

INTRODUCTION

This manual provides information needed to operate and understand the Newco chassis and its components.

The safety or performance of your vehicle could be adversely affected by the installation of non-standard components. Note the limitations and specifications provided in the vehicle and chassis manuals, and consult your selling dealer before making any alterations to the vehicle or chassis. For your reference, keep this manual in the vehicle at all times.

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

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION REPORTING PROCEDURE

If you believe that your vehicle has a defect that 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 Newmar Corporation.

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

FOREWORD

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

CUSTOMER SERVICE

If you are having trouble finding service please call Newmar Corporation Customer Service at 1-800-731-8300. Call night or day, weekdays or weekends, for dealer referral, vehicle information, and breakdown coordination. Our people are knowledgeable, professional, and committed to keeping your vehicle moving.

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VEHICLE IDENTIFICATION

Vehicle Specification Label	1.1
Vehicle Identification Number (VIN)	1.1

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VEHICLE IDENTIFICATION

VEHICLE SPECIFICATION LABEL

This label contains the name of the manufacturer, the month and year of manufacture, the certification statement, vehicle identification number, gross vehicle weight rating (GVWR), front and rear gross axle weight ratings (GAWRs), suitable tire and rim combinations that can be installed on the vehicle, and the recommended tire inflation pressures. (FIG. 1.1)

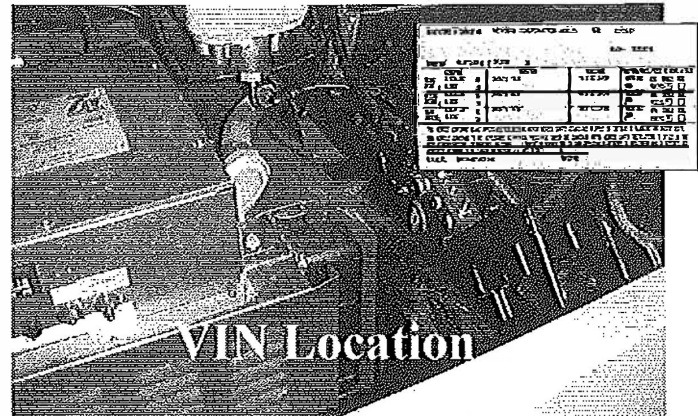
SPECIFICATION LABEL					
SERIAL #	40915	VIN #	5NCAAD1A31N00011	MODEL #	NADP2801
SECOR #	NA1-422	WOOD COLOR		MODEL YEAR	2001
		DRY WEIGHT	18,354		
APPLIANCE INFORMATION					
	MODEL #	SERIAL #		MODEL #	SERIAL #
FRONT A/C	636515-321	04115663	REAR A/C		
FRONT TV	FLC2050	COA525672	REAR TV	CT5R11A	M331E70025
FRONT FURUL	DSW2610.73	40204163	DA*	RV200443	18334
WATER HEATER	S-600	870*		2243-1100	045443
GENERATOR	CD7033				
FRONT RADIO	COVA7074E		REAR RADIO	G45G54	USP300454200
WASHER			DRYER		
CB RADIO			VCR		
CONVERTER			MICROWAVE	R225W	01565
REFRIGERATOR	RFS7500	215979	AWNING	G2080	025333
MONITOR			AWNING HOW		
ICE MAKER			FREEZER		
RYVERTER	51-3303-12	256182	CD PLAYER	DF25-CXU	513749

(FIG. 1.1)

VEHICLE IDENTIFICATION NUMBER (VIN)

The chassis vehicle identification number (VIN) is stamped on a metal plate permanently attached to the chassis. The VIN plate is on the driver's side frame rail exposed under the front hood. The last six digits are the chassis serial number. (FIG. 1.2)

NOTE: Always include the chassis serial number (last six digits of the VIN) when communicating with Newmar Corporation.



(FIG. 1.2)

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DRIVER CONTROLS AND INSTRUMENTS

Instrument Panel	2.1
Controls	2.1
Warning and Indicator Lights	2.2
Instruments	2.8

DRIVER CONTROLS AND INSTRUMENTS

INSTRUMENT PANEL

The warning and indicator light module is located on the instrument panel and contains all of the standard and optional warning and indicator lights. (FIG. 2.1A&B)

CONTROLS

If your unit is equipped with a motor home dash heater/air conditioner, please refer to the manufacturer's literature in your Owner's Information Package.

IGNITION SWITCH AND KEY (FIG. 2.2)

The ignition switch can be turned to four positions: ACCESSORY, OFF, ON, and START.

The key can be inserted and removed only from the OFF position (key slot is vertical). The headlights (low beams), brake lights, dome lights, clearance lights, turn signals, hazard warning lights, and parking lights operate with the ignition switch off, regardless of whether the key is inserted.

In the accessory (ACC) position (key is turned counterclockwise) all electric gauges operate.

Turn the key fully clockwise to the START position only when starting the engine. When the engine starts, release the key. When released, the key will move to the ON position.

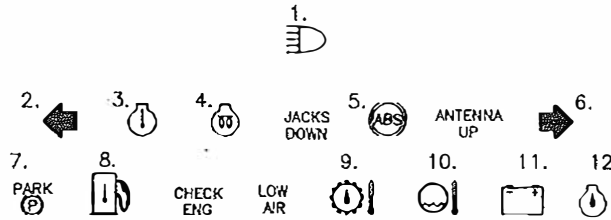
In the ON position (key turned 45° clockwise), all chassis electrical systems are operable. Warning lights for low air pressure and low oil pressure operate until the engine is started and minimum pressures are built up.



- 1. Accessory
- 2. Off

- 3. On
- 4. Start

(FIG. 2.2)



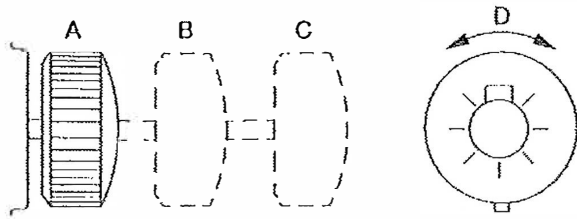
(FIG. 2.1A&B)

1. High Beam
2. Left Turn
3. Engine Protect
4. Wait to Start
5. ABS
6. Right Turn
7. Park Brake
8. H₂O in Fuel
9. Trans Temp
10. H₂O Temp
11. Volt Meter
12. Oil Pressure

HEADLIGHT SWITCH AND PANEL LIGHT (FIG. 2.3)

The control knob for the headlights, side marker lights, tail lights, parking lights, license plate lights, and panel lights are located on the instrument panel. Control knob positions are as follows:

- All lights are off if the knob is pushed all the way in.
- If pulled out to the first stop, all lights are on except the headlights.
- If pulled all the way out, all lights including the headlights are on.
- Turn the knob to the right to brighten the panel lights or turn it to the left to dim them. The high beam headlights are activated by pulling the turn signal lever toward the driver. When the head lights are on high beam, the high beam light comes on in the instrument panel.



- A. Off
- B. Parking Lights
- C. All Lights Including Headlights
- D. Panel Light Brightness

(FIG. 2.3)

DAYTIME RUNNING LIGHTS

This unit is equipped with Daytime Running Lights. These lights will automatically turn on when the following conditions are met:

- The unit is running and the park brake is not applied.
- The headlight switch knob is in position A. See (FIG. 2.3).

PARKING BRAKE CONTROLS (FIG. 2.4)

All vehicles will be equipped with a diamond-shaped parking brake control knob. Pulling the knob applies the

spring parking brakes. Before the spring parking brakes can be released, the air pressure must be at least 65 psi (447 kPa). See chapter 6 for detailed operating instructions.



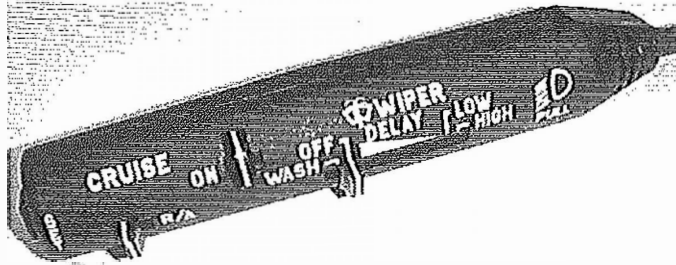
(FIG. 2.4)

WARNING!

This vehicle is equipped with an air suspension system, do not move the vehicle with the air suspension deflated. This could result in loss of vehicle control, possibly causing personal injury and property damage.

TURN SIGNAL SWITCH (FIG. 2.5)

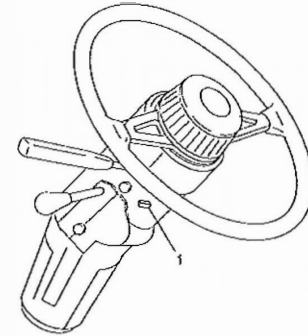
The turn signal lever is mounted on the steering column. Move the multi-function lever upward for the right turn signal and downward for the left turn signal. When one of the signal lights is on, a green indicator light flashes at the far left or far right of the warning and indicator light panel. When the turn is completed, the signal will cancel and the lever will return to the neutral position.



(FIG. 2.5)

HAZARD WARNING LIGHTS (FIG. 2.6)

Pull out on the hazard warning light tab on the steering column to activate the hazard warning lights. The hazard warning light tab will be located on either the top or bottom of the steering column, depending on vehicle equipment. When the switch or tab is pulled out, all of the turn signal lights and both of the indicator lights on the control panel will flash. To cancel the warning lights, push the tab in.

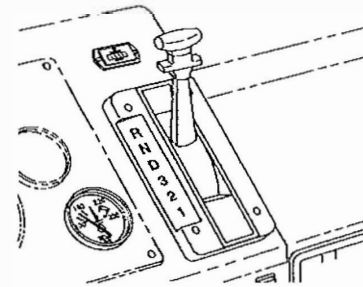


1. Hazard Warning Light Switch

(FIG. 2.6)

TRANSMISSION OPERATION (FIG. 2.7)

For transmission operation, see chapter 4 and the Allison Operator's Manual.



(FIG. 2.7)

CRUISE CONTROL SYSTEM (FIG. 2.5)

The cruise control is set by using the multi-function lever mounted on the steering column.

The cruise control allows you to automatically control the speed of the vehicle above 32 mph (50 km/h). To set the speed, move the slide button to the left to the ON position and drive at any speed above 32 mph at which you want automatic control. Hold that speed with your foot while you press and release the SET button. One second after release, take your foot off of the accelerator pedal. You can increase speed at any time with the accelerator pedal. When you release the pedal, you will return to the set speed.

To increase the set speed, hold the R/A slide button to the right and your vehicle will accelerate until you release it. By releasing the button, you will set the cruise at the current speed.

When you press and hold the SET button, you erase the set speed from memory and allow the vehicle to coast. Just before you reach the lower speed you want, release the button and it will control there, providing it is above the low speed setting.

To disengage the cruise control, depress the brake pedal about an inch. You can also disengage the speed control by

pushing the cruise control slide button to the OFF position, but this erases the set speed from memory.

When you disengage the system with the brake, you do not erase the set speed from memory, even if you come to a complete stop. To return to a chosen speed, drive to a speed above 32 mph, then push and release the R/A slide button. The speed control will take you back to your set speed and control there.

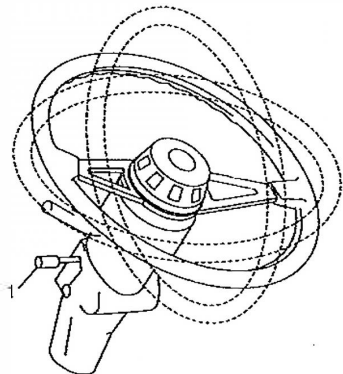
NOTE: The set speed will be maintained within 4 mph (6 km/h) above or below the set speed when grades do not exceed 7 percent (most interstate highways). At higher altitudes, the set speed can vary by more than 4 mph (6 km/h). If actual vehicle speed decreases 5 mph (8km/h) or more below the set speed, the cruise control will automatically disengage.

When pulling a heavy load, climbing a very steep hill, or driving into a strong wind, bring the vehicle up to speed with the accelerator pedal, and then let the cruise control take over.

In high idle mode, place the shift lever in neutral (N) and on the cruise control switch, move the slide button to the "ON" position. Accelerate to desired rpm. Press and release the "Set/Coast" button. Disengage this by stepping

on the brake pedal or moving the “ON/OFF” switch to the “OFF” position.

TILT/TELESCOPE STEERING COLUMN



1. Tilt/Telescope Lever

(FIG. 2.9)

To change the position of the steering wheel, pull the lever upward and move the steering wheel to the desired position. Release the lever to lock. The steering wheel can also be tilted up to provide easier exit and re-entry. The vehicle is equipped with a telescoping steering column, push the lever down and extend or retract the steering wheel as desired. (FIG. 2.9)

ELECTRIC HORN

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

WINDSHIELD WIPERS

Windshield wipers are controlled using the turn signal switch (FIG. 2.5). Push the wiper control slide switch to the left and release; wash solution is delivered with five wipe cycles to follow and then turns itself off. A (demand) wash and wipe is performed for as long as the knob is depressed.

To operate the wiper delay system move the wiper slide switch to the right. The delay system is turned on. The first time the system is turned on there will be one wipe and then the position of the slide switch will establish the time delay between wipes. The further to the right the switch is moved, the faster the wipers will cycle. The delay intervals can be adjusted from two seconds up to 75 seconds by moving the slide switch.

A continuous LO speed or HI speed can be obtained by moving the slide switch further to the right. To achieve LO speed, slide the switch to the first click position to the right of the delay function. Move the switch all the way to the right to obtain the HI speed function.

NOTE: Heavy snow or ice can overload the wiper motor. A circuit breaker will stop the motor until it cools. Make sure the windshield is cleared of snow or ice to prevent a circuit overload.

BACKUP ALARM

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

WARNING AND INDICATOR LIGHTS

All of the warning and indicator lights are housed in lens and bezel assemblies, located on the instrument panel (FIG. 2.1).

The warning and indicator light module may include:

- A low water warning light, which comes on when the coolant level is too low (if equipped).
- Green right-and left-turn signal lights, which lash on and off whenever the outside turn signal lights are flashing.
- A high beam indicator light, which comes on when the headlights are on high beam.
- A red parking brake indicator light, which comes on whenever the parking brakes are activated and the ignition is on.
- Red warning lights for the brake system. Whenever

conditions cause the brake system warning light to come on.

- With hydraulic brake systems, the brake warning light comes on when the fluid level is low, or whenever there is a fluid pressure problem within the master cylinder.
- A coolant temperature warning light, which comes on whenever the engine coolant temperature exceeds 210° F (99° C).
- An oil pressure warning light, which comes on whenever the oil pressure falls below the minimum oil pressure recommended by the engine manufacturer. (Table 2.1)

When the ignition is turned on, oil-and brake system warnings (as equipped) activate until the engine starts and minimum pressures are exceeded. If the low-oil pressure warning light or brake system warning light remains on after running the engine for 15 seconds, shut down the engine and determine the cause.

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

Engine Model	Oil Pressure*	
	Oil Pressure at Idle Speed psi (kPa)	Oil Pressure at Rated Speed psi (kPa)
Cummins B Series	10 (69) min.	30 (207) min.

(Table 2.1)

* With the engine at operating temperature. With the engine cold, oil pressure may be higher.

ANTILOCK BRAKING SYSTEM (ABS), OPTIONAL

Vehicles equipped with the Meritor WABCO ABS system may have an ABS warning light. Once the vehicle moves faster than 4 mph (6 km/h), the warning light goes out only if all of the vehicle's ABS components are working.

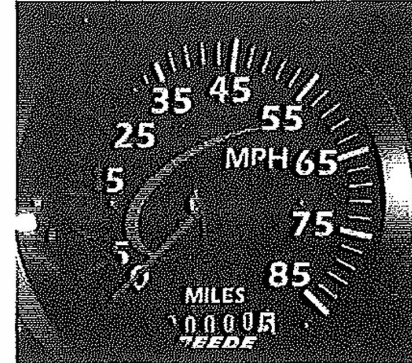
IMPORTANT: If the ABS warning light does not work or come on while driving, repair the ABS system immediately to ensure full antilock braking capability.

INSTRUMENTS

SPEEDOMETER (FIG. 2.11)

The speedometer registers vehicle speed in miles per hour

(mph). Standard speedometer gauges are equipped with an odometer that records total distance traveled.



(FIG. 2.11)

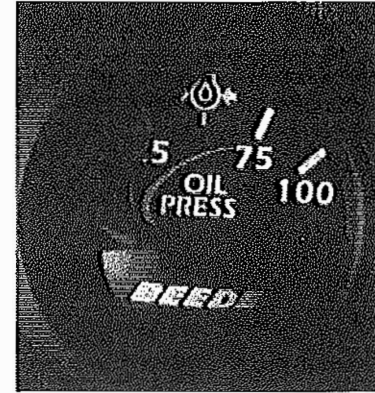
COOLANT TEMPERATURE GAUGE (FIG. 2.12)

During normal engine operation, the coolant temperature gauges should read from 181° to 203° F (83° to 95° C). If the temperature remains below 158° F (70° C) or exceeds a maximum temperature of 212° F (100° C), inspect the cooling system to determine the cause.



(FIG. 2.12)

ENGINE OIL PRESSURE GAUGE (FIG. 2.13) The oil pressure gauge should read as shown in Table 2.1.



(FIG. 2.13)

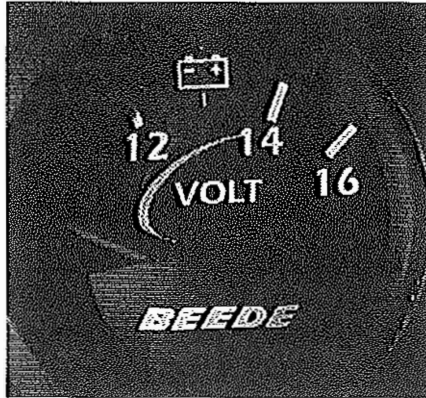
CAUTION!

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

VOLTMETER (FIG. 2.14)

The voltmeter indicates the vehicle charging system voltage when the engine is running and the battery voltage

when the engine is stopped. By monitoring the voltmeter, the driver can be aware of potential charging system problems and have them fixed before the batteries discharge enough to create starting difficulties.



(FIG. 2.14)

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

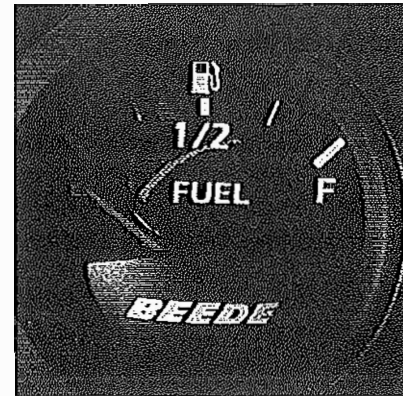
If the voltmeter shows an undercharged or overcharged

condition for an extended period, have the charging system and batteries checked at a repair facility.

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

FUEL GAUGE (FIG. 2.15)

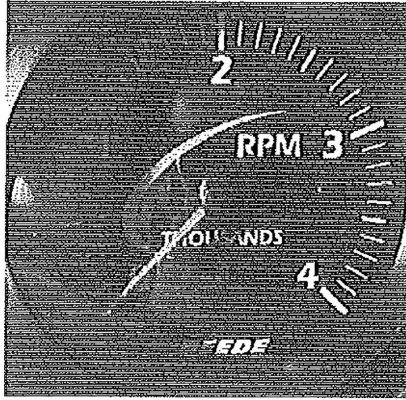
The fuel gauge indicates the amount of fuel in the fuel tank (s).



(FIG. 2.15)

TACHOMETER (FIG. 2.16)

The tachometer indicates the revolutions per minute of the engine (rpm).



(FIG. 2.16)

TRANSMISSION TEMPERATURE GAUGE, OPTIONAL

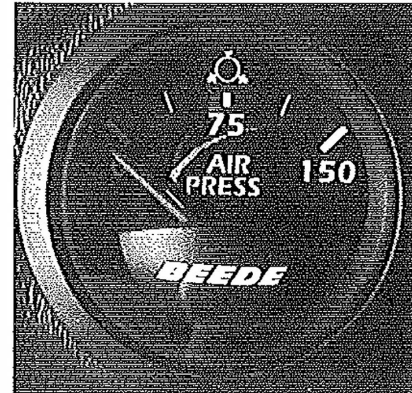
The transmission temperature gauge indicates the temperature of the transmission oil. The temperature gauge reading should not exceed 225° F (107° C).

CAUTION!

If the transmission continues to overheat during normal operation, have it checked and repaired. Continued operation over 300° F (149° C) may cause damage to the transmission.

AIR PRESSURE GAUGE (FIG. 2.17)

This air gauge indicates pressure in the air suspension system. Build air pressure in system to 120 psi (620 to 827 kPa) before moving.



(FIG. 2.17)

INTAKE-AIR RESTRICTION INDICATOR

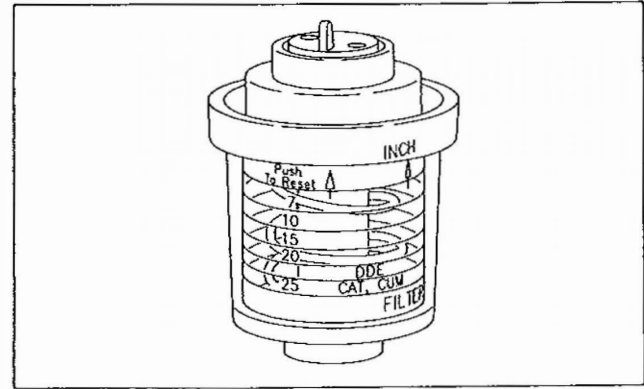
(FIG. 2.18A & B)

An intake-air restriction indicator measures the vacuum on the engine side of the air cleaner at the air cleaner outlet. If the yellow signal stays locked at or above the values shown in **Table 2.2, FIG 2-18B** after the engine is shut down, service the air cleaner. Then, reset the indicator by pressing the yellow button.

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



(FIG. 2.18A)



Intake-Air Restriction Indicator

(FIG. 2.18B)

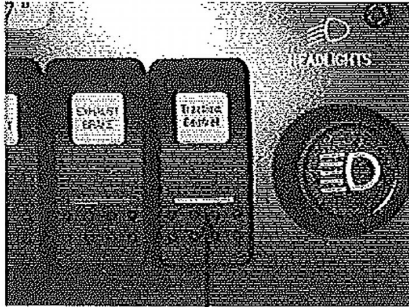
Maximum Air Restriction in Inches of Water (inH₂O)

Engine	At Full Load and Governed RPM	At No-Load and Governed RPM
Cummins	25	12

Maximum Air Restriction in Inches of Water (inH₂O)

(TABLE 2.2)

TRACTION CONTROL OPERATION



(FIG. 2.19)

DCDL Indicator Light

INTRODUCTION

The Traction Control device can be operated from a switch located on the left side of the vehicle instrument panel. See (Fig. 2.19). The operation of this switch will activate a Driver Controlled Differential Lock (DCDL) in the drive axle, locking both wheels to enhance traction effort. When the DCDL is locked the indicator light in the switch and or dash will be on. By releasing the switch or exceeding 15 mph. the operation will cease. During the operation of the switch the air spring for the tag axle will dump a portion of its pressure, which will cause weight to be shifted towards the drive axle to further enhance traction.

OPERATING TIPS

1. The DCDL can be locked or unlocked if the vehicle is standing still or moving at a constant low speed when the wheels are not spinning, slipping, or losing traction.
2. When the DCDL is locked, operate the vehicle at low speeds, under 15 mph.
3. When the DCDL is locked, the vehicles turning radius will increase. This condition is called "understeer." The driver must use caution, good judgement, and drive at low speeds when operating the vehicle with the DCDL locked.
4. Always unlock the DCDL as soon as the need for maximum traction has passed and the vehicle is traveling on a good road or highway.
5. Do not lock the DCDL when the wheels are slipping or losing traction, or damage to the axle can result.
6. Do not lock the DCDL when the vehicle is traveling down steep grades, or potential loss of vehicle capability could result.

The DCDL will only function while the Traction Control switch is depressed and the vehicles speed remains under 15 mph.

CAUTION!

This vehicle may be equipped with Driver-Controlled Full Locking Differential (DCDL). Engage DCDL *only* under poor road conditions. DO NOT engage during downhill operation. DO NOT engage at speeds above 25 mph. When DCDL is engaged, the vehicle can experience understeer, which requires careful driving procedures. When you disengage DCDL, normal steering resumes.

DRIVING INSTRUCTIONS

When encountering poor road or highway conditions where maximum traction is needed, follow the recommended procedures:

1. Without the wheels spinning, slipping, or losing traction flip the Traction Control switch to the ON position while maintaining a constant speed of less than 15 mph.
2. Let up momentarily on the accelerator to relieve torque on the gearing, allowing the DCDL to lock.
3. When the DCDL is activated, the indicator light on the switch and or dash will be on. See FIG. 2.19.
4. When the DCDL is fully locked, the vehicle will have an “understeer” condition when making turns. Proceed cautiously over poor road or highway conditions. NEVER exceed 15 mph and always use good driving judgment.

UNLOCKING THE DCDL

When the vehicle can safely operate at speeds above 15 mph and driving conditions have improved, disengage the Traction Control switch following the recommended procedures:

1. Release the Traction Control switch, when the vehicle is stopped or when traveling below 15 mph while the wheels are not spinning, slipping, or losing traction.
2. Let up momentarily on the accelerator to relieve torque on the gearing, allowing the DCDL to unlock. It may take up to 1/2 mile of driving before differential unlocks.
3. When the DCDL is de-activated, the indicator light on the switch and or dash will be off.
4. Exceeding 15 mph while depressing the Traction Control switch will automatically de-activate the DCDL.
5. Resume driving at normal speed using good driving judgment.

3

ENGINES

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Jacobs Engine Braking	3.4

ENGINES

ENGINE STARTING

For cold weather starting, refer to “Cold Weather Operating” in this chapter.

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

CAUTION!

If the engine is equipped with a turbocharger, protect the turbocharger during the start-up by not opening the throttle or accelerating the engine above 1000 rpm until normal engine idle oil pressure registers on the gauge.

CUMMINS

1. Before engine start-up, perform the engine pretrip inspection and daily maintenance checks in Chapter 7 of this manual.
2. Set the parking brake.
3. Check for free throttle operation.
4. Keep your foot off the throttle pedal while cranking the engine.
5. Turn the ignition switch to the START position. After the engine starts, release the key.

CAUTION!

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

6. When the engine is started, engine oil pressure should register on the oil pressure gauge within 15 seconds. If the oil pressure gauge indicates any drop in lubricating oil pressure, or registers no oil pressure at all, shut down the engine and determine the cause.

The B-series engine will automatically idle at about 1000 rpm until the coolant temperature reaches 60° F (16° C). Then, the idle speed will drop to normal.

NOTE: Idle the engine about three to four minutes at 1000 rpm before operating the vehicle.

COLD WEATHER OPERATION

CUMMINS

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

the modifications applied, the engines must still be capable of operation in warmer climates without extensive changes.

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

There are three basic objectives:

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

If satisfactory engine temperature is not maintained, higher maintenance cost will result, due to increased engine wear.

Special provisions to overcome low temperatures are definitely necessary, whereas a change to a warmer climate normally requires only minor revision. Most of the accessories should be designed in such a way that they can be disconnected so there is little effect on the engine when they are not in use.

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

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

- Adequate lubrication with low-temperature lubricating oils.
- Protection from the cold air (insulation). The metal temperature does not change, but the rate of heat dissipation is affected.
- Using an engine block heater to raise the engine block and component temperatures to at least -25°F (-32°C) for starting in lower temperatures.
- Electrical equipment capable of operating in the lowest expected temperature. All switches, connections, and batteries in the electrical system should be inspected, and kept in good condition to prevent loss through poor contact.
- Arctic specifications refer to the design of material and specifications of components necessary for satisfactory engine operation in extremely low temperatures to -64°F (-53°C). Contact the nearest Newmar dealer or Cummins engine dealer, to obtain the special items required.

CAUTION!

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

ENGINE BREAK-IN

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 during the initial 100 hours or 3,000 miles (5000 km) of service the operator has an opportunity to establish conditions for the best service life by:

1. Operating as much as possible at three-quarter load.
2. Avoiding operation longer than five minutes at engine idle speeds or at maximum horsepower levels.
3. Developing the habit of closely watching the engine instruments during operation. Let up on the throttle if the oil temperature reaches 250 degrees F (121 degrees C), or if the coolant temperature exceeds 195 degrees F (100 degrees C).
4. Checking the oil level frequently during the break-in period.

ENGINE OPERATION

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

ENGINE SHUT DOWN

CUMMINS

1. With the vehicle stopped, place the transmission shift lever in the neutral position and set the parking brake using the parking brake control knob.
2. It is important to idle an engine 3 to 5 minutes before shutting it down. This allows the lubricating oil and the water to carry heat away from the combustion chambers, bearings, shafts, etc. This is especially important with turbocharged engines. Bearings and seals in the turbocharger are subjected to the high heat of combustion exhaust gases. While the engine is running, this heat is carried away by oil circulation, but if the engine is stopped suddenly, the turbocharger temperature may rise to an extreme level. The extreme heat may cause bearings to seize or oil seals to leak. The extreme

- heat may also cause oil coking problems.
3. Do not idle the engine for excessively long periods. Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low the fuel may not burn completely. This will cause carbon to clog the piston rings and may result in stuck valves.

CAUTION!

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

4. If the engine is not being used, shut it down by turning the ignition key off.

HIGH ALTITUDE OPERATION

CUMMINS

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

engine. Most turbocharged engines are rated for higher altitudes than naturally aspirated engines. An engine will have smoky exhaust at high altitudes unless a lower gear is used. The engine will not demand full fuel from the fuel system unless the engine is altitude-compensated by the use of a turbocharger. Shift gears as needed to avoid excessive exhaust smoke.

JACOBS ENGINE BRAKING

JACOBS EXHAUST BRAKE

IMPORTANT: The Jacobs exhaust brake is a vehicle slowing device, not a vehicle stopping device. It is not a substitute for the vehicle service brakes. Use of the exhaust brake for vehicle downhill control and slowing down on level terrain will allow the service brakes to remain cool and ready for any emergency. To get the best result from the exhausted brake, it is necessary to observe simple operating principles.

The exhaust brake is activated when the following conditions are satisfied:

1. The "ON/OFF" switch is in the ON position.
2. The engine is not being fueled. The Allison transmission provides for optimum retarding downshift operation when the exhaust brake is selected. When the switch is turned ON and your foot is removed from the throttle

pedal, the transmission will immediately preselect a lower gear. The gear preselected is second gear. The transmission then starts to downshift through the gears to reach the preselected gear. Down shifting occurs at a higher speed than is usual when the exhaust brake is not turned on. This allows the exhaust brake to provide the maximum retarding power.

NOTE: If the vehicle is equipped with an ABS system and stopping conditions cause the ABS system to engage, the exhaust brake (if turned on) will automatically disengage. Upon release of the service brake, the exhaust brake will automatically re-engage.

WARNING!

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

4

TRANSMISSION

Allison Automatic Transmission4.1
--------------------------------------	------

ALLISON AUTOMATIC TRANSMISSIONS (See additional operator's manual provided in Owner's Information Packet.)

ALLISON AT TRANSMISSIONS (FIG. 4.1)

GENERAL INFORMATION

Allison five-speed automatic transmissions have either six or seven shift positions on the selector level. If equipped, the shifter will have a seventh position (PB) for the parking brake. The selector lever is lighted for night driving. Each forward shift position provides a range of forward gears that are selected automatically according to the speed of the vehicle, engine temperature, and throttle position.

OPERATION

IMPORTANT: Do not race the engine when shifting from Neutral into a drive gear range.

1. Use reverse (R) to back the vehicle. Completely stop the vehicle before shifting from a forward gear to reverse or from reverse to forward. There is only one reverse gear.
2. Use neutral (N) and apply the parking brake, or use the parking brake (PB) setting on the lever selector (if equipped) to park the vehicle with the engine on or off.

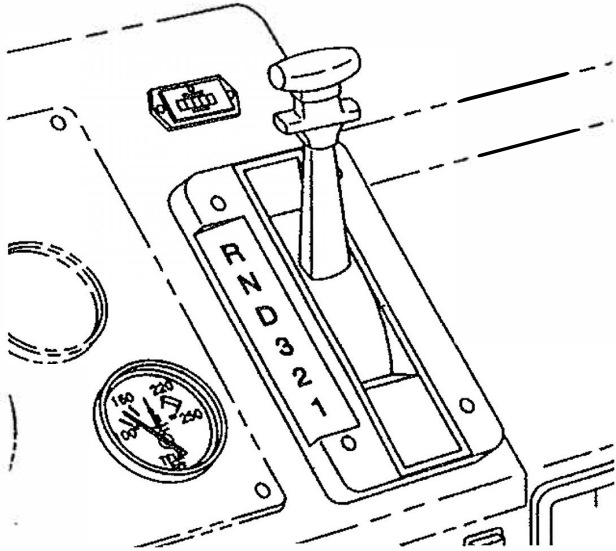
Always chock the tires for hilly or off-road parking. The engine may be started in this position.

CAUTION!

Do not allow the vehicle to coast in neutral. This can result in severe transmission damage. Also, no engine braking is available.

3. Select drive (OD) for all normal driving conditions. The vehicle will start out in first gear, and as speed increases, the transmission will upshift through each gear automatically. As the vehicle slows down, the transmission will downshift to the correct gear automatically. Occasionally the road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. The lower the gear in range, the greater the engine braking power.
4. Use second (2) or third (3) for slow driving in heavy city traffic, or on mountain roads when more precise speed control is desirable. Use it also for climbing long grades and for engines braking when descending moderately steep grades. To prevent excessive engine speed, do not drive faster than 45 mph (72 km/h) in this range.
5. Use first (1) for climbing very steep grades and for engine braking at low speeds when going downhill. To prevent excessive engine speed, do not drive faster than 25 mph (40 km/h) in this range.

NOTE: In the lower gear ranges, the transmission will not upshift above the highest gear selected unless the engine governed speed is exceeded.



(FIG. 4.1)

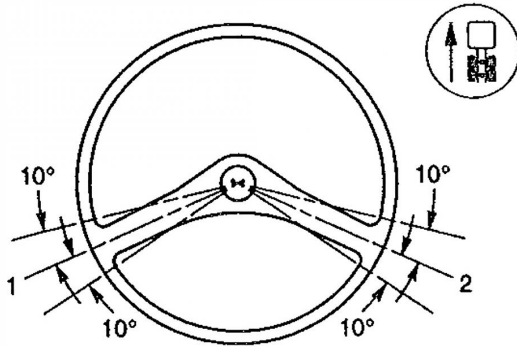
5

STEERING SYSTEM

General Information.....	5.1
Power Steering System	5.1

GENERAL INFORMATION

When there is no load on the vehicle, and the front tires are pointed straight ahead, the steering wheel spokes should be at the 4 and 8 o'clock positions, or within 10 degrees to either side. See (FIG. 5.1).



1. 8 o'clock

2. 4 o'clock

(FIG. 5.1)

POWER STEERING SYSTEM

The power steering system consists of an integral steering gear (which includes a manual steering mechanism, a hydraulic control valve, and a hydraulic power cylinder),

hydraulic hoses, power steering pump, reservoir, and other components. The power steering pump, driven by the engine, provides the power assist for the steering system. If the engine is not running, there is no power assist.

If the power-assist feature does not work due to hydraulic fluid loss, steering pump damage, or some other cause, bring the vehicle to a safe stop. Do not drive the vehicle until the cause of the problem has been corrected.

WARNING!

Driving the vehicle without the power-assist feature of the steering system requires much greater effort, especially in sharp turns or a 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.

6

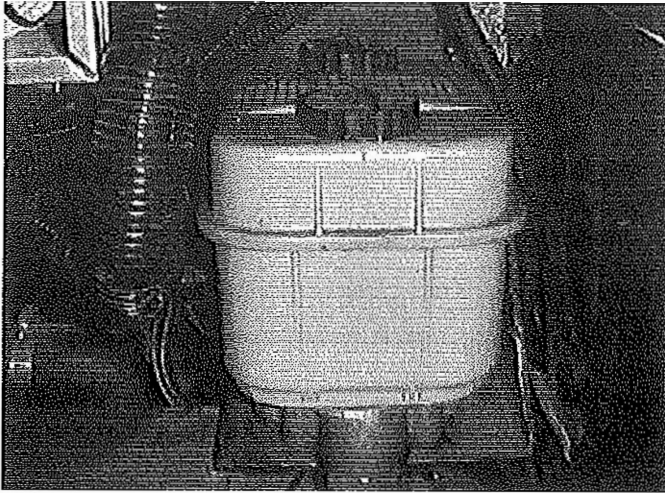
BRAKE SYSTEM

Hydraulic Brake System.	6.1
Tag Axle Brake	6.2
Meritor WABCO Antilock Braking System (ABS).	6.3

HYDRAULIC BRAKE SYSTEM

GENERAL INFORMATION (FIG. 6.1)

The hydraulic brake system includes a power booster, master cylinder, reservoir, hydraulic lines, a brake rotor on each wheel hub, and a brake caliper and pad assembly at each rotor.



(FIG. 6.1)

IMPORTANT: Make sure that the fluid level in the master cylinder reservoirs is up to the flange that surrounds the reservoir. Use only heavy-duty brake fluid, DOT 3, in the hydraulic brake system. Do not mix types and brands of fluid because of possible incompatibility.

The master cylinder controls braking power to the front and rear brakes. The Bendix Hydro-Max power booster is attached to the rear of the master cylinder and is connected to the power steering system (which provides pressurized power steering fluid). An electronically powered “reserve” pump operates if there is inadequate fluid flow from the power steering pump to the power booster. The brake system warning light comes on if there is a problem within the system. Bring the vehicle to a safe stop and correct the problem before continuing operation of the vehicle.

OPERATION

Before driving the vehicle, secure all loose items in the cab so that they will not fly forward during a full brake application. Check that the brake system warning light is off after releasing the parking brake. If the warning light does not go off, correct the problem before continuing operation of the vehicle.

During normal brake stops, depress the foot brake control pedal until braking action slows down the vehicle. Increase or decrease the pressure on the pedal so that the vehicle comes to a smooth, safe stop. When the forward speed of the vehicle has decreased to almost the idling speed of the engine, shift the transmission into neutral. Pull out the parking brake knob (FIG. 6.2) if the vehicle is to be parked.

WARNING!

If the vehicle is equipped with an air suspension system, do not move the vehicle with the air suspension deflated. This could result in loss of vehicle control, possibly causing personal injury and property damage.

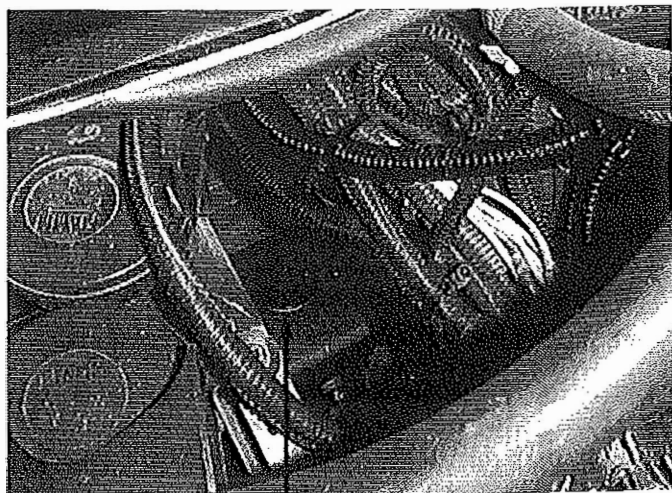


(FIG. 6.2)

TAG AXLE BRAKE

The ElecDraulic tag axle brake actuator is compatible with DOT 3 brake fluids.

Brake fluid level should be checked regularly. Check the brake fluid level at every 5,000 mile interval. This procedure is recommended to reduce the chance of brake failure due to loss of fluid. In the event brake fluid is lost the dash indicator light will come on. Check fluid at this location. (FIG. 6.3)



(FIG. 6.3)

Tag Axle Brake Fluid

Brake fluid levels are reduced in normal operation by fluid consumed in the brakes as a result of brake lining wear. This fluid must be replaced on a regular basis and is the responsibility of the owner or other person driving the motor home.

Any sudden drop in brake fluid level indicates a problem in the brake system. This may include wheel cylinder leakage, brake hose or brake line leakage, or master cylinder leakage.

MERITOR WABCO® ANTILOCK BRAKING SYSTEM (ABS)®

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

Meritor WABCO® ABS includes signal-generating tone wheels and sensors located in the wheel hubs of each sensed axle. The sensors transmit vehicle wheel speed information to an electronic control unit (located behind the passenger seat). The control unit's main circuit interprets the wheel 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 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 the vehicle's ABS components are working properly.

A wheel spin indicator light comes on if one of the drive wheels spins during acceleration. The light goes out when the wheel stops spinning. When the light comes on, partially release the throttle pedal until the light goes out.

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

During emergency or reduced-traction stops, fully depress the brake pedal until the vehicle comes to a safe stop; do not pump the brake pedal. With the brake pedal fully depressed, the ABS system will control all wheels to provide steering control and a reduced braking distance. Although the ABS system improves vehicle control during emergency braking situations, the driver still has the responsibility to change driving styles depending on the existing traffic and road conditions. For example, the ABS system cannot prevent an accident if the driver is speeding or following too closely on slippery road surfaces.

7

PRETRIP INSPECTION AND DAILY MAINTENANCE

Pretrip Inspection Checklist	7.1
Pretrip Inspection and Daily Maintenance Procedures	7.2

PRETRIP INSPECTION CHECKLIST

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

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

Each checklist step corresponds with detailed instructions found under "Pretrip Inspection and Daily Maintenance Procedures." If any system or component does not pass this inspection, it must be corrected before operating the vehicle.

NOTE: Apply the parking brake and chock the tires.

1. Drain the air suspension air tanks.
2. Inspect the batteries and battery cables.
3. Check the fluid level in the windshield washer reservoir.
4. Examine the steering components.
5. Check the fluid level in the coolant reservoir. Check the radiator and charge air cooler for clogging or damage. Check the radiator for coolant leaks.
6. Check the condition of the coolant hoses and heater hoses.
7. Check the condition of the drive belts.
8. Inspect the engine for fuel, oil, and coolant leaks.
9. Inspect the engine and chassis wiring.
10. Check the fluid level in the brake system hydraulic fluid reservoir, if equipped.
11. Check the fluid level in the steering system hydraulic fluid reservoir. If needed, fill the reservoir to a level between the MAX and MIN marks. Use ONLY A/W-D 32 hydraulic oil. DO NOT fill the system with ATF (automatic transmission fluid).
12. Check the engine's lubricating oil level.
13. Check the oil level in the automatic transmission.
14. Check the intake-air restriction indicator.
15. Inspect the fuel tank, other fuel system components, and the fuel line connections.
16. Check the fuel level in the fuel tank and be sure the fuel cap vent area, if equipped, is clean.
17. If equipped with a fuel/separator, check the sight glass and drain any water found.
18. Inspect the front and rear suspension components, including the springs, shocks, and suspension brackets.
19. Check the steering wheel for excessive play.
20. Turn on the ignition and start the engine. Be sure the oil-pressure warning system is operating. Leave the engine running.
21. Make sure the horn, windshield wipers and washer, and

- heater and defroster are operating properly.
22. Check the operation of the backup alarm, if equipped.
 23. Make sure all of the lights are working, including the brake lights, high and low-beam headlights, turn signals, and emergency flashers. Turn the lights off.
 24. Check the tire inflation pressures and inspect each tire for bulges, cracks, cuts, and punctures.
 25. Check for indications of loose wheel nuts or rim nuts and examine each rim and wheel component.
 26. Test the service brakes before leaving the lot.
 27. Test the parking brake on a 20 percent grade.

PRETRIP INSPECTION AND DAILY MAINTENANCE PROCEDURES

1. Drain the air suspension system air tanks, if equipped.

Air reservoirs serve as storage tanks for compressed air. They collect water condensed from the air, and small amounts of oil normally enter the reservoir in the form of vapor because of the heat generated during compression.

After the water and oil condense, they collect near the tank drain valves. Drain the resulting emulsion as follows:

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

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

WARNING!

When draining the air reservoir, do not look into the air jets, or direct them towards 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 pretrip inspection.
2. Inspect the batteries and battery cables.
 - 2.1 Be sure the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.

CAUTION!

Take care to keep the vent plugs tight, so that the neutralizing solution does not enter any of the battery cells.

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

If the battery post or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of petroleum jelly to the posts and terminals, to help retard corrosion.

3. Check the fluid level in the windshield washer reservoir. Add water fluid as needed.

WARNING!

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

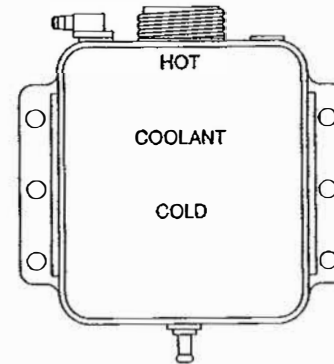
4. Examine the steering components.

CAUTION!

Keep the coolant level up. Low coolant could result in engine overheating, which could cause engine damage.

5. Check the fluid level in the coolant reservoir (FIG. 7.1). Check the condition of the radiator fins, and the charge air cooler.

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. (FIG. 7.1)



(FIG. 7.1)

Good airflow through the radiator core and charge air cooler is essential for proper engine cooling. The cores allow air passage, but form a particle barrier which tends to collect insects and airborne debris. Inspect for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.

Inspect and clean the charge air cooler. 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.

6. Check the condition of the coolant hoses and heater hoses.

Make sure the radiator inlet and outlet coolant hoses and heater hoses are pliable and are not cracking or bulging. Replace hoses that show signs of cracking, weakening, or bulging. Replace all hoses, including the heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. 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.

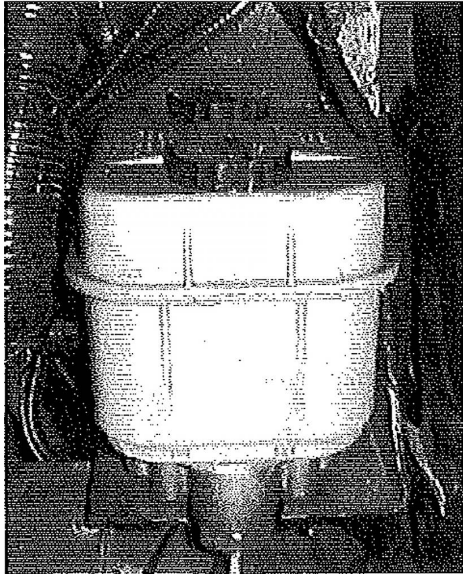
7. Check the condition of the drive belts.

Check the serpentine and hydraulic pump belts for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, replace the belt.

NOTE: On Cummins engines, a belt tensioner automatically adjusts belts to the correct tension. If the belt slips, repair or replace the tensioner. For instructions, refer to the Cummins Shop Manual.

8. Inspect the engine for fuel, oil, and coolant leaks. Correct any leaks found.
9. Inspect the engine and chassis wiring. Inspect the engine and chassis for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.
10. Check the fluid level in the brake system hydraulic fluid reservoir (**FIG. 7.2**), if equipped.

If needed, fill the reservoir up to the flange that surrounds the reservoir. Use only heavy-duty brake fluid, DOT 3.

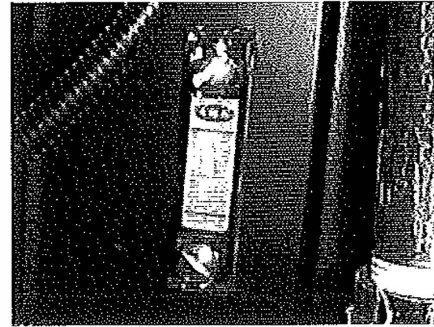


(FIG. 7.2)

11. Check the fluid level in the steering system hydraulic fluid reservoir (FIG. 7.3).

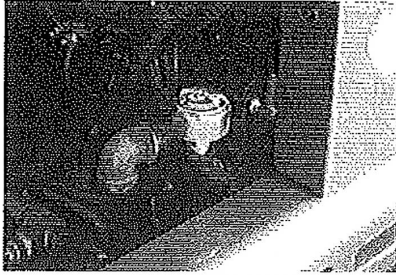
If needed, fill the reservoir to a level between the MIN

and MAX marks. Use only low hydraulic oil. See FIG. 7.3A.

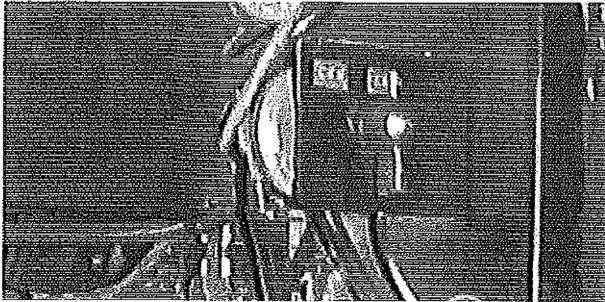


(FIG. 7.3)

12. Check the engine's lubricating oil level (FIG. 7.4). The oil level should show between the upper and lower marks on the dipstick. Add enough oil to bring the level up to the operating range. Refer to the engine manufacturer's operation and maintenance manual for recommended lubricants and capacities.



(FIG. 7.3A)

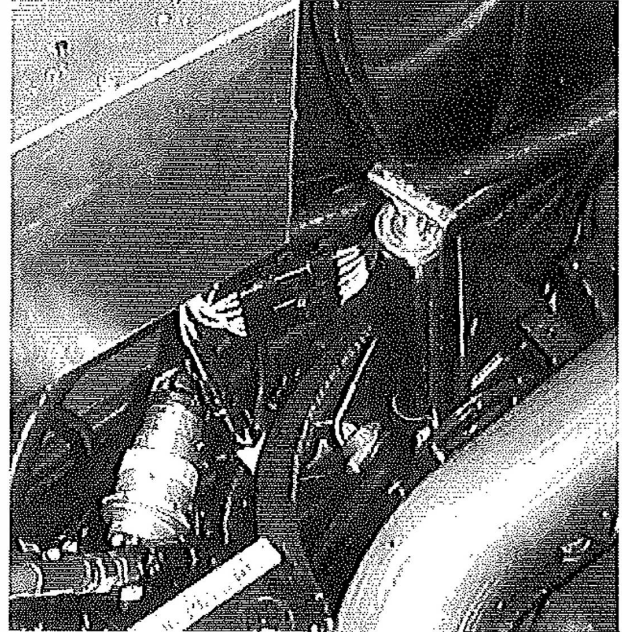


(FIG. 7.4)

CAUTION!

Maintain the correct engine oil level. Operating the engine with the oil level below the low mark, or above the high mark, could result in engine damage.

13. Check the oil level in the automatic transmission.
(FIG. 7.5)



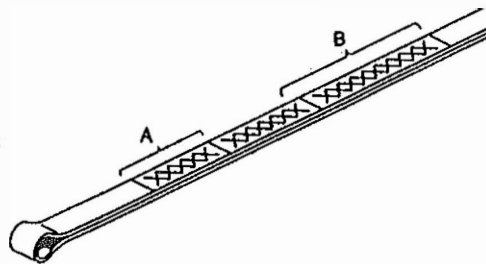
(FIG. 7.5)

NOTE: The fluid must be warm to ensure an accurate check. The fluid level rises as temperature increases. With the vehicle on a level surface, check the oil level in

the transmission using one of the following procedures:

Hot Check:

- Operate the transmission in a drive range until normal operating temperature, 160° to 200° F (71° to 93° C), is reached.
- Park the vehicle. Set the parking brake, and shift the transmission shift lever into the neutral position. Let the engine run at idle.
- Wipe the dipstick clean and check the fluid level. A safe operating level is any level with the HOT RUN (upper) band on the dipstick. See (FIG. 7.6)
- If the fluid is not within this range, add or drain fluid as needed to bring the level to the top of the HOT RUN band. See Table 7.1 or Table 7.2 for fluid types and capacities.



A. Cold Run Band

B. Hot Run Band

(FIG. 7.6)

Approved Transmission Lubricants*		
Lubricant Type	Temperature	SAE Viscosity
Dexron® III	-25° to +120°F (-32° to +48°C)	—

* Factory filled with Dexron III. For off-highway operation or where ambient temperature is consistently above +86°F (+30°C) or below -25°F (-32°C), see the manufacturer's fluid recommendations.

(Table 7.1)

Transmission Lubricant Capacities	
Model	Refill Capacity* Quarts (liters)
T2000	14.8 (14)

* Quantities listed are approximate. Add the recommended amount of fluid as listed under refill capacity, then perform a "hot check" and add fluid as needed. Do not overfill.

(Table 7.2)

Cold Check:

- A cold check may be made when the sump temperature is 60° to 104° F (15° to 40° C).
- Run the engine for at least one minute to clear the fluid system of air.
- With the engine running, wipe the dipstick clean

and check the fluid level. See (FIG. 7.6). Any level within the COLD RUN (lower) band is satisfactory for operating the vehicle. If the level is not within the COLD RUN band, add or drain fluid until it reaches the middle of the COLD RUN band.

- Perform a hot check at the first opportunity after normal operating temperature, 160° to 200° F (71° to 93° C), is reached.
14. Check the intake-air restriction indicator (FIG. 7.7) to determine if the air cleaner filter element needs to be changed.



(FIG. 7.7)

Replace the air cleaner element after the first six months and thereafter replace it when the yellow line reaches 25

in H₂O vacuum or every two years regardless of mileage.

After the air cleaner element is replaced, press the rubber button on the bottom of the air restriction indicator to reset.

CAUTION!

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

15. Inspect the fuel tanks, fuel regulators, fuel filters, and the fuel lines. Replace leaking fuel tanks; repair or replace any mechanisms, lines or connections that are leaking.
16. Check the fuel level in the tank. To keep condensation to a minimum, the fuel tanks should be filled at the end of each day, but not to more than 95 percent of liquid capacity. Federal guidelines prohibit filling a fuel tank to more than 95 percent of its liquid capacity. Select the proper grade of fuel, as specified by the engine manufacturer.

WARNING!

Never fill the fuel tank to more than 95 percent of its liquid capacity. This could make them more likely to rupture from impact, possibly causing fire and resulting in serious personal injury or death by burning.

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion. When filling fuel tanks, do not smoke or use an open flame near the fuel tanks, combustion of diesel fuel oil or fuel vapors could result.

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

- 16.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter, and reduce the chances of dirt getting into the engine.
- 16.2 Before installing the fuel cap, check the vent area (if equipped). The vent area is the annular opening between the casting and the top stamped cover plate. Clean the

area with a rag, or if necessary, clean the cap with solvent. Make sure the fuel cap vent is open.

CAUTION!

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

IMPORTANT: When draining fluid from a fuel/water separator, drain the fluid into an appropriate container, and dispose of it properly. Many states now issue fines for draining fuel/water separators onto the ground. On all types of separators, stop draining fluid when you see fuel come out of the separator drain valve.

17. Drain the water from the fuel/water separator.

NOTE: The fuel/water separator is mounted by the body manufacturer and the locations will vary. The final manufacturer may relocate.

- 17.1 Shut off the engine.
- 17.2 Turn the valve clockwise until draining occurs. Drain the filter sump of water until clear fuel is visible.

17.3 Tighten the drain. Run the engine and check for leaks.

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

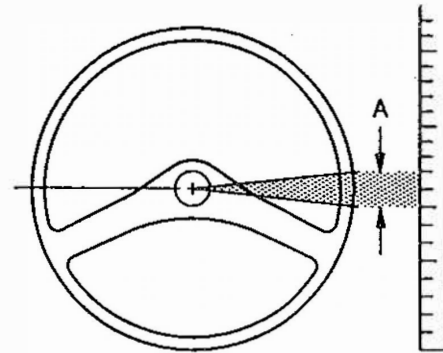
Check for loose U-bolts, cut or ruptured air springs (bags), cracks in the suspension brackets, and loose fasteners. Inspect the shock absorbers for loose fasteners and leaks.

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

19. Check the steering wheel for excessive play.

With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels. Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction, until motion is again detected at the wheels. Measure the lash (free play) at the rim of the steering wheel. See (FIG. 7.8)

Excessive lash exists if steering wheel movement exceeds 4-3/4 inches (121 mm) with an 18-inch (470 mm) steering wheel. If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear, before operating the vehicle.



A. Lash Area

(FIG. 7.8)

20. Start the engine and make sure the oil-pressure warning system is working.

When the engine is started, the oil-pressure warning light will come on until the oil pressure rises above the preset minimum. If the warning light does not come on when the ignition is turned on, repair the system.

21. Make sure the horn, windshield wipers and washer, and heater and defroster are operating properly.

22. Check the operation of the backup alarm, if equipped.

23. Make sure all of the lights are working.

Turn on the headlights, dash lights, and emergency flashers, and leave them on. If any of the gauge bulbs, the switch panel label bulb, the dome light bulb, or the right- and left-turn indicator bulbs are not working, replace them.

Turn all lights off.

24. Check the tire inflation pressures, and inspect each tire for bulges, cracks, cuts, and punctures.

IMPORTANT: The load and cold inflation pressure must not exceed the rim or wheel manufacturer's recommendations, even though the tire may be approved for a higher load or inflation. Some rims and wheels are stamped with a maximum load and maximum cold inflation rating. If the load exceeds the maximum rim or wheel capacity, the load must be adjusted or reduced.

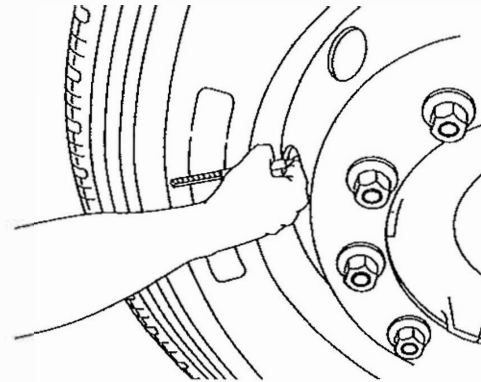
NOTE: The following tire load limits refer only to individual tires, and do not indicate the weights for the entire axle.

- 24.1 Check the inflation pressures of the tires before each trip, using an accurate pressure gauge (FIG. 7.9). Tires

should be checked when cool. The maximum inflation pressure for each tire is provided on the outer wall of the tire. Inflate the tires to the applicable pressures, if needed. Be sure the valve stem caps are on every tire, and that they are screwed on finger-tight.

Refer to **Table 7.3** for the correct tire inflation pressures for the vehicle load. When traveling at unusual speeds, use **Table 7.4** to adjust tire pressure.

Overinflation gives the treaded surface of the tire a convex shape (**FIG. 7.10**). This causes extreme tire wear in the middle part of the tire since primarily this section is in contact with the road.



(FIG. 7.9)

245/70R19.5 LRF - XR^v

PSI		70	75	80	85	90	95
lbs.	S	6880	7080	7280	7480	7780	8160
per axle	D	12860	13260	13660	14060	14620	15440
kg.	S	3121	3211	3302	3393	3529	3700
per axle	D	5833	6015	6196	6378	6632	7000

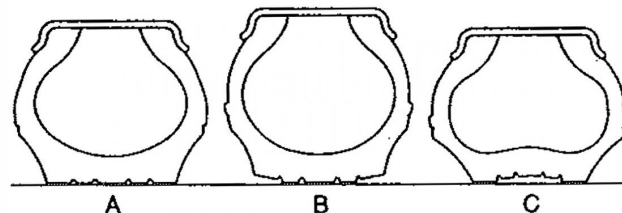
(Table 7.3)

Underinflation gives the tread surface a concave shape (FIG. 7.10). This causes excessive tire wear on the outer edges of the tire since primarily those edges are in contact with the road.

Variations in Load and Inflation Limits According to Speed

Speed Range mph (km/h)	Inflation Pressure Increase in psi (kPa)	Percent Increase/ Decrease in Load
70-75 (113-121)	10 (69)	(-10)
61-70 (98-113)	10 (69)	0
51-60 (82-97)	0	0
41-50 (66-80)	0	+9
31-40 (50-64)	0	+16
21-30 (34-48)	10 (69)	+24
11-20 (18-32)	15 (103)	+32

(Table 7.4)



- A. Tire correctly inflated.
- B. Tire overinflated.
- C. Tire underinflated.

(FIG. 7.10)

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.

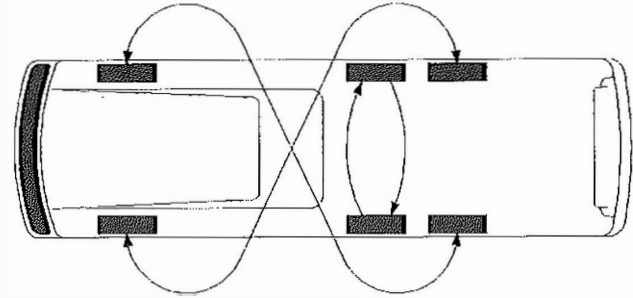
- 24.2 If a tire has been run flat or underinflated, before adding air, check the wheel for proper locking and side ring seating, and possible wheel, rim, or tire damage.
- 24.3 Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-

maintained inline moisture traps, and service them regularly.

24.4 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.

24.5 If the tires are wearing irregularly, rotate them. If the front steering axle tires become irregularly worn, move them to the tag axle (FIG. 7.11). Have the front axle alignment checked to determine the cause of irregular tire wear.

Government regulations require the removal of front axle tires at 4/32-inch (3 mm) remaining tread depth and rear axle tires at 2/32-inch (1.5 mm) remaining tread depth. However, front axle tires may be rotated to the tag axle to use the remaining 2/32-inch (1.5 mm) tread rubber.



(FIG. 7.11)

- 24.6 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.
25. Check for indications of loose wheel nuts or rim nuts, and examine each wheel component.

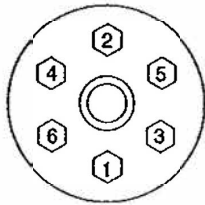
Check the wheel nuts or rim nuts for indications of looseness. Remove all dirt and foreign material from the assembly. Dirt or rust streaks from the stud holes, metal buildup around stud holes, or out-of-round or worn stud holes, may be caused by loose wheel nuts. Tighten the wheel nuts 450 to 500 lbf.ft (610 to 680 N.m), and see (FIG. 7.12) for the tightening sequence.

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

Replace broken, cracked, badly worn, bent, rusty, or sprung rings and rims. Be sure that the rim base, locking, and side ring are matched according to size and type.

WARNING!

Have any worn or damaged wheel components replaced by a qualified person using the wheel manufacturer's instructions and the wheel industry's standard safety precautions and equipment. Otherwise a vehicle or workshop accident could occur, possibly resulting in serious personal injury or death.



(FIG. 7.12)

CAUTION!

Insufficient wheel nut (rim nut) torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values, and follow the proper tightening sequence.

26. Test the service brakes before leaving the lot.

Depress the brake pedal, release the parking brake, and check that the brake system warning light goes off. If the warning light remains on after releasing the parking brake, correct the problem before driving off.

27. Test the parking brake on a 20 percent grade.

Apply the parking brake with the vehicle on a 20 percent grade (or as steep a grade that the vehicle may normally be parked on). The ramp surface should be made of Portland cement or equivalent. If the parking brake does not hold the vehicle, repair the parking brake system.

8

IN AN EMERGENCY

Hazard Warning Lights	8.1
Emergency Starting with Jumper Cables	8.1
Changing a Flat Tire	8.2
Running Out of Fuel	8.4

HAZARD WARNING LIGHTS

Pull out on the hazard warning light tab on the steering column to activate the hazard warning lights. When the hazard warning light tab is pulled out, all of the turn signal lights and both of the indicator lights on the control panel will flash. To cancel the warning lights, push the tab in.

EMERGENCY STARTING WITH JUMPER CABLES

When using jumper cables, follow the instructions below.

WARNING!

Vehicle batteries produce hydrogen gas and can create sparks, possibly leading to an explosion. Do not allow the vehicles to touch each other, and keep sparks, flames, cigarettes, etc. away from batteries. Do not lean over the batteries when making connections, and keep all other persons away from the batteries, otherwise severe personal injury could result from explosion and acid burns.

CAUTION!

Make sure both starting systems have the same voltage outputs, and avoid making sparks. Otherwise the vehicle charging systems could be severely damaged. Also, do not attempt to charge isolated, deep-cycle batteries with jumper cables; follow the

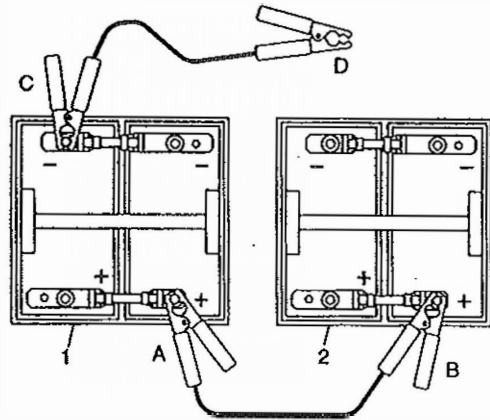
manufacturer's instructions when charging deep-cycle batteries.

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 of the booster battery, and connect the other end of the cable to the positive terminal of the discharged battery. See (FIG. 8.1).

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.

3. Connect one end of the second jumper cable to the negative terminal of the booster battery, and connect the other end of the cable to a ground at least 12 inches (300 mm) away from the batteries of the vehicle needing the start. The vehicle frame is usually a good ground. Do NOT connect the cable to or near the discharged batteries.



- | | |
|--------------------|-----------------------|
| A. 1st | C. 3rd |
| B. 2nd | D. To Frame (ground) |
| 1. Booster Battery | 2. Discharged Battery |

(FIG. 8.1)

4. Start the engine of the vehicle with the booster batteries, and let the engine run a few minutes to charge the batteries of the other vehicle.
5. Attempt to start the engine of the vehicle with the batteries receiving the charge. Do not operate the starter longer than 30 seconds, and wait at least two minutes between starting attempts to allow the starter to cool.

6. When the engine starts, let it idle a few minutes.

WARNING!

Do the next step exactly as instructed, and do not allow the clamps of one cable to touch the clamps of the other cable, otherwise a spark could occur near a battery, possibly resulting in severe personnel injury from explosion and acid burns.

7. Disconnect the grounded cable from the frame or other nonbattery location; then disconnect the other end of the cable.
8. Disconnect the remaining cable from the newly charged battery first; then disconnect the other end.

CHANGING A FLAT TIRE

WARNING!

This vehicle is very heavy. Jacking this vehicle should be done with extreme caution. The vehicle could slip, causing personal injury or death.

WARNING!

Wheel lug nut torque is very high, and the wheel/tire assemblies are very heavy. Changing a tire could result in back injury. If possible, call a qualified service facility to change a flat tire.

IMPORTANT: If a flat tire occurs while driving, gradually decrease vehicle speed, Holding the steering wheel firmly, move to a safe place on the side of the road.

1. If possible, stop the vehicle on a level surface, away from traffic.
2. Apply the parking brake, and turn off the ignition.
3. Turn on the emergency flashers.
4. Remove the spare wheel, jack, jack handle, and lug wrench from storage, if equipped.
5. Block the wheel diagonally opposite the wheel being changed.

NOTE: The jacking point for the front and rear wheels is directly under the axle.
6. Place the jack on a solid surface. Insert the jack handle and pump the handle to slightly raise the vehicle. Do not raise the wheel off the ground. Loosen the wheel lug nuts, but do not remove them.

NOTE: The dual rear wheels are attached using two-element lug nuts. The larger nut retains the outer dual.

The inner square stud retains the inner dual. Remove and install these nuts separately. The rear dual outer lug nut must be loosened to check and retighten the inner nut.

7. Raise the vehicle until the wheel is off the ground. Remove the lug nuts and the wheel.
8. Install the spare wheel and lug nuts. Make sure the beveled sides of the nuts face inward.
9. In a star pattern, tighten the nuts evenly until snug.
10. Lower the vehicle until the wheel touches the ground. Tighten the nuts in the same pattern 450 to 500 blf.ft (610 to 678 N.m).
11. Finish lowering the vehicle to the ground, then remove the jack.
12. Remove the block, then stow the jack, jack handle, and lug wrench.
13. After operating the vehicle for 50 to 100 miles (80 to 160 km), retighten the nuts 450 to 500 lbf.ft (610 to 678 N.m).

RUNNING OUT OF FUEL

WARNING!

Diesel fuel is highly flammable. Whenever you approach a vehicle and a smell of gas is present, immediately shut off all engines and ignition sources. Avoid causing sparks, and stay away from arcing switches and equipment. Extinguish any cigarettes, pilot lights, flames, or other sources of ignition in the area and adjacent areas. Immediately provide extra ventilation to the area. Do not start the equipment or any other type of equipment until the gas leak is corrected and the area is cleared of fuel. Failure to perform these actions could lead to the ignition of the fuel, which could cause death, bodily harm, or severe property damage.

If your vehicle runs out of fuel, stop the vehicle on a level location away from traffic. The engine may be restarted by adding at least two gallons (eight liters) of fuel to the fuel tank. If the vehicle is not level, up to six gallons (22 liters) of fuel may be required. Prolonged engine cranking may be required to pump fuel to the fuel tank to the engine before the engine will start.

CAUTION!

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

If your vehicle will not start by cranking the engine, the fuel system may need to be primed. Refer to your Cummins Operation and Maintenance Manual.

9

SPECIFICATIONS

Replacement Light Bulbs.....	9.1
Fluid and Lubricants	9.1
Fuse/Relay/Circuit Breaker Identification.....	9.1

REPLACEMENT LIGHT BULBS (Table 9.1)

Replacement Light Bulbs	
Light Location	Lamp Trade Number
Warning Panel Lights	53 or LB-0108
Gauge Illumination	53, 194 or LB-0107
Automatic Transmission Gear Selector	53

(Table 9.1)

FLUIDS AND LUBRICANTS (Table 9.2)

Fluid and Lubricant Specifications	
Component	Recommended Fluid or Lubricant
Front Axle Spindle Pins, Tie Rods, Drag Link, Intermediate Steering Shaft, Front Brake Pedal Shafts, Slip Spline and Universal Joints	Multipurpose Grease Lithium 12 Hydroxy Stearate NLGI No. 2; for temperatures below 0°F (-18°C), use MIL-G-10924B
Hydraulic Brake Master Cylinder Reservoir	Heavy-Duty DOT 3 Brake Fluid
Hydraulic Steering System Reservoir	Low Hydraulic Oil
Brake and Clutch Pedal Pivots	Sarplex 2 (lithium soap-based grease)
Engine Oil	SAE 15W-40 CE/SG
Allison Transmission Fluid	Dexron® III ATF
Fuel	Grade No. 2-0 or 2-D
Disc Brake Caliper Rails	Aeroshell Grade 5 (ES-1246) Grease

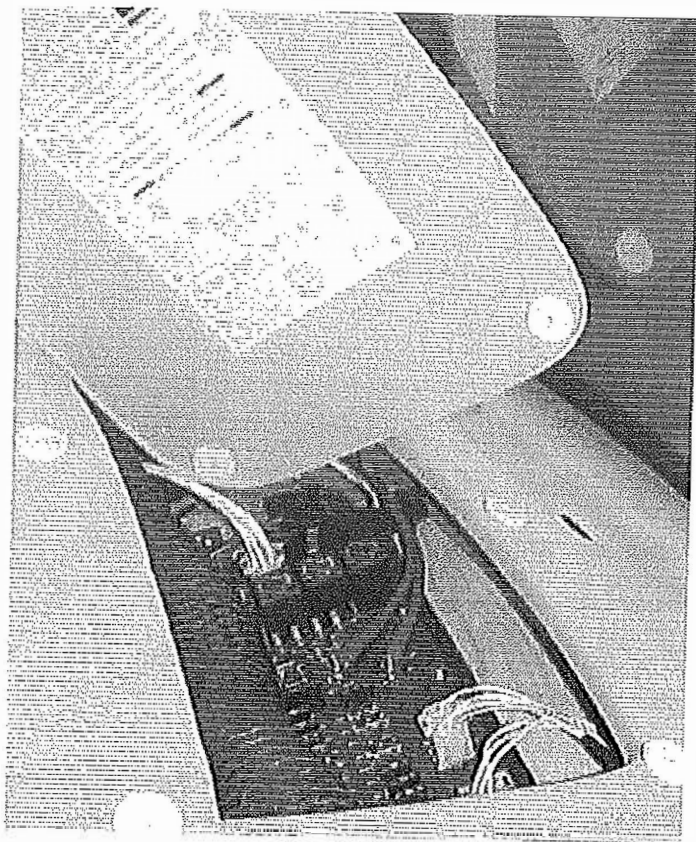
(Table 9.2)

Fluid and Lubricant Specifications	
Component	Recommended Fluid or Lubricant
Rear Axle Differential	Synthetic Gear Oil
Engine Coolant	50% Water/50% Ethylene Glycol Antifreeze (with approved SCAs)

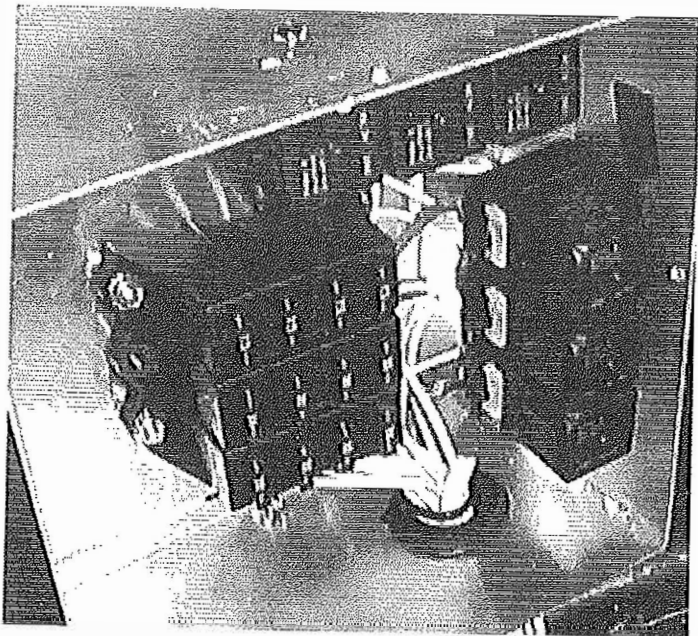
(Table 9.2 Cont.)

FUSE/RELAY/CIRCUIT BREAKER IDENTIFICATION

NOTE: The fuse/circuit breaker panel (Fig. 9.1) is located under the instrument panel near the steering column. Circuit breakers protect against circuit overload. If a circuit becomes overloaded (usually caused by a short to ground), the circuit breaker opens, stopping current flow. The vehicle may be equipped with auto-reset breakers. Depending on vehicle options, fuse/circuit breaker locations may vary from those shown. A power distribution panel may also be installed on the vehicle. This panel houses plug in fuses and relays. See (Fig. 9.2)



(Fig. 9.1)



(Fig. 9.2)

10

TOWING

Towing the vehicle.....	10.1
General Information.....	10.2

TOWING THE VEHICLE

IMPORTANT: When it is necessary to tow the vehicle, make sure the instructions below are closely followed to prevent damage to the vehicle.

FRONT TOWING HOOKUP

1. Disconnect the battery ground cable.
2. If the vehicle is to be lifted and towed, remove the drive axle shafts.

CAUTION!

Failure to remove the axle shafts when towing the vehicle with the rear wheels on the ground could result in damage to the transmission and other parts.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out, and will keep contaminants from getting into the axle lubricant and damaging the wheel bearings.
4. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator, who must be familiar with standard towing industry safety measures.

5. Lift the vehicle, and secure the safety towing chains. If additional clearance is needed, remove the front wheels.
6. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.

WARNING!

Before releasing the parking brake, make the connection to the towing vehicle, or chock the disabled vehicle's tires. Failure to do so could result in hazardous conditions because the vehicle could suddenly roll and injury could occur.

7. Release the parking brake.

REAR TOWING HOOKUP

1. Place the front tires straight forward, and secure the steering wheel in this position.
2. Disconnect the battery ground cable.
3. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator, who must be familiar with standard towing industry safety measures.

4. Lift the vehicle, and secure the safety towing chains. If additional clearance is needed, remove the bumper extension, if equipped.
5. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.
2. Use the Gross Combined Weight Rating (GCWR) and Gross Vehicle Weight (GVW) to determine the towing capacity. Refer to the final manufacturer for GCWR. If the GCWR is exceeded, serious damage to the drive train and brake system may result. Loading past the GCWR may lead to unsafe operating and braking conditions.

WARNING!

Do not tow unbraked vehicles if the combined weight of both vehicles is more than the sum of the gross axle weight (GAWRs) of the towing vehicle. Otherwise, brake capacity will be inadequate, which could result in personal injury or death.

GENERAL INFORMATION

Towing a load puts an additional strain on your vehicle's engine, drive train, brakes, tires, and suspension. For your safety and the care of your vehicle, properly match the towed load to the vehicle as follows:

1. Never load the vehicle over the Gross Vehicle Weight Rating (GVWR). Considerable damage to the drive train may result if the vehicle is over the GVWR. Check the GVWR safety compliance certification label (provided by the final manufacturer) to find the GVWR.

3. Subtract the GVW (which is the actual weight of the vehicle alone) from the GCWR (which is the total weight this vehicle can safely pull) to determine the acceptable weight this vehicle can tow.
4. Make sure the towing equipment is properly and safely attached to your vehicle.

CAUTION!

Do not use this vehicle for towing during the first 500 miles (800 km) of vehicle operation as premature power train wear may occur.

5. When descending a steep grade, shift the transmission into the next lower gear to provide additional engine braking.

NOTE: In a high altitude operation movement, your engine will lose power at the rate of 1 percent per 1,000

feet (305 meters) elevation. For these high-altitude operating conditions, a reduction in gross vehicle weights and gross combination weights is recommended and will result in improved vehicle performance.

6. To avoid vehicle damage and handling difficulty, evenly distribute the trailer load. Always tie the load down securely.

HITCHES

Use a hitch and ball recommended by your vehicle manufacturer or your dealer, and make sure its location is compatible with that of the trailer. Use a good weight carrying hitch which uniformly distributes the trailer tongue loads through the bumper and frame. Do not exceed the recommended towing capacity of the vehicle.

CAUTION!

Always disconnect the battery and engine electronic module before welding anything to the chassis frame.

CAUTION!

Do not use single-clamp bumper hitches or hitches which attach to the vehicle's axles. However, multiclamp bumper hitches for occasional use of a rental trailer are acceptable if properly attached. Follow the towing instructions of a reputable rental agency. Never attach safety chains to the bumper.

Whenever a trailer hitch is removed, be certain to have all mounting holes in the underbody properly sealed to prevent possible entry of exhaust fumes, dirt or water.

TRAILERS

WARNING!

Always use safety chains between your vehicle and the trailer. Failure to do so could cause injury or death if the hitch fails.

CAUTION!

Do not couple a trailer brake system directly to the vehicle brake system. Doing so will result in inadequate braking and possible personal injury.

CAUTION!

Before connecting a trailer lighting system directly to the lighting system of the vehicle, see your dealer or rental trailer agency for the correct type of wiring and relays for your trailer and heavy duty flashers.

PARKING WITH A TRAILER

Park the vehicle on a flat surface. Chock the tires as follows:

1. Select “N” (Neutral) on the gear shift selector while holding the service brake.
2. Hold the service brake and have another person place wheel chocks under the trailer wheels.
3. Once the wheel chocks are in place, release the service brake, making sure the chocks are holding the vehicle and trailer.

TRAILER TOWING TIPS

Towing a trailer significantly alters the manner in which the vehicle performs.

- Before starting on a trip, practice turning, stopping, and backing in an area away from heavy traffic to gain experience in handling the extra weight and length of the trailer. Take enough time to learn the

“feel” of the vehicle/trailer combination before starting out on a trip.

- Skillful backing requires practice. Back very slowly, with someone outside at the rear of the trailer to guide your efforts. Place your hand at the bottom of the steering wheel and move it in the direction you want the rear of the trailer to swing. Make small corrections instead of exaggerated ones. A slight movement of the steering wheel will result in a much larger movement of the rear of the trailer.
- Allow considerably more room for stopping when the trailer is attached. If you have a manual brake controller, “lead” with the trailer brakes when approaching a stop, if possible. Trailer brakes are also handy for correcting trailer side sway. Just touch them for a moment without using your vehicle brakes and the trailer should settle down and track steadily again.
- To assist in attaining good handling of the vehicle trailer combination, it is important that the trailer tongue load be maintained at approximately 10 to 15 percent of the loaded trailer weight.

- Check everything before starting out on the road. After you have traveled about 50 miles (80 km), stop in a protected location and double-check your trailer hitch and electrical connections for security. Also, examine the trailer wheel lug nuts for tightness.
- Because the trailer wheels will be closer than the towing vehicle wheels to the inside of the turn, drive slightly beyond normal turning point.
- Allow extra distance for passing other vehicles. Downshift to a lower gear for better acceleration, if necessary.
- Allow at least the equivalent of one vehicle and trailer length combined for each 10 mph (16 km/h) of speed.
- If your vehicle begins to lose speed as you climb a hill, downshift to a lower gear for more power at the rear wheels.
- Before descending a steep grade, slow down and shift to a lower gear. Driving with the transmission

in a lower gear will assist in reducing downhill speed. If the trailer should begin to sway, touch the trailer brakes (not the vehicle brakes) and the trailer should settle down.