## Introduction

The *Condor*<sup>®</sup> *Operator's Manual* provides information needed to operate and understand the Condor<sup>®</sup> and its components. It is recommended that you read this manual before you operate your vehicle.

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

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

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

# Environmental Concerns and Recommendations

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

## **Event Data Recorder**

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

## **Customer Assistance Center**

Having trouble finding service? Call American LaFrance Customer Assistance Center at 1-800-325-3100 dealer referral, vehicle information, or breakdown coordination. Our people are knowledgeable, professional, and committed to following through to help you keep your vehicle moving.

# **Reporting Safety Defects**

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

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

To contact NHTSA, you may call the Vehicle Safety Hotline toll-free at 1-888-327-4236 (TTY: 1-800-424-9153); go to <u>http://www.safercar.gov</u>; or write to: Administrator, NHTSA, 400 Seventh Street, SW, Washington, DC 20590. You can also obtain other information about motor vehicle safety from <u>http://www.safercar.gov</u>.

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

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

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# **Vehicle Identification**

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#### **Component Information Label**

The component information label (**Fig. 1.1**) is located on the wall below the dash panel on the primary driver's side of the vehicle. The component information label provides the following information:

- vehicle model
- · vehicle identification number
- major component models
- · major assemblies and installations



Fig. 1.1, Component Information Label

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

#### Federal Motor Vehicle Safety Standard (FMVSS) Labels

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

If purchased for service in the U.S., vehicles built without a body have a certification label (**Fig. 1.2**) attached to the left door jamb on vehicles with primary left-hand drive, and to the right door jamb on vehicles with primary right-hand drive. In addition, after the vehicle is completed, a certification label must be attached by the final-stage manufacturer. This label will be located on the left door jamb on vehicles with primary left-hand drive, and on the right door jamb on vehicles with primary right-hand drive. The certification label certifies that the vehicle conforms to all applicable FMVSS regulations in effect on the date of completion.



Fig. 1.2, Labels on Left Door Jamb

#### Canadian Motor Vehicle Safety Standard (CMVSS) Labels

If purchased for service in Canada, vehicles built without a body are certified by a "Statement of Compliance" label (similar to the U.S. certification label) and the Canadian National Safety Mark (**Fig. 1.3**). The "Statement of Compliance" label and the Canadian National Safety Mark must be attached by the final-stage manufacturer after completion of the vehicle. Both labels are affixed to the left door jamb on vehicles with primary left-hand drive, and to the right door jamb on vehicles with primary right-hand drive. The certification label certifies that the vehicle conforms to all applicable CMVSS regulations in effect on the date of completion.

## **Tire and Rim Labels**

Tire and rim labels (**Fig. 1.4**) 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. 1.3, Canadian National Safety Mark

One tire and rim label is located on the left door jamb on vehicles with primary left-hand drive, and on the right door jamb on vehicles with primary right-hand drive. The second tire and rim label is affixed to one page of the incomplete vehicle document.



ing each component in an axle system -including suspension, axle, wheels, and tires - and using the lowest component capacity as the value for the system

Fig. 1.4, Tire and Rim Label

### EPA Vehicle Noise Emission Control Label

A vehicle noise emission control label (**Fig. 1.5**) is attached to the left front door jamb and certifies that the vehicle, as built, meets applicable Federal noise emission control standards.

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



Fig. 1.5, Vehicle Noise Emission Control Label

# 2

# Instruments and Controls Identification

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### **Instrument and Control Panel**

**Figure 2.1** represents a typical sit-down left-handdrive instrument and control panel equipped with all of the standard and many of the optional instruments and controls.

**Figure 2.2** represents a typical sit-down left-handdrive and stand-up right-hand-drive instrument and control panel equipped with all of the standard and many of the optional instruments and controls.

**Figure 2.3** represents a typical sit-down left-handdrive and sit-down right-hand-drive instrument and control panel equipped with all of the standard and many of the optional instruments and controls.

## Controls

Most of the controls are located on the center dash panel. For the location of center dash panel controls:

- See Fig. 2.4 for a sit-down left-hand-drive vehicle;
- See **Fig. 2.5** for a sit-down left-hand-drive and stand-up right-hand-drive vehicle;
- See **Fig. 2.6** for a sit-down left-hand-drive and sit-down right-hand-drive vehicle.

#### Ignition Switch and Key

The ignition switch can be turned to four positions: off, on, start, and accessory. See **Fig. 2.7**. The key can be inserted and removed only in the off position.

With the ignition switch in the off position, whether the ignition key is inserted or not, the low-beam headlights, brake lights, dome lights, clearance lights, identification lights, turn signals, hazard warning lights, parking lights, and the cigarette lighter will operate.

To start the engine, turn the key 90 degrees clockwise until the engine starts. After the engine has started, release the key and it will return to the on position.

In the on position, the key is turned 45 degrees clockwise. With the ignition switch in the on position, all electrical systems are operable. Warning lights and buzzer for low air pressure and low oil pressure operate until the engine is started and minimum pressures are built up. In the accessory position, the key is turned 45 degrees counterclockwise. With the ignition key in the accessory position, the windshield wipers, heated mirrors, backup lights, radio, and all electric gauges operate.

#### Head Lamp Switch

The head lamp switch is a three-position switch. Press the upper end of the HEAD LAMP switch (**Fig. 2.8**) to turn on the headlights, marker lights, taillights, clearance lights, identification lights, and the instrument and control panel lights. Press the lower end of the HEAD LAMP switch to turn on the taillights, marker lights, clearance lights, identification lights, and the instrument and control panel lights. With the head lamp switch in the middle position, all of these lights are off.

# Instrument and Control Panel Dimmer Switch

The instrument and control panel lights can be brightened by moving the dimmer switch lever (**Fig. 2.8**) up, or dimmed by moving the lever down. To turn the instrument and control panel lights off, move the lever all the way down.

#### Daytime Running Lights, Optional

The daytime running lights are turned on when the engine is started, the parking brake is released, and the headlight switch is in the off position. The daytime running lights illuminate the headlights at a reduced intensity during daytime driving. These lights are not to be used in place of the headlights during reduced visibility or nighttime driving conditions.

For vehicles built to operate in Canada, daytime running lights are required.

# WARNING

When the daytime running lights are on, only the headlights are illuminated at a reduced intensity. The marker lights, taillights, and trailer lights are not illuminated. Turn the headlights on at dusk. Using the daytime running lights at night could cause an accident resulting in personal injury or property damage.



Fig. 2.1, Instrument and Control Panel for a Sit-Down Left-Hand-Drive Vehicle

#### Interior Lights

An interior light with one white bulb and one red bulb is mounted on the cab ceiling. The white light automatically comes on when one of the cab doors is opened and the ignition switch is in the on position. The white light can also be manually turned on by pressing the dimpled end of the light. The red light must be manually turned on by pressing the dimpled end of the light.

#### Left-Hand/Right-Hand Drive Switch

A left-hand/right-hand drive switch is located on the center control panel on vehicles with dual drive. Press the upper (LH) end of the switch to transfer control of the throttle and transmission to the left-hand drive. Press the lower (RH) end of the switch to transfer control of the throttle and transmission to the right-hand drive. A guard surrounding the switch helps to prevent the switch from being moved to the opposite position unintentionally.

NOTE: Both sets of service brakes and steering controls on dual drive vehicles are always operable regardless of which position the left-hand/ right-hand drive switch is in.

# WARNING

When driving in the standing position, do not exceed 20 mph (32 km/h). Driving faster than 20 mph (32 km/h) in the standing position could result in loss of vehicle control and possible personal injury, death, or property damage.





#### Power Mirror Switch, Optional

The position of the door-mounted and cab-mounted mirrors is controlled by the power mirror switch located on the center dash panel.

To move the left-side mirror, press the left arrow on the rocker portion of the power mirror switch; press the right arrow to move the right-side mirror. After pressing either the left arrow or right arrow on the rocker switch, press the upper portion of the power mirror switch in one or more directions until the mirror is positioned as needed.

#### Mirror Heat Switch, Optional

The door-mounted and cab-mounted mirrors can be heated to keep them defrosted. Press the upper end of the MIRROR HEAT switch to heat the mirrors. When the mirror heat switch is on, a mirror icon is visible on the switch.

#### Power Window Switch

The power window switches are located on the center control panel. Press the lower end of the POWER WIN-DOW switch to lower the window. Press the upper end of the POWER WINDOW switch to raise the window.

# Instruments and Controls Identification



Fig. 2.3, Instrument and Control Panel for a Sit-Down Left-Hand-Drive and Sit-Down Right-Hand-Drive Vehicle

#### Hazard Warning Light Switch

The hazard warning light switch is located on the center control panel. Press the upper end of the HAZARD switch to turn the hazard warning lights on.

#### **Cigarette Lighter**

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

#### **Power Outlet**

A 12V-10A power outlet is located on the center control panel. The power outlet can be used for a cell phone or other accessory items that need 12V charging.



- Traction Control Differential Switch, Optional 8.
- Spare Gauge/Switch Location 9.

- 16. Trailer Air Supply Knob, Optional
- 17. Obstacle Detection Monitor, Optional

#### Fig. 2.4, Center Dash Panel Controls for a Sit-Down Left-Hand-Drive Vehicle

#### Traction Control Differential Switch, Optional

The traction control differential switch locks the differential case, gearing, and rear axle shafts together to provide maximum traction in unfavorable driving conditions such as mud or ice. The traction control differential lock should not be used when favorable driving conditions exist.

Move the traction control differential switch to the LOCK position while maintaining a constant vehicle speed of 25 mph (40 km/h). The indicator on the switch comes on when the switch is in the LOCK position. A guard surrounding the switch helps to prevent the switch from being moved to the LOCK position unintentionally. See Chapter 7 for complete operating instructions.

# Instruments and Controls Identification



#### 01/12/2001

- 1. Cigarette Lighter
- 2. Power Outlet
- 3. Ammeter, Optional
- 4. Mirror Heat Switch, Optional
- 5. Power Mirror Switch, Optional
- 6. Auto Neutral Switch, Optional
- 7. Interaxle Differential Switch
- 8. Traction Control Differential Switch, Optional
- 9. Spare Gauge/Switch Location
- 10. Heater and Air Conditioner Controls

- 11. Left-Hand Power Window Switch
- 12. Right-Hand Power Window Switch
- 13. Ignition Switch
- 14. Hazard Warning Light Switch
- 15. Optional Switch
- 16. Parking Brake Knob
- 17. Obstacle Detection Monitor, Optional
- 18. Head Lamp Switch
- 19. Primary Air Pressure Gauge
- 20. Secondary Air Pressure Gauge

#### Fig. 2.5, Center Dash Panel Controls for a Sit-Down Left-Hand-Drive and Stand-Up Right-Hand-Drive Vehicle

#### Interaxle Differential Switch

The interaxle differential switch locks the axles on a tandem drive together so that both axles turn together at the same speed. The interaxle differential lock 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.

Move the interaxle differential switch to the LOCK position when improved traction is required. The indicator on the switch comes on when the switch is in the LOCK position. A guard surrounding the switch helps to prevent the switch from being moved to the LOCK position unintentionally. See **Chapter 7** for complete operating instructions.

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#### Fifth Wheel Slide Switch, Optional

The fifth wheel slide switch allows the operator to adjust the air slide fifth wheel forward or rearward from inside the cab. Move the fifth wheel slide switch to the UNLOCK position to unlock the fifth wheel slide mechanism. Changes can now be made to the total length of the tractor-trailer and to the axle load to comply with state or provincial regulations. When the fifth wheel is in the correct position, move the switch to the LOCK position to lock the fifth wheel to the baseplate.



01/12/2001

- 1. Cigarette Lighter
- 2. Power Outlet
- 3. Ammeter, Optional
- 4. Mirror Heat Switch, Optional
- 5. Power Mirror Switch, Optional
- 6. Auto Neutral Switch, Optional
- 7. Interaxle Differential Switch
- 8. Traction Control Differential Switch, Optional
- 9. Spare Gauge/Switch Location
- 10. Heater and Air Conditioner Controls

- 11. Left-Hand Power Window Switch
- 12. Left-Hand/Right-Hand Drive Switch
- 13. Ignition Switch
- 14. Hazard Warning Light Switch
- 15. Right-Hand Power Window
- 16. Parking Brake Knob
- 17. Trailer Air Supply Knob, Optional
- 18. Obstacle Detection Monitor, Optional
- 19. Optional Switch

#### Fig. 2.6, Center Dash Panel Controls for a Sit-Down Left-Hand-Drive and Sit-Down Right-Hand-Drive Vehicle

The indicator on the switch comes on when the switch is in the UNLOCK position. A guard surrounding the switch helps to prevent the switch from being moved to the UNLOCK position unintentionally.

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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.

#### **Electric Horn**

To sound the electric horn, push the button in the center of the steering wheel.

#### Air Horn, Optional

To sound the air-operated horn, pull the cable located above the cab door.







6. Instrument and Control Panel Dimmer Switch

Fig. 2.8, A Panel Controls

#### Parking Brake Knob

Pull the PARKING BRAKE knob out to apply the parking brakes. Push the knob in to release the parking brakes. Before the parking brakes can be released, the air pressure in the air system must be at least 65 psi (448 kPa).

#### Trailer Air Supply Knob, Optional

After the vehicle and air hoses are connected to a trailer and the pressure in the air system is at least 65 psi (448 kPa), the TRAILER AIR SUPPLY 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 knob must be pulled out.

#### Turn Signal/Windshield Wiper Lever

#### **Turn Signals**

The turn signal lever is located on the left side of the steering column. Push the lever up to turn the right-turn signal on. Pull the lever down to turn the left-turn signal on. The turn signal lever will return to the neutral position after the turn has been completed.

#### **Windshield Wipers**

To turn the windshield wipers on, turn the windshield wiper lever. There are three intermittent wiper speeds, a standard speed, and a fast speed. See **Fig. 2.9**.



Fig. 2.9, Windshield Wiper Speeds

# 

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

#### Windshield Washers

To turn the windshield washer on, push the button (**Fig. 2.10**) on the end of the windshield wiper lever in. Windshield washer fluid will continue to spray as long as the button is pushed in.

#### **High-Beam Head Lamps**

Push the turn signal lever away from you to change the head lamps from low beam to high beam.



Fig. 2.10, Turn Signal/Windshield Wiper Lever

#### **Flash to Pass**

Pull the turn signal lever toward you and release the lever to momentarily ash the high-beam head lamps when the head lamps are off.

#### Work Brake

To use the work brake, come to a complete stop and turn the work brake (**Fig. 2.11**) to the ON position. The work brake operates the front and rear brakes. The work brake uses less air than the parking brakes and therefore, doesn't deplete the air in the system. Turn the work brake to the OFF position when ready to operate the vehicle.



Fig. 2.11, Work Brake

Do not use the work brake to stop the vehicle. Using the work brake to stop the vehicle may increase the stopping distance, which may cause an accident resulting in injury, death, or vehicle damage.

#### Retarder Switch, Optional

Push the upper end of the retarder switch, labeled RTRDR, to apply the exhaust brake, engine brake, driveline retarder, or transmission retarder. See **Chapter 5** for additional information on the retarder systems.

NOTE: If the cruise control is on, the exhaust brake cannot be used.

#### Battery Shutoff Switch, Optional

The battery shutoff switch, located on the side of the battery box (**Fig. 2.12**), cuts off all battery power to the vehicle. The switch can be locked in the off position.



Fig. 2.12, Battery Shutoff Switch

The switch is used when workshop procedures require that the batteries be disconnected. It is also used when the vehicle is placed out of service for extended periods to prevent battery discharge.

#### Utility Light Switch, Optional

The utility light is mounted at the back of the cab. The utility light switch (**Fig. 2.13**) is located below the wind-shield washer fluid reservoir.

#### Automatic Transmission Shift Selector

The Allison MD and HD automatic transmissions come with a push button shift selector. See **Chapter 7** for the push button shift selector operating instructions.



Fig. 2.13, Utility Light and Switch

#### **Instrument Pod**

The instrument pod (**Fig. 2.14**) is located on the steering column and contains the following features:

- a speedometer
- a tachometer
- an engine oil pressure gauge
- a high-beam head lamp indicator
- a check engine indicator
- the Speedometer Message Center
- turn signal indicators

See **Fig. 2.15** for Speedometer Message Center displays.

#### Speedometer

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



10. High-Beam Head Lamp Indicator

Fig. 2.14, Instrument Pod



Fig. 2.15, Speedometer Message Center Displays

#### Tachometer

The tachometer indicates engine speed in revolutions per minute (rpm) and serves as a guide for shifting the transmission and keeping the engine in the appropriate rpm range. For low idle and rated rpm, refer to the engine identification plate.

#### Engine Oil Pressure Gauge

The oil pressure gauge should read as shown in **Table 2.1**.

Oil Pressure*				
Engine Model	Oil Pressure at Idle Speed: psi (kPa)	Oil Pressure at Rated rpm: psi (kPa)		
Cummins ISC, ISL	10 (70)	30 (207)		
Cummins CG+, ISM	10 (70)	40–50 (276–345)		
Caterpillar CFE/ 3126B	6 (41)	48 (331)		
Caterpillar C-11, C-13	10 (70)	52 (359)		

Oil pressures are given with the engine at operating temperature. With the engine cold, oil pressure may be higher Table 2.1, Oil Pressure

#### Speedometer Message Center

The Speedometer Message Center (SMC) provides information in a liquid crystal display (LCD) within the speedometer. The SMC displays:

- an odometer (not resettable)
- · two resettable trip odometers
- an hour meter (not resettable)
- diagnostics

The mode button, located on the speedometer, is used to scroll through the displays on the speedometer message center. The SMC default display is the odometer. To view a different display, press and release the mode button until the desired display appears.

The SMC display goes blank when the ignition is turned off. Press either the mode button or the set button to reactivate the display. The display will remain on for 10 seconds. If a warning alarm is triggered, a warning message will override all other displays until the condition that caused the warning alarm is corrected. The warning message may be temporarily overridden by pressing the set button.

#### **Trip Odometer Operation**

- To display the trip odometer 1 or trip odometer 2, press and release the mode button until 1 XXXX or 2 XXXX is displayed. XXXX represents the actual mileage reading.
- 2. To reset a trip odometer to zero, display the odometer to be reset.
- 3. Press the set button until zeros are displayed.

#### **Diagnostic Test Modes**

The diagnostic test modes are used to confirm the operation of the gauges, LEDs, and the warning and indicator lights. The ignition key must be in the ON position to display the diagnostics in the SMC.

Automatic Test Procedure

- 1. To display diagnostics, press the mode button until DIAGTST is displayed.
- 2. Press the set button to enter the test mode.
- 3. Press the mode button until AUTO (automatic) is displayed.
- 4. Press the set button to start the automatic test.
- 5. The gauges and warning and indicator lights will cycle with MIN, MID, MAX, and LED messages in the display. Verify that the gauges and warning and indicator lights function as follows:
  - MIN–All gauges point to zero-scale. All the warning LEDs and warning and indicator lights are off.
  - MID–All gauges point to mid-scale. All the warning LEDs are off and the warning and indicator lights display pattern A (**Fig. 2.16**).
  - MAX–All gauges point to full-scale. All the warning LEDs are off and the warning and indicator lights display pattern B (**Fig. 2.16**).
  - LED–All gauges point to zero-scale. All the warning LEDs and the warning and indicator lights are on.

- 6. All gauges, warning LEDs, and warning and indicator lights must function as described.
- 7. When the test is complete, press the set or mode button to stop the test.
- 8. Press the mode button until EXIT appears.
- 9. Press the set button to return to normal operation.



Fig. 2.16, Patterns Displayed During Automatic Test Procedure

#### Manual Test Procedure

- 1. To display diagnostics, press the mode button until DIAGTST is displayed.
- 2. Press the set button to enter the test mode.
- 3. Press the mode button until MANUAL is displayed.
- 4. Press the set button to start the manual test.
- 5. Press the mode button to scroll through the menu until the name of the gauge you want tested is displayed. To test a warning or indicator light, stop when LB1 (lightbar) is displayed.
- 6. Press the set button to enable the test for the selected item.
- 7. Press the set switch again to cycle through each test. You must continue pressing the set button to cycle through the test.

- 8. Verify that the gauge or warning or indicator light behaves as follows:
  - MIN–The gauge points to zero-scale and its warning LED is off.
  - MID-The gauge points to mid-scale and its warning LED is off.
  - MAX-The gauge points to full-scale and its warning LED is off.
  - LED-The gauge points to zero-scale and its warning LED is on.
- Cycle through TT1 to TT15 to verify that the correct warning or indicator light is on as indicated in the SMC display.
- 10. Press the mode button to scroll through the menu until EXIT appears.
- 11. Press the set button to exit the manual mode and return to normal operation.

#### Warning Alarms and Messages

A warning alarm indicates that some condition in the vehicle requires attention. A warning alarm can be indicated in the following ways:

- · a message in the SMC
- a lit LED in a gauge
- an audible alarm from the SMC

A warning alarm will continue until the condition that caused the alarm is corrected or the set button is pressed. Once the condition has been corrected, the SMC will display a reset message for 10 seconds and the warning indications will cease.

See **Table 2.2** for the warning messages that may appear in the SMC.

Press the MODE button to display another function. Warning messages will reappear every 20 seconds until the alarm condition is corrected.

SMC Messages					
Message	Condition	Associated Gauge LED	Warning Alarm	Reset Message	
AIR1 LO	Primary air pressure below setpoint	Primary Air Pressure	Yes	AIR1 OK	
AIR2 LO	Secondary air pressure below setpoint	Secondary Air Pressure	Yes	AIR2 OK	
OIL LO	Oil pressure below setpoint	Engine Oil Pressure	Yes	OIL OK	
H2OT HI	Water temperature above setpoint	Water Temperature	Yes	H2OT OK	
OILT HI	Oil temperature above setpoint	Engine Oil Temperature	Yes	OILT OK	
TRAN HI	Transmission temperature above setpoint	Main Transmission Oil Temperature	Yes	TRAN OK	

Table 2.2, SMC Messages

#### Instruments and Gauges

All of the gauges have a warning light, but not all of the warning lights are used. See **Table 2.3** for the conditions that activate the warning lights.

#### Voltmeter

The voltmeter (**Fig. 2.17**) indicates the vehicle charging system voltage when the engine is running and the battery voltage when the engine is stopped. By monitoring the voltmeter, the driver can be aware of potential charging system problems and have them xed before the batteries discharge enough to create starting difficulties.

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

If the voltmeter shows an undercharged or overcharged condition for an extended period, have the charging system and batteries checked at a repair facility.

#### Transmission Oil Temperature Gauge

With an Allison automatic transmission, the transmission oil temperature gauge (**Fig. 2.17**) reading should not exceed 250°F (121°C) during normal operation.



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.

Gauge Warning Light Activation			
Gauge	Condition When On	Activating Condition	
Engine Oil Pressure	Too low	Programmable	
Voltmeter	Too low or too high	>15 volts or <10 volts	
Transmission Oil Temperature	Too high	Programmable	
Primary and Secondary Air Pressure	Too low	65 psi (448 kPa) or less	
Fuel Level	1/8 tank or less	210 ohms or more from sensor	
Water (Coolant) Temperature	Too high	Programmable	
Drive Axle(s) Oil Temperature Gauge	Too high	230°F (110°C) or higher	
Intake Air Restriction	Clogged	25 inH <sub>2</sub> 0ormore	
Brake Application Air Gauge	Not used	Not activated	
Ammeter	Incorrect charging	Charge rate >50 amps or discharge rate > 25 amps	

Table 2.3, Gauge Warning Light Activation



Fig. 2.17, Instrument Cluster

# Primary and Secondary Air Pressure Gauge

The air pressure gauge (**Fig. 2.17**) registers the constant pressure in the air system. Normal pressure, with the engine running, is 95 to 125 psi (655 to 862 kPa). A low-air-pressure warning light and alarm come on when air pressure in the system drops below a minimum pressure of 62 to 68 psi (427 to 469 kPa). When the engine is started, the warning light and alarm remain on until the air pressure exceeds minimum pressure.

#### Fuel Level Gauge

The fuel gauge (Fig. 2.17) indicates the level of fuel in the fuel tank(s).

#### Water Temperature Gauge

During normal engine operation, the water (coolant) temperature gauge (**Fig. 2.17**) 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 2.4**, inspect the cooling system to

determine the cause. Refer to **Section 20.00** of the *Condor*<sup>®</sup> *Workshop Manual* for troubleshooting and repair procedures.

Maximum Water (Coolant) Temperature		
Engine Model	Maximum Coolant Temperature: °F (°C)	
Caterpillar	220 (104)	
Cummins	212–225 (100–107)	

Table 2.4, Maximum Water (Coolant) Temperature

#### Drive Axle(s) Oil Temperature Gauge, Optional

During normal operation, the drive axle oil temperature gauges should read between 150 to 230°F (65 to 110°C). Under heavy loads, such as when climbing steep grades, temperatures up to a maximum of 250°(121°C) 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.

#### Intake-Air Restriction Indicator

The intake-air restriction indicator, located behind the cab at the air cleaner (**Fig. 2.18**), measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the indicator stays locked at or above the value shown under the Service inH<sub>2</sub>O heading in **Table 2.5** after the engine is shut down, replace the air filter, then reset the indicator by pressing the reset button.

NOTE: Avoid opening the air cleaner and disturbing the seals or air filter until the indicator stays locked at or above the value shown in **Table 2.5**.

Intake-Air Restriction Indicator Values			
Engine Type	Initial inH <sub>2</sub> O	Service inH₂O	
Caterpillar	15	25	
Cummins	10	25	

Table 2.5, Intake-Air Restriction Indicator Values



Fig. 2.18, Intake-Air Restriction Indicator

#### Intake-Air Restriction Gauge, Optional

The intake-air restriction gauge (**Fig. 2.8**), located on the instrument and control panel, measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the LED on the gauge is lit, the air filter needs to be replaced.

#### Brake Application Air Gauge, Optional

A brake application air gauge (**Fig. 2.8**) 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 service brake is depressed.

#### Ammeter, Optional

The ammeter indicates the current flowing to and from the battery. A positive reading indicates that the charging system is supplying enough power to operate all the electrical accessories in use and the battery charge is being maintained. A negative reading indicates that the electrical accessories are consuming more power than the charging system can supply and the batteries are being discharged. A slightly negative reading may be corrected by increasing the engine idle speed. If the negative reading is high, some electrical equipment should be shut off to reduce the electrical load.

## Warning and Indicator Lights

See Fig. 2.19 for the warning and indicator lights layout.



- 10. Retarder Active Indicator
- 11. Air Restriction Indicator
- 12. Low Air Pressure Warning
- 13. Transmission Temperature Warning
- 14. Water in Fuel Indicator
- 15. Parking Brake Indicator

Fig. 2.19, Instrument Cluster

#### Stop Engine Warning

The stop engine (STOP ENG) warning light comes on when the engine is not functionally properly. Move the vehicle out of traffic and shut down the engine immediately.

#### Power Takeoff Indicator

The power takeoff (PTO) indicator comes on when the PTO is in use.

#### **Grid Heat Indicator**

The GRID HEAT indicator comes on when the grid heater (or air intake warmer) is warming up. Start the engine after the indicator turns off.

#### Low Air Pressure Warning

The low air pressure warning light (LOW AIR) comes on and an alarm sounds when the air pressure in the primary air reservoir drops below 64 to 76 psi (441 to 524 kPa).

#### **ABS Warning**

The ABS (Antilock Braking System) warning light comes on when the safety circuit senses a failure in any part of the ABS system. If the ABS warning light stays on after the engine has been started, there is a malfunction in the antilock brake system. See **Chapter 5** for more information on the ABS.

The ABS warning light is also used during diagnostics to display blink codes. For troubleshooting with blink code diagnostics, see **Group 42** of the *Condor*<sup>®</sup> *Workshop Manual*.

#### ATC Warning

The ATC (Automatic Traction Control) warning light comes on if the vehicle is equipped with traction control and if one of the drive wheels spins during acceleration. The ATC warning light will come on and remain on if there is a fault in the traction control system.

#### **Cruise Indicator**

The CRUISE indicator comes on when the cruise control is in use.

#### **Check Transmission Indicator**

The check transmission (CHECK TRANS) indicator is a standard feature of the Allison MD and HD Series transmissions. The CHECK TRANS indicator comes on when the temperature in the sump exceeds 250°F (121°C) or when the temperature in the retarder exceeds 330°F (166°C). When the check transmission indicator stays on after vehicle start-up, the ECU indicates a diagnostic code. For more information on this feature, see **Chapter 7**.

#### Park Brake Indicator

The PARK BRAKE indicator comes on when the parking brake is applied. If the indicator does not go off after releasing the parking brake, correct the problem before continuing to operate the vehicle. The alarm sounds when the vehicle is moving at a speed greater than 2 mph (3 km/h) with the parking brake set.

#### Water in Fuel Indicator

The WATER IN FUEL indicator comes on when there is water in the fuel/water separator. The water should be drained from the fuel/water separator at the next convenient time. For instructions on how to drain the fuel/ water separator, see **Chapter 9**.

The fuel/water separator is an optional feature.

#### Transmission Temperature Warning

The transmission temperature (TRANS TEMP) warning light comes on when the transmission-to-cooler oil temperature reaches  $300^{\circ}$ F ( $149^{\circ}$ C). If the warning light comes on, stop the vehicle and put the transmission into neutral. Accelerate the engine from 1200 to 1500 rpm to allow the transmission to return to a normal temperature of 160 to 220°F (71 to 104°C) before resuming operation. Check the transmission oil fluid level.

#### **Neutral Indicator**

The NEUTRAL indicator comes on when the auto neutral switch is on.

#### Air Restriction

The air restriction indicator comes on when the air filter needs cleaning or changing.

#### **Retarder Active Indicator**

The retarder active (RTD ACTIVE) indicator comes on when the engine brake, exhaust brake, driveline retarder, or transmission retarder is on.

#### Low Battery Voltage Warning

The low battery voltage warning light comes on when the battery voltage is low.

# 3

# **Vehicle Access and Features**

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## **Cab Door Locks**

The key that operates the ignition switch also locks and unlocks the cab doors from the outside, with the exception of the folding door on a stand-up-drive vehicle. The folding door has a separate cab door key.

To unlock the left-side door from outside the cab, insert the ignition key (or the cab door key for a folding door) in the lock and turn the key counterclockwise. Pull the handle out to open the door. To lock the left-side door from the outside, insert the key in the lock and turn the key clockwise.

To unlock the right-side door from outside the cab, insert the ignition key (or the cab door key for a folding door) in the lock and turn the key clockwise. Pull the handle out to open the door. To lock the right-side door from the outside, insert the key in the lock and turn the key counterclockwise.

To lock the left-or right-side door from inside the cab, with the exception of the folding door, push down the lock button (**Fig. 3.1**).

To unlock the left-or right-side door from inside the cab, with the exception of the folding door, lift up on the lock button.

## **Folding Door**

A folding door is provided on vehicles with stand-up drive. The folding door can be opened, folded up, and secured to the cab when frequent exits and entries are being made. A restraint that extends across the opening of the door is also provided. See **Fig. 3.2**.

Use the following instructions to fold and secure the folding door.

- 1. Open the folding door until it is at a 90-degree angle to the cab.
- 2. Lift the lower portion of the door until the door striker is connected to the latch. Lock the door in the folded position by locking the outer door lock.
- 3. Move the folded door back toward the cab until the door striker is connected to the finger latch.

Use the following instructions to unfold and close the folding door.

1. Lift up on the finger latch (**Fig. 3.3**) to release the door from its secured position to the cab.



2. Move the folded door away from the cab until it is

- at a 90-degree angle to the cab.
- 3. Unlock the door lock.
- 4. Place one hand on the lower portion of the door to prevent the door from unfolding too quickly. With one hand on the door, use your other hand to pull the door handle out to release the door from its folded position. See **Fig. 3.4**.



Fig. 3.2, Stand-Up Drive Entry

## Cab Entry and Exit

## 

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 Vehicle from the Left Side

- 1. Open the left-side door and place anything you are carrying in the cab.
- 2. Grasp the cab grab handle with your right hand and the door grab handle with your left hand.

 Place your left foot on the cab access step (Fig. 3.1).



Fig. 3.3, Finger Latch

- 4. Move your right foot to the lower cab step and place your left foot on the upper cab step.
- 5. Grasp the steering wheel and pull yourself into the cab.

#### Exiting the Vehicle from the Left Side

- 1. Grasp the steering wheel with your left hand and move your left foot to the lower cab step.
- 2. Grasp the cab grab handle with your right hand, the door grab handle with your left hand, and place your right foot on the cab access step.
- 3. Step to the ground with your left foot first.

# Entering the Vehicle from the Right Side

1. Open the right-side door and place anything you are carrying in the cab.



Fig. 3.4, Unfolding the Door

- 2. Grasp the cab grab handle with your left hand and the door grab handle with your right hand.
- 3. Place your right foot on the cab access step.
- 4. Move your left foot to the lower cab step and place your right foot on the upper cab step.
- 5. Grasp the seat with your left hand and pull yourself into the cab.

#### Exiting the Vehicle from the Right Side

- 1. Grasp the door grab handle with your right hand, grasp the seat with your left hand, and move your right foot to the lower cab step.
- 2. Grasp the cab grab handle with your left hand and place your left foot on the cab access step.
- 3. Step to the ground with your right foot first.

# Entering a Stand-Up-Drive Vehicle from the Right Side

- 1. Open the right-side door and place anything you are carrying in the cab.
- 2. Place your right hand on the interior grab handle (**Fig. 3.5**).



Fig. 3.5, Stand-Up Drive Entry

3. Place your left foot on the cab floor, grasp the steering wheel with your left hand, and pull yourself into the cab.

# Exiting a Stand-Up-Drive Vehicle from the Right Side

- 1. Grasp the interior grab handle with your right hand and the steering wheel with your left hand.
- 2. With your left foot on the cab floor, lower your right foot to the ground.

# Entering a Stand-Up-Drive Vehicle from the Left Side

- 1. Open the left-side door and place anything you are carrying in the cab.
- 2. Place your left hand on the interior grab handle.
- 3. Place your right foot on the cab floor, grasp the steering wheel with your right hand, and pull your-self into the cab.

# Exiting a Stand-Up-Drive Vehicle from the Left Side

- 1. Grasp the interior grab handle with your left hand and the steering wheel with your right hand.
- 2. With your right foot on the cab floor, lower your left foot to the ground.

## **Front Cab Access Panel**

The front cab access panel, when open, allows the operator access to the steering gears, air conditioner condenser, and the power takeoff (PTO) when it is mounted on the front frame.

To open the access panel, place your fingers under the lower edge of the access panel at the corners and press the latches. See **Fig. 3.6**. The right-side latch has a secondary safety latch. After the left-side latch has released, continue to press on the right-side latch to release the secondary latch. Release the support rod (**Fig. 3.7**) and place the end of the support rod in the grommet under the access panel.

To close the access panel, remove the support rod from the grommet and return it to its stored location. Close the access panel and make sure the latches are secure.

#### **Cab Tilt System**

The cab can be tilted open 42 degrees to access the engine and other components. A hydraulic pump, located behind the right side of the cab, is used to operate the hydraulic cab tilt mechanism. Refer to **Fig. 3.8**.

For instructions on maintaining the fluid level in the hydraulic pump and checking the cab tilt system, refer to **Group 60** of the *Condor*<sup>®</sup> *Maintenance Manual*.



Fig. 3.6, Opening the Front Cab Access Panel



Fig. 3.7, Front Cab Access Panel

Do not use the tilt cylinder or tilt cylinder rod as a step or hand-hold. To do so could damage the transmission, tilt cylinder, or tilt cylinder rod.



Fig. 3.8, Cab Tilt Pump

#### Raising the Cab

IMPORTANT: Before raising or lowering the cab, read the warning label on the hydraulic pump.

- 1. With the vehicle parked on a level surface, shut down the engine, place the transmission in neutral, and apply the brakes.
- 2. Secure all loose items in the cab and make sure the doors are securely latched.

Objects falling in the cab or a door flying open could damage the vehicle or cause personal injury.

- 3. Make sure there are no people or objects in the path the cab will be traveling.
- 4. Move the pump control lever to the TILT position.
- 5. Remove the pump handle from behind the primary driver's seat and attach it to the pump.
- 6. Raise and lower the pump handle several times to unlock the cab mounts.

IMPORTANT: Check the indicator pin on each cab mount. The cab mounts are unlocked if the pins are out. See **Fig. 3.9**.

NOTE: If air is present in the hydraulic tilt system, the pump operation may seem spongy or ineffective. If this happens, bleed the air from the system. For instructions, refer to **Group 60** of the *Condor*<sup>®</sup> *Workshop Manual*.

7. Continue to operate the pump handle until the cab is tilted open about 30 degrees.



Fig. 3.9, Cab Mount Indicator Pin

IMPORTANT: If the cab stops moving while it is being raised, don't force it to move with the tilt pump. The velocity fuses have locked up the tilt cylinders. To unlock the tilt cylinders, see "Hydraulic Lockup of Cab Tilt System."

8. Put the safety stop on the right tilt cylinder in place. See **Fig. 3.10**. The safety stop prevents the cab from dropping below a specific angle.



Make sure the safety stop is engaged on the right tilt cylinder rod. If the safety stop isn't engaged, and the cab should drop, the result could be serious injury or death.

9. Continue to operate the pump handle until the cab has reached the 42-degree, fully open position.



Fig. 3.10, Safety Stop In Place

#### Lowering the Cab

## DANGER

Stay completely clear of the cab's travel path at all times. Once the safety stop has been released, don't lean over the frame rails, the engine, or the transmission for any reason. To do so could result in serious injury or death.

- 1. Secure all loose items in the cab and make sure the doors are securely latched.
- 2. Make sure the parking brakes are applied and there are no obstructions in the cab travel path.
- 3. Pull the safety stop release cable to lift the safety stop. Continue pulling on the safety stop release cable until the safety stop no longer rests on the tilt cylinder rod. See **Fig. 3.11**. The cab may need to

be raised if the safety stop is resting against the tilt cylinder rod.

4. Move the pump control lever to the RETURN position. The cab will automatically begin to return to the operating position.

# NOTE: To slow the descent of the cab, reverse the tilt pump lever.

 After the cab is completely lowered, check the indicator pin on each cab mount. The cab mounts are locked when the pins have moved back into the piston and cylinder spring assembly. If the pins are out (Fig. 3.9), the cab mounts are not locked. Raise and lower the pump handle until the cab is completely lowered and the cab mounts are locked.



Fig. 3.11, Safety Stop Released

IMPORTANT: If the cab stops moving while it is being lowered, don't force it to move with the tilt pump. The velocity fuses have locked up the tilt cylinders. To unlock the tilt cylinders, see "Hydraulic Lockup of Cab Tilt System."

6. Make sure the pump control lever is in the RETURN position.
7. Remove the pump handle and return it to its stored location.

## Hydraulic Lockup of Cab Tilt System

Hydraulic lockup can occur for the following reasons:

- very cold weather
- use of the wrong hydraulic fluid
- air in the system
- sudden cab movement
- a ruptured hydraulic line

Any of the above situations will cause the velocity fuses to function as safety check valves and lock up the tilt cylinders. To unlock the cylinders, the cab must be moved in the opposite direction of travel.

IMPORTANT: If the tilt cylinders lock up, check for a major problem, such as a ruptured line or leaking fitting, before trying to unlock the tilt cylinders. If such a problem is found, make any necessary repairs before unlocking the cylinder.

If the cab is moving toward the fully open position when the lockup occurs, move the pump control lever to the RETURN position and raise and lower the pump handle for a few strokes. This will unlock the cylinders. Move the pump control lever to TILT and allow the cab to raise to a fully open position.

If the cab is moving toward the lowered position when the lockup occurs, move the pump control lever to the TILT position and raise and lower the pump handle for a few strokes. This will unlock the cylinders. Move the pump control lever to RETURN and allow the cab to lower to the operating position.

# Tilt and Telescoping Steering Column

## WARNING

Make sure that the steering column is locked before driving the vehicle. Never tilt or telescope the steering wheel while driving the vehicle. Doing so could cause loss of vehicle control, personal injury, and property damage. To tilt the steering column, turn the knob (**Fig. 3.12**) on the side of the steering column and tilt the column to the desired position. Tighten the knob and make sure the steering column is locked in place.

To telescope the steering column, turn the knob on the side of the steering column and pull the steering wheel closer to you or push the steering wheel farther away. Tighten the knob and make sure the steering column is locked in place.

## Seats

When adjusting the seat, all adjustments should be made while seated, unless otherwise noted, and before the engine is started. The seats featured in this section may not have all of the adjustments described for each seat.



Fig. 3.12, Tilt and Telescoping Steering Column



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

## Bostrom® Talladega™ 915 Seat

#### **Back Cushion Tilt**

To tilt the back cushion, lean slightly forward to remove pressure from the cushion and hold the back cushion

tilt lever (**Fig. 3.13**) down. Lean backward slowly to the desired position and release the lever to lock the cushion in place.

#### **Height Adjustment**

To raise the seat, push the upper end of the height adjustment switch. To lower the seat, push the lower end of the height adjustment switch.

#### Fore and Aft Seat Adjustment

Move the fore and aft seat adjustment lever to the side to adjust the seat forward or backward to the desired position. Move the lever back to its original position to lock the seat in place.

#### **Bottom Cushion Tilt Adjustment**

Turn the bottom cushion tilt adjustment knob to increase or decrease the bottom cushion tilt.

# 09/24/1999 1. Back Cushion 2. Upper and Lower Lumbar Support Switches 3. Height Adjustment Switch 4. Bottom Cushion Tilt Adjustment Knob 5. Fore and Aft Seat Adjustment Lever

Fig. 3.13, Bostrom Talladega 915 Seat

#### Lumbar Support

For seats with air lumbar support, use the upper and lower lumbar support switches to adjust the top lumbar and bottom lumbar supports.

#### National 2000 Series Seat

#### **Back Cushion Tilt**

To tilt the back cushion, turn the back cushion tilt knob (**Fig. 3.14**) until the desired position is reached.

#### **Height Adjustment**

To raise or lower the height of the seat, use the height adjustment switch on the side of the seat.

#### Fore and Aft Seat Adjustment

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



7. Rear Cushion Adjustment Knob

Fig. 3.14, National 2000 Series Seat

#### **Rear Cushion Adjustment**

To adjust the height of the rear of the seat cushion, remove your weight from the seat and turn the rear cushion adjustment knob to one of three positions.

#### Isolator

Also called a Chugger Snubber, the isolator reduces the amount of road shock by isolating the occupant from the motion of the vehicle and allowing the seat to move in a simple pendulum motion. To use the isolator feature, turn the isolator handle to the horizontal position. Turn the isolator handle down when the isolator feature is not desired.

#### Lumbar Support

To adjust the lumbar support, use the lumbar support switch on the side of the seat to give more or less support to your lower back.

#### **Bottom Cushion Front Height**

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

### National 2000 Series Toolbox Seat

The National 2000 Series toolbox seat features an open storage area under the seat. See **Fig. 3.15**.



- 3. Fore and Aft Seat Adjustment Lever
- 4. Back Cushion Tilt Knob
- 5. Storage Area

#### Fig. 3.15, National 2000 Series Toolbox Seat

#### **Back Cushion Tilt**

To tilt the back cushion, turn the back cushion tilt knob until the desired position is reached.

#### Fore and Aft Seat Adjustment

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

#### Lumbar Support

To adjust the lumbar support, turn the lumbar support knob on the side of the seat to give more or less support to your lower back.

#### **Bottom Cushion Front Height**

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

### Stand-Up Seat

The stand-up seat can be adjusted for stand-up or sitdown use. The back of the seat has four forward positions and one rearward position. To adjust the position of the seat back, pull forward on the seat back adjustment handle (**Fig. 3.16**), adjust the seat to the desired position, and release the handle. When the seat back is in one of the five positions, the seat back adjustment handle will snap back into place.

To adjust the height of the stand-up seat, pull up on the height adjustment handle. Adjust the height of the seat to the desired position and push the height adjustment handle down.

## Seat Belts and Tether Belts

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

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

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



Fig. 3.16, National 2000 Series Seat

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 that 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.

Refer to **Chapter 9** for the seat belt inspection procedure.

## Seat Belt Operation

#### **Three-Point Seat Belt**

While your vehicle is in motion, the combination lap and shoulder belt adjusts to your movement. However, if you brake hard, corner hard or if your vehicle receives an impact of 5 mph (8 km/h) or more, the lap and shoulder belt locks and prevents you from moving.



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

## 

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

- 1. Pull the lap-shoulder portion of the belt from the retractor so that the shoulder portion of the belt crosses your shoulder and chest. Insert the belt tongue into the proper buckle until you hear a snap and feel it latch.
- 2. Tighten the lap portion of the belt, pull up on the shoulder piece until it fits you snugly. The belt should rest as low on your hips as possible.
- 3. To unbuckle the three-point seat belt, push the button on the buckle as shown in **Fig. 3.17**.



Fig. 3.17, Releasing the Three-Point Seat Belt

## Stand-Up Drive Seat Belt and Restraint Operation

When the vehicle is equipped with a stand-up drive, a lap belt and a separate shoulder harness are provided. When the seat in a stand-up drive is used in the stand-up position, use the retractable lap seat belt. Pull the belt across your hips and insert the tongue into the buckle until you hear a snap and feel it lock. Make sure the buckle is securely fastened.

A restraint (**Fig. 3.2**) that extends across the opening of the door should also be used when driving in the standup position with the folding door open. Pull the restraint from the side of the cab behind the seat and hook it into the eyebolt on the side of the cab in front of the door.

When the seat in a stand-up drive is used in the sitdown position, first pull the lap belt across your hips and insert the tongue into the buckle until you hear a snap and feel it lock. Then pull the shoulder harness across your chest and attach it to the pin on the lap belt buckle. See **Fig. 3.18**. Make sure both the belt and the harness are securely fastened.

## Obstacle Detection System, Optional

For instructions on how to use the monitors provided for the obstacle detection system, refer to the monitor manufacturer's operating instructions.

# Relay, Fuse, and Circuit Breaker Identification

There are three power distribution modules (PDM) located under the electrical access panel on the tunnel. For identification of the components on each of the three PDMs, refer to Fig. 3.19, Fig. 3.20, and Fig. 3.21 and Table 3.1, Table 3.2, and Table 3.3.

A set of dill blocks is located in the upper right overhead panel on vehicles with primary left-hand drive. For identification of the components on the dill block, refer to **Fig. 3.22** and **Table 3.4**.



Fig. 3.18, Stand-Up Drive Seat Belt

Power Distribution Module Number 1			
Pos. No.	Description	Part Number	Rating
F1	Overhead Accessory Power	BUS21120 00	20A
F2	Windshield Wipers	BUS21120 00	20A
F3	Amot/Axle Lock/Tag Axle	BUS21175 00	7.5A
F4	ABS Ignition Power	BUS21175 00	7.5A
F5	Engine Ignition Power	BUS21115 00	15A
F6	Trailer Power	BUS21120 00	20A
F7	Left-Hand Power Window	BUS21120 00	20A
F8	Power Mirror Control	BUS21115 00	15A
F9	Right-Hand Power Window	BUS21120 00	20A
F10	Fuel/Water Separator	BUS21120 00	20A
F11	Transmission Ignition Power	BUS2111000	10A
F12	Air Dryer	BUS21115 00	15A
F13	Air Tank Drain Heaters	BUS2111500	15A
F14	Air Tank Drain Heaters	BUS2111500	15A
F15	Gauges	BUS21175 00	7.5A
F16	HVAC Low, Med. Blower Motor	BUS2111500	15A
R1	Windshield Wipers, High	PAC12077866	—
R2	Right-Hand Wiper, Low	PAC12077866	—
R3	Left-Hand Wiper, Low	PAC12077866	—
R4	Tag Axle	PAC12077866	—
D1	Windshield Wiper Park Cut Out	PAC12135037	—

Table 3.1, Power Distribution Module Number 1



#### Fig. 3.19, PDM Number 1 Relay and Circuit Breaker Identification

Power Distribution Module Number 2			
Pos. No.	Description	Part Number	Rating
F1	Turn Signal	BUS21120 00	20A
F2	Service Brake	BUS21120 00	20A
F3	Horn	BUS21175 00	7.5A
F4	Spare	—	—
F5	Spare	—	_
F6	Diagnostic	BUS21110 00	10A
F7	Ignition Switch	BUS21115 00	15A
F8	Headlights	BUS2112000	20A
F9	HVAC High Speed	BUS21120 00	20A
F10	Power Receptacle	BUS2112000	20A
F11	Overhead Battery Power	BUS21120 00	20A
F12	Instrument Panel Backlighting	BUS21115 00	15A
F13	Marker Lights	BUS21120 00	20A
R1	Road/Fog Lights	PAC12077866	

Table 3.2, Power Distribution Module Number 2

Power Distribution Module Number 2			
Pos. No.	Description	Part Number	Rating
R2	Headlight	PAC12077866	—
R3	HVAC High	PAC12077866	—
R4	Instrument Panel Backlighting	PAC12077866	_
R5	Marker Lights	PAC12077866	—

Table 3.2, Power Distribution Module Number 2

Power Distribution Module Number 3			
Pos. No.	Description	Part Number	Rating
F1	Neutral	BUS21115 00	15A
F2	Cigar	BUS21110 00	10A
F3	Reverse	BUS21120 00	20A
F4	Cigar	BUS21110 00	10A
F5	Trailer Tail Lights	BUS21120 00	20A
F6	Beacon Light	BUS21115 00	15A
F7	Trailer Marker Lights	BUS21120 00	20A
F8	Spare	_	
R1	Park Brake	PAC12077866	
R2	Backup Lights/Alarm	PAC12077866	—
R3	Trailer Tail Lights	PAC12077866	
R4	Trailer Marker Lights	PAC12077866	—
R5	Neutral	PAC12077866	
R6	Neutral Start	PAC12077866	—
R7	Starter Lockout	PAC12077866	—
R8	Spare		_

Table 3.3, Power Distribution Module Number 3

## **Vehicle Access and Features**



Fig. 3.20, PDM Number 2 Relay and Circuit Breaker Identification

Dill Block			
Pos. No.	Description	Part Number	Rating
CB1	CB Radio (positive)	_	
CB2	CB Radio (negative)	_	—
F1	Spare	_	_
F2	Marker Lights	BUS21175 00	
F3	Rear Fans	BUS21175 00	
F4	CB Radio	BUS21215 00	
F5	Radio Memory	BUS21175 00	
F6	Front Fans	BUS21175 00	
F7	Radio	BUS21215 00	
F8	Camera	BUS21215 00	
R1	Spare	_	—
R2	Marker Lights	PAC12077866	—

Table 3.4, Dill Block



Fig. 3.21, PDM Number 3 Relay and Circuit Breaker Identification



Fig. 3.22, Dill Block Identification

# 4

# **Heater and Air Conditioner**

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## Heater and Air Conditioner

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

A three-speed fan forces fresh or recirculated air through the air outlets at the windshield, door windows, dash panel, and cab floor. If equipped with air conditioning, an air conditioning on/off lever is installed with the fan switch.

An air selection switch controls the direction of warm or cool air through the dash panel outlets to either the windshield (defrost), the feet, face, and windshield, or the feet and face. An air source lever is installed with the air selection switch and is used to select fresh air or recirculated air.

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

The louvers in the dash panel outlets can be adjusted to the left and right, and up and down by turning the dial on one end of the outlet. The dash panel outlets can be opened or closed by turning the dial on the other end of the outlet.

The windshield outlets also have dials that can be turned to adjust the louvers and to open and close the louvers. The door window outlets on either end of the dash panel are not adjustable.

# Defogging and Defrosting Using Fresh Air

- Turn the temperature control switch all the way clockwise for warm air, turn the fan switch to off, and if equipped, move the air conditioning on/off lever 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 the highest speed. Leave it in this position for 30 seconds. This will clear the system of moist air.
- 4. Move the air selection switch to the windshield (defrost) position, turn the air source lever to the

fresh air position, and if equipped, move the air conditioning on/off lever to the on position as shown in **Fig. 4.2**. In this position warm, dry air is directed to the windshield.



Fig 4.1, Climate Control Panel



Fig 4.2, Climate Control Panel

IMPORTANT: To prevent the buildup of fumes or odors (for example from smoking) and to prevent

oxygen depletion inside the cab, do not operate the heater and air conditioning system with the air source lever in the recirculated air position for more than 20 minutes.

NOTE: At the defrost position, airflow is directed to the windshield outlets and the door window outlets.

## Heating

- 1. With the engine at operating temperature, move the temperature control switch all the way clockwise for heat.
- 2. Turn the fan switch to the desired speed.
- 3. Move the air source lever to the fresh air position and move the air selection switch to the desired setting. See **Fig. 4.3**.





IMPORTANT: If the windows start to fog, move the air selection switch to the windshield (defrost) position, and if equipped, move the air conditioning on/off lever to the on position. Make sure the fan is on.

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

4. When a comfortable temperature has been reached, adjust the fan switch setting and tempera-

ture control switch as needed to maintain the temperature.

IMPORTANT: To prevent the buildup of fumes or odors (for example from smoking) and to prevent oxygen depletion inside the cab, do not operate the heater and air conditioning system with the air source lever in the recirculated air position for more than 20 minutes.

## Air Conditioning, Optional

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

- 1. If the cab is hot inside, temporarily open the windows to let the hot air out.
- 2. Move the air conditioning on/off lever to the off position and turn the fan switch off before starting the engine.
- 3. Start the engine.
- 4. Move the air conditioning on/off lever to the on position and move the air selection switch to the position where the air ow is directed to the face and feet. See **Fig. 4.4**. Then select fresh or recirculated air with the air source lever.



Fig 4.4, Air Conditioning Settings

IMPORTANT: If the outside air is dusty or smoky, set the air source lever to the recirculated air position and keep the windows and vent closed to prevent drawing in dust or smoke.

- 5. Move the temperature control switch counterclockwise for cool air. In this position, no heat is given off by the heater.
- 6. Turn the fan switch to the highest speed.
- 7. As soon as cool air is owing from the dash panel outlets, close the windows. Adjust the fan switch setting as desired.
- 8. If the air from the outlets is too cold, move the temperature control switch clockwise for warmer air flow.

IMPORTANT: To prevent the buildup of fumes or odors (for example from smoking) and to prevent oxygen depletion inside the cab, do not operate the heater and air conditioning system with the air source lever in the recirculated air position for more than 20 minutes.

## Fresh Air

1. Move the air source lever to the fresh air position. Move the air selection switch to the desired position.

- 2. Move the temperature control switch counterclockwise for no heat, or move it clockwise for heat.
- 3. Turn the fan switch to the desired speed.

IMPORTANT: To prevent the buildup of fumes or odors (for example from smoking) and to prevent oxygen depletion inside the cab, do not operate the heater and air conditioning system with the air source lever in the recirculated air position for more than 20 minutes.

# 5

# Steering, Brake, and Retarder Systems

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## **Steering System**

When there is no load on the vehicle and the front tires are pointed straight ahead, the steering wheel spokes should be evenly centered, or within 10 degrees of being centered. See **Fig. 5.1**. For steering wheel adjustment procedures, see **Group 46** in the *Condor*<sup>®</sup> *Workshop Manual*.



Fig. 5.1, Steering Wheel Centered

### Power Steering System

The power steering system consists of a steering gear (which includes a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder), hydraulic hoses, power steering pump, power steering 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 is corrected.

## WARNING

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

Drivers should use the power available with a power steering system carefully. 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.

## Air Brake System

A dual air brake system consists of two independent air brake systems that use a single set of brake controls. Each system has its own reservoir, plumbing, and brake chambers. The primary air system operates the service brakes on the rear axle; the secondary air system operates the service brakes on the front axle. On tractor-trailer combinations, the 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 air system causes the rear service brakes to become inoperative. The front brakes will continue to be operated by the secondary air system. In addition, trailer brakes will be operated by the secondary air system.

Loss of air pressure in the secondary air system causes the front axle brakes to become inoperative. The rear service brakes and trailer brakes will continue to be operated by the primary air system.

IMPORTANT: When air pressure is lost in the primary or secondary air system, the air compressor will operate but will not replenish the air supply in the air system that is not leaking. There will only be enough air in the other system to get the vehicle stopped. Therefore, it is important to bring the vehicle to a safe stop and not drive the vehicle until the cause of the problem is corrected.

Vehicles are equipped with spring brake modulation. If an air pressure loss occurs in the primary air system, the rear spring brakes will be modulated (applied and released) in proportion to the service brake application. There will only be enough air in the secondary system for two to four brake applications, at which time the parking brake knob will pop out and fully apply the brakes.

Before driving your vehicle, allow time for the air compressor to build up a minimum pressure of 95 psi (655 kPa) in both the primary and secondary air systems. Monitor the air pressure system by observing the primary and secondary air pressure gauges 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 low air pressure 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 air system pressure gauges to determine which system has low air pressure. Although vehicle speed can be reduced using the service brake, either the front or rear service brakes will have reduced stopping power or will not be operating, causing a longer stopping distance. Bring the vehicle to a safe stop and have the air system repaired before continuing.

If both the primary and secondary air systems become inoperative on tractor-trailers, the trailer service brakes or spring parking brakes will automatically apply when the air pressure drops below 35 to 45 psi (241 to 310 kPa). The tractor spring parking brakes will automatically apply when the air pressure drops below 20 to 30 psi (138 to 207 kPa). On trucks, spring parking brakes will apply when the air pressure drops below 20 to 30 psi (138 to 207 kPa). Do not wait for the brakes to apply automatically. When the low air pressure warning light and buzzer first come on, immediately bring the vehicle to a safe stop. Before continuing to operate the vehicle, correct the cause of the air loss.

## WARNING

Do not drive the vehicle with the parking brakes caged. If the vehicle is driven with the parking brakes caged, there would be no means of stopping the vehicle if a complete loss of air pressure occurred. This could result in serious personal injury or vehicle damage.

IMPORTANT: Before caging the spring parking brakes, make the connection to a towing vehicle or chock the tires.

NOTE: Before a vehicle with insufficient system air pressure can be moved, the spring parking brakes must be released by applying an external air source at the gladhands, or by manually caging (manually releasing) the parking brake springs.

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

### Operation of the Air Brakes

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

During normal brake stops, depress the service brake 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.

The parking brake knob (**Fig. 5.2**) on the control panel applies the parking brake valve. Pulling out the knob applies both the tractor and the trailer spring parking brakes and automatically causes the trailer air supply knob to pop out.



Fig. 5.2, Parking Brake Knob

If the vehicle is equipped for trailer towing, a trailer air supply knob (**Fig. 5.3**) on the control panel applies the trailer air supply valve. After the air hoses from the vehicle are connected to the trailer and the pressure in both air systems is at least 65 psi (448 kPa), the trailer air supply 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 also 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 (241 to 310 kPa), the trailer air supply knob automatically pops out exhausting the trailer air supply and applying the trailer service or spring parking brakes.



Fig. 5.3, Trailer Air Supply Knob

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 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 parking brake 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 can be released by pushing in the trailer air supply knob, leaving the tractor parking brakes applied. Air pressure in the primary or secondary reservoir must be at least 64 psi (441 kPa) before the tractor spring parking brakes, or the trailer service or spring parking brakes, can be released.

On trailers without spring parking brakes, chock the trailer tires before disconnecting the tractor when parking just the trailer. When parking a tractor with a trailer, when the trailer is not equipped with spring parking brakes, apply the tractor spring parking brakes.



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

## Meritor WABCO Antilock Braking System (ABS), Air Brake Systems

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

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

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

The electronic control unit also has a safety circuit that constantly monitors the wheel sensors, solenoid control valves, and the electrical circuitry. The ABS warning light comes on after turning on the ignition switch. The warning light goes out only if all of the ABS components are working.

If equipped with Automatic Traction Control (ATC), the ATC 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, turn the interaxle differential lock switch on. See **Chapter 7** for interaxle differential lock instructions.

## - 🛕 CAUTION -

#### Do not turn the interaxle differential lock switch on while the ATC indicator light is on. To do so could damage the rear axle.

Automatic Traction Control is an option available on ABS-equipped vehicles with air brake systems. It helps

improve traction when vehicles are on slippery surfaces by reducing drive wheel overspin. ATC works automatically in two ways.

- If a drive wheel starts to spin, ATC applies air pressure to brake the wheel. This transfers engine torque to the wheels with better traction.
- If all drive wheels spin, ATC reduces engine torque to provide improved traction.

ATC turns itself on and off. Drivers do not have to select this feature. If drive wheels spin during acceleration, the ATC indicator comes on, indicating that the ATC is active. It goes off when the drive wheels stop spinning.

The ABS diagnostic switch is a momentary switch that turns on the blink code diagnostic capabilities. It may also be used to disable the traction control for dynamometer testing. The switch is located inside the electrical control panel on the tunnel. For information on troubleshooting with blink code diagnostics, see **Group 42** in the *Condor*<sup>®</sup> *Workshop Manual*.

## WARNING

# Failure to disable the ATC before dynamometer testing could result in serious personal injury and damage to the vehicle.

Vehicles with ATC must have the ATC disabled to test the vehicle on a dynamometer. To disable the ATC, press and hold the ABS diagnostic switch for at least three seconds. Once the system configuration code begins, ATC has been disabled. The ATC indicator comes on and stays on while disabled.

The Meritor WABCO ABS system combines one frontaxle control channel with either one rear axle (the foursensor system), or two rear axles (the six-sensor system) to form one control circuit. For example, the sensor and solenoid control valve at the left-front axle form a control circuit with the sensor(s) and solenoid valve(s) on the right rear axle(s). If during vehicle operation, the safety circuit senses a failure in any part of the ABS system (a sensor, solenoid control valve, wiring connection, short circuit, etc.), the ABS warning light comes on and the control circuit where the failure occurred is switched to normal braking action. The remaining control circuit will retain the ABS effect. Even if the ABS system is partially or completely inoperative, normal braking ability is maintained. An exception would be if a solenoid control valve (or combination solenoid control valve) is damaged and inoperative. As these components are an integral part of the air brake system, normal braking may be impaired or inoperative.

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

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

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

## Automatic Slack Adjusters

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

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

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

## WARNING

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

## Telma Driveline Retarder, Optional

The Telma driveline retarder is used to slow the vehicle. The retarder unit is attached to the forward side of the rear differential and is controlled by the service brake pedal. The retarder is applied when the retarder switch (**Fig. 5.4**) is turned on. The amount of retarder engagement is determined by brake pedal position via two pressure switches connected to the front brake air line. When the retarder is applied it creates electromagnetic drag to slow the vehicle. The vehicle brake lights will be on when the retarder is applied. The retarder can be turned off by pressing the lower end of the retarder switch.



Fig. 5.4, Retarder Switch

## Operation of the Telma Driveline Retarder



Do not use the retarder during inclement weather or when road surfaces are slippery. Turn the retarder switch off during inclement weather or when the road surfaces are slippery.



Operate the retarder only when the engine is at closed throttle. In the event of overheating, decrease use of the retarder and use the service brakes.

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.

When vehicle braking is required, the driveline retarder may be used. There is no time limit for operation of the driveline retarder.

## 

If the driveline retarder fails to shut off when the brake pedal is released, turn the retarder switch off and do not use the retarder until the system is repaired. If the retarder fails to shut off when the retarder switch is turned off, the engine should be shut down and the retarder repaired before continuing operation. Failure to do so could result in damage to the engine, transmission, and driveline.

## Allison Transmission Retarder, Optional

The transmission retarder is used to slow the vehicle and to lessen the demand on the service brakes. The self-contained retarder is located at the output of the transmission and consists of a vaned rotor that rotates in a vaned cavity. The rotor is driven by the output shaft. An external accumulator holds transmission fluid until the retarder is applied. When the retarder is applied, the fluid in the accumulator is pressurized and directed into the retarder cavity. The interaction of the fluid with the rotating and stationary vanes causes the retarder rotor speed, and hence the output shaft, to decrease and slow the vehicle.

Operation of the Allison Transmission Retarder



Do not use the transmission retarder during inclement weather or when road surfaces are slippery. Turn the retarder switch off during inclement weather or when the road surfaces are slippery.

## 

Operate the transmission retarder only when the engine is at closed throttle. In the event of overheating, decrease use of the retarder and use the service brakes.

To apply the transmission retarder, the retarder switch (**Fig. 5.4**) must be turned on. The transmission retarder is automatically applied by the throttle and the brake. When the throttle pedal is released, the retarder is either 30 percent or 50 percent engaged, depending on the type of retarder the vehicle is equipped with. The remainder of the retarder engagement can be gained by depressing the brake pedal. When the retarder is applied, the retarder active (RTD ACTIVE) indicator comes on. The vehicle brake lights will also be on when the retarder is applied.

To disengage the transmission retarder, release the brake pedal and turn the retarder switch off.

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. The transmission retarder can be used to stop a vehicle if the service brakes quit working. By energizing the transmission retarder as soon as a service brake problem is apparent, a retarding effect is applied to the vehicle. As grade conditions permit, the transmission retarder will stop the vehicle.

## 

Using the transmission retarder 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.

When vehicle braking is required, the transmission retarder may be used with the service brakes. There is no time limit for operation of the transmission retarder.

## 

If the transmission retarder fails to shut off when the service brake pedal is released, turn the retarder switch off and do not use the transmission retarder until the system is repaired. If the transmission retarder fails to shut off when the retarder switch is turned off, the engine should be shut down and the transmission retarder repaired before continuing operation. Failure to do so could result in damage to the engine and transmission.

With an Allison automatic transmission without a retarder, the transmission oil temperature gauge reading should not exceed 300°F (149°C) during normal operation. On a transmission with a retarder, the transmission oil temperature gauge reading should not exceed 330°F (160°C) during normal operation.

## 

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. NOTE: If transmission oil temperature rises too high, an alarm sounds and the TRANS TEMP indicator comes on.

An Allison MD or HD transmission with an output retarder has a maximum operating temperature of 330°F (160°C).



Transmissions that have reached the maximum

temperature need to be cooled. Stop the vehicle, place the transmission in neutral (N), and raise the engine to 1000 to 1200 rpm. If the transmission does not cool down, shut down the engine. Do not operate the vehicle until the cause has been determined and corrected. Operating the vehicle could damage the transmission.

## **Engine Braking System**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

## **Engine Braking Switch**

The engine brake switch controls the degree of engine braking. Normally there are two paddle switches, a two-position On/Off switch to activate the engine brake, and a two-position Hi-Lo switch to control the amount of engine braking.

To turn the two-position On/Off switch on, raise the paddle. When the two-position switch is on, an amber LED (light-emitting diode) illuminates inside the switch.

To turn the two-position Hi-Lo switch on high, raise the paddle (at the Hi-Lo icon). To turn the two-position Hi-Lo switch on low, lower the paddle (at the ENG BRK legend). See **Fig. 5.5**.



Fig. 5.5, Engine Brake Switches

A three-position switch is used on MBE900 engines equipped with both the regular engine brake and the constant-throttle (decompression) brake. It works the same as the two-position Hi-Lo switch, except that there is a third (off) position when the switch is left at its normal position.

When the panel lights are on, the Hi-Lo icon is backlit in amber on the three-position switch. On both the threeposition switch and the two-position switch, the ENG BRK legend is backlit in green when the panel lights are on.

### Mercedes-Benz

#### **Constant-Throttle Valves**

To increase braking performance, Mercedes-Benz engines are equipped with constant-throttle valves (optional) in each combustion chamber. Small valves built into the cylinder head allow a small amount of compressed air to escape through the exhaust port during the combustion stroke. The constant-throttle valves are open during the entire time that the engine brake is activated. Although some braking ability is lost because the valves are constantly open, constantthrottle braking is quieter in operation than other types of engine brakes.

When both the exhaust brake and the constant throttles are installed, a three-position switch on the dash controls the amount of engine braking delivered. Like the exhaust brake, the constant throttles are deactivated when the accelerator or clutch pedal is depressed. The ABS system, when active, also deactivates constant-throttle braking.

The engine brake will deactivate if the engine speed falls below a preset level. This level is programmable but is set at the factory at 1100 rpm.

## Jacobs Engine Brake

The Jacobs Engine Brake is a diesel retarder that uses the engine to aid in slowing and controlling the vehicle. When applied, the engine brake alters the operation of the engine's exhaust valves so that the engine works as a power-absorbing air compressor. This provides a retarding or slowing action to the vehicle's drive wheels, enabling you to have improved vehicle control without using the service brakes. This results in reduced service brake maintenance.

## Jacobs Engine Brake Operation With Automatic Transmission

## 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.

The operation of the Jacobs Engine Brake is fully automatic once it is turned on. When you move your foot off the throttle pedal, the engine brake is automatically applied. When you apply pressure to the throttle pedal, the Jacobs Engine Brake is deactivated. The Jacobs Engine Brake will continue to be applied after the service brake has been depressed giving the combined power of both the engine brake and the service brakes to the drive wheels.

Vehicles equipped with an antilock braking system have the ability to turn the engine brake off if a wheel slip condition is detected. The engine brake will automatically be turned back on when the wheel slip condition is no longer detected.

The electronic engine controls will deactivate the engine brake when engine speed falls below approximately 1000 rpm or when the vehicle slows down to a preset speed, which varies depending on the vehicle and engine configuration. This prevents stalling the engine.

Since the engine brake is most effective at higher speeds, gear selection is very important. You obtain maximum retarding power when you use the lowest possible gear without exceeding the recommended engine speed for engine braking. Best retarding performance is obtained at engine speeds between 1800 rpm and high idle. Below 1700 rpm, retarding power may be significantly reduced.

IMPORTANT: Before turning on the engine brake (ENG BRK) switch (**Fig. 5.6**), be sure the engine has reached full operating temperature.

The engine brake switch must be in either the LO or HI position in order to operate the Jacobs Engine Brake. Once it is in either of those positions, merely take your foot off the throttle pedal to slow your vehicle. Depending on the engine model, LO will provide one-third or one-half of the full braking capacity of the engine. HI will provide maximum engine braking. Apply the service brakes when it's time to come to a complete stop.



Fig. 5.6, Engine Brake Switch

Do not use the engine brake if road surfaces are slippery. Using the engine brake on wet, icy, or snow-covered roads could result in loss of vehicle control, possibly causing personal injury and property damage.

## **Exhaust Braking System**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

#### **Exhaust Brake Switch**

The optional exhaust brake is controlled by a dashmounted rocker switch to help slow the vehicle when the accelerator is released.

To turn the exhaust brake on, press on the upper part of the rocker (at the light inside the switch). The exhaust brake turns off automatically. See **Fig. 5.7**.

When the exhaust brake switch is on, an amber LED illuminates inside the switch. When the panel lights are on, the EXHST BRK legend is backlit in green.

#### Mercedes-Benz Exhaust Brake

An exhaust brake is an optional auxiliary braking system that assists but does not replace the service brake system. The retarder switch, in combination with the accelerator and clutch pedals, allows the driver to make maximum use of the exhaust brake in off-highway and mountain driving as well as in traffic or high speed highway driving.



Fig. 5.7, Exhaust Brake Switch

The exhaust brake is a buttery type valve mounted in the exhaust pipe. When the driver's foot is not on the accelerator pedal and the retarder switch is on, an air cylinder shuts the buttery valve which restricts the ow of exhaust gases and retards the engine. This retarding action is carried through the engine and drivetrain, slowing the vehicle and reducing the need for frequent service brake applications.

When only the exhaust brake is installed, a two-position switch on the dash controls the engine braking system. The exhaust brake is only active when the engine speed is between 1100 and 2700 rpm. Depressing the accelerator or clutch pedal deactivates the exhaust brake. The ABS system, when active, also deactivates the exhaust brake.

Exhaust brakes are not intended for use as the primary braking system during vehicle operation.

## Starting the Engine

Before starting the engine, make sure that the lower half of the exhaust break switch is pressed in and the amber light is not illuminated. Do not turn the exhaust brake on until the engine has reached normal operating temperatures.

## Exhaust Brake Operating Characteristics

When you remove your feet from both the accelerator and clutch pedals and the retarder switch is on, the exhaust brake is applied. The following conditions should exist if the brake is operating properly:

- A slight change in the sound of the engine may be noticed when the exhaust brake is applied.
- Exhaust smoke should appear normal.
- Engine temperature should remain in the normal operating range.
- Road speed usually decreases when the exhaust brake is applied during a descent. When the vehicle is carrying a heavy load or the grade is extremely steep, you may need to apply the service brakes occasionally.
- Do not expect a retarding effect similar to sudden hard application of the service brakes. The exhaust brake retards the vehicle with a smooth braking effect.
- During a descent, the tachometer usually shows a drop in rpm depending on the grade and the vehicle load.

• Depending on the grade and vehicle load, you may or may not feel the retarding force acting against your body when the brake is applied. The retarding force of the brake may not always be noticed, but it is actually preventing the vehicle from going much faster.

## **Driving Downhill**

While approaching a steep grade, make sure that the upper half of the exhaust brake switch is pressed on, with the amber light illuminated. The exhaust brake comes on as soon as you remove your foot from the accelerator pedal. While going down the grade, use a low enough gear to safely descend with a minimum application of the service brakes. As a general guideline, use the same gear as you would to ascend the hill.



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

Apply the service brakes to reduce the engine rpm or make a slower descent by using a lower gear.

## WARNING

Do not use the exhaust brake when driving on slippery or low traction road surfaces. Failure to follow this precaution could result in a loss of vehicle control and possible personal injury or property damage.

## Shutting Off the Engine

Make sure the retarder switch is turned off before shutting off the engine.

## Pacbrake Exhaust Brake

The Pacbrake exhaust brake is intended as a supplement to the service brakes and will not bring the vehicle to a complete stop. The Pacbrake will assist in the control or reduction of road speed in conjunction with, or independent of, the service brakes. The amount of retarding or braking force is controlled by the driver.

#### Pacbrake Operation (Caterpillar)

The Pacbrake is controlled by the exhaust brake switch and the throttle pedal. All applications are additionally affected, controlled, or governed by engine speed through transmission gear selection. The Allison MD3060 transmission has automatic downshifting when the exhaust brake is requested. See the information on the "Allison World Transmission" later in this chapter.

On some applications, when the Pacbrake is in use, it may be necessary to check that the cruise control is not set and that the throttle is in the idle position.

On some applications the engine, transmission, cruise control, and the Pacbrake exhaust brake may electronically interact with each other, which automatically operates their functions. Following are some examples of the programmed options that may be available with the cruise control in the on position:

- The coast mode engages the Pacbrake when the service brake is applied and disengages when the service brake is released.
- The latch mode engages the Pacbrake when the service brake is applied and the Pacbrake remains on after the service brake is released. The Pacbrake is disengaged when another input (depressing the throttle or clutch, engine speed drops below 800 rpm, or the exhaust brake switch is turned off) is supplied.
- The manual mode does not require the cruise control switch to be on and operates the Pacbrake manually at the driver's discretion.

The amount of braking power the engine will develop is related to the speed (rpm) of the engine. The higher the engine rpm, the greater the retarding power.

Certain conditions may require that the transmission be downshifted in order to generate adequate rpm for the amount of retarding power required. Pacbrake exhaust brakes are designed and approved for safe use at 300 rpm above the engine's maximum governed rpm. Refer to individual engine manufacturer's specifications.

The Pacbrake will function best if it is used all of the time. However, if the vehicle is used inconsistently or

seasonally, it may be necessary to perform a preventive maintenance procedure.

1. With the engine shut down, use any oil-free or nonpetroleum based high-heat lubricant and spray or coat a sufficient amount on the restricter valve shaft and the attaching locations at each end of the actuation cylinder. See **Fig. 5.8**.



Fig. 5.8, Pacbrake Exhaust Brake and Air Cylinder

2. With your hands or a pair of pliers, motion the valve several times to distribute the lubricant down the shaft and the attaching locations.

NOTE: Starting the engine and idling for short periods of time is not recommended. During a cold engine start-up, enough moisture is developed within the engine and the exhaust system to create a corrosion hazard that could affect the future operation of the Pacbrake. The brake housing may trap water in the valve shaft bore causing corrosion in an improper or nonfunctional brake. If it is necessary to periodically start the engine, it is recommended that normal operating temperatures be attained before shutting down the engine.

#### **Allison World Transmission**

Pacbrake exhaust brakes on engines that are used with the Allison World Transmission MD series, are interfaced with the transmission electronic control module (ECM). An exhaust brake enabled transmission ECM will usually provide converter lockup in gears two through six. Effective exhaust braking begins when the transmission automatically downshifts into fifth gear (62 mph or less). Once on, the Pacbrake exhaust brake will control road speed and/or slow the vehicle sufficiently that the transmission will automatically downshift, if necessary, to Allison's preselect mode.

The preselect mode is normally assigned to second gear; however, the transmission can be reprogrammed by an Allison Transmission Distributor to third or fourth gear should the operator desire. If additional retarding power is required before the automatic downshifting occurs, you can select a lower transmission gear on the Allison shift selector.

# 6

# Engines

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## **Engine Starting**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

For cold weather starting, refer to "Cold Weather Starting" later in this chapter.

Before starting the engine, the driver should be familiar with the vehicle warning system in order to bring the vehicle to a safe stop if the engine malfunctions. If the driver doesn't understand how the warning system works, an engine shutdown could occur causing a safety hazard. To become familiar with the warning system, read **Chapter 2**.

Whenever you start an engine, watch for any signs of engine problems. If the engine vibrates, misfires, or makes unusual noises, turn the engine off as soon as possible and determine the cause of the problem. Frequently, engine damage may be avoided by a quick response to early indications of problems.



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

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

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

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

## 

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

### Pre-Start

NOTE: These pre-start steps apply to all engines.

- 1. Perform the engine pretrip inspection and daily maintenance checks in **Chapter 9**.
- 2. Set the parking brake.
- 3. For manual transmissions, place the transmission in neutral and disengage the clutch. For automatic transmissions, make sure the transmission shift control is in neutral or park.
- 4. Turn the engine to the ON position (Fig. 6.1 or Fig. 6.2). If applicable, all the electronic gauges on the instrument pod and instrument cluster complete a full sweep of the dials, the warning and indicator lights should come on, and the buzzer sounds for three seconds.



Fig. 6.1, Ignition Switch Position



NOTE: Ignition Switch shown for single-drive vehicles.

- 1. Ignition Switch (located here on single-drive vehicles)
- 2. Head Lamp Switch
- 3. Brake Application Air Gauge, Optional
- 4 Air Restriction Gauge, Optional
- 5. **Optional Switch**
- Instrument and Control Panel Dimmer Switch 6.

Fig. 6.2, A Panel Controls

## Starting Precautions, All Engines

## CAUTION -

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

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

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

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

## WARNING

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

## 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.

## CAUTION -

Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until minimum engine idle oil pressure registers on the gauge. Failure to do so could damage the turbocharger.

#### Caterpillar

NOTE: Before doing these steps, do the steps in the "Pre-Start" section.

1. Turn the ignition switch to the on position. The CHECK ENGINE indicator on the instrument pod comes on for five seconds. If equipped with an air intake heater, the GRID HEAT indicator comes on for a minimum of two seconds, regardless of coolant temperature.

IMPORTANT: If equipped with an air intake heater and if the GRID HEAT indicator comes on for more than two seconds, wait until the light turns off before attempting to start the engine.

- 2. Turn the ignition switch to the START position. Do not depress the throttle pedal while the engine is cranked. Release the ignition key the moment the engine starts.
  - 2.1. If the engine does not start after 30 seconds of cranking, turn the ignition switch to the OFF position.
  - 2.2. Wait two minutes to allow the starter motor to cool. Turn the ignition switch back to the ON position and try to start the engine again.
  - 2.3. As soon as the engine starts, release the ignition switch allowing the engine to run at a slow idle.

## - f A CAUTION -

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

- 3. The engine may be operated at low load and speed once the engine oil pressure has reached 10 psi (69 kPa) and air pressure (if applicable) has reached 64 to 76 psi (441 to 524 kPa).
- 4. When the engine has reached the normal operating temperature of 183°F (84°C), the engine may be operated at full load.

#### Cummins



Never attempt to start any Cummins IS series electronic engine (ISB, ISC, ISL) using ether or any other starting fluid. Serious engine damage could result.

NOTE: Before doing these steps, do the steps in the "Pre-Start" section.

 Turn the ignition switch to the on position. The CHECK ENGINE indicator on the instrument pod will come on. Leave the ignition switch on until the CHECK ENGINE indicator goes off. If equipped with an air intake heater, the GRID HEAT indicator comes on for a minimum of two seconds, regardless of coolant temperature.

IMPORTANT: If equipped with an air intake heater and if the GRID HEAT indicator comes on for more than two seconds, wait until the light turns off before attempting to start the engine.

2. Turn the ignition switch to the start position. Do not depress the throttle pedal while the engine is cranked. After the engine starts, release the ignition key.



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

3. Allow the engine to gradually warm up to operating speed and develop a stable oil pressure.

NOTE: When the engine is started, it takes a short time to build up a lubricating oil film between the shafts and bearings, and between the pistons and liners. The oil pressure gauge indicates any drop in lubricating oil pressure within 15 seconds of engine start-up.  If minimum oil pressure at idle of 10 psi (69 kPa) does not register within 15 seconds, shut down the engine.



Protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until minimum engine idle oil pressure registers on the gauge. Failure to do so could damage the turbocharger.

5. Idle the engine for three to five minutes at 1000 rpm before operating the engine under load.

#### Mercedes-Benz

NOTE: Before doing these steps, do the steps in "Pre-Start."



Never attempt to start any Mercedes-Benz electronic engine using ether or any other starting fluid. Serious engine damage could result.

- 1. Turn the ignition switch to the START position. Without touching the accelerator pedal, start the engine.
- 2. Idle the engine for one to three minutes at 600 to 850 rpm before operating the engine under load.
- Check the oil pressure gauge for any drop in lubricating oil pressure or mechanical malfunction in the lubricating oil system. Minimum oil pressure at idle is 7 psi (50 kPa).

## 

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

## **Cold Weather Starting**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

## WARNING

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

Modern electronic engines do not normally require special starting aids. At low temperatures, air intake heaters, manifold heaters, or water jacket heaters are sometimes used to assist in starting.

#### Caterpillar

Caterpillar truck engines with direct injection are designed to start at temperatures above  $32^{\circ}F(0^{\circ}C)$  without using start systems. If the temperature is below  $32^{\circ}F(0^{\circ}C)$ , start ability will be improved by the use of an automatic ether injection system and/or a jacket water heater.



Directing ether at the heater element in the air intake heater could cause extensive engine damage.

An optional ether starting aid is available for use with Caterpillar C–10 and C–12 engines. This system injects ether into the air inlet manifold after the air intake heater.



When using starting fluid, follow the manufacturer's instructions carefully. Use starting fluid sparingly and spray it only while cranking the engine. Excessive ether can cause piston and ring damage. Use ether for cold weather starting purposes only.

#### Cummins



Starting fluid is highly flammable and explosive. It can cause serious injury or death if improperly handled. Do not smoke where starting fluid is in use. Keep sparks, flames, and arc welding equipment away from starting fluid.

Do the following steps when starting the Cummins ISM series engine in cold weather using starting fluid with mechanical or electrical metering equipment.

IMPORTANT: Due to increased safety hazards and the potential for engine damage, do not use starting fluid without metering equipment.

- 1. Set the throttle at idle.
- 2. Put the transmission in neutral and if equipped, disengage any driven accessories.
- 3. Turn the ignition switch to the on position to power up the electronic control module.



#### Do not use excessive amounts of starting fluid when starting an engine. The use of too much starting fluid will damage the engine.

- 4. While cranking the engine, inject a metered amount of starting fluid.
- 5. Do not increase the engine speed above idle until the coolant temperature gauge needle starts to move or 10 minutes have elapsed. This will provide adequate lubrication to the bearings.
- 6. Monitor the oil pressure after normal operation is initiated.

#### Mercedes-Benz



Never attempt to start any Mercedes-Benz electronic engine using ether or any other starting fluid. Serious engine damage could result. The intake air preheater is activated by turning the ignition switch to the ON position. If the engine is at normal temperature, the INTAKE HEATER indicator goes out after two seconds.

If the temperature is low enough to require the heater, the INTAKE HEATER indicator stays on while the intake air preheater warms up. After the indicator goes out, start the engine. If the engine doesn't start after about 30 seconds of cranking, turn the key to the OFF position and wait two minutes; then repeat the starting procedure.

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

# Starting After Extended Shutdown or Oil Change

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

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

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

- 1. Make sure the transmission is filled with the correct type of fluid, as recommended by the transmission manufacturer.
- 2. Make sure the fuel tank is full. If air has entered the fuel system, prime the fuel system, using the engine manufacturer's instructions.
- 3. If the engine is equipped with a fuel/water separator, drain off any accumulated water.
- 4. Check the drive belts to make sure they are in good condition and properly adjusted. Replace any drive belts that are cracked, worn, or glazed.
- 5. Check the turbocharger for signs of oil or exhaust leaks. Correct any problems before starting the engine.

## Engines

- 6. Check the engine mounting bolts for tightness. Retighten them if necessary.
- 7. Make sure the battery cable connections are clean and tight. Check that the batteries are charged.
- 8. Start the engine. See "Engine Starting."

## **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.
- Avoiding operation at engine idle speeds or at maximum horsepower levels longer than 5 minutes.
- Developing the habit of closely watching the engine instruments during operation. Let up on the throttle (where applicable) 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 breakin period.

## Mercedes-Benz

Every Mercedes-Benz engine is tested on a dynamometer before shipment. Therefore, no break-in period is necessary. Before running the engine for the first time, follow the instructions in the engine manufacturer's operator's manual.

## **Engine Operation**

NOTE: For information not covered in this section, see the engine manufacturer's operators's manual.

## 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.

Operating any vehicle in an area where there are concentrated flammable vapors (such as diesel, gasoline, natural gas, 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.

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

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

While you are driving, watch for any signs of engine problems. If the engine overheats, uses excessive fuel or lubricating oil, vibrates, misfires, makes unusual noises, or shows an unusual loss of power, turn the engine off as soon as possible and determine the cause of the problem. Frequently, engine damage may be avoided by a quick response to early indications of problems.
# 

Stop the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed the warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

All electronic engines have an engine protection system designed to warn the driver of engine malfunctions. If the driver doesn't understand the how the shutdown protection system works, and engine shutdown could occur, causing a safety hazard.

IMPORTANT: On vehicles with the shutdown protection system, a red engine protecting (ENG PROT) warning light illuminates when the ignition switch is turned to the ON position.

The warning and derate system does not cause an engine shutdown, but derates the engine, allowing it to be brought safely to a place where the engine can be serviced. See **"Engine Shutdown"** for information on the shutdown protection (standard) and warning/derate (optional) system.

NOTE: Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low that 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.

For long powertrain life, use the following information when operating the engine and shifting gears.

### Caterpillar

Proper operation, driving techniques, 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 Manual and this manual for trouble-free, economical engine operation.

### Idling

The idle speed is adjustable on Caterpillar electronic engines. Consult your Caterpillar dealer for information. The idle rpm is preset between 700 and 750 rpm. Avoid excess idling. If the vehicle is parked for more than five minutes, stop the engine. An engine can burn from 0.7 to 1.5 gallons (2.8 to 5.7 L) of fuel per hour while the engine is idling. Excessive idling can cause carbon buildup and/or cause the engine to slobber, which is harmful to the engine.

Caterpillar electronic engines do not require long warm-up periods. Typically, the engine should be at normal operating temperature in a few minutes. Begin operating the engine at low load. After normal oil pressure is reached and the temperatures gauges begin to rise, the engine may be operated at full load.

#### **Getting Started**

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

Continue to upshift until cruising speed is reached. Use only the rpm needed to make an upshift into the next gear. This technique will improve fuel economy because the engine will be operating at the lowest rpm needed to pull the load.

Keep the engine rpm to a minimum. For CFE/3126B engines, use an rpm that is from 1400 to 2000 rpm. For C-10 and C-12 engines, use an rpm that is from 1200 to 1600 rpm.

The amount of rpm that is required to upshift increases as the vehicle speed increases, unless upshifts are made on upgrades. Experience with the vehicle will show the amount of rpm that is required to upshift under various conditions.

### **Uphill Operation**

On uphill grades, allow the engine to lug downward to between 1440 to 1550 rpm for CFE/3126B engines and between 1100 to 1200 rpm for C–10 and C–12engines before downshifting. Continue to downshift in this manner until you reach a gear that maintains the desired speed. Continue to operate the engine at this low rpm if the vehicle will crest the top of the hill without a downshift in the transmission. Begin upshifting as the grade of the hill decreases and the engine begins to accelerate above 2000 rpm for CFE/3126B engines or above 1600 rpm for C–10 and C–12 engines. Driving this way will provide optimum fuel economy and performance.

NOTE: Allowing the engine to lug below peak torque is permissible if the vehicle is cresting the top of a hill. However, extended operation at an engine rpm that is below peak torque (1400 rpm for CFE/3126B engines and 1200 rpm for C–10 and C–12 engines) will raise the exhaust temperature and the cylinder pressure. This can lead to reduced engine service life.

IMPORTANT: On Caterpillar CFE/3126B engines, do not allow the engine to exceed 2900 rpm. On Caterpillar C–10 and C–12 engines, do not allow the engine to exceed 2300 rpm in any situation or 2100 rpm if equipped with an engine brake.

### **Downhill Operation**

On a downhill grade, do not coast or put the transmission in neutral. If no engine power is needed, disengage the cruise control. Select the correct gear that does not allow the engine speed to exceed 2900 rpm for CFE/3126B engines or 2300 rpm for C–10 and C– 12 engines. Use the service brakes to control the speed of the vehicle. As a basic rule, select the same gear that would be required to go up the grade.

### Cummins

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

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Do not keep the engine at low idle for long periods. Idling for periods longer than 10 minutes can damage the engine, causing the combustion chamber temperatures to drop so low that the fuel will not burn completely. This will cause carbon to build up around the injector spray holes and piston rings, and can cause the valves to stick. Monitor the oil pressure and coolant temperature gauges frequently. Refer to the *Cummins Operation and Maintenance Manual* for recommended operating pressures and temperatures. Shut down the engine if any pressure or temperature does not meet the specications.

# CAUTION

Continuous operation with a coolant temperature below  $140^{\circ}F$  ( $60^{\circ}C$ ), or a coolant temperature above  $212^{\circ}F$  ( $100^{\circ}C$ ) can damage the engine.

If an overheating condition occurs, reduce the power output of the engine by releasing the throttle pedal pressure or by shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does not return to normal, shut off the engine and refer to the troubleshooting section in the Cummins Operation and Maintenance Manual.

Most failures give an early warning. Look and listen for changes in performance, sound, or engine appearance that can indicate service or engine repair is needed. Some of these changes are:

- engine misfires
- vibration
- unusual engine noises
- sudden changes in engine operating temperatures or pressures
- excessive smoke
- loss of power
- an increase in oil consumption
- an increase in fuel consumption
- fuel, oil, or coolant leaks

# CAUTION -

Do not operate the engine at full throttle below peak torque rpm for more than 30 seconds. Operating the engine below peak torque rpm will shorten the engine life to overhaul and can cause serious engine damage. Cummins engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed. This is consistent with recommended operating practices.

Operation of the engine below peak torque rpm can occur during gear shifting due to the difference of ratios between transmission gears, but engine operation must not be sustained for more than 30 seconds at full throttle below peak torque rpm.



Do not operate the engine beyond high-idle speed (2900 rpm for ISC engines, 2600 rpm for ISL engines, and 2300 for ISM engines) under any circumstances. Operating the engine beyond highidle speed can cause severe engine damage. When descending a steep grade, use a combination of transmission gears and engine or service brakes to control the vehicle and engine speed.

### Mercedes-Benz

Proper operation and maintenance are key factors in obtaining the maximum life and economy of a vehicle engine. Follow the directions in this manual and the engine manufacturer's operator's manual for troublefree, economical engine operation.

Mercedes-Benz engines are equipped with the electronic engine control system, which monitors the engine as it is running.

If the engine control unit (ECU) detects a fault serious enough to harm normal operation, the electronic engine system switches over to emergency running mode. When in emergency running mode, the engine operates at a constant 1300 rpm. This allows you to move the vehicle to a service location.

- 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.
- 2. Cruise at partial throttle whenever road conditions and speed requirements permit. This driving tech-

nique permits operating within the most economical power range of the engine.

- 3. Never allow the engine to exceed the high-idle governed speed (2700 rpm). Use the exhaust brake and the optional turbo or constant-throttle brake, if installed, to lower engine rpm below the high-idle governed speed.
- 4. Never allow the engine to idle for more than 30 minutes. Excessive idling can cause oil to leak from the turbocharger.

### **Cold Weather Operation**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

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

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

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

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

There are three basic objectives:

- Reasonable starting characteristics followed by practical and dependable warm up of the engine and equipment.
- A unit or installation which is as independent as possible from external influences.

• Modifications which maintain satisfactory operating temperatures with a minimum increase in maintenance of the equipment and accessories.

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

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.

On all engines, the following steps are necessary when operating in cold weather:

- 1. Check for cracks in the battery cases, for corrosion of the terminals, and for tightness of the cable clamps at the terminals.
- 2. Charge the batteries to full capacity. Replace any battery that is unable to hold full charge or is physically damaged.

If so equipped, turn off the battery disconnect switch after the engine is shut down, to prevent battery discharge.

- 3. Have the alternator output checked at an authorized American LaFrance service provider.
- 4. Check the condition and tension of the drive belts.
- 5. Use low-viscosity lubricating oils for adequate lubrication.
- At temperatures below 32°F (0°C), do not use summer-grade (2-D) diesel fuel. To avoid fuel problems due to paraffin separation, use winter-grade (1-D or winterized 2-D) diesel fuel only.

NOTE: 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.

7. When the use of unblended summer-grade diesel fuel in winter cannot be avoided, install a thermostatically-controlled fuel heater. Fuel heaters can prevent wax from clogging the fuel filters and formation of ice crystals from water in the fuel.

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

### Caterpillar

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

For cold weather operation, use the following guidelines:

- When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity. Refer to the Caterpillar Operation and Maintenance Manual for specifications.
- 2. When the temperature is below freezing, use sufficient antifreeze solution in the cooling system to prevent freezing.
- 3. For starting below 0°F (–18°C), an optional coldweather starting assist is recommended. For temperatures below –10°F (–23°C), consult your Caterpillar dealer for recommendations.
- 4. When customer parameters include cold mode operation, the system puts the engine into cold mode if the temperature condition is not met. In cold mode, the low idle adjusts to 1000 rpm. The system also advances the timing, to reduce white smoke emissions and improve warm-up time.

NOTE: This temperature condition requires that the sum of the coolant temperature and the inlet air temperature is below 127°F (35°C).

5. The system will keep the engine in cold mode until the temperature condition has been met.

After cold mode has been completed, operate the vehicle at low load and low rpm until the engine coolant reaches normal operating temperature of 183°F (84°C).

### Cummins

Operating diesel engines in extremely cold environments is possible if they are properly prepared and maintained. The correct fuels, lubricants, and coolants must be used for cold weather operation. See **Table 6.1** for the recommended fuels, lubricants, and coolants in the appropriate cold weather ranges.

### Mercedes-Benz

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

For cold weather operation, use the following guidelines:

- 1. Periodically check the coolant mixing ratio (concentration of antifreeze in the coolant). Add more if necessary. The coolant mixing ratio should never rise above 60 percent antifreeze.
- At outside temperatures below –4°F (–20°C),a coolant preheater is recommended.

# WARNING

The addition of kerosene lowers the ash point of diesel fuel. To prevent re and risk of injuries due to burning, do not smoke or use open flames around fuel mixed with kerosene. Comply with all appropriate safety regulations.

3. When winter-grade diesel fuel is not adequate, it is possible to mix kerosene with the diesel fuel. Add the kerosene only when refilling the tank, and before adding the diesel fuel.

NOTE: Engine power may drop according to the proportion of kerosene. For this reason, never add more than 50 percent kerosene to the fuel.

### **High Altitude Operation**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

Recommended Fuels, Lubricants, and Coolants for Cold Weather Operation with Cummins Engines						
Commodity	Engine Model	Winterize –25°F to 32°F (–32°C to 0°C)	Arctic Specification –65°F to –25°F (–54°C to –32°C)			
Fuel	ISC, ISL, ISM	Fuel is to have maximum cloud and pour points 43°F (6°C) lower than the ambient temperature in which the engine operates.	Fuel is to have maximum cloud and pour points 43°F (6°C) lower than the ambient temperature in which the engine operates.			
Lubricant	ISC	Use multiviscosity oil that meets API CG–4/SF or CF–4/SF.	Use synthetic arctic oil that meets API CE/SF or higher, such as 5W–20 or 5W–30.			
	ISL	Use multiviscosity oil that meets API CG-4 or CH-4.	Use synthetic arctic oil that meets API CE/SF or higher, such as 5W–20 or 5W–30.			
	ISM	Use multiviscosity 10W-30 oil.	Use arctic oil meeting API CH4 or CES 20071specications.			
Coolant	ISC, ISL	Use 50 percent ethylene glycol or propylene glycol antifreeze and 50 percent water in your coolant mixture.	Use 60 percent ethylene glycol or propylene glycol antifreeze and 40 percent water in your coolant mixture.			
	ISM	Use 50 percent ethylene glycol antifreeze and 50 percent water in your coolant mixture.	Use 60 percent ethylene glycol antifreeze and 40 percent water in your coolant mixture.			

Table 6.1, Recommended Fuels, Lubricants, and Coolants for Cold Weather Operation with Cummins Engines

Engines lose horsepower when operated at high altitude because the air is too thin to burn as much fuel as at sea level. This loss is about three percent for each 1000 feet (300 m) altitude above sea level for a naturally aspirated engine. Most turbocharged engines are rated for higher altitudes than naturally aspirated engines.

An engine will have smoky exhaust at high altitudes unless a lower gear is used. The engine will not demand full fuel from the fuel system unless the engine is altitude-compensated by the use of a turbocharger. Shift gears as needed to avoid excessive exhaust smoke.

### **Engine Shutdown**

NOTE: For information not covered in this section, see the engine manufacturer's operator's manual.

# **A** CAUTION -

Stop the engine at the first sign of malfunction. Almost all malfunctions give some warning to the operator before significant damage occurs. Many engines are saved because alert operators heed the warning signs (sudden drop in oil pressure, unusual noises, etc.) and immediately shut down the engine.

### Caterpillar

# A 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 center-housing will cause oil coking problems. Follow the procedure, outlined below, to allow the engine to cool.

- 1. With the vehicle stopped, apply the parking brakes. Reduce the engine speed to low idle.
- 2. Place the transmission shift lever in neutral.

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 three minutes to reduce and stabilize internal engine temperatures before stopping.

3. Turn off the ignition switch and shut down the engine.

NOTE: Perform periodic maintenance as instructed in the Maintenance Interval Schedule in

the Caterpillar Operation and Maintenance Manual.

- An engine, if equipped with an idle shutdown timer, can be set to shut down after a preset amount of time.
  - 4.1. Ninety seconds before the preset shutdown time, the CHECK ENGINE light will begin to ash at a rapid rate.
  - 4.2. To disable the idle shutdown timer, press down on the clutch or brake pedal at any time during the final ninety seconds. The idle shutdown timer will be disabled until reset.

### Cummins

- 1. With the vehicle stopped, apply the parking brakes and place the transmission in neutral.
- 2. Allow the engine to idle three to five minutes after a full load operation before shutting it down. This allows adequate cool down for the pistons, cylinder liners, bearings, and turbocharger components.
- 3. Turn the ignition switch to the off position to shut down the engine.

NOTE: Perform periodic maintenance as instructed in the Maintenance Interval Schedule in the Cummins Operation and Maintenance Manual.

### Mercedes-Benz

#### **Emergency Shutdown**

If any of the following occur, shut down the engine immediately:

- The oil pressure swings back and forth or falls sharply.
- Engine power and rpm fall even though the accelerator pedal remains steady.
- The engine gives off heavy exhaust smoke.
- The coolant and/or oil temperature climb abnormally.
- Abnormal sounds suddenly occur in the engine or turbocharger.

### **Normal Engine Shutdown**

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



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

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

IMPORTANT: Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise as much as 115°F (46°C).

# 

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

3. Turn off the ignition switch and shut down the engine.

# Clutches

### **General Information**

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 ow and the friction facing material to char and burn.

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.

Heat and wear are practically nonexistent when a clutch is fully engaged. But during the moment of engagement, when the clutch is picking up the load, it generates considerable heat. An improperly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

To ensure long service life of the clutch; start in the right gear, be alert to clutch malfunctions, and know when to adjust the clutch.

### **Clutch Operation**

### 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 skipshift 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, see **Chapter 7**.

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.

# 

Never apply the clutch brake while the vehicle is moving. The clutch pedal should never be pressed down fully before putting the transmission in neutral. Considerable heat will be generated, which will be detrimental to the friction discs, release bearings and transmission front bearings.



Overloading will not only result in damage to the clutch, but also to the entire powertrain.

#### Excessive Vehicle Overload, or Overloading the Clutch

Clutches are designed for specific vehicle applications and loads. These limitations should not be exceeded.

### **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 to hold a vehicle on a hill.



Do not coast with the clutch released (pedal depressed) and the transmission in gear. High driven disc rpm could cause the clutch facing to be thrown off the disc. Flying debris could cause injury to persons in the cab.

Coasting With the Clutch Released (pedal down) 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.

### **Engaging the Clutch While Coasting**

Engaging the clutch while coasting can result in tremendous shock loads and possible damage to the clutch, as well as to the entire drivetrain.

### Reporting Erratic Clutch Operation Promptly

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect and lubricate the clutch components, make necessary internal clutch and linkage adjustments, etc.

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

See **Group 25** of the *Condor® Workshop Manual* for clutch adjustment procedures and specifications.



# Operating the vehicle with incorrect free pedal could result in clutch damage.

Clutch brake squeeze is an increased resistance (greater than the force of the clutch spring) felt as the clutch pedal approaches the end of its stroke. If the gears grind when shifting into first or reverse gear with the clutch pedal fully depressed, the clutch is out of adjustment or the clutch brake is worn and needs to be replaced.

#### **Clutch Adjustments**

Clutches have an internal adjustment and external linkage adjustment. See **Group 25** of the *Condor*<sup>®</sup> *Workshop Manual* for clutch adjustment procedures and specifications.



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 at frequent intervals. See **Group 25** of the *Condor® Maintenance Manual* for intervals and procedures.



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

7

# Transmissions and Rear Axles

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### Transmissions

### Allison MD and HD Series Transmissions

The Allison MD and HD automatic transmissions are electronically controlled and come with a push button shift selector. See **Fig. 7.1**. The automatic transmissions provide six forward ranges and one reverse range.



Fig. 7.1, Push Button Shift Selector

The push button shift selector has an R (reverse), an N (neutral), a D (drive), an up arrow, a down arrow, a mode button, and a digital display.

# WARNING

Do not leave the vehicle unattended with the engine running. If you leave the vehicle and the engine is running, the vehicle can move suddenly, which could result in personal injury or property damage.

If you must leave the engine running, do not leave the vehicle until you do the following.

- Put the transmission in neutral.
- Apply the work brake or the parking brake and make sure it is properly engaged.

• Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

### R (Reverse)

Press the R button to select reverse. The digital display will show R when reverse is selected. Completely stop the vehicle and let the engine return to idle before shifting from a forward range to reverse, or from reverse to a forward range.

### N (Neutral)

Press the N button to select neutral. The digital display will display N when neutral is selected. It is not necessary to press neutral before starting the vehicle. The ECU (electronic control module) automatically places the transmission in neutral at start-up. Always select neutral before turning off the engine.

Neutral is also used during stationary operation of the power takeoff (PTO).



Do not let the vehicle coast in neutral. If the vehicle is allowed to coast in neutral, the engine brake will not work and you could lose control of the vehicle. This can cause an accident possibly resulting in personal injury or property damage. Coasting in neutral can also cause severe transmission damage.

### D (Drive)

When the D button is pushed, the highest forward range will appear in the display. The transmission will initially attain first range when drive is selected (except for those units programmed to start in second range). As vehicle speed increases, the transmission will upshift automatically through each range. As the vehicle slows, the transmission will downshift automatically.

# 5, 4, 3, and 2 (Fifth, Fourth, Third, and Second Ranges)

NOTE: The Allison automatic transmissions can be programmed to include a sixth range.

Occasionally, road conditions, load, or traffic conditions will make it desirable to restrict automatic shifting to a lower range. Lower ranges provide greater braking for going down grades. The lower the range, the greater the braking effect.

Push the up or down arrows on the push button shift selector to select individual forward ranges. The digital display will display your choice of range. When a lower range is selected, the transmission may not downshift until the vehicle speed is reduced.



When going downhill, use a combination of downshifting, braking, and other retarding devices to control vehicle speed and the engine's rated governed speed. Failure to do so could reduce vehicle braking, possibly causing loss of vehicle control and resulting in personal injury or property damage.

IMPORTANT: When descending a hill, downshift to a lower transmission range to increase engine braking and to help you maintain control. The transmission has a feature to prevent automatic upshifting above the lower range selected. However, during downhill operation, if the engine governed speed is exceeded in the lower range, the transmission may upshift to the next higher range.

### 1 (First Range)

Use the first range when pulling through mud or deep snow, when maneuvering in tight spaces, or when driving up or down steep grades. First range provides the vehicle with its maximum driving torque and maximum engine braking effect. Push the down arrow until the first range appears on the display.

#### **Up and Down Arrows**

When a lower range is desired, after **D** has been pressed, press the down arrow until the desired range is shown on the display. Pressing the down arrow continuously causes the range position to continue to go down until the button is released or the lowest range is attained.

When the transmission is in drive and the down arrow has the transmission in a lower range position, press the up arrow to shift to a higher selector position. Pressing the up arrow continuously causes the range position to continue to rise until the button is released or the highest available position is attained.

Pressing the up or down arrows does not override the transmission automatic shifting operation. If a higher or lower position is selected, the transmission continues shifting through the ranges according to the vehicle operating characteristics until the highest or lowest selected position is reached.

If your transmission is equipped with an oil level sensor, the up and down arrows can be used to access transmission fluid level information. Fluid level information is displayed after the first simultaneous press of the up and down arrows. Press both arrows again to obtain diagnostic data.

To exit the fluid level display mode, press any range button on the push button shift selector.

- 1. Park the vehicle on a level surface, shift to neutral, and apply the parking brake.
- 2. Press the up and down arrows at the same time.

NOTE: The fluid level check may be delayed until the following conditions are met:

- The fluid temperature is above 140°F (60°C) and below 220°F (104°C).
- The transmission is in neutral.
- The vehicle has been stationary for about two minutes to allow the fluid to settle.
- The engine is at idle.
- The transmission output shaft is stopped.

The fluid level diagnostic displays occur one character at a time.

- Correct Fluid Level: o,L, which represents fluid (oil) level check mode, is displayed followed by o,K which indicates that the fluid is within the correct fluid level zone. The sensor display and the transmission dipstick may not agree because the oil level sensor compensates for fluid temperature.
- Low Fluid Level: o,L is displayed followed by Lo and the number of quarts the transmission fluid is low.

- High Fluid Level: o,L is displayed followed by HI and the number of quarts the transmission is overfilled.
- Invalid for Display: o,L is displayed followed by a dash (–) and a numerical display. The numerical display is a fault code and indicates that conditions are not proper to receive the fluid level information, or that there is a system malfunction. See Table 7.1 for fault codes that may be displayed.

Oil Level Fault Codes				
Fault Code	Cause of Code			
o,L,–,0,X	Settling time too short			
o,L,–,5,0	Engine speed (rpm) too low			
o,L,–,5,9	Engine speed (rpm) too high			
o,L,–,6,5	Neutral must be selected			
o,L,–,7,0	Sump fluid temperature too low			
o,L,–,7,9	Sump fluid temperature too high			
o,L,–,8,9	Output shaft rotation			
o,L,–,9,5	Sensor failure *			

\* Report sensor failure display to an Allison Transmission distributor or dealer in your area.

Table 7.1, Oil Level Fault Codes

#### **Mode Button**

The mode button is programed to start a specialized input or output function. The mode indicator comes on when the MODE button is pressed to obtain a specific function operation. A mode identification label, located above the MODE button, identifies the function associated with a mode change.

#### **Diagnostic Data**

Press the up and down arrows on the push button shift selector at the same time and release. Press the up and down arrows simultaneously a second time to obtain diagnostic data. When the CHECK TRANS (check transmission) indicator stays on after vehicle start-up, the ECU indicates a diagnostic code. Poor performance may turn on a diagnostic code without turning on the CHECK TRANS indicator. Up to five diagnostic codes can be recorded.

Diagnostic codes can be read and cleared by using the Pro-Link® 9000 Diagnostic Tool or by using the shift selector. Use of the Pro-Link® 9000 Diagnostic Tool is described in the instruction manual furnished with each

tool. Code reading, clearing methods, and complete code descriptions are written in the applicable trouble-shooting manual.

### **Rear Axles**

# Meritor<sup>™</sup> Traction Control Differential Lock, Optional

The Meritor<sup>™</sup> traction control differential lock provides maximum traction in unfavorable driving conditions such as mud or ice. When the traction control differential switch (**Fig. 7.2**) is in the LOCK position, a clutch collar completely locks the differential case, gearing, and axle shafts together. This maximizes traction to both wheels. The lock position will also protect against spinout damage to the differential. The traction control differential lock should not be used when favorable road conditions exist.



Fig. 7.2, Traction Control Differential Switch

When the traction control differential switch is in the LOCK position, the indicator on the traction control differential switch will come on.



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.

# Operation of Traction Control Differential Lock

1. When maximum traction is needed, and while the wheels are not spinning, slipping, or losing traction, move the traction control differential switch to the LOCK position while maintaining a constant vehicle speed under 25 mph (40 km/h).

# 

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: The traction control differential lock system on some vehicles is connected through the low speed range of the transmission. If this type of differential lock system is used, the transmission must be operating in the low speed range to allow the differential to lock.

- 2. Let up momentarily on the accelerator to relieve torque on the gearing, allowing the traction control differential lock to lock.
- 3. Proceed cautiously and never exceed 25 mph (40 km/h). When the traction control differential lock is fully locked, the vehicle will have an understeer condition when making turns. See **Fig. 7.3**.



B. Turning radius when differential is unlocked.

Fig. 7.3, Turning Radii

- 4. When driving conditions have improved and the vehicle can operate safely at speeds above 25 mph (40 km/h), move the traction control differential switch to the UNLOCK position when the vehicle is stopped or traveling under 25 mph (40 km/h) and while the wheels are not spinning, slipping, or losing traction.
- 5. Let up momentarily on the accelerator to relieve torque on the gearing, allowing the traction control differential lock to unlock. It may take up to one-half mile (0.8 km) of driving before the differential unlocks.

NOTE: If the traction control differential lock system is connected through the low range speed of the transmission, shifting out of low speed range will also unlock the differential.

- 6. When the traction control differential switch is in the UNLOCK position, the indicator on the traction control differential switch will go off.
- 7. Resume driving at normal speed.

# Meritor<sup>™</sup> Tandem Drive Axles With Interaxle Differential Lock

Meritor tandem drive axles have an interaxle differential lock feature. The interaxle differential lock is controlled by the interaxle differential switch (**Fig. 7.4**)on the control panel.



Fig. 7.4, Interaxle Differential Switch

When the interaxle differential switch is 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 switch in the UNLOCK position when driving on roads where traction is good.

When the interaxle differential switch is in the LOCK position, the axles are locked together and the driveshaft becomes a solid connection between the two axles. Power entering the forward axle is transmitted straight through to the rear axle so that both axles turn together at the same speed. The interaxle differential lock 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.

When the interaxle differential switch is in the LOCK position, the indicator on the interaxle differential switch comes on. The indicator will go off when the switch is moved to the UNLOCK position.

# 8

# **Fifth Wheels**

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### **Holland Fifth Wheels**

# Holland 3500 Series Stationary and Air Slide Models

The Holland 3500 Series stationary fifth wheel can be a plate mount or an angle mount. See **Fig. 8.1**.

The Holland 3500 Series air slide fifth wheel is mounted on a baseplate which permits forward and rearward adjustment of the fifth wheel for optimum weight distribution over the tractor axles.

The air-operated release slide assembly (**Fig. 8.2**) contains a double-ended air cylinder which locks and unlocks both sides of the sliding member at the same time. The air cylinder is applied by the fifth wheel slide switch.

The Holland Type B kingpin lock mechanism (**Fig. 8.3**) utilizes two spring-loaded lock halves. The final forward motion of the kingpin into the open lock halves forces the locks to close around the kingpin. The kingpin can be released only by pulling the release handle all the way out. The lock adjustment nut will compensate for wear on the lock or kingpin.

### Fifth Wheel Locking Operation for Holland Fifth Wheels

#### Locking the Fifth Wheel Mechanism

1. Make sure the coupling area is level and clear of persons and obstacles.



Fig. 8.1, Holland 3500 Series Fifth Wheels



3. Slide Plunger Release

Fig. 8.2, Air-Operated Release Slide Assembly

 The fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see Group 31 of the Condor<sup>®</sup> 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.





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 mov-

# ing rapidly to the far forward or rearward position, which could damage the fifth wheel or kingpin.

- 3. Make sure the locks are open. If the locks are closed, pull the release handle all the way out.
- 4. Position the tractor so that the fifth wheel lock opening is in line with the trailer kingpin.

- 5. Back the tractor close to the trailer and stop.
- 6. Chock the trailer wheels.
- 7. 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. Apply the trailer brakes.
- 9. Adjust the trailer height so that the fifth wheel will lift the trailer. The trailer should contact the fifth wheel four to six inches (10 cm to 15 cm) behind the fifth wheel bracket pin.
- 10. Slowly back the tractor toward the trailer until positive lockup occurs.
- 11. Check for correct maximum clearance between the lock halves. If more than 1/8-inch (3.2-mm) clearance exists between the lock halves, the lock must be adjusted. See **Group 31** of the *Condor*<sup>®</sup> *Work-shop Manual* for adjustment procedures.



Adjust the locks correctly to a maximum clearance of 1/8 inch (3 mm). Incorrect adjustment of the lock could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

- 12. Test for kingpin lockup by pulling on the trailer against the chocks.
- 13. Make a visual inspection for proper kingpin lockup. Make sure the lock is closed and that the adjustment nut is snug against the fifth wheel.

# WARNING

The coupling procedure is not complete without an inspection. You must get out of the tractor and verify that the fifth wheel is properly coupled to the kingpin. Failure to verify that the fifth wheel is properly coupled to the kingpin could cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

- 14. Charge the air brake system with air. Make sure that the air connections do not leak.
- 15. Retract the trailer landing gear and secure the ratchet handle.

- 16. Remove the chocks from the trailer tires.
- 17. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door jamb 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.



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

- 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.



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 release handle (**Fig. 8.1**) all the way out.
- 7. Slowly drive the tractor away from the trailer.

# Fifth Wheel Slide Operation for Holland Fifth Wheels

- 1. Connect the trailer kingpin to the tractor fifth wheel. For instructions, refer to Holland "Fifth Wheel Locking Operation" in this chapter.
- After positive lockup of the fifth wheel lock mechanism has been accomplished, release the slide assembly by moving the fifth wheel slide switch (Fig. 8.4) in the cab to the UNLOCK position.



Fig. 8.4, Traction Control Differential Switch

- 3. Lower the trailer landing gear just enough to remove the weight from the tractor.
- 4. Pull the trailer air supply valve to cut off the air supply to the trailer.
- 5. Chock the front and rear trailer tires to prevent trailer from moving.

# WARNING

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



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 slide assembly into position by moving the fifth wheel slide switch to the LOCK position. Visually check the slide plungers to make sure they are engaged in the fully locked position.
- The amount of load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are shown on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door jamb 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.

### Fontaine<sup>®</sup> Fifth Wheels

# Fontaine 6000 Series No-Slack® II Stationary and Air Slide Models

On stationary fifth wheel models the fifth wheel top plate is mounted to the tractor frame using a mounting angle. The fifth wheel should be mounted in a position that best distributes the trailer load over the tractor axles.

On air slide fifth wheel models the fifth wheel top plate is mounted on a slide assembly, which is attached to slide rails that are mounted on the tractor frame. The slide rails allow forward and rearward movement of the fifth wheel to obtain 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.

The air slide fifth wheel is controlled by a fifth wheel slide switch located in the cab. The switch controls an air cylinder that locks and unlocks the fifth wheel slide. See **Fig. 8.5**.



Fig. 8.5, Air Slide Fifth Wheel

On Fontaine fifth wheels, kingpin release is accomplished by pulling the release handle located on the side of the fifth wheel. Kingpin lockup occurs when the kingpin is forced into the jaws and the release handle moves to the locked position.

# Fifth Wheel Lock Mechanism for Trailer Kingpin for Fontaine Fifth Wheels

The Fontaine fifth wheel lock mechanism (**Fig. 8.6**) 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 t into elongated notches in the release 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.



Fig. 8.6, Fontaine Kingpin Lock Mechanism

During lockup, the jaw is moved first with the springloaded wedge being allowed to slip into place against the jaw. A timing bracket ensures that the wedge and jaw are moved at the correct time.

Placing the release handle in the unlocked position moves the wedge away from the jaw. This action unlocks the jaw so that it can be moved by the trailer kingpin. When the tractor is moved out from under the trailer, the kingpin moves the jaw until the kingpin is out of the mechanism. With the jaw in the unlocked position, the release handle will remain in the unlocked position until manually moved by the operator.

During coupling, the motion of the kingpin entering the jaw will move 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. Correct adjustment of the wedge stop rod is important to the proper functioning of the locking mechanism. For adjustment instructions, see **Group 31** of the *Condor*<sup>®</sup> *Maintenance Manual*.

Special precautions must be taken during cold weather to ensure that the Fontaine® No-Slack® locking mechanism operates freely. Ice and sludge can build up and lubricants become thick and binding at low temperatures. When the temperature drops below freezing, Fontaine recommends the use of a cleaner or degreaser on the latching mechanism, making sure that the moving parts operate freely. This should be followed by an application of 90weight oil to all moving parts.

### Fifth Wheel Locking Operation for Fontaine Fifth Wheels

#### Locking the Fifth Wheel Lock Mechanism

- 1. Chock the front and rear trailer tires to prevent the trailer from moving.
- 2. On air slide models, lightly oil the locking mechanism. Operate the air slide mechanism several times to ensure it is functioning properly.

# 

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.

3. The kingpin lock mechanism must be fully open, the release handle should be in the extended position, and the fifth wheel plate must be completely lubricated with chassis grease. If the fifth wheel is equipped with a retractable handle, the handle will not be fully extended. For lubrication instructions, see **Group 31** of the Condor<sup>®</sup> 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.

- 4. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, as shown in **Fig. 8.6**. Adjust the trailer landing gear to give enough alignment height for positive kingpin lockup.
- 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 and physical check for positive kingpin lockup. When lockup has occurred, the fifth wheel release handle will have moved to the locked position. See **Fig. 8.7**.
- 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-totrailer air system lines and the 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.
- 11. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fth 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 manufacturer's service information.

# WARNING

Eliminate slack between the trailer and the tractor. Incorrect fth wheel adjustment could cause the trailer to disconnect, possibly resulting in serious personal injury or death.

- 12. Retract the trailer landing gear and secure the ratchet handle.
- 13. Remove the chocks from the trailer tires.
- 14. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

Determine the front and rear axle weights by weighing the vehicle on scales designed for this purpose.

The maximum axle weight ratings are given on the Federal Motor Vehicle Safety Standard (FMVSS) label or Canadian Motor Vehicle Safety Standard (CMVSS) label attached to the left rear door jamb of the tractor. The desired load on the axle is no less than 80 percent of the maximum axle weight rating, but in no case should the axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.



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.



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

4. Lower the trailer landing gear until the weight is removed from the fth wheel.

### **Fifth Wheels**



#### Fig. 8.7, Fontaine 6000 Series Fifth Wheel, Locked and Unlocked (bottom view

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.

### 

Before attempting to lock or unlock the fth wheel lock mechanism of a sliding type fth 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 fth wheel or kingpin.

- Release the kingpin locking mechanism by pulling the release handle to the unlocked position. See Fig. 8.7.
- 7. Slowly drive the tractor away from the trailer.

### Fifth Wheel Slide Operation for Fontaine Fifth Wheels

- Connect the trailer kingpin to the tractor fth wheel. For instructions, refer to Fontaine "Fifth Wheel Locking Operation" in this chapter.
- 2. After positive lockup of the fth wheel lock mechanism has been accomplished, release the slide

assembly by moving the fth wheel slide switch (**Fig. 8.4**) in the cab to the UNLOCK position.

- 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 trailer tires to prevent the trailer from moving.

### WARNING

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

# 

After moving the fth 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 fth wheel is in the desired location.
- 7. Apply the tractor parking brakes.

NOTE: The fth wheel may have to be moved slightly to enable the locking plungers to enter the fully locked position.

- 8. Lock the slide assembly into position by moving the fth wheel slide switch to the LOCK position. Visually check the slide plungers to make sure they are engaged in the fully 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 jamb 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.

# 9

# Daily or Weekly Inspection and Maintenance

Daily or Weekly Inspection and Maintenance Checklist	9.1
Daily or Weekly Inspection and Maintenance Procedures	9.2

# Daily or Weekly Inspection and Maintenance Checklist

Use the following inspection checklist to help ensure that the vehicle components are in good working condition.

Inspections cannot be done quickly. The following inspection may seem to be overly time-consuming. However, careful inspections save time by eliminating stops later to adjust items overlooked or forgotten.

Each numbered item in the checklist corresponds to the numbered instructions found under "Daily or Weekly Inspection and Maintenance Procedures."

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Refer to the Condor® Workshop Manual for repair procedures, and the Condor® Maintenance Manual for lubricant recommendations, specifications, and maintenance intervals.

NOTE: Apply the parking brakes and chock the tires.

- 1. Drain the air brake system air reservoirs.
- 2. Check the fluid level in the windshield washer reservoir.
- 3. Check the coolant level in the surge tank.
- 4. Check the engine oil level.
- 5. Inspect the batteries and battery cables.
- 6. If equipped with oil-lubricated wheel bearings, check the front hub lubricant level.
- 7. Raise the cab and examine the steering gear components.
- Check the radiator and charge air cooler cooling fins for accumulated debris that may clog the fins. Check for damage to the fins. Check the radiator for coolant leaks.
- 9. Check the condition of the coolant hoses and heater hoses.
- 10. Check the condition of the drive belts.
- 11. Inspect the engine for fuel, oil, and coolant leaks.
- 12. Inspect the engine and chassis wiring.

- 13. Check the intake-air restriction indicator mounted on the air cleaner outlet. Inspect the intake-air system for leaks or damage.
- 14. Close the drain valves on the air brake system air reservoirs.
- 15. Inspect the fuel tank(s), fuel lines, and connections for leaks. If equipped with fuel tank shutoff valves, be sure the valves are open.
- 16. Check the fuel level in the fuel tank(s) and be sure the fuel cap vent area is clean.
- 17. If equipped with a fuel/water separator, check the sight bowl. Drain any water found in the fuel/ water separator and check the fuel/water separator for leaks.
- 18. Check the transmission oil cooler for debris and for leaks.
- 19. Inspect the front and rear suspension components, including the springs, spring hangers, equalizers, and shocks.
- 20. Return the cab to its operating position.
- 21. Clean the head lamps, rearview and down-view mirrors, and the outside of the windshield and all window glass. Check the condition of the windshield wiper arms and blades.
- 22. Clean the inside of the windshield, the gauges on the instrument and control panel, and all window glass.
- 23. Check for excessive play at the steering wheel(s).
- 24. Adjust the driver's seat, then align the rearview and down-view mirrors.
- 25. Check the seat belts for secure mounting and for damage. If equipped with a stand-up drive, check the restraint.
- 26. Check the cab interior for loose items, and secure or remove them. Check the emergency equipment.
- 27. Check the power steering fluid level.
- 28. Turn on the ignition and start the engine. Be sure the oil-and air-pressure warning systems are operating. Leave the engine running.
- 29. If equipped with an intake-air restriction gauge on the instrument and control panel, check the Daily

or Weekly Inspection and Maintenance LED on the gauge. If the LED is lit, the air filter needs to be replaced.

- 30. Check the automatic transmission fluid level by using the push button shift selector or by using the dipstick.
- 31. Make sure the electric horn, air horn, windshield wipers and washer, heater, defroster, and mirror heat are operating properly.
- 32. If equipped with a backup alarm, check the operation of the backup alarm.
- 33. Check all interior and exterior lights.
- 34. Check the outer surfaces of the cab and body for visible surface breaks and damage. Make sure the cab doors are secure.
- 35. Inspect the air brake components.
- 36. Check the brake lining wear.
- 37. Make sure the brakes are adjusted on all axles.
- 38. Check the tire inflation pressures.
- 39. Inspect each tire for bulges, cracks, cuts, and penetrations.
- 40. Check to make sure the wheel nuts or rim nuts are tight.
- 41. Check the air brake system for proper operation.
- 42. Remove the chocks from the tires and release the spring parking brakes.
- 43. Test the service brakes.
- 44. Test the parking brakes on an inclined surface.
- 45. Check accessory air system components for leaks.
- 46. If equipped with a fifth wheel, inspect it and check it for adequate lubrication.
- 47. If equipped with a fifth wheel, inspect the 7-way trailer cable receptacle(s) for good connections.
- 48. If equipped with a fifth wheel, connect a trailer to the tractor and inspect the trailer system.
- 49. If equipped with dual steering, check that the control of the throttle and transmission has been transferred to the chosen left-hand or right-hand drive.

50. If equipped with a Vogel chassis lubrication system, verify that the lubrication system is functioning correctly.

# Daily or Weekly Inspection and Maintenance Procedures

Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, refer to the Condor® Workshop Manual for repair procedures, and to the Condor® Maintenance Manual for lubricant recommendations, specifications, and maintenance intervals.

1. Air reservoirs serve as storage tanks for compressed air. They collect water condensed from the air and small amounts of oil from the air compressor. Water and oil normally enter the reservoir in the form of vapor because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows.

# WARNING

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

NOTE: If the air reservoirs are not equipped with manual 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 air reservoir drain valve or pull the drain cable located on the forward end of the air reservoir. 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 form 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 post-trip inspection.
- 1.4. If the drained water is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system which could adversely affect braking.
- 2. Check that the windshield washer reservoir (Fig. 9.1) is filled. Add washer fluid as needed.



5. Engine Dipstick

Fig. 9.1, Reservoir and Dipstick Locations

# WARNING

Washer fluids may be flammable and poisonous. Do not expose washer fluid to an open flame or any burning material, such as a cigarette. Always comply with the washer fluid manufacturer's recommended safety precautions.

3. Check the coolant level in the surge tank (Fig. 9.1). If the coolant is low, check the amount of antifreeze protection. If the protection is adequate, add a 50/ 50 mixture of water and antifreeze. If additional protection is needed, add antifreeze only. Fill the surge tank with coolant to the MAX line.



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

4. Check the engine oil level. See Fig. 9.1. If the oil is low, add enough oil to bring the level up to the H (high) mark or FULL mark on the dipstick. Refer to the engine manufacturer's operation and maintenance manual for recommended lubricants.



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

- 5. Inspect the batteries and battery cables as follows.
  - 5.1. Check for loose connections.



Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. To prevent possible personal injury, always wash your hands after handling battery parts and related accessories.

- 5.2. Be sure the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.
- 5.3. Remove any corrosion from the hold-down and the top of the battery.

# A 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.

- 5.4. Use a baking soda and water solution to neutralize the acid present, then rinse off the soda solution with clean water.
- 5.5. If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire or nylon brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of nonconductive grease or petroleum jelly to the posts and terminals to help retard corrosion.

### WARNING

Do not short the battery posts or cable terminals to the battery hold-down. Doing so could cause damage to the vehicle electrical components, which could result in personal injury or property damage.

 Check the level of the wheel bearing lubricant in the hub cap at each end of the front axle. See Fig. 9.2. If needed, fill the hubs to the level indicated on the hub cap. Use the lubricant recommended for the drive axle. See Group 35 of the Condor<sup>®</sup> Maintenance Manual for recommended lubricants.

IMPORTANT: Before removing the fill plug on the hub cap, always clean the hub cap and the plug.

 Examine the steering gear mounting bolts, pitman arm nut(s), and the drag link nuts for tightness. Inspect the steering drive shaft(s) and steering linkage(s) for excessive looseness or other damage. Check the power cylinder mount bolts and ball-joint nuts for tightness. Tighten loose nuts, and replace damaged parts as needed.

8. 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.



Fig. 9.2, Wheel Bearing Lubricant Checking

Inspect the radiator and charge air cooler for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.

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

On vehicles equipped with an air/oil power steering cooler, inspect the fins of the heat exchanger for damage or clogging. Use compressed air or water to backflush any material restricting airflow.

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

9. 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 yarnreinforced neoprene hose is acceptable. Silicone hoses, having an extended service life, can be substituted for the reinforced neoprene type.

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

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

 Check the fan belt(s), alternator belt, and refrigerant compressor belt for signs of glazing, frayed edges, breaks, cracks, or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, replace the belt.

Check all of the V-belts for proper tension. Use your index finger to apply about 25 lb (11 kg) force at the center of the belt free-span. See **Fig. 9.3**. When belt deflection is about 1/2 to 3/4 inch (13 to 19 mm), stop and adjust the belt tension.

If the accessory drive has a poly-vee V-belt and spring loaded self tensioning-idler, there is no adjustment for belt tension.



Fig. 9.3, Checking Belt Tension

- 11. Check the engine for fuel, oil, or coolant leaks and correct any leaks found.
- 12. Inspect the engine and chassis for loose wiring, chafed insulation, and damaged or loose holddown clamps. Tighten loose wires or hold-down clamps and replace damaged wiring or clamps.
- 13. Check the intake-air restriction indicator (Fig. 9.4) mounted on the air cleaner outlet to determine if the air cleaner filter needs to be changed. Replace the filter if the indicator stays locked at 25 inH<sub>2</sub>O. After replacing the filter, reset the restriction indicator by pressing the reset button. See Group 09 of the Condor<sup>®</sup> Workshop Manual for filter replacement instructions.

Check the engine intake-air 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.



Fig. 9.4, Intake-Air Restriction Indicator

# 

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.

- 14. Close the drain vales on the air brake system air reservoirs before proceeding to the next step.
- 15. Inspect the fuel tank, fuel lines, and connections for leaks. Replace a leaking fuel tank. Repair or replace any lines or connections that are leaking.

#### 

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 re 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 or 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.

16. Check the fuel level in the tank. To keep condensation to a minimum, the fuel tank 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.

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.

Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.

Prime the fuel system if needed.

- 16.1. Remove the fuel tank cap.
- 16.2. Loosen the fuel supply line at the fuel transfer pump.
- 16.3. 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 ow at the loosened fuel supply line.
- 16.4. Remove the air hose and tighten the fuel supply line.

# 

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.

16.5. 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.

17. If equipped with a fuel/water separator, drain the water from the fuel/water separator as follows.

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. Stop draining the fluid when you see uncontaminated fuel come out of the separator drain valve.

- 17.1. 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.
- 17.2. Close and tighten the valve finger tight.
- 17.3. Check the filter element and replace it if it is clogged.
- 17.4. Rust streaks may indicate loose fittings and components.
- 18. Remove any debris found on the transmission oil cooler. Check the transmission oil cooler for leaks.
- Inspect the front and rear suspension components, including the springs, shocks, and suspension brackets.

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

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

# WARNING

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

- 20. Return the cab to the operating position.
- 21. 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.



Replace wiper arms and blades when 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.

- 22. Clean the inside of the windshield, the gauges on the instrument and control panel, and all window glass.
- 23. Check the steering wheel(s) 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. 9.5**.

Excessive lash exists if steering wheel movement exceeds 2-1/2 inches (64 mm). If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear before operating the vehicle.

24. Adjust the driver's seat, then align the rearview and down-view mirrors.

# **Daily or Weekly Inspection and Maintenance**



Fig. 9.5, Measuring Lash at the Steering Wheel

25. Inspect the seat belts. If equipped with a stand-up drive, check the restraint.



Inspect and maintain seat belts as instructed below. Worn or damaged seat belts could fail during a sudden stop or crash, possibly resulting in serious injury or death.

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

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

- 25.1. Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
- 25.2. Check the web for extreme dirt or dust, and for severe fading from exposure to sunlight.
- 25.3. Check the buckle and latch for operation and for wear or damage.

- 25.4. Check the Komfort Latch for function and cracks or other damage.
- 25.5. Check the web retractor for function and damage.
- 25.6. Check the mounting bolts for tightness, and tighten any that are loose.
- 26. Check the cab interior for loose items, and secure or remove them. If provided, be sure the following emergency equipment is in place and in good working condition:
  - a fully charged re extinguisher
  - triangular reflectors
  - ares
  - tire chains (in cold weather)
- 27. With the engine cool, use a shop towel or a clean rag to clean the area around the power steering reservoir fill cap. See **Fig. 9.1**. Remove the cap and dipstick assembly. Check the cold power steering fluid level. The level should be at FULL COLD with the engine off.

Start the engine and run it at idle until it reaches operating temperature. Remove the dipstick, and check that power steering fluid reaches the FULL HOT line. If the fluid level is low, add enough fluid to bring the level up to the FULL HOT mark on the dipstick. See **Table 9.1** for recommended power steering fluids.

Install the dipstick and remove the chocks from the tires.

# CAUTION -

Do not start the engine until the static transmission fluid level has been checked. It should be near the HOT FULL mark. Failure to do so can result in transmission damage.

28. After starting the engine, make sure the oil-and airpressure 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.

Recommended Power Steering Fluids					
Fluid Type	Approved Fluid				
Automatic Transmission	Dexron Type "E Type "F Mobil 21	9   " "   O			
	Shell Rotella T	30W			
	Shell Rotella T	SAE 30			
Heavy-Duty Engine Oil	Chevron Chevron Custom Mobil Super Texaco Union	10W-40			
	Union Unocal Guardol	15W-40			
Hydraulic Fluid	Chevron	Torque 5			
	Exxon Nuto	H32			
Power Steering Fluid	Fleetrite	PSF			
	Texaco	TL-1833			

 Table 9.1, Recommended Power Steering Fluids

# 

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

29. Check the intake-air restriction gauge on the instrument and control panel to determine if the air cleaner filter needs to be changed. If the LED on the intake-air restriction gauge is lit, replace the filter. After replacing the filter, reset the intake-air restriction indicator mounted on the air cleaner outlet by pressing the reset button. See **Group 09** of the *Condor*<sup>®</sup> *Workshop Manual* for filter replacement instructions. 30. To check the automatic transmission fluid level using the push button shift selector, see **Chapter 7**.

To check the automatic transmission fluid level using the dipstick, use the following instructions.



Do not allow foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages.

30.1. Clean all dirt away from around the end of the fluid fill tube before removing the dipstick.

IMPORTANT: It is important to check the fluid level cold to determine if the transmission has a sufficient amount of fluid to be safely operated until a hot check can be performed.

30.2. Run the engine for at least one minute. If the transmission fluid is at the normal operating temperature of 160 to 200°F (71 to 93°C), skip to substep 11. If the transmission is not at normal operating temperature begin with the cold check by performing the following substeps.



Set the parking brake while checking the transmission fluid level. Failure to do so could result in the vehicle moving unexpectedly, which could cause personal injury or property damage.

- 30.3. Shift from drive to neutral, and then shift to reverse to fill the hydraulic system.
- 30.4. Shift to neutral and allow the engine to idle at 500 to 800 rpm.
- 30.5. With the engine running at idle, remove the dipstick from the tube and wipe it clean.
- 30.6. Insert the dipstick into the tube, then remove it.
- 30.7. Check the fluid level reading and repeat the check procedure to verify the reading.

30.8. If the fluid level is within the COLD RUN band, the transmission may be operated until the fluid is hot enough to perform a hot run check.

# 

Do not fill above the COLD RUN band if the transmission fluid is below the normal operating temperature. As the fluid temperature increases, so does the fluid level. Filling above the COLD RUN band when the transmission is below normal operating temperature may result in an overfilled transmission, which causes fluid foaming and aeration. Fluid foaming and aeration cause transmission overheating and erratic shifting.

30.9. If the fluid level is not within the COLD RUN band, add or drain fluid as needed to adjust the fluid level to the middle of the COLD RUN band. See **Table 9.2** for transmission fluid grade and temperature information.

Allison Transmission Fluid Grades and Temperatures				
Viscosity Grade	Ambient Temperature Below Which Preheat is Required: °F (°C)			
SAE 0W-20	-22 (-30)			
TransSynd™	-22 (-30)			
Dexron <sub>®</sub> III	-17 (-27)			
SAE 10W	-4 (-20)			
SAE 10W-30	-4 (-20)			
SAE 15W-40	5 (–15)			
SAE 30	32 (0)			
SAE 40	50 (10)			

 Table 9.2, Allison Transmission Fluid Grades and Temperatures

NOTE: Perform a hot run check by completing the following substeps at the first opportunity after the transmission reaches the normal operating temperature of 160 to 200°F (71 to 93°C).

30.10.Shift the transmission to neutral.

30.11.Operate the engine at idle (500 to 800 rpm) until normal operating temperature is reached. Check that the transmission sump oil temperature is 160°F (71°C).

- 30.12. With the engine idling, remove the dipstick from the tube and wipe it clean.
- 30.13.Insert the dipstick into the tube and remove it.
- 30.14.Check the fluid level reading and repeat the check procedure to verify the reading. Safe operating level is within the HOT RUN band on the dipstick. The HOT RUN band is between the HOT FULL and HOT ADD marks.
- 30.15. If the fluid level is not within the HOT RUN band, add or drain fluid as needed to bring the fluid level within the HOT RUN band. See **Table 9.2** for transmission fluid grade and temperature information.
- 31. Make sure that both the electric horn and the air horn work. Then check the windshield wiper and washer controls. These devices must be in good working order for safe vehicle operation. If they are not working, repair them before trip departure.

Check the operation of the heater and defroster controls. Turn on the mirror heat switch and make sure the system is working.

- 32. If equipped with a backup alarm, check the operation of the backup alarm.
- 33. Turn on the head lamps and hazard warning lights. Check the operation of the interior lights. If any of the control panel lights or interior lights are not working, replace them.

Be sure the brake lights, taillights, marker lights, head lamps, clearance lights, identification lights, and turn-signal lights are working and are clean. See **Fig. 9.6**. Test the high-and low-beam headlights. Replace lights that are not working.

Be sure all reflectors and lenses on the vehicle are in good condition and are clean. Replace any broken reflectors or lenses.

34. Check the outer surfaces of the cab and body for visible surface breaks and damage. Make sure the cab doors are secure.

# DANGER

Do not loosen or remove the parking brake clamp ring (Fig. 9.7) 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.



4. Identification Light

Fig. 9.6, Exterior Lights

Before doing any repairs or adjustments on a service/parking brake chamber, read the applicable warnings and instructions available from the equipment manufacturer.

# 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.

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If the external breather tube or breather cap is missing or incorrectly installed, road dirt and debris can adversely affect the operation of the brake chamber. Once inside of the chamber, dirt and debris can cause the internal parts of the chamber to deteriorate faster.

NOTE: Vehicles operating under severe or adverse conditions should be checked more frequently.

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

Visually inspect the piston rod engagement with the clevis. At least seven threads of engagement are required. There should be 1-inch (25-mm) clearance from the centerline of the clevis pin hole to the end of the piston rod. See **Fig. 9.8**.

See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the service chamber and cause a dragging brake.

Visually inspect the exterior surfaces of the chamber for damage. Make sure that breather holes in the service section(s) are open and free of debris. Refer to instructions available from the equipment manufacturer 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 in place.

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, see **Group 42** of the *Condor*<sup>®</sup> *Workshop Manual* for instructions.

Inspect all hoses and air lines as follows.

35.1. Check the clearance between the rubber 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 if the hose is located above the heat source.



Fig. 9.7, Parking Brake Chamber Clamp



- 35.2. Check for kinks, dents, or swelling of the hoses. If damaged, replace the hose with the same size and type.
- 35.3. Do not route the hose on top of anything likely to be stepped on or walked on.
- 35.4. Check for damage to hoses located near moving parts, such as drivelines, kingpins, suspensions, and axles. If the moving parts are catching or pinching the lines, correct as needed.
- 35.5. 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.
- 35.6. 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).

- 35.7. Inspect nylon air tubing. In cold weather, nylon tubing is more sensitive to nicks and cuts. Replace nicked or cut tubing even if it is not leaking.
- 35.8. Check the minimum bend radii of all hoses. The minimum bend radius of a hose is the bend that the hose will withstand without experiencing damaging stresses or kinking. See **Table 9.3** and **Table 9.4**.

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. See **Fig. 9.9**.

35.9. Check straight hose installations (those hoses that do not bend along their routings). Pressure changes can cause a hose to lengthen up to two percent or shorten up to four percent. A 100-inch (254-mm) length of hose, for example, can contract to 96 inches (244 mm). If the hose has no slack when it is exhausted of air, replace it with one of adequate length to avoid a possible blowoff from the fitting during vehicle operation.

Nylon Tube Minimum Bend Radii								
Number	Inside Diameter: inches	Outside Diameter: inches	Minimum Bend: inches (mm)					
4	0.170	1/4	1.00 (25)					
6	0.251	3/8	1.50 (38)					
8	0.376	1/2	2.00 (51)					
10	0.439	5/8	2.50 (64)					
12	0.566	3/4	3.00 (76)					

Table 9.3, Nylon Tube Minimum Bend Radii

Wire Braid Hose Minimum Bend Radii							
Number	Inside Diameter: inches	Outside Diameter: inches	Minimum Bend inches (mm)				
4	3/16	0.49	0.75 (19)				
5	1/4	0.55	1.00 (25)				
6	5/16	0.62	1.25 (32)				
8	13/32	0.74	1.75 (44)				
10	1/2	0.83	2.25 (57)				
12	5/8	0.96	2.75 (70)				
16	7/8	1.21	3.50 (89)				
20	1-1/8	1.49	4.50 (114)				

Table 9.4, Wire Braid Hose Minimum Bend Radii



A. Bend Radius

#### Fig. 9.9, Bend Radius

- 35.10.Check for kinked or twisted hoses. A sevenpercent 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.
- 36. Inspect the front air brake lines for leaks at the fitting where they enter the air chamber.

With an assistant at the front wheels to inspect the brake lines, turn the wheels to full lock in one direction. While holding the service brake pedal down, inspect the front brake air lines closely where they enter the air chambers. Turn the wheels to full lock in the other direction, hold the service brake pedal down, and repeat the inspection.

If there is a leak, the hose should be replaced.See **Group 42** of the *Condor*<sup>®</sup> *Workshop Manual* for the hose replacement procedure.

- 37. 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.
  - 37.1. If the axle assembly is not equipped with a dust shield or backing plate, measure the axle brake lining thickness. If any of the 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** of the *Condor*<sup>®</sup> *Workshop Manual* for instructions.

37.2. 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

(6.4 mm) at the thinnest point, replace the linings on all brake assemblies on that axle. See **Group 42** of the *Condor® Workshop Manual* for instructions.

37.3. Install the inspection plugs in the dust shields or backing plates if equipped.

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

38. Inspect the slack adjusters as follows.

For Meritor slack adjusters, see Fig. 9.10.

For Haldex slack adjusters, see Fig. 9.11.

Check the boot for cuts, tears, or other damage. Replace it if necessary.

Chock the rear tires, then release the parking brake.



Fig. 9.10, Brake Stroke Check, Meritor Automatic Slack Adjuster



- 1. With the brakes released, measure this distance.
- 2. With the brakes applied, measure this distance.

Fig. 9.11, Brake Stroke Check, Haldex Automatic Slack Adjuster

• With the brakes fully released, measure the distance from the base of the brake chamber to the center of the clevis pin.

Check for correct brake chamber stroke:

• Build air pressure to 100 psi (690 kPa), then shut down the engine. With the brakes fully applied, measure the distance from the bottom of the brake chamber to the center of the clevis pin.

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 9.5**. Long stroke design is indicated by a tag, or embossing, on the brake chamber.

Maximum Allowable Brake Chamber Stroke					
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	1-3/4 (44)				
24 (long stroke)*	2-1/2 (64)				
30	2 (51)				
30 (long stroke)*	2-1/2 (64)				
36	2-1/4 (57)				

\* Long stroke design is indicated by a tag, or embossing, on the brake chamber.

#### Table 9.5, Maximum Allowable Brake Chamber Stroke

- If the stroke is greater than the specified range, check brake components including drums, camshafts, camshaft bushings, anchor pins, rollers, chamber brackets, the clevis, and clevis pins.
   See Group 42 of the Condor® Workshop Manual for instructions.
- If there are no problems with the foundation brakes, manually adjust the slack adjuster. See Group 42 of the Condor<sup>®</sup> Workshop Manual for instructions.

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# Do not hammer on the control arm. This may cause internal damage.

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. Also, 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.

39. Using an accurate tire pressure gauge, check the inflation pressures of the tires before each trip. Tires should be checked when cool. Be sure the valve stem caps are on every tire and that they are screwed on finger-tight. Inflate the tires to the applicable pressures if needed.

See **Table 9.6** or **Table 9.7** for the correct tire inflation pressures for the vehicle load. The information in this table is representative of most tires. Operator should verify the load vs. tire pressure with local tire representatives as needed.

When traveling at unusual speeds, use **Table 9.8** to adjust tire pressure.

If a tire has been run at or underinflated, check the wheel for proper lockring and side-ring seating before adding air. Check for 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.

	Tire Load Limits, Michelin Radial Ply Tubeless Tires at Various Cold Inflation Pressures												
	Load		Мах					Press	ure: psi (	kPa)			
Size	Range Ply Rating	Axle	Speed: mph (km/h)	90 (621)	95 (655)	100 (689)	105 (724)	115 (793)	120 (827)	123 (848)	125 (862	130 (896)	131 (903)
11R22.5	G/14	Single Dual	75 (120)	_	_	6175 5750	_	_	_	_	_	_	_
11R22.5	H/16	Single Dual	75 (120)	_	_	_	_	6610 5950	_		_	_	_
11R22.5	G/14	Single Dual	65 (105)	_	_	6175 5750	_	_	_		_	_	_
11R22.5	G/14	Single Dual	65 (105)	—	—	—	6175 5840	_	_		_	_	_
11R22.5	H/16	Single Dual	65 (105)	_	_	_	_	_	6610 6005		_	_	_
12R22.5	H/16	Single Dual	65 (105)	_	_	_	_	7390 6610	_	_	_	_	_
12R22.5	H/16	Single Dual	65 (105)	—	_	_	_	7390 6750	_	_	_	_	_
12R22.5	H/16	Single Dual	55 (88)	—	_	_	_	7390 6750	_	_	_	_	_
12R22.5	H/16	Single Dual	65 (105)	_	_	_	_	_	15,660 27,800	_	_	_	_
235/80R22.5	G/14	Single Dual	65 (105)	4675 4410	_	_	_	_	_		_	_	_
255/70R22.5	H/16	Single Dual	65 (105)	_	_	_	_	5510 5205	_		_	_	_
255/80R22.5	G/14	Single Dual	65 (105)	_	5205 4810	_	_	_	_		_	_	_
275/80R22.5	G/14	Single Dual	75 (120)	—	_	6175 5675	_	_	_	_	_	_	_
275/80R22.5	H/16	Single Dual	75 (120)	—	_	_	_	6940 6175	_	_	_	_	_
275/70R22.5	H/16	Single Dual	65 (105)	_	_	_	_	_	_		_	_	6945 —
275/80R22.5	G/14	Single Dual	65 (105)	—	_	6175 5675	_	_	_	_	_	_	_
315/80R22.5	L/20	Single Dual	55 (88)	—	_	_	_	_	_	_	_	9000 8255	_
315/80R22.5	L/20	Single Dual	55 (88)	_	_	_		_				10,000 8255	
315/80R22.5	L/20	Single Dual	65 (105)	—	—	_	_	_	_	_	_	9000 8255	_
385/65R22.5	J/18	Single Dual	65 (105)	—	—	_	—	—	_	—	9370 —	_	—

Table 9.6, Tire Load Limits, Michelin Radial Ply Tubeless Tires at Various Cold Inflation Pressures

	Tire Load Limits, Michelin Radial Ply Tubeless Tires at Various Cold Inflation Pressures												
	Load	ad	Max		Pressure: psi (kPa)								
Size	Range Ply Rating	Axle	Speed: mph (km/h)	90 (621)	95 (655)	100 (689)	105 (724)	115 (793)	120 (827)	123 (848)	125 (862	130 (896)	131 (903)
385/65R22.5	J/18	Single Dual	62 (100)	_	_	—	_	_	_	_	—	9920 —	—
425/65R22.5	L/20	Single Dual	65 (105)	_	_	—	_	_	_	_	11,400 —	_	—
445/65R22.5	L/20	Single Dual	65 (105)	_	_	_	_	_		_	_	_	12,800 —

Table 9.6, Tire Load Limits, Michelin Radial Ply Tubeless Tires at Various Cold Inflation Pressures

	Tire Load Limits, Goodyear Tubeless Tires at Various Cold Inflation Pressures									
Sizo	Load Range	Avio	Max Speed:		Pre	essure: psi (k	ure: psi (kPa)			
5120	Ply Rating	Axie	mph (km/h)	100 (689)	105 (724)	110 (758)	120 (827)	125 (862)		
11R22.5	G/14	Single Dual	75 (120)	—	6175 5750	—	_	—		
11R22.5	H/16	Single Dual	75 (120)	—	_	 5800	6610 —	—		
11R22.5	G/14	Single Dual	65 (105)	_	6175 5750	—	—	—		
11R22.5	H/16	Single Dual	65 (105)	_		 5800	6610 —	_		
12R22.5	H/16	Single Dual	65 (105)	_		_	7390 6750	_		
275/70R22.5	H/16	Single Dual	75 (120)	_	_	_	—	6610 6175		
295/75R22.5	G/14	Single Dual	75 (120)		_	6175 —	—	_		
295/75R22.5	H/16	Single Dual	75 (120)	_	_		6610 —	_		
295/80R22.5	H/16	Single Dual	75 (120)	—	—	—	—	7830 6940		
315/80R22.5	J/18	Single Dual	75 (120)	_	_	_	—	8820 7390		
315/80R22.5	J/18	Single Dual	65 (105)	_	_	_	8270 7610	_		
315/80R22.5	L/20	Single Dual	55 (88)	_	_	_	9000 7750	_		
315/80R22.5	J/18	Single Dual	75 (120)	—	—	—	8270 7610	—		
385/65R22.5	J/18	Single Dual	65 (105)	—	—	—	9370 —	—		

Table 9.7, Tire Load Limits, Goodyear Tubeless Tires at Various Cold Inflation Pressures

Variations in Load and Inflation Limits According to Speed						
Speed Range: mph (km/h)	Inflation Pressure Increase: 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 9.8, Variations in Load and Inflation Limits

 According to Speed

# 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.

40. 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 allowed to contact the tires, will soften the rubber and destroy the tire.

- 41. Check to make sure the wheel nuts or rim nuts are tight.
  - 41.1. Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes (Fig. 9.13), metal buildup around stud holes, or out-of-round or worn stud holes

(Fig. 9.12) may be caused by loose wheel nuts.

See **Group 40** of the *Condor® Workshop Manual* for torque specifications and the correct tightening sequence.



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.

Wheel damage could result in loss of a wheel resulting in property damage, serious personal injury, or death.

41.2. Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks or other damage.

> See **Group 40** of the *Condor*® *Workshop Manual* for service procedures on the studs, hubs, and wheel and tire servicing.

# **Daily or Weekly Inspection and Maintenance**



Fig. 9.12, Worn Stud Holes

41.3. Replace broken, cracked, badly worn, bent, rusty, or sprung rings and rims.



Fig. 9.13, Dirt and Rust Streaks from the Stud Holes

### 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. 42. Check components of the air brake system for proper operation as follows.

NOTE: Be sure the tires are chocked.

- 42.1. 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 115 to 125 psi (793 to 862 kPa). With the engine idling, make a series of foot valve applications. The air governor should cut in the air compressor at approximately 95 to 100 psi (655 to 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. See **Group 40** of the *Condor® Workshop Manual* for adjusting or replacing the air governor.
- 42.2. Check the air pressure buildup time as follows.

Release the parking brakes on the vehicle by pushing in the parking brake knob.

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.

- 42.3. Check the air pressure reserve. With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.
- 42.4. 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 the cut-out pressure of 115 to 125 psi (793 to 862 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 the cut-out pressure of 115 to 125 psi (793 to 862 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 2 psi (14 kPa) per minute with the service brakes released or 3 psi (21 kPa) per minute with the service brakes applied, repair all areas of leakage before driving the vehicle.

- 43. Remove the chocks from the tires and release the spring parking brakes.
- 44. When starting to move the vehicle and before picking up speed, test the brakes with the foot valve and parking brake knob to be sure they will bring the vehicle to a safe stop.
- 45. Pull the parking brake knob with the vehicle on an incline (the ramp surface should be made of Portland cement or equivalent). If the parking brakes do not hold the vehicle in place when set, repair the

parking brake system. See **Group 42** of the Condor<sup>®</sup> Workshop Manual for instructions.

- 46. Check accessory air system components such as air suspension seats and air horns for leaks.
- 47. If equipped with a fifth wheel, inspect it and check it for adequate 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.

47.1. Lubricate the fifth wheel top plate with automotive chassis grease or use a plastic lube plate to provide a lubricated surface. Use engine oil to lubricate the pivot points within the fifth wheel.

NOTE: Vertical movement of the kingpin is provided to accommodate the use of a plastic lube plate in place of automotive grease on the bearing surfaces of the kingpin and the fifth wheel top plate. The plastic must not exceed 3/16 inch (5 mm) in thickness. If a plastic lube plate is used it must be 10 inches (25.4 cm) in diameter or larger.

- 47.2. Operate the handle and make sure the jaws open and close freely.
- 47.3. Visually check all the bolts and nuts that attach the fifth wheel to the fifth wheel mounting plate to be sure they are tight.
- 47.4. Visually check the fifth wheel assembly for cracks, wear, and fractured welds. Repair or replace damaged or worn components.



Repair or replace damaged or worn fifth wheel components. The use of damaged or worn components could cause the trailer to detach from the tractor, possibly resulting in serious personal injury or death.

- 47.5. Before connecting the fifth wheel to the trailer kingpin, always be sure that the fifth wheel top plate is lubricated with automotive chassis grease or that the plastic lube plate is installed on the fifth wheel top plate.
- 47.6. After connecting the fifth wheel to the trailer kingpin, check that the fifth wheel lock mechanism is locked to the trailer kingpin. See Chapter 8 for coupling instructions.

# WARNING

Check to be sure that the trailer is securely connected to the truck. Failure to achieve complete fifth wheel lockup may result in the trailer becoming detached from the truck possibly resulting in serious personal injury or death.

- 47.7. Make sure that the electrical cable is connected to the trailer and that the brake lights and taillights are working.
- 48. If equipped with a fifth wheel, inspect the 7-way trailer cable receptacle(s) for good connections.

Clean and grease the 7-way socket and plug regularly, especially in regions where magnesium chloride or calcium chloride are used as road de-icers. These chemicals are highly corrosive to brass and copper, the base materials for the contact pins used in the 7-way receptacles. Clean the socket and plug with a plug brush and apply a moderate amount of dielectric grease to both the socket and plug pins. See **Group 15** of the *Condor® Maintenance Manual* for an approved dielectric grease.

- 49. Hook the trailer to the truck and inspect the trailer system.
  - 49.1. Make sure all fifth wheel connections are engaged and locked. Check that all connections to the dolly or trailer hitch and safety chains are secure.
  - 49.2. Make sure the gladhands in front of each trailer are engaged and that all air hoses are properly suspended.
  - 49.3. Make sure the air shutoff valves are turned on and air is available to the lines on the trailer.

49.4. Make sure all light cables are connected and correctly suspended.

Check that all trailer lights are working.

- 50. If equipped with dual steering, check that the control of the throttle and transmission has been transferred to the chosen left-hand or right-hand drive.
- 51. If equipped with a Vogel chassis lubrication system, perform a system check to verify that the lubrication system is functioning correctly. Turn on the vehicle ignition and observe the dash mounted indicator lamp. The indicator lamp on the dash and at least one LED (PAUSE or CONTACT) on the control unit should all come on following ignition activation. The indicator lamp on the dash will go out after 3 seconds. This confirms that the lubrication system is operating correctly. For further information see **Group 31** of the *Condor® Maintenance Manual*.

# 10

# **Cab Appearance**

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### **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 the finish of your cab, 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 specially designed for this purpose. Remove all road tar and tree sap before waxing. It is recommended that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface off with water.
- To prevent rust, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

# Care of Chromed Finishes and Stainless-Steel Parts

To prevent rust, keep chromed finishes and stainlesssteel 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 chromed finishes or stainless-steel 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.

IMPORTANT: Use only nonabrasive chrome cleaners on stainless-steel parts. This prevents scratching and marring of the polished surfaces.

To help protect the chromed finishes 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.

# **Vinyl Upholstery Cleaning**

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

#### **Ordinary Dirt**

Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times, as necessary.

If dirt is deeply imbedded, use a soft bristle brush after applying the soap.

If dirt is extremely difficult to remove, wall-washing preparations normally found around the home can be used. Powdered cleaners, such as those used for sinks and tiles, are abrasive and must be used with caution as they can scratch the vinyl or give it a permanent dull appearance.

#### **Chewing Gum**

Harden the gum with an ice cube wrapped in a plastic bag, then scrape off with a dull knife. Any remaining traces of gum can be removed with an all-purpose light oil (peanut butter will also work) and wiped off.

#### Tars, Asphalts, and Creosote

Each of these items stains vinyl after prolonged contact. They should be wiped off immediately and the area carefully cleaned, using a cloth dampened with naphtha.

#### Paint, Shoe Heel Marks

Paint should be removed immediately. Do not use paint remover or liquid-type brush cleaner on vinyl. An unprinted cloth, dampened with naphtha or turpentine may be used. Use care to prevent contact with parts of the upholstery that are not vinyl.

#### Sulfide Stains

Sulfide compounds, such as those found in eggs and some canned goods, can stain after prolonged contact with vinyl. These stains can be removed by placing a clean, unprinted piece of cloth over the spotted area and pouring a liberal amount of six percent hydrogen peroxide onto the cloth.

Allow the saturated cloth to remain on the spot for 30 to 60 minutes. For stubborn spots, allow the hydrogenperoxide saturated cloth to remain on the area overnight. Use caution to prevent the solution from seeping into the seams, or it will weaken the cotton thread.

#### Nail Polish and Nail Polish Remover

Prolonged contact with these substances causes permanent damage to vinyl. Careful blotting immediately after contact minimizes damage. Do not spread the liquid during removal.

#### Shoe Polish

Most shoe polishes contain dyes which penetrate vinyl and stain it permanently. Shoe polish should be wiped off as quickly as possible using naphtha or lighter fluid. If staining occurs, try the same procedure as that under "Sulfide Stains."

#### **Ball Point Ink**

Ball point ink can sometimes be removed if rubbed immediately with a damp cloth, using water or rubbing alcohol. If this does not work, try the procedure used under "Sulfide Stains."

#### Miscellaneous

If stains do not respond to any of the treatments described above, it is sometimes helpful to expose the vinyl to direct sunlight for up to 30 hours. Mustard, ball point ink, certain shoe polishes, and dyes often bleach out in direct sunlight, leaving the vinyl undamaged.

# **Cloth Upholstery Cleaning**

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Spot clean with a mild solvent or upholstery shampoo or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow instructions carefully and clean only in a well-ventilated area. Avoid any product that contains carbon tetrachloride or other toxic materials. With either method, pretest a small area before proceeding. Use a professional upholstery cleaning service when extensive cleaning is needed.

#### Grease and Oil-Based Stains

Dampen a small absorbent cloth with dry-cleaning solvent or spot remover. Apply carefully to the spot from the outer edge to the center. Pat and blot with a clean, dry cloth. Repeat several times as necessary, turning the cloth so that the stain does not redeposit on the fabric.

#### Sugar and Water-Based Stains

Apply water-based detergent or cleaner, working in circular motions. Pat and blot as dry as possible. Repeat, if necessary, before drying thoroughly.

#### Chewing Gum or Wax

Harden the gum or wax with an ice cube wrapped in a plastic bag, then scrape off with a dull knife. Excess wax can be absorbed by placing a thick white blotter over the wax and heating with a warm (not hot) iron.

Remove the remainder by using the same procedure under "Grease and Oil-Based Stains."

#### Mildew

Brush the dry fabric with a soft brush. Sponge with detergent, and blot. If the fabric is colorfast, dilute a teaspoon of bleach in one quart (one liter) of cool water. Apply with a swab directly on the mildew stain. Dab repeatedly with clear, cool water, and blot dry.

# 11

# In an Emergency

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# **Hazard Warning Lights**

The hazard warning light switch (**Fig. 11.1**) is located on the center control panel. Press the upper end of the hazard warning light switch to turn the hazard warning lights on. All of the turn signal lights and the turn signal indicators will ash when the hazard warning light switch is on.

If there is an emergency while driving, cautiously pull off the road. Turn on the hazard warning lights. Place the reflectors or ares along the side of the road to alert other drivers that an emergency situation exists.



Use extreme care when placing ares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or re could occur causing serious personal injury.



Fig. 11.1, Hazard Warning Light Switch

## Fire Extinguisher, Optional

If equipped with a re extinguisher (**Fig. 11.2**), it is located inside the left-hand door on vehicles with primary left-hand-drive, and inside the right-hand door on vehicles with primary right-hand drive.

## **Emergency Kit, Optional**

If equipped with an emergency kit, it is located behind the primary driver's seat. The emergency kit contains triangular reflectors. It may also contain flares.



Fig. 11.2, Location of Fire Extinguisher

# First Aid Kit, Optional

If equipped with a first aid kit, it is located behind the primary driver's seat.

# Towing

When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.



Do not tow an unbraked vehicle if the combined weight of both vehicles is more than the sum of the gross axle weight ratings (GAWR) of the towing vehicle. Otherwise brake capacity will be inadequate, which could result in personal injury or death.

#### Front Towing Hookup

NOTE: It is recommended that towing be performed using an underslung hookup that lifts up from under the front axle beam and secures the lifting device at the spring pack.

1. Disconnect the battery ground cables.

# 

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. If a vehicle with tandem axles is to be lifted and towed, remove only the rearmost drive axle shafts.
- 3. Cover the ends of the hubs with metal plates or plywood cut to t the axle opening and drilled to t 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.



# Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

- 4. If a vehicle with tandem axles 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. Attach the towing device. Due to the many variables that exist in towing, positioning of the lifting

and towing device is the sole responsibility of the tow truck operator. Front tow hooks (**Fig. 11.3**) are standard; rear tow hooks are optional.

6. Lift the vehicle and secure the safety chains. If extra towing clearance is needed, remove the front wheels.



Fig. 11.3, Front Tow Hooks



Failure to lower the vehicle could result in the air fairing striking an overhead obstruction, such as a bridge or overpass, and causing vehicle damage or personal injury.

7. Connect the clearance lights, taillights, and turn signal lights. Connect any special towing lights required by local regulations.

# WARNING

Failure to chock the tires or connect the tow truck's air brake system before releasing the spring parking brakes could allow the disabled vehicle to suddenly roll. This could cause property damage or personal injury.

8. Chock the disabled vehicle's tires and connect the tow truck's air brake system to the vehicle being

towed. Then release the spring parking brakes and remove the chocks.

#### **Emergency Starting with Jumper Cables**

When using jumper cables, follow the instructions below.

# WARNING

Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.



Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Also, do not attempt to charge isolated, deep-cycle batteries with jumper cables. Follow the manufacturer's instructions when charging deep-cycle batteries.

- 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 or positive jump-start post of the booster batteries, and connect the other end of the cable to the positive terminal or positive jump-start post of the discharged batteries. See **Fig. 11.4**.



Fig. 11.4, Jumper Connections

# 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.

 Connect one end of the second jumper cable to the negative terminal or negative jump-start post (Fig. 11.5) of the booster batteries, 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.



Fig. 11.5, Jump-Start Posts

- 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.

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Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in severe personal injury from explosion and acid burns.

- 7. Disconnect the grounded cable from the frame or other nonbattery location, then disconnect the other end of the cable.
- 8. Disconnect the remaining cable from the newly charged batteries or jump-start post first, then disconnect the other end.

## Fire in the Cab

The incidence of re in heavy-and medium-duty trucks is rare according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab, but despite this, most materials will burn. The cab of this vehicle contains urethane foam, which is of concern in this respect.

# WARNING

Urethane foam is flammable! Do not allow any flames, sparks, or other heat sources such as cigarettes or light bulbs to contact urethane foam. Urethane foam in contact with such heat sources could cause a serious, rapid re, which could result in death, severe burns, or gas poisoning, as well as damage to the vehicle.

#### In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

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