Brake Systems

foot brake control pedal, either the front or rear service brakes will not be operating, causing a longer stopping distance. Bring the vehicle to a safe stop, and have the air system repaired before continuing.

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

Before the vehicle can be moved, the spring parking brakes must be released by applying an external air source at the gladhands, or by manually caging the parking brake springs.

WARNING

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

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

Brake System Operation

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

Steering and Brake Systems

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 hand control valve (**Fig. 6.2**, Ref. 2) actuates the trailer service brakes independently from the vehicle chassis service brakes. The valve can be partially or fully applied, but in any partially-on position it will be overridden by a full application of the foot brake control pedal. Moving the valve handle clockwise actuates the trailer brakes, while moving it counterclockwise releases the trailer brakes; the valve handle remains in the position selected until it is manually moved.



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 damage or injury.

The red octagonal-shaped knob (**Fig. 6.3**, Ref. 1) in the control panel actuates the trailer air supply valve. After the vehicle's air hoses are connected to a trailer, and the pressure in both air systems is at least 65 psi (448 kPa), the red knob must be pushed in. It should stay in, to charge the trailer air supply system and to release the trailer spring parking brakes; it must be pulled out before disconnecting a trailer. It must also be pulled out when operating a vehicle without a trailer. If pressure in both air systems drops to 35 to 45 psi (242 to 310 kPa), the red knob automatically pops out, exhausting the trailer

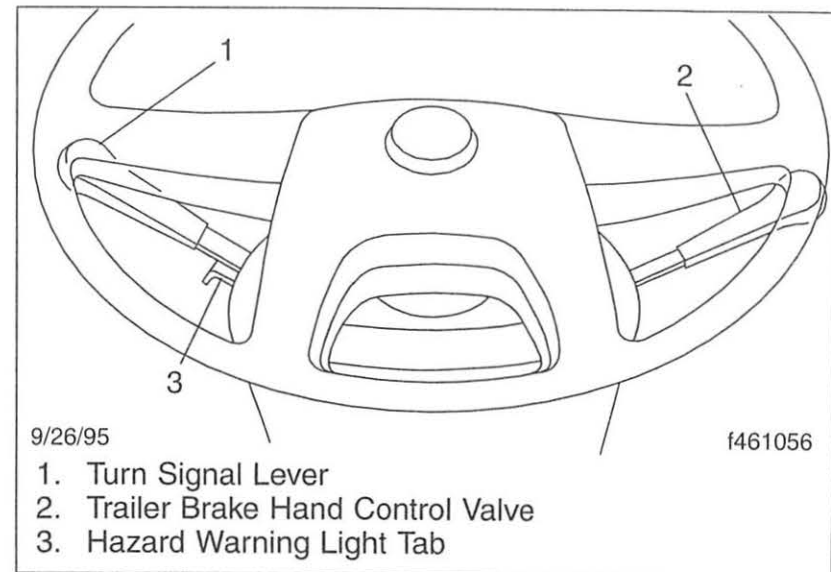


Fig. 6.2, Steering Column-Mounted Controls

Steering and Brake Systems

air supply, and applying the trailer service or spring parking brakes.

The yellow diamond-shaped knob (**Fig. 6.3**, Ref. 2) in the control panel actuates the parking brake valve. Pulling out the knob applies both the tractor and trailer spring parking brakes and automatically causes the trailer air supply valve knob to pop out.



CAUTION

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

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

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

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

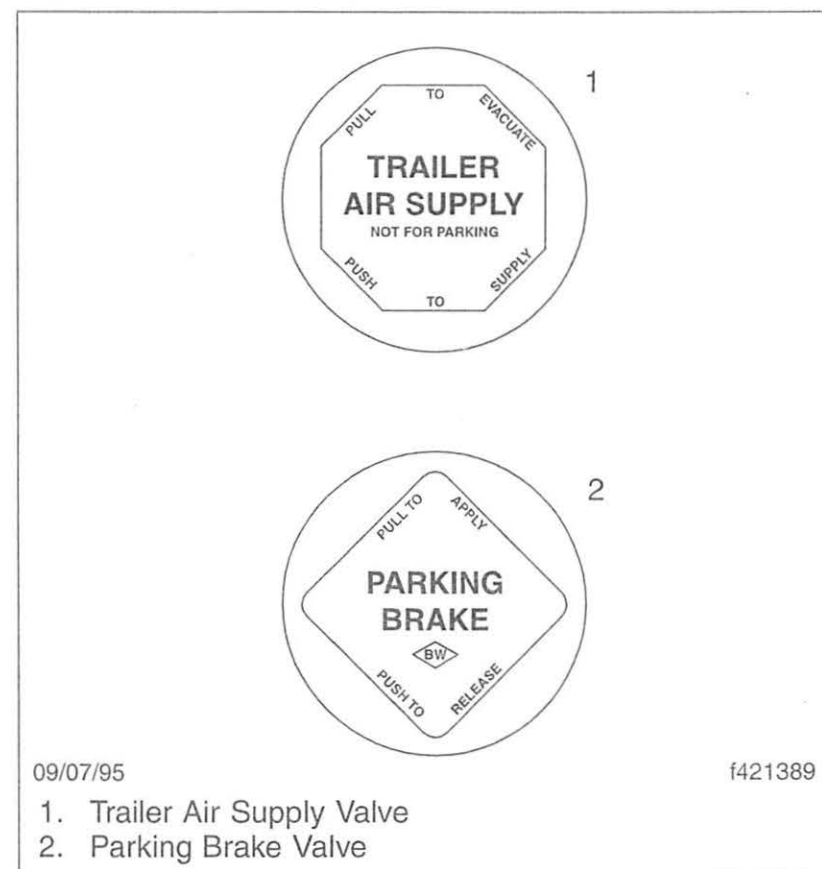


Fig. 6.3, Brake Valves

Steering and Brake Systems

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.

Rockwell WABCO® Antilock Braking System (ABS) (Fig. 6.4)

The Rockwell 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

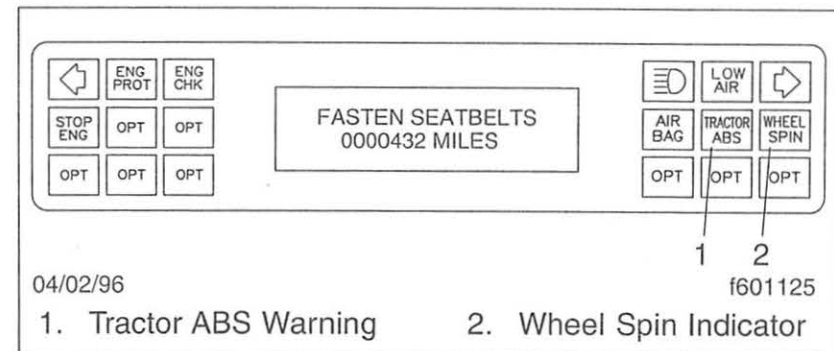


Fig. 6.4, ABS Dash Lights

Steering and Brake Systems

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 in a panel behind the driver's seat). The control unit's main circuit interprets the speed sensor signals and calculates wheel speed, wheel retardation, and a vehicle reference speed. If the calculations indicate wheel lockup, the main circuit signals the appropriate solenoid control valve to reduce braking pressure. During emergency braking, the solenoid control valve alternately reduces, increases, or maintains air pressure supply in the brake chamber to prevent front and rear wheel lockup.

If equipped with Automatic Traction Control, an additional solenoid valve is installed. During reduced-traction situations, the valve increases or reduces air pressure supply in the brake chamber 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), solenoid control valves, and the electrical circuitry.

After the ignition switch is turned on, the tractor warning light (Ref. 1, TRACTOR ABS) and, if equipped with Automatic Traction Control, the wheel spin (Ref. 2, 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.

The wheel spin (WHEEL SPIN) indicator light comes on if one of the drive wheels spins during acceleration. The light goes out when the wheel stops spinning. When the light comes on, partially release the throttle pedal until the light goes out. If slippery road conditions continue, engage the axle lock.



CAUTION

Axle 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).



CAUTION

Do not engage the axle lock while the "WHEEL SPIN" light is on. To do so could damage the rear axle. Refer to Chapter 9 for axle lock instructions.

Vehicles with electronic engines and ABS may have automatic traction control (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 "NORM/SPIN" and "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 NORM/SPIN 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 NORM/SPIN again will cycle the system back to normal operation.

The Rockwell WABCO ABS system combines one front-axle control channel with one rear axle to form one control circuit. For example, the sensor and solenoid control valve on the left-front axle form a control circuit with the sensor and solenoid control 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, solenoid control 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 solenoid control valve (or combination solenoid control valve) is damaged and inoperative. As these compo-

nents 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.

Engines and Clutches

Engine Starting	7.1
Ether Start System	7.3
Cold Weather Operation	7.4
Engine Break-In	7.7
Engine Operation	7.8
Engine Shutdown	7.26
High Altitude Operation	7.28
Engine Braking System, Optional	7.28
Clutches	7.31

Engines and Clutches

Engine Starting

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

Caterpillar

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

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



WARNING

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

1. Before engine start-up, perform the engine pretrip inspection and daily maintenance checks in **Chapter 11**.
2. Set the spring parking brakes.
3. Place the transmission in neutral, and disengage the clutch.

NOTE: On vehicles equipped with a neutral start switch, the transmission must be in neutral before the engine can be started. For air start systems, check the air sup-

ply before starting the engine. There must be 100 psi (689 kPa) of air pressure available.

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



CAUTION

Don't crank the engine for more than 30 seconds at a time; wait two minutes after each try to allow the starter to cool. Failure to do so could cause starter damage.

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

5. Turn on the ignition switch. Release the switch the moment the engine starts.
6. If the engine doesn't start after the above step, turn the ignition switch. After the engine begins to crank, push the accelerator pedal down halfway, and hold it while cranking. As soon as the engine starts, release the accelerator pedal so the engine runs at low idle, and release the ignition switch.
7. Do not apply a load to the engine or increase the engine speed until the oil pressure gauge reading is normal. Within 15 seconds after the engine starts, oil pressure should rise to 10–20 psi (69–138 kPa)

for C-10 engines and 18 psi (124 kPa) for 3406E engines. If low oil pressure or no oil pressure is indicated, shut down the engine immediately to prevent serious damage. Do not operate the engine until the cause of the problem has been corrected. If the vehicle is equipped with an automatic shutdown system, the engine will shut down after 30 seconds if the oil pressure does not build up to the preset minimum. If the engine shuts down, do not operate it (except in an emergency) until the cause of the problem has been corrected.

8. Operate the engine at low load. After normal oil pressure is reached and the temperature gauge begins to move, the engine may be operated at full load. Check all gauges during the warm-up period.

Cummins and Detroit Diesel

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

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



CAUTION

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

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



CAUTION

Don't crank the engine for more than 30 seconds at a time; wait two minutes after each try to allow the starter to cool. Failure to do so could cause starter damage.

IMPORTANT: For Detroit Diesel engines, pumping the accelerator before or during cranking will not aid in starting. If the engine won't start, check the main engine power fuses; they may have blown. The fuses are located along the main engine electrical harness on the left frame rail, near the batteries. If needed, replace the fuses. Be sure to find the cause of the blown fuses as soon as possible.

5. Turn on the ignition switch. Release the switch the moment the engine starts.

NOTE: Some starters are equipped with an optional thermostat. If overcranking occurs, the thermostat

Engines and Clutches

breaks the electrical current to the starter motor until the motor has cooled.

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

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

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

Starting After Extended Shutdown or Oil Change

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

1. Disconnect the wire from the fuel pump solenoid valve.
2. Crank the engine until oil pressure shows on the gauge.

3. Connect the wire to the fuel pump solenoid valve.
4. Start the engine. Refer to "Engine Starting" above.

Ether Start System

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

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

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



WARNING

Do not attempt to use "Fleetguard" or other vapor compound type start systems near heat or open flame. Engine damage due to an explosion or fire in the intake manifold could result.

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

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

Cold Weather Operation

Caterpillar

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

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

For cold-weather operation, use the following guidelines:

1. When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity. Refer to your engine operation and maintenance

manual or to the vehicle maintenance manual for specifications.

2. When the temperature is below freezing, use sufficient antifreeze solution in the cooling system to prevent freezing.
3. During cold weather, give more attention to the condition of the batteries. Test them frequently to ensure sufficient power for starting. Inspect all switches and connections in the electrical system and keep them in good condition to prevent losses through poor contacts. Refer to the alternators and starters section in the vehicle workshop manual for detailed information.
4. If so equipped, turn off the battery disconnect switch after the engine is stopped, to prevent battery discharge while the starter motor is cooling.

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



WARNING

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

Engines and Clutches

5. When customer parameters include cold mode operation and the coolant temperature is below 64°F (18°C), the system puts the engine in cold mode, limiting engine power, advancing timing, and adjusting the low idle to 600 rpm to improve warm-up time. The system will keep the engine in cold mode until coolant temperature rises above 64°F (18°C) or until the engine has been running for 12 minutes. The system will then stop the cold mode and allow the engine to operate normally.
6. Fuel cloud point is the temperature at which wax crystals become visible, which is generally above the pour point of the fuel. To keep the fuel filter elements from plugging with wax crystals, the cloud point should be no higher than the lowest ambient temperature at which the engine must start.

Cummins

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 temperatures the greater the amount of modification required, and yet with the modifications applied, the engines must still be capable of operation in warmer climates without extensive changes.

The following information is provided to engine owners, operators, and maintenance personnel on how the mod-

ifications can be applied to get satisfactory performance from their diesel engines.

There are three basic objectives:

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

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

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

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

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

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



CAUTION

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

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

Detroit Diesel

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

1. Engine oil thickens as it gets colder, slowing cranking speed. When cold, multi-grade oil offers less resistance to the cranking effort of the engine and permits sufficient rpm to be developed to start the engine. Refer to "Lubricating Oil Recommendations" in the Detroit Diesel *Owner's and Operator's Guide* for specific recommendations.
2. When an engine equipped with a DDEC system is started at temperatures below 25°F (-4°C), the idle speed automatically increases to 900 rpm. The injection timing is also advanced to decrease white smoke. As the engine oil warms up, the idle speed gradually decreases. When the oil temperature

Engines and Clutches

reaches 122°F (50°C), both the idle speed and the injection timing return to normal.

3. During cold weather, the batteries should be tested more frequently to ensure ample power for starting. All electrical connections should be tight and in good condition to prevent losses through loose or corroded connections.
4. The ether start system should be properly charged and in good working order.
5. Ethylene glycol base antifreeze is recommended. An inhibitor system is included in this type of antifreeze, and the corrosion protection is sufficient as long as the recommended concentration range of 30 to 67 percent (antifreeze to water by volume) is employed.
6. If the engine is to be operated in arctic temperatures, consult the nearest Freightliner dealer, or an authorized Detroit Diesel engine dealer, for information regarding availability of special cold-weather equipment.

Engine Break-In

Caterpillar

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

Cummins

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

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

Detroit Diesel

Detroit Diesel engines can be put to work upon delivery without having to follow a formal break-in schedule. The

engine has been "run-in" on a factory dynamometer during performance and quality assurance tests prior to shipment.

Engine Operation

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



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

Caterpillar

Proper operation and maintenance are key factors in obtaining the maximum life and economy of a vehicle engine. Follow the directions in the Caterpillar *Operation*

and Maintenance Management Manual and this manual for trouble-free, economical engine operation.

Caterpillar C-10, C-12, and 3406E electronic engines can be equipped with a variety of options designed to warn the driver of engine malfunctions. The driver of a vehicle equipped with these engines should know the extent of the warning system in order to bring the vehicle to a safe stop if the engine malfunctions. If the driver doesn't understand how the warning system works, an engine shutdown could cause a safety hazard. See **Chapter 2** for information on the control panel for these engines.

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

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

Engines and Clutches

IMPORTANT: If a winterfront is used on a vehicle equipped with a Caterpillar electronic charge air cooled engine, make sure there is an opening (one that can't be closed) in the center of the winterfront, to allow air-flow through the aftercooler core.

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

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

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

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

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

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

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

4. On uphill grades, begin downshifting when the engine rpm falls to 1200 rpm for C-10, C-12, and 3406E electronic engines. Fuel economy will be best if you let the engine lug back to around this speed before you downshift. Downshift until a gear is reached in which the engine will pull the load. Let

the engine lug down if you can make it to the top of a hill without down-shifting.

IMPORTANT: Don't let C-10, C-12, and 3406E electronic engines exceed 2300 rpm (2100 rpm if equipped with an exhaust brake).

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

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

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

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

Cruise Control

The cruise control is activated by the "Spd Cntl" (on/off) and "Rsm/Acc-Set/Cst" switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (**Fig. 7.2**). The minimum speed at which cruise control can be used on Caterpillar

electronic engines is 30 mph (48 km/h). On Caterpillar engines, the minimum and maximum speed cruise control set limits can be programmed, by authorized personnel, into the ECM personality module.

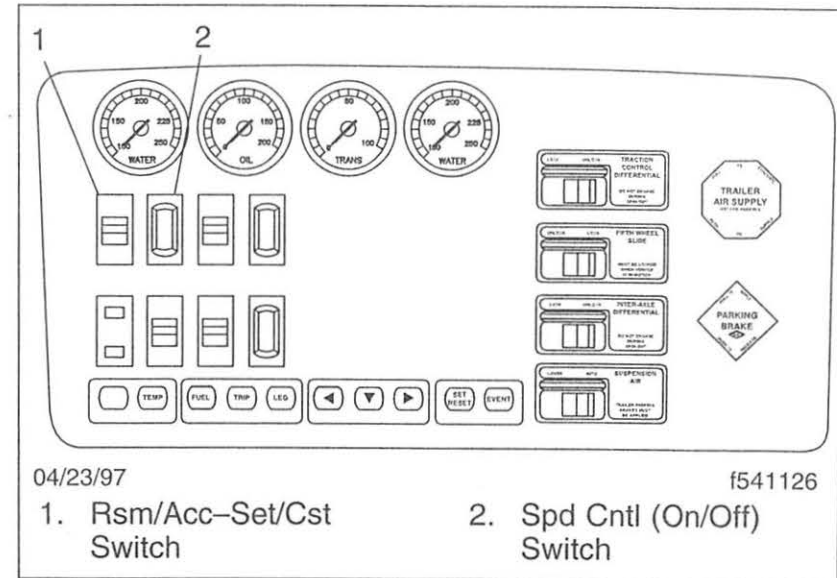


Fig. 7.1, Cruise Control Switches, Dash-Mounted

Engines and Clutches



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.

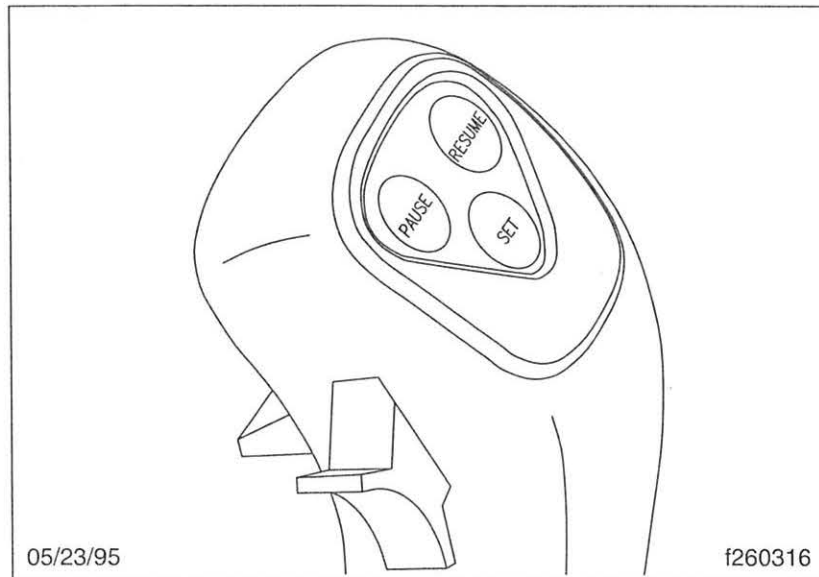


Fig. 7.2, Cruise Control, Transmission Shift Knob Buttons



CAUTION

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

1. To cruise at a particular speed:
 - 1.1 Press the upper half of the "Spd Cntl" (on/off) rocker switch on the instrument control.
 - 1.2 Hold the throttle down until the speedometer reaches the desired speed.
 - 1.3 Momentarily flip the "Rsm/Acc-Set/Cst" paddle switch on the instrument control panel down to "Set/Cst," or push the "Set" button on the transmission shift knob.
2. To disengage the cruise control:
 - 2.1 Depress the brake pedal or clutch pedal, *or*
 - 2.2 Press the lower half of the "Spd Cntl" rocker switch on the instrument control panel, or push the "Pause" button on the transmission shift knob.
3. To resume a preselected cruise speed:

- 3.1 If the "Spd Cntl" rocker switch on the instrument control panel is off, turn it on.
- 3.2 Momentarily flip the "Rsm/Acc-Set/Cst" paddle switch on the instrument control panel to "Rsm/Acc" or push the "Resume" button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the paddle switch on the instrument control panel at "Rsm/Acc" to accelerate or at "Set/Cst" to decelerate until the desired speed is reached, or press the "Set" button on the transmission shift knob to accelerate or the "Resume" button to decelerate until the desired speed is reached.

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

Power Takeoff (PTO) Governor

Caterpillar electronic engines may be equipped with a PTO governor. This mode is used only when the vehicle is parked. The PTO mode is activated by the "Spd Cntl" and "Rsm/Acc-Set/Cst" switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (**Fig. 7.2**).

1. To engage the PTO:

- 1.1 Press upper half of the "Spd Cntl" rocker switch on the instrument control pane.
 - 1.2 Hold the throttle down until the tachometer reaches the desired engine speed.
 - 1.3 Momentarily flip the paddle switch on the instrument control panel down to "Set/Cst," or push the "Set" button on the transmission shift knob.
2. To disengage the PTO:
 - 2.1 Depress the brake pedal or clutch pedal, *or*
 - 2.2 Press the lower half of the "Spd Cntl" rocker switch on the instrument control panel, or press the "Pause" button on the shift knob.
 3. To resume a previously selected engine speed:
 - 3.1 If the "Spd Cntl" switch on the instrument control panel is turned off, turn it on.
 - 3.2 Momentarily flip the paddle switch on the instrument control panel up to "Rsm/Acc," or press the "Resume" button on the transmission shift knob.

To adjust engine speed up or down, hold the "Rsm/Acc-Set/Cst" paddle switch up to accelerate or down to decelerate until the desired speed is reached, or press the "Set"

Engines and Clutches

button on the transmission shift knob to accelerate or the "Resume" button to decelerate until the desired speed is reached.

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

BrakeSaver, Optional

The BrakeSaver (optional on 3406E engines) permits the operator to control the speed reduction of the vehicle on grades, curves, or anytime speed reduction is necessary but long applications of the service brakes are not desired.

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



Do not engage the BrakeSaver and control the wheel speed with the accelerator. The design of the cooling system is for the control of the temperature of the oil at full engine power or full BrakeSaver capacity, but not both at the same time.

Cummins

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

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

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

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

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

essary does not allow proper utilization of this flexibility. The driver who stays in top gear and uses the wider speed range will achieve the best fuel economy.

6. The Cummins diesel engine is effective as a brake on downhill grades, but care must be used not to overspeed the engine going downhill. The governor has no control over engine speed when it is being pushed by the loaded vehicle.

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



CAUTION

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

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

Cruise Control

The cruise control is activated by the "Spd Cntl" (On/Off) and "Rsm/Acc-Set/Cst" switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on

Engines and Clutches

the transmission shift knob (**Fig. 7.2**). The minimum speed at which cruise control can be used on Cummins CELECT Plus engines is 30 mph (48 km/h).



WARNING

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



CAUTION

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

1. To cruise at a particular speed:
 - 1.1 Press the upper half of the "Spd Cntl" (on/off) rocker switch on the instrument control.
 - 1.2 Hold the throttle down until the speedometer reaches the desired speed.
 - 1.3 Momentarily flip the "Rsm/Acc-Set/Cst" paddle switch on the instrument control panel

down to "Set/Cst," or push the "Set" button on the transmission shift knob.

2. To disengage the cruise control:
 - 2.1 Depress the brake pedal or clutch pedal, *or*
 - 2.2 Press the lower half of the "Spd Cntl" rocker switch on the instrument control panel, or push the "Pause" button on the transmission shift knob.
3. To resume a preselected cruise speed:
 - 3.1 If the "Spd Cntl" rocker switch on the instrument control panel is turned off, turn it on.
 - 3.2 Momentarily flip the paddle switch on the instrument control panel to "Rsm/Acc" or push the "Resume" button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the paddle switch on the instrument control panel at "Rsm/Acc" to accelerate or at "Set/Cst" to decelerate until the desired speed is reached, or press the "Set" button on the transmission shift knob to accelerate or the "Resume" button to decelerate until the desired speed is reached.

NOTE: The resume vehicle speed memory is not maintained if the cruise control "Spd Cntl" switch is turned off or if the ignition is shut off.

Power Takeoff (PTO) Governor

Cummins electronic engines may be equipped with a PTO governor. This mode is used only when the vehicle is parked. The PTO mode is activated by the "Spd Cntl" and "Rsm/Acc-Set/Cst" switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (**Fig. 7.2**).

1. To engage the PTO:
 - 1.1 Press the upper half of the "Spd Cntl" rocker switch on the instrument control panel.
 - 1.2 Hold the throttle down until the tachometer reaches the desired engine speed.
 - 1.3 Momentarily flip the "Rsm/Acc-Set/Cst" switch on the instrument control panel to "Set/Cst," or push the "Set" button on the transmission shift knob.

IMPORTANT: Two PTO engine speeds can be preset on CELECT Plus engines. With the "Spd Cntl" switch on, flip the "Rsm/Acc-Set/Cst" switch to "Set/Cst" to reach the first preset value, or flip the switch to "Rsm/Acc" for the second preset value. After one preset value has been selected, you must turn the

"Spd Cntl" switch off, then turn it back on before using the second preset value.

2. To disengage the PTO:
 - 2.1 Depress the brake pedal, clutch pedal, throttle pedal (CELECT Plus engines only), *or*
 - 2.2 Press the lower half of the "Spd Cntl" rocker switch on the instrument control panel, or press the "Pause" button on the shift knob.
3. To resume a previously selected engine speed:
 - 3.1 If the "Spd/Cntl" switch on the instrument control panel is turned off, turn it on.
 - 3.2 Momentarily flip the paddle switch on the instrument control panel to "Rsm/Acc," or press the "Resume" button on the transmission shift knob.

To adjust engine speed up or down, hold the "Rsm/Acc-Set/Cst" paddle switch up to accelerate or down to decelerate until the desired speed is reached, or press the "Set" button on the transmission shift knob to accelerate or the "Resume" button to decelerate until the desired speed is reached.

NOTE: The resume engine speed memory is not maintained if the cruise control "Spd Cntl" switch is turned off, or if the ignition is shut off.

Engines and Clutches

Detroit Diesel

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

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

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

IMPORTANT: If a winterfront is used on a vehicle equipped with a Detroit Diesel air-to-air aftercooled engine, make sure there is a 12-inch by 12-inch opening

(one that can't be closed) in the center of the winterfront, to allow airflow through the aftercooler core.

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

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

As described by Detroit Diesel, this "progressive shifting" technique will get the vehicle up to the desired cruising speed while minimizing noise emission and maximizing fuel economy. A progressive shift pattern is illustrated in **Fig. 7.3**.

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

2. For city driving, run in the highest gear possible and reduce engine speed. This enables you to operate at a safe speed for traffic conditions while using less fuel and reducing noise. Also, when slowing down for reduced speed zones, remain in your running gear and reduce engine rpm to stay within the

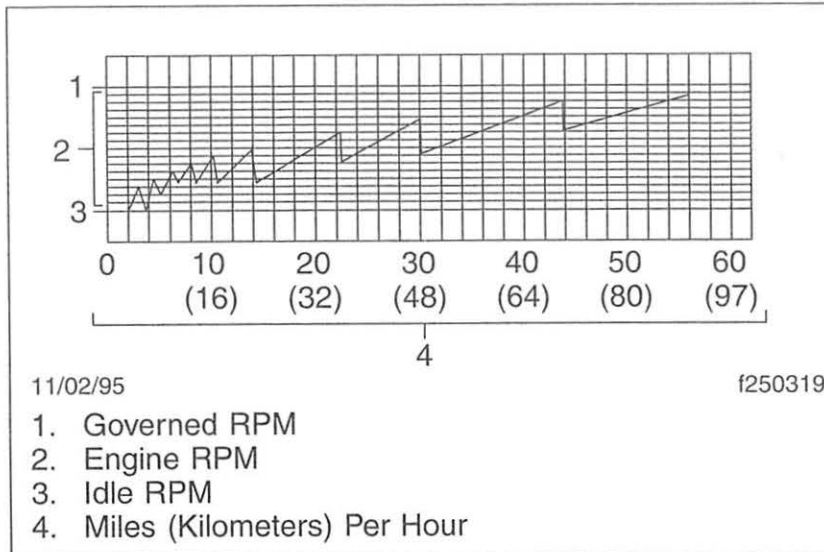


Fig. 7.3, Progressive Shift Pattern

speed limit. Avoid downshifting until you are ready to return to highway cruising speed.

3. For highway cruising, and for best fuel economy, run the engine at 80 to 90 percent of rated rpm to maintain highway speed. Engines with 1800 rpm ratings are exceptions and will provide fuel economy when run at their rated speed. Proper gear selection should permit cruising in the economy range with no appreciable sacrifice in desired highway speed.

It is okay to operate below rated rpm at full throttle if you are satisfied with the way the vehicle performs.

However, there are times when hilly terrain, high winds, or other conditions make it impractical to operate without reserve power. Such conditions are better met if the vehicle is operated in a lower gear with reserve power available for changes in terrain, wind, etc.

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

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

5. Because of their constant torque over a wide speed range, Detroit Diesel engines can be operated at full throttle at lower rpm than other engines. This offers benefits in fuel economy and engine life. And more than likely, it will be possible to top most grades without down-shifting.

When the vehicle starts into a grade, allow the engine to lug down to maximum torque rpm before

Engines and Clutches

downshifting. Downshift, if required, at maximum torque rpm also or at the predetermined road speed for the next lower gear.

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

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

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



CAUTION

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

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

IMPORTANT: The engine governor has no control over engine rpm when the engine is being pushed by a loaded vehicle down a grade. Use service brakes and gears in combination on long grades to keep the vehicle speed under control and the engine rpm below full-load rated governed speed.

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

Maintenance literature is also available for drivers of Allison-equipped vehicles who desire trouble-free performance and maximum life from their equip-

ment. These maintenance books are available from any authorized Detroit Diesel engine distributor.

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

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

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

Cruise Control

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

The cruise control is activated by the "Spd Cntl" (on/off) and "Rsm/Acc-Set/Cst" switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (**Fig. 7.2**).



WARNING

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



CAUTION

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

1. To cruise at a particular speed:
 - 1.1 Press the upper half of the "Spd Cntl" (on/off) rocker switch on the instrument control.
 - 1.2 Hold the throttle down until the speedometer reaches the desired speed.
 - 1.3 Momentarily flip the paddle switch on the instrument control panel down to "Set/Cst," or push the "Set" button on the transmission shift knob.
2. To disengage the cruise control:

Engines and Clutches

- 2.1 Depress the brake pedal or clutch pedal, *or*
 - 2.2 Press the lower half of the "Spd Cntl" rocker switch on the instrument control panel, or push the "Pause" button on the transmission shift knob.
3. To resume a preselected cruise speed:
- 3.1 If the "Spd Cntl" rocker switch on the instrument control panel is in the "Off" position, press the upper half of the switch.
 - 3.2 Momentarily flip the paddle switch on the instrument control panel to Rsm/Acc" or push the "Resume" button on the transmission shift knob. Cruise will return to the last speed selected.

To adjust cruise speed up or down, hold the paddle switch on the instrument control panel at "Rsm/Acc" to accelerate or at "Set/Cst" to decelerate until the desired speed is reached, or press the "Set" button on the transmission shift knob to accelerate or the "Resume" button to decelerate until the desired speed is reached.

NOTE: The resume vehicle speed memory is not maintained if the ignition is shut off or if the "Spd Cntl" switch is off for more than 10 seconds.

Power Takeoff (PTO)

A power takeoff option is available for vehicles equipped with a DDEC system. The PTO operates only when the vehicle is at a standstill.

Some vehicles have separate controls for the PTO. In the case of a preset nonadjustable PTO engine speed, there is only an on/off switch labeled "Fast Idle." If the vehicle is equipped with a variable PTO engine speed, there are two controls: an on/off switch, and a potentiometer knob. Both of these are labeled "Governor."

On other vehicles, the PTO mode is activated by the cruise control switches on the dash (**Fig. 7.1**) or by optional "Pause," "Resume," and "Set" buttons on the transmission shift knob (**Fig. 7.2**).).

Operating the PTO With Separate PTO Controls:

1. Set the parking brake.
2. Turn on the switch labeled "Governor" (or "Fast Idle" for vehicles with a preset PTO system).
3. For vehicles with a variable PTO, use the potentiometer knob to adjust the engine rpm.

Operating the PTO Using Cruise Control Switches:

1. To engage the PTO:

- 1.1 Press the upper half of the "Spd Cntl" rocker switch on the instrument control panel.
 - 1.2 Hold the throttle down until the tachometer indicates the desired engine speed.
 - 1.3 Momentarily flip the "Rsm/Acc-Set/Cst" switch on the instrument control panel to "Set/Cst," or push the "Set" button on the transmission shift knob.
2. To disengage the PTO:
 - 2.1 Depress the brake pedal, clutch pedal, or
 - 2.2 Turn off the "Spd Cntl" switch on the instrument control panel, or press the "Pause" button on the shift knob.
3. To resume a previously selected engine speed:
 - 3.1 If the "Spd Cntl" switch on the instrument control panel is in the off position, turn it on.
 - 3.2 Momentarily flip the "Rsm/Acc-Set/Cst" switch on the instrument control panel to "Rsm/Acc," or press the "Resume" button on the transmission shift knob.

To adjust engine speed up or down, hold the "Rsm/Acc-Set/Cst" paddle switch up to accelerate or down to decelerate until the desired speed is reached, or press the "Set" button on the transmission shift knob to accel-

erate or the "Resume" button to decelerate until the desired speed is reached.

Optimized Idle®

The Optimized Idle option on DDEC III-equipped vehicles is a system that automatically stops and restarts the engine to accomplish the following:

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

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

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

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

Engines and Clutches

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 and a dash light. On vehicles built before January 1997, the dash light is on the "B" panel of the dashboard. See **Fig. 7.4**. On vehicles built after January 1997, the dash light is on the dash message center, on the "A" panel. See **Fig. 7.5**. See **Fig. 7.6** for the dash label detail. If equipped with the thermostat mode, a thermostat is located in the sleeper, above the bunk. See **Fig. 7.7**.

The thermostat consists of an LCD readout and four buttons.

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

The button functions are as follows:

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

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

1. Activate Optimized Idle (engine mode) as follows:
 - 1.1 Set the parking brake.
 - 1.2 If it is tilted, close and secure the hood.
 - 1.3 Start the engine and let it idle.

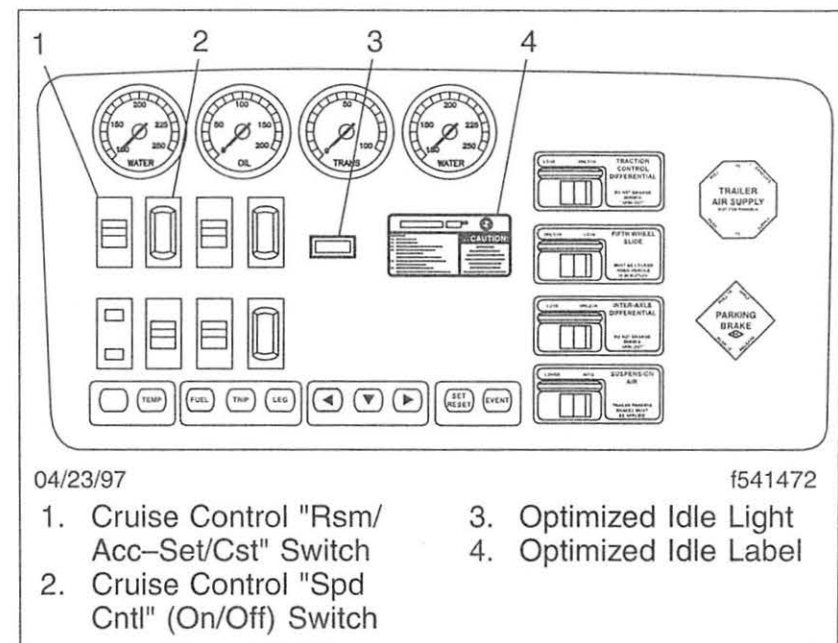


Fig. 7.4, Dash Light, Vehicles Built Before January 1997

Engines and Clutches

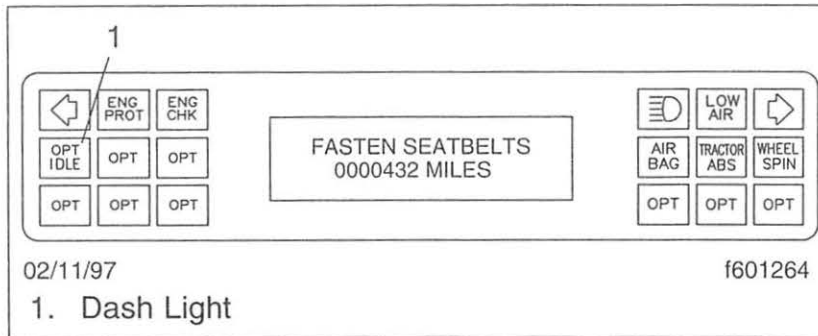


Fig. 7.5, Dash Light, Vehicles Built After January 1997

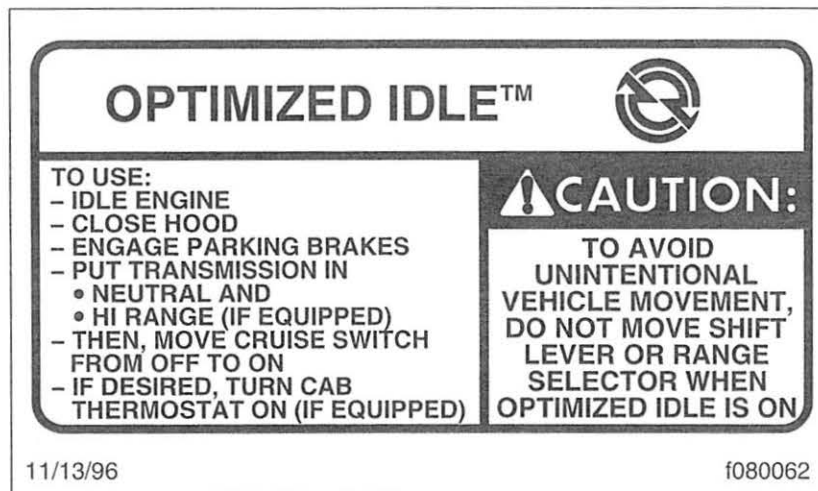


Fig. 7.6, Optimized Idle Dash Label

- 1.4 Put the transmission in neutral.
- 1.5 Turn on the cruise control.

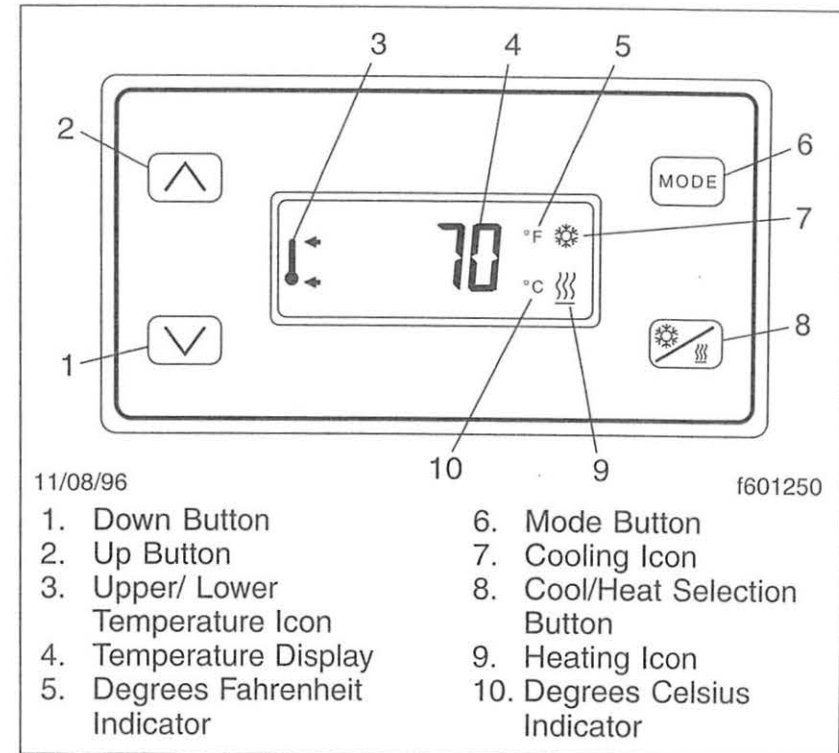


Fig. 7.7, Optimized Idle Thermostat

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

- 1.6 The dash light will begin blinking, indicating that Optimized Idle is active. The system is now in the engine mode, and after an initial

Engines and Clutches

phase, in which the idle speeds up to 1000 or 1500 rpm (depending on the outside temperature), the engine will stop and start automatically to keep the battery charged and the engine oil warm. The dash light stays on and shines steadily at this point.

2. Activate the thermostat mode (if so equipped) as follows:

NOTE: When the system is in the thermostat mode, it is also in the engine mode. It will continue to operate in the engine mode even if the thermostat mode is turned off.

- 2.1 With the system in the engine mode, set the cab and sleeper heater or air conditioner controls to the highest setting.
- 2.2 Turn on the thermostat by touching any of the four buttons. See **Fig. 7.7**.

The display will flash the current sleeper temperature and the previous mode (cooling or heating) selected. If the cab needs to be cooled or heated, the cool/heat icon will flash.

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

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

- 2.4 Select Fahrenheit or Celsius by pressing and holding the *Mode* button until either the "F" or "C" is displayed.
 - 2.5 Select the temperature set point by pressing either the *Up* button or the *Down* button, as applicable. Holding the button will cause the display to count up or down rapidly. When the desired set point is displayed, release the button. The set point is stored in memory.
 - 2.6 Select the temperature comfort zone by pressing the *Mode* button until the upper and lower temperature limit icon is displayed. Then use the *Up* or *Down* button to select one of the three comfort zones of 4°F (2°C), 7°F (4°C), or 10°F (6°C).
3. To change the display to either Fahrenheit or Celsius, press the *Mode* button until only the *F°* or *C°* icon is flashing. Press the *Up* or *Down* button to change to the desired value. The main display will appear five seconds after the button is released.
 4. To deactivate the thermostat mode and return to just the engine mode, press the *Mode* button and hold it for three seconds.

5. To shut down Optimized Idle completely, either turn off the ignition or use the drive away feature.

The drive away feature allows the use of all the DDEC features. Use the drive away feature as follows:

- 5.1 *If the engine is running:* Release the parking brakes or put the transmission in gear.

If the engine is not running: Start the engine. Release the parking brakes or put the transmission into gear.
- 5.2 Let the engine return to base idle. The active light will turn off. Optimized Idle is now disabled and all the DDEC features are available.

Engine Shutdown

Caterpillar



CAUTION

Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of the engine components. Excessive temperatures in the turbocharger centerhousing will cause oil coking problems. Follow the procedure, outlined below, to allow the engine to cool.

1. With the vehicle stopped, apply the parking brakes. Reduce the engine speed to low idle.
2. Place the transmission shift lever in neutral.
3. Reduce the engine speed to low idle.

NOTE: If the engine has been operating at low loads, run it at low idle for 30 seconds before stopping. If the engine has been operating at highway speed or at high loads, run it at low idle for 3 minutes to reduce and stabilize internal engine temperatures before stopping.

4. Check the crankcase oil level while the engine is idling. Maintain the oil level between the add and full marks on the dipstick.
5. Turn off the ignition key to shut down the engine.
6. If equipped with an idle shutdown timer, it can be set to shut the engine down after a preset amount of time. Ninety seconds before the preset shutdown time, the "check engine" light will begin to flash at a rapid rate. If the clutch pedal or service brake indicate a position change during this final ninety seconds, (diagnostic lamp flashing), the idle shutdown timer will be disabled until reset.
7. After stopping the engine, fill the fuel tank.
8. If freezing temperatures are expected, allow the engine jacket water expansion tank to cool; then, check the coolant for proper antifreeze protection.

Engines and Clutches

The cooling system must be protected against freezing to the lowest expected outside temperature. Add permanent-type antifreeze, if required.

9. Repair any leaks, perform minor adjustments, tighten loose bolts, etc. Observe the vehicle mileage or the service meter reading, if so equipped. Perform periodic maintenance as instructed in the Lubrication and Maintenance Chart in the Caterpillar *Operation and Maintenance Management*.

Cummins

1. With the vehicle stopped, apply the parking brakes, and place the transmission in neutral.
2. It is important to idle an engine 3 to 5 minutes before shutting it down. This allows the lubricating oil and the water to carry heat away from the combustion chamber, bearings, shafts, etc. This is especially important with turbocharged engines.

Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 100°F (56°C). The extreme heat may cause bearings to seize or oil seals to leak.

3. Do not idle the engine for excessively long periods. Long periods of idling are not good for an engine

because the combustion chamber temperatures drop so low the fuel may not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and may result in stuck valves.

If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil; therefore, all moving parts of the engine will suffer from poor lubrication.

4. If the engine is not being used, shut it down by turning the ignition key off.



CAUTION

Stop the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

Detroit Diesel

1. With the vehicle stopped, apply the parking brakes, and place the transmission in neutral.
2. Allow the engine to run at half speed or slower, with no load, for four to five minutes, to cool the engine gradually and uniformly.

3. Shut down the engine by turning the ignition key off.

High Altitude Operation

Caterpillar

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



CAUTION

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

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

The engine can be operated at a lower altitude than specified without danger of engine damage. In this situation the engine will perform at slightly less than maximum efficiency. When operated at a higher altitude, the rack setting and high idle speed setting must be

changed. These settings should be made only by an authorized Caterpillar engine dealer. The adjustments can be made by reprogramming the personality module in the ECM.

Cummins

Engines lose horsepower when operated at high altitude because the air is too thin to burn as much fuel as at sea level. This loss is about 3 percent for each 1000 feet (300 m) altitude above sea level for a naturally aspirated engine. Most turbocharged engines are rated for higher altitudes than naturally aspirated engines. An engine will have smoky exhaust at high altitudes unless a lower gear is used. The engine will not demand full fuel from the fuel system unless the engine is altitude-compensated by the use of a turbocharger. Shift gears as needed to avoid excessive exhaust smoke.

Engine Braking System, Optional

Jacobs Engine Brake

A Jacobs engine brake is a hydraulic-electric engine attachment that converts a diesel engine into an air compressor. This is done by changing engine exhaust valve operation. An engine brake is not a substitute for a service braking system, except in emergencies, because

Engines and Clutches

it does not provide the precise control available from the service brakes.

The Jake Brake is controlled by a single, dash-mounted paddle switch with three positions: OFF, LO and HI.

Jacobs Engine Brake Operation



Don't use the engine brake if road surfaces are slippery. Using the engine brake on wet, icy, or snow-covered roads could result in loss of vehicle control, possibly causing personal injury and property damage.

To engage the engine brake, the dash switch must be in the LO or HI position and both the clutch and throttle pedals must be fully released. To disengage the engine brake, depress the throttle or clutch pedal, or move the dash switch to OFF.



The engine brake must be disengaged when shifting gears. The clutch must be used if the dash switch is in the LO or HI position. 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.

Since the engine brake is most effective at rated engine speed, gear selection is very important. Gearing down the vehicle within the limits of the rated engine speed makes the engine brake more effective. Maximum braking occurs with the use of the lowest gear that does not exceed the rated engine speed. A rule of thumb for gear choice is to select the gear that normally would be used to climb an approaching downhill grade. Generally, this same gear can be used with the engine brake for a controlled descent of the hill.

"Control speed" is the speed at which the engine brake performs 100 percent of the required downhill braking, resulting in a constant speed of descent. The control speed varies, depending on vehicle weight and the downhill grade.

For faster descent, select a higher gear than that used for control speed. Service brakes must then be used in-

termittently to prevent engine overspeed and to maintain desired vehicle speed.

IMPORTANT: When descending a grade, remember that frequent use of service brakes causes them to become hot, which results in a reduction of their stopping ability. Grade descent speed should be such that the service brakes are used infrequently and that they remain cool, thus retaining their effectiveness.

A driver may descend slower than control speed by selecting a lower gear, one that will not overspeed the engine. The engine brake retarding force will then be sufficient to cause vehicle deceleration. Occasional deactivation of the engine brake may be necessary to maintain the designated road speed under these conditions.

The engine brake can be used to stop a vehicle if the service brakes quit working. By energizing the engine brake as soon as a service brake problem is apparent, a retarding effect is applied to the vehicle. As grade conditions permit, the driver can progressively downshift, using the engine brake in each gear. Eventually, the engine brake will stop the vehicle.



WARNING

Using the engine brake as a primary braking system when the service brakes are operable is dangerous. This can cause long, unpredictable stopping distances, possibly resulting in personal injury or property damage.

Whenever vehicle braking is required, the engine brake may be used with the service brakes. There is no time limit for operation of the engine brake.

1. After the engine is warmed up and the vehicle is in motion, move the paddle switch to the desired position, LO or HI. Depending on the engine model, LO will provide 1/3 or 1/2 of the full braking capacity of the engine. HI will provide maximum engine braking.
2. The engine brake activates when the dash switch is in LO or HI position and the driver's feet are removed from both the clutch and throttle pedals. If it fails to activate, stop the vehicle in a safe spot, and check the adjustment of the throttle and clutch switches. If no cause can be detected in the electrical system, check the engine brake system. Refer to the vehicle workshop manual for instructions.
3. To obtain maximum retarding, maintain the top governed speed of the engine through appropriate selection of gears when the engine brake is in use.

Engines and Clutches

4. When either the clutch or throttle pedal is depressed, the engine brake is deactivated.



CAUTION

If the engine brake fails to shut off when either the throttle or clutch pedal is depressed, place the dash switch in the OFF position and do not use the engine brake until the throttle or clutch switch system is repaired. If the engine brake fails to shut off when the dash switch is turned off, the engine should be shut down and the engine brake repaired before continuing operation. Failure to do so could result in damage to the engine.

Clutches

General Information

The major reason why clutches wear out too soon is excessive heat. Clutches are designed to absorb and dissipate more heat than encountered in typical operation. The temperatures developed in typical operation will not break down the clutch friction surfaces. However, if a clutch is slipped excessively, or asked to do the job of a fluid coupling, high temperatures develop quickly and destroy the clutch. Temperatures generated between the flywheel, driven discs, and pressure plates can be high enough to cause the metal to flow and the friction facing material to char and burn.

Heat and wear are practically nonexistent when a clutch is fully engaged. But during the moment of engagement, when the clutch is picking up the load, it generates considerable heat. An improperly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

The most important items that a driver should be aware of to ensure long service life of the clutch include: starting in the right gear; clutch malfunctions; and when to adjust a clutch.

Clutch Operation

Valeo Clutch Break-In

With a new or newly-installed Valeo clutch, the clutch may slip for a short time while the friction surfaces "break in." However, allowing the clutch to slip for more than two seconds can severely damage the clutch disc, pressure plate, and the flywheel.

During initial operation of a new vehicle or a vehicle with a new clutch, check for clutch slippage during acceleration. If the clutch slips, decelerate until the clutch does not slip. Allow the clutch to cool 15 to 30 seconds, and then gradually accelerate again. If the clutch continues to slip, repeat the procedure. If necessary, repeat the procedure up to five times. If the clutch slips after five attempts, stop the vehicle. Allow the clutch to cool for at least one hour. Notify your Freightliner dealer of the problem.



CAUTION

Do not allow sustained slippage of the clutch: This could severely damage the clutch disc, pressure plate, or flywheel. Damage caused by clutch slippage due to improper break-in is not warrantable.

Starting the Vehicle in the Proper Gear

An empty truck can be started in a higher transmission gear ratio than a partially or fully loaded truck. A good rule of thumb for the driver to follow is: select the gear combination that allows you to start moving with an idling engine, or, if necessary, just enough throttle to prevent stalling the engine. After the clutch is fully engaged, the engine should be accelerated to the correct rpm for the upshift into the next higher gear.

Gear Shifting Techniques

Many drivers upshift into the next gear, or even skip-shift into a higher gear, before the vehicle has reached the proper speed. This type of shifting is almost as bad as starting off in a gear that is too high, since the engine rpm and vehicle speeds are too far apart, requiring the clutch to absorb the speed difference with friction, creating heat. For transmission operating instructions, refer to **Chapter 8** in this manual.

The clutch brake is applied by fully depressing the clutch pedal. Its purpose is to stop the transmission

gears from rotating in order to engage the transmission gears quickly in making an initial start.



CAUTION

Never apply the clutch brake when making downshifts or upshifts. The clutch pedal should never be fully depressed before the transmission is put in neutral. If the clutch brake is applied with the transmission still in gear, a reverse load will be put on the gear. At the same time, it will have the effect of trying to stop or decelerate the vehicle with the clutch brake. Rapid wear of the friction discs will take place necessitating frequent replacement. Considerable heat will be generated, which will be detrimental to the release bearings and transmission front bearings.

Excessive Vehicle Overload, or Overloading the Clutch

Clutches are designed for specific vehicle applications and loads. These limitations should not be exceeded.



CAUTION

Overloading will not only result in damage to the clutch, but also to the entire power train.

Engines and Clutches

Riding the Clutch Pedal

Riding the clutch pedal is very destructive to the clutch, since partial clutch engagement permits slippage, generating excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing, which can thin out the lubricant. Release bearing failures can be attributed to this type of misuse.

Holding the Vehicle on an Incline With a Slipping Clutch

A slipping clutch accumulates heat faster than it can be dissipated, resulting in early clutch failures. Never use the clutch as a hill holder.

Coasting With the Clutch Released (Pedal Depressed) and the Transmission in Gear

Coasting with the clutch released and the transmission in gear can cause high driven disc rpm through multiplication of ratios from the final drive and transmission.



WARNING

High driven disc rpm could cause the clutch facing to be thrown off the discs. Ample safety factors are provided for normal operation, but the burst strength of the facing is limited. If this limit is exceeded, flying debris could cause injury to persons in the cab.

Engaging the Clutch While Coasting

Engaging the clutch while coasting can result in tremendous shock loads and possible damage to the clutch, as well as to the entire drivetrain.

Reporting Erratic Clutch Operation Promptly

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect and lubricate the clutch components, make necessary internal clutch and linkage adjustments, etc.

Clutch free pedal is a decreased resistance felt at the top of the clutch pedal stroke. See **Fig. 7.8**. With the clutch pedal in this range, the clutch is fully engaged, and the only resistance to clutch pedal movement is the force of the return spring. If clutch free pedal is 3/4 inch (20 mm) or less, measured at the pedal, have the clutch adjusted.

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

Refer to **Group 25** in the vehicle workshop manual for clutch adjustment procedures and specifications.

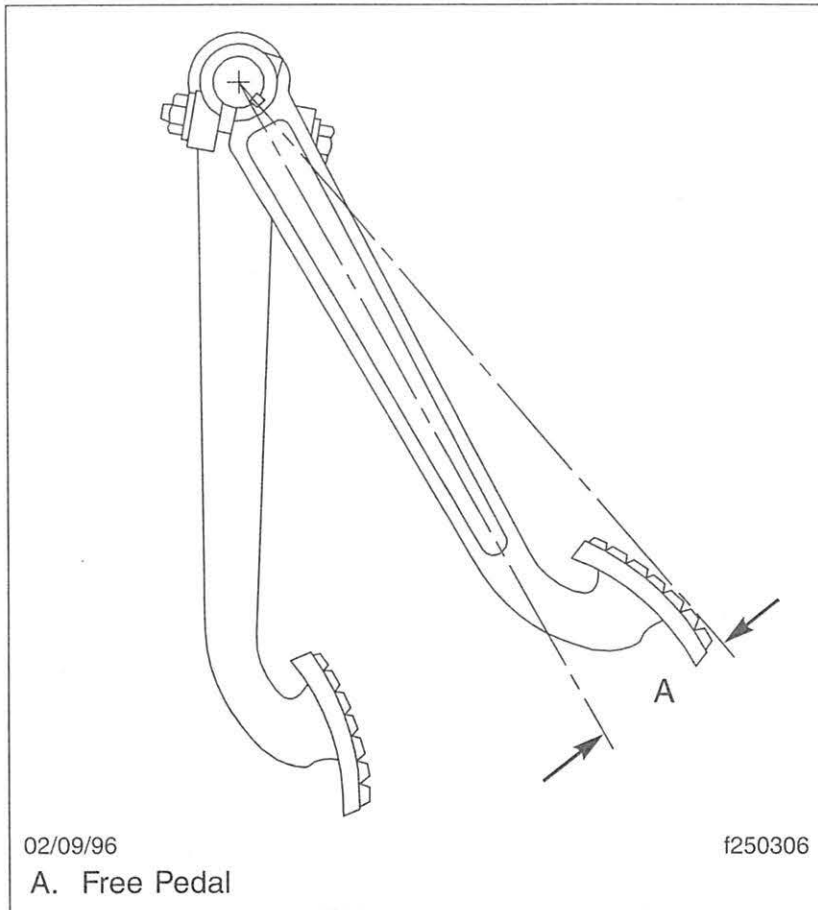


Fig. 7.8, Clutch Free Pedal



CAUTION

Operating the vehicle with incorrect free pedal could result in clutch damage.

Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring) felt as the clutch pedal approaches the end of its stroke. If the gears grind when shifting into first or reverse gear with the clutch pedal fully depressed, the clutch is out of adjustment, or the clutch brake is worn and needs to be replaced.

Clutch Adjustments

Clutches have an internal adjustment, and external linkage adjustment. Refer to **Group 25** in the vehicle workshop manual for clutch adjustment procedures and specifications.



CAUTION

Operating the vehicle with the clutch improperly adjusted could result in clutch or clutch brake failure.

Lubrication

On vehicles equipped with a greaseable release bearing, the release bearing and linkage should be lubricated

Engines and Clutches

at frequent intervals. Refer to **Group 25** in the vehicle maintenance manual for intervals and procedures.



CAUTION

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

Transmissions

Fuller Straight-Shift Models	8.1
Fuller Range-Shift Models	8.2
Fuller Splitter and Range-Shift Models	8.6
Fuller Deep-Reduction and Range-Shift Models	8.11
Rockwell Range-Shift Models	8.17
Rockwell Splitter and Range-Shift Models	8.19
Allison Automatic Models	8.23

Transmissions

Fuller Straight-Shift Models

General Information

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

Operation

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

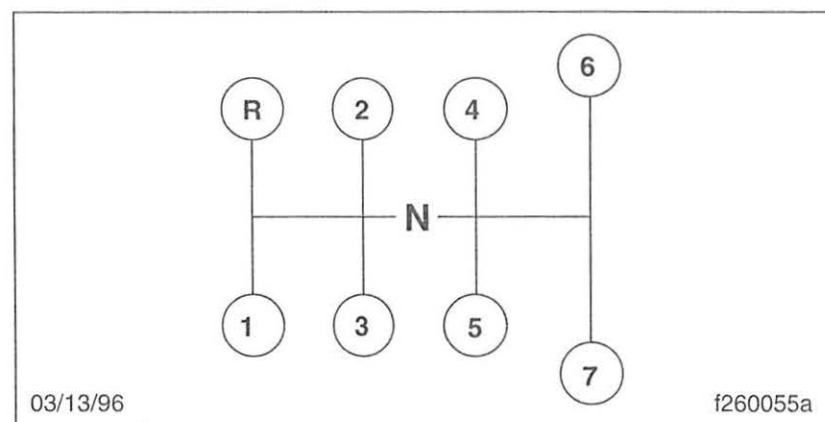


Fig. 8.1, Fuller Straight-Shift Model Transmissions Shift Pattern

2. Use the clutch brake to stop gear rotation when shifting into 1st or reverse when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Use double-clutching between all upshifts and downshifts.
4. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

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

Upshifting

1. Position the gear shift lever in neutral, then start the engine. Bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Depress the clutch pedal to the floor; shift into 1st gear, then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to engine governed speed.
3. Once governed speed has been reached, disengage the clutch, and shift the lever to neutral. Engage the

clutch; allow the engine speed to drop about 800 rpm (the rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 2nd gear, then engage the clutch, and accelerate to engine governed speed.

Continue shifting upward, from 2nd to 3rd gear, 3rd to 4th gear, and 4th to 5th gear, using the same sequence. See **Fig. 8.1** for the shift pattern.

4. Again, at governed speed, disengage the clutch, and shift into neutral. Engage the clutch; allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds), then disengage the clutch. Move the shift lever to 6th gear, then engage the clutch, and accelerate to engine governed speed.

Shift into 7th gear, using the same sequence.

Downshifting

When downshifting, shift down from 7th gear through each lower gear, as follows:

1. Allow the engine speed to drop about 500 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. While holding full throt-

tle, disengage the clutch; shift into gear; engage the clutch smoothly.

Follow the same sequence to downshift from 6th into 5th gear.

2. When in 5th gear, and ready for the next downshift, allow the engine speed to drop about 800 rpm (rpm drop may vary with engines of different governed speeds) below the governed speed. Depress the clutch pedal enough to release the torque, then shift into neutral. Engage the clutch and bring the engine rpm up to governed speed. While holding full throttle, disengage the clutch; shift into 4th gear; engage the clutch smoothly.

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

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

Fuller Range-Shift Models

General Information

9-Speed RT, RTO, and RTX Models

Fuller RT-8608L, RT-8609, RT-11609A, RT-11709H, RT-12609A, RT-12709H, RT-13609A, RT-13709H, RT-14609A, RT-14709H, RTO-11909MLL, RTO-14909MLL, RTX-11609B/R, RTX-11709H,

Transmissions

RTX-12609B/R, RTX-12709H, RTX-13609B/R, RTX-13709H, RTX-14609B/R, RTX-14709H, and RTX-16709B/H transmissions have a 5-speed front section, and a 2-speed rear range section. The low gear in the front sections of the RT-8609 and A and B ratio transmissions is used only as a starting ratio. The high gear in the front section of the "R" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range.

See **Fig. 8.2** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RT (direct ratio) and

RTX-B (overdrive ratio) transmissions are opposite of the RTO (overdrive ratio) transmissions. The RTX-R ratio transmissions have the 1st/5th shift positions where LO is in the A and B ratio transmissions. The top gear in the RTX-R ratio transmissions is called 9th gear.

10-Speed RT, RTO and RTX Models

Fuller RT-11710B, RT-12710B, RT-13710B, RT-14710B, RTO-15210C, RTO-16210C, RTLO-12610B, RTLO-13610B, RTLO-14610B, RTLO-15710B/C, RTLO-16610B, RTX-11710B/C, RTX-12710B/C, RTX-13710B/C, RTX-14710B/C,

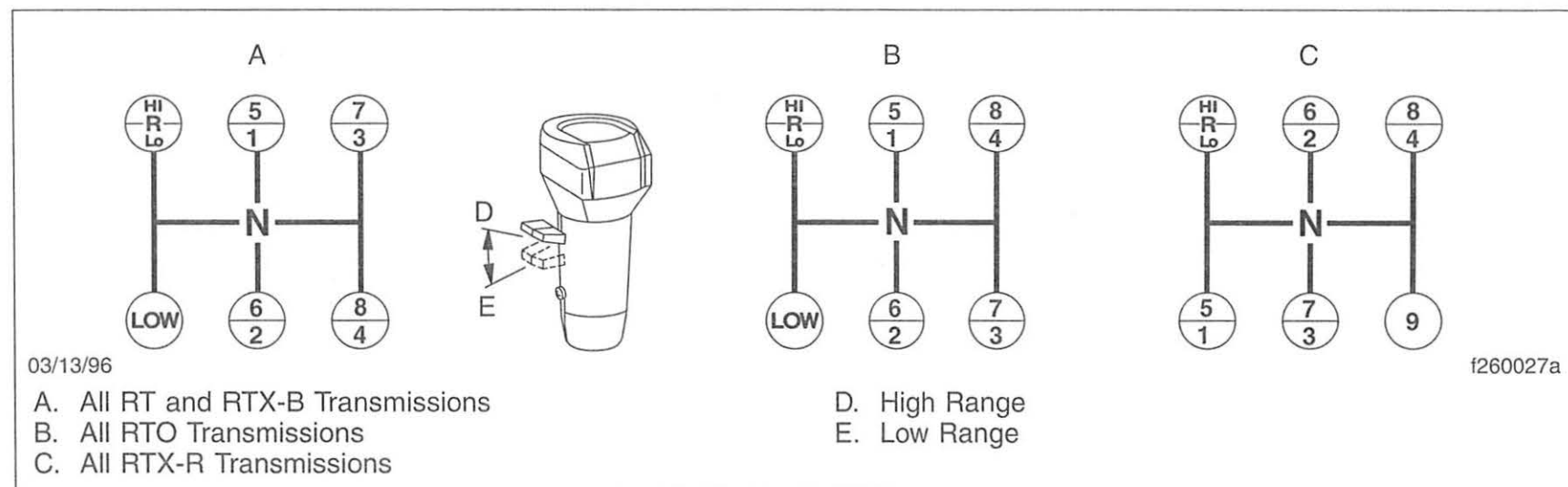


Fig. 8.2, Fuller 9-Speed RT, RTO, and RTX Model Transmissions Shift Patterns

RTX-15710B/C and RTX-16710B transmissions have ten selective, evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed rear range section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range; the second time in high range. See **Fig. 8.3** for the shift patterns, noting that the 4th/9th and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation

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.

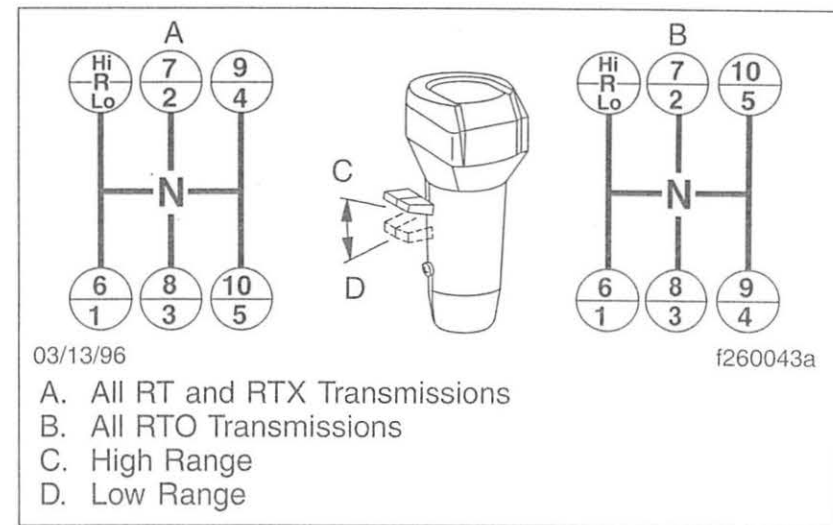


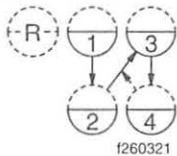
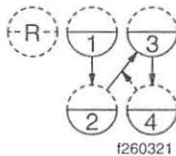
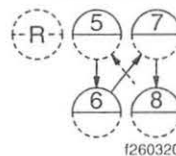
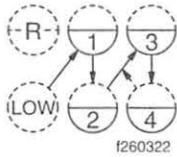
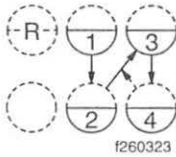
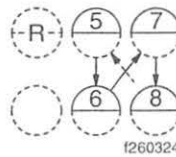
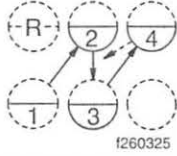
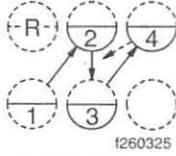
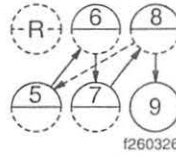
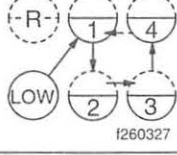
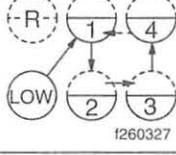
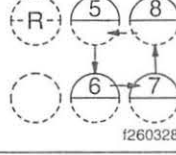
Fig. 8.3, Fuller 10-Speed RT, RTO and RTX Model Transmissions Shift Patterns

Transmissions

- Do not shift from high range to low range at high vehicle speeds.
- Use double-clutching between all upshifts and downshifts.
- After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

- Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
- Position the range preselection lever down, into low range.
- Depress the clutch pedal to the floor; shift into low or 1st gear (**Table 8.1**), then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.

TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
8-Speed Direct (RT)	 f260321	 f260321	 f260320
9-Speed Direct or Overdrive (RT or RTX)	 f260322	 f260323	 f260324
9-Speed Direct (RTX-P)	 f260325	 f260325	 f260326
9-Speed Overdrive (RTO)	 f260327	 f260327	 f260328

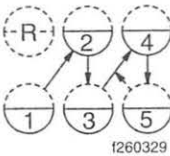
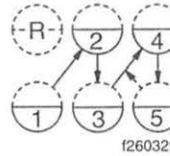
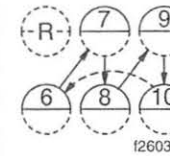
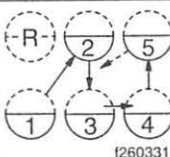
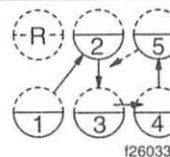
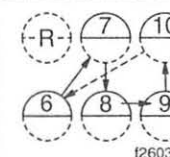
TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
10-Speed Direct or Overdrive (RT or RTX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RTO)	 f260331	 f260331	 f260332

Table 8.1, Fuller Shift Progressions

- Shift progressively upward from low or 1st gear, to the top gear in low range (**Table 8.1**), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
- While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double clutch through neutral, and shift into the bottom gear in high range (**Table 8.1**). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

- With the transmission in high range, shift progressively upward through each of the high range gears (**Table 8.1**), double-clutching between shifts.

Downshifting

- With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
- When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
- With the transmission in low range, downshift through the low range gears as conditions require.

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

Transmissions

Fuller Splitter and Range-Shift Models

General Information

13-Speed RTO Models

Fuller RTLO-12713A, RTLO-14713A, and RTLO-16713A transmissions have thirteen forward speeds and two reverse speeds. Each transmission consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See **Fig. 8.4** for the shift pattern.

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

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high range gear positions can be split with the underdrive ratio (RT models), or overdrive ratio (RTO models) of the splitter gear. Ratios cannot be split while the transmission is in low range.

18-Speed RTO Models

Fuller RTLO-14718B, RTLO-16718B and RTLO-18718B transmissions have eighteen forward speeds and four reverse, consisting of a 5-speed front section and a 3-speed auxiliary section. The auxiliary section contains low and high range ratios, plus an overdrive splitter gear.

One ratio in the front section (low) is used as a starting ratio; it is never used when the transmission is in high range.

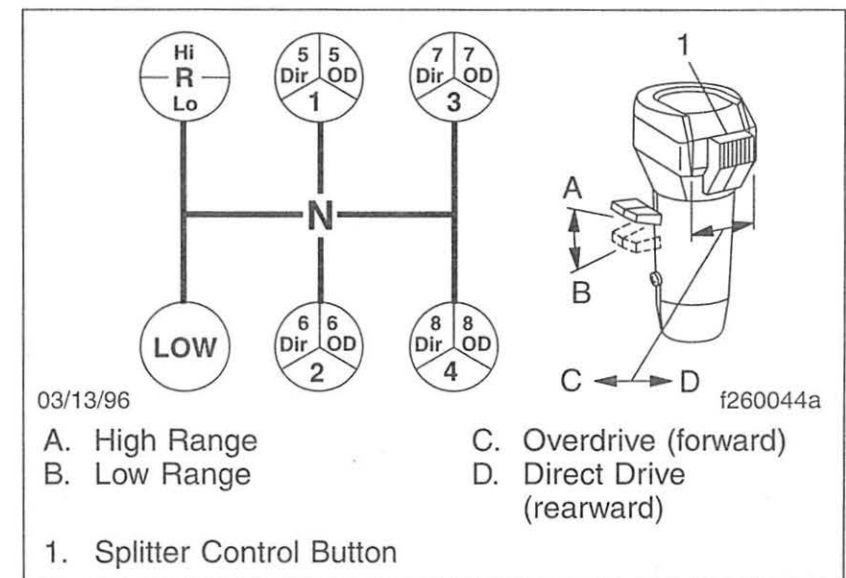


Fig. 8.4, Fuller 13-Speed RTO Transmissions Shift Pattern

The other four ratios in the front section are used once in low range and once again in high range; however, each of the five ratios (low-1-2-3-4) in low range and each of the four ratios (5-6-7-8) in high range can be split with the overdrive splitter gear.

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

Operation

IMPORTANT: On 13-speed transmissions, the shifter knob has an interlock feature that prevents the splitter control button from being moved forward when the range preselection lever is down (in low range); when in high range and the splitter control button is in the forward position, the range preselection lever cannot be moved down.

1. When operating off-road, or under adverse conditions, always use low gear when starting to move the vehicle forward.

When operating on-highway, with no load, or under ideal conditions, use 1st gear when starting to move the vehicle forward.

For all conditions, use the highest gear that is still low enough to start the vehicle moving with the en-

gine 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.

Transmissions

9. Do not make range shifts with the vehicle moving in reverse gear.
10. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
11. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

1. Position the gear shift lever in neutral. Start the engine, and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range. See **Fig. 8.4** or **Fig. 8.5**.
3. Make sure the splitter control button is in the direct (rearward) position. See **Fig. 8.4** or **Fig. 8.5**.
4. For 13-speed transmissions:

Depress the clutch to the floor, shift into low or 1st gear; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.

For 18-speed transmissions:

Depress the clutch to the floor, shift into low; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving.

To shift from low direct to low overdrive, move the splitter control button (**Fig. 8.5**) 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:

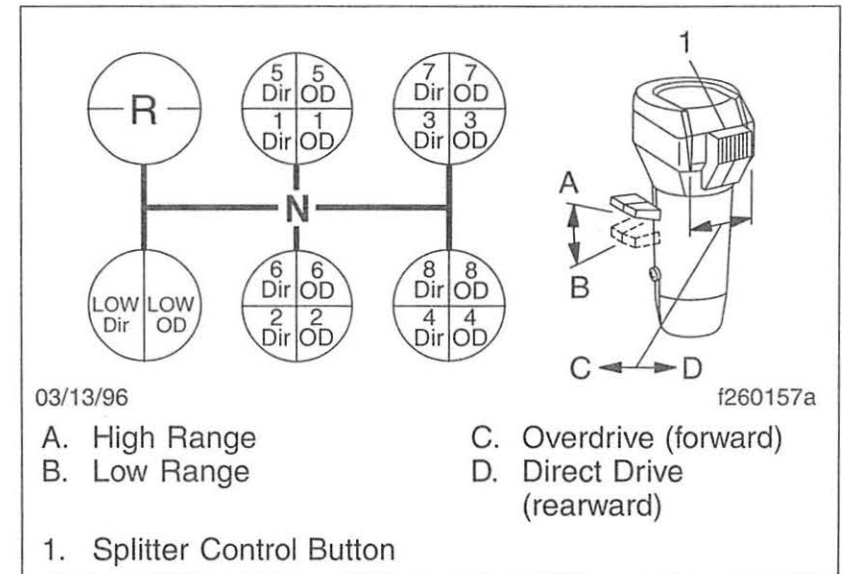


Fig. 8.5, Fuller 18-Speed RTO Model Transmissions Shift Pattern

Shift upward from low to 1st gear, 2nd, etc. until 4th gear, double-clutching between shifts, and accelerating to 80 percent of engine governed speed. See **Fig. 8.4**.

For 18-speed transmissions:

Shift upward from low overdrive to 1st direct by first moving the splitter control button into the direct (rearward) position (**Fig. 8.5**). Move the shift lever, double-clutching, to the 1st gear position.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (1st to 2nd to 3rd to 4th); single-clutch during split shifts (1st direct to 1st overdrive, etc.).

6. When in 4th gear (13-speed transmissions) or 4th overdrive (18-speed transmissions) and ready to shift up to 5th gear, use the range shift lever as follows:

For 13-speed transmissions:

While in 4th gear, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral. Then, disengage the clutch; double-clutch through neutral; move the shift lever to 5th gear; engage the clutch, and accelerate the engine.

For 18-speed transmissions:

While in 4th overdrive, pull the range shift preselection lever up, into high range. The transmission will automatically shift from low to high range as the shift lever passes through neutral.

Move the shift lever, double-clutching, to the 5th gear position. Just before making final clutch engagement, move the splitter control button to the direct (rearward) position; then engage the clutch and accelerate. Do not move the control button while the shift lever is in neutral.

7. Shift up through the high range gears as follows:

For 13-speed transmissions:

To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.4**) into the overdrive (forward) position, then immediately release the accelerator. Press and release the clutch pedal. After releasing the clutch, accelerate again.

Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

For 18-speed transmissions:

To shift from 5th direct to 5th overdrive, move the splitter control button (**Fig. 8.5**) into the overdrive (forward) position, then immediately release the ac-

Transmissions

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

Continue upshifting through the shift pattern. Double-clutch during lever shifts (6th to 7th to 8th); single-clutch during split shifts (6th direct to 6th overdrive, etc.).

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button to the direct (rearward) position; then, immediately release the accelerator, and disengage the clutch. Engage the clutch, and accelerate the engine only after the transmission has shifted.
2. Start the downshift from 8th direct to 7th overdrive by flipping the splitter control button to the overdrive (forward) position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Shift downward through each of the high range gears, alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct and ready for the downshift to 4th (13-speed transmissions) or 4th overdrive (18-speed transmissions), push the range preselection lever down. Then, double-clutch through neutral and move the shift lever to the 4th gear position. On 18-

speed transmissions, move the splitter control button to the overdrive (forward) position *before* engaging the clutch. Do not move the control button while the shift lever is in neutral.

5. Continue downshifting from 4th to 1st as follows:

For 13-speed transmissions:

Downshift through the low range gears as conditions require. Never use the clutch brake when downshifting, or as a brake to slow the vehicle.

For 18-speed transmissions:

Continue downshifting from 4th overdrive to 4th direct, then 4th direct to 3rd overdrive, 3rd overdrive to 3rd direct, etc. Single clutch when split shifting (direct to overdrive, overdrive to direct). Double clutch when making lever shifts (4th to 3rd, 3rd to 2nd, etc.).

Fuller Deep-Reduction and Range-Shift Models

General Information

10-Speed RT, RTO and RTX Models

Fuller RT-7608LL, RT-8908LL, RTO-11708LL, RTO-11908LL, RTO-14708LL, RTO-14908LL, RTX-11708LL, and RTX-14708LL transmissions have a

5-speed front section, and a 2-speed rear-range section, with a deep reduction gear. The low-low, deep reduction gear is used only when operating under adverse conditions. Low gear in the front section is used only for rough, off-highway conditions, as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. See **Fig. 8.6** for the shift pattern, noting that the 3rd/7th and 4th/8th shift positions in the RT and RTX-LL transmissions are opposite of the RTO-LL transmissions.

15-Speed RT, RTO, and RTX Models

Fuller RT-14715, RT-14915B, RT-15715, RTO-14715, RTO-14915B, RTO-15715, RTO-16915B, RTX-14715, and RTX-15715 transmissions have a 5-speed front section, and a 2-speed rear, range section. They also have five additional deep reduction ratios. The 5-speed front section, and the low- and high-range sections provide ten evenly and progressively spaced forward speeds. The five deep reduction ratios are also evenly and progressively spaced; however, they do overlap the low-range ratios, and should be used only when operating under adverse conditions. See **Fig. 8.7** for the shift patterns, noting that the 4th/9th, and the 5th/10th shift positions in the RT (direct ratio) and RTX (overdrive ratio) transmissions are directly opposite in the RTO (overdrive ratio) transmissions.

Operation

IMPORTANT: The shifter knob has an interlock feature that prevents the deep reduction button from being moved forward when the range preselection lever is up (in high range); when in low range and the deep reduction button is in the forward position, the range preselection lever cannot be moved up.

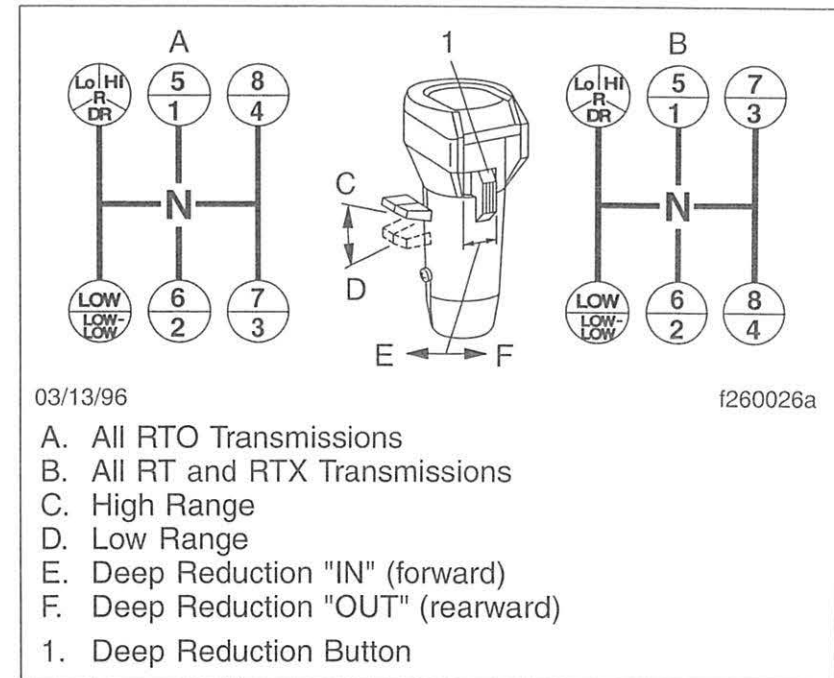


Fig. 8.6, Fuller 10-Speed RT, RTO and RTX Model Transmissions Shift Patterns

Transmissions

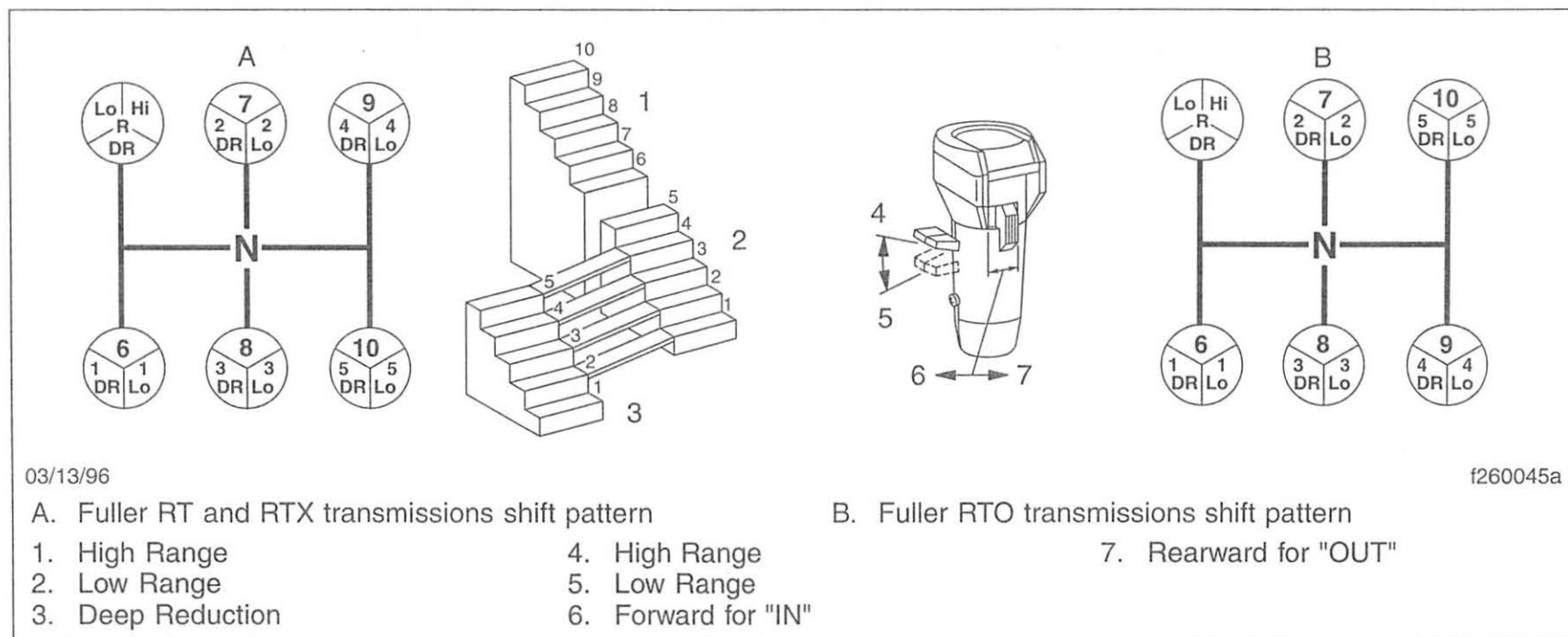


Fig. 8.7, Fuller 15-Speed RT, RTO and RTX Model Transmissions Shift Patterns

1. For all driving conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling, and without slipping the clutch excessively.
2. Use the clutch brake to stop gear rotation when shifting into low-low, low-1st (whichever is used as a starting ratio) or reverse, when the vehicle is sta-

tionary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Use double-clutching between all upshifts and downshifts.

4. Never move the shift lever into low gear while in high range.
5. Do not preselect with the deep reduction button. When making the shift from a deep reduction ratio to a low-range ratio, move the deep reduction button from a forward position to a rearward position, then complete the shift immediately.
6. Never move the deep reduction button from a rearward position to a forward position when the transmission is in high range.
7. Do not shift from high range to low range at high vehicle speeds.
8. Do not make range shifts with the vehicle moving in reverse gear.
9. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
10. After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

There are several patterns of upshifting, depending on the vehicle load and the road conditions. See **Table 8.2**

for suggested shifting sequences. Deep reduction gears are best suited for heavy loads and steep inclines. Low gear (in 10-speed transmissions) is best suited for off-highway use.

The following instructions are recommended for starting a loaded vehicle moving, under adverse conditions.

1. Position the gear shift lever in neutral. Start the engine, and bring the vehicle air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range.
3. Move the deep reduction button to the forward position, to engage the deep reduction gears.
4. Depress the clutch pedal to the floor; shift into low-low gear (10-speed transmissions) or 1st gear of deep reduction (15-speed transmissions); then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
5. For 10-speed transmissions:

When ready for the next upshift, move the deep reduction button rearward, then break the torque on

Transmissions

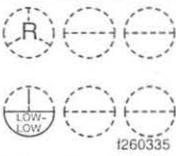
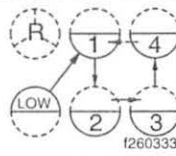
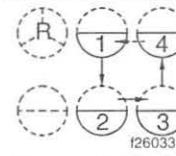
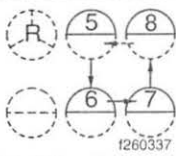
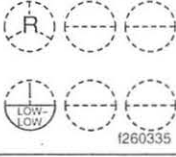
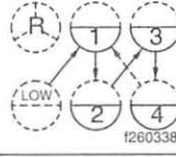
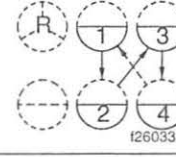
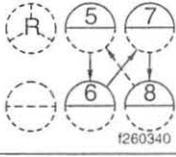
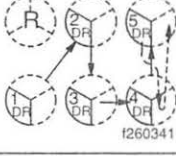
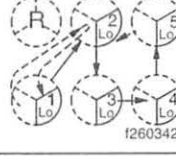
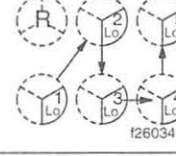
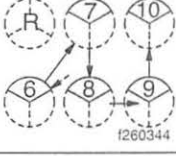
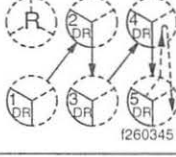
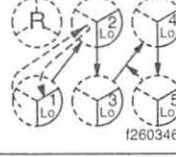
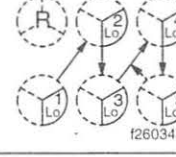
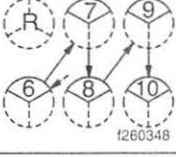
TRANSMISSION MODEL	DEEP REDUCTION	LOW RANGE		HIGH RANGE
	Adverse Conditions Only	Off-Highway and Adverse Conditions	On-Highway and Ideal Conditions	All Conditions
10-Speed RTO	 f260335	 f260333	 f260336	 f260337
10-Speed RTX	 f260335	 f260338	 f260339	 f260340
15-Speed RTO	 f260341	 f260342	 f260343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

Table 8.2, Fuller Shift Progressions

the gears by momentarily releasing the accelerator or depressing the clutch pedal. Do not move the shift lever.

For 15-speed transmissions:

Shift upward from 1st gear of deep reduction to 5th gear of deep reduction, double-clutching between shifts and accelerating to 80 percent of engine governed speed. See **Table 8.2**.

When ready for the next upshift, move the deep reduction button from the forward position to the rearward position, then double-clutch through neutral, and move the shift lever to the 4th gear position in the low range.

6. Shift upward from low gear (10-speed transmissions) or 4th gear (15-speed transmissions), to the top gear in low range (see **Table 8.2**), double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
7. While in the top gear of the low-range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral, and shift into the bottom gear in high range (see **Table 8.2**). As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
8. With the transmission in high range, shift progressively upward through each of the high range gears (see **Table 8.2**), double-clutching between shifts.

Alternate Upshifting Procedures (15-Speed Transmissions Only)

The shift from deep reduction to low range can also be made from 2nd, 3rd, or 4th gear of deep reduction, but

must be made to the next gear lower in the low range. The shift from 2nd gear of deep reduction to 1st gear in low range (or 3rd gear of deep reduction to 2nd gear in low range, and 4th gear of deep reduction to 3rd gear in low range), is an upshift, and the same procedure should be followed as that shown for shifting from 5th gear of deep reduction to 4th gear in low range. See step 5, under "Upshifting."

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears, as conditions require.

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

Transmissions

Rockwell Range-Shift Models

General Information

9-Speed RM, RMO, and RMX Models

Rockwell RM9-115A, RM9-125A, RM9-135A, RM9-145A, RM9-155A, RMO9-115B, RMO9-125A/B, RMO9-135A/B, RMO9-145A/B, RMX9-115B, RMX9-125A/B, RMX9-135A/B, RMX9-145A/B, RMX9-155B, RMX9-115R, RMX9-125R, RMX9-135R, and RMX9-145R transmissions have a 5-speed front section, and a 2-speed auxiliary section. The low gear in the front sections of the "A" and "B" ratio transmissions is used only as a starting ratio. The high gear in the front section of the "R" ratio transmissions is used only as the top gear. The remaining gear positions of the above transmissions are used once in the low range and once in the high range. See **Fig. 8.8** for the shift patterns, noting that the 3rd/7th and 4th/8th shift positions in the RM and RMX (direct ratio) are opposite of the RMO (overdrive ratio) transmissions. The RMX-R ratio transmissions have the 1st/5th shift positions where low is in the A and B ratio transmissions. The top gear in the RMX-R ratio transmissions is called 9th gear.

10-Speed RM and RMX Models

Rockwell RM10-115A, RM10-125A, RM10-135A, RM10-145A, RMX10-115A, RMX10-125A,

RMX10-135A, RMX10-145A, RMX10-155A and RMX10-165A transmissions have ten evenly-spaced forward ratios. Each transmission consists of a 5-speed front section, and a 2-speed auxiliary section. The ten forward speeds are obtained by twice using a 5-speed shift pattern: the first time in low range; the second time in high range. See **Fig. 8.9** for the shift pattern.

Operation

Reverse

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

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.

Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear

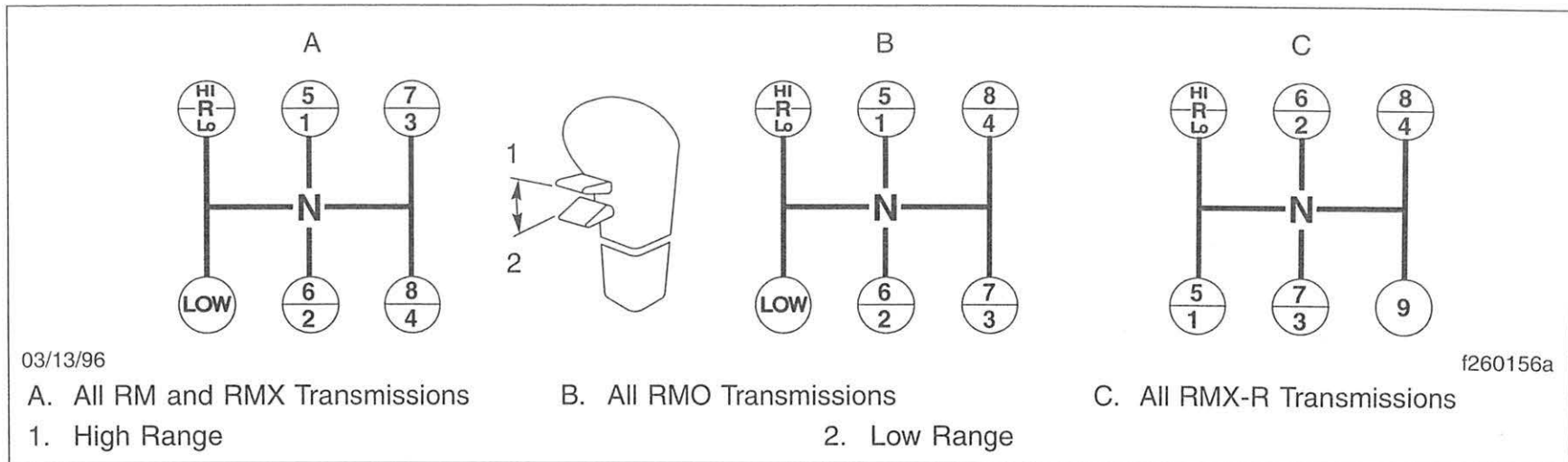


Fig. 8.8, Rockwell 9-Speed RM, RMO and RMX Model Transmissions Shift Patterns

- engagement; holding the clutch pedal at the bottom of travel, shift into low.
2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the clutch pedal, and move the shift lever into neutral.
4. Release the clutch, and allow the engine to decelerate until the road speed and the engine RPM match.
5. Partially depress the clutch pedal, and move the shift lever into first gear.
6. Double clutch to continue upshifting until the top gear in the low range—4th gear in 9-speed models, 5th gear in 10-speed models. See **Table 8.3**.
7. To upshift into high range—with the transmission still in the highest low-range gear—move the range selector lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

Transmissions

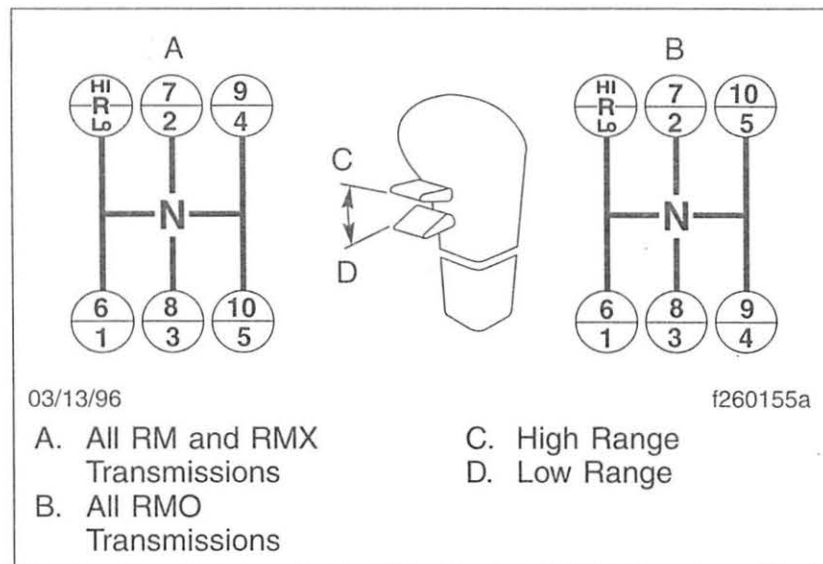


Fig. 8.9, Rockwell 10-Speed RM, RMO and RMX Model Transmissions Shift Patterns

8. Release the clutch pedal, and let the engine slow until the road speed and engine RPM match.
9. Partially depress the clutch pedal, and move the shift lever into the lowest gear in the high range-5th gear in 9-speed models, 6th gear in 10-speed models.
10. Double clutch to continue upshifting.

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range-5th gear in 9-speed models, 6th gear in 10-speed models-double-clutching between shifts. See **Table 8.3**.
2. When in the bottom gear of the high-range shift pattern, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

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

Rockwell Splitter and Range-Shift Models

General Information

13-Speed RMO Models

The Rockwell RMO13-145A transmission has thirteen forward speeds and two reverse speeds. Each transmis-

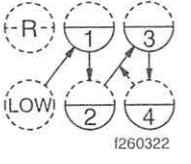
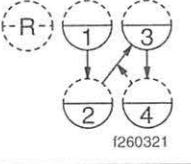
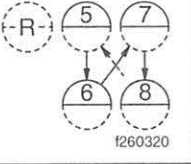
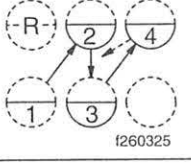
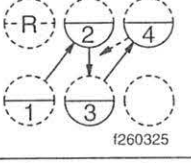
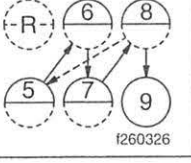
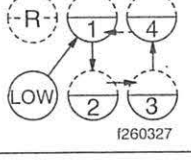
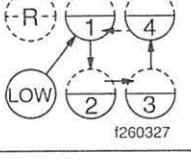
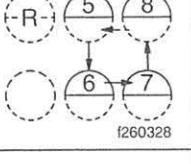
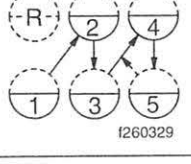
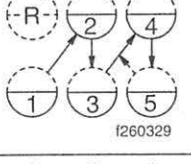
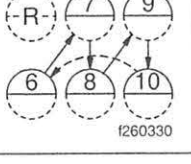
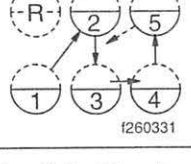
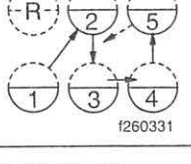
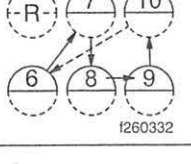
TRANS. MODEL	LOW RANGE		HIGH RANGE
	Off-Highway	On-Highway	
9-Speed Direct or Overdrive (RM or RMX)	 f260322	 f260321	 f260320
9-Speed Direct (RMX-R)	 f260325	 f260325	 f260326
9-Speed Overdrive (RMO)	 f260327	 f260327	 f260328
10-Speed Direct or Overdrive (RM or RMX)	 f260329	 f260329	 f260330
10-Speed Overdrive (RMO)	 f260331	 f260331	 f260332

Table 8.3, Rockwell Shift Progressions

sion consists of a 5-speed front section, and a 3-speed auxiliary section. The auxiliary section contains low- and high-range ratios, plus, an overdrive splitter gear. See **Fig. 8.10**.

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

Low gear in the front section is used only as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. However, each of the four high range gear positions can be split with the overdrive ratio of the splitter gear. Ratios cannot be split while the transmission is in low range.

Operation

IMPORTANT: The shifter knob has an interlock feature that prevents the splitter control button from being moved up when the range selection lever is down (in the low range); when the transmission is in the high range, and the splitter control button is up, the range selection lever cannot be moved down.

Reverse

To drive in reverse, push the range selector lever down to put the transmission in the low range. Push the clutch

Transmissions

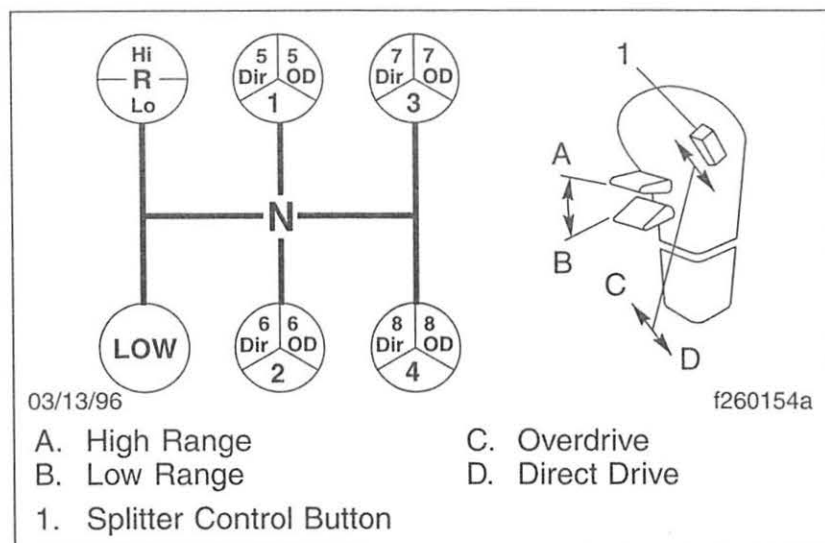


Fig. 8.10, Rockwell 13-Speed RMO Model Transmission Shift Pattern

pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement; holding the clutch pedal at the bottom of travel, shift into reverse.

Slowly release the clutch pedal to move the vehicle in reverse.

Upshifting

1. To drive forward, make sure the vehicle is completely stopped and the range selector lever is pushed down to put the transmission in the low range.

Push the clutch pedal to the bottom of travel so the clutch brake slows the transmission for initial gear engagement; holding the clutch pedal at the bottom of travel, shift into low.

2. Slowly release the clutch pedal to begin moving the vehicle forward.
3. To upshift into 1st gear, only partial depression of the clutch pedal is needed. Do not push the clutch pedal all the way to the floor and engage the clutch brake; instead, partially depress the clutch pedal, and move the shift lever into neutral.
4. Release the clutch pedal, and allow the engine to decelerate until the road speed and the engine RPM match.
5. Partially depress the clutch pedal, and move the shift lever into 1st gear.
6. Double clutch to continue upshifting until in fourth gear. See **Table 8.3**.
7. To upshift into high range—with the transmission still in 4th gear—push the range selection lever up to put the transmission into high range, then partially depress the clutch pedal and move the shift lever into neutral. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

8. Release the clutch pedal, and let the engine slow until the road speed and engine RPM match.
9. Partially disengage the clutch, and move the shift lever into 5th gear.
10. To upshift from 5th gear into 5th overdrive, flip the splitter control button up to the overdrive position; then, immediately release the accelerator, and press and release the clutch pedal. It is not necessary to move the shift lever when shifting from direct to overdrive; the transmission will shift when synchronization with the engine's speed is reached. Accelerate the engine only after the transmission has shifted.
11. To shift from 5th overdrive to 6th direct, partially disengage the clutch, shift into 6th—but before engaging the clutch—flip the splitter control button down into the direct drive position; then engage the clutch, and accelerate the engine.

Do not move the control button while the shift lever is in neutral.
12. Shift upward through each of the high range gears, alternating the procedures in steps 10 and 11, above.

Downshifting

1. Downshift from 8th overdrive to 8th direct without moving the shift lever. Flip the splitter control button

down to the direct drive position; then, immediately release the accelerator, and press and release the clutch pedal. Accelerate the engine only after the transmission has shifted.

2. To downshift from 8th direct to 7th overdrive, flip the splitter control button up to the overdrive position; then, immediately double-clutch through neutral, moving the shift lever from 8th to 7th gear.
3. Downshift through each of the high range gears alternating the procedures in steps 1 and 2, above, until reaching 5th direct.
4. While in 5th direct, and ready for the next downshift, push the range selection lever down into low range. Double-clutch through neutral, and shift into 4th gear. See **Fig. 8.10**. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
5. With the transmission in low range, downshift through the low range gears as conditions require.

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

Transmissions

Allison Automatic Models (See Fig. 8.11)

General Information

HD-series automatic transmissions have six forward speeds and one reverse speed. These transmissions have electronic shift controls that can be programmed to allow the use of different numbers of geared speeds. For instance, the transmission can be programmed to operate as a 4-speed, 5-speed, or 6-speed unit in the "primary" shift mode. If needed, a "secondary" shift mode can be programmed to provide another shift configuration to optimize vehicle use under different operating conditions. To activate a secondary shift mode, or other special function programmed into the electronic control unit (ECU), depress the Mode button. "Mode On" is displayed in the indicator panel just above the push-buttons. A label just above the Mode button identifies the special function.

NOTE: Each time a pushbutton is depressed on the shift selector, a short beep will be heard. This indicates that the ECU has received input to change operation.

The HD-series transmission system is designed to warn the driver of transmission malfunctions. The driver of a vehicle equipped with these transmissions should know the extent of the warning system in order to safely oper-

ate the vehicle. See **Chapter 2** for information on the warning system.

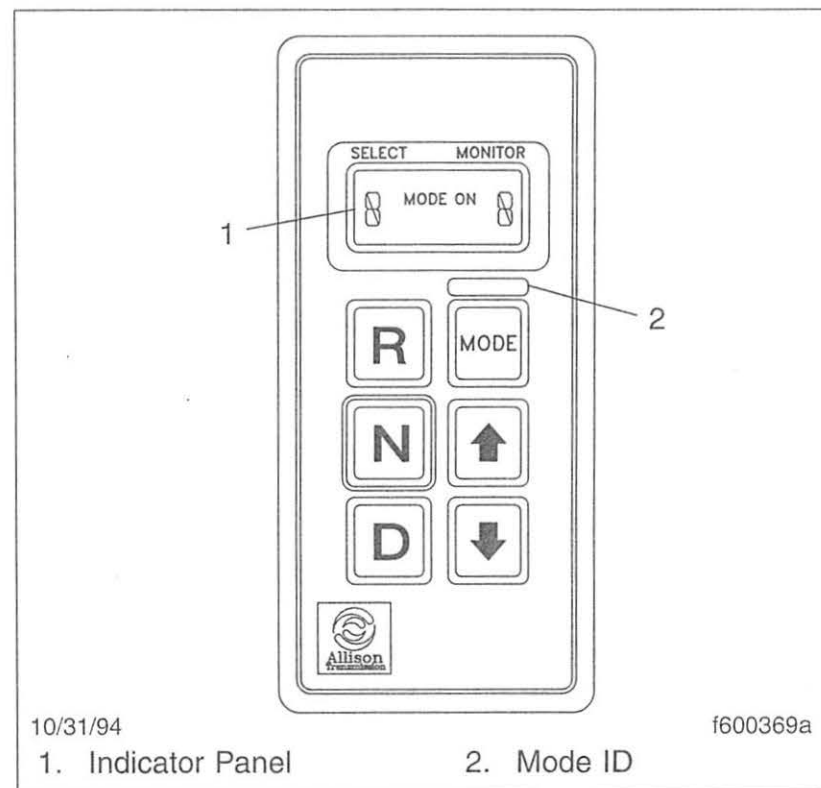


Fig. 8.11, Allison Pushbutton Shift Selector

Operation



CAUTION

The engine should never be operated for more than 30 seconds at full throttle with the transmission in gear and the output stalled. Prolonged operation of this type will overheat the transmission fluid and will result in severe damage to the transmission.

1. Start the engine, then check the digital display on the "pushbutton shift selector." Under "Select" at the top of the unit, the display should always show the "primary" shift mode. Under "Monitor," the gear the transmission is in should be displayed.



WARNING

Never shift from neutral (N) to drive (D) or reverse (R) at engine speeds above idle. The vehicle will lurch forward or rearward; this could cause property damage and personal injury.

2. Use reverse (R) to back the vehicle. Completely stop the vehicle before shifting from a forward gear to reverse or from reverse to forward. There is only one reverse gear.
3. Select drive (D) for all normal driving conditions. The vehicle will start out in 1st gear, and as speed increases, the transmission will upshift through each

gear automatically. As the vehicle slows down, the transmission will downshift to the correct gear automatically.

The pressure of your foot on the accelerator pedal influences the automatic shifting. When the pedal is fully depressed, the transmission will automatically upshift near the governed speed of the engine. A partially depressed position of the pedal will cause the upshifts to occur at a lower engine speed.

4. Occasionally the road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. The lower the gear range, the greater the engine braking power.

Use the up or down arrow buttons on the shift selector to reach the desired gear. The "Select" indicator will display your choice, and the "Monitor" indicator will show the selected gear once it is reached.

NOTE: In the lower gear ranges, the transmission will not upshift above the highest gear selected unless the engine governed speed is exceeded.

5. Use neutral (N) and apply the parking brake when the vehicle is parked with the engine running.

Transmissions



CAUTION

Do not allow the vehicle to coast in neutral. This can result in severe transmission damage. Also, no engine braking is available.

Rear Axles

Rockwell Single Drive Axles With Traction Equalizer	9.1
Rockwell Drive Axles With Main Differential Lock	9.1
Rockwell Main Differential Lock Operation	9.2
Rockwell Tandem Drive Axles With Interaxle Differential	9.3
Rockwell Interaxle Differential Lockout Operation	9.3
Eaton Single Reduction Axles With Controlled Traction Differential	9.4
Eaton 2-Speed Tandem Axles	9.4
Eaton Interaxle Differential Lockout Operation	9.5

Rear Axles

Rockwell Single Drive Axles with Traction Equalizer

Some Rockwell single drive axles are equipped with a traction equalizer which is a load sensing, self-actuating feature. A traction equalizer provides normal differential action where traction is good. When one wheel begins to spin faster than the other, clutch plates in the differential housing automatically engage, delivering power to both wheels. There is no operator control with this feature.

A traction equalizer occasionally tends to slip in a jerking motion, producing irregular intervals of sharp noises. This generally occurs when the vehicle is operating at low speeds on fairly sharp turns. This condition, called slip-stick, is corrected by adding a friction modifier to the axle lubricant. This additive tends to reduce the static coefficient of friction to a value equal to, or lower than, the sliding coefficient.

Refer to the vehicle maintenance manual for additional information on friction modifiers and when to add them to axle lubricants.



CAUTION

Tire sizes on both rear wheels should be the same on axles equipped with a traction equalizer. If not, excessive wear may occur in the traction equalizer.

Rockwell Drive Axles with Main Differential Lock

The Rockwell main differential lock is a driver-controlled traction device operated from the vehicle cab. A switch allows the driver to lock or unlock the differential. An indicator light 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.

Rockwell Main Differential Lock Operation

To lock the main differential and obtain maximum traction under slippery conditions, move the control switch to the lock position.

WARNING

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

NOTE: On some vehicles, the differential lock system is connected through the low speed range of the transmission. If this system is used, the transmission must be in the low speed range for the differential to fully lock.

If the vehicle is moving, maintain a constant vehicle speed while engaging the differential lock. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully lock. The indicator light should come on and the buzzer should sound on vehicles so equipped. When the differential is fully locked, the turning radius will increase because the

vehicle understeers. See **Fig. 9.1**. Drive cautiously and do not exceed 25 mph (40 km/h).

To unlock the main differential, move the control switch to the unlock position. Briefly let up on the accelerator to relieve torque on the gearing, allowing the differential to fully unlock.

NOTE: If the differential lock system is connected through the low speed range of the transmission, shifting out of low speed range will also unlock the differential.

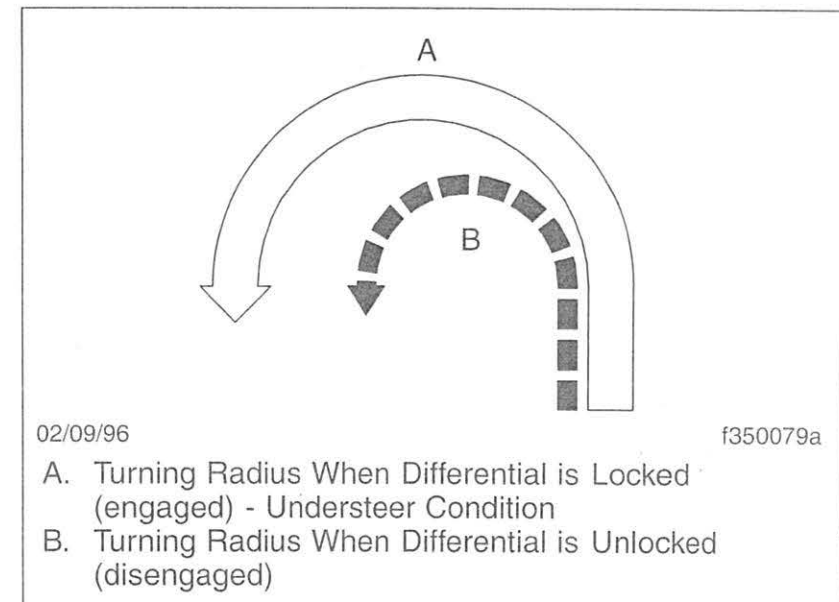


Fig. 9.1, Turning Radius

Rear Axles

When the differential lock disengages, the indicator light will go off and the buzzer will stop.

Rockwell Tandem Drive Axles with Interaxle Differential

Rockwell tandem drive axles with an interaxle differential have a lockout feature. Differential lockout is controlled by a switch (**Fig. 9.2**) on the control panel.

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.

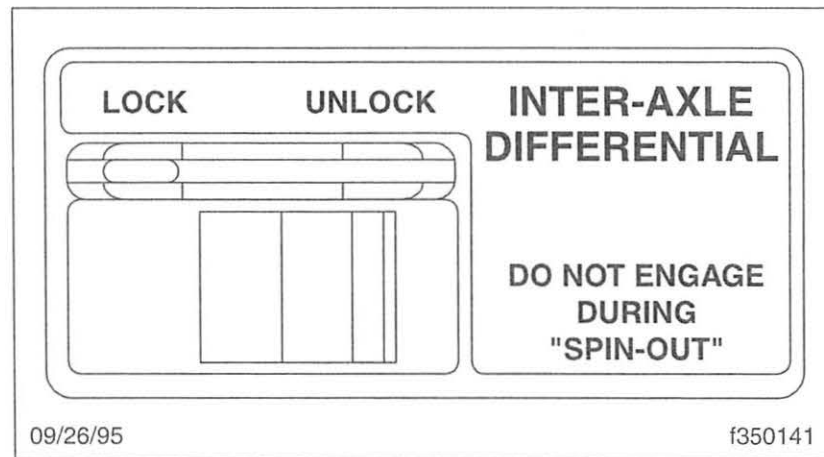


Fig. 9.2, Interaxle Differential Control

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.

Rockwell Interaxle Differential Lockout Operation

To lock the interaxle differential and achieve maximum pulling power when approaching slippery or poor road conditions, move the lockout control valve to LOCK while maintaining vehicle speed, before encountering the poor road conditions. Let up momentarily on the accelerator to engage the differential lock. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before locking the interaxle differential.

⚠ CAUTION

Do not actuate the interaxle differential control valve while the tires are slipping. Do not operate the vehicle continuously with the interaxle differential locked during extended good road conditions. To do so could result in damage to the axle gearing and excessive tire wear.

To unlock the interaxle differential, move the lockout control valve to UNLOCK while maintaining vehicle speed, after leaving the poor road conditions. Let up momentarily on the accelerator to allow the shift, then resume driving at normal speed.

Eaton Single Reduction Axles with Controlled Traction Differential

The controlled traction differential system is a differential assembly designed to transfer torque from the slipping wheel to the one with traction.

A control valve (**Fig. 9.3**) in the cab is actuated by the driver to engage and disengage the controlled traction feature.

Disengaged, the axle has differential action all the time. One wheel will spin independently of the other, if slippery conditions are encountered.

Engaged, wheel slippage and spinout are minimized.

NOTE: The controlled traction differential can be engaged at any speed, except during spinout.

Eaton 2-Speed Tandem Axles

Each axle of the 2-speed tandem contains a high range single reduction gear set and a low range double reduction gear set. The operator selects the desired axle range by moving the range preselection lever located on the shifter knob. See **Fig. 9.4**.

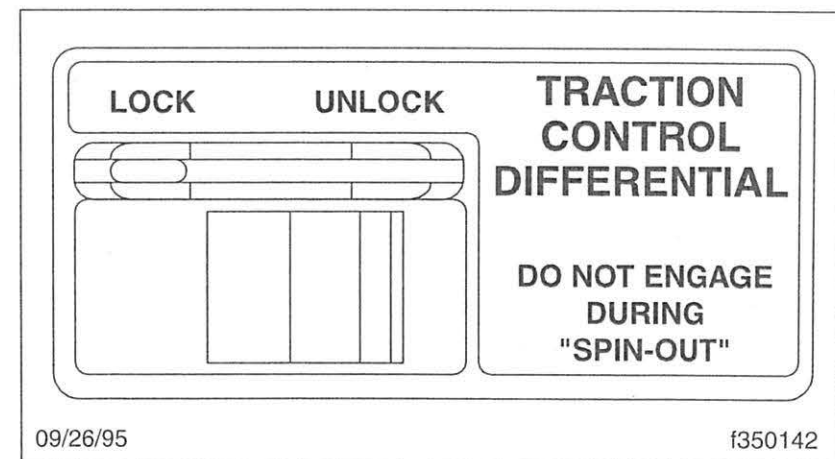


Fig. 9.3, Traction Control Differential Control

Rear Axles

Dual Range 2-Speed Tandem Axle Operation with Multispeed Transmissions

NOTE: Refer to **Chapter 8**, "Transmissions," for detailed information on how to use the range preselection lever.

On multispeed transmission applications, the 2-speed axle should be used as a dual range. Use the low range when operating off-highway or when starting out with a heavy load on-highway. After the vehicle is moving on the highway, the axle can be shifted to high range.

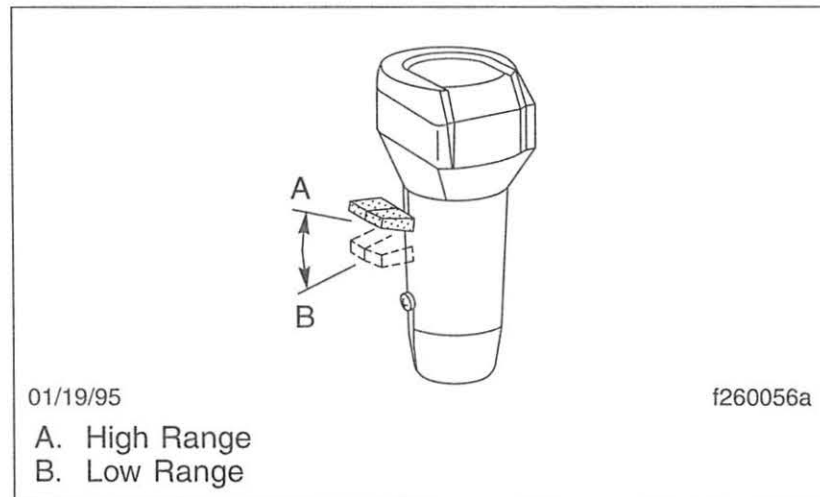


Fig. 9.4, Range Preselection Lever

To shift the axle to the high range: Make sure the inter-axle differential lockout is disengaged; keep the throttle pedal down; move the range preselection lever to high; release the throttle pedal until the axle shifts; then accelerate.

To shift the axle to the low range: Keep the throttle pedal down; move the range preselection lever to low; release and depress the throttle pedal quickly to increase engine rpm. The axle will shift to low range.

NOTE: When parking the vehicle, put the axle in the low range with the engine running. Engage the clutch and transmission to be sure the axle has completed the shift into the low range. Some vehicle motion is required to ensure engagement of the axle.

IMPORTANT: Refer to "Eaton Interaxle Differential Lockout Operation" for precautions that must be taken when shifting axles in relation to the interaxle differential lockout.

Eaton Interaxle Differential Lockout Operation

Interaxle differential lockout systems include a lockout control valve (**Fig. 9.5**) located in the cab, and an air-operated shift unit mounted on the forward rear axle.

When the interaxle differential lockout control valve is in the LOCK position, the interaxle differential is locked out

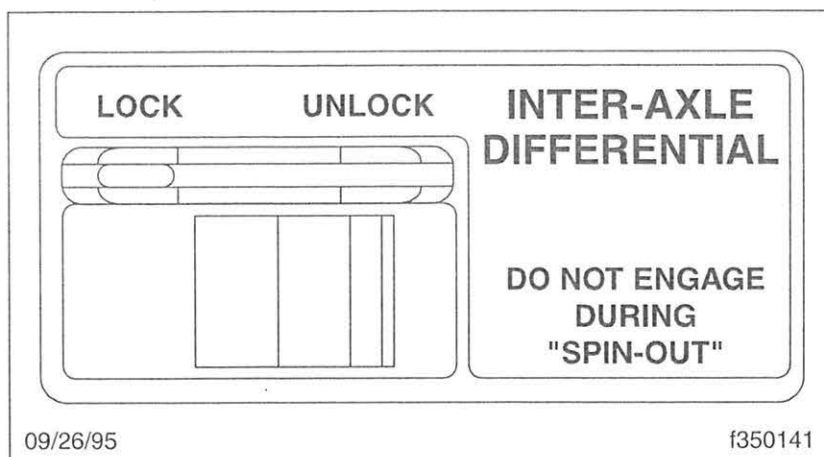


Fig. 9.5, Interaxle Differential Control

and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is also transmitted straight through to the rear axle, so both axles turn together at the same speed. The LOCK position should be used when additional traction is needed.



CAUTION

Engage the lockout only when stopped or at slow speeds and never when the wheels are spinning. Do not operate the axles on dry pavement with the lockout engaged for prolonged periods. Use only when additional traction is needed under adverse road conditions. Disengage the interaxle differential lockout before shifting the axle to a higher range.

When the interaxle differential lockout control valve is in the UNLOCK position, the interaxle differential allows differential action between the axles thereby compensating for different wheel speeds and variations in tire size. Keep the interaxle differential lockout in the UNLOCK position for normal driving on roads where traction is good. On 2-speed axles, the interaxle differential must be in the UNLOCK position before attempting to shift the axles out of low or high range.

Fifth Wheels and Trailer Couplings

Holland Fifth Wheels	10.1
ASF Castloc® II and Simplex® Series Fifth Wheels	10.9
Fontaine Fifth Wheels	10.18
Premier Trailer Couplings	10.26
Holland Trailer Coupling	10.29

Fifth Wheels and Trailer Couplings

Holland Fifth Wheels

General Information

The 2535 sliding fifth wheel models incorporate a Model 3500 fifth wheel (**Fig. 10.1**), equipped with either an air-operated release slide, or a manual release slide. Sliding fifth wheel assemblies are mounted on a baseplate which permits forward and rear movement along notched rails. Plungers are meshed into teeth on the baseplate to lock the sliding mechanism. Disengagement of the sliding member is accomplished when the plungers are withdrawn (manually or air-operated), releasing the fifth wheel assembly so that it can be positioned for optimum weight distribution over the tractor axles.

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

The manual release slide assembly (**Fig. 10.3**) is equipped with a single release lever. Pulling on the release lever unlocks both plungers.

Type "B" Kingpin Lock Mechanism (Fig. 10.4)

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

close in a 360 degree grip around the shoulder and neck of the kingpin, positioning sliding yokes between the lock halves and tapered rib members of the fifth wheel understructure. The kingpin can be released only by manually operating the kingpin lock control handle. The adjustment nut will compensate for wear on the lock or kingpin.

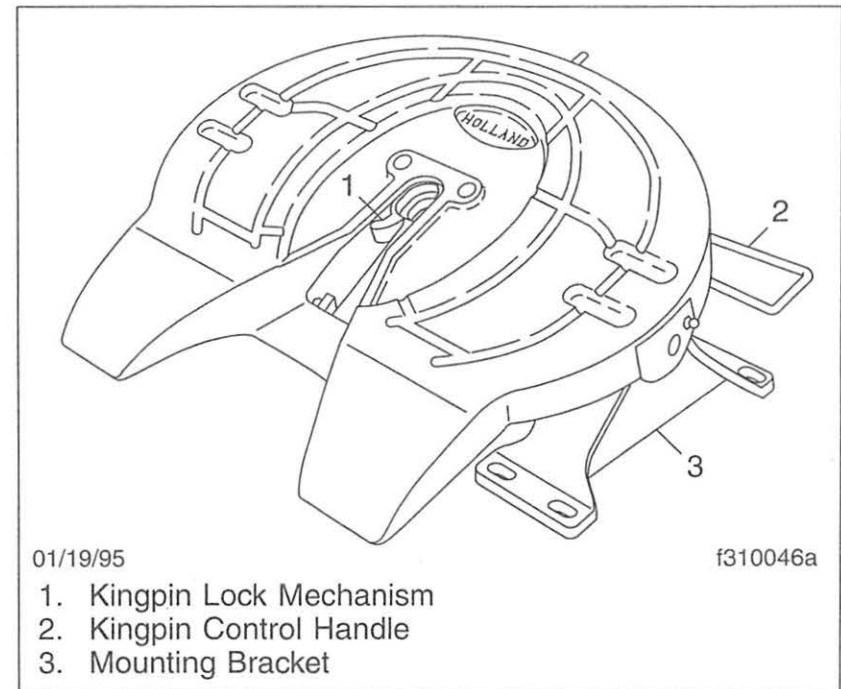


Fig. 10.1, Holland Fifth Wheel

Fifth Wheels and Trailer Couplings

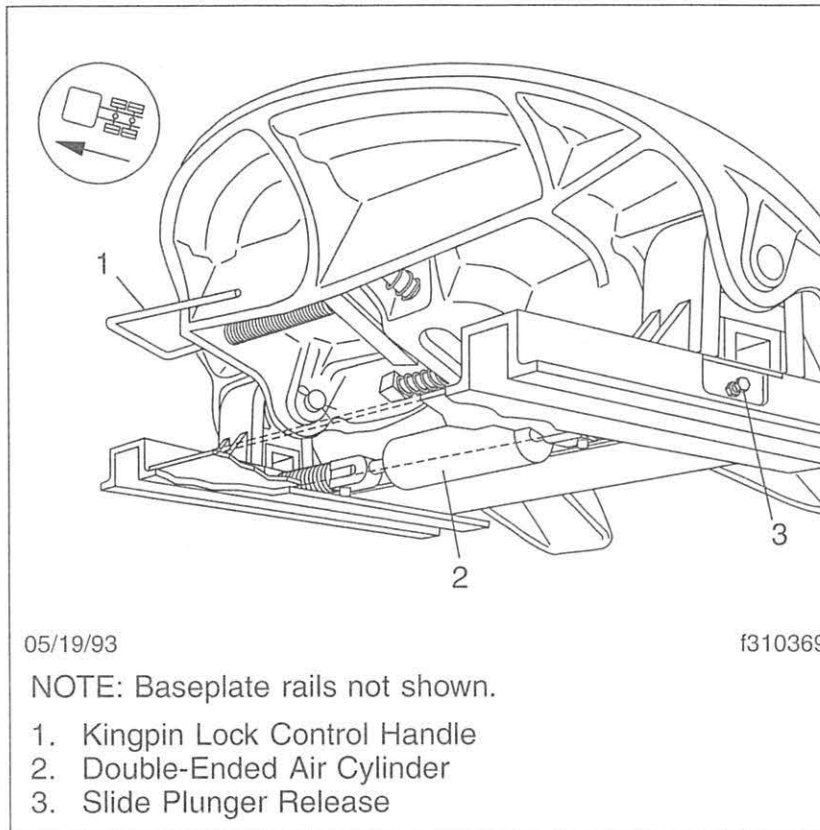


Fig. 10.2, Air-Operated Release Slide Assembly

Lockguard (Fig. 10.4)

The Holland lockguard is a device that prevents a false lockup, and is used on all models. The Lockguard is a spring-tensioned, smooth-surfaced tongue that the king-

pin passes over and depresses when entering the lock mechanism. The Lockguard will prevent the locks from engaging before the kingpin fully enters the locks. If the kingpin enters the fifth wheel incorrectly and does not depress the tongue, the locks are unable to close.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Mechanism



CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

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



WARNING

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

Fifth Wheels and Trailer Couplings

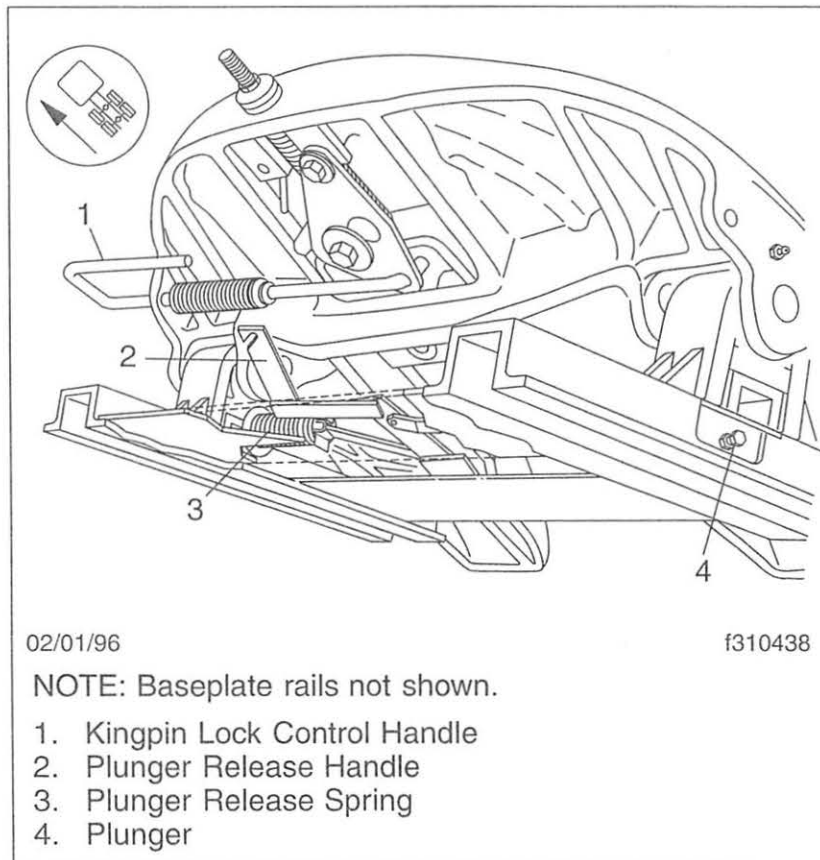


Fig. 10.3, Manual Release Slide

2. The kingpin lock mechanism must be fully open, and the fifth wheel plate must be completely lubricated with chassis grease. For lubrication in-

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

3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, to prevent a false lockup. See **Fig. 10.5**. Adjust the trailer landing gear to give enough alignment height so that the fifth wheel picks up the trailer on the fifth wheel ramps.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin correctly enters the throat of the locking mechanism. When the trailer is picked up by the fifth wheel, stop the tractor, then continue slow backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.

WARNING

Adjust the locks correctly to a maximum clearance of 1/8-inch (3.2 mm). Incorrect adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

6. Make a visual check for proper kingpin lockup. Release the tractor parking brakes. Test for kingpin

Fifth Wheels and Trailer Couplings

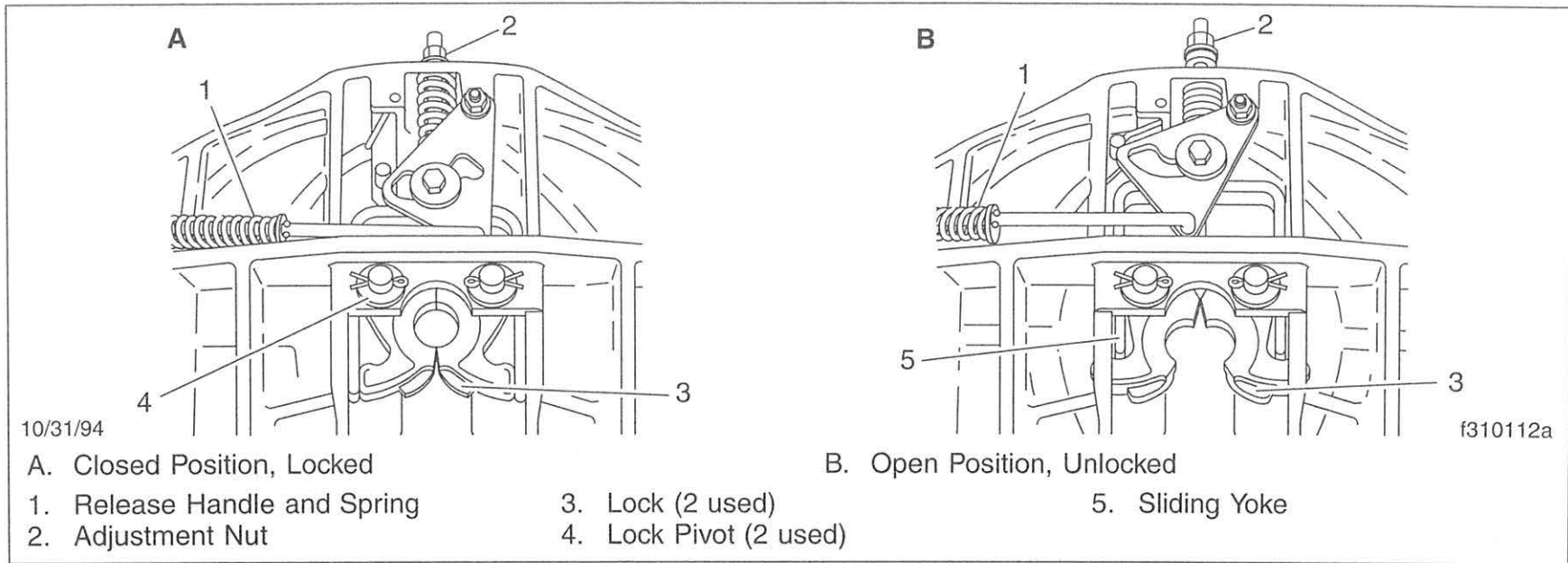


Fig. 10.4, Type "B" Kingpin Lock Mechanism (bottom view)

lockup by pulling on the trailer against the chocks. Check for kingpin clearance in the lock. If more than 1/8-inch (3.2 mm) clearance exists between the kingpin and the lock, the lock must be adjusted. Refer to **Group 31** in the vehicle workshop manual for adjustment procedures.

7. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air lines.
8. Charge the air brake system with air. Make sure that the air connections do not leak.
9. Retract the trailer landing gear and secure the ratchet handle.
10. Remove the chocks from the trailer tires.
11. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Fifth Wheels and Trailer Couplings

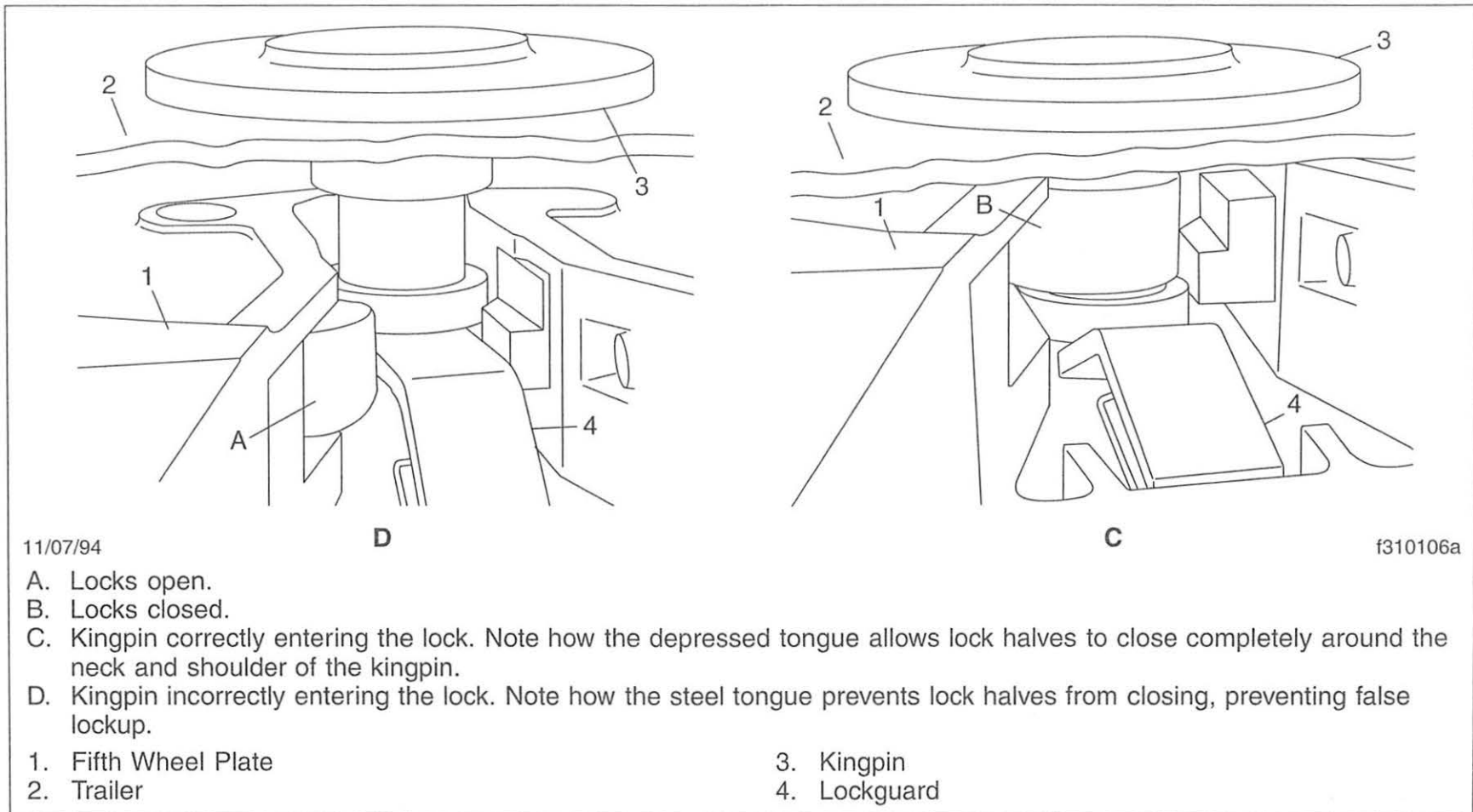


Fig. 10.5, Lockguard Mechanism (rear view)

Fifth Wheels and Trailer Couplings

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.
3. Chock the front and rear of the trailer tires to prevent the trailer from moving.



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

4. Lower the trailer landing gear until the weight is removed from the fifth wheel.
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.



CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release plungers must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel or kingpin.

6. Release the kingpin locking mechanism by pulling the kingpin lock control handle (**Fig. 10.1**) to the outward position.
7. Slowly drive the tractor away from the trailer.

Fifth Wheels and Trailer Couplings

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Holland "Fifth Wheel Locking Operation," in this chapter.
2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the sliding member using one of the following methods:
 - 2.1 For air-operated models, set the cab-operated control switch (**Fig. 10.6**) to UNLOCK.
 - 2.2 For manual release models, pull the release lever (**Fig. 10.3**) using a release hook, or other suitable tool. Make sure both slide

plungers have released. See **Fig. 10.7**. If the plungers haven't released (haven't come out), lower the trailer landing gear to relieve pressure on the plungers.

3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.
5. Chock the front and rear of the trailer tires to prevent the trailer from moving.



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

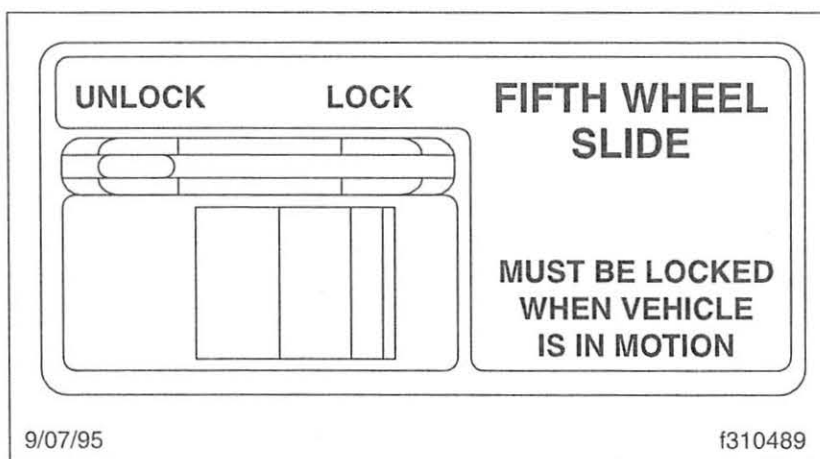


Fig. 10.6, Cab Control, Fifth Wheel Slide

Fifth Wheels and Trailer Couplings

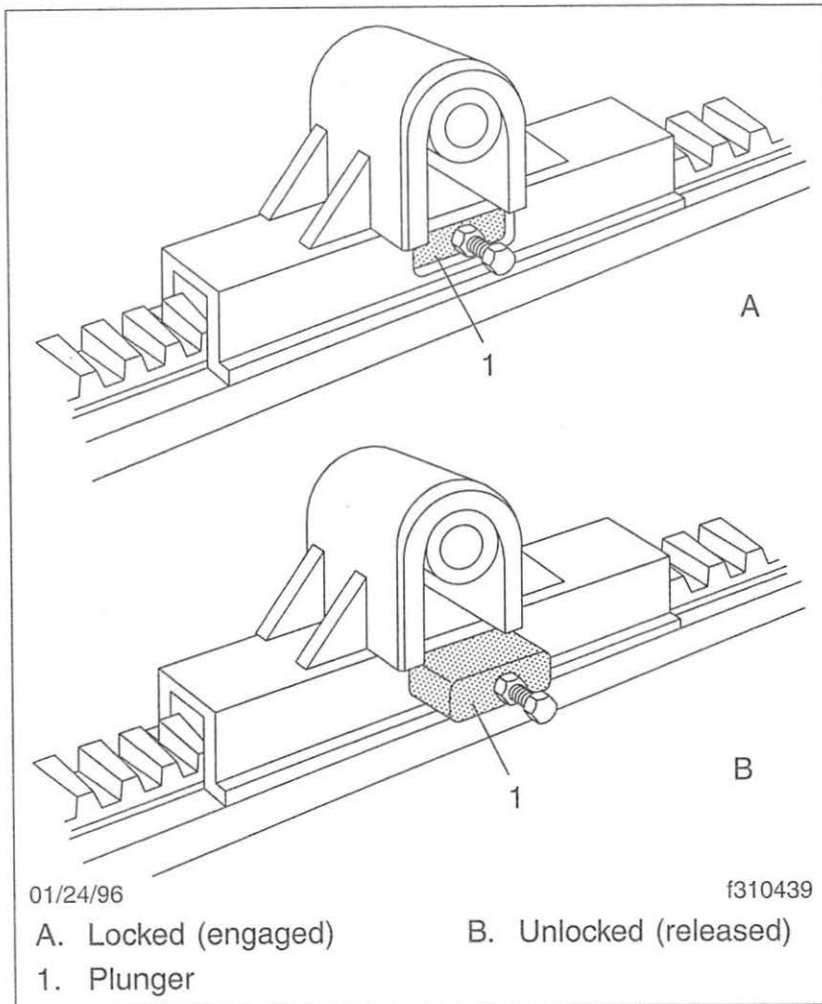


Fig. 10.7, Plunger Positions



CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking plungers to enter the fully locked position.

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



WARNING

Physically check to be sure that the slide plungers are in the locked position. Failure to achieve complete lockup may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

Fifth Wheels and Trailer Couplings

- 8.1 For air-operated models, set the cab-operated control switch to LOCK. Visually check the slide plungers to make sure they are engaged in the fully locked position. See **Fig. 10.7**.
 - 8.2 For manual release models, trip the release lever (**Fig. 10.3**) using a release hook or other suitable tool. Make sure that both plungers have locked (retracted into their pockets), and are fully engaged in the rack teeth. See **Fig. 10.7**. It may be necessary to move the tractor slightly while keeping the trailer brakes locked.
9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication



WARNING

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

For lubrication instructions, refer to **Group 31** in the vehicle maintenance manual.

ASF Castloc® II and Simplex® Series Fifth Wheels

General Information

The ASF Castloc II and Simplex series fifth wheels are used for pulling trailers having the standard 2-inch diameter kingpin. When installed as a stationary fifth wheel (**Fig. 10.8**), they are bracket-mounted to the tractor

Fifth Wheels and Trailer Couplings

frame in a position that best distributes the trailer load over the tractor axles. When used as a sliding fifth wheel (**Fig. 10.9**), they are mounted on the Taperloc® sliding mount (air-operated or manual release).

The fifth wheel lock mechanism for the trailer kingpin consists of a rotating jaw that grips the trailer kingpin and a spring-actuated lock. The jaw rotates on a jaw pin during coupling and uncoupling operations. Kingpin lockup occurs when the kingpin is forced into the jaw and the operating rod handle moves to the locked position. The kingpin is released either by activating a manual operating rod, or if equipped with Touchloc®, by a dash mounted release-knob, which activates an air cylinder underneath the top plate. The air cylinder activates the operating rod. The operating rod is located on the left side of the fifth wheel for Castloc II and Simplex II fifth wheels, and on the right side for the Simplex fifth wheel assembly.

On sliding fifth wheels, the top plate is mounted on a sliding saddle plate, which slides along the baseplate attached to the tractor frame. The baseplate rails allow forward and rear movement of the slide assembly, for optimum weight distribution over the tractor axles.

Tapered slots in the baseplate rails, aligned in 4-inch (102 mm) increments, provide for location of the fifth wheel along the baseplate. Retractable, spring-actuated lockpins are positioned through the slots to hold the fifth wheel in the desired position. The lockpins are retracted

either manually or by an air-operated cylinder controlled from the cab.

The manually-operated slide contains an operating rod (**Fig. 10.9**), which unlocks both sides of the plate at the same time.

The air-operated sliding saddle plate contains an air cylinder which moves the operating lever to unlock both sides of the plate at the same time. The air cylinder is

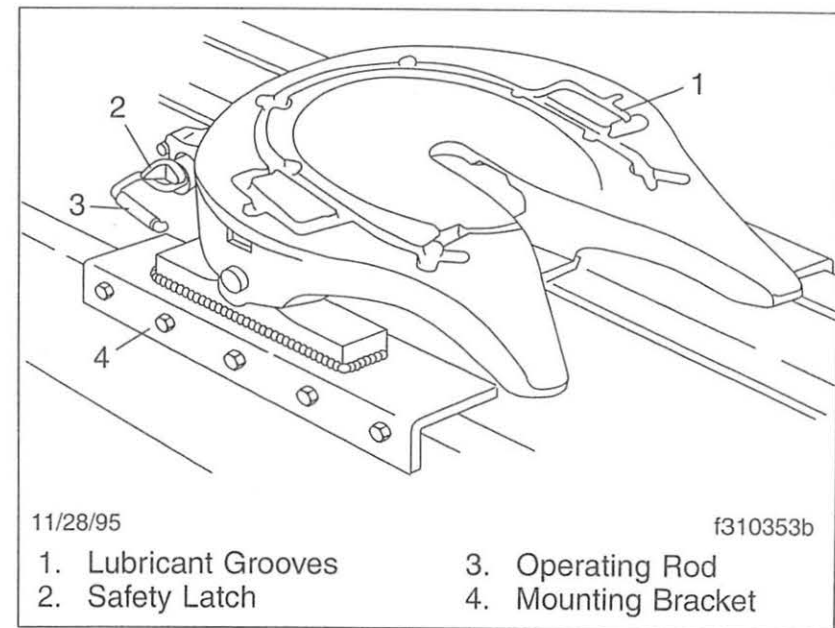


Fig. 10.8, Simplex Stationary Fifth Wheel

Fifth Wheels and Trailer Couplings

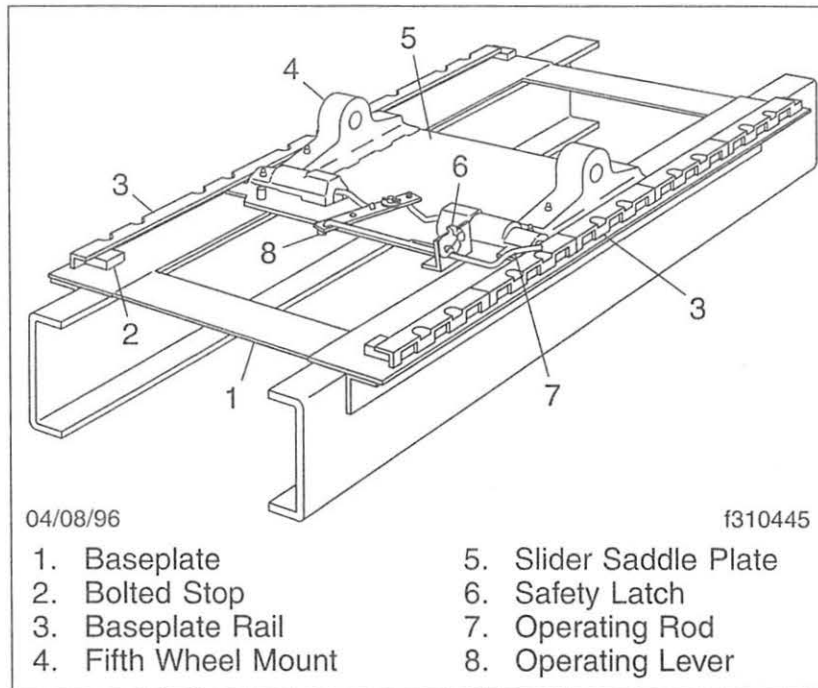


Fig. 10.9, Taperloc Slide, Manually-Operated Release

activated by a two-position air-control valve in the tractor cab.

Fifth Wheel Lock Mechanism for Trailer Kingpin (Fig. 10.10)

The Castloc II and Simplex Series fifth wheel lock mechanism consists of a rotating jaw and a spring-actuated

lock that grips the trailer kingpin. The jaw rotates on an eccentric pin during coupling and uncoupling operations. The spring-actuated lock holds the jaw in the locked position once kingpin lockup has occurred.

In the locked position, there is approximately 1/16-inch (1.6 mm) clearance between the jaw and kingpin. The jaw eccentric pin can be removed and rotated to compensate for wear and maintain an approximate 1/16-inch (1.6 mm) clearance during service.

Placing the operating rod in the lockset position moves the lock away from the jaw. This action unlocks the jaw so that it can be rotated by movement of the kingpin. When the tractor is moved out from under the trailer, the kingpin will rotate the jaw until the jaw is in the unlocked position, allowing the kingpin to move out of the mechanism. With the jaw in the fully open position, the operating rod drops out of the lockset position, and the fifth wheel is ready for coupling. See **Fig. 10.11**.

During coupling, the kingpin contacts and rotates the jaw into the locked position. This action automatically moves the operating rod into the locked position. This securely locks the jaw around the kingpin. In the locked position the safety latch swings freely over the operating rod. See **Fig. 10.12**.

Fifth Wheels and Trailer Couplings

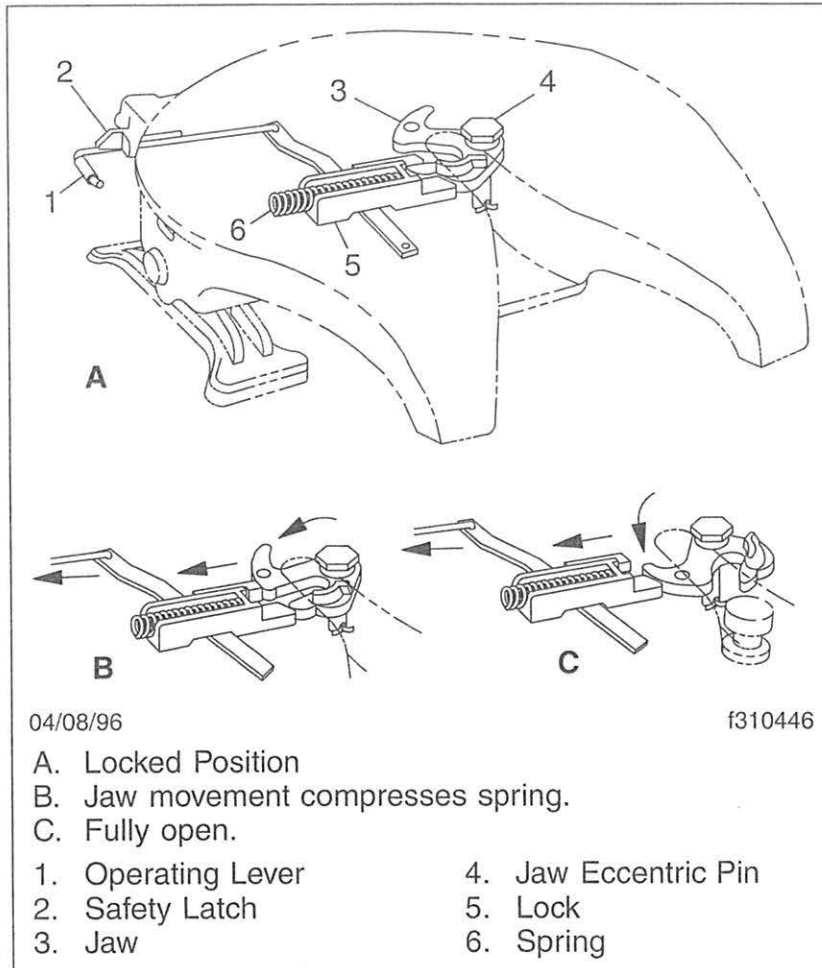


Fig. 10.10, ASF Castloc II and Simplex Series Kingpin Locking Mechanism Operation

Fifth Wheel Locking and Unlocking

Locking the Fifth Wheel Lock Mechanism

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



CAUTION

Before attempting to lock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide locking handle (Fig. 10.9) must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

2. The fifth wheel jaw must be fully open. Make sure that the operating rod is in the unlocked position. The fifth wheel must be completely lubricated with chassis or multi-purpose grease. For lubrication instructions, refer to **Group 31** in the vehicle maintenance manual.



WARNING

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

Fifth Wheels and Trailer Couplings

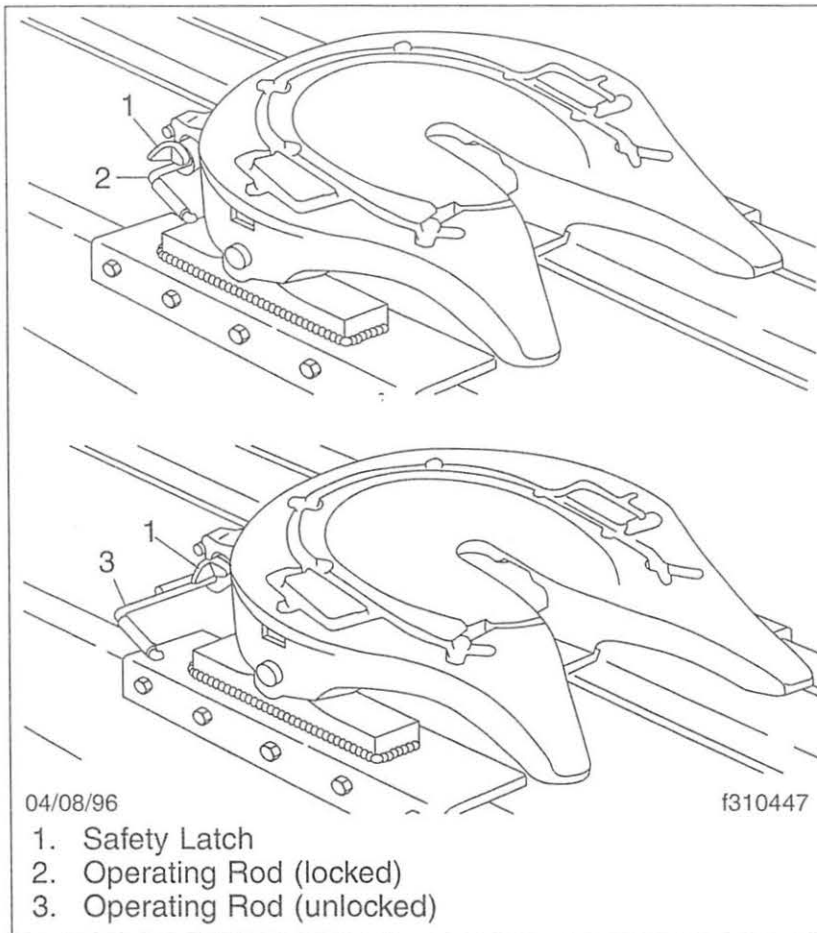


Fig. 10.11, Simplex Kingpin Locking Mechanism, Locking and Unlocking

3. Make sure the fifth wheel top plate is tilted so the ramps are as low as possible. If equipped with an air suspension, make sure the air bags are completely inflated.
4. Position the tractor so that the center of the fifth wheel is in line with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism. See **Fig. 10.10**. Adjust the trailer landing gear so that the lower front trailer edge contacts the top surface of the tilted fifth wheel plate, approximately 8 inches (20 cm) before the fifth wheel center.
5. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.
6. Apply the tractor parking brakes.
7. Make a visual check (even if equipped with the Touchloc air-operated system) for positive kingpin lockup. The trailer bed plate must be flush on the fifth wheel plate surface. When positive lockup has occurred, the fifth wheel operating rod will have moved inward to the locked position, and the safety latch will swing freely over the operating rod. See **Fig. 10.12**.

Fifth Wheels and Trailer Couplings

NOTE: Only when the operating rod is fully retracted in the locked position will the safety latch be freely rotated down.

8. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.
9. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
10. Charge the air brake system with air. Make sure that the air connections do not leak.

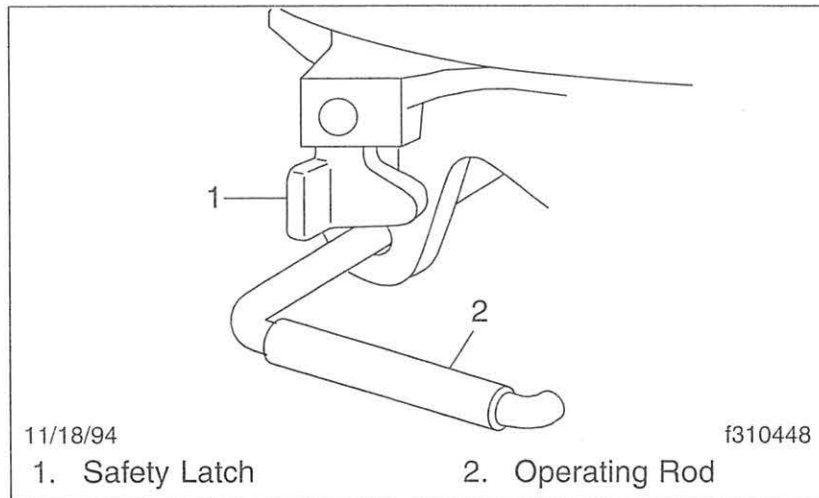


Fig. 10.12, Simplex Kingpin Locking Mechanism, Safety Latch (locked position)

WARNING

Adjust the jaw pin if there is more than 1/8-inch (3.2 mm) clearance between the kingpin and the lock. Incorrect adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

11. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. A clearance of approximately 1/16-inch (1.6 mm) between the jaw and kingpin is allowable. When clearance between the jaw and kingpin exceeds 1/8-inch (3.2 mm), adjust the jaw to restore the 1/16-inch (1.6 mm) clearance between the jaw and kingpin. For instructions, refer to **Group 31** in the vehicle workshop manual.
12. Retract the trailer landing gear, and secure the ratchet handle.
13. Remove the chocks from the trailer tires.
14. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

Fifth Wheels and Trailer Couplings

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight ratings given on the FMVSS or CMVSS label.



WARNING

Do not overload any tractor axle by incorrectly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.
4. Lower the trailer landing gear until the trailer rises about 1/2 inch (13 mm).
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.



CAUTION

Before attempting to unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide operating rod (Fig. 10.9) must be in the locked position, and the slide lockpins must be in the locked position (fully inserted in baseplate rail slots. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

Fifth Wheels and Trailer Couplings

6. *If equipped with a manual kingpin lock release:* Release the kingpin lock mechanism by raising the safety latch to the rear and pulling the lock operating rod out and up into the lockset position. See **Fig. 10.11**. The offset of the lock control upper rod should bottom against the plate casting above the hole. If the operating rod cannot be pulled to the lockset position, back the tractor slightly to release the kingpin force against the jaw.

If equipped with an air-operated kingpin lock release: Pull the air-release knob on the dash. From outside the cab, visually check that the operating rod has bottomed out against the plate casting above the hole. See **Fig. 10.11**. If the operating rod isn't in the unlocked position, back the tractor slightly to release the kingpin force against the jaw.

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

7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to "Fifth Wheel Locking Operation," in this chapter.

3. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:
 - 3.1 For air-operated models, set the cab-operated control switch (**Fig. 10.13**) to UNLOCK.
 - 3.2 For manually-operated models, raise the safety latch and pull the slide operating rod (**Fig. 10.9**) outward until the shoulder is outside of the operating rod support, then lower the operating rod as far as it will go.
4. Lower the trailer landing gear just enough to remove the weight from the tractor.

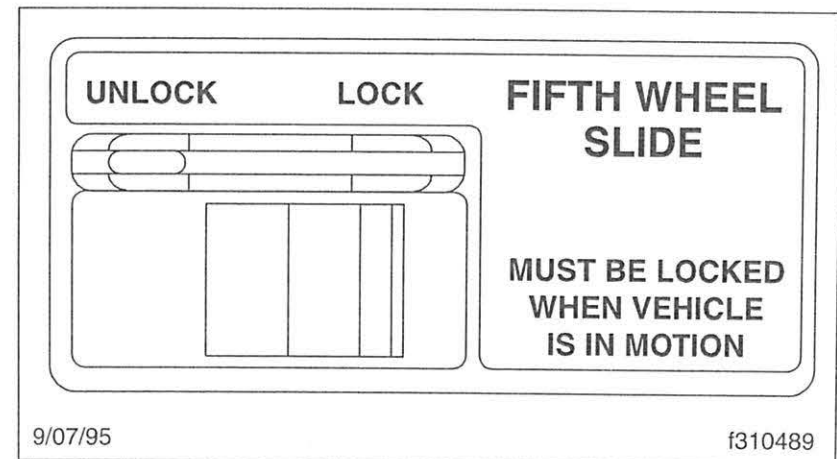


Fig. 10.13, Cab Control, Fifth Wheel Slide

Fifth Wheels and Trailer Couplings

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



CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.



WARNING

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

NOTE: The fifth wheel may have to be moved slightly to enable the locking pins to enter the fully locked position.

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

For air-operated models: Set the cab-operated control switch to LOCK. Visually inspect the lockpins to make sure they have seated in the baseplate rail holes.

For manually-operated models: Raise the operating rod so that it is free to move inward. Make sure that the lockpins have seated in the baseplate rail holes and the operating rod moves into the locked position. Also, the safety latch must drop downward so that it holds the operating rod in the locked position.

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

Fifth Wheels and Trailer Couplings



WARNING

Adjust the fifth wheel slide correctly, and do not overload any tractor axle by incorrectly loading the trailer. Incorrect slide adjustment or incorrect axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication



WARNING

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

The fifth wheel plate must be kept well lubricated with chassis grease to prevent friction and binding between the tractor fifth wheel plate and the trailer. For lubrication instructions, refer to **Group 31** in the vehicle maintenance manual.

Fontaine Fifth Wheels

General Information

The Fontaine sliding fifth wheel mount is designed to provide optimum axle loading for maximum tractor use with different lengths and types of trailers. The sliding fifth wheel mount is used with the Fontaine 5092 series fifth wheel and is equipped with either an air-operated release slide (5AWB model), or a manual release slide (5MWS model).

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

The fifth wheel top plate is mounted on a slide assembly, which is attached to slide rails that are mounted on the vehicle frame. The slide rails permit forward and rearward movement of the slide assembly, allowing for optimum weight distribution over the tractor axles.

Slots are evenly spaced along the slide rails, and retractable tapered wedges are positioned through the slots to hold the fifth wheel in the desired position. See **Fig. 10.14** or **Fig. 10.15**.

The slide portion of the sliding model may be attached to either an air-operated release slide, or a manual release slide.

Fifth Wheels and Trailer Couplings

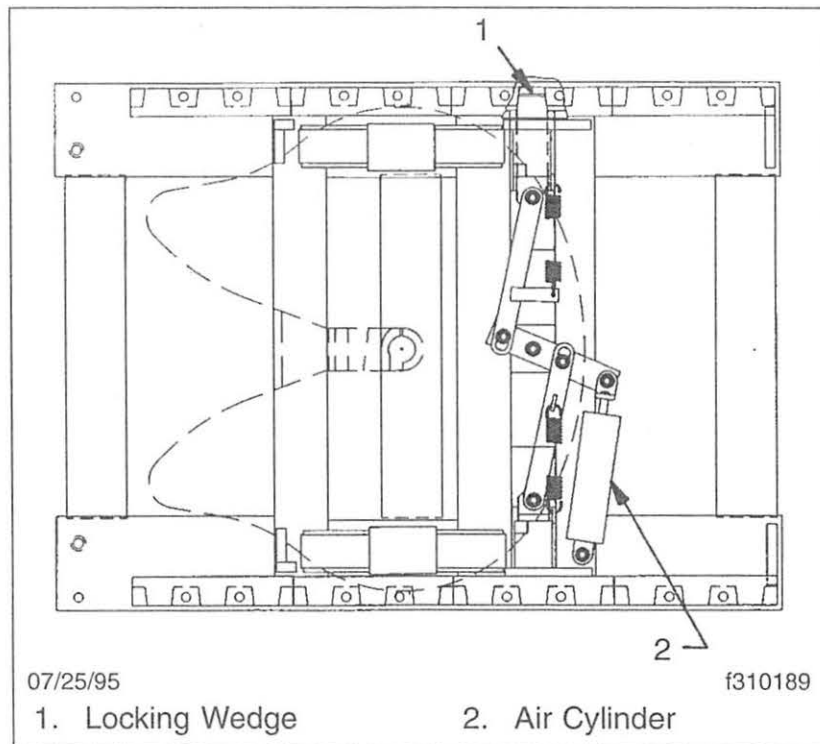


Fig. 10.14, Air-Operated Sliding Fifth Wheel Mount, 5AWB Model

The air-operated release slide contains an air cylinder that locks and unlocks the fifth wheel slide. See **Fig. 10.14**. The air cylinder is activated by a two-position air-control valve in the tractor cab.

The manual release slide contains a slide release pull handle, located on the left side of the fifth wheel, which locks or unlocks the fifth wheel slide. See **Fig. 10.15**.

Fifth Wheel Lock Mechanism for Trailer Kingpin (Fig. 10.16)

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

The jaw and wedge each have a pin permanently attached. The pin on the jaw and the pin on the wedge fit into elongated notches in the lock control handle. The notches in the handle control the limit of movement for both the jaw and wedge. The notches are arranged so that the wedge is actuated first during release of the kingpin.

During lockup, the jaw is moved first with the spring-loaded wedge being allowed to slip in place against the jaw. A timing bracket ensures that the wedge and jaw are moved at the proper time.

Placing the lock control handle in the unlocked position moves the wedge away from the jaw. This action unlocks the jaw so that it can be moved by the trailer kingpin. When the tractor is moved out from under the trailer, the kingpin moves the jaw until the kingpin is out of the mechanism. With the jaw in the unlocked position,

Fifth Wheels and Trailer Couplings

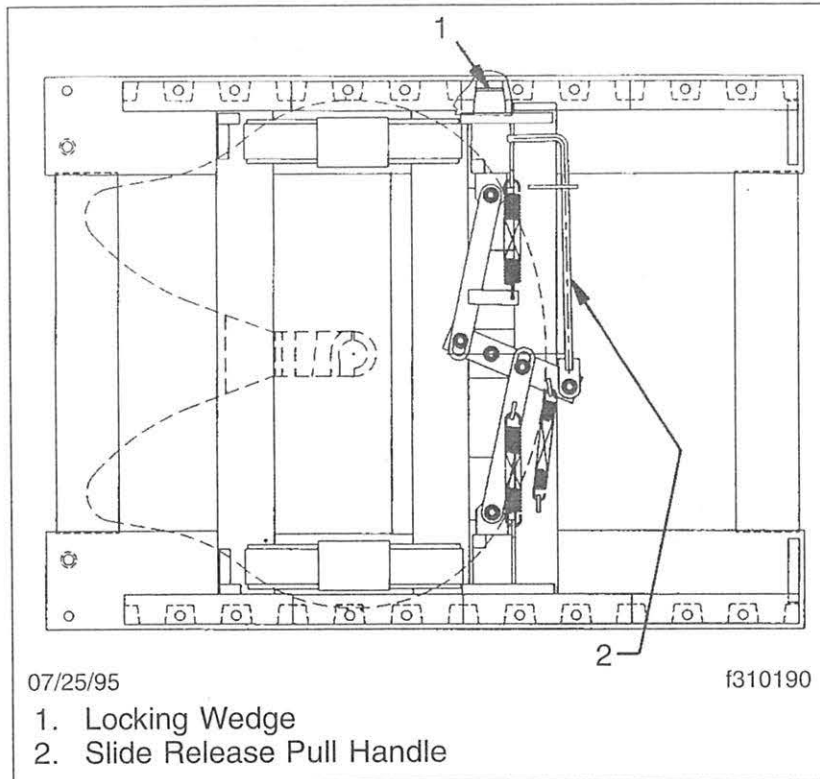


Fig. 10.15, Manual Release Sliding Fifth Wheel Mount, 5MWS Model

the lock control handle will remain in the unlocked position until manually moved by the operator.

During coupling (**Fig. 10.16**), the motion of the kingpin entering the jaw will actuate the jaw and wedge. The jaw

will move behind the kingpin, followed by the wedge. The purpose of the wedge is to reinforce the jaw and take up slack around the pin. Any wear on the jaw is immediately taken up by the wedge so there is no slack in the connection.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Lock Mechanism



CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release pull handle, if so equipped, and the slide locking wedges must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

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



WARNING

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

Fifth Wheels and Trailer Couplings

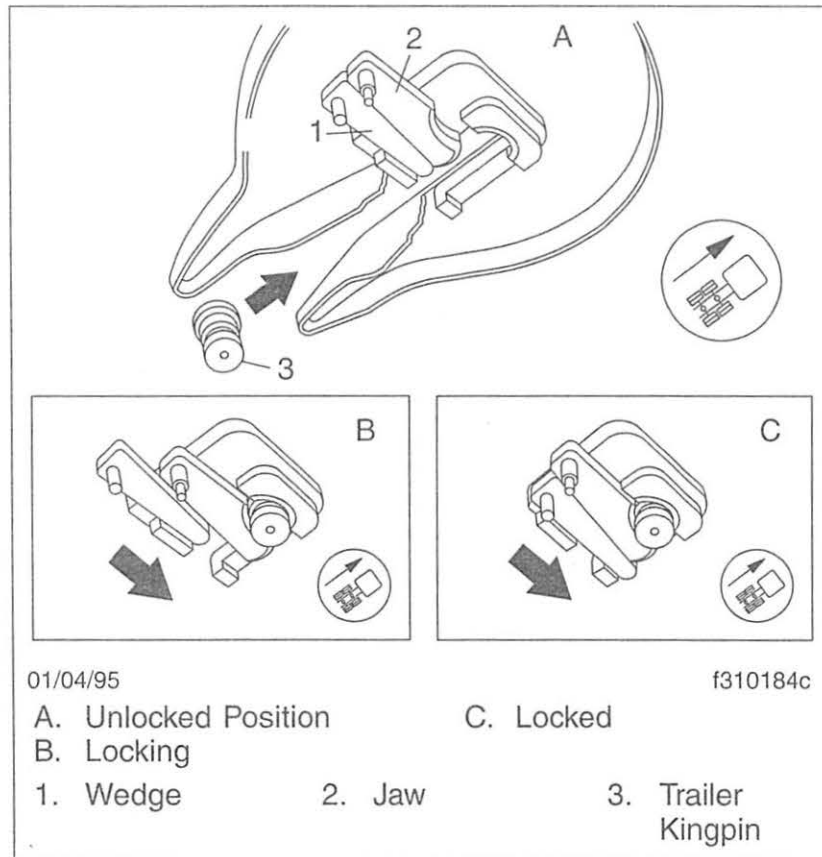


Fig. 10.16, Fontaine Kingpin Lock Mechanism

2. The kingpin lock mechanism must be fully open, the fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, refer to **Group 31** in the vehicle maintenance manual.

3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism (**Fig. 10.16**). Adjust the trailer landing gear to give enough alignment height for positive kingpin lockup.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.
6. Make a visual and physical check for positive kingpin lockup. When lockup has occurred, the fifth wheel control handle will have moved to the locked position. Make sure that the safety latch is down over the lock control handle. See **Fig. 10.17**. This will hold the control handle in the locked position.
7. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.
8. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
9. Charge the air brake system with air. Make sure that the air connections do not leak.

Fifth Wheels and Trailer Couplings

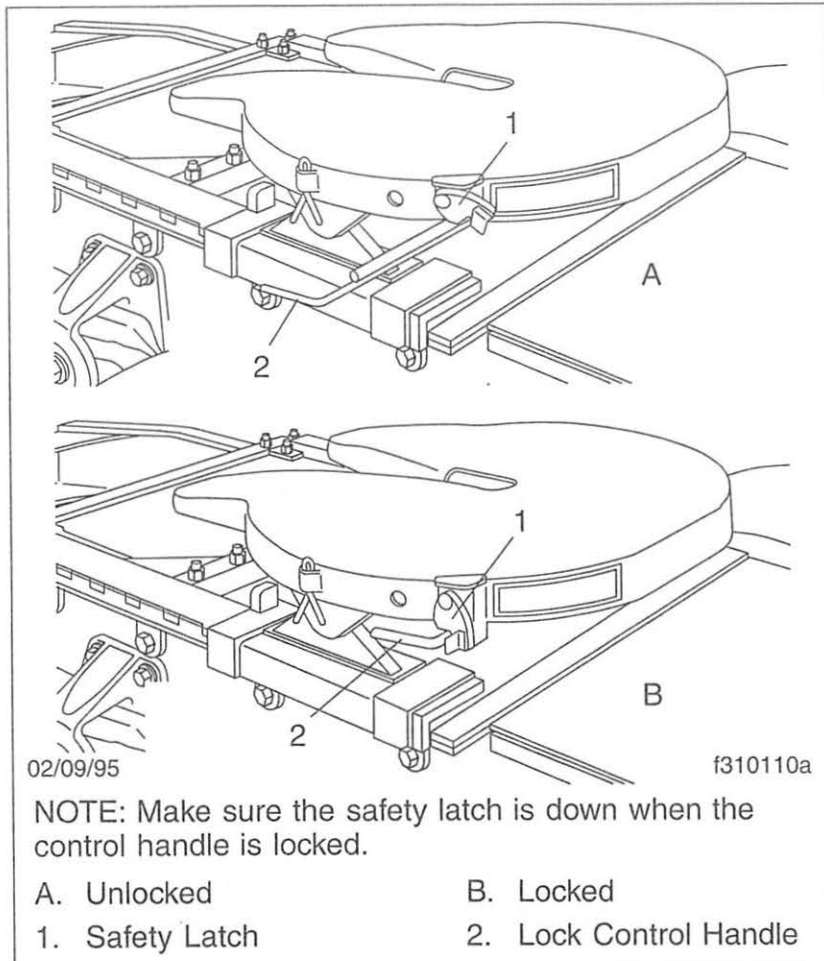


Fig. 10.17, Fontaine Fifth Wheel, Locking and Unlocking

WARNING

Eliminate slack between the trailer and the tractor. Incorrect fifth wheel adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

10. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. There should be no slack between the tractor and the trailer. If slack is present, uncouple the trailer.

For adjustment instructions, refer to the applicable manufacturer's service information.

11. Retract the trailer landing gear, and secure the ratchet handle. Remove the chocks from the trailer tires.
12. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of

Fifth Wheels and Trailer Couplings

the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

3. Chock the front and rear of the trailer tires to prevent the trailer from moving.
4. Lower the trailer landing gear until the weight is removed from the fifth wheel.
5. Disconnect the tractor-to-trailer air system lines and electrical cable. Plug the air lines to prevent dirt or foreign material from entering the lines.



CAUTION

Before attempting to lock or unlock the fifth wheel lock mechanism of a sliding type fifth wheel, the slide release pull handle, if so equipped, and the slide locking wedges must be in the locked position. This prevents the sliding member from moving rapidly to the far forward or rearward position, which could damage the fifth wheel member or kingpin.

6. Release the kingpin locking mechanism by lifting the safety latch and pulling the lock control handle to the unlocked position. See **Fig. 10.17**.
7. Slowly drive the tractor away from the trailer.

Fifth Wheel Slide Operation

1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Fontaine "Fifth Wheel Locking Operation," in this chapter.

Fifth Wheels and Trailer Couplings

2. After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide using one of the following methods:

- 2.1 For air-operated release models, set the cab-operated control switch (**Fig. 10.18**) to UNLOCK.
- 2.2 For manual release models, lift the slide release pull handle to disengage it from the guide plate. Then, pull out the handle (**Fig. 10.19**) until it is in the unlocked position and can be positioned against the guide plate to hold it out. The slide release pull handle will stay in the unlocked position until it is manually disengaged from the guide plate.

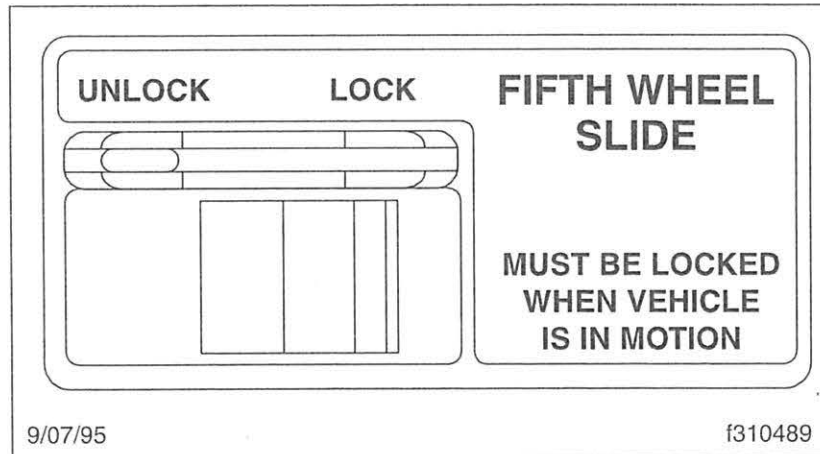


Fig. 10.18, Cab Control, Fifth Wheel Slide

3. Lower the trailer landing gear just enough to remove the weight from the tractor.
4. Pull the trailer air supply valve to cut off the air supply to the trailer.

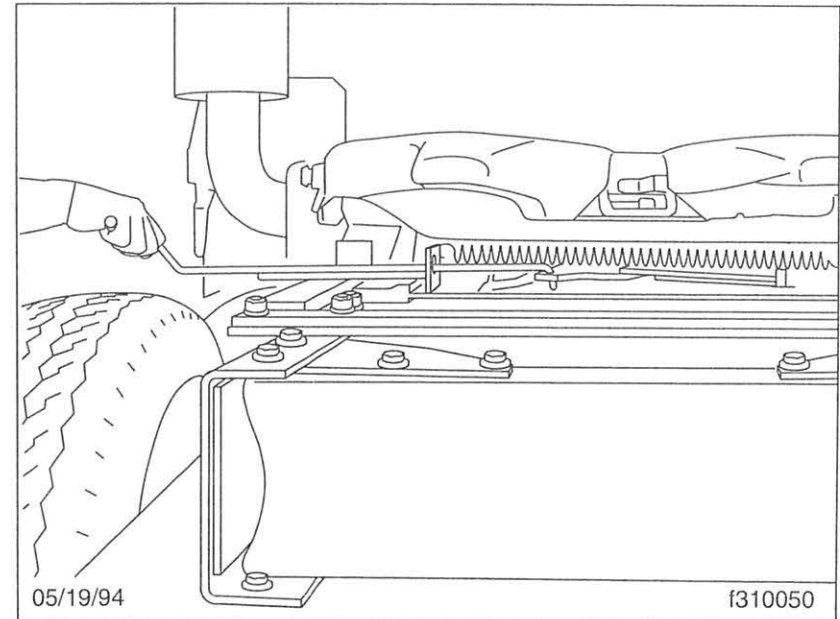


Fig. 10.19, Fontaine Sliding Fifth Wheel Manual Release

Fifth Wheels and Trailer Couplings

WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

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

CAUTION

After moving the fifth wheel to the desired position, be sure the trailer landing gear will not, at any time, come in contact with the tractor frame or other components. Make sure that the front of the trailer will not come in contact with the rear of the cab or with other components if they extend beyond the rear of the cab.

6. Slowly move the tractor forward or backward until the fifth wheel is in the desired location.
7. Apply the tractor parking brakes.

NOTE: The fifth wheel may have to be moved slightly to enable the locking wedges to enter the fully locked position.

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

WARNING

Physically check to be sure that the 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.

- 8.1 For air-operated release models, set the cab-operated slide control switch to LOCK. Visually inspect the locking wedges to make sure that they are fully inserted in the slide rail slots.
- 8.2 For manual release models, 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. The fifth wheel may have to be moved slightly to enable the locking wedges to fully enter the locked position. When 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 slide release pull handle is locked in position against the guide plate.

Fifth Wheels and Trailer Couplings

9. The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door post of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no instances should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



Adjust the fifth wheel slide correctly, and do not overload any tractor axle by improperly loading the trailer. Incorrect slide adjustment or improper axle loading could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Fifth Wheel Lubrication



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

For lubrication instructions, refer to **Group 31** in the vehicle maintenance manual.

Premier Trailer Couplings

(Fig. 10.20 and Fig. 10.21)

General Information

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

The Premier 260 and 460 trailer couplings (**Fig. 10.20**) have a rigid pintle hook, and are air-adjusted. An air chamber, mounted forward of the coupling, operates a push rod, which pushes against a shoe (Ref. 6) inside the coupling. The shoe maintains constant pressure on the eye of the trailer drawbar when it's over the pintle hook. This takes up any slack in the trailer connection, providing smoother towing and less wear on the pintle

Fifth Wheels and Trailer Couplings

hook. The air pressure is activated when the trailer brakes are released.

The Premier 690 trailer coupling (**Fig. 10.21**) has a moveable pintle hook, and is non-air adjusted. It is used for heavy-duty applications.

Operation

Trailer Hook-Up

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

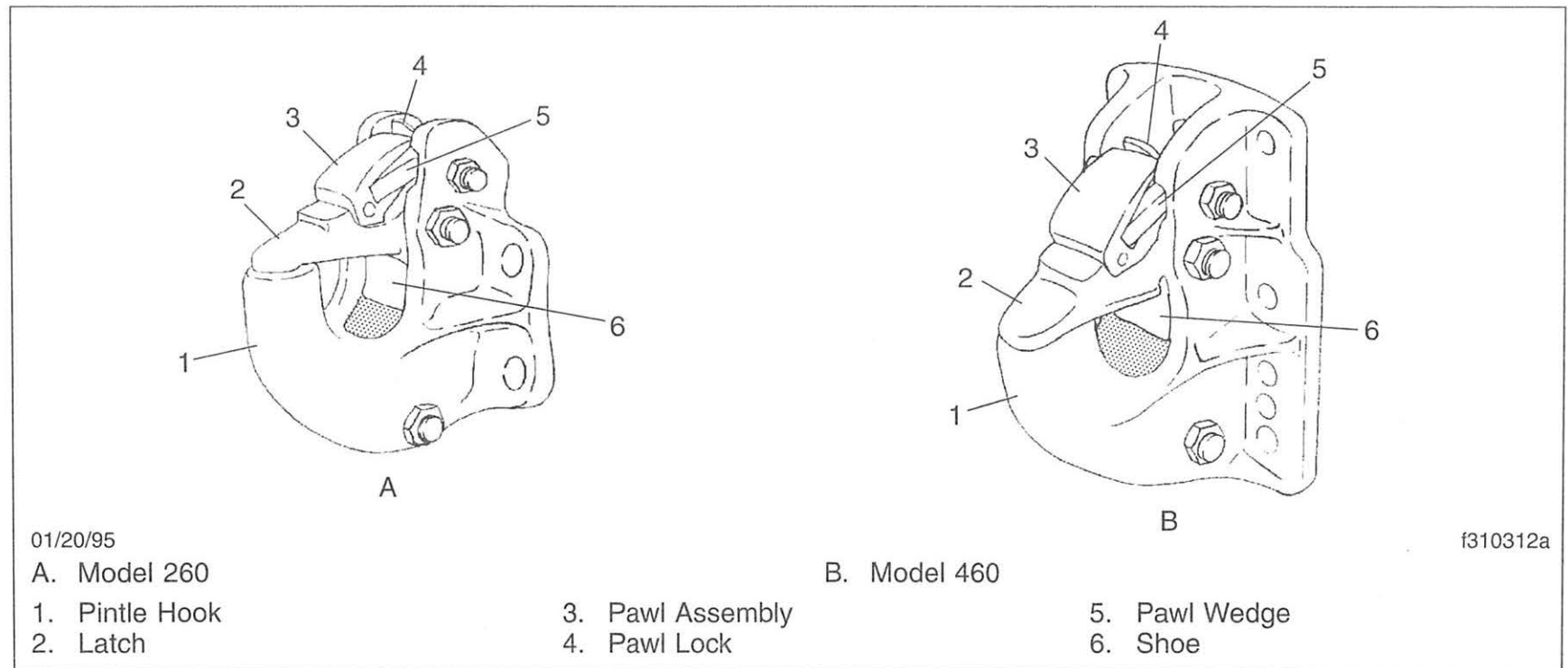


Fig. 10.20, Premier 260 and 460 Trailer Couplings

Fifth Wheels and Trailer Couplings

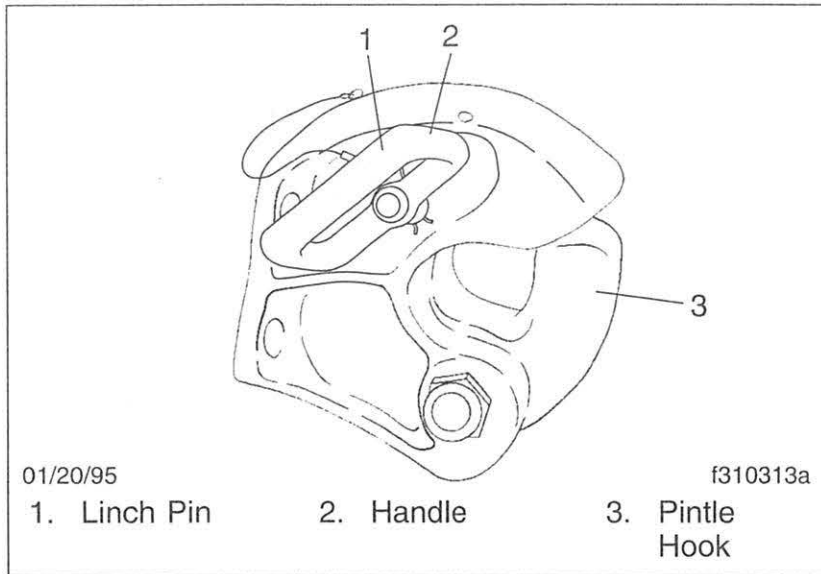


Fig. 10.21, Premier 690 Trailer Coupling

Models 260 and 460 (Fig. 10.20): Pull up on the pawl lock (Ref. 4); then, while squeezing the pawl wedges (Ref. 5) together, lift up the pawl assembly (Ref. 3.) Lift up the latch (Ref. 2), and push it up against the pawl assembly, locking the latch in place.

Model 690 (Fig. 10.21): Remove the linch pin (Ref. 1) from the handle (Ref. 2), then push in on the handle and turn it toward you. Open the pintle hook (Ref. 3) by pulling it down and toward you. Release the handle, locking the pintle hook open.

3. *Models 260 and 460:* Back up the vehicle until the drawbar eye is over the pintle hook, then lower the trailer.

Model 690: Back up the vehicle until the drawbar eye enters the open jaw, contacts the back of the pintle hook, and closes the coupling.

4. Close the coupling.

Models 260 and 460: Push in on the pawl wedges and lift the pawl assembly. The latch will drop into the closed position. Lock the latch by lowering the pawl assembly.

Model 690: The pintle hook will automatically close and lock from the pressure of the drawbar eye against it. Install the linch pin.

5. Hook up the trailer's electrical and air lines.
6. Remove the chocks from the trailer's tires.

Trailer Release

1. Apply the truck and trailer parking brakes.

Fifth Wheels and Trailer Couplings



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

2. Chock the front and rear tires of the trailer.
3. Disconnect the trailer air and electrical lines. Plug the air lines to keep out dirt.
4. Take the weight of the trailer drawbar eye off the pintle hook.
5. Open the coupling.

Models 260 and 460: Pull up on the pawl lock; then, while squeezing the pawl wedges together, lift up the pawl assembly. Lift up the latch, and push it up against the pawl, locking the latch in place.

Model 690: Remove the linch pin from the handle, then push in on the handle and turn it toward you. Open the pintle hook by pulling it down and toward you. Release the handle, locking the pintle hook open.

6. Slowly drive the vehicle away from the trailer.

Holland Trailer Coupling (Fig. 10.22)

General Information

The Holland PH-T-60-AL trailer coupling is designed for use with trailers having a maximum gross weight of 10,000 lbs. It is a rigid type pintle hook, used only on truck applications, and is fastened to the rear closing crossmember of the vehicle. It is a non-air adjusted coupling.

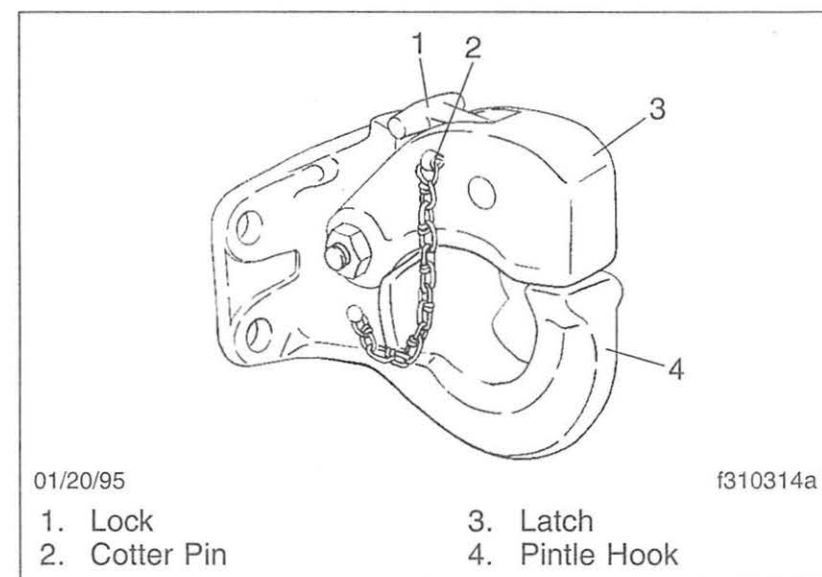


Fig. 10.22, Holland PH-T-60-AL Trailer Coupling

Fifth Wheels and Trailer Couplings

Operation

Trailer Hook-Up

1. Chock the front and rear tires of the trailer.
2. Remove the cotter pin (Ref. 2); then lift the lock (Ref. 1) and raise the latch (Ref. 3).
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's electrical and air lines.
7. Remove the chocks from the trailer's tires.
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.

Trailer Release

1. Apply the truck and trailer parking brakes.



WARNING

Do not use the trailer air supply for parking trailers not equipped with spring parking brakes. This applies the trailer service brakes only. As air bleeds from the trailer brake system, brake application is lost. This could allow the unattended vehicle to roll away, possibly resulting in serious personal injury or death.

Pretrip Inspection and Daily Maintenance

Pretrip Inspection Check List	11.1
Pretrip Inspection and Daily Maintenance Procedures	11.4

Pretrip Inspection and Daily Maintenance

Pretrip Inspection Check List

Use the following pretrip inspection check list to help ensure that the vehicle components are in good working condition before each trip.

Pretrip inspections cannot be done quickly. In check list form, the sequence below may seem to be overly time-consuming. However, careful pretrip inspections save time by eliminating stops later to adjust items overlooked or forgotten.

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

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, refer to the vehicle workshop manual for procedures and specifications, and to the vehicle maintenance manual for lubricant recommendations, specifications, and other periodic maintenance intervals.

1. Apply the parking brakes, and chock the tires.
2. Drain the air brake system air tanks (1).
3. Inspect the batteries and battery cables (2).
4. Check the fluid level in the windshield washer reservoir (3).
5. Check the wheel bearing lubricant level (4).
6. Tilt the hood. Examine the steering gear components (5).
7. Check the coolant level in the surge tank (6) and check the radiator and charge air cooler cooling fins for clogging (debris accumulated on coolers) or damage (7). Check the radiator for coolant leaks.
8. Check the condition of the coolant hoses and heater hoses (8).
9. Check the condition of the drive belts (9).
10. Inspect the engine for fuel, oil, and coolant leaks.
11. Inspect the engine and chassis wiring (10).
12. Inspect the air intake system for leaks or damage (11). Check the intake-air restriction indicator if it is mounted on the air intake system.
13. Check the engine's lubricating oil level (12).
14. Close and latch the hood.
15. Close the drain valves on the air brake system air tanks.
16. Inspect the fuel tank(s) and fuel line connections; if so equipped, be sure the fuel tank shutoff valves are open (13). Check the fuel level in the fuel tank(s) (14). If equipped with a fuel/water separator,

Pretrip Inspection and Daily Maintenance

- check the sight glass. Drain any water found (15). Also check the fuel/water separator for leaks.
17. If so equipped, check the transmission oil cooler for debris and for leaks.
 18. If so equipped, inspect the fifth wheel (16), and check it for adequate lubrication (17).
 19. Inspect the front and rear suspension components, including the springs, spring hangers, equalizers, and shocks (18).
 20. If so equipped, check that the exhaust rain cap covers the top of the exhaust stack.
 21. Clean the headlights, rearview and downview mirrors, and the outside of the windshield and all window glass. Check the condition of the windshield wiper arms and blades (19).
 22. Clean the inside of the windshield, the gauges on the dash, and all window glass.
 23. Check for excessive play at the steering wheel (20).
 24. Adjust the driver's seat, then align the rearview and downview mirrors.
 25. Check the clutch free pedal and clutch brake squeeze (21).
 26. Check the seat belts, tether belts and, if so equipped, the bunk restraints for secure mounting and for damage (22).
 27. Check the cab interior for loose items, and secure or remove them. Check the emergency equipment and warning devices (23).
 28. Check the air restriction indicator if it is dash mounted.
 29. Turn on the ignition, and start the engine. Be sure the oil- and air-pressure warning systems are operating; then check the instrumentation control unit for fault codes (24). Leave the engine running.
 30. Make sure the electric horn and air horn, windshield wipers and washer, heater and defroster, and mirror heat (if so equipped), are operating properly (25).
 31. Check the operation of the interaxle differential, if so equipped.
 32. Check the operation of the back-up alarm, if so equipped.
 33. Turn on the lights. Check the operation of all gauge lights and interior lights (26). Leave the lights on.
 34. If not already done, hook the trailer(s) to the vehicle.
- Whether or not the trailer was already hooked to the vehicle, check the following:
- Make sure all fifth wheel connections are engaged and locked (27). If so equipped, check the operation of the fifth wheel air slide.

Pretrip Inspection and Daily Maintenance

Check that all connections to the dolly or trailer hitch and safety chains are secure.

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

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

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

Pretrip Inspection and Daily Maintenance

Pretrip Inspection and Daily Maintenance Procedures

Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, refer to the vehicle workshop manual for procedures and specifications, and to the vehicle maintenance manual for lubricant recommendations, specifications, and other periodic maintenance intervals.

1. Air reservoirs serve as storage tanks for compressed air; they collect water condensed from the air, and small amounts of oil from the air compressor. Water and oil normally enter the reservoir in the form of vapor, because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows:



WARNING

Drain the air reservoirs as instructed to prevent sludge formation in the air brake system. Sludge could adversely affect braking, causing loss of control, which could result in serious personal injury or death.

NOTE: If the air tanks are not equipped with automatic drain valves, they must be drained daily. If they are equipped with automatic drain valves, they

must be drained in this same manner at least once a week.

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



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 forms pockets which will not drain while compressed air is in the reservoirs. Because of these pockets, leave the valves blocked open during the first part of the pretrip inspection.
- 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.

Pretrip Inspection and Daily Maintenance

2. Inspect the batteries and battery cables, as follows:
 - 2.1 Remove the battery cover. Be sure the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.
 - 2.2 If equipped with maintenance-free batteries with a built-in hydrometer, examine the hydrometer. If a green dot shows in the sight glass, the battery is sufficiently charged. If the sight glass is dark, the charge is low, and the battery must be recharged.

If the sight glass is clear, the battery has a low level of electrolyte and must be replaced.
 - 2.3 Remove any corrosion from the hold-down and the top of the battery.



CAUTION

Take care to keep the vent plugs tight, so that the neutralizing solution does not enter any of the battery cells and damage the battery.

- 2.4 Use a soda solution to neutralize the acid present, then rinse off the soda solution with clean water.
- 2.5 If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a

wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of petroleum jelly to the posts and terminals, to help retard corrosion.

3. Check that the windshield washer reservoir is filled. Add washer fluid as needed. See **Fig. 11.1**. The windshield washer reservoir is located on the left-hand side of the frontwall between the surge tank and the hood. Unscrew the cap to add fluid.



WARNING

Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

4. Observe the level of the wheel bearing lubricant in the hub cap at each end of the front axle and, if needed, fill the hubs to the level indicated on the hub cap. Use the lubricant recommended for the drive axle. Refer to **Group 35** in the vehicle maintenance manual for recommended lubricants.

IMPORTANT: Before removing the fill plug, always clean the hub cap and plug.

5. Examine the steering gear mounting bolts, pitman arm nut, and the drag link nuts for tightness. See

Pretrip Inspection and Daily Maintenance

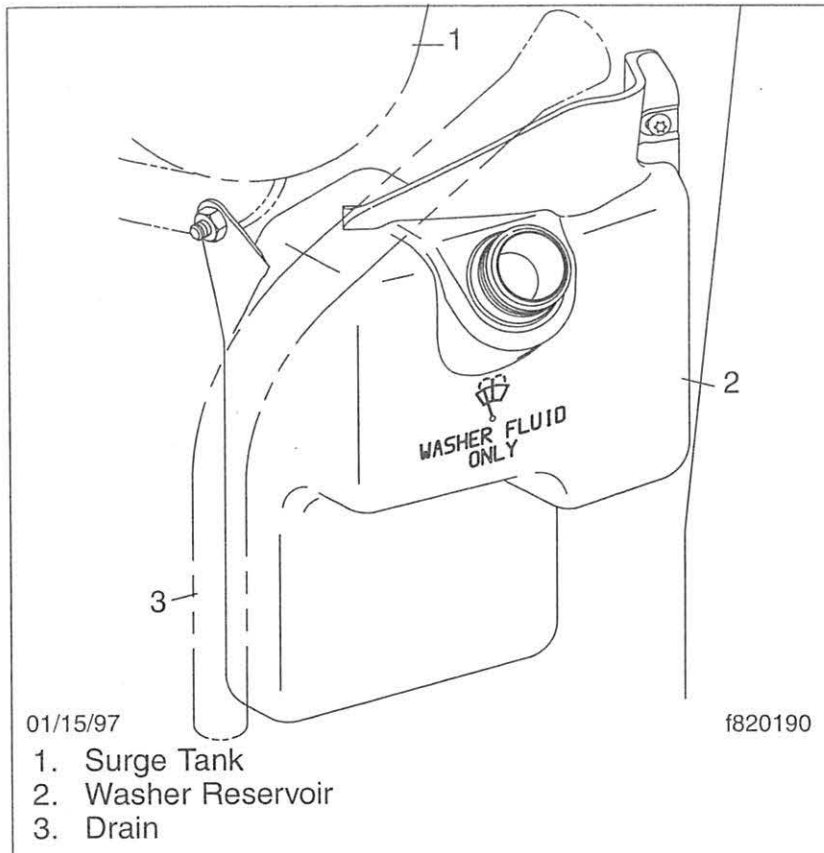


Fig. 11.1, Windshield Washer Reservoir

Fig. 11.2. Inspect the steering drive shaft and steering linkage for excessive looseness, or other damage. If so equipped, check the right-side power cylinder mount bolts and ball-joint nuts for tightness.

Tighten loose nuts, and replace damaged parts as needed; refer to **Group 46** in the vehicle workshop manual.

6. Check the coolant level in the surge tank. See **Fig. 11.3**. If the coolant is low, check the amount of antifreeze protection. If the protection is adequate, add a 50/50 mixture of water and fully formulated, or equivalent, antifreeze. If additional protection is needed, add antifreeze only. Fill the surge tank with coolant to the MAX line.



CAUTION

Coolant must be filled to the full line of the surge tank. Low coolant could result in engine overheating, which could cause engine damage.

NOTE: You can mix purple-pink coolant (pre-charged with a borate/nitrate-based additive) with the common green coolant, although some color change will be apparent.

7. Good airflow through the radiator core and charge air cooler is essential for proper engine cooling. The cores allow air passage, but form a particle barrier which tends to collect insects and airborne debris.

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

Pretrip Inspection and Daily Maintenance

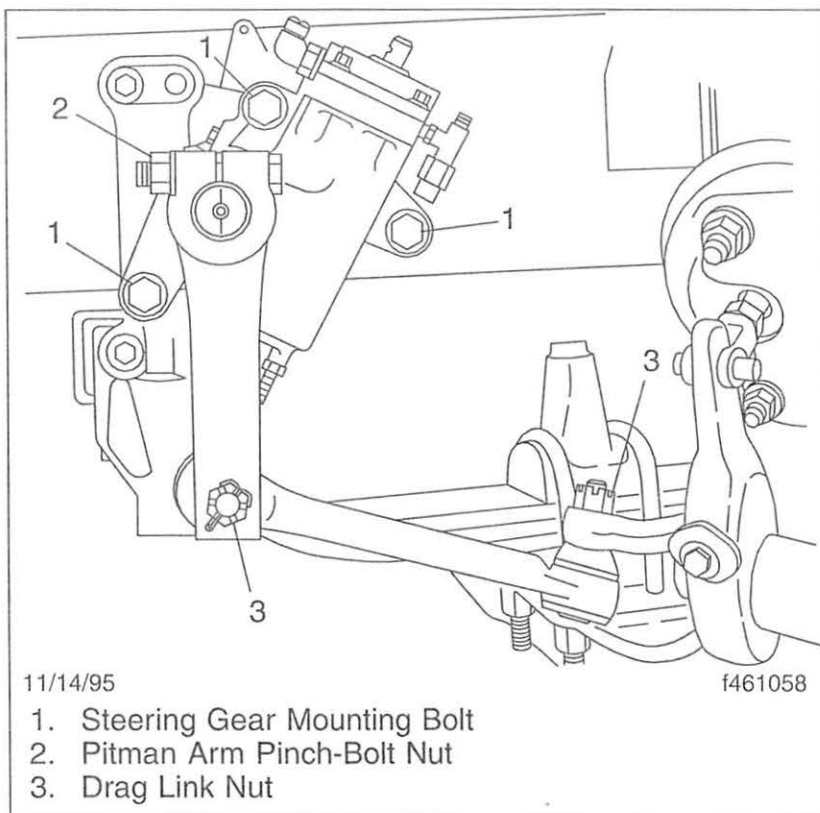


Fig. 11.2, Steering Gear Fasteners

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

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

Repair or replace the radiator if it is leaking. Refer to **Group 20** in the vehicle workshop manual for instructions.

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

8. Make sure the radiator inlet and outlet coolant hoses and heater hoses are pliable, and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning. Replace all hoses, including heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. Silicone hoses, having an extended service life, can be substituted for the reinforced neoprene type. Refer to the Freightliner *Parts Book* or contact your Freightliner Dealer.

Tighten hose clamps as necessary, but do not over-tighten, as hose life can be adversely affected.

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

9. Check the fan belt(s), alternator belt, and refrigerant compressor belt for signs of glazing, wear (frayed

Pretrip Inspection and Daily Maintenance

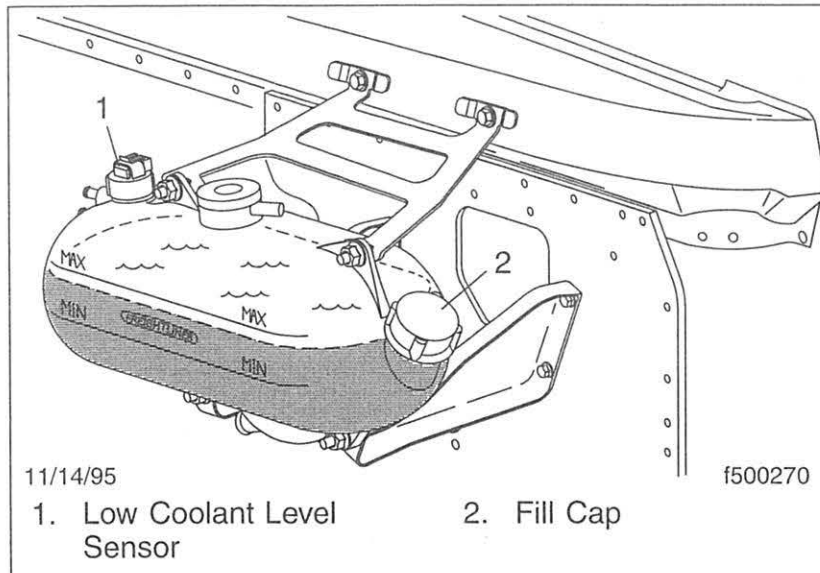


Fig. 11.3, Coolant Level Checking

edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, replace the belt, following the instructions in **Group 01** in the vehicle workshop manual.

Check all of the belts for proper tension. Use your index finger to apply force at the center of the belt free-span. See **Fig. 11.4**. If the accessory drive has a micro vee belt and spring loaded self tensioning idler, there is no adjustment for belt tension. Refer to **Group 01** in the vehicle workshop manual for instructions.

10. Inspect the engine and chassis for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.
11. Inspect the air intake system for leaks or damage.
 - 11.1 Check the intake-air restriction indicator (if equipped) to determine if the air cleaner filter element needs to be changed. Replace the filter element if the yellow signal stays locked at 25 inH₂O for Caterpillar and Cummins engines or 20 inH₂O for Detroit Diesel engines. Refer to **Group 09** in the vehicle workshop manual for filter element replacement instructions.

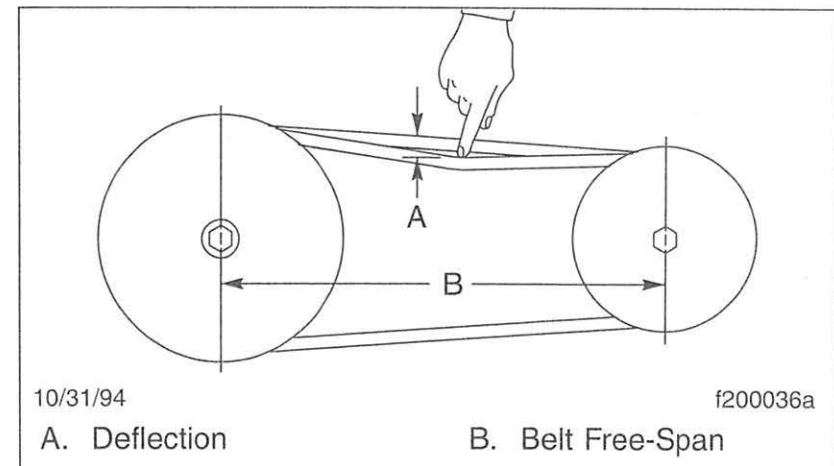


Fig. 11.4, Checking Belt Tension

Pretrip Inspection and Daily Maintenance



CAUTION

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

NOTE: After replacing the filter element, reset the restriction indicator by pressing the rubber reset button.

- 11.2 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 replace damaged components. Make sure the piping system is airtight so that all of the intake air passes through the air cleaner.
12. Check the engine's lubricating oil level. See **Fig. 11.5**. If the oil is low, add enough oil to bring the level up to the high ("H") or "full range" mark on the dipstick. Refer to the engine manufacturer's operation and maintenance manual for recommended lubricants.



CAUTION

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

13. Inspect the fuel tanks, fuel lines, and connections for leaks. Replace leaking fuel tanks; repair or replace any lines or connections that are leaking. For procedures, refer to **Group 47** in the vehicle workshop manual.

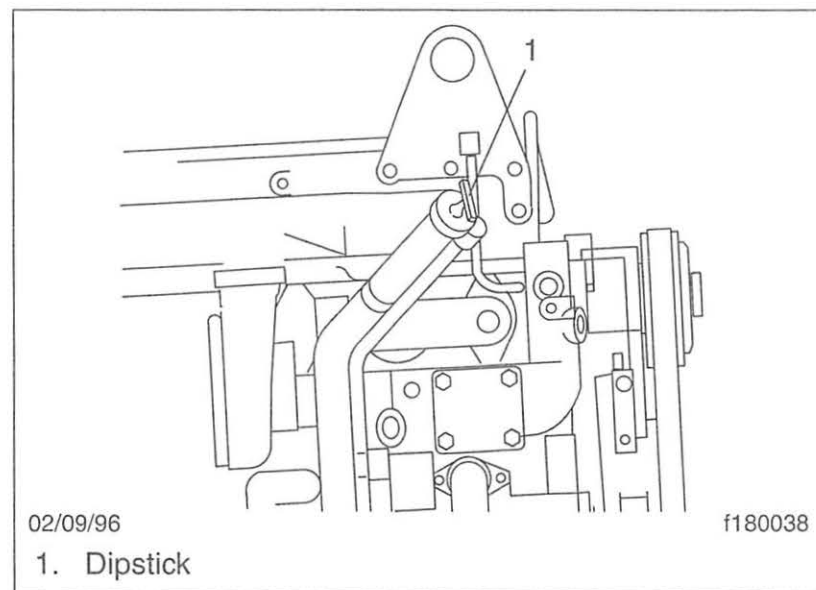


Fig. 11.5, Oil Level Checking

Pretrip Inspection and Daily Maintenance

If equipped with fuel tank shut-off valves, be sure the valves are fully open.

WARNING

Never operate the engine with the fuel tank shut-off valves partially closed. This could damage the fuel pump, causing sudden loss of engine power, possibly resulting in serious personal injury due to reduced vehicle control.

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

WARNING

Never fill fuel tanks to more than 95 percent of their liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, 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: Use only low-sulfur diesel fuels. Low-sulfur diesel fuels have a maximum 0.05 percent sulfur content, compared to a 0.26 to 0.30 percent sulfur content. Failure to use low-sulfur diesel fuels may void the warranty on emission components.

- 14.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter, and reduce the chances of dirt getting into the engine.
- 14.2 Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.

Pretrip Inspection and Daily Maintenance



CAUTION

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

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

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

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

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

Push the plunger in and tighten it by hand.

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

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

Remove the fuel tank cap.

Loosen the fuel supply line at the fuel transfer pump.

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

Remove the air hose and tighten the fuel supply line.

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

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

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

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

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

Remove the fuel tank cap from each tank.

Partially cover the fuel tank opening with your hand. Using an air hose, apply no more than

Pretrip Inspection and Daily Maintenance

5 psi (35 kPa) air pressure to the primary tank to fill the supply lines with fuel. Apply air pressure until air bubbles appear. Close the control valve to the secondary tank.

Loosen the fuel supply line at the fuel transfer pump.

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

Remove the air hose and tighten the fuel supply line.

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

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

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

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

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

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

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

For a Racor Model (Fig. 11.6): Check the water level in the sight bowl. To drain the water, loosen the valve at the bottom of the bowl two full turns, and allow the water to run out. Close and tighten the valve finger-tight. Check the filter element and replace if clogged.

For a ConMetCo Model (Fig. 11.7): Check the water level in the sight bowl (if equipped). To drain the water, loosen the valve at the bottom, and allow the water to run out. Close and tighten the valve finger-tight.

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.

16. If so equipped, inspect the fifth wheel.

- 16.1 If the vehicle is a truck-trailer combination, be sure the trailer hitch is locked and the safety

Pretrip Inspection and Daily Maintenance

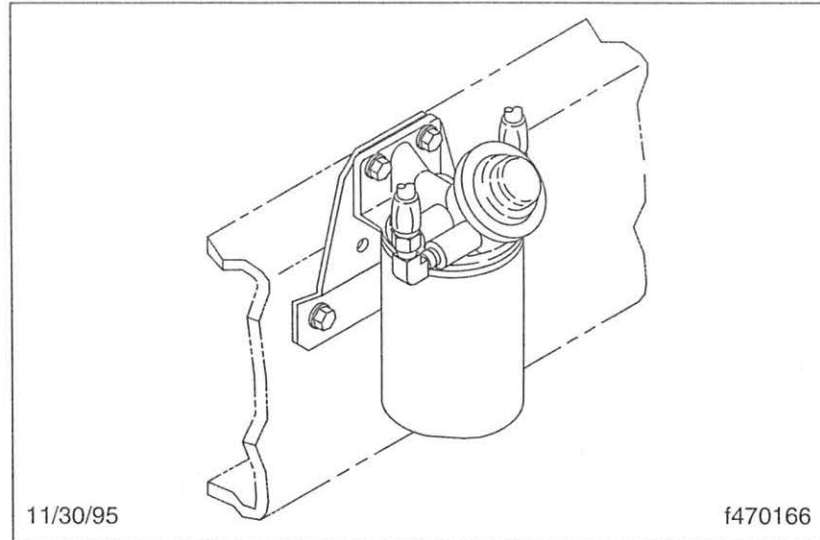


Fig. 11.6, Racor Fuel/Water Separator

cable or chains are connected. Be sure air hoses and the light cable are connected.



WARNING

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

- 16.2 If the vehicle is a tractor-trailer combination, check that the fifth wheel lock mechanism is

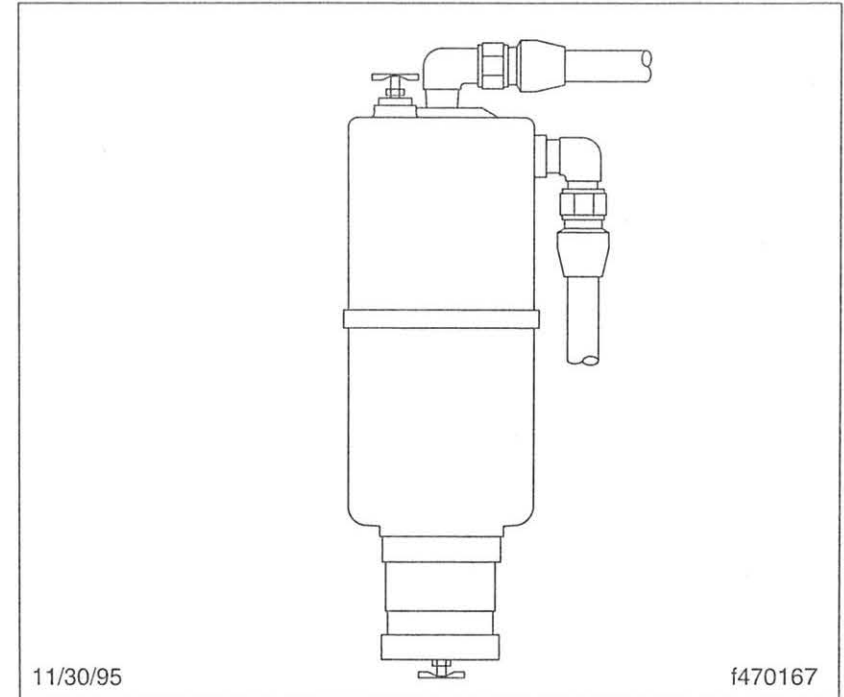


Fig. 11.7, ConMetCo Fuel/Water Separator

locked to the trailer kingpin. If equipped with a sliding fifth wheel, be sure the sliding portion of the fifth wheel is locked in place. Refer to **Chapter 10** for instructions.

Pretrip Inspection and Daily Maintenance



WARNING

Physically check to be sure that the trailer hitch is securely connected to the truck. Failure to lock the trailer hitch and to connect safety cables or chains may allow disengagement of the truck from the trailer, possibly resulting in serious personal injury or death.

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

- Loose nuts or broken bolts on the fifth wheel assembly, slide mechanism, and mounting brackets. Replace broken bolts, and tighten loose nuts.
- Cracks or wear on the fifth wheel assembly, slide mechanism, and mounting brackets. Replace each damaged or worn component.
- Incorrect jaw locking action, and cracks or wear on the jaw locking mechanism. Replace the mechanism if cracked or worn; repair it if the jaw locking action is incorrect.
- Gouges or wear on the fifth wheel plate. Replace the plate if damaged or worn.

- Fatigue or cracking of welds, which must be repaired according to the manufacturer's specifications.



WARNING

Repair or replace any damaged fifth wheels, slides, or mountings. The use of damaged fifth wheel parts may allow disengagement of the tractor from the trailer, possibly resulting in serious personal injury or death.

NOTE: For adjustment and replacement instructions, refer to **Group 31** in the vehicle workshop manual.

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

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

Clean all foreign material from the fifth wheel top plate. Lubricate the top plate surface, pickup ramps, and mounting bracket pivot pins, using a waterproof or multipurpose chassis lubricant. Lubricate the jaw mechanism.

Pretrip Inspection and Daily Maintenance

WARNING

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

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

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

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

For instructions, refer to **Group 32** in the vehicle workshop manual.

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

WARNING

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

20. Check the steering wheel for excessive play. With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels. Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction, until motion is again detected at the wheels. Measure the lash (free-play) at the rim of the steering wheel. See **Fig. 11.8**.

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

21. The main indicators for assessing clutch wear are clutch free pedal and clutch brake squeeze. Clutch free pedal is a decreased resistance felt at the top of the clutch pedal stroke. See **Fig. 11.9**. With the clutch pedal in this range, the clutch is fully engaged, and the only resistance to clutch pedal

Pretrip Inspection and Daily Maintenance

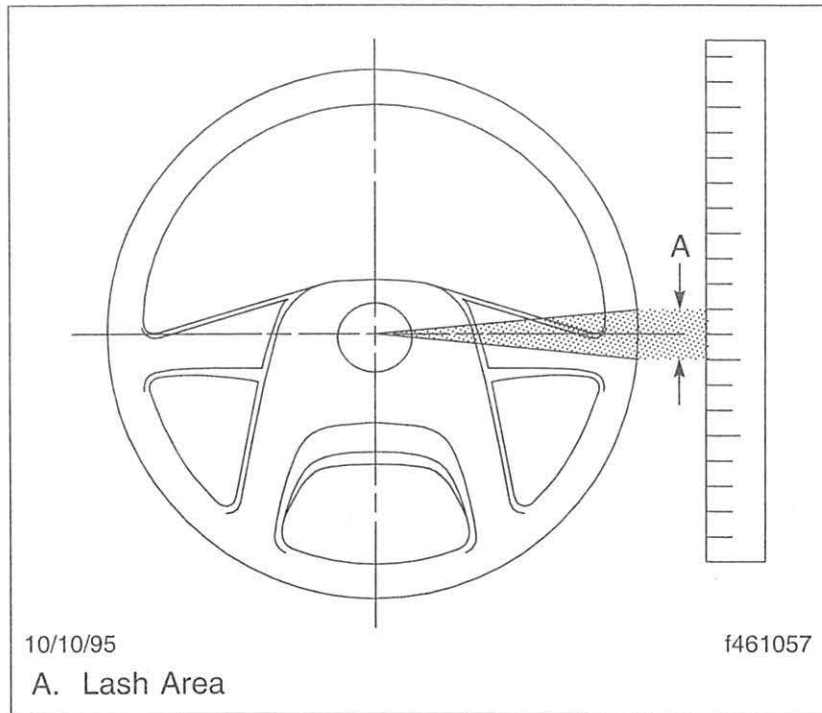


Fig. 11.8, Measuring Lash at the Steering Wheel

movement is the force of the return spring. If clutch free pedal is $\frac{3}{4}$ inch (20 mm) or less, measured at the pedal, have the clutch adjusted.

Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring) felt as the clutch pedal approaches the end of its stroke. If the gears grind when shifting into first or reverse

gear with the clutch pedal fully depressed, the clutch is out of adjustment, or the clutch brake is worn and needs to be replaced.

For instructions, refer to **Group 25** in the vehicle workshop manual.



CAUTION

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

22. Inspect the seat belts and tether belts.



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 personal 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.

Pretrip Inspection and Daily Maintenance

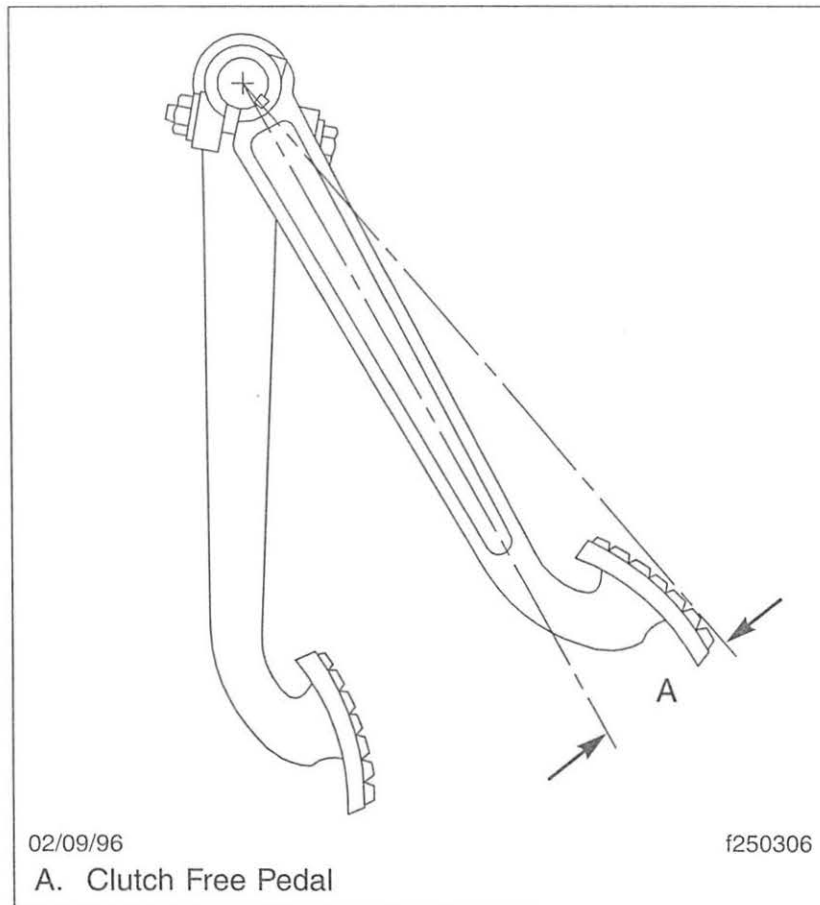


Fig. 11.9, Clutch Free Pedal

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

- 22.1 Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
 - 22.2 Check the web for extreme dirt or dust, and for severe fading from exposure to sunlight.
 - 22.3 Check the buckle and latch for operation and for wear or damage.
 - 22.4 Check the Komfort Latch for function and cracks or other damage.
 - 22.5 Check the web retractor for function and damage.
 - 22.6 Check the mounting bolts for tightness, and tighten any that are loose.
23. Check the cab interior for loose items, and secure or remove them. Be sure the following emergency equipment and warning devices are in place and in good working condition:
- One fully charged fire extinguisher;
 - Three standard reflectors;
 - Three red flags with standards;

Pretrip Inspection and Daily Maintenance

- Fusees (flares) if not hauling explosives or combustibles;
- Tire chains (in winter weather).

24. After starting the engine, make sure the oil- and air-pressure warning systems are working. When the engine is started, oil- and air-pressure warnings will come on until the oil pressure rises above a preset minimum, and the air pressure in both the primary and secondary air reservoir systems goes above 64 to 76 psi (441 to 524 kPa). If the air pressure in both systems is above 64 to 76 psi when the engine is started, test the low pressure warning system by lowering the pressure to below this range, or until the warning system comes on. If the warning systems do not come on when the ignition is turned on, repair the systems.

During the power up sequence, if an active fault is detected in the dash, or any other system connected to the data bus, the driver dash display will show the total number of active faults ("Active Faults" screen). Pressing the right arrow key on the keypad shows the first fault code and a brief description of the problem. A list of fault codes and definitions can be found in **Group 54** of the vehicle workshop manual. Continuing to press the right arrow key will display all additional fault codes (if any).

With the parking brake applied, active faults can be seen on the "Active Faults" screen. To display the

codes, repeat the procedure described previously. To access dash historical fault codes, press the Down arrow key. These codes may be cleared from memory in the "Clear Dash Faults" screen. Refer to **Chapter 2** for detailed operating instructions.



CAUTION

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

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

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

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

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

Pretrip Inspection and Daily Maintenance

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



WARNING

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

28. Be sure the brake lights, taillights, side marker lights, road lights (if so equipped), headlights, signal lights, daytime running lights, and clearance and identification lights are working and are clean. See **Fig. 11.10**. Test the high- and low-beams of the headlights. Replace light bulbs or sealed beam units that are not working.

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



DANGER

DANGER: Do not loosen or remove the parking brake clamp ring (see Fig. 11.11) for any purpose. The parking/emergency brake section of the brake chamber is not intended to be serviced. Serious injury or death may result from sudden release of the power spring.

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions in *Group 42* of the vehicle 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.



CAUTION

If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside the chamber, dirt and debris cause the internal parts to deteriorate and shorten their lives.

Pretrip Inspection and Daily Maintenance

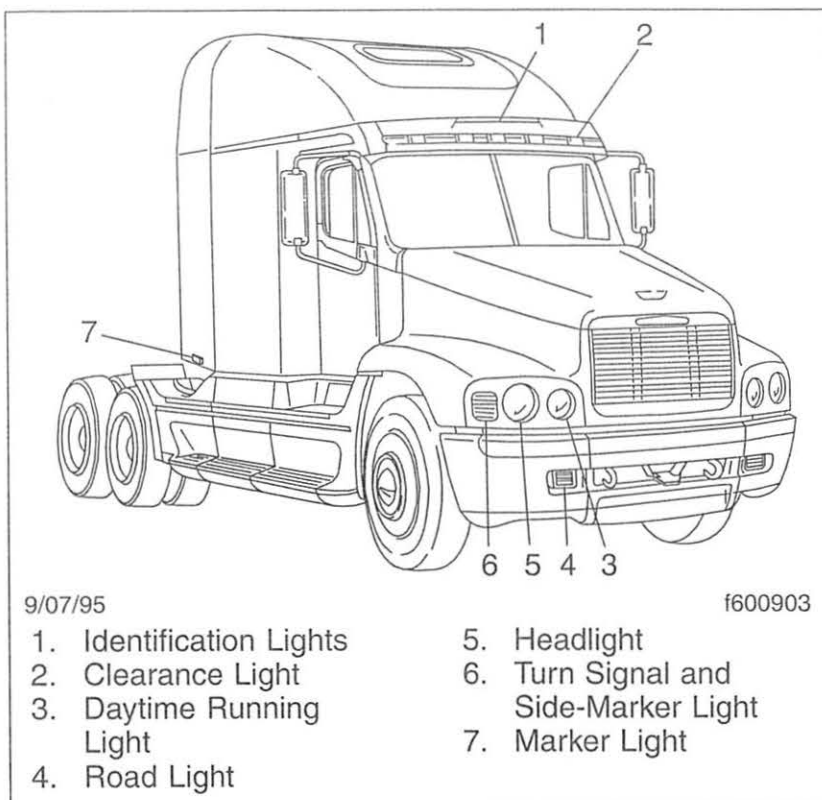


Fig. 11.10, Exterior Lights

NOTE: Vehicles operating under severe or adverse conditions should be checked more frequently.

29. Look for worn clevis pins on brake chamber push rods, and missing or damaged cotter pins on the

brake chamber push-rod clevis pins. Replace worn clevis pins, and install new cotter pins, if necessary.

Visually inspect the piston rod engagement with the clevis. At least 7 threads of engagement is required; there should be 1-inch (25 mm) clearance from the center-line of the clevis pin hole to the end of the piston rod. See **Fig. 11.12**. Refer to **Group 42** in the vehicle workshop manual for adjustment procedures.

See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the non-pressure chamber and cause a dragging brake. Refer to **Group 42** in the vehicle workshop manual if the chamber piston rod is improperly aligned.

Visually 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. Refer to **Group 42** in the vehicle workshop manual to replace any damaged parts.

On all parking brake installations, check for presence of an end cover cap or dust plug and make sure the cap or plug is securely snapped into place. On most MGM parking brake chambers equipped with an integral release bolt, an end cover cap is installed over the release bolt. Be sure the end cover cap is snapped tightly into place.

Pretrip Inspection and Daily Maintenance

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

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

Check the alcohol evaporator (if so equipped). The Midland alcohol evaporator requires service at 1500 mile intervals or less during the antifreeze season. Service consists of filling the container with a methyl alcohol type antifreeze.

Inspect the air lines, as follows:

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

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

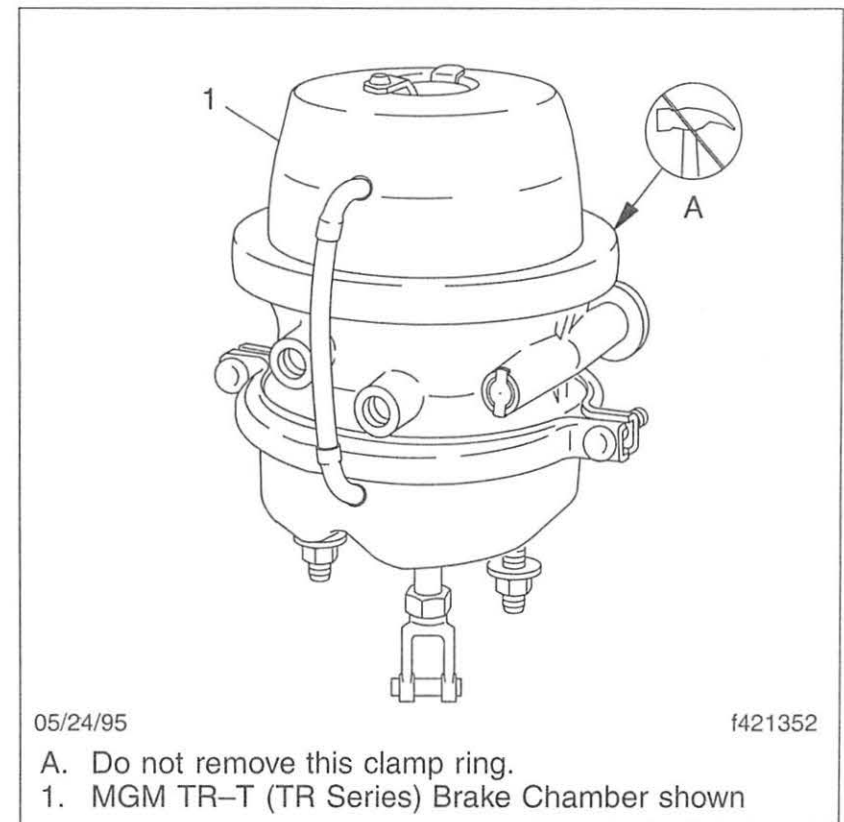


Fig. 11.11, Parking Brake Chamber Clamp

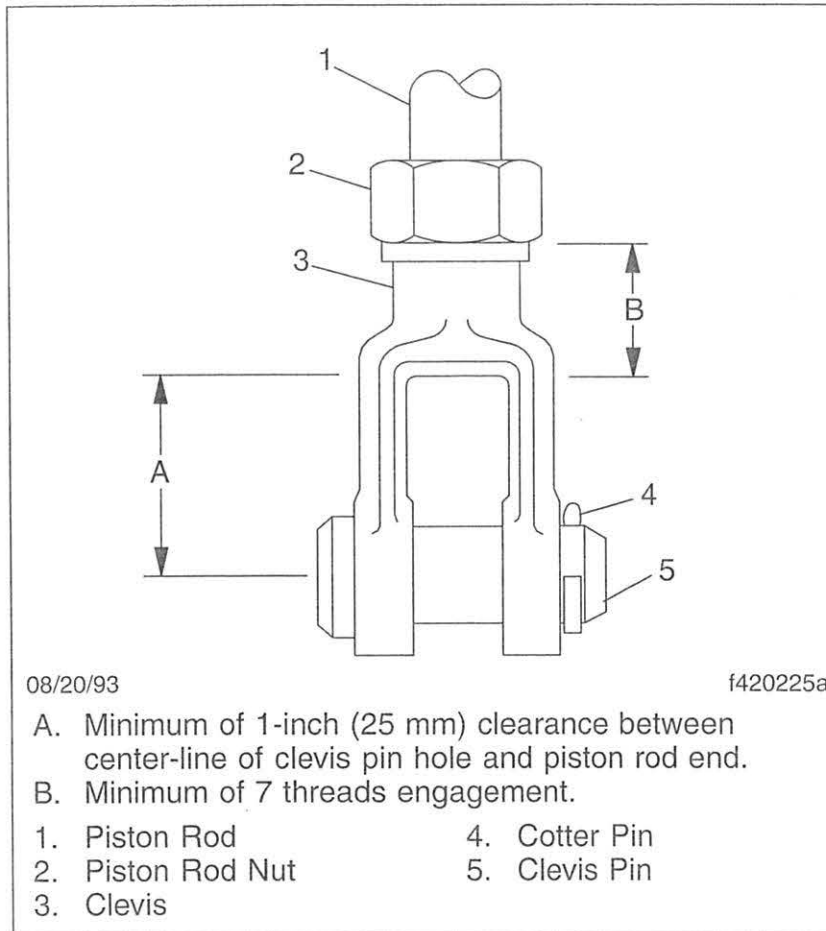


Fig. 11.12, Piston Rod Engagement with the Clevis

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

- 29.4 Check for damage to hoses located near moving parts, such as drivelines, trailer bodies, kingpins, suspensions, and axles. If the moving parts are catching or pinching the lines, correct as needed.
- 29.5 Check for hose damage caused by abrasion. If abraded, replace the hose. Check for the cause of abrasion, such as loose or damaged hose clamps. Repair or replace the clamps, as needed.
- 29.6 Observe the hose cover condition, especially hoses exposed to water splash and ice. If dried out or ragged (the wire or liner is showing through the cover), replace the hose(s).
- 29.7 Inspect air tubing, especially tubing made of nylon. In cold weather, nylon tubing is sensitive to damage, such as nicks or cuts. Replace nicked or cut tubing, even if it is not leaking.
- 29.8 Check the minimum bend radii of all hoses. The minimum bend radius of a hose is that bend which the hose will withstand without experiencing damaging stresses or kinking. See **Fig. 11.13**. For minimum bend radius values, refer to **Group 42** in the vehicle workshop manual.

Pretrip Inspection and Daily Maintenance

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

- 29.9 Check straight hose installations (those hoses that do not bend along their routings). Pressure changes can cause a hose to lengthen up to 2 percent, or shorten up to 4 percent. A 100 inch (2540 mm) length of hose, for example, can contract to 96 inches (2440 mm). If the hose has no slack when it

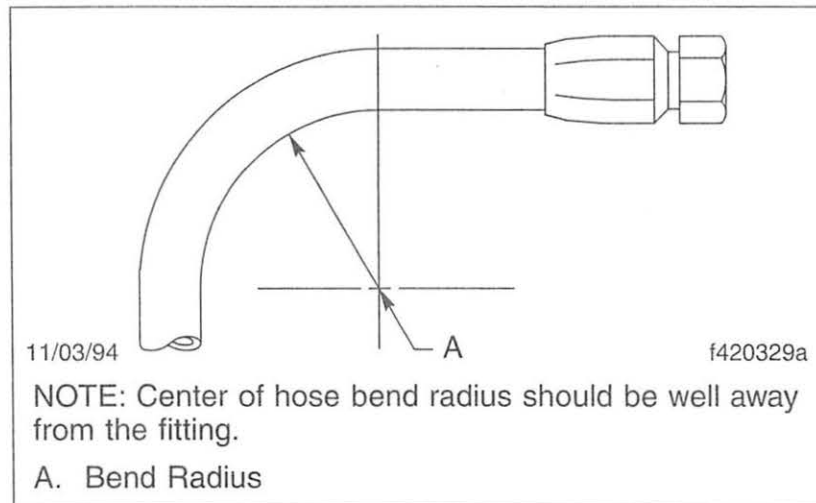


Fig. 11.13, Bend Radius

is exhausted of air, replace it with one of adequate length to avoid a possible blow-off from the fitting during vehicle operation.

- 29.10 Check for kinked or twisted hoses. A 7 percent twist in the hose can reduce its life by up to 90 percent. Also, a twisted hose under pressure tends to untwist. This will cause it to loosen the fitting. Reconnect hoses that are twisted.
30. Check the brake lining wear on all vehicles, including those with automatic slack adjusters. Proper brake operation is dependant on periodic maintenance and inspection of the brake linings.
- 30.1 Apply the parking brakes, and chock the tires to prevent vehicle movement.
- 30.2 If the axle assembly is not equipped with a dust shield or backing plate, measure the axle brake lining thickness. If *any* of the brake linings are worn to less than 1/4 inch (6.5 mm) at the thinnest point, replace the linings on *all* brake assemblies on that axle. See **Group 42** in the vehicle workshop manual for lining replacement instructions and camshaft endplay inspection.
- 30.3 If the axle assembly is equipped with a dust shield or backing plate, remove the inspection plugs to inspect the brake lining

thickness. If *any* of the brake linings are worn to less than approximately 1/4 inch at the thinnest point, replace the linings on *all* brake assemblies on that axle. See **Group 42** in the vehicle workshop manual for lining replacement instructions and camshaft end-play inspection.

30.4 Install the inspection plugs in the dust shields or backing plates (if equipped).

30.5 Remove the chocks from the tires.

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

31. Inspect the slack adjusters as follows:

31.1 For Gunite Automatic Slack Adjusters:

Inspect the slack adjuster for any signs of damage. If damaged, replace the slack adjuster.

Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, replace it. See **Fig. 11.14**.

Check for correct brake chamber stroke:

- With the brakes fully released, use a ruler to measure the distance from the bottom of the brake chamber to the

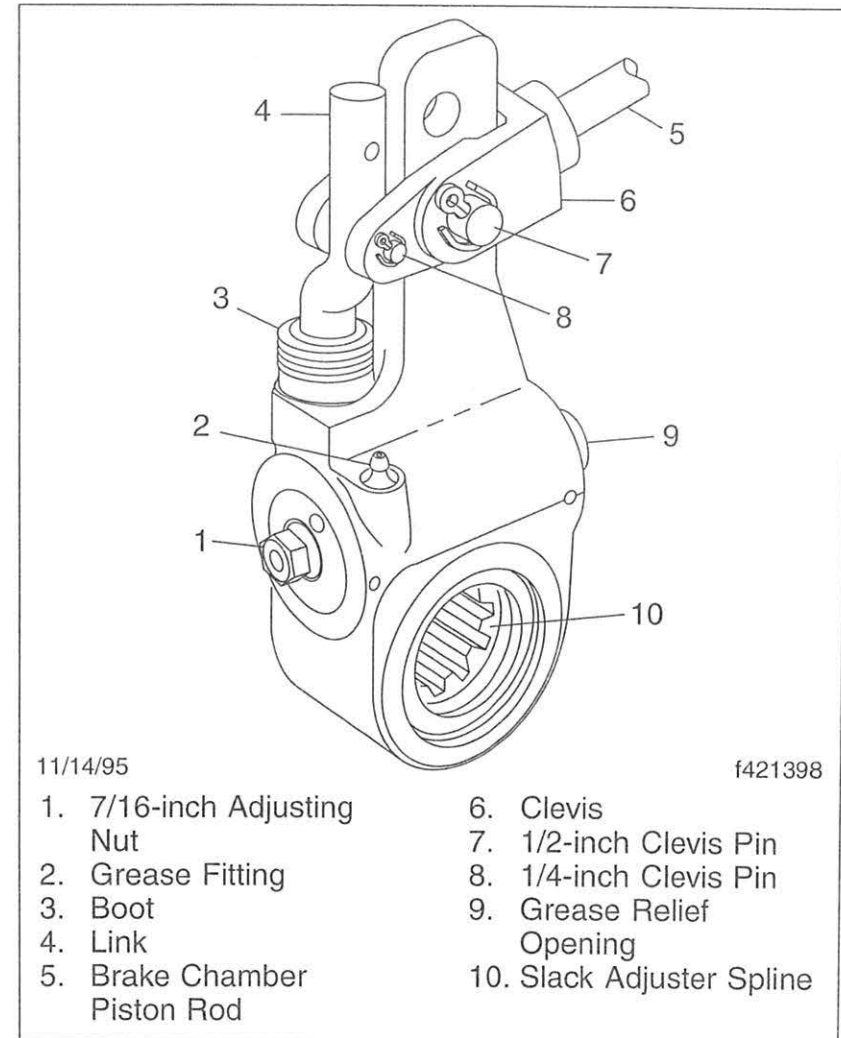


Fig. 11.14, Gunite Automatic Slack Adjuster

Pretrip Inspection and Daily Maintenance

center of the large clevis pin. See **Fig. 11.15**, Ref. A.

- Build air pressure to at least 85 psi (585 kPa). Apply the brakes, then measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See **Fig. 11.15**, Ref. B. The difference between the measurements is the brake chamber stroke.

Compare the brake chamber stroke with the measurements shown in **Table 11.1**. Long stroke design is indicated by a tag, or embossing, on the brake chamber. If the brake chamber stroke exceeds the measurements shown in **Table 11.1**, check the foundation brakes for problems such as worn cams, bushings, pins and rollers, or broken springs. Repair or replace as needed. For instructions, see the applicable section in **Group 42** in the vehicle workshop manual.

If there are no problems with the foundation brakes, manually adjust the slack adjuster. See **Group 42** in the vehicle workshop manual for instruc-

tions to adjust the Gunitite slack adjuster.

31.2 For Haldex Slack Adjusters:

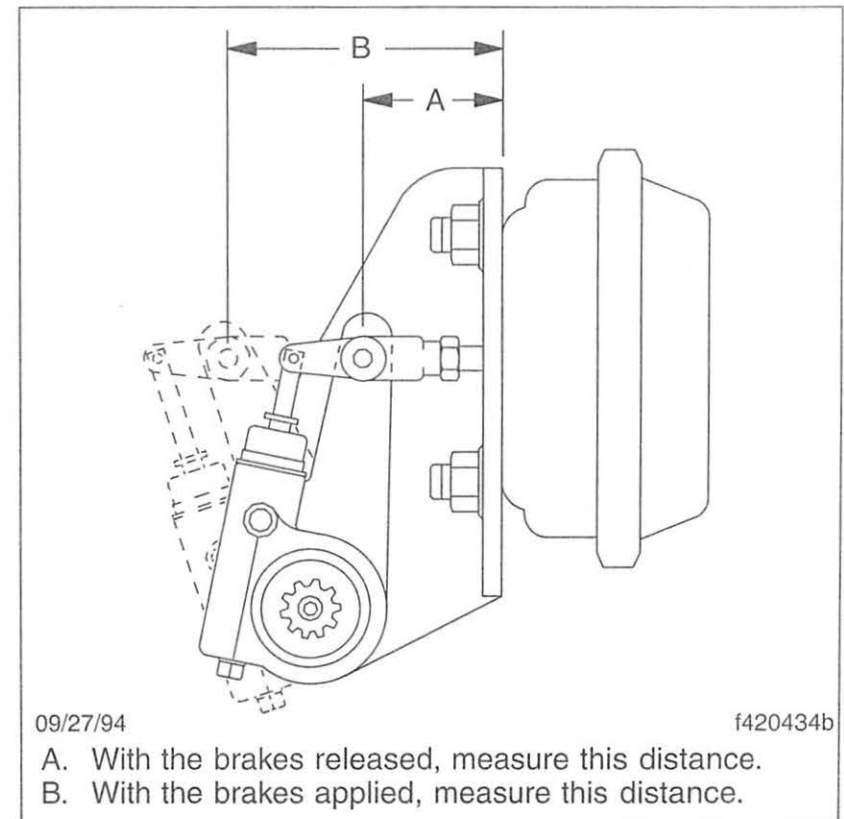


Fig. 11.15, Brake Stroke Check, Gunitite Automatic Slack Adjuster

Pretrip Inspection and Daily Maintenance

Chamber Size	Maximum Allowable Stroke, inches (mm)
16	1-3/4 (44)
16 (long stroke)*	2 (51)
20	1-3/4 (44)
20 (long stroke)*	2 (51)
24	2 (51)
24 (long stroke)*	2-1/2 (64)
30	2 (51)
30 (long stroke)*	2-1/2 (64)
36	2-1/2 (64)

* Long stroke design is indicated by a tag, or embossing, on the brake chamber.

Table 11.1, Maximum Allowable Brake Chamber Stroke

Inspect each slack adjuster and anchor strap for damage. See **Fig. 11.16**. Replace any damaged components.

Check that the control-arm nut is tightened 10 to 15 lbf·ft (14 to 20 N·m).

If the control arm is in the wrong position, the brakes will drag. Verify that the control arm is in its full-release position as follows:

Chock the rear tires, then release the parking brakes.

Remove the clevis pin.

With your finger, lightly push the slack adjuster *into* the clevis, then release it. The adjuster may move slightly due to springing of the anchor strap, but will return to its original position (holes in the adjuster and the clevis will remain in alignment). This shows that the control arm is fully released.

If the control arm is fully released, install the clevis pin. If the holes in the adjuster and the clevis do not remain aligned, it means the control arm is not against the internal body stop. This indicates an incorrect installation. Move the adjuster into alignment with the clevis hole, and install the clevis pin. Loosen the control-arm nut, and rotate the control arm toward the brake chamber until you can feel it contacting the internal stop. See **Fig. 11.17**, Ref. A. Be sure the control-arm stud moves freely in the slot of the anchor strap.

Tighten the control-arm nut 10 to 15 lbf·ft (14 to 20 N·m).

Repeat this step to be certain that the control arm is fully released. Final operating

Pretrip Inspection and Daily Maintenance

travel is obtained after the vehicle has been driven and the brakes are heated.

Check for correct brake chamber stroke:

- With the brakes released, measure the distance from the face of the air chamber to the far side of the clevis-pin hole. See **Fig. 11.17**, Ref. A. Record the exact distance as measurement A.
- Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa). Measure the distance from the face of the brake chamber to the far side of the clevis-pin hole. See **Fig. 11.17**, Ref. B. Record the exact distance as measurement B.
- Subtract measurement A from measurement B to determine the applied stroke. Compare this value to the allowable stroke value in **Table 11.1**. Long stroke design is indicated by a tag, or embossing, on the brake chamber.
- If the stroke varies or is greater than the specified range, check the brake components and, if necessary, replace the slack adjuster.

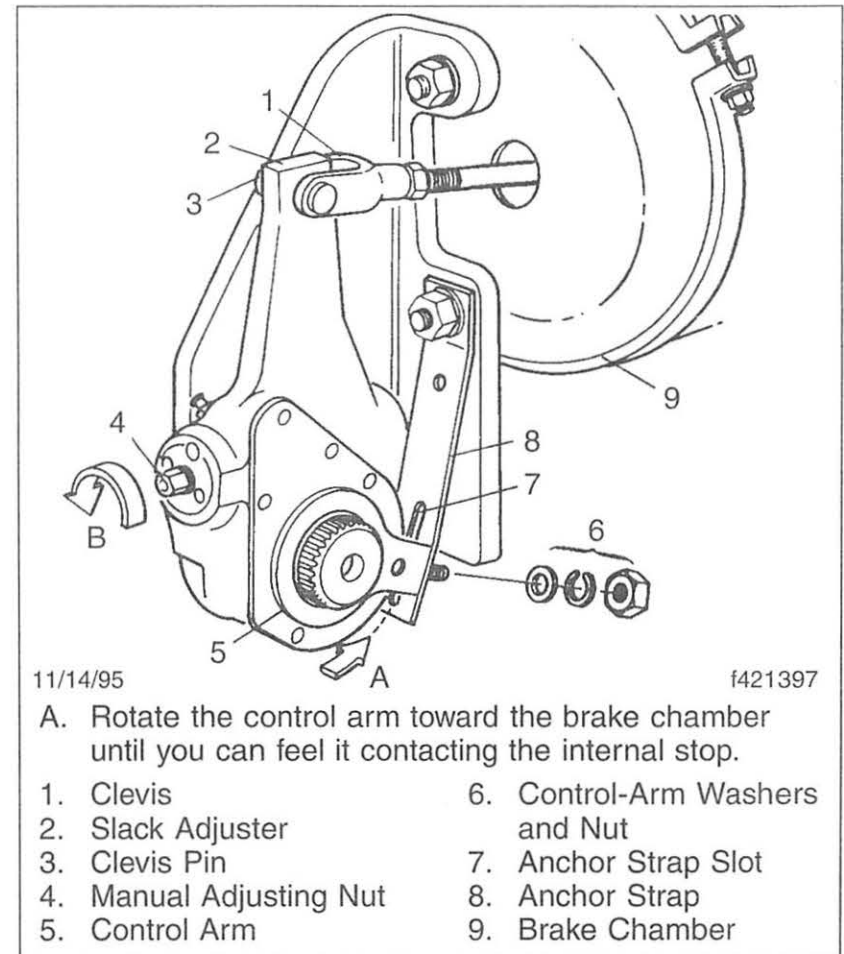


Fig. 11.16, Haldex Automatic Slack Adjuster

Pretrip Inspection and Daily Maintenance

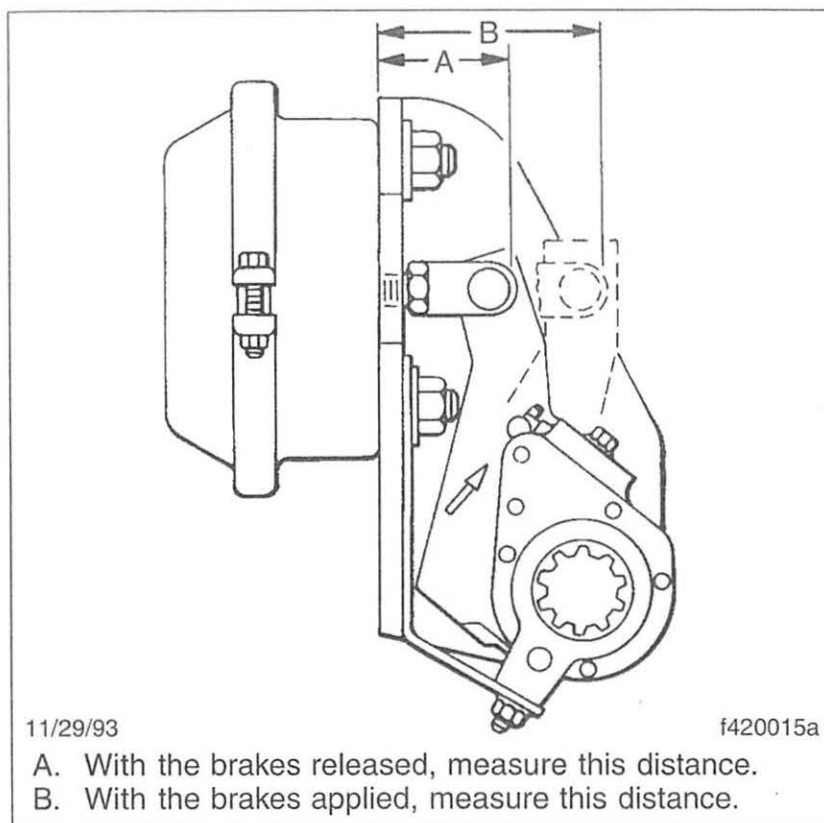


Fig. 11.17, Brake Stroke Check, Haldex Automatic Slack Adjuster

If the stroke is less than the specified range, see **Group 42** in the vehicle workshop manual for adjustment and troubleshooting information.

Apply the parking brakes and remove the chocks from the tires.



CAUTION

Do not hammer on the control arm. This may cause internal damage.

IMPORTANT: Haldex automatic slack adjusters should never need to be adjusted during normal use. The only time they need adjustment is during installation, removal, or to back off the brake shoes during repair work. Constant manual adjustment will shorten internal clutch life.

31.3 For Rockwell Slack Adjusters:

Check the boot for cuts, tears, or other damage. Replace it if necessary.

If the vehicle has new brakes or brakes with new linings, you must check the free-stroke. If the brakes or linings are not new, go to the next step.

With the brakes fully released, measure the distance from the bottom of the brake chamber to the center of the large clevis pin. See **Fig. 11.18**, Ref. A.

Use a pry bar to move the slack adjuster, applying the brakes. Again, measure the distance from the bottom of the brake chamber

Pretrip Inspection and Daily Maintenance

to the center of the large clevis pin. See **Fig. 11.18**, Ref. B.

The difference between the two measurements is the initial free-stroke, and sets the clearance between the linings and the drum. The free-stroke must be 5/8 to 3/4-inch (16 to 19 mm) for drum brakes, or 7/8 to 1-1/8 inch (22 to 29 mm) for disc brakes.

If the free-stroke is incorrect, remove the pressure relief cap screw, spring, and pawl assembly (See **Fig. 11.19**, Ref. 5) from the slack adjuster housing. If equipped with a pull-pawl assembly, See **Fig. 11.20**, carefully insert a screwdriver and raise the relief cap about 1/8 inch (3.2 mm).

Turn the adjusting nut one-eighth turn, as shown in **Fig. 11.21**. Measure the stroke again and adjust until correct.

If removed, install the pawl assembly, spring, and the pressure relief capscrew. Tighten the capscrew 15 to 20 lbf·ft (20 to 27 N·m) or, remove the screwdriver from the pull-pawl assembly (if equipped).

Check for correct brake chamber stroke:

- With the brakes fully released, measure the distance from the bottom of the brake chamber to the center of the

large clevis pin. See **Fig. 11.18**, Ref. A.

- Build air pressure to 100 psi (690 kPa), then shut down the engine. With

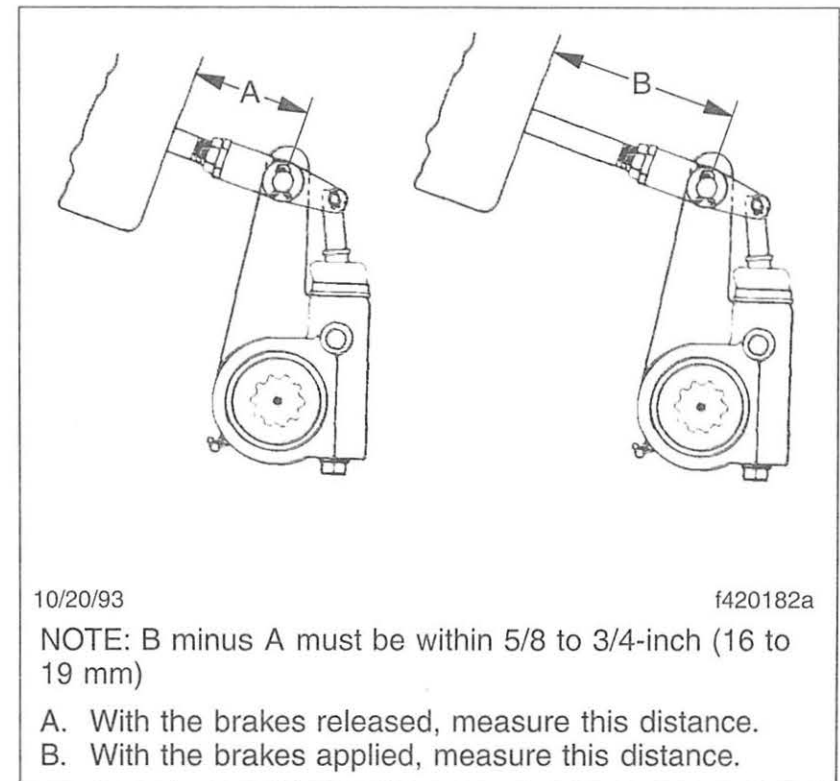


Fig. 11.18, Brake Stroke Check, Rockwell Automatic Slack Adjuster

Pretrip Inspection and Daily Maintenance

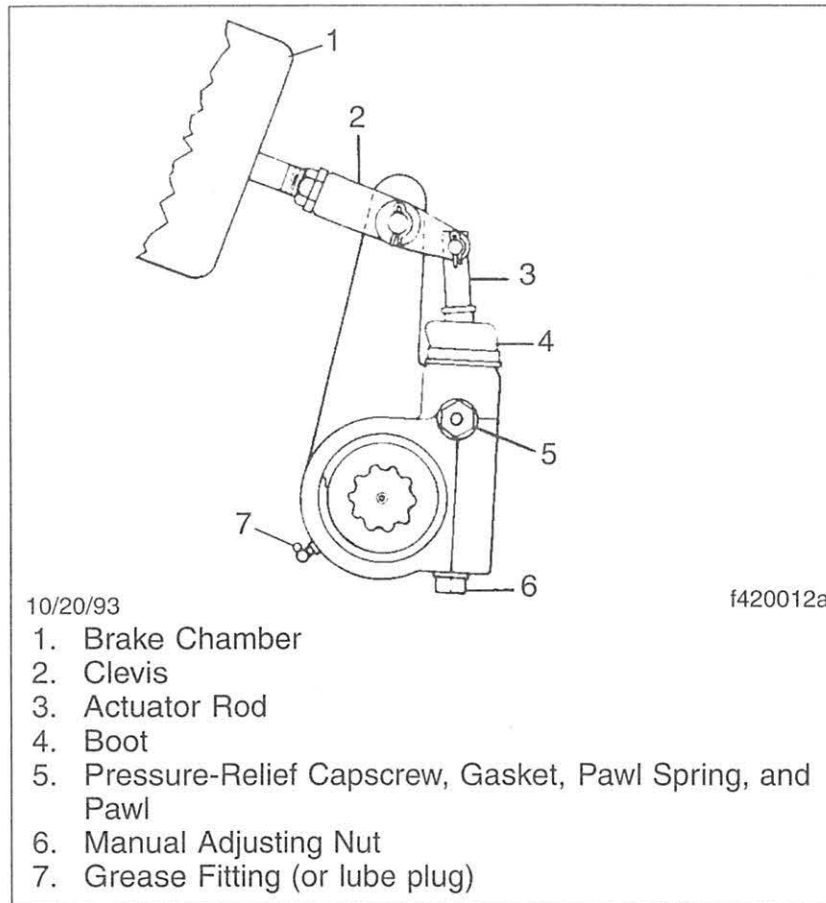


Fig. 11.19, Rockwell Automatic Slack Adjuster

the brakes fully applied, measure the distance from the bottom of the brake

chamber to the center of the large clevis pin. See **Fig. 11.18**, Ref. B.

The difference between measurement A and measurement B is the brake chamber stroke.

The brake chamber stroke must be less than the measurements shown in **Table 11.1**. Long stroke design is indicated by a tag, or embossing, on the brake chamber.

- If the brake chamber stroke is incorrect, remove the pressure-relief capscrew, spring, and pawl assembly (**Fig. 11.19**, Ref. 5) from the slack adjuster housing. If equipped with a pull-pawl assembly (**Fig. 11.20**), carefully insert a screwdriver and raise the relief cap about 1/8-inch (3.2 mm).
- Turn the adjusting nut one-eighth turn (**Fig. 11.21**). Measure the stroke again and adjust until correct.

If the stroke varies or remains greater than the specified range, check brake components, including camshafts, camshaft bushings, anchor pins, rollers, chamber brackets, the clevis, and clevis pins. For instructions, see

Pretrip Inspection and Daily Maintenance

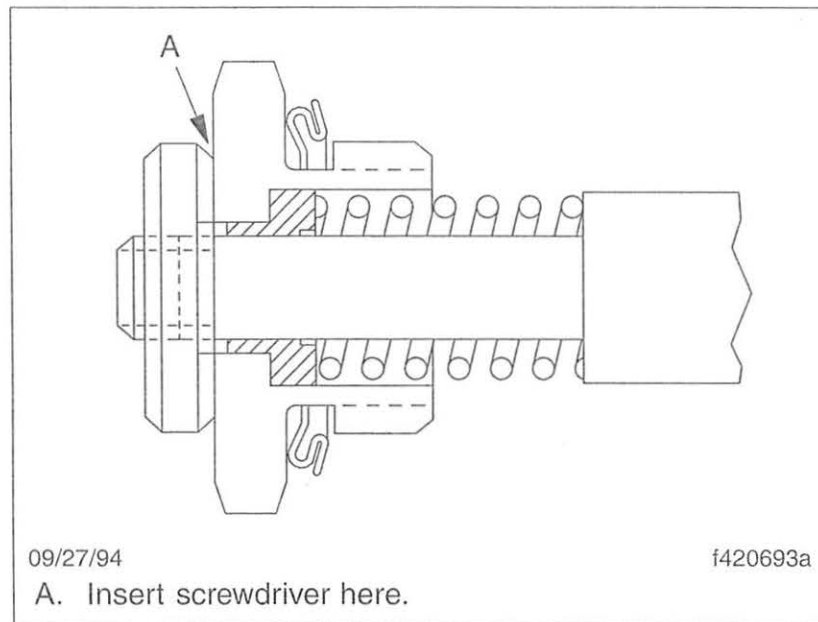


Fig. 11.20, Pull-Pawl Assembly (sectional view)

Group 42 in the vehicle workshop manual.

- If removed, install the pawl assembly, spring, and the pressure-relief cap-screw. Tighten the cap-screw 15 to 20 lbf·ft (20 to 27 N·m) or, remove the screwdriver from the pull-pawl assembly (if equipped).

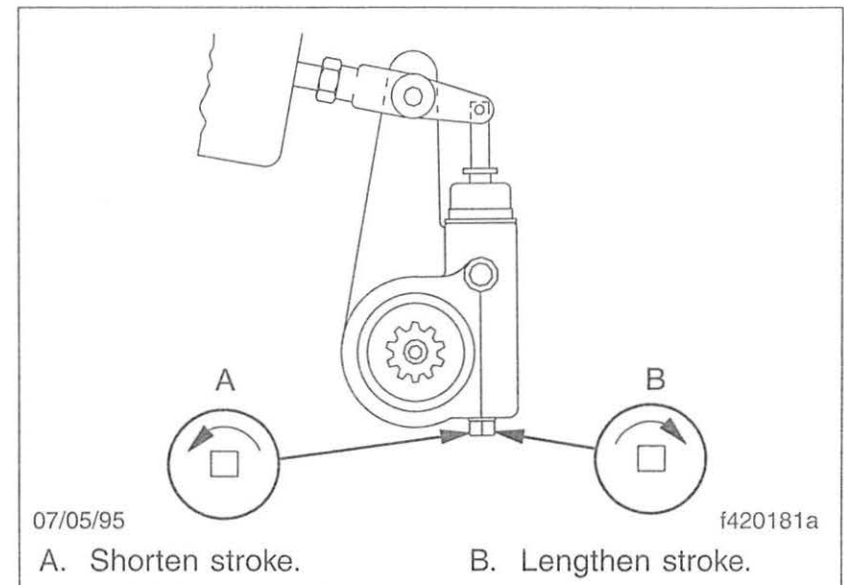


Fig. 11.21, Brake Stroke Adjusting

Pretrip Inspection and Daily Maintenance



CAUTION

Before turning the adjusting nut, remove the pressure-relief capscrew, spring, and pawl assembly. If equipped with a pull-pawl assembly, raise the relief cap as instructed. Failure to do so could strip the teeth on the pawl.

Do not make the adjusted chamber stroke too short. The free-stroke must not be less than the measurements given previously. If the chamber stroke is too short, the linings can drag, which could damage the brake.

IMPORTANT: Do not use installation templates to check the slack adjuster angles. Installation templates are used only when installing a new slack adjuster or reinstalling the existing slack adjuster.

32. Check the inflation pressures of the tires before each trip, using an accurate tire pressure gauge. Tires should be checked when cool. Be sure the valve stem caps are on every tire, and that they are screwed on finger-tight. Inflate the tires to the applicable pressures, if needed.

Refer to **Table 11.2**, **Table 11.3**, and **Table 11.4** for the correct tire inflation pressures for the vehicle load. When traveling at unusual speeds, use **Table 11.5** to adjust tire pressure.

If a tire has been run flat or underinflated, before adding air, check the wheel for proper locking and side-ring seating, and possible wheel, rim, or tire damage.

Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-maintained 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.

33. Inspect the tires for bulges, cracks, cuts, or penetrations. A tire pressure check will assist in uncovering hidden damage; a weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage, and the tire should be inspected and repaired or replaced.

Check the tire tread depth. If tread is less than 4/32 inch (3 mm) on front tires, or less than 2/32 inch (1.5 mm) on rear tires, the tires should be replaced.

Tires should also be inspected for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if

Pretrip Inspection and Daily Maintenance

Size	Load Range Ply Rating	Application	Pressure in psi (kPa)										
			70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)	115 (793)	120 (827)
11R-22.5	G-14	Single Dual	4530 4380	4770 4580	4990 4760	5220 4950	5430 5120	5640 5300	5840 —	6040 —	—	—	—
11R-22.5	H-16	Single Dual	4530 4380	4770 4580	4990 4760	5220 4950	5430 5120	5640 5300	5840 5470	6040 5630	6240 5800	6430 —	6610 —
11R-24.5	G-14	Single Dual	4820 4660	5070 4870	5310 5070	5550 5260	5780 5450	6000 5640	6210 —	6430 —	—	—	—
11R-24.5	H-16	Single Dual	4820 4660	5070 4870	5310 5070	5550 5260	5780 5450	6000 5640	6210 5820	6430 6000	6630 6170	6840 —	7030 —

Table 11.2, Tire Load Limits for Radial Ply Tubeless Tires—Maximum 60 mph (97 km/h)

Size	Load Range Ply Rating	Application	Pressure in psi (kPa)								
			70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)
285/75R 24.5	G-14	Single Dual	4545 4540	4770 4740	4990 4930	5210 5205	5420 5310	5675 5495	5835 5675	6040 —	6175 —
295/75R 22.5	G-14	Single Dual	4500 4500	4725 4690	4945 4885	5155 5070	5370 5260	5510 5440	5780 5675	5980 —	6175 —

Table 11.3, Tire Load Limits for Low Profile Radial Ply Tubeless Tires—Maximum 65 mph (105 km/h)

allowed to contact the tires, will soften the rubber and destroy the tire.

34. Check the wheel nuts or rim nuts for indications of looseness.

Pretrip Inspection and Daily Maintenance

Size	Load Range Ply Rating	Application	Pressure in psi (kPa)										
			65 (448)	70 (483)	75 (517)	80 (552)	85 (586)	90 (621)	95 (655)	100 (689)	105 (724)	110 (758)	115 (793)
10R-22.5	G-14	Single Dual	—	—	4693 4224	4950 4550	5215 4693	5470 4923	5755 5180	6040 5440	—	—	—
10R-24.5	G-14	Single Dual	—	—	4960 4534	5235 4740	5513 4976	5780 5200	6105 5495	6430 5790	—	—	—
255/70R 22.5	H-16	Single Dual	3385 3135	3598 3329	3810 3521	4023 3713	4235 3905	4448 4096	4652 4280	4805 4420	4940 4540	5273 4851	5510 5070
275/80R 22.5	G-14	Single Dual	—	4560 4113	4825 4350	5090 4588	5365 4833	5625 5070	5920 5335	6175 5675	—	—	—
275/80R 22.5	H-16	Single Dual	4155 3680	4435 3920	4715 4168	4990 4425	5260 4675	5535 4930	5805 5175	6080 5415	6345 5650	6615 5883	6940 6175
275/80R 24.5	G-14	Single Dual	—	4520 4070	4775 4300	5030 4530	5280 4755	5530 4980	5767 5245	6005 5510	—	—	—

Table 11.4, Tire Load Limits for Michelin Standard and Low Profile Radial Ply Tubeless Tires—Maximum 65 mph (105 km/h)

34.1 Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes (**Fig. 11.22**), metal build-up around stud holes, or out-of-round or worn stud holes (**Fig. 11.23**), may be caused by loose wheel nuts.

Refer to **Group 40** in the vehicle maintenance manual for torque specifications and the correct tightening sequence.

Pretrip Inspection and Daily Maintenance

Speed Range mph (km/h)	Inflation Pressure Increase in psi (kPa)	Percent Increase/ Decrease in Load
70–75 (113–121)	10 (69)	(–10)
61–70 (98–113)	10 (69)	0
51–60 (82–97)	0	0
41–50 (66–80)	0	+9
31–40 (50–64)	0	+16
21–30 (34–48)	10 (69)	+24
11–20 (18–32)	15 (103)	+32

Table 11.5, Variations in Load and Inflation Limits
According to Speed



CAUTION

Insufficient wheel nut (rim nut) torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values, and follow the proper tightening sequence.

- 34.2 Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks, or other damage.

Refer to **Group 33** or **Group 35** in the vehicle workshop manual for service procedures on the studs and hubs, and to **Group 40** in the same manual for wheel and tire servicing.

- 34.3 Replace broken, cracked, badly worn, bent, rusty, or sprung rings and rims. Be sure that

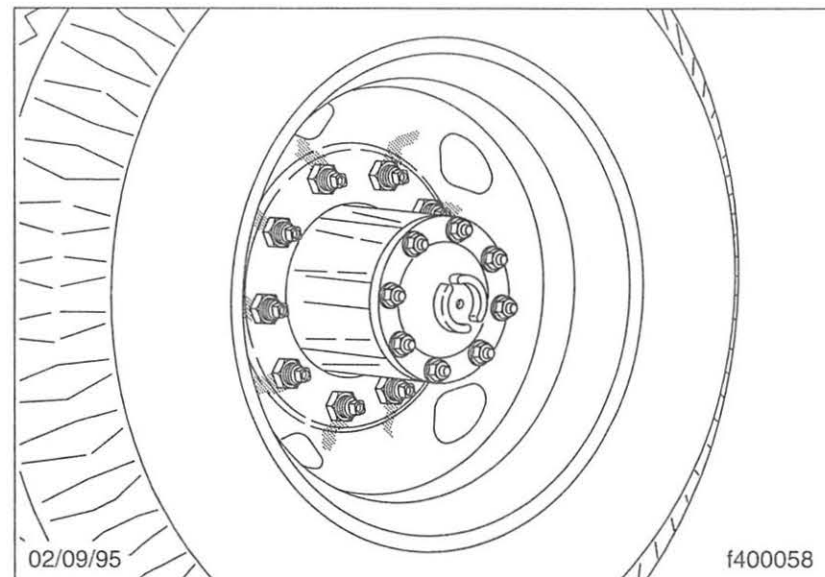


Fig. 11.22, Dirt and Rust Streaks from the Stud Holes

Pretrip Inspection and Daily Maintenance

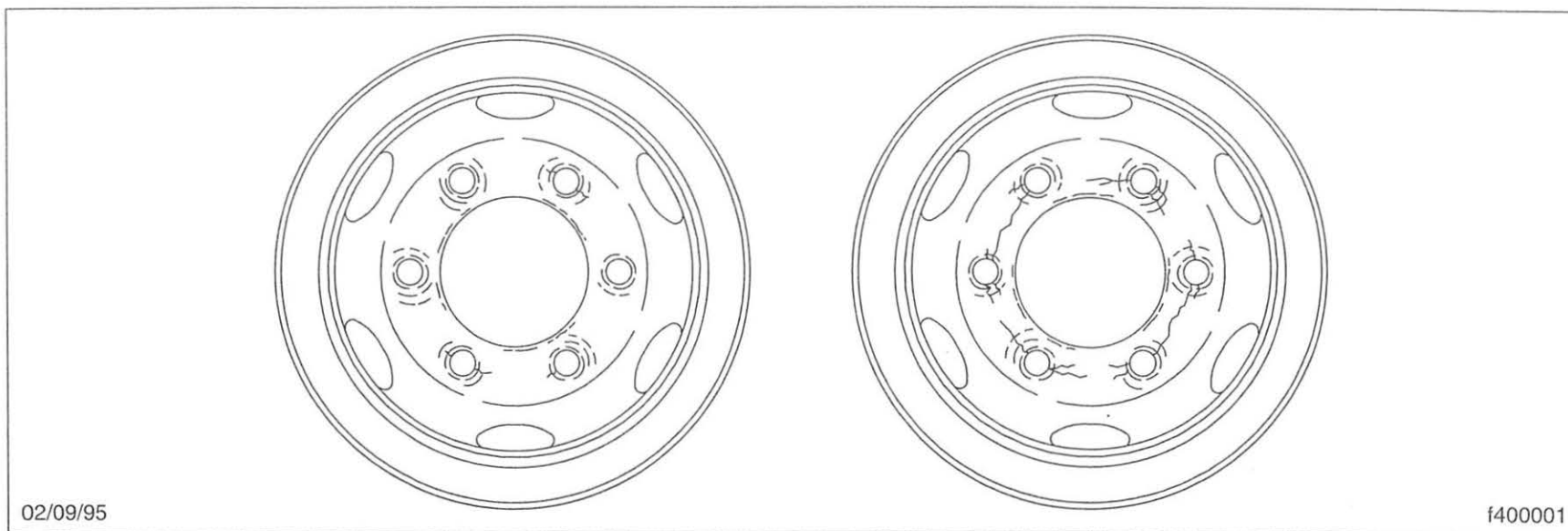


Fig. 11.23, Worn Stud Holes

the rim base, lockring, and side ring are matched according to size and type.



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.

Pretrip Inspection and Daily Maintenance

35. Check components of the air brake system for proper operation, as follows:

35.1 Check the air governor cut-in and cut-out pressures. Run the engine at fast idle. The air governor should cut out the air compressor at approximately 120 psi (827 kPa). With the engine idling, make a series of foot valve applications. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not cut in and out as described above, it must be adjusted to these specifications. If the air governor cannot be adjusted or repaired, replace it before operating the vehicle.

35.2 Check the air pressure build-up time as follows:

For vehicles without a trailer air brake hookup, release the parking brakes on the vehicle by pushing in the parking brake control valve knob. See **Fig. 11.24**.

For vehicles with a trailer air brake hookup, release the parking brakes on the vehicle by pushing in the parking brake control valve knob. See **Fig. 11.25**, Ref. 2. Apply the trailer parking brakes by pulling out the trailer air supply valve knob. See **Fig. 11.25**, Ref. 1.

With the air system fully charged to 120 psi (827 kPa), make one full brake application, and note the air pressure reading on the gauge. Continue to reduce the air pressure by moderate brake applications, to a maximum of 90 psi (620 kPa), then run the engine at governed rpm. If the time required to raise the air pressure to 120 psi (827 kPa) (from the pressure noted after one brake application) is more than 30 seconds, eliminate any leaks, or replace the air compressor, before operating the vehicle.

35.3 Check the air pressure reserve. With the air system fully charged to 120 psi (827 kPa), stop the engine, and note the air pressure. Then make one full brake application, and observe the pressure drop. If it drops more

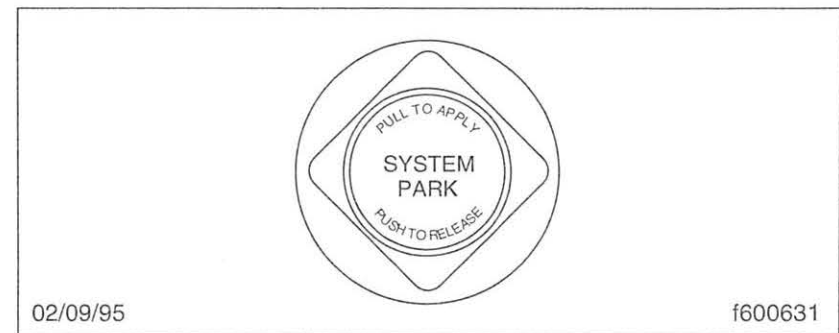


Fig. 11.24, Parking Brake Valve (vehicles without trailer air brake hookup)

Pretrip Inspection and Daily Maintenance

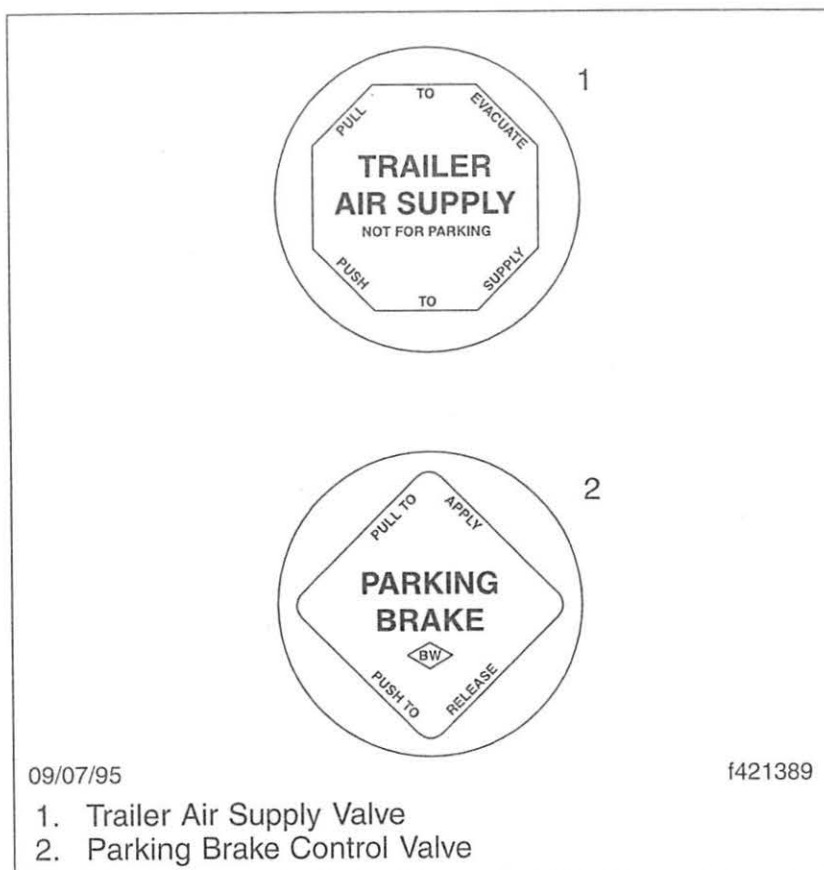


Fig. 11.25, Dash-Mounted Valve Knobs

than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

NOTE: On vehicles with a trailer air brake hookup, charge the trailer-brake system with air by pushing in the trailer air supply valve knob.

35.4 Check the air leakage in the system.

With the parking brakes applied, the transmission out of gear, and the tires chocked, charge the air system until cut-out pressure of 120 psi (827 kPa) is reached.

With the service brakes released, shut down the engine, wait one minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

Charge the air system until cut-out pressure of 120 psi (827 kPa) is reached. With the parking brakes released and the service brake applied, shut down the engine, wait one minute, and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

If leakage exceeds the limits shown in **Table 11.6**, repair all areas of leakage before driving the vehicle.

35.5 On vehicles with a trailer air brake hookup, be sure the trailer brake hand control valve operates the trailer brakes, and not the tractor brakes. Apply the hand control valve, and

Pretrip Inspection and Daily Maintenance

Description	Service Brakes Maximum Allowable Air Leakage in psi (kPa) Per Minute	
	Released	Applied
Truck or Tractor Only	2 (14)	3 (21)
Truck or Tractor w/Single Trailer	3 (21)	4 (28)
Truck or Tractor w/Two Trailers	5 (35)	6 (42)

Table 11.6, Maximum Allowable Service Brake Air Leakage

observe which brakes apply. If the tractor brakes apply, correct the hand control valve plumbing before operating the vehicle.

NOTE: For trailers not equipped with spring parking brakes, the trailer service brakes automatically apply when the trailer air supply valve knob pops out.

- 35.6 On vehicles with a trailer air brake hook-up, check the spring parking brake system by pushing in the trailer air supply valve knob, and releasing the trailer parking brakes. Pull the parking brake control valve knob out; the trailer air supply valve knob must pop out immediately, and the tractor and trailer spring parking brakes must both apply.

With a fully charged air system of 120 psi (827 kPa), push in the parking brake control valve knob. The tractor spring parking brakes should release. Push the trailer air supply valve knob in. With the trailer air system charged to 120 psi (827 kPa), the trailer brakes (spring parking brakes, if so equipped; or service brakes) should release. Pull the trailer air supply valve knob out; the trailer brakes should apply.



WARNING

Before operating the vehicle, be sure the spring parking brakes on the tractor and the spring parking (or service) brakes on the trailer pass the above tests. Otherwise an unexpected parking brake application could occur, causing some loss of vehicle control and possibly resulting in serious personal injury.

36. When starting to move the vehicle, and before picking up speed, test the brakes with the foot valve, hand valve, and parking brake valve, to be sure they will bring the vehicle to a safe stop.
37. Pull the parking brake control valve knob (**Fig. 11.25**, Ref. 2), with the vehicle on a 20 percent grade (the ramp surface should be made of Portland cement or equivalent). If the parking brakes do not hold the vehicle, repair the parking brake system.

Cab Appearance

Cab Washing and Polishing	12.1
Care of Fiberglass Parts	12.1
Care of Chrome Parts	12.1
Dashboard Care	12.2
Vinyl Upholstery Cleaning	12.2
Velour Upholstery Cleaning	12.3

Cab Appearance

Cab Washing and Polishing

To protect the finish of your new vehicle, follow these guidelines carefully:

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle's finish, follow these guidelines:

- Avoid washing your vehicle in the hot sun.
- Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. Before waxing, if the finish has become dull, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Freightliner recom-

mends 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. Rinse it 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 nonabrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

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 vinyl cleaners on the dashboard. Some of these cleaners contain compounds which are damaging to the dash, and may cause it to crack.

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.

Cab Appearance

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 thirty to sixty 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.

In an Emergency

Hazard Warning Lights	13.1
Fire Extinguisher	13.1
Emergency Kit, Optional	13.1
Towing	13.2
Emergency Starting With Jumper Cables	13.4
Fire in the Cab	13.6

In an Emergency

Hazard Warning Lights

The hazard warning light switch tab is located on the turn signal control lever. See **Fig. 13.1**. To operate the hazard lights, pull the tab out. All of the turn signal lights and both of the indicator lights on the control panel will flash.

To cancel the hazard warning lights, push the turn signal control lever either up or down, then return the lever to its neutral position.

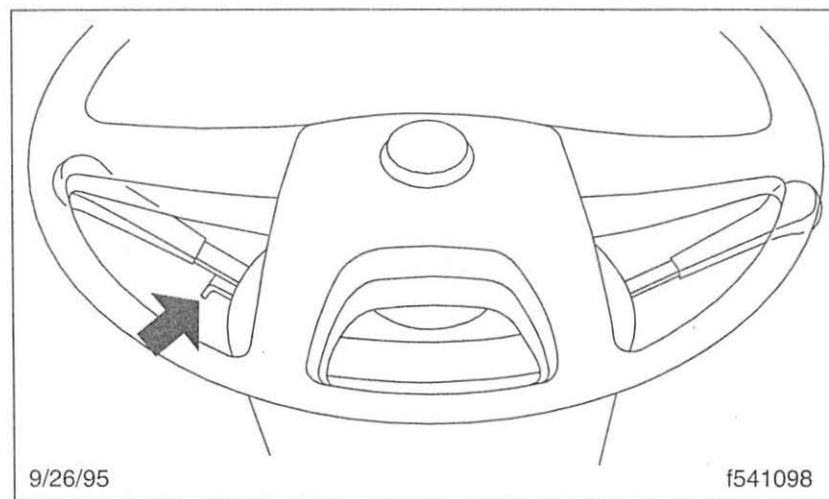


Fig. 13.1, Hazard Warning Light Switch Tab

Fire Extinguisher

A fire extinguisher is located in the cab by the driver's door.

Emergency Kit, Optional

An optional emergency kit package is located between the seats, at the front of the center console, if the vehicle does not have a sleeper compartment. If there is a sleeper compartment, the emergency kit is located elsewhere, depending on vehicle configuration. The package includes one or more of each of the following: first aid kit, a reflective vest, and a triangular-reflector and flare kit.

If there is an emergency while driving, cautiously pull off the road, paying attention to other traffic. Turn on the hazard warning lights. Place the flares and reflector along the side of the road, to alert other drivers that an emergency situation exists.

WARNING

Use extreme care when placing flares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or fire could occur causing serious personal injury.

Towing

When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.



WARNING

Do not tow unbraked vehicles if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWRs) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

Front Towing Hook-Up

1. Disconnect the battery ground cables.



CAUTION

Failure to remove the axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

2. Remove both drive axle shafts. On dual-drive axles, if the vehicle is to be lifted and towed, remove only the rearmost drive axle shafts.

On vehicles equipped with an air fairing, remove both the forward and rearmost drive axle shafts if there is insufficient towing clearance.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out, and will keep contaminants from getting into and damaging the wheel bearings and axle lubricant.



CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

4. On dual-drive axles, if the vehicle is to be lifted and towed, chain the forward rear-axle assembly to the vehicle frame; use protection to keep the chains from damaging the frame.
5. Remove the bumper extension and chrome bumper, if so equipped. Remove the bumper fairing, if so equipped.
6. On vehicles equipped with an air fairing, adjust the trim tab to the lowest position.
7. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.

In an Emergency

8. On vehicles equipped with an air fairing, measure the distance from the ground to the bumper, or from the ground to a frame bracket.
9. Lift the vehicle, and secure the safety chains. If extra towing clearance is needed, remove the front wheels.



WARNING

Failure to lower the vehicle could result in the air fairing striking an overhead obstruction (bridge or overpass), causing vehicle damage or personal injury.

10. On vehicles equipped with an air fairing, repeat the measurement taken in step 8. The difference between the two measurements must not exceed 14 inches (36 cm). If necessary, lower the vehicle.
11. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.



WARNING

Failure to chock the tires or connect the towing vehicle's air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

12. Chock the disabled vehicle's tires, and connect the towing vehicle's air brake system to the vehicle being towed. Then, release the spring parking brakes and remove the chocks.

Rear Towing Hook-Up



CAUTION

Using a rear towing hook-up on a vehicle equipped with a roof fairing could cause damage to the cab structure because of the possibility of excessive wind force.

1. Place the front tires straight forward, and secure the steering wheel in this position.
2. Disconnect the battery ground cables.



CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

3. On dual-drive axles, using protection to keep the chains from damaging the vehicle frame, chain the forward-rear drive axle to the frame.
4. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing

device is the sole responsibility of the towing-vehicle operator.

5. Lift the vehicle, and secure the safety chains. If extra clearance is needed, remove the bumper extension, if equipped.
6. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.

Emergency Starting with Jumper Cables

When using jumper cables, follow the instructions below.



WARNING

Vehicle batteries produce hydrogen gas and can create sparks, possibly leading to an explosion. Do not allow the vehicles to touch each other, and keep sparks, flames, cigarettes, etc. away from batteries. Do not lean over the batteries when making connections, and keep all other persons away from the batteries, otherwise severe personal injury could result from explosion and acid burns.



CAUTION

Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Do not attempt to charge gel cells (isolated batteries) with jumper cables. The gel cell requires a special charger and should be removed from the vehicle before charging. To avoid damage, follow the manufacturer's instructions.

NOTE: On vehicles equipped with an optional jump-start post, attach the positive cable clamp to that post instead of to the battery.

1. Apply the parking brakes and turn off the lights and all other electrical loads.
2. Connect an end of one jumper cable to the positive terminal of the booster battery (or jump-start post, if equipped), and connect the other end of the cable to the positive terminal of the discharged battery (or jump-start post, if equipped). See **Fig. 13.2**.

In an Emergency

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.

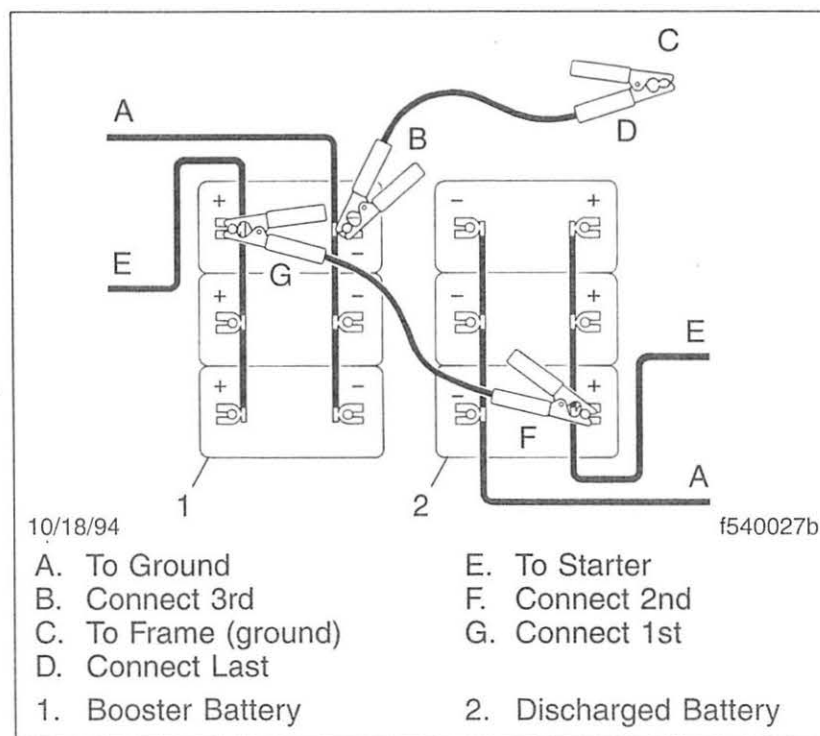


Fig. 13.2, Jumper Connections

3. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to a ground at least 12 inches (300 mm) away from the batteries of the vehicle needing the start. The vehicle frame is usually a good ground. Do *not* connect the cable to or near the discharged batteries.
4. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.
5. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.
6. When the engine starts, let it idle a few minutes.

WARNING

Do the next step exactly as instructed, and do not allow the clamps of one cable to touch the clamps of the other cable, otherwise a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

7. Disconnect the grounded cable from the frame or other non-battery location; then disconnect the other end of the cable.

8. Disconnect the remaining cable from the newly charged battery (or jump-start post, if equipped) first; then disconnect the other end.

Fire in the Cab

The incidence of fire in heavy- and medium-duty trucks is rare, according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab, but despite this, most materials will burn. The cab of this vehicle contains urethane foam, which is of concern in this respect.



Urethane foam is flammable! Do not allow any flames, sparks, or other heat sources such as cigarettes or light bulbs to contact urethane foam. Urethane foam in contact with such heat sources could cause a serious, rapid fire, which could result in death, severe burns, or gas poisoning, as well as damage to the vehicle.

In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

Agency

A	Chapter
Adloner	4
Aspen Dump Valve	2
Automatic Transmissions	8
Antilock Braking System (ABS)	2, 6

Subject	B	Chapter
Back-of-Cab Access		3
Baggage Compartment Doors		3
Battery Box Cover		3
Battery Isolator System		2
Brake System		6
Bunk Restraints		5

Subject	C	Chapter
Cab Access		3
Cab-to-Sleeper Access		3
Cab Washing and Polishing		12
Canadian Motor Vehicle Safety Standard (CMVSS) Labels		1
Cassette Player		2
Caterpillar Engines:		
Cold Weather Operation		7
Engine Break-In		7
Engine Operation		7
Engine Shutdown		7
Engine Starting		7
High Altitude Operation		7
Chrome Parts Care		12
Circuit Breaker, Relay Panel		3

Cleaning, Velour Upholstery	12
Cleaning, Vinyl Upholstery	12
Clutches	7
Controlled Traction Differential, Eaton	9
Controls Identification	2
Cruise Control, Caterpillar Electronic Engines	2, 7
Cruise Control, DDEC III®	2, 7
Cruise Control, CELECT™ Plus	2, 7
Cummins Engines:	
Cold Weather Operation	7
Engine Break-In	7
Engine Operation	7
Engine Shutdown	7
Engine Starting	7
High Altitude Operation	7

Subject	D	Chapter
Daily Maintenance Procedures		11
Dashboard Care		12
DDEC III®, Electronic Engine Operation		2, 7
Detroit Diesel Electronic Engine Control (DDEC III®)		2, 7
Detroit Diesel Engines:		
Cold Weather Operation		7
Engine Break-In		7
Engine Operation		7
Engine Shutdown		7
Engine Starting		7

Differential Lock Operation, Rockwell Main	9
Differential Lockout Operation, Eaton Interaxle	9
Door Locks and Handles, Cab	3
Door Windows and Vent Windows	3
Duraform Fleetcruiser Seat	5

Subject	E	Chapter
Eaton Interaxle Differential Lockout Operation		9
Eaton Single Reduction Axles With Controlled Traction Differential		9
Eaton Two-Speed Tandem Axles		9
Emergency Kit, Optional		13
Emergency Starting With Jumper Cables		13
Engine Brake, Jacobs		2, 7
Engines:		
See Caterpillar Engines, Cummins Engines, or Detroit Diesel Engines		2, 7
EPA Vehicle Noise Emission Control Label		1
Ether Start System		2, 7
Exterior Switches		2

Subject	F	Chapter
Federal Motor Vehicle Safety Standard (FMVSS) Labels		1
Fiberglass Parts Care		12

Fifth Wheels:	
Fontaine 5000 Series	10
Holland	10
Simplex	10
Fire in the Cab	13
Fontaine Fifth Wheels	10
Freightliner/Bostrom Seat	5
Front Towing Hook-Up	13
Fuller Transmissions:	
Straight-Shift Models	8
Range-Shift Models	8
Splitter and Range-Shift Models	8
Deep-Reduction and Range-Shift Models	8

Subject **G** Chapter

Gauge Identification	2
----------------------------	---

Subject **H** Chapter

Hazard Warning Lights	13
Heater	4
Holland Fifth Wheels	10
Holland Trailer Couplings	10
Hood Tilting Instructions	3

Subject **I** Chapter

Indicator Lights Identification	2
Instruments Identification	2
Integral Power Steering	4

Interaxle Differential Lockout, Eaton	9
Interaxle Differential Lockout, Rockwell	9

Subject **J** Chapter

Jacobs Engine Brake	2, 7
Jumper Cables, Emergency Starting	13

Subject **M** Chapter

Main Differential Lock, Rockwell	9
--	---

Subject **N** Chapter

National Cush-N-Aire® II Seat	5
Noise Emission Control Label	1

Subject **P** Chapter

Parking Brake Control Valve	6
Power Steering	6
Premier Trailer Couplings	10
Pretrip Inspection Check List	11
Pretrip Inspection and Daily Maintenance Procedures	11

Subject **R** Chapter

Radio, AM/FM Stereo	2
Rear Towing Hook-Up	13

Rear Axles:	
Eaton Single Reduction Axles With Controlled Traction Differential	9
Eaton Two-Speed Tandem Axles	9
Rockwell Drive Axles With Main Differential Lock	9
Rockwell Single Drive With Traction Equalizer	9
Rockwell Tandem Drive Axles With Interaxle Differential	9
Rockwell Interaxle Differential Lockout Operation	9
Rockwell Main Differential Lock Operation	9
Rockwell Range-Shift Model Transmission	8
Rockwell Splitter and Range-Shift Model Transmissions	8
Rockwell WABCO® Antilock Braking System (ABS)	2, 6

Subject **S** Chapter

Seat Belt Operation	5
Seats	5
Simplex Fifth Wheels	10
Sleeper Access	3
Steering System	6
Steering Wheel, Tilt	2

Index

Switch Identification 2

Subject **T** Chapter

Tether Belt 5
 Tilt Steering Wheel 2
 Tire and Rim Labels 1
 Towing, Front Hook-Up 13
 Towing, Rear Hook-Up 13
 Trailer Couplings:
 Holland 10
 Premier 10
 Trailer Brake Hand Control Valve 6
 Trailer Air Supply Control Valve 6
 Transmissions:
 Allison Automatic Models 8
 Fuller Straight-Shift Models 8

Fuller Range-Shift Models 8
 Fuller Splitter and Range-Shift
 Models 8
 Fuller Deep-Reduction and
 Range-Shift Models 8
 Rockwell Range-Shift Models 8
 Rockwell Splitter and
 Range-Shift Models 8
 Two-Speed Tandem Axle, Eaton 9

Subject **U** Chapter

Upholstery Cleaning:
 Velour 12

Vinyl 12

Subject **V** Chapter

Vehicle Specification Decal 1
 Velour Upholstery Cleaning 12
 Vents, Cab-Door and Sleeper
 Compartment 3
 Vinyl Upholstery Cleaning 2

Subject **W** Chapter

Warning Lights Identification 2
 Water Temperature Gauge 3
 Windows, Door and Vent 3
 Windshield Washer Control 2
 Windshield Wiper Control 2

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