

6. Never allow the engine to idle for more than 30 minutes. Excessive idling can cause oil to leak from the turbocharger.



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.

NOTE: Long periods of idling are not good for an engine because the combustion chamber temperatures drop so low the fuel may not burn completely. This will cause carbon to clog the injector spray holes and piston rings, and may result in stuck valves.

If the engine coolant temperature becomes too low, raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil, causing all moving parts of the engine to suffer from poor lubrication.

Caterpillar

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

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

Caterpillar electronic engines automatically idle at 900 to 1000 rpm for the correct warm-up time after a cold engine start when the air temperature is lower than 40°F (5°C). These electronic engine systems will reduce the idle speed to 600 rpm when the engine has warmed sufficiently to operate the vehicle.

IMPORTANT: Fuel heaters used on vehicles with Caterpillar electronic engines could cause excessive fuel temperatures that affect engine performance and operation of the electronic engine controls. If a fuel heater is used, make sure

it has thermostatic controls. If the fuel heater has a timer, set the timer to activate only for a limited period of time before the engine starts. Make sure the fuel heater is used only for starting the engine.

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

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

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

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

4. On uphill grades, begin downshifting when the engine rpm falls to 1200 rpm. Fuel economy will be best if you let the engine lug back to around this speed before you downshift. Downshift until a gear is reached in which the engine will pull the load. Let the engine lug down if you can make it to the top of a hill without downshifting.

IMPORTANT: Do not allow Caterpillar electronic engines to exceed 2300 rpm (2100 rpm if equipped with an exhaust brake).

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

Engines and Clutches

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

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

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

Cummins

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

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

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

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



CAUTION

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

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

Cold-Weather Operation

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

Mercedes-Benz

Special precautions must be taken during cold weather. For service products to use in cold weather, see **Chapter 5** of the *MBE900 Engine Operator's Manual*.

IMPORTANT: At outside air temperatures below -4°F (-20°C), a coolant preheater is recommended.

1. Check for cracks in the battery cases, for corrosion of the terminals, and for tightness of the cable clamps at the terminals. Run a load test to determine full or partial charging. Charge the batteries to full capacity. Replace any battery that is unable to hold full charge or is physically damaged.

2. Check the alternator output. Check the condition and tension of the poly-V belt.
3. Periodically check the coolant mixing ratio (concentration of antifreeze in the coolant). Add more if necessary. The coolant mixing ratio should never rise above 55 percent antifreeze.
4. Use low-viscosity lubricating oils for adequate lubrication.
5. 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.
6. If the use of unblended summer-grade diesel fuel in winter cannot be avoided, install a thermostatically controlled fuel heater to prevent wax from clogging the fuel filters, and formation of ice crystals from water in the fuel. If a fuel heater is used, make sure it has thermostatic controls to prevent excessive heating of the fuel in warm weather. Excessive heating of fuel can cause a loss of engine power.

Caterpillar

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

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

For cold-weather operation, use the following guidelines:

1. When starting the engine in temperatures below 32°F (0°C), use engine lubricants of lower viscosity. See the engine operation and maintenance manual for specifications.
2. When operating in temperatures below 32°F (0°C), use sufficient antifreeze solution in the cooling system to prevent freezing.
3. During cold weather, give more attention to the condition of the batteries. Test them frequently to ensure sufficient power for starting. Inspect all switches and connections in the electrical system and keep them in good condition to prevent losses through poor contacts. See **Group 15** of the *Acterra® Workshop Manual* for detailed information.

4. If so equipped, turn off the battery disconnect switch after the engine is stopped to prevent battery discharge while the starter motor is cooling.

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

WARNING

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

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

Cummins

Satisfactory performance of a diesel engine operating in low ambient temperatures requires modification of the engine, surrounding equipment, operating practices, and maintenance procedures. The lower the temperatures the greater the amount of modification required, and yet with the modifications applied, the engines must still be capable of operation in warmer climates without extensive changes.

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

There are three basic objectives:

Engines and Clutches

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 a minimum of revision. Most of the accessories should be designed in such a way that they can be disconnected so there is little effect on the engine when they are not in use.

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

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

- Proper lubrication with low-temperature lubricating oils.
- Protection from the low-temperature air. The metal temperature does not change, but the rate of heat dissipation is affected.
- Fuel of the proper grade for the lowest temperature.
- Heat 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 losses through poor contacts.

Arctic specifications refer to the design of material and specifications of components necessary for satisfactory engine operation in extremely low temperatures to -64°F (-53°C). Contact the nearest Sterling dealer or Cummins engine dealer, to obtain the special items required.

CAUTION

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

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

Engine Shutdown

Mercedes-Benz

If any 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 exhaust pipe gives off heavy smoke.
 - The coolant and/or oil temperature climb abnormally.
 - Abnormal sounds suddenly occur in the engine or turbocharger.
1. With the vehicle stopped, apply the parking brakes and put the transmission in neutral.

CAUTION

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 (61°C).



CAUTION

Except in emergency, do not shut down the MBE900 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.

Caterpillar



CAUTION

Stopping the engine immediately after it has been working under load can result in overheating and accelerated wear of the engine components. Excessive temperatures in the turbocharger centerhousing will cause oil coking problems. Follow the procedure, outlined below, to allow the engine to cool.

1. With the vehicle stopped, apply the parking brakes.
2. Reduce the engine speed to low idle.
3. 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.

4. Turn off the ignition key to shut down the engine.
5. If equipped with an idle shutdown timer, it can be set to shut the engine down after a preset amount of time. Ninety seconds before the preset shutdown time, the CHECK ENGINE indica-

tor will begin to flash at a rapid rate. If the position of the clutch pedal or service brake changes during this final ninety seconds (diagnostic lamp flashing) the idle shutdown timer will be disabled until reset.

6. After stopping the engine, fill the fuel tank.
7. Check the crankcase oil level while the engine is stopped. Maintain the oil level between the ADD and FULL marks on the dipstick.
8. If temperatures below 32°F (0°C) are expected, allow the engine water jacket expansion tank to cool, then check the coolant for proper antifreeze protection. The cooling system must be protected against freezing to the lowest expected outside temperature. Add permanent-type antifreeze if required.
9. Repair any leaks, perform minor adjustments, tighten loose bolts, etc. Observe the vehicle mileage or the service meter reading, if so equipped. Perform periodic maintenance as instructed in the Lubrication and Maintenance Chart in the *Caterpillar Operation and Maintenance Management* manual.

Cummins

1. With the vehicle stopped, apply the parking brakes and put the transmission in neutral.
2. It is important to idle an engine three to five minutes before shutting it down. This allows the lubricating oil and the water to carry heat away from the combustion 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 as much as 115°F (61°C). The extreme heat may cause bearings to seize or oil seals to leak.

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

Engines and Clutches

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.

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



CAUTION

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

High-Altitude Operation

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

Exhaust Braking System, Optional

General Information

An exhaust brake is an optional auxiliary braking system that assists but does not replace the service brake system. The exhaust brake switch, located on the control panel, 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.

The exhaust brake is a butterfly-type valve mounted in the exhaust pipe. When the driver's foot is not on the accelerator pedal and the exhaust brake switch is

in the on position, an air cylinder shuts the butterfly valve which restricts the flow 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.

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 exhaust brake switch is in the off position. Do not turn the exhaust brake on until the engine has reached normal operating temperatures.

Driving Downhill

While approaching a steep grade, make sure that the exhaust brake switch is in the on position. 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.



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.

Exhaust Brake Operating Characteristics

When you remove your feet from both the accelerator and clutch pedals and the exhaust brake switch is in the on position, 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.

Shutting Off the Engine

Make sure the exhaust brake 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

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 restrictor valve shaft and the attaching locations at each end of the actuation cylinder. See Fig. 7.6.
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 nonfunctioning brake. If it is necessary to periodically start

Engines and Clutches

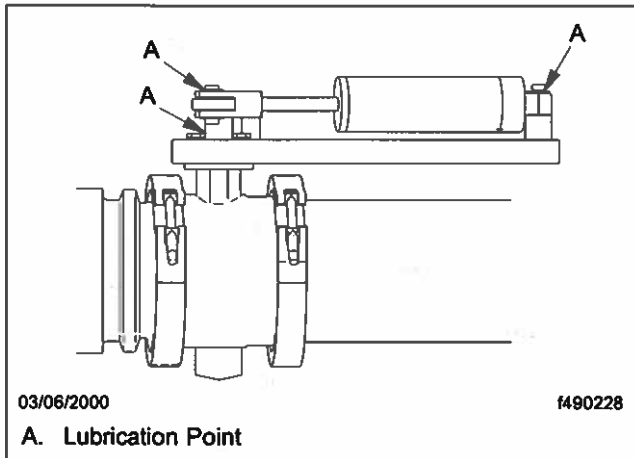


Fig. 7.6, Pacbrake Exhaust Brake and Air Cylinder

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.

Engine Braking System, Optional

Mercedes-Benz Engine Brake/Constant-Throttle Valves

To increase braking performance, the MBE900 engine can be equipped with constant throttles 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.

When a vehicle is equipped with both an exhaust brake and an engine brake, a three-position engine brake switch is used to apply the exhaust and/or engine brakes. When the top of the engine brake switch is pressed, both the engine brake and exhaust brakes are applied. Using the engine brake and exhaust brake provides the best braking performance. With the switch in the center position, only the exhaust brake is applied. When the bottom of the switch is pressed, the switch is off.

Clutches

General Information

The major reason clutches wear out too soon is excessive heat. Clutches are designed to absorb and dissipate more heat than encountered in typical operation. The temperatures developed in typical operation will not break down the clutch friction surfaces. However, if a clutch is slipped excessively or required to do the job of a fluid coupling, high temperatures develop quickly and destroy the clutch. Temperatures generated between the flywheel, driven discs, and pressure plates can be high enough to cause the metal to flow and the friction facing material to char and burn.

CAUTION

Do not allow sustained slippage of the clutch; this could severely damage the clutch disc, pressure plate, or flywheel. Damage caused by clutch slippage due to improper break-in is not warrantable.

Slipping and excessive heat 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 incorrectly adjusted or slipping clutch will rapidly generate sufficient heat to destroy itself.

The most important items that a driver should be aware of to ensure long service life of the clutch include: starting in the right gear, recognizing clutch malfunctions, and knowing when to adjust a clutch.

Clutch Operation

Gear Shifting Techniques

Many drivers upshift into the next gear or even skip-shift into a higher gear before the vehicle has reached the correct 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 by generating heat. For transmission operating instructions, see **Chapter 8**.

Apply the clutch brake by fully depressing the clutch pedal. The purpose of the clutch brake is to stop the transmission gears from rotating in order to engage the transmission gears quickly in making an initial start.

CAUTION

Never apply the clutch brake when making downshifts or upshifts. The clutch pedal should never be fully depressed before the transmission is put in neutral. If the clutch brake is applied with the transmission still in gear, a reverse load will be put on the gear. At the same time, it will have the effect of trying to stop or decelerate the vehicle with the clutch brake. Rapid wear of the friction discs will take place necessitating frequent replacement. Considerable heat will be generated, which will be detrimental to the release bearings and transmission front bearings.

Vehicle Overload, or Overloading the Clutch

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

CAUTION

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

Riding the Clutch Pedal

Riding the clutch pedal is destructive to the clutch since partial clutch engagement permits slippage, generating excessive heat. Riding the clutch pedal will also put a constant thrust load on the release bearing which can thin out the lubricant. Release bearing failures can be attributed to this type of misuse.

Holding the Vehicle on an Incline With a Slipping Clutch

A slipping clutch accumulates heat faster than it can be dissipated, resulting in early clutch failures. Never use the clutch as a hill holder.

Coasting With the Clutch Released (Pedal Depressed) and the Transmission in Gear

Do not allow the vehicle to coast with the clutch released and the transmission in gear. If the transmission remains in a low gear and the vehicle gains speed, which may occur on a downgrade, the input shaft and clutch driven disc will turn at speeds that are higher than normal. This occurs because the rear wheels and the driveline become the input for the transmission, and a higher-than-normal speed for a given transmission gear translates to a higher rpm value for the clutch driven disc.

WARNING

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.

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.

Engines and Clutches

Reporting Erratic Clutch Operation Promptly

Reporting erratic clutch operation as soon as possible will give maintenance personnel a chance to inspect the clutch components.

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



CAUTION

Operating the vehicle with incorrect clutch pedal free-travel could result in clutch damage. See Group 25 of the *Acterra® Workshop Manual* for free-pedal adjustment procedures and specifications.

Clutch Adjustments

Some clutches have an internal adjustment. See the applicable section in Group 25 of the *Acterra® Workshop Manual* for clutch adjustment procedures and specifications.



CAUTION

Operating the vehicle with the clutch incorrectly adjusted could result in clutch or clutch brake failure.

Lubrication

The release bearing should be lubricated at frequent intervals. See Group 25 of the *Acterra® Maintenance Manual* for intervals and procedures.



CAUTION

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

Transmissions

| | |
|--|------|
| Freightliner SmartShift Shift Control | 8.1 |
| Eaton Fuller AutoShift Automated Transmissions | 8.1 |
| Eaton Fuller UltraShift™ | 8.5 |
| Eaton Fuller Straight-Shift Transmissions | 8.10 |
| Eaton Fuller Range-Shift Transmissions | 8.11 |
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Transmissions

Freightliner SmartShift Shift Control

The SmartShift transmission control is an electronic transmission control device. It is installed with the following transmissions:

- Eaton® Fuller® AutoShift™
- Eaton Fuller UltraShift™
- Mercedes-Benz Automated Gear Shift (AGS)

It replaces either the typical floor-mounted shift lever or dash-mounted push button control.

SmartShift accepts driver requests for transmission functions and transmits them through hard wiring to the transmission control unit (TCU). SmartShift is a true shift-by-wire system.

SmartShift offers two main advantages over conventional transmission control devices. Without a floor-mounted shift control, usable cab space is increased. The SmartShift control mounts to the right-hand side of the steering column and is operated by the fingers of the driver's right hand, allowing both hands to remain on the steering wheel.

A two-position slide switch (**Fig. 8.1**) is mounted on the body of the control lever just before the paddle widens out. The slide switch allows the driver to choose automatic (AUTO) or manual (MAN) mode.

In AUTO mode, gears shift automatically, without driver interaction. Manual gear shifts are accomplished by a momentary pull or push on the control in the plane perpendicular to the steering wheel. Pull upward (toward you) on the control to upshift and push downward (away from you) to downshift. The control is spring-loaded and returns to mid-position when released after an upshift or downshift.

For the Eaton Fuller automated transmissions (**Fig. 8.1**), a four-position (R, N, D, L) selector switch is located at the end of the lever. For the Mercedes-Benz AGS (**Fig. 8.2**), a three-position (R, N, D) selector switch is located at the end of the lever.

Embedded in the selector switch is a small neutral lock button to prevent accidental shifts into gear from neutral. Any time you shift through N, press down on the neutral lock button to move the switch from neutral (N) to another gear, such as drive (D), low (L), or reverse (R). When shifting to N, it is not necessary to press the neutral lock button.

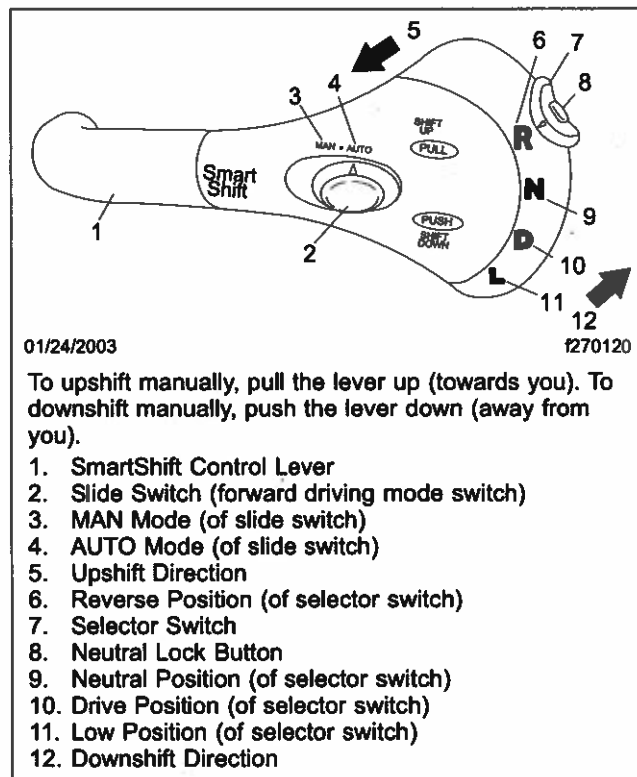


Fig. 8.1, SmartShift Control (with Eaton Fuller AutoShift and UltraShift)

Eaton Fuller AutoShift Automated Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

IMPORTANT: Before starting the vehicle, always do the following:

- Be seated in the driver's seat.
- Place the transmission in neutral.
- Set the parking brakes.
- Press the clutch pedal down to the floor.

General Information, AutoShift

The AutoShift ASX is a partially automated 6-speed or 7-speed Eaton Fuller transmission. The AutoShift AS2 is a partially automated 10-speed Eaton Fuller transmission. On all models, the driver must use the clutch and put the transmission in neutral to start and

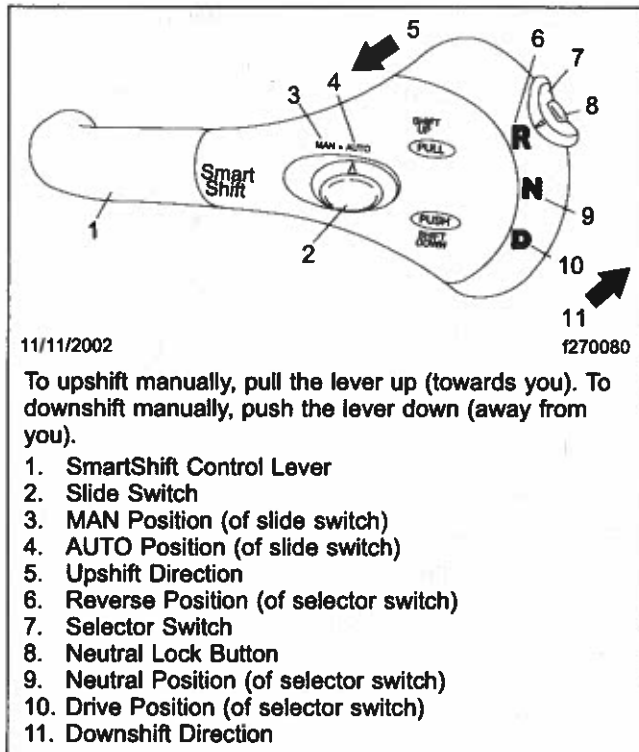


Fig. 8.2, SmartShift Control (with Mercedes-Benz AGS)

stop the vehicle. The SmartShift transmission shift control (**Fig. 8.3**) is used with the AutoShift transmission.

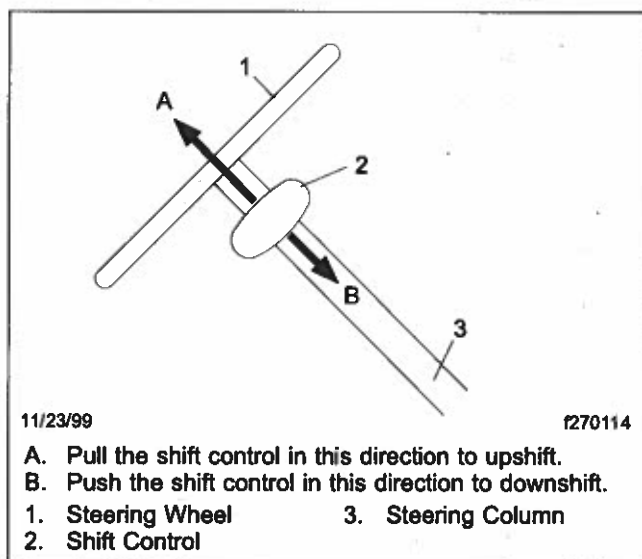


Fig. 8.3, SmartShift Control Operation

The driver does not need to break torque or increase or decrease engine speed to synchronize the shift. The transmission signals the engine controller when to break torque and the engine controller automatically increases or decreases engine speed. When engine speed is correct, the transmission engages the next gear and signals the engine controller to resume operation.

The AutoShift transmission can be operated in an automatic (AUTO) mode or a manual (MAN) mode. Select the mode you want to use by moving the slide switch on the shift control.

Gear information is presented to the driver on a gear display module mounted on the dashboard (**Fig. 8.4**). In automatic mode, the number of the forward gear currently selected appears continually on the display when in drive.

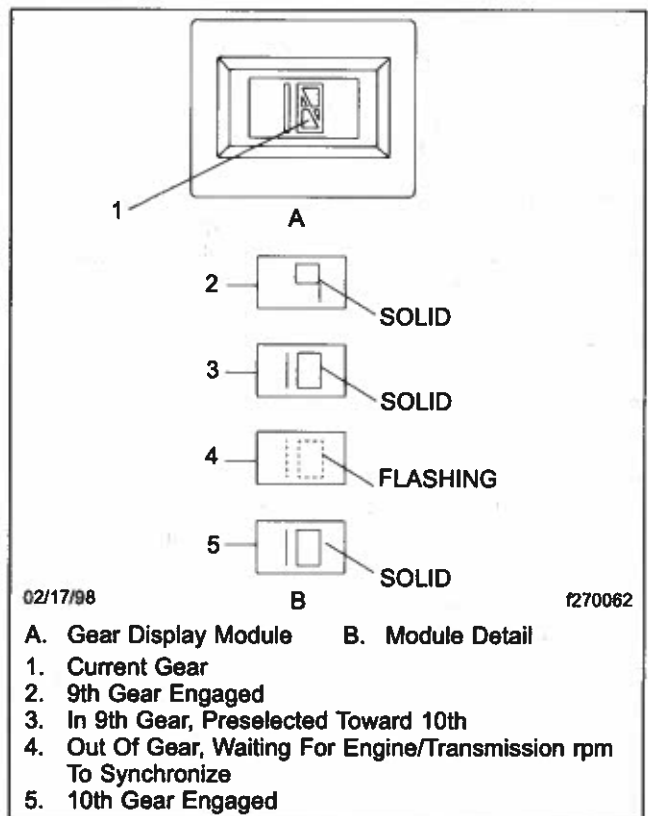


Fig. 8.4, Gear Display Module

The display also flashes the next gear to be engaged while the transmission is in neutral during a gear

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change. In manual mode, the current gear is displayed until a new gear is requested. When neutral is selected, N will appear on the display.

If the gear display continues to flash after releasing the clutch pedal, gear engagement is not complete. Press down the clutch again and wait for the gears to fully engage.

When reverse (R) is engaged on 10-speed AutoShift transmissions, either "RL" or "RH" will appear on the message display screen. AutoShift transmissions with fewer speeds do not have a dual range reverse gear. "R" will appear when reverse is engaged.

IMPORTANT: The information shown on the digital display indicates the state of the transmission only, not the state of the SmartShift control.

Operation, SmartShift With Eaton Fuller AutoShift

WARNING

If the engine cranks in any gear other than neutral, have the vehicle serviced immediately. If the vehicle is started in gear it will suddenly move forward or backward, which could result in personal injury and damage to property and the transmission.

Automatic and Manual Modes

A two-position slide switch (forward driving mode switch) is located near the end of the control. See [Fig. 8.1](#). The switch positions are labelled MAN (manual shift mode) and AUTO (automatic drive mode).

NOTE: In automatic drive mode, upshifts and downshifts require no driver interaction. Move the selector switch to the drive (D) position, disengage the clutch to engage the gear selected, engage the clutch and drive the vehicle. In manual shift mode, upshifts and downshifts require either a pull upward or push downward on the control.

Start-Up

1. With the parking brake applied, press the clutch all the way down to the floor.

2. Check to make sure the transmission is in neutral.

IMPORTANT: To start the engine, the transmission must be in neutral.

3. Start the engine.
4. With the transmission in neutral, release the clutch pedal.

NOTE: This allows the speed sensor on the input shaft to get a reading.

5. Press down on the clutch again and release the parking brake.
6. Select the desired starting gear.
7. Release the clutch.

IMPORTANT: If you have to leave the cab with the engine running:

- Place the transmission in neutral.
- Set the parking brakes.
- Chock the tires.

Reverse

1. To engage reverse (R), slide the selector switch upward to the next position above the neutral position and disengage the clutch.

NOTE: AutoShift 10-speed transmissions have a dual-range reverse. Reverse low (RL) is the default reverse gear.

2. Select reverse high (RH) by pulling upward on the control.

NOTE: Reverse may be engaged below a programmable forward speed in order to rock the vehicle. If reverse is selected above the programmed forward speed, an audible warning will sound and a message indicating that the gear is not available will appear on the message display screen.

Neutral

Neutral (N) is used for starting, parking, or any stationary operation. No gear is selected. The transmission must be in neutral before the engine can be started.

Select neutral by moving the mode selector switch to N while depressing the clutch pedal. Verify that the letter N appears on the auxiliary display. Set the parking brakes and slowly release the clutch pedal.

NOTE: Neutral is always available during vehicle operation. When in neutral, upshift and downshift requests are ignored. If the mode selector switch is moved from N to D (drive) while the vehicle is moving, the transmission will select an appropriate gear for the road speed.

Selecting a Starting Gear

1. In automatic mode, select drive (D) by sliding the selector switch downward to the next position below the neutral position.
2. Disengage the clutch to engage the gear selected. Engage the clutch and drive the vehicle.

NOTE: To select a starting gear other than the default starting gear, either pull upward or push downward on the control while the vehicle is stopped and in drive (either manual or automatic mode).

Each pull upward on the control increases the starting gear by one gear, but no higher than 4th gear. The number of the gear selected will flash on the message display screen until the driver engages the clutch.

This gear will be stored in memory as the default starting gear until either a different starting gear is selected by the driver or the engine is shut down. The transmission may also be programmed so that it is not possible to select a starting gear other than the preprogrammed default starting gear.

Upshifting

In drive (D), the transmission selects the starting gear and automatically selects gears between the starting gear and the top gear.

1. To select drive, move the selector switch to D while depressing the clutch pedal. Slowly release the clutch pedal and drive the vehicle.

NOTE: With the transmission in drive (D) in the automatic mode, upshifts require no driver interaction.

2. With the transmission in drive in the manual mode, request an upshift by pulling upward on the control. See Fig. 8.3. If the requested gear is available, the transmission will upshift.

NOTE: A single, momentary pull upward on the control selects the next higher gear when it is available. Two consecutive, momentary upward pulls will cause a skip shift when the next two higher gears are available and conditions are right.

3. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

NOTE: If a requested gear is not available, an audible warning will sound and the message display screen will indicate that the gear is not available. An unavailable requested upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: With the transmission in drive (D) in the automatic mode, downshifts require no driver interaction.

1. With the transmission in drive in the manual mode, request a downshift by pushing downward on the control. If the requested gear is available, the transmission will downshift.

NOTE: A single, momentary push downward on the control selects the next lower gear when it is available. Two consecutive, momentary downward pushes will cause a skip shift, when the next two lower gears are available and conditions are right.

2. To skip shift, move the control two times in less than 1/2 second. The number of the gear engaged will appear on the message display screen.

NOTE: If a requested gear is not available, an audible warning will sound and the message display screen will indicate that the requested gear is not available. Unlike upshifting, an unavailable requested downshift is stored in memory and the shift will be made when the

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gear is available. The time limit for this memory is a programmable parameter.

Low Gear Operation

Use low (L) when descending steep hills and using compression braking. Engine speed will be increased by 200 rpm and shift points will be offset by 200 rpm. The efficiency of the exhaust brake will be maximized.

Select low by moving the mode switch selector while depressing the clutch pedal if the vehicle is stopped. If L is selected while the vehicle is moving, the transmission downshifts at the earliest opportunity for maximum engine braking.

Using the Clutch

Use the clutch to start and stop the vehicle. Be sure to put the transmission in neutral and apply the parking brake before shutting down the engine.

Eaton Fuller UltraShift™

General Information, UltraShift ASW

UltraShift ASW is a fully-automated six-speed medium-duty transmission. No clutch pedal is required to operate the vehicle. This transmission uses a "wet" clutch system in which the drive and driven discs rotate in a bath of automatic transmission fluid (Dexron III).

The UltraShift transmission uses the four-position SmartShift control lever on the steering column to select gears. To know what gear the transmission is in, look at the round current gear indicator on the right-hand control panel as shown in [Fig. 8.5](#). All forward shifts can be made either manually or automatically, at the driver's choice.

Operation, UltraShift ASW

Power Up

1. With the parking brake set, select neutral (N) by moving the selector switch to the N position.
2. With the transmission in neutral, turn on the ignition switch. The "CHECK TRANS" and "TRANS TEMP" telltale lights come on and go out again (bulb check). See [Fig. 8.6](#).
3. After the ignition is turned on, the current gear indicator shows the dot display, arranged in a

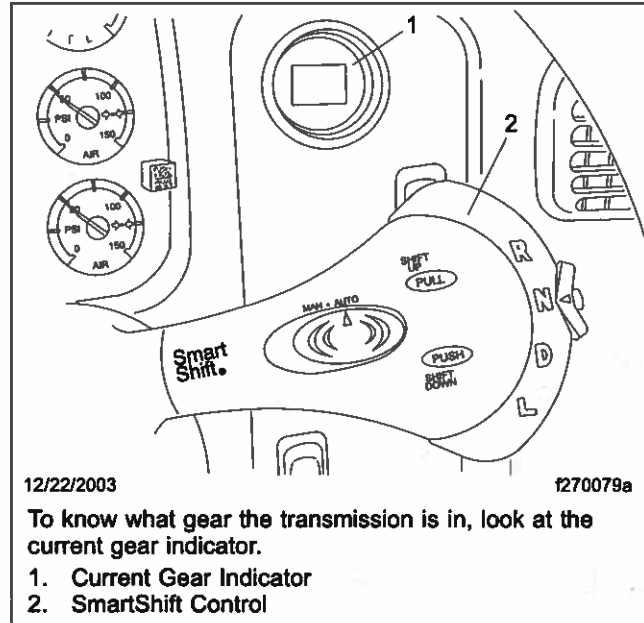


Fig. 8.5, Shift Controls and Indicators, UltraShift Transmissions

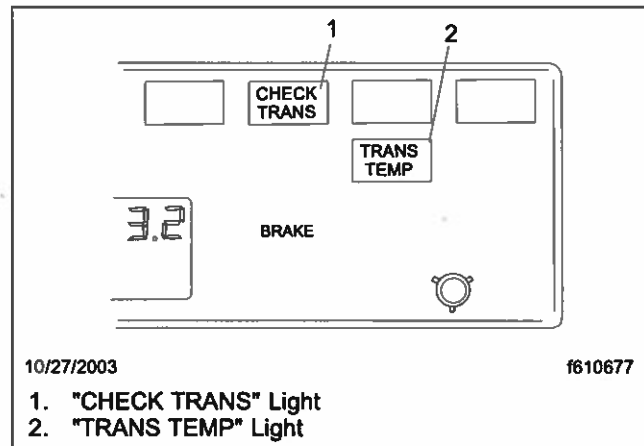


Fig. 8.6, Telltale Lights

square pattern. All dots in the pattern should light up, without gaps or spaces. See [Fig. 8.7](#).

4. Wait for the current gear indicator to show a solid "N." When the "N" is solid, rather than flashing, the UltraShift ASW transmission control unit (TCU) is powered up. Start the engine and apply the service brake.
5. Select drive (D) by pressing in the neutral lock button and moving the selector switch downward

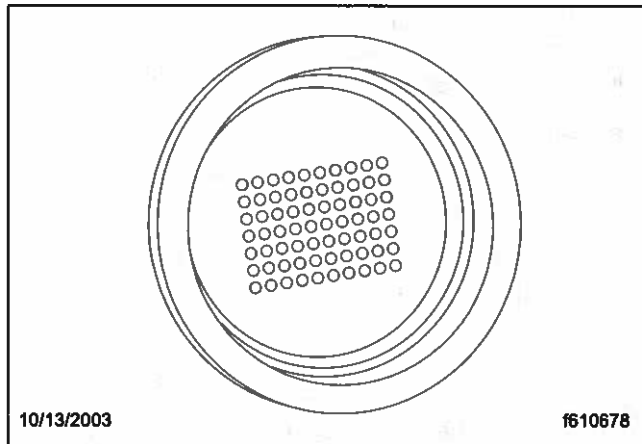


Fig. 8.7, Power Up Dot Display

to the position below neutral. Release the parking brake. The gear is displayed on the current gear indicator.

NOTE: When D is selected, the transmission starts up in default starting gear, either first or second.

6. On a level grade, release the service brake and press down on the throttle pedal to allow the vehicle to move forward.

WARNING

When starting or stopping on hills and grades, use extra care to prevent the vehicle from rolling back. A rollback accident could cause death, serious personal injury, or property damage.

7. Prevent the vehicle from rolling backwards when stopped on a hill or grade, or when the vehicle is starting from a stop on a hill or grade.

- 7.1 *To start from a full stop on hill or grade, quickly move your foot from the brake pedal and press firmly on the throttle pedal.*

On steep hills, set the parking brake and release it only when there is enough engine power to prevent rollback.

- 7.2 *To stop on a hill or grade, press and hold the brake pedal to keep the vehicle from moving.*

On steep hills, set the parking brake and chock the tires, front and/or rear. Never hold a hill with the throttle pedal. This will cause the clutch to overheat.

Power Down

1. Apply the service brakes.
2. Select neutral (N) by moving the selector switch to N. When the "N" on the current gear indicator is solid, rather than flashing, the ASW TCU is ready to power down.
3. With the transmission in neutral, set the parking brake.
4. Turn off the ignition key and shut down the engine.

Automatic and Manual Modes

The SmartShift control has a slide switch located on the body of the control lever just before the paddle widens out. See Fig. 8.8. The slide switch controls the forward driving mode, automatic or manual.

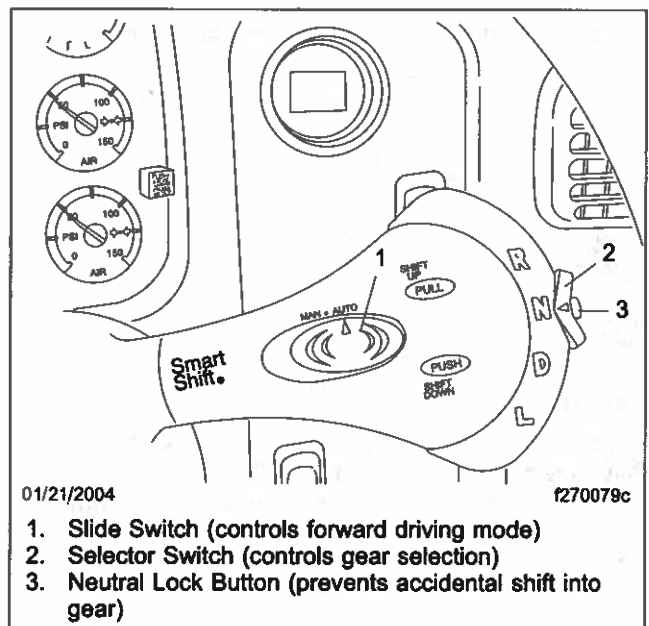


Fig. 8.8, Switches, UltraShift Transmissions

To change mode at any time, move the slide switch in the desired direction. This allows the driver to respond flexibly to a wide range of driving conditions, such as blind corners, tight curves, and steep hills.

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IMPORTANT: Whatever the mode, it is always possible to shift manually by moving the lever up or down as needed. When the engine speed is within 75 revolutions per minute (rpm) of the load-based shift point for an automatic shift, the ASW TCU will advance the shift.

In either mode, the gear indicator displays the current gear. See [Fig. 8.9](#).

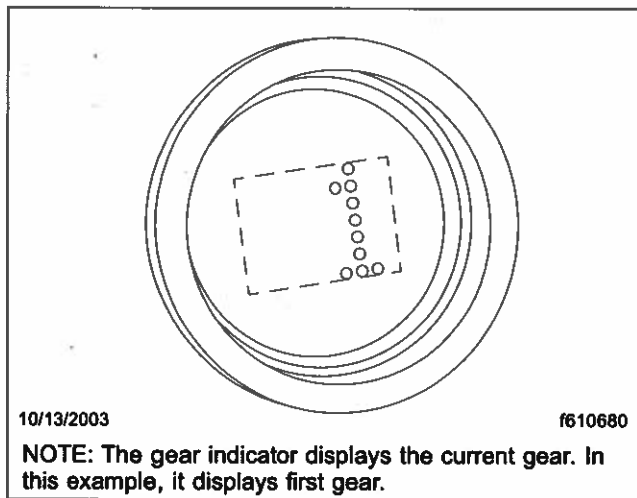


Fig. 8.9, Current Gear Display

At the start of a shift, the current gear continues to display until the transmission has been pulled into neutral. At this point, as the transmission is synchronizing for the new (target) gear, the gear indicator flashes the number of the new gear.

When the shift is complete, the new gear displays solid, without flashing.

Automatic Mode (AUTO)

In automatic drive mode (AUTO), upshifts and downshifts are made by the transmission without driver intervention. Press in the neutral lock button, move the selector switch to drive (D), and press down on the throttle pedal. The transmission will shift automatically.

If driving conditions require, it is still possible to request a manual shift. The transmission will make the shift if the engine speed is within 75 rpm of the load-based shift point for that gear.

If the driver presses down on the throttle pedal after a manual downshift in automatic mode, the transmission will upshift again if the ASW TCU requires it.

Manual Mode (MAN)

In manual drive mode (MAN), upshifts and downshifts are made by the driver:

- To shift up, pull the lever up (towards you).
- To shift down, push the lever down (away from you).

The system will hold the current gear until the driver requests a shift. In downhill situations in particular, the driver must be alert to vehicle speed by downshifting and/or using the service brakes as needed.

A shift request will still be refused if the selected gear would cause engine overspeed or excessive lugging.

Selecting Gears

Reverse

Reverse (R) is at the upper end of the four-position selector switch located at the end of the SmartShift control lever. To select R, press in the neutral lock button and move the selector switch upward to the position above neutral. When reverse is selected, the letter "R" displays on the current gear indicator. See [Fig. 8.10](#).

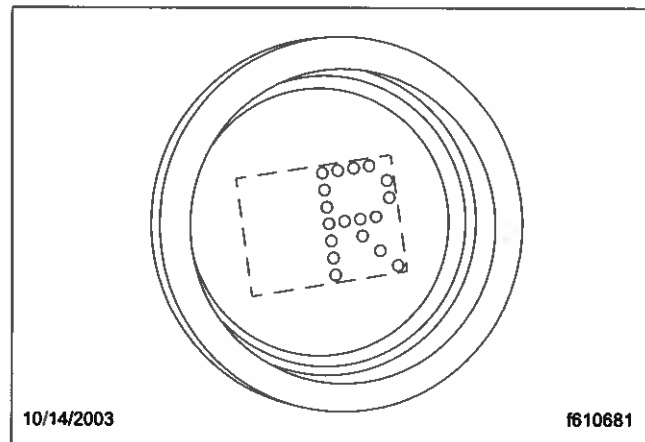


Fig. 8.10, Reverse Gear Display

IMPORTANT: Under normal conditions, do not select reverse with the vehicle moving forward.

The vehicle must be moving at less than two miles per hour (3 km/h) before selecting reverse. If reverse

is selected when the vehicle is moving faster, an audible warning will sound and continue sounding at three-second intervals until the control lever is returned to the D position. When the vehicle is moving at the proper speed, reverse can be engaged.

Neutral

IMPORTANT: Always start the engine with the transmission in neutral, the parking brake set, and the service brakes applied.

Neutral (N) is directly below R on the four-position selector switch located at the end of the SmartShift control lever. To select N, move the selector switch to the position below R. When neutral is selected, the letter "N" displays on the current gear indicator. See Fig. 8.11.

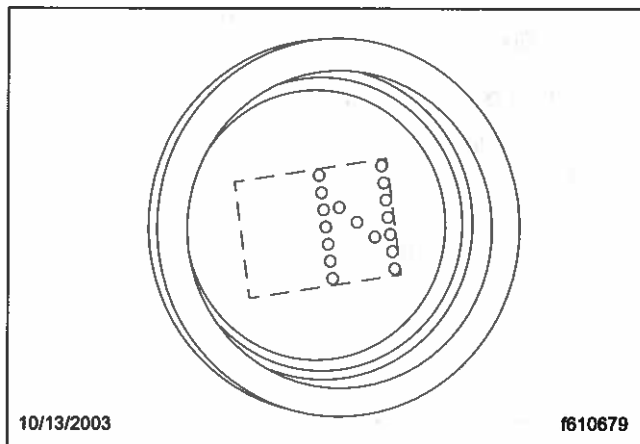


Fig. 8.11, Neutral Display

⚠ WARNING

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Neutral is always available during operation, whatever the vehicle speed. When in neutral, requests to upshift or downshift are ignored. If the selector switch is moved from neutral to drive while the vehicle is moving, the transmission will shift into a gear within the engine's operating torque range.

Before shutting down the engine, return the selector switch to N. When the ignition is turned off, the transmission will reset to neutral in a few minutes regardless of the position of the shift lever.

Drive

Drive (D) is directly below N on the four-position selector switch located at the end of the SmartShift control lever. To select D, press in the neutral lock button and move the selector switch to the position below N. When drive is selected, the number of the currently selected forward gear (1, 2, 3, 4, 5, or 6) displays on the gear indicator. See Fig. 8.9.

When in drive, requests to upshift or downshift are enabled. Either manual or automatic mode can be selected on the slide switch.

The vehicle starts up in either first or second gear, depending on load and grade.

The ASW UltraShift controller adapts to the working conditions of each vehicle and its driver. After power up or a load change, it needs to learn the new conditions. While learning, it may hold a gear too long before upshifting. Start the upshift manually. It may take three or four shifts before ASW succeeds in learning the new load-based shift points, but after that it will handle the shifting automatically.

Low

Low (L) is located at the lower end of the four-position selector switch located at the end of the SmartShift control lever. To select L, press in the neutral lock button and move the selector switch to the position below D.

When in low, the current gear is maintained. Requests to upshift are not enabled.

IMPORTANT: If the engine is approaching overspeed, the ASW TCU will override the current gear setting and upshift to prevent engine damage.

To enhance engine braking, downshifts are performed at higher rpm than normal.

If L is selected from neutral while stopped, the vehicle starts up in first gear and stays there until the engine approaches overspeed.

Upshifting

To request an upshift with the transmission in drive, pull the control lever up (towards you). If the gear is available, the transmission upshifts and the new gear displays on the gear indicator. No skip shifts are available while upshifting.

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No upshifts are available in low, except to prevent engine overspeed.

If the transmission does not upshift quickly enough after power-up or a load change, begin the shift manually. The ASW TCU will learn the new load-based shift conditions after three or four shifts.

If the gear requested is unavailable, a tone will sound. An unavailable request to upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: The driver can manually downshift at any time, even when the slide switch is set to AUTO mode.

To request a downshift with the transmission in drive or low, push the control lever down (away from you). If the gear is available, the transmission downshifts and the new gear displays on the gear indicator. Skip shifts are available while downshifting.

For best engine braking, select low while moving. In low, downshifts are performed at higher rpm than in drive.

IMPORTANT: If the engine is approaching overspeed, the ASW TCU will override the current gear setting and upshift to prevent engine damage.

If the gear requested is unavailable, a tone will sound. An unavailable request to downshift is not stored in memory. The downshift must be requested again.

When coasting to a stop, the ASW TCU does not finish the downshift until the driver presses down on the throttle pedal again.

IMPORTANT: A downshift request can never result in a shift into neutral, even if the vehicle is in the drive position in the lowest possible gear.

Before starting down a hill, slow down. Downshift to a speed that you can control without hard pressure on the service brakes.

Before entering a curve, slow down to a safe speed. Downshift if necessary. This lets you use some power through the curve to help the vehicle be more stable on the turn. It also allows you to regain speed faster as you come out of the curve.

Ultrashift Diagnostics

Clutch Calibration

The ASW TCU automatically adjusts for clutch wear. The calibration takes place whenever the following conditions are met:

- The engine is at normal operating temperature
- The vehicle is stopped
- The engine is at idle speed
- The selector switch on the controller is in neutral

Calibration may take up to two minutes to complete. The engine may slow and return to normal idle several times during calibration.

To stop calibration at any time, select one of the drive positions on the selector switch (R, D, or L).

Clutch Protection Fault

Excessive clutch slippage creates heat and reduces the life of the clutch. These are some conditions which lead to clutch abuse:

- Using the throttle to hold the vehicle on a grade
- Starting the vehicle in too high a gear
- Overloading the vehicle
- Using high idle with the vehicle in gear

The ASW TCU is programmed to prevent clutch abuse. When the clutch overheats, the following alerts take place:

- The "TRANS TEMP" light comes on
- The current gear indicator displays "CA"
- A warning tone sounds at one-second intervals

The alerts continue until the clutch cools, the throttle is released, or the clutch is fully engaged.

System Problem

In the event of a problem, do the following steps:

1. Note the driving conditions at the time the problem occurred.

2. Record the status of the transmission at the time of the problem (AUTO or MAN mode, gear setting R, N, D, or L, current gear, engine speed, etc.)
3. Reset the system, using the procedure below.

Reset Procedure

Transmission operation can sometimes be restored by doing the following reset procedure:

1. Stop the vehicle when it is safe to do so. Set the parking brake.
2. Place the selector switch in neutral and turn off the ignition.
3. Check all harness connectors as described in **Chapter 11**.
4. Wait at least two minutes with the engine shut down.
5. Restart the engine.

If the problem continues, contact an authorized Freightliner or Eaton service facility.

Locked In Gear

If the transmission becomes locked in gear, a dash (-) will appear on the current gear indicator when the vehicle is restarted during the reset procedure.

NOTE: If the transmission becomes locked in gear while the vehicle is moving, increased braking effort may be required to stop the vehicle.

If the current gear indicator displays a dash during power-up with the selector switch in neutral, do the following steps:

1. Make sure the parking brake is set. Turn off the ignition and wait at least two minutes.
2. Apply the service brakes.
3. With the service brakes applied, release the parking brake.
4. Make sure the selector switch is in neutral and turn on the ignition key. Do not attempt to start the engine at this time.
5. If necessary to get the transmission to shift into neutral, release the pressure on the brake pedal slightly.

6. Once the ASW TCU reaches neutral, a solid "N" will appear on the current gear indicator and the vehicle will start. Make sure the service brakes are applied and the parking brake is set.

If the current gear indicator continues to display a dash, contact an authorized Freightliner or Eaton service facility.

Eaton Fuller Straight-Shift Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Straight-Shift

Eaton Fuller 5-speed FS models are fully synchronized. They have five forward speeds and one reverse. See **Fig. 8.12** for the shift pattern.

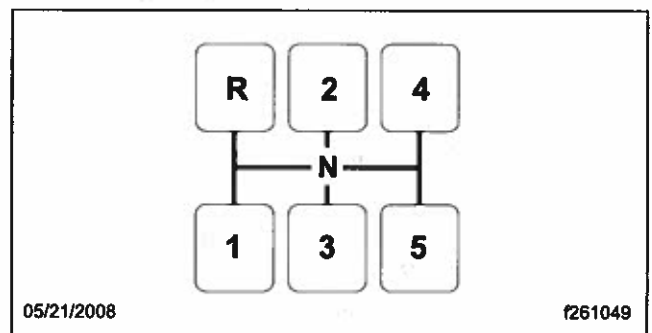


Fig. 8.12, Shift Pattern, 5-Speed FS Models

Eaton Fuller 6-speed FS and FSO models are fully synchronized. They have six forward speeds and one reverse. See **Fig. 8.13** for the shift pattern.

Eaton Fuller 7-speed T models are not synchronized. They have seven forward speeds and one reverse. See **Fig. 8.14** for the shift pattern.

These transmissions are designed for use with on-highway, fuel economy engines where a minimum of shifting is desired and less gear reduction is acceptable.

Operation, Straight-Shift

1. Always use 1st gear when starting to move the vehicle forward.
2. Accelerate to build up the engine speed (rpm) needed to shift into 2nd gear. Disengage the

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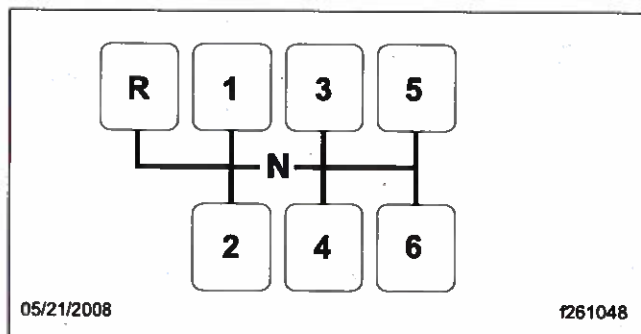


Fig. 8.13, Shift Pattern, 6-Speed FS and FSO Models

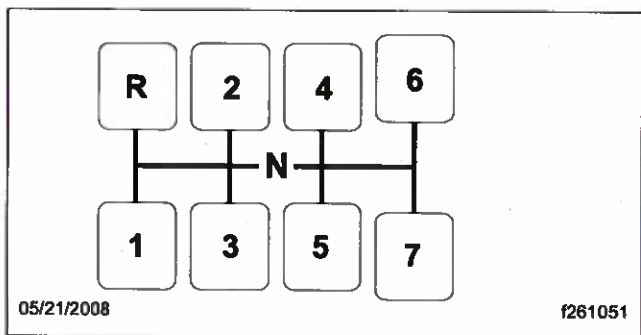


Fig. 8.14, Shift Pattern, 7-Speed T Models

clutch and move the shift lever to 2nd gear. Engage the clutch and accelerate again. This is known as progressive shifting.

3. Continue upshifting using the same progressive sequence described in the previous step. Follow the pattern on the shift lever.
4. When downshifting, shift progressively down through each successive lower gear as follows:

When the engine speed drops to the same rpm to which it fell immediately after upshifting to that same gear, press the clutch pedal down and move the shift lever to the next lower gear. Engage the clutch smoothly.

Continue downshifting as required using the same sequence described above.

CAUTION

If the vehicle is moving when shifting, depress the clutch pedal just far enough to disengage the clutch. Pressing it to the floor will engage the clutch brake, if so equipped, causing premature clutch brake wear.

IMPORTANT: Do not rest your foot on the clutch pedal while driving. This causes partial clutch disengagement which could cause premature clutch wear.

NOTE: On synchronized models, disengage the clutch completely when shifting gears. Double-clutching is unnecessary. On unsynchronized models, use double-clutching to engage 1st gear or reverse.

Eaton Fuller Range-Shift Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Range-Shift Eaton Fuller 9-Speed RT Models

Eaton Fuller 9-speed RT models have nine forward speeds and two reverse speeds, consisting of a 5-speed front section and a 2-speed auxiliary section. The first position in the front section is used only as a starting gear. The other four ratios are used once in LO range and once again in HI range. See Fig. 8.15 for the shift patterns.

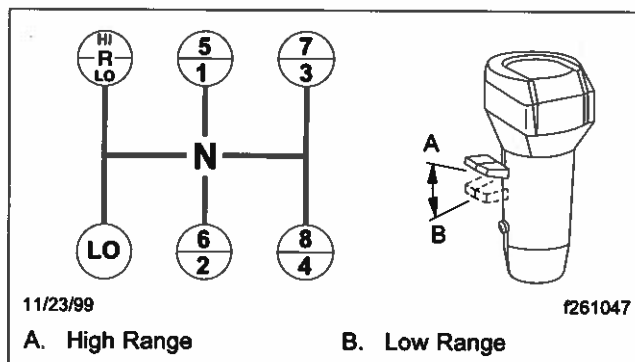


Fig. 8.15, Shift Pattern, 9-Speed RT Models

After shifting out of the first position, use the Roadranger® repeat H shift pattern. LO range and HI range are selected with the range knob or range lever. It is used once during the upshift sequence and once during the downshift sequence.

Always preselect the range shift. After preselection, the transmission will automatically make the synchronizer range shift as the shift lever passes through neutral.

Eaton Fuller 10-Speed RT Models

Eaton Fuller Roadranger 10-speed RT and FR models have ten forward speeds and two reverse speeds. The gear shift lever mechanically engages and disengages five forward gears and one reverse gear in the transmission front section. The range lever on the roadranger valve allows the driver to control an air shifted auxiliary section to provide a LO and HI range. The five forward gears selected in LO range are used again in HI range to provide the 10 progressive forward gear ratios. See Fig. 8.16 for the shift patterns. See Table 8.1 for the shift progressions.

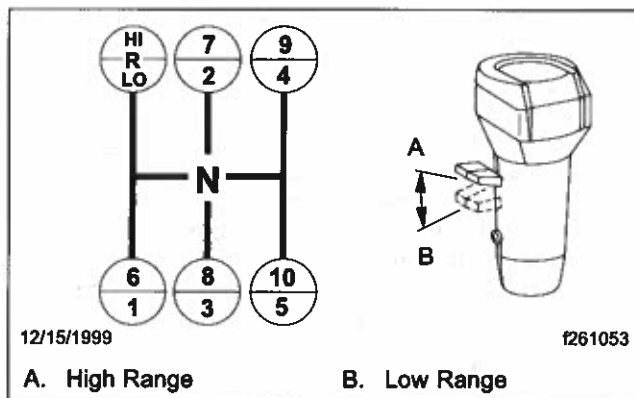


Fig. 8.16, Shift Pattern, 10-Speed RT and FR Models

| Eaton Fuller Shift Progressions | | | |
|-----------------------------------|-------------|------------|----------|
| Model | LO Range | | HI Range |
| | Off-Highway | On-Highway | |
| 9-Speed Direct or Overdrive (RT) | | | |
| 10-Speed Direct or Overdrive (RT) | | | |

Table 8.1, Eaton Fuller Shift Progressions

Once the highest shift lever position (5th gear) is reached in LO range, the driver preselects the range

shift lever for HI range. The range shift occurs automatically as the shift lever is moved from 5th gear position to the 6th gear position.

When downshifting, the driver preselects the range lever for LO range and the range shift occurs automatically during the shift lever movement to the next gear position.

Operation, Range-Shift

1. When operating off-highway or under adverse conditions, always use the low gear when starting to move the vehicle.

When operating on-highway, with no load or under ideal conditions, use 1st gear when starting to move the vehicle.

For all conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling and without excessively slipping the clutch.

2. Use the clutch brake to stop gear rotation when shifting into low (or 1st) or reverse when the vehicle is stationary. The clutch brake is applied by depressing the clutch pedal all the way to the floor.

For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Do not make range shifts with the vehicle moving in reverse gear.
4. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
5. Do not shift from high range to low range at high vehicle speeds.
6. Double-clutch between all upshifts and downshifts.
7. After your shifting ability improves, you may want to skip some of the ratios. This may be done only when operating conditions such as load, grade, and road speed permit.

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Upshifting

1. Position the gear shift lever in neutral. Start the engine and bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down into low range.
3. Press the clutch pedal to the floor. Shift into low or 1st gear, then engage the clutch with the engine at or near idle speed to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
4. Shift progressively up from low or 1st gear to the top gear in low range, double-clutching between shifts and accelerating to 80 percent of engine governed speed.
5. While in the top gear of the low-range shift pattern and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral and shift into the bottom gear in high range. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.
6. With the transmission in high range, shift progressively up through each of the high range gears, double-clutching between shifts.

Downshifting

1. With the transmission in high range, shift progressively down to the bottom gear in high range, double-clutching between shifts.
2. When in the bottom gear of the high-range shift pattern and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral and shift into the top gear of the low-range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears as conditions require.

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

Eaton Fuller Deep-Reduction Transmissions

Refer to the Eaton website for additional information, www.roadranger.com.

General Information, Deep Reduction

IMPORTANT: Not all lever positions are used in each range and the shift patterns vary between transmissions. Be sure to read the shift pattern decal on the dash for the operating instructions for the specific transmission installed in your vehicle.

9-Speed RT-L Models

Eaton Fuller 9-speed deep-reduction transmissions have a 5-speed front section, and a 2-speed rear-range section, with a deep reduction button. The deep reduction (low-low) gear is used only when operating under adverse conditions. Low gear in the front section is used only for rough, off-highway conditions, as a starting ratio. Both the low gear and 1st gear in the low range can be split, using the deep reduction button, for another reduction ratio in those shift lever positions. The remaining four forward positions are used once in the low range and once in the high range. Reverse in the low range can also be split with the deep reduction button for a lower ratio.

10-Speed RT-LL Models

Eaton Fuller 10-speed deep-reduction transmissions have a 5-speed front section, and a 2-speed rear range section, with a deep reduction button. The deep reduction (low-low) gear is used only when operating under adverse conditions. Low gear in the front section is used only for rough, off-highway conditions, as a starting ratio. The remaining four forward positions are used once in the low range and once in the high range. See **Fig. 8.17** for the shift pattern.

Operation, Deep Reduction

IMPORTANT: The shifter knob has an interlock feature that prevents the deep reduction button from being moved forward when the range preselection lever is up (in high range); when in low range and the deep reduction button is in the

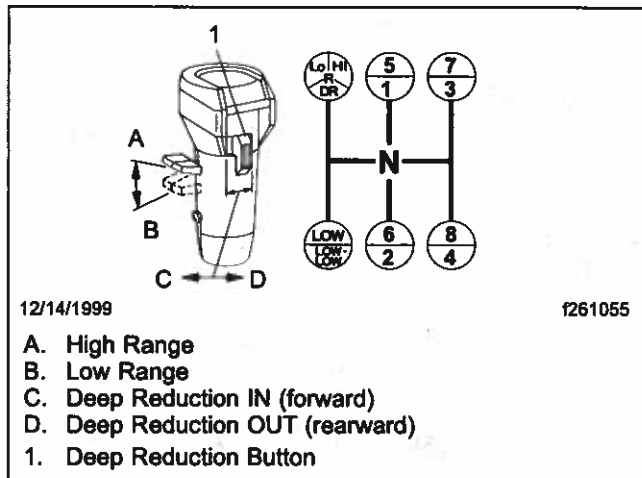


Fig. 8.17, Eaton Fuller 10-Speed Deep-Reduction Transmission Shift Patterns

forward position, the range preselection lever cannot be moved up.

1. For all driving conditions, use the highest gear that is still low enough to start the vehicle moving with the engine idling, and without slipping the clutch excessively.
2. Use the clutch brake to stop gear rotation when shifting into low-low, low-1st (whichever is used as a starting ratio) or reverse, when the vehicle is stationary. The clutch brake is actuated by depressing the clutch pedal all the way to the floor.

For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

3. Double-clutch between all upshifts and downshifts.
4. Never move the shift lever into low gear while in high range.
5. Do not preselect with the deep reduction button. When making the shift from a deep reduction ratio to a low range ratio, move the deep reduction button from a forward position to a rearward position, then complete the shift immediately.
6. Never move the deep reduction button from a rearward position to a forward position when the transmission is in high range.
7. Do not shift from high range to low range at high vehicle speeds.

8. Do not make range shifts with the vehicle moving in reverse gear.
9. Never attempt to move the range preselection lever with the gear shift lever in neutral while the vehicle is moving. Preselection with the range preselection lever must be made prior to moving the shift lever out of gear into neutral.
10. After your shifting ability improves, you may want to skip some of the ratios. This may be done *only* when operating conditions permit, depending on the load, grade, and road speed.

Upshifting

There are several patterns of upshifting, depending on the vehicle load and the road conditions. Deep reduction gears are best suited for heavy loads and steep inclines. Low gear (in 10-speed transmissions) is best suited for off-highway use.

The following instructions are recommended for starting a loaded vehicle moving, under adverse conditions.

1. Position the gear shift lever in neutral. Start the engine, and bring the vehicle air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. Position the range preselection lever down, into low range.
3. Move the deep reduction button to the forward position, to engage the deep reduction gears.
4. Depress the clutch pedal to the floor; shift into low-low gear; then engage the clutch, with the engine at or near idle speed, to start the vehicle moving. Accelerate to 80 percent of engine governed speed.
5. When ready for the next upshift, move the deep reduction button rearward, then break the torque on the gears by momentarily releasing the accelerator or depressing the clutch pedal. Do not move the shift lever.
6. From low gear, shift upward to the top gear in low range, double-clutching between shifts, and accelerating to 80 percent of engine governed speed.
7. While in the top gear of the low range shift pattern, and ready for the next upshift, flip the range preselection lever up into high range. Double-clutch through neutral, and shift into the bottom

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gear in high range. As the shift lever passes through neutral, the transmission will automatically shift from low range to high range.

8. With the transmission in high range, shift progressively upward through each of the high range gears, double-clutching between shifts.

Downshifting

1. With the transmission in high range, shift progressively downward to the bottom gear in high range, double-clutching between shifts.
2. When in the bottom gear of the high range shift pattern, and ready for the next downshift, push the range preselection lever down into low range. Double-clutch through neutral, and shift into the top gear of the low range shift pattern. As the shift lever passes through neutral, the transmission will automatically shift from high range to low range.
3. With the transmission in low range, downshift through the low range gears, as conditions require.

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

Mercedes-Benz Manual Transmissions

CAUTION

Operating a manual transmission with the fluid level higher or lower than recommended can result in transmission damage.

Mercedes-Benz transmissions use a simple 6-speed gear pattern as shown in [Fig. 8.18](#).

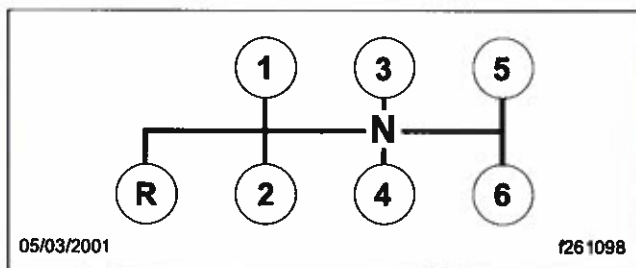


Fig. 8.18, Shift Pattern, M-B Transmissions

Always use first gear when starting to move the vehicle forward.

IMPORTANT: Do not rest your foot on the clutch pedal while driving. This causes partial clutch disengagement which could cause premature clutch wear.

While traveling, check the tachometer regularly to be sure the engine speed is within the most economical range (1400 to 2000 rpm).

On level roads, drive in the highest usable gear, keeping engine speed down.

CAUTION

Do not rest your hand on the gear shift lever while driving. This can cause synchronizer damage.

When approaching an uphill grade, shift down ahead of time to prevent loss of engine rpm. When approaching a downhill grade, shift down ahead of time to prevent runaway speed. For information about shift points and "progressive shifting," see [Chapter 7](#).

Change gears only when absolutely necessary. Skip gears if needed.

When shifting, always press the clutch pedal all the way down. Do not force the gear lever.

Before shifting into reverse, be sure the engine is idling and the vehicle is not moving.

CAUTION

If the transmission locks up while driving, making further shifting impossible, continue driving in the gear already selected to reach service assistance, as circumstances allow. Or, safely park the vehicle off the roadway and contact your nearest Sterling dealer or other qualified service provider for roadside assistance. To prevent further transmission damage, do not move the vehicle from a standing start unless this can be accomplished safely, taking into account the gear that is engaged and the load on the vehicle.

TTC Manual Transmissions

Refer to the TTC website for additional information, www.ttcautomotive.com.

General Information, TTC

TTC (Spicer) 7-speed series transmissions are synchronized in all gears except 1st and reverse. They have seven forward gears and one reverse gear. See **Fig. 8.19** for the shift pattern.

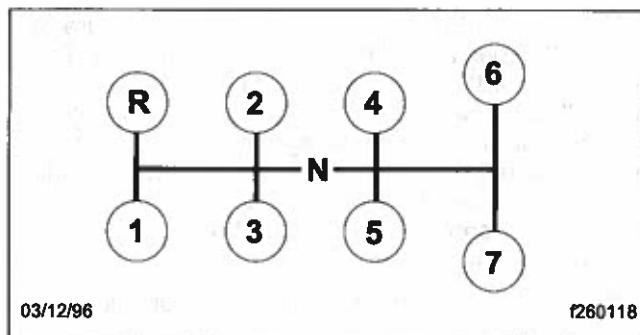


Fig. 8.19, TTC 7-Speed Transmission Shift Pattern

Operation, TTC

1. Always use 1st gear when starting to move the vehicle forward.
2. To save fuel, use progressive shifting techniques. It is usually not necessary to go all the way to governed speed before upshifting.
3. Double-clutch only when shifting out of neutral, or when shifting down into 1st.

NOTE: 1st gear, like reverse, is not synchronized.

Upshifting

1. Position the gear shift lever in neutral, then start the engine. Bring the air system pressure up to 100 to 120 psi (689 to 827 kPa).
2. To shift, press down on the clutch and wait for the clutch to release completely. Move the shift lever into 1st gear and engage the clutch (remove your foot from the lever).
3. Accelerate until your rpm is high enough to shift into 2nd. Press down on the clutch and move the shift lever to second gear. Engage the clutch and continue driving.

4. Use this progressive shifting technique to shift into each higher gear. See **Fig. 8.19** for the shift pattern.

IMPORTANT: As you approach top speed, it will be necessary to accelerate closer and closer to governed speed before allowing the engine rpm to drop down at the next shift point.

Downshifting

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

1. Depress the clutch pedal enough to release the torque, shift into the next lower gear, and engage the clutch smoothly while accelerating the engine to keep the vehicle moving at the desired speed.
2. Continue downshifting, as conditions require, using the same sequence described above. When shifting down into 1st gear, remember that 1st gear isn't synchronized. Double-clutch when shifting down into 1st gear.

Allison On-Highway Transmissions

The Allison on-highway transmissions are fully automatic and include the 1000 Series™, 2000 Series™, and 2400 Series™. Refer to the Allison website for additional information, www.allisontransmission.com.

Safety Precautions, On-Highway Transmissions

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.

1000 Series

On vehicles with Allison 1000 series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

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Without Park Position

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle rpm.
3. Put the transmission in neutral.
4. Apply the parking brake, and make sure it is properly engaged.
5. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

With Park Position

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle rpm.
3. Put the transmission in P (park).
4. Apply the parking brake (if equipped), and make sure it is properly engaged.
5. Engage the park range by slowly releasing the service brake.
6. Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

2000 Series

On vehicles with Allison 2000 series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

Without Auto-Apply Parking Brake

Follow the instructions for vehicles with 1000 series transmissions, under the heading "Without Park Position."

With Auto-Apply Parking Brake

1. Bring the vehicle to a complete stop using the service brake.
2. Ensure that the engine is at low idle rpm.
3. Put the transmission in PB (auto-apply parking brake).
4. Apply the parking brake (if equipped), and make sure it is properly engaged.

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

2400 Series

On vehicles with 2400 series transmissions, follow the instructions for vehicles with 1000 series transmissions.

Range Inhibit Indicator, 2000 and 2400 Series

A RANGE INHIBIT indicator is a standard feature of the 2000 series and 2400 series transmissions. The RANGE INHIBIT indicator comes on to alert the driver that transmission operation is being inhibited and that the range shifts being requested by the driver may not occur. When certain operating conditions are detected by the TCM (transmission control module), the controls will lock the transmission in the current operating range.

Shift inhibits occur under the following conditions:

- Shifts from neutral to reverse or from neutral to a forward range when the engine is above idle, greater than 900 rpm.
- Forward/reverse directional shifts are typically not permitted if appreciable output shaft speed is detected.
- When some types of unusual transmission operating conditions are detected by the TCM, the TCM temporarily limits transmission operation until the vehicle can be driven to a service location. When this type of situation is detected, the TCM will lock the transmission in a safe gear range.
- The TCM will prevent shifts from park or neutral to range when auxiliary equipment, such as a power takeoff unit (PTO), is in operation.

Operating Instructions, On-Highway Transmissions

Allison automatic transmissions are electronically controlled. The shift selector provides five or six forward ranges and one reverse range. A lever shift selector (**Fig. 8.20**) is used by the driver to select the ranges.

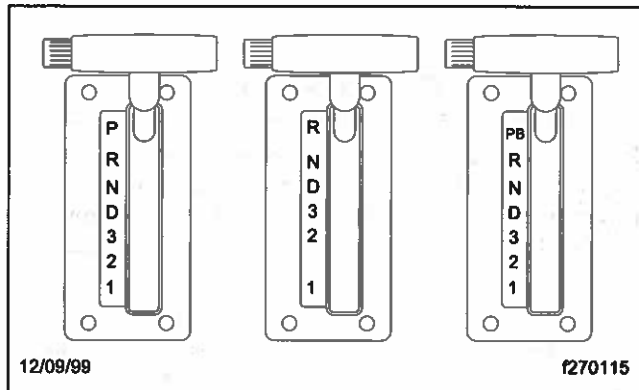


Fig. 8.20, Lever Shift Selectors

P (Park, optional on 1000 and 2400 Series)

Use park when turning the engine on or off, to check vehicle accessories, to operate the engine in idle for longer than 5 minutes, and for stationary operation of the power takeoff, if equipped. This position places the transmission in neutral and engages the park pawl of the transmission.

NOTE: This does not apply the parking brake.

PB (Auto-Apply Parking Brake, optional on 2000 Series)

The auto-apply parking brake places the transmission in neutral and applies the parking brake.

R (Reverse)

Reverse is used to back the vehicle. When the selector is in reverse, the reverse warning signal will sound. Always bring the vehicle to a complete stop before shifting from a forward range to reverse, or from reverse to a forward range.

CAUTION

Extended idling in reverse may cause transmission overheating and damage.

Do not idle in reverse for more than 5 minutes. Select P (park), PB (auto-apply parking brake), or N (neutral) when time at idle exceeds 5 minutes.

NOTE: The shift into reverse may not succeed if a range inhibitor is active. Check for illumination of the RANGE INHIBIT indicator.

N (Neutral)

The neutral position places the transmission in neutral. This position is used when starting the engine and for stationary operation.

WARNING

Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

When neutral is selected, the vehicle service brakes, parking brake, or emergency brake must be applied. Selecting neutral does not apply vehicle brakes unless an auxiliary system to apply the parking brake is installed.

WARNING

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

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.

CAUTION

Coasting in neutral can cause severe transmission damage.

D (Drive)

WARNING

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.

In the drive position, the transmission will initially go into first range when drive is selected. As vehicle speed increases, the transmission will upshift automatically through each available range up to fourth range or fifth range. As the vehicle slows, the transmission will downshift automatically.

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

CAUTION

Do not idle in drive for more than 5 minutes. Extended idling in drive may cause transmission overheating and damage. Always select PB (auto-apply parking brake) or P (park) if time at idle is longer than 5 minutes.

NOTE: The shift into drive may not succeed if a range inhibitor is active. Check for illumination of the RANGE INHIBIT indicator.

4 and 3 (Fourth and Third Ranges, optional)

Use the fourth or third range for city traffic and for braking on steep downgrades.

3 and 2 (Third and Second Ranges, standard)

Use the third or second range for heavy city traffic and for braking on steeper downgrades.

1 (First Range)

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

NOTE: To have the transmission select these ranges automatically, leave the selector lever in D (drive).

Allison MD Series Transmissions

Refer to the Allison website for additional information, www.allisontransmission.com.

Safety Precautions

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.

On vehicles with MD series transmissions, do the following steps if you have to leave the cab with the engine running (for example, when checking the transmission fluid):

1. Bring the vehicle to a complete stop using the service brake.
2. Put the transmission in N (neutral).
3. Ensure that the engine is at low idle rpm (500 to 800 rpm).
4. Apply the parking brake and emergency brakes, and make sure they are properly engaged.
5. Check the rear tires and take any other steps necessary to keep the vehicle from moving.

Operating Instructions, MD Series

The Allison MD transmission is electronically controlled and comes with a push-button shift control that provides five or six forward ranges and one reverse range. 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.

New shift controls — known as "fourth generation" — were introduced in mid-2006. They replaced the previous units that are commonly referred to as "WTEC III". See [Fig. 8.21](#) and [Fig. 8.22](#).

R (Reverse)

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

CAUTION

Extended idling in reverse may cause transmission overheating and damage.

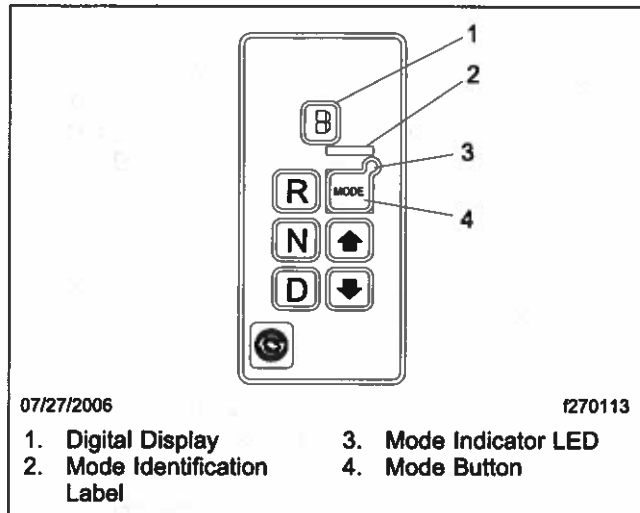


Fig. 8.21, WTEC III Push-Button Shift Selector

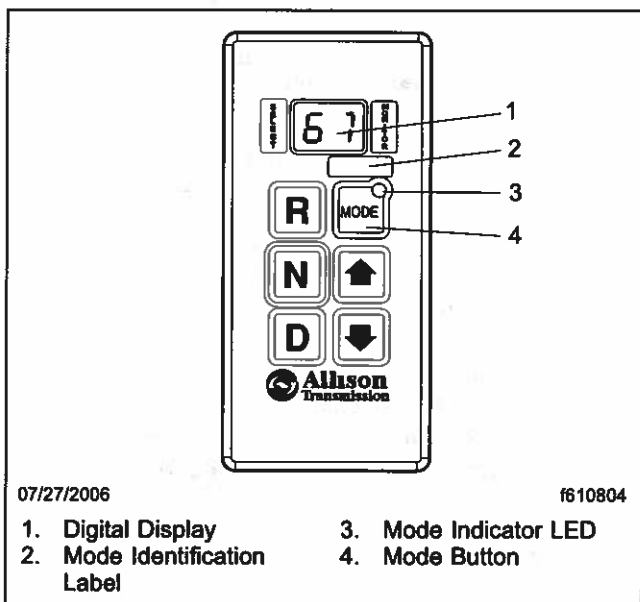


Fig. 8.22, Fourth Generation Push-Button Shift Selector

Do not idle in reverse for more than 5 minutes. Select neutral when time at idle exceeds 5 minutes.

NOTE: The shift into reverse may not succeed if a range inhibitor is active. When reverse is selected, always be sure that R is not flashing.

N (Neutral)

! WARNING

When starting the engine, make sure that the service brakes are applied. Failure to apply the service brakes may result in unexpected vehicle movement, which could cause severe personal injury or death. Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

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 unit) or TCM (transmission control module) automatically places the transmission in neutral at start-up.

! WARNING

Failure to apply the vehicle parking brakes when the transmission is in neutral may allow the vehicle to move unexpectedly, possibly causing property damage or personal injury.

When neutral is selected, the vehicle service brakes, parking brake, or emergency brake must be applied. Selecting neutral does not apply vehicle brakes unless an auxiliary system to apply the parking brake is installed.

! WARNING

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

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.

Always select neutral before turning off the engine. Neutral is also used during stationary operation of the power takeoff if your vehicle is equipped with a PTO.

D (Drive)

When the D button is pushed, the highest forward range will appear in the display. The transmission will normally go into first range when drive is selected

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(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.

CAUTION

Do not idle in drive for more than 5 minutes. Extended idling in drive may cause transmission overheating and damage. Always select neutral if time at idle is longer than 5 minutes.

NOTE: The shift into drive may not succeed if a range inhibitor is active. When drive is selected, always be sure that D is not flashing.

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

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 or engine RPM (engine governed speed) is reduced.

WARNING

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.

When going downhill, downshift to a lower transmission range to increase engine braking and to help 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.

Mode Button

The MODE button starts a specialized input or output function that has been previously programmed into the ECU or TCM. Pressing the MODE button changes transmission operation for a specific function.

Mode Indicator LED

When the MODE button is pressed, the mode indicator LED illuminates. A mode identification label, located above the MODE button, identifies the function associated with a mode change.

Digital Display

The dual digital display shows both the selected range (SELECT) and actual range attained (MONITOR). The single digital display shows the selected range.

Oil Level Sensor

Allison MD Series transmissions have an electronic oil level sensor to read fluid level information. The fluid level diagnostic will display whether the oil level is OK, too low, or too high. It will also display a default code and indicate if the preconditions (of receiving the fluid level information) are not met.

IMPORTANT: Maintain the the proper fluid level at all times. If the fluid level is too low, the converter and clutch do not receive an adequate supply of fluid. If the level is too high, the transmission may shift erratically or overheat.

To access the oil level display mode, park the vehicle on a level surface, shift to N (Neutral), apply the parking brake, and idle the engine. Then simultaneously press both the up and down arrows once. The oil level will display at the end of a two-minute countdown.

Diagnostic Codes

Diagnostic codes are numerical indications relating to a malfunction in transmission operation. These codes are logged in the TCM/ECU memory. The most severe or most recent code is listed first. A maximum of five codes (numbered d1-d5) may be listed in memory at one time. If the mode indicator LED is illuminated, the displayed code is active. If it is not illuminated, the displayed code is not active.

NOTE: During normal operation, an illuminated mode indicator LED signifies the specialized mode operation is in use.

To enter diagnostics mode, first park the vehicle and apply the parking brake. Then simultaneously press both the up and down arrows twice.

Allison AT/MT Series Transmissions

Refer to the Allison website for additional information, www.allisontransmission.com.

Allison AT 500 Series

The Allison AT 500 Series transmissions provide four forward ranges and one reverse range. A lever shift selector (Fig. 8.20) is used by the driver to select the ranges.

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 parking brake and emergency brakes and make sure they are properly engaged.
- Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

PB (Auto-Apply Parking Brake, optional)

When the shift selector does not have an auto-apply parking brake, always put the shift selector in neutral and apply the parking brake to hold the vehicle when it is unattended and before turning off the engine.

R (Reverse)

Reverse is used to back the vehicle. Completely stop the vehicle before shifting from a forward range to reverse, or from reverse to a forward range. The reverse warning signal will sound when the selector is in reverse.

N (Neutral)

Place the shift selector in neutral before starting the engine. When the shift selector has no park provision, always put the shift selector in neutral and apply the parking brake to hold the vehicle when it is unattended and before turning off the engine. The neutral position is also used during stationary operation of the power takeoff if your vehicle is equipped with a PTO.

WARNING

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.

Transmissions

D (Drive)

In the drive position, the transmission will initially attain 1st range and as the vehicle speed increases, the transmission will upshift to second range, third range, and fourth range automatically. As the vehicle slows down, the transmission will downshift to the correct range automatically.

3 and 2 (Third and Second Ranges)

Third range and second range are used when road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. When conditions improve, return the selector to the drive position. The third and second ranges also provide greater engine braking for going down grades. The lower the range, the greater the braking effect.

WARNING

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)

The first range is used when pulling through mud or snow, or when driving up and down steep grades. This range provides the vehicle with maximum driving power and maximum braking power.

Allison MT 600 Models

The Allison MT 643 transmission provides four forward ranges and one reverse range. The Allison MT 653DR transmission provides five forward ranges and one reverse range. A lever shift selector (**Fig. 8.20**) is used by the driver to select the ranges.

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 parking brake and emergency brakes and make sure they are properly engaged.
- Chock the rear tires and take any other steps necessary to keep the vehicle from moving.

R (Reverse)

Reverse is used to back the vehicle. Completely stop the vehicle before shifting from a forward range to reverse or from reverse to a forward range. The reverse warning signal will sound when the selector is in reverse.

N (Neutral)

Place the shift selector in neutral before starting the engine. Shift to neutral and set the parking brake any time the vehicle is parked with the engine running. The neutral position is also used during stationary operation of the power takeoff if your vehicle is equipped with a PTO.

WARNING

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)

In the drive position, the MT 643 transmission will initially attain first range and, as vehicle speed increases, the transmission will upshift to second range, third range, and fourth range. In the drive position, the MT 653DR transmission will initially attain second range and as the vehicle speed increases,

the transmission will upshift to third range, fourth range, and fifth range automatically. As the vehicle speeds slows down, the transmission will downshift to the correct range automatically.

4, 3, and 2 (Fourth, Third, and Second Ranges)

On the MT 643 transmission, the third range and second range are used when road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. When conditions improve, return the selector to the drive position. The third and second ranges also provide greater engine braking for going down grades. The lower the range, the greater the braking effect.

On the MT 653DR transmission, the fourth, third, and second ranges are used when road, load, or traffic conditions make it desirable to restrict the automatic shifting to a lower range. When conditions improve, return the selector to the drive position.

On the MT 653DR transmission, the third and second ranges are used for vehicle speed control up or down steep grades or for undesirable road conditions.

WARNING

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 going downhill, 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)

On the MT 643 transmission, the first range is used when pulling through mud or snow, or when driving up and down steep grades. This range provides the

vehicle with maximum driving power and maximum braking power.

On the MT 653DR transmission, the first range is used for off-highway operation or when pulling through mud or snow. It is recommended that full power shifts *not* be made from first range to second range, or from second range to first range.

Mercedes-Benz Automated Transmissions

General Information, AGS

The AGS Automated Gear Shift is a fully automated 6-speed medium-duty transmission. The clutch is activated by a hydraulic system that is integral to the transmission. No clutch pedal is needed to operate the vehicle.

AGS transmissions use the SmartShift control lever on the steering column to select gears. A manual shift is possible at any time by moving the SmartShift lever up or down as needed.

The transmission control unit (TCU) can direct all forward shifts in response to driving conditions and the driver's pressure on the brake and throttle pedals. To know which gear the transmission is in, look at the round current gear indicator on the right-hand control panel as shown in Fig. 8.23.

The TCU always selects first gear to start the vehicle in motion. It is possible, in manual mode, to start an unloaded vehicle in second gear. In most cases, second gear is acceptable for downhill starts. In other situations, for best results always start moving in first gear. Loaded vehicles, or vehicles on substantial grades, must start moving only in first gear.

CAUTION

At the first sign of a transmission malfunction, take the vehicle out of service immediately. Depending on the type of problem, further shifting may not be possible, and driveline torque may be interrupted.

Transmissions

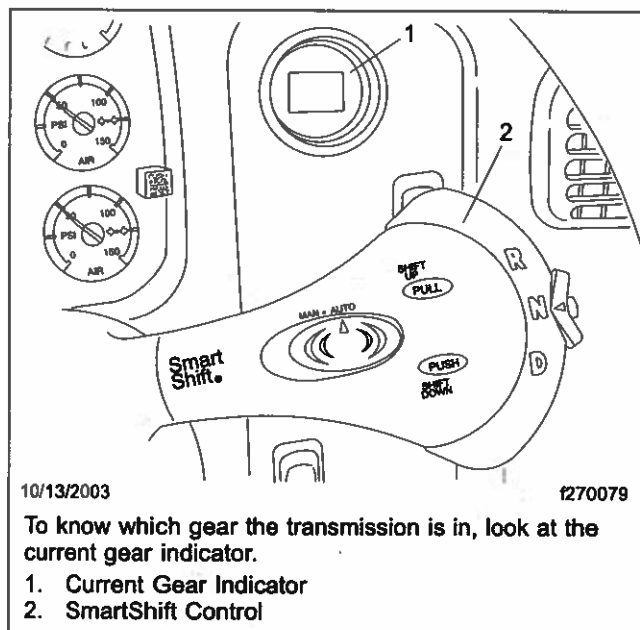


Fig. 8.23, Shift Controls and Indicators, AGS Transmissions

Operation, AGS

Power Up

1. With the parking brake set and/or the brake pedal pressed down, select neutral (N) by moving the selector switch to the center position.
2. With the transmission in neutral, turn on the ignition switch. The "CHECK TRANS" and "TRANS TEMP" telltale lights come on and go out again (bulb check). See **Fig. 8.24**.
3. On power up, the current gear indicator shows the dot display, arranged in a square pattern. All dots in the pattern should light up, without gaps or spaces. See **Fig. 8.25**.
4. When the current gear indicator shows "N," start the engine.

NOTE: No matter what the circumstances, do not start the engine unless the current gear indicator shows "N." See **Chapter 13** for jump starting information.

5. Select drive (D) by pressing in the neutral lock button and moving the selector switch downward to the position below neutral. Release the park-

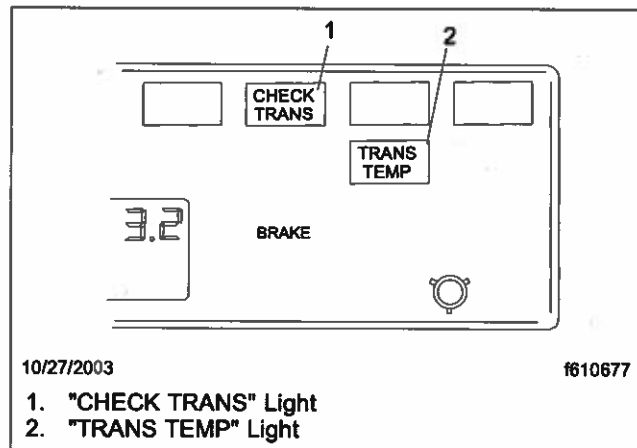


Fig. 8.24, Telltale Lights

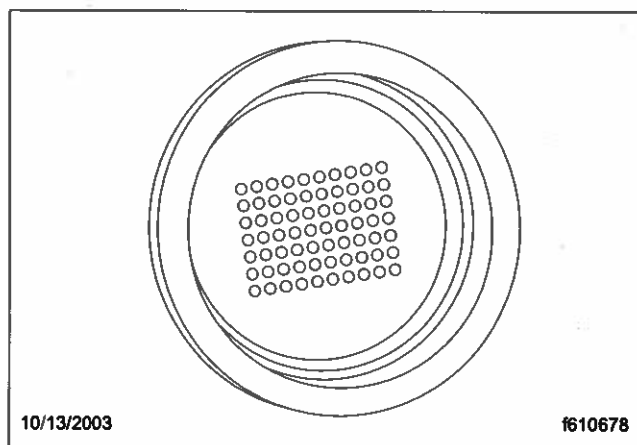


Fig. 8.25, Power-Up Dot Display

ing brake and/or service brake pedal. The gear is displayed on the current gear indicator.

NOTE: When D is selected, the transmission starts up in first gear. To start up in second gear (downhill start, vehicle unloaded or lightly loaded), pull up on the SmartShift lever when the current gear indicator displays "1."

6. On a level grade, press down on the throttle pedal to allow the vehicle to move forward. The vehicle will not move until the pedal is depressed.

WARNING

When starting or stopping on hills and grades, use extra care to prevent the vehicle from rolling

back. A rollback accident could cause death, serious personal injury, or property damage.

7. Prevent the vehicle from rolling backwards when stopped on a hill or grade, or when the vehicle is starting from a stop on a hill or grade.

- 7.1 *To start from a full stop on a hill or grade, quickly move your foot from the brake pedal and press firmly on the throttle pedal.*

On steep hills, set the parking brake and release it only when there is enough engine power to prevent rollback.

- 7.2 *To stop on a hill or grade, press and hold the brake pedal to keep the vehicle from moving.*

On steep hills, set the parking brake. Never hold a hill with the throttle pedal. This will cause the clutch to overheat.

Power Down

1. Bring the vehicle to a complete stop.
2. Set the parking brake.
3. Move the selector switch to N. Wait until "N" appears on the current gear indicator.



WARNING

Always apply the parking brake before shutting down the engine. AGS will shift into neutral after shutdown, regardless of the position of the shift lever. If you do not set the parking brake, the vehicle could roll and cause an accident resulting in death, serious personal injury, or property damage.

4. Turn the ignition switch off and shut down the engine.
5. If the current gear indicator flashes "PB" when the engine is shut down, set the parking brake and move the selector switch to "N."

Automatic and Manual Modes

The SmartShift control has a slide switch located on the body of the lever just before the paddle widens out. See [Fig. 8.26](#). The slide switch controls the forward driving mode, automatic or manual.

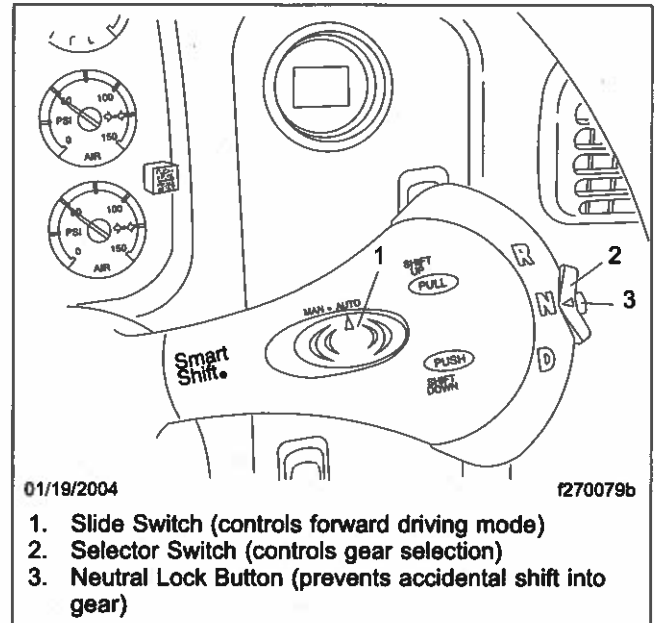


Fig. 8.26, Switches, AGS Transmission

To change mode at any time, move the slide switch in the desired direction. This allows the driver to respond to a wide range of driving conditions, such as blind corners, tight curves, and steep hills.

IMPORTANT: Whatever the mode, it is always possible to shift manually by moving the lever up or down as needed.

In either mode, the gear indicator displays the current gear. See [Fig. 8.27](#).

Automatic Mode (AUTO)

Automatic drive mode (AUTO) is recommended for most driving conditions. For the best fuel economy, always use AUTO mode.

In AUTO mode, upshifts and downshifts are made by the transmission without driver intervention. Press in the neutral lock button, move the selector switch to drive (D), and press down on the throttle pedal. The transmission will shift automatically through the forward gears.

If driving conditions require, it is still possible to request a manual shift. The transmission will make the shift unless the selected gear would cause engine overspeed.

Transmissions

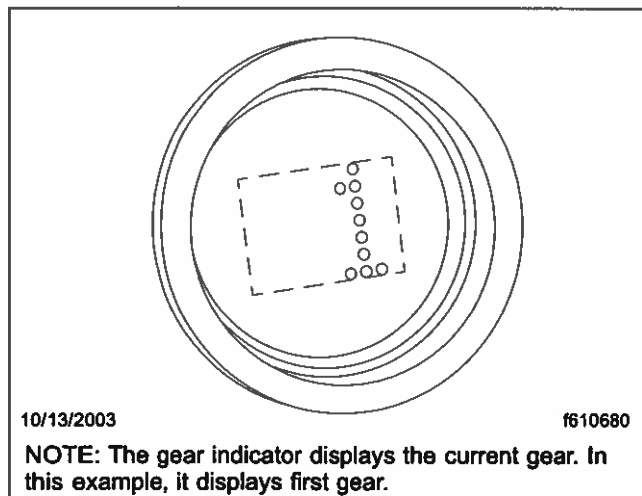


Fig. 8.27, Current Gear Display

If the driver presses down on the throttle pedal after a manual downshift in automatic mode, the transmission will upshift again if the TCU requires it.

On downgrades, the transmission holds the current gear until the driver requests a shift, or presses the throttle pedal.

WARNING

While driving off-road or with locked differential in AUTO mode, use extra caution. Shifts of the AGS could interrupt power to the drive wheels, causing a rollback accident while climbing steep grades at low speeds. A rollback accident could cause death, serious personal injury, or property damage.

Manual Mode (MAN)

Manual mode may be required under certain conditions, such as:

- In difficult or slippery conditions
- On hills, steep grades, or other situations where driveline torque interruption is not desirable
- During off-road driving or driving with a locked differential
- In downhill driving where control of engine braking is needed

- If necessary to hold a specific gear on a downgrade

In manual drive mode (MAN), upshifts and downshifts are made by the driver:

- To shift up, pull the lever up (towards you).
- To shift down, push the lever down (away from you).

The system will hold the current gear until the driver requests a shift. In downhill situations in particular, the driver must be alert to vehicle speed and maintain vehicle control by downshifting and/or using the service brakes as needed.

When braking or slowing in MAN, downshift as necessary to prevent lugging the engine when speed is resumed. If the vehicle comes to a complete stop, the TCU resets the transmission to neutral.

NOTE: A downshift request will be refused if the selected gear would cause engine overspeed.

Cruise Control

Cruise control is fully functional with AGS transmission in either AUTO or MAN mode.

In AUTO, the TCU will adjust the gear selections to maintain the speed settings as desired. No driver action is necessary.

In MAN, the vehicle speed settings must be within the engine speed range for the gear selected. If the engine cannot maintain set speed due to changes in road grade, the driver must downshift or upshift as necessary.

For vehicles equipped with a power take-off (PTO) unit, two modes of operation are possible, stationary and mobile. For PTO operation, see [Chapter 7](#).

Selecting Gears

Reverse

Reverse (R) is at the upper end of the three-position selector switch located at the end of the SmartShift control lever. To select reverse (R), press in the neutral lock button and move the selector switch upward to the position above neutral. When reverse is selected, the letter "R" displays on the current gear indicator. See [Fig. 8.28](#).

IMPORTANT: The vehicle must come to a complete stop before selecting reverse. If reverse is

selected with the vehicle moving forward, an audible alert will sound and continue sounding at three-second intervals until the selector switch is returned to N or D.

Once the vehicle has come to a complete stop, reverse can be engaged.

Neutral

Neutral (N) is in the center of the three-position selector switch located at the end of the SmartShift control lever. Always start the engine in neutral. To select neutral, move the selector switch to the center position. When neutral is selected, the letter "N" displays on the current gear indicator. See [Fig. 8.29](#).

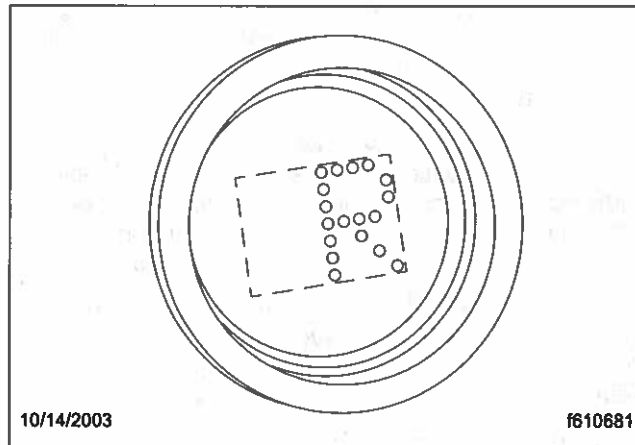


Fig. 8.28, Reverse Gear Display

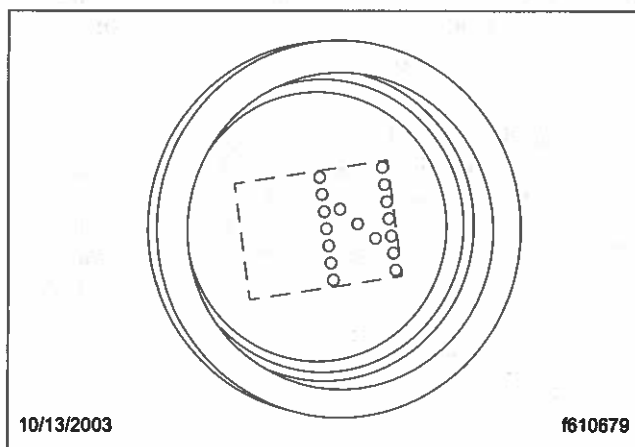


Fig. 8.29, Neutral Display

WARNING

Do not coast in neutral. Coasting in neutral can cause an accident, possibly resulting in severe personal injury or death.

Neutral is always available during operation, whatever the vehicle speed. When in neutral, requests to upshift or downshift are ignored. If the selector switch is moved from neutral to drive while the vehicle is moving, the transmission will shift into a gear within the operating torque range of the engine.

WARNING

Always apply the parking brake before shutting down the engine. AGS will shift into neutral after shutdown, regardless of the position of the shift lever. If you do not set the parking brake, the vehicle could roll and cause an accident resulting in death, serious personal injury, or property damage.

Before shutting down the engine, return the selector switch to "N." When the ignition is turned off, the transmission will reset to neutral during power down.

Drive

IMPORTANT: The vehicle must come to a complete stop before selecting drive. If drive is selected with the vehicle moving in reverse, an audible alert will sound and continue sounding at three-second intervals until the selector switch is returned to N or R.

Drive (D) is at the lower end of the three-position selector switch located at the end of the SmartShift control lever. To select drive, press in the neutral lock button and move the selector switch to the position below N. When drive is selected, the number of the currently selected forward gear (1, 2, 3, 4, 5, or 6) displays on the gear indicator. See [Fig. 8.27](#).

Upshifting

NOTE: The driver can manually upshift at any time, even when the slide switch is set to AUTO mode.

To request an upshift with the transmission in drive, pull the control lever up (towards you). If the gear is

Transmissions

available, the transmission upshifts and the new gear displays on the gear indicator.

As in a manual transmission, upshifting too early causes engine lugging and uneven operation.

To achieve smooth operation in MAN mode, upshift when the engine speed reaches approximately 2000 revolutions per minute (rpm). Heavy loads or steep grades require higher rpm; lighter loads require lower rpm.

An unavailable request to upshift is not stored in memory. The upshift must be requested again.

Downshifting

NOTE: The driver can manually downshift at any time, even when the slide switch is set to AUTO mode.

To request a downshift with the transmission in drive, push the control lever down (away from you). If the gear is available, the transmission downshifts and the new gear displays on the gear indicator.

Downshifts are not available if the engine speed after the shift would exceed 2700 rpm. If the gear requested is unavailable, an audible alert will sound. An unavailable request to downshift is not stored in memory. The downshift must be requested again.

IMPORTANT: A downshift request can never result in a shift into neutral, even if the vehicle is in the drive position in the lowest possible gear.

To achieve smooth operation in MAN mode, downshift when the engine speed reaches approximately 1200 rpm.

Before starting down a hill, slow down. Downshift to a speed that you can control without hard pressure on the service brakes.

Before entering a curve, slow down to a safe speed. Downshift if necessary. This lets you use some power through the curve to help the vehicle be more stable on the turn. It also allows you to regain speed faster as you come out of the curve.

AGS Diagnostics



At the first sign of a transmission malfunction, take the vehicle out of service immediately. De-

pending on the type of problem, further shifting may not be possible, and driveline torque may be interrupted.

System Malfunction

If the "CHECK TRANS" telltale light comes on while driving, the audible alert sounds, and the current gear indicator begins to flash between the current gear and "SM" (system malfunction), there is a problem which may or may not be apparent to the driver. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance.

Clutch Overload

If the "TRANS TEMP" telltale light comes on while driving and the current gear indicator begins to flash between the current gear and "CO" (clutch overload), the clutch has begun to overheat.

The clutch overload may have been caused by improper driving practices such as frequent and rapid start/stop driving, or hillholding with the throttle pedal. In this case, allow the clutch to cool, and continue on, but cease the improper driving practices.

If the clutch overload message returns or continues, the clutch is worn or damaged. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance.

Low Hydraulic Fluid Level

IMPORTANT: The only hydraulic fluid permitted in this system is Pentosin CHF 11S. No other fluid can be substituted.

If the "CHECK TRANS" telltale light comes on while driving and the current gear indicator begins to flash between the current gear and "FL" (fluid level), there has been an unusual loss of hydraulic fluid. Bring the vehicle at once to a safe stopping place and call an authorized Freightliner service facility for assistance. The hydraulic reservoir holds about 1.05 quarts (one liter) of Pentosin CHF 11S.

NOTE: After hydraulic fluid loss, a special procedure is required to fill the hydraulic reservoir. This procedure must be carried out by an authorized Freightliner service facility.

9

Rear Axles

| | |
|--|-----|
| Meritor™ Drive Axles With Wheel Lock | 9.1 |
| Meritor™ Wheel Lock Operation | 9.1 |
| Meritor™ Tandem Drive Axles With Axle Lock | 9.2 |
| Meritor™ Axle Lock Operation | 9.2 |

Rear Axles

Meritor™ Drive Axles With Wheel Lock

The Meritor wheel lock is a driver-controlled traction device operated from the vehicle cab. The wheel lock switch (Fig. 9.1) allows the driver to lock the wheels on the same axle together. The wheel lock indicator light comes on when the wheel lock is turned on.

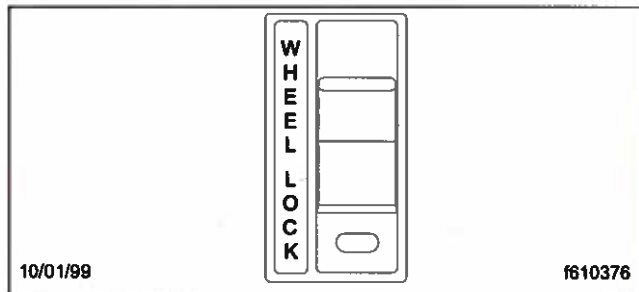


Fig. 9.1, Wheel Lock Switch

The wheel lock provides maximum traction under slippery conditions. When the wheel lock is engaged, the clutch collar completely locks the differential case, gearing, and axle shafts together, maximizing the traction of both wheels and protecting against spinout.

Under normal traction conditions, do not use the wheel lock feature.

WARNING

Be especially careful when driving under slippery conditions with the differential locked. Though forward traction is improved, the vehicle can still slip sideways, causing possible loss of vehicle control, personal injury, and property damage.

Meritor™ Wheel Lock Operation

To lock the wheels and obtain maximum traction under slippery conditions, push the wheel lock switch up.

WARNING

Lock the wheels only when the vehicle is standing still or moving less than 25 mph (40 km/h). Never lock the wheels when the vehicle is travel-

ing down steep grades or when the wheels are slipping. This could damage the differential or lead to loss of vehicle control, causing personal injury and property damage.

NOTE: On some vehicles, the wheel lock system is connected through the low speed range of the transmission. If this system is used, the transmission must be in the low speed range for the wheels to fully lock.

If the vehicle is moving, maintain a constant vehicle speed when the wheel lock is turned on. Briefly let up on the accelerator to relieve torque on the gearing, allowing the wheels to fully lock. The wheel lock indicator comes on when the wheel lock is turned on. When the wheels are fully locked, the turning radius will increase because the vehicle understeers. See Fig. 9.2. Drive cautiously and do not exceed 25 mph (40 km/h).

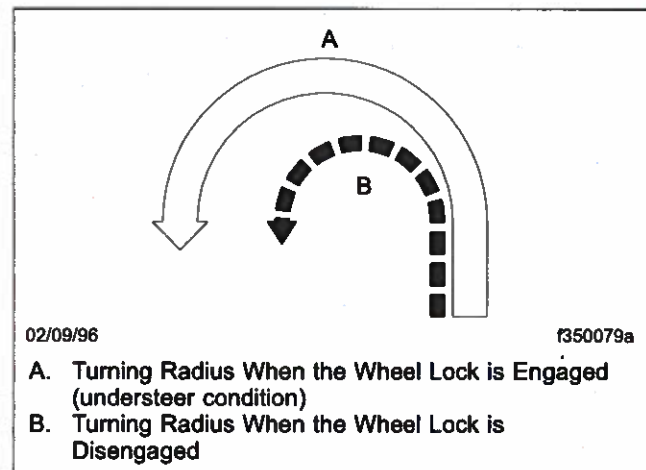


Fig. 9.2, Turning Radii

To disengage the wheel lock, move the wheel lock switch to the center position. Briefly let up on the accelerator to relieve torque on the gearing, allowing the wheels to fully unlock.

NOTE: If the wheel lock system is connected through the low speed range of the transmission, shifting out of low speed range will also disengage the wheel lock.

When the wheel lock is disengaged, the wheel lock indicator will turn off.

Meritor™ Tandem Drive Axles With Axle Lock

Meritor tandem drive axles have an axle lock feature. The axle lock is controlled by the axle lock switch (Fig. 9.3) on the control panel.

To disengage the axle lock after leaving poor road conditions, move the axle lock switch to the center position while maintaining vehicle speed. Let up momentarily on the accelerator to allow the shift, then resume driving at normal speed.

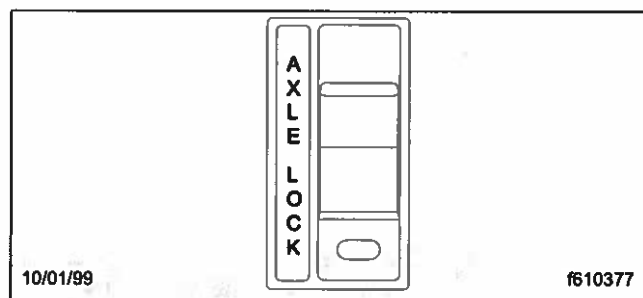


Fig. 9.3, Axle Lock Switch

When the axle lock is not engaged, there is differential action between the two axles. The differential compensates for different wheel speeds and variations in tire size. Keep the axle lock disengaged when driving on roads where traction is good.

When the axle lock is engaged, 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 axle 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.

Meritor™ Axle Lock Operation

To engage the axle lock and achieve maximum pulling power when approaching slippery or poor road conditions, push the axle lock switch up while maintaining vehicle speed. Let up momentarily on the accelerator to engage the axle lock. Proceed over poor road conditions with caution. Do not wait until traction is lost and the tires are spinning before engaging the axle lock.



CAUTION

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

10

Fifth Wheels

| | |
|------------------------------|------|
| Holland Fifth Wheels | 10.1 |
| Fontaine® Fifth Wheels | 10.3 |

Fifth Wheels

Holland Fifth Wheels

3500 Series Stationary Models

Holland 3500 Series stationary fifth wheels are best suited for applications where the axle loading, kingpin setting, and vehicle combination length all remain constant throughout the fleet. The stationary fifth wheel can be a plate mount or an angle mount. See **Fig. 10.1**.

The Type B kingpin lock mechanism (**Fig. 10.2**) 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

Locking the Fifth Wheel Mechanism

1. Make sure the coupling area is level and clear of persons and obstacles.
2. The fifth wheel plate must be completely lubricated with chassis grease. For lubrication instructions, see **Group 31** of the *Acterra® 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.

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. Apply the trailer brakes.
8. 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.
9. Slowly back the tractor in to the trailer.

10. Test for kingpin lockup by pulling on the trailer against the chocks. 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 *Acterra® Workshop Manual* for adjustment procedures.

WARNING

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.

11. 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.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

12. After lockup is completed, connect the tractor-to-trailer air system lines and electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air lines.
13. Charge the air brake system with air. Make sure that the air connections do not leak.
14. Retract the trailer landing gear and secure the ratchet handle.
15. Remove the chocks from the trailer tires.

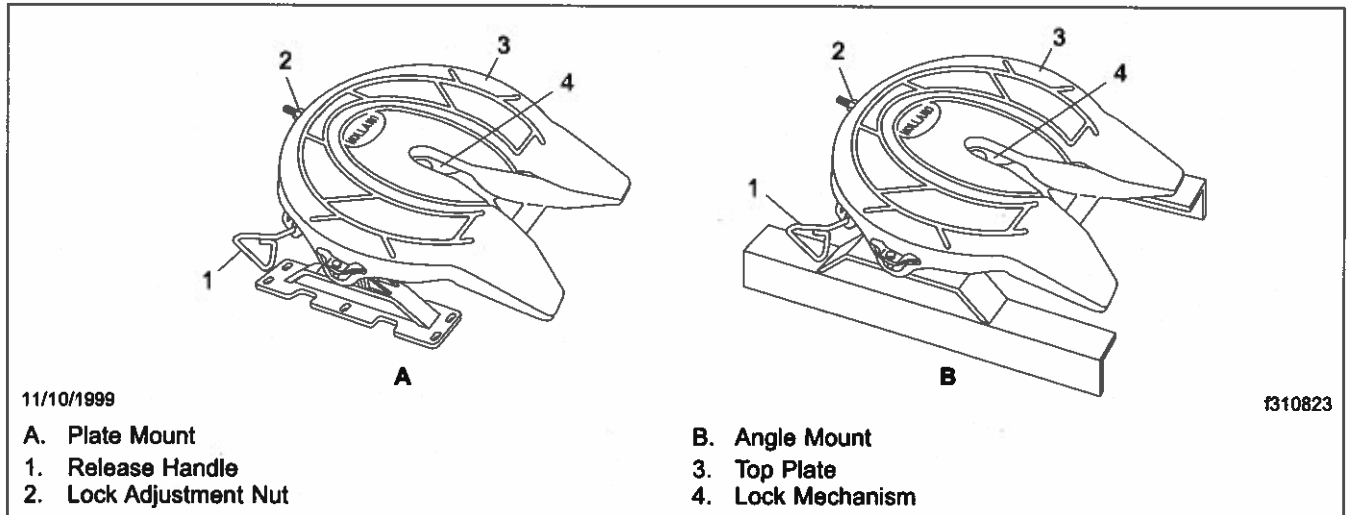


Fig. 10.1, Holland 3500 Series Fifth Wheels

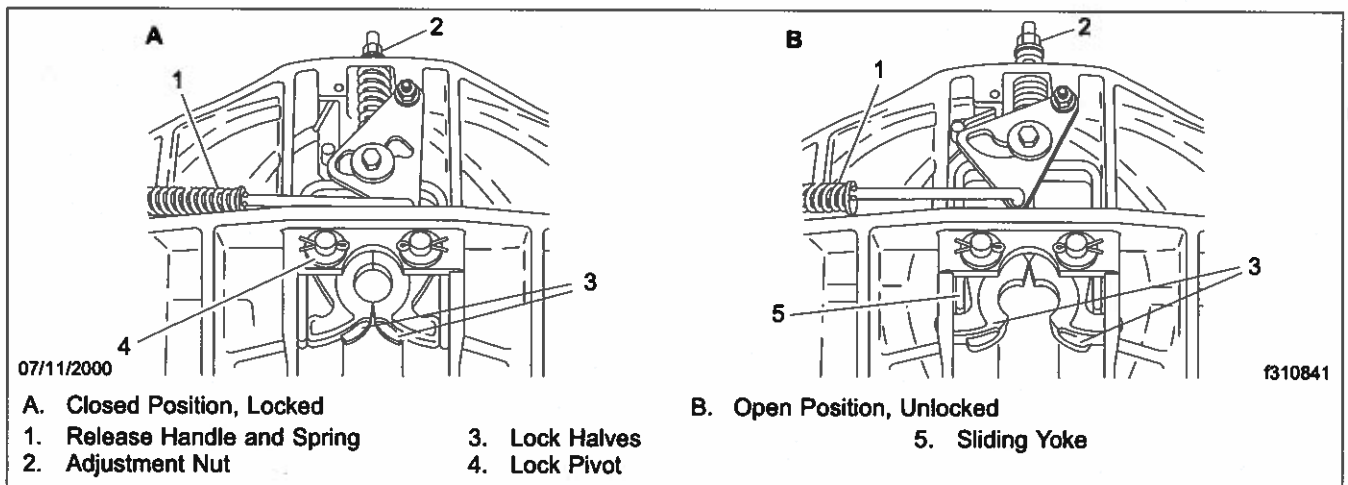


Fig. 10.2, Type B Kingpin Lock Mechanism (bottom view)

16. The load distribution on the front steering axle and rear drive axle(s) will have a direct effect on the steering control of the vehicle.

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

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

axle load exceed the maximum axle weight rating given on the FMVSS or CMVSS label.

WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.

Fifth Wheels

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.
6. Release the kingpin locking mechanism by pulling the release handle (**Fig. 10.1**) all the way out.
7. Slowly drive the tractor away from the trailer.

Fontaine® Fifth Wheels

6000/7000 Series No-Slack® II Stationary Models

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.

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.

Fifth Wheel Lock Mechanism for Trailer Kingpin

The Fontaine fifth wheel lock mechanism (**Fig. 10.3**) for the trailer kingpin consists of a spring-loaded jaw and a sliding wedge. The jaw and wedge each have a pin permanently attached. The pin on the jaw and the pin on the wedge fit into elongated notches in the 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.

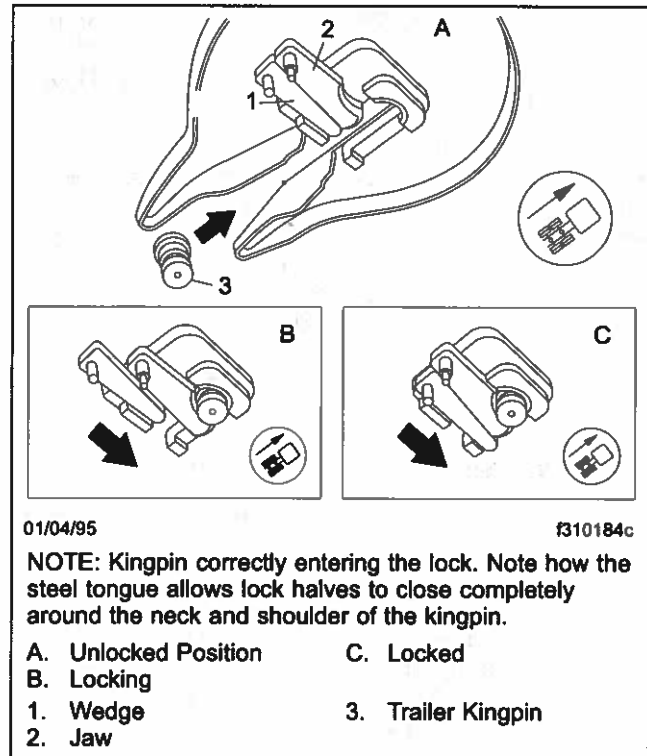


Fig. 10.3, Fontaine Kingpin Lock Mechanism

During lockup, the jaw is moved first with the spring-loaded 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 *Acterra® 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 90-weight oil to all moving parts.

Fifth Wheel Locking Operation

Locking the Fifth Wheel Lock Mechanism

1. Chock the front and rear of the trailer tires to prevent the trailer from moving.
2. 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 *Acterra® 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.

3. Position the tractor so that the fifth wheel lock opening is in line (both vertically and horizontally) with the trailer kingpin. The kingpin should be in a position to enter the throat of the locking mechanism, as shown in **Fig. 10.3**. Adjust the trailer landing gear to give enough alignment height for positive kingpin lockup.
4. With the fifth wheel lock opening aligned with the trailer kingpin, back the tractor slowly toward the trailer, making sure that the kingpin enters the throat of the locking mechanism. Continue backward motion until positive lockup occurs.
5. Apply the tractor parking brakes.

6. Make a visual and physical check for positive kingpin lockup. When lockup has occurred, the fifth wheel release handle will have moved to the locked position. See **Fig. 10.4**.
7. Release the tractor parking brakes. Test for kingpin lockup by pulling on the trailer against the chocks.

NOTICE

Always make sure the connect-hanger/support keeps the trailer air hoses and electrical cables positioned so that they do not rub on anything. Rubbing may wear through hoses or cables, resulting in air leaks, or exposed or broken wires, potentially affecting trailer brake or electrical systems.

8. After lockup is completed, connect the tractor-to-trailer air system lines and the electrical cable to the trailer. Take care to prevent dirt or foreign material from entering the air system lines.
9. Charge the air brake system with air. Make sure that the air connections do not leak.
10. With the trailer wheels chocked and the brakes set, check for clearance between the kingpin and the fifth wheel jaws by moving the tractor forward and backward against the locked kingpin. There should be no slack between the tractor and the trailer. If slack is present, uncouple the trailer.

For adjustment instructions, refer to the manufacturer's service information.

WARNING

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

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

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

Fifth Wheels

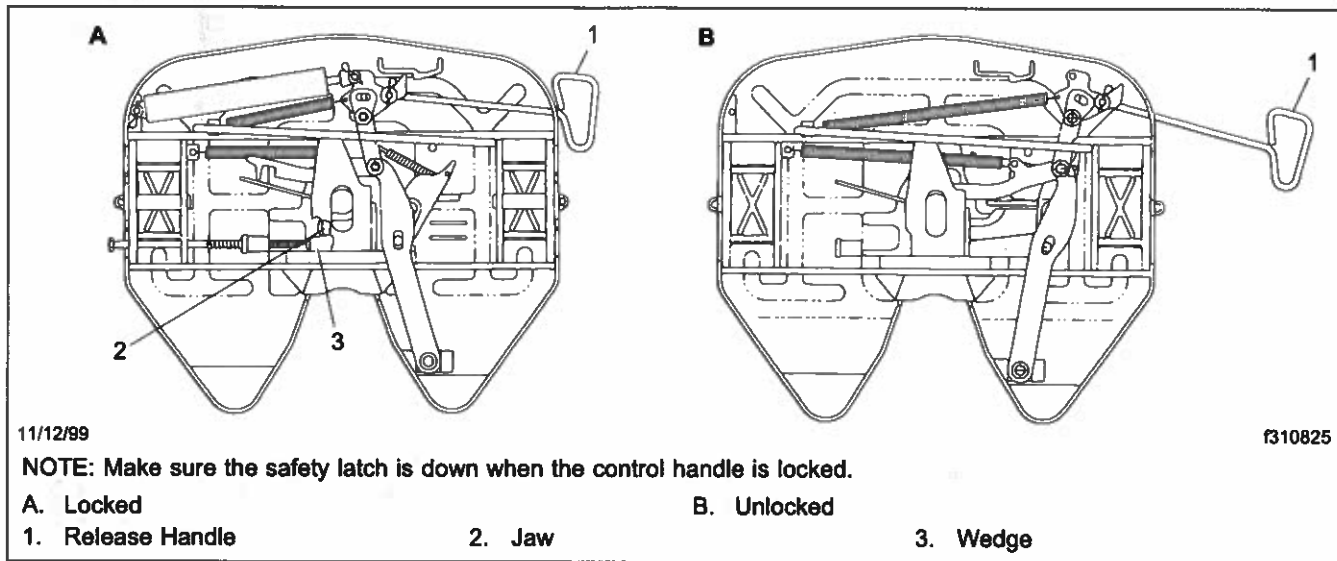


Fig. 10.4, Fontaine 6000/7000 Series Fifth Wheel, Locked and Unlocked (bottom view)

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

! WARNING

Do not overload any tractor axle by improperly loading the trailer. This could cause erratic steering and loss of vehicle control, possibly resulting in serious personal injury or death.

Unlocking the Fifth Wheel Lock Mechanism

1. Apply the tractor parking brakes.
2. Pull the trailer air supply valve to cut off the air supply to the trailer.
3. Chock the front and rear of the trailer tires to prevent the trailer from moving.

! WARNING

Do not use the trailer 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.
6. Release the kingpin locking mechanism by pulling the release handle to the unlocked position. See Fig. 10.4.
7. Slowly drive the tractor away from the trailer.

11

Pretrip and Post-Trip Inspections and Maintenance

| | |
|--|------|
| Pretrip and Post-Trip Inspection Checklists | 11.1 |
| Pretrip and Post-Trip Maintenance Procedures | 11.3 |

Pretrip and Post-Trip Inspections and Maintenance

Pretrip and Post-Trip Inspection Checklists

Regulations in both Canada and the United States clearly indicate that it is the driver's responsibility to perform an inspection and ensure the complete road-worthiness of a vehicle before placing it into service for the day. Commercial vehicles may be subject to inspection by authorized inspectors, and an unsafe vehicle can be put "out of service" until the driver or owner repairs it.

IMPORTANT: The pre- and post-trip checklists, and inspections and maintenance procedures detailed in this chapter, are **not all-inclusive**. Also refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions.

Use the inspection checklists to ensure that vehicle components are in good working condition before each trip. A driver that is familiar with the vehicle, and drives it regularly, can perform the daily inspections, then add the weekly and monthly post-trip inspections as scheduled. If the driver does not operate the vehicle on a consistent basis, all three of the inspection procedures should be performed before the trip.

NOTE: Procedure reference numbers in the the checklists reference the corresponding detailed instructions found under the pretrip and post-trip maintenance procedures.

Pre- and post-trip inspections cannot be done quickly. However, careful inspections save time by eliminating stops later to adjust items overlooked or forgotten.

If any system or component does not pass this inspection, it must be corrected before operating the vehicle. Whenever equipment requires adjustment, replacement, repair, addition of lubricants, or a change of lubricants, see the *Acterra® Workshop Manual* for procedures and specifications, and see the *Acterra® Maintenance Manual* for lubricant recommendations, specifications, and maintenance intervals.

See **Table 11.1** for a list of procedures that should be performed daily, before the first trip.

See **Table 11.2** for a list of procedures that should be performed weekly, post-trip.

See **Table 11.3** for a list of procedures that should be performed monthly, post-trip.

IMPORTANT: Before performing any checks, apply the parking brake and chock the tires.

Pretrip and Post-Trip Inspections and Maintenance

| Procedure Performed (check off) | Daily Pretrip Inspections/Checks | Procedure Reference |
|------------------------------------|---|------------------------|
| _____ | Drain manually drained air reservoirs (that are not equipped with automatic drain valves) | D1 |
| Check _____ | windshield washer reservoir fluid | D2 |
| Inspect _____ | wheel seal and hub cap (for leakage) | — |
| Check _____ | surge tank coolant level | D3 |
| Inspect _____ | radiator and charge air cooler | D4 |
| Check _____ | engine for fuel, oil, or coolant leaks | — |
| Inspect _____ | engine and chassis wiring | D5 |
| Inspect _____ | air intake system | D6 |
| Check _____ | intake-air restriction indicator mounted on air intake | D6 |
| Check _____ | engine oil level | D7 |
| Check _____ | power steering fluid level | — |
| Inspect _____ | fuel tank(s), fuel lines, and connections | D8 |
| Check _____ | fuel level | D9 |
| Check _____ | fuel/water separator | D10 |
| Inspect _____ | front and rear suspension components | D11 |
| Inspect _____ | headlights, mirrors, and window glass, and windshield wipers | D12 |
| Check _____ | doors (open without difficulty and close securely) | — |
| _____ | Adjust driver's seat, then align rearview and downview mirrors | — |
| Check _____ | dash-mounted intake-air restriction indicator | D6 |
| Check _____ | oil- and air-pressure warning systems | D13 |
| Check _____ | ICU fault codes | D14 |
| Check _____ | horn, windshield wipers, and windshield washer | D15 |
| Check _____ | heater, defroster, and optional mirror heat controls | D16 |
| Check _____ | backup alarm | — |
| Check _____ | panel lights and interior lights | D17 |
| Check _____ | exterior lights and reflectors | D18 |
| Check _____ | tire pressure | D19 |
| Inspect _____ | tire condition | D20 |
| Inspect _____ | rims and wheels | D21 |
| Check _____ | automatic transmission fluid level | — |
| Inspect _____ | air brake chambers and pushrods | D22 |
| Inspect _____ | air brake lines | D23 |
| Inspect _____ | slack adjusters | D24 |
| Check _____ | air brake system operation | D25 |
| Inspect _____ | frame rails (missing bolts), crossmembers (bent or loose) | — |
| Check _____ | mud flaps (aren't damaged, at least 10 inches above the ground, and brackets are secure) | — |
| Check _____ | exhaust system (mounted securely, connected tightly, no signs of leaks such as soot trails) | — |
| _____ | Remove chocks and test service brakes | D26 |
| Inspector _____ Date _____ | | |

Table 11.1, Daily Pretrip Inspection and Maintenance Checklist

Pretrip and Post-Trip Inspections and Maintenance

| Procedure Performed (check off) | Weekly Post-Trip Inspections/Checks | Procedure Reference |
|------------------------------------|---|---------------------|
| | Manually drain air reservoirs that are equipped with automatic drain valves | — |
| Inspect | batteries and battery cables | W1 |
| Check | wheel bearing lubricant level | W2 |
| Inspect | steering components | W3 |
| Check | serpentine drive belt condition | W4 |
| Check | V-belt tension | W5 |
| Inspect | seat belts and tether belts | W6 |
| Inspector _____ Date _____ | | |

Table 11.2, Weekly Post-Trip Inspection and Maintenance Checklist

| Procedure Performed (check off) | Monthly Post-Trip Inspections/Checks | Procedure Reference |
|------------------------------------|--|---------------------|
| | Clean the battery terminals | M1 |
| Inspect | radiator hoses and heater hoses | M2 |
| Check | fluid level in the hydraulic clutch reservoir (if applicable, and if necessary, fill with DOT 4 brake fluid) | — |
| Check | steering wheel play | M3 |
| Check | outer surfaces of the hood and body (for visible surface breaks and damage) | — |
| Check | hood tilt damper (attached at both ends) | — |
| Inspect | brake lining wear | M4 |
| Inspect | driveshaft | — |
| Inspector _____ Date _____ | | |

Table 11.3, Monthly Post-Trip Inspection and Maintenance Checklist

Pretrip and Post-Trip Maintenance Procedures

Daily Pretrip Inspection and Maintenance

Whenever equipment requires adjustment, replacement, and/or repair, see the *Acterra® Workshop Manual* for procedures and specifications. Specific references to the manual will be found where appropriate.

1. Drain manually drained air reservoirs.

Water and oil normally enter the air reservoir in the form of vapor because of the heat generated during compression. After the water and oil condense, drain the resulting emulsion as follows:

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

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.

Pretrip and Post-Trip Inspections and Maintenance

- 1.3 Water and oil emulsion often form pockets that will not drain while compressed air is in the reservoirs. Because of these pockets, leave the valves blocked open during the first part of the pretrip inspection.
 - 1.4 If the drained water is cloudy or oily, it may indicate a problem with the compressor. If oil is allowed to contaminate the air dryer, it will not remove the water from the air brake system, which could adversely affect braking.
2. *Check the fluid level in the windshield washer reservoir.*
Add washer fluid as needed. Unscrew the cap to add fluid.

WARNING

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

3. *Check the coolant level in the surge tank.*
See **Fig. 11.1**. If the coolant is low, add a 50/50 mixture of water and the type of antifreeze currently installed in your vehicle. Fill the surge tank with coolant to the MAX line when the tank is cool. If the surge tank was empty, start the engine after refilling and check the level again when the engine is at operating temperature.

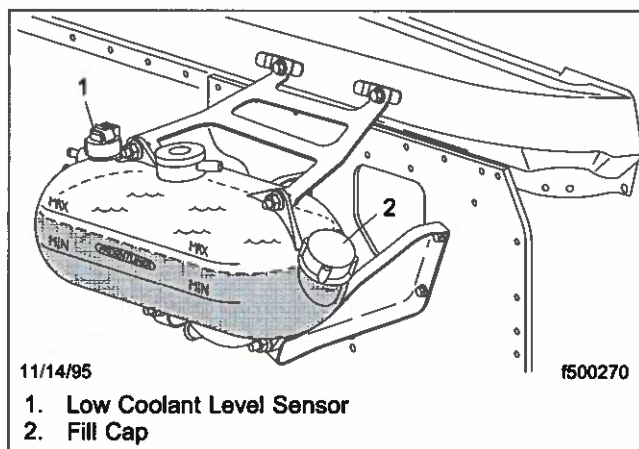


Fig. 11.1, Coolant Level Checking

CAUTION

Coolant must be filled to the full line of the surge tank. Low coolant could result in engine overheating, which could cause engine damage.

4. *Inspect the radiator and charge air cooler.*
 - 4.1 Inspect the radiator and charge air cooler for clogged fins. Use compressed air or water directed from the fan side of the core to backflush any material restricting airflow.
 - 4.2 Inspect the radiator and charge air cooler for damage and accumulated debris. Straighten bent or damaged fins to permit airflow across all areas of the cores.
- NOTE: When traveling through areas of high insect concentration, it may be necessary to clean the exterior of the radiator or the charge air cooler core as often as every 200 miles (320 km).
- 4.3 On vehicles equipped with air conditioning, also inspect and clean the condenser. If clogged, the condenser can restrict airflow through the radiator.
 - 4.4 Check the radiator for leaks. If leaks are found, have the radiator repaired or replaced. See **Group 20** of the *Acterra® Workshop Manual* for instructions, or take the vehicle to an authorized Sterling dealer.

5. *Inspect the engine and chassis wiring.*
Check for loose wiring, chafed insulation, and damaged or loose hold-down clamps. Tighten loose wires or hold-down clamps; replace damaged wiring or clamps.
6. *Inspect the air intake system for leaks or damage.*

CAUTION

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

- 6.1 Check the intake-air restriction indicator.

Pretrip and Post-Trip Inspections and Maintenance

- 6.2 Replace the filter element if the yellow signal stays locked at 25 inH₂O for Cummins or Caterpillar engines or 22 inH₂O for Mercedes-Benz engines. See **Group 09** of the *Acterra® Workshop Manual* for filter element replacement instructions.

NOTE: After replacing the filter element, reset the restriction indicator by pressing the rubber reset button.

- 6.3 Inspect the secondary or safety filter element in the air cleaner when replacing the primary element, and replace it when clogged or dirty. This element should be replaced with every third primary element replacement.
- 6.4 Check the engine air intake piping from the air cleaner to the engine intake. Inspect the piping for loose connections, cracks, torn or collapsed hoses, punctures, and other damage. Tighten loose connections, and have damaged components replaced. Make sure the piping system is airtight so that all intake air passes through the air cleaner.

7. Check the engine oil level.

If the oil level is at or below the minimum fill (or "add") mark on the dipstick, add enough oil to maintain the level between the minimum fill (or "add") and the maximum fill (or "full") marks on the dipstick. See Fig. 11.2. Engine lube oil must have a sulfated ash level less than 1.0 wt %; currently referred to as CJ-4 oil. Use the proper SAE viscosity rating for the temperature and time of year.

CAUTION

Operating the engine with the oil level below the minimum fill (or "add") mark or above the maximum fill (or "full") mark could result in engine damage.

8. Inspect the fuel tanks, fuel lines, and connections for leaks.
- 8.1 Check that the fuel tanks are secured to their mounting brackets and that the mounting brackets are secured to the frame.

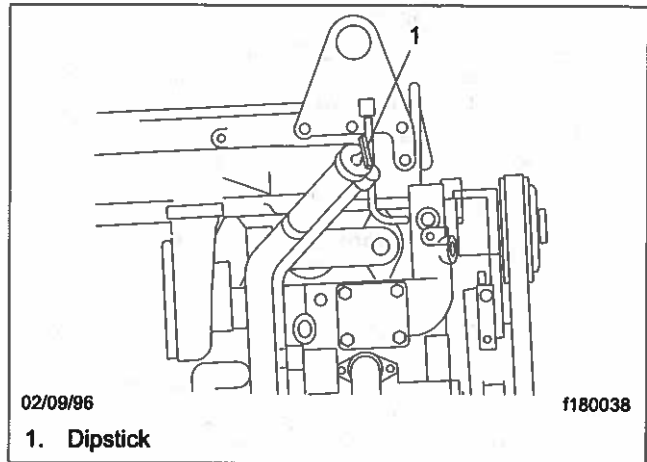


Fig. 11.2, Oil Level Checking

- 8.2 Replace leaking fuel tanks.
- 8.3 If lines or connections are leaking, have them repaired or replaced.

For repair and/or replacement procedures, see **Group 47** of the *Acterra® Workshop Manual*, or take the vehicle in to an authorized Sterling dealer.

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

WARNING

Never operate the engine with the fuel tank shut-off valves partly closed. This could damage the fuel pump, causing sudden loss of engine power, possibly resulting in serious personal injury due to reduced vehicle control.

9. Check the fuel level in the fuel tank(s).

To keep condensation to a minimum, fuel tanks should be filled at the end of each day. Federal regulations prohibit filling a fuel tank to more than 95 percent of its liquid capacity.

WARNING

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

Pretrip and Post-Trip Inspections and Maintenance

Do not mix gasoline or alcohol with diesel fuel. This mixture could cause an explosion, possibly resulting in serious personal injury or death. Do not fill the fuel tanks in the presence of sparks, open flames, or intense heat. These could ignite the fuel, possibly causing severe burns.

IMPORTANT: Use ultralow-sulfur diesel (ULSD) with 15 ppm sulfur content or less, based on ASTM D2622 test procedure. Failure to use ultralow-sulfur diesel fuels may void the warranty on emission components.

- 9.1 Fuel should always be strained or filtered before being put into the tanks. This will lengthen the life of the engine fuel filter and reduce the chances of dirt getting into the engine.
 - 9.2 Before installing the fuel cap, clean the area with a rag, or if necessary, clean the cap with solvent.
 - 9.3 If needed, prime the fuel system. For priming procedures, see the applicable engine manufacturer's manual.
10. *If equipped with a fuel/water separator, check it for contaminants.*
- 10.1 With the engine shut down, partially open the drain valve under the collection bowl and drain water and contaminants as needed.
 - 10.2 Check the fuel/water separator for leaks.

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

11. *Inspect the front and rear suspension components, including springs, spring hangers, shocks, and suspension brackets.*
- 11.1 Check for broken spring leaves, loose U-bolts, cracks in the suspension brackets, and loose fasteners in the spring hangers and shackles.
 - 11.2 Inspect the shock absorbers for loose fasteners and leaks.

- 11.3 Tighten all loose fasteners and have any component(s) replaced that are worn, cracked, or otherwise damaged.

- 11.4 On vehicles with air suspensions, check for leaks. Check air suspension components for cuts and bulges.

12. *Clean the windshield, side, and rear windows, then check the condition of the windshield wiper arms and blades.*

- 12.1 Replace the wiper arms if the wiper blades are not tensioned against the windshield.

- 12.2 Replace damaged or deteriorated wiper blades.

WARNING

When cleaning windshields and windows, always stand on the ground or on a secure ladder or platform. Use a long-handled window cleaner. Do not use the cab steps, tires, fenders, fuel tanks, engine, or under-hood components to access the windshield or windows. Doing so could cause a fall and result in an injury.

13. *Check the oil- and air-pressure warning systems.*

- 13.1 Check if the warning systems come on when the ignition is turned on, and if not, have the systems repaired.

- 13.2 Start the engine, then check that the oil- and air-pressure warning systems are operating. The buzzer should stop sounding when the preset minimum is reached. If the air pressure in both systems is above the preset minimum when the engine is started, test the low air pressure warning system by lowering the pressure to below this range, or until the warning system comes on.

The air pressure in both the primary and secondary air reservoir systems must be above 65 psi (448 kPa) on most vehicles. For vehicles with an optional Bendix dryer reservoir module (DRM), the cut-out pressure is 130 psi (896 kPa).

14. *Check the instrumentation control unit (ICU) for fault codes.*

Pretrip and Post-Trip Inspections and Maintenance

During the ignition sequence, if an active fault is detected in any device that is connected to the ECU, the message display screen will show the active fault codes, one after the other, until the parking brake is released or the ignition switch is turned off. See **Chapter 2** for detailed operating instructions for the ICU.

15. *Make sure that the horn, windshield wipers, and windshield washers are operating properly. These devices must be in good working order for safe vehicle operation.*

15.1 Make sure that the horn works. If a horn is not working, have it repaired before trip departure.

15.2 Check the wiper and washer control on the multifunction turn signal switch. If the wipers and/or washers are not working, have them repaired before trip departure.

16. *During cold weather, make sure the heater, defroster, and optional mirror heat controls are operating properly. If so equipped, turn on the mirror heat switch and make sure the system is working.*

17. *Check the operation of all the panel lights and interior lights.*

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

18. *Make sure all the exterior lights are working properly.*

Check that all the lights and reflectors are clean. See **Fig. 11.3**.

18.1 Check that the brake lights, taillights, headlights, parking lights, turn signals, marker lights, identification lights, road lights (if so equipped), and front clearance lights are working properly and are clean.

18.2 Test the high and low beams of the headlights.

18.3 Replace light bulbs or sealed beam units that are not working.

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

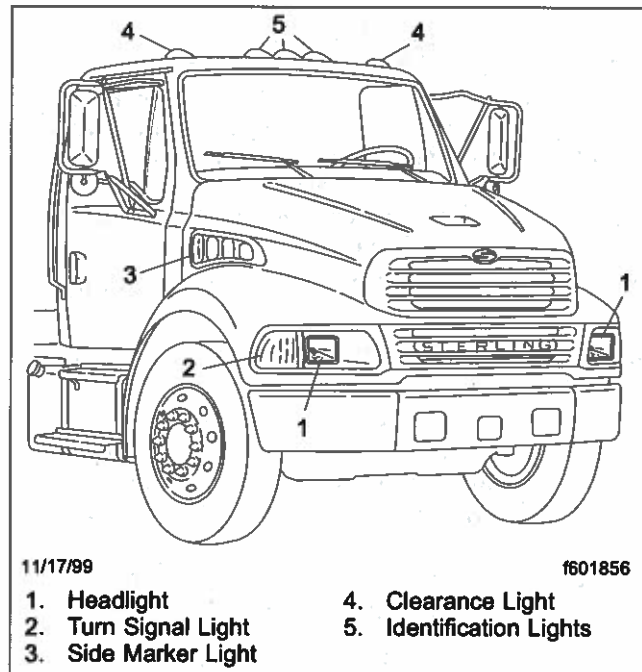


Fig. 11.3, Exterior Light Locations

19. *Check tire inflation pressures using an accurate tire pressure gauge.*

Tires should be checked when cool. For inflation pressures and maximum loads (per tire) see the tire manufacturer's guidelines.

19.1 Be sure valve stem caps are on every tire and that they are screwed on finger-tight.

19.2 Inflate the tires to the applicable pressures if needed. A weekly pressure loss of 4 psi (28 kPa) or more in a tire may indicate damage. The tire should be inspected and, if necessary, repaired or replaced.

19.3 If a tire has been run flat or underinflated, check the wheel for proper locking and side-ring seating, and possible wheel, rim, or tire damage before adding air.

Moisture inside a tire can result in body ply separation or a sidewall rupture. During tire inflation, compressed air reservoirs and lines must be kept dry. Use well-maintained inline moisture traps and service them regularly.

Pretrip and Post-Trip Inspections and Maintenance

WARNING

Do not operate the vehicle with underinflated or overinflated tires. Incorrect inflation can stress the tires and make the tires and rims more susceptible to damage, possibly leading to rim or tire failure and loss of vehicle control, resulting in serious personal injury or death.

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

20. *Inspect each tire for wear, bulges, cracks, cuts, penetrations, and oil contamination.*
 - 20.1 Check the tire tread depth. If tread is less than 4/32 inch (3 mm) on any front tire, or less than 2/32 inch (1.5 mm) on any rear tire, replace the tire.
 - 20.2 Inspect each tire for bulges, cracks, cuts, and penetrations.
 - 20.3 Inspect each tire for oil contamination. Fuel oil, gasoline, and other petroleum derivatives, if allowed to contact the tires, will soften the rubber and destroy the tire.
21. *Check the wheel nuts or rim nuts for indications of looseness. Examine each rim and wheel component.*
 - 21.1 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. See [Fig. 11.4](#) and [Fig. 11.5](#).
 - 21.2 Examine the rim and wheel assembly components (including rims, rings, flanges, studs, and nuts) for cracks, or other damage.

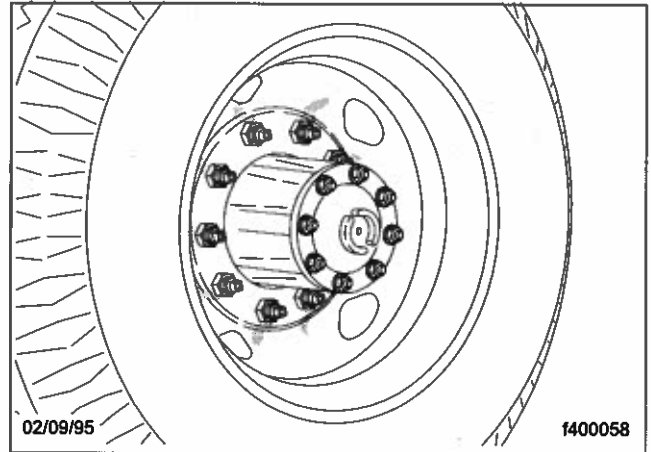


Fig. 11.4, Dirt and Rust Streaks from the Stud Holes

See **Group 33** or **Group 35** of the *Acterra® Workshop Manual* for service procedures on the studs and hubs, and see **Group 40** in the same manual for wheel and tire servicing, or take the vehicle to an authorized Sterling dealer.

WARNING

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

- 21.3 Have broken, cracked, badly worn, bent, rusty, or sprung rings and rims replaced. Be sure that the rim base, lockring, and side ring are matched according to size and type.
- 21.4 Make sure all wheel nuts are tightened 450 to 500 lbf·ft (610 to 678 N·m) for Accuride wheels with unlubricated threads. Use the tightening pattern in [Fig. 11.6](#) for 10-hole wheels and the tightening pattern in [Fig. 11.7](#) for 8-hole wheels. See **Group 40** of the *Acterra® Workshop Manual* for more information.

Pretrip and Post-Trip Inspections and Maintenance

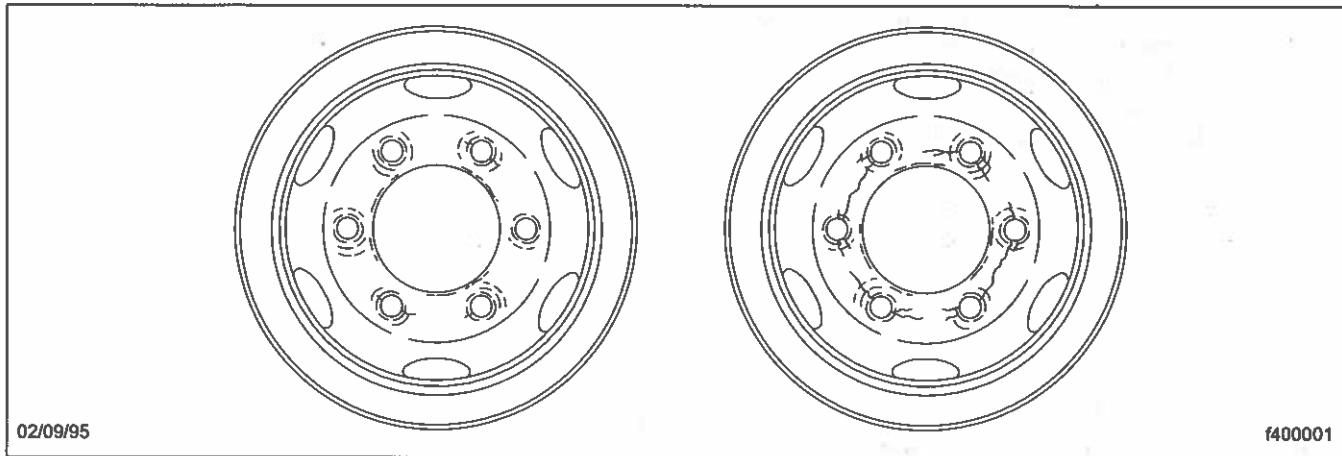


Fig. 11.5, Worn Stud Holes

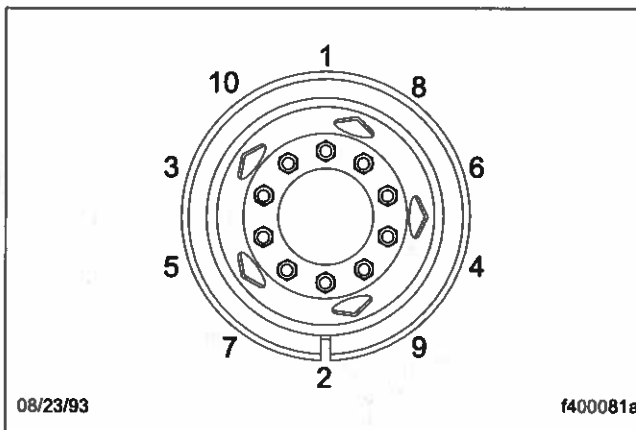


Fig. 11.6, Tightening Pattern, 10-Hole Wheels

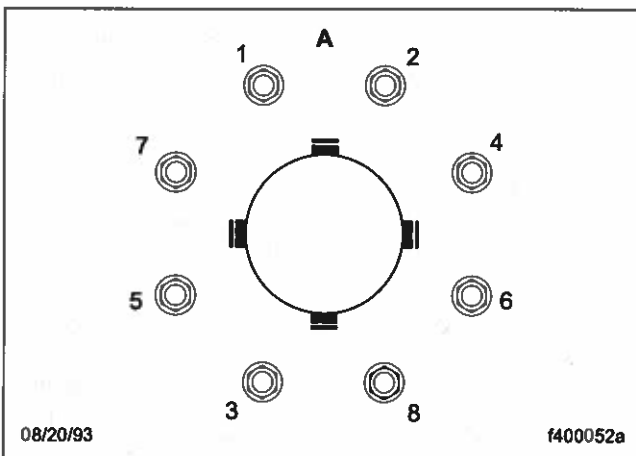


Fig. 11.7, Tightening Pattern, 8-Hole Wheels

CAUTION

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

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

22. *Inspect the air brake chamber and the air brake chamber pushrods.*

WARNING

Do not operate the vehicle with the front brakes backed off or disconnected. Backing off or disconnecting the front brakes will not improve vehicle handling and may lead to loss of vehicle control resulting in property damage or personal injury.

- 22.1 Check that the air brake chamber is mounted securely on its mounting bracket, and that there are no loose or missing bolts.

Pretrip and Post-Trip Inspections and Maintenance

- 22.2 Look for worn clevis pins on brake chamber pushrods and missing or damaged cotter pins on brake chamber pushrod clevis pins. Replace worn clevis pins and install new cotter pins if necessary.
- 22.3 See if the chamber piston rod is in line with the slack adjuster. Misalignment can cause the piston rod to rub on the non-pressure chamber and cause a dragging brake. See **Group 42** of the *Acterra® Workshop Manual*.

CAUTION

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

- 22.4 Inspect the exterior surfaces of the chamber for damage. Make sure that breather holes in the non-pressure section(s) are open and free of debris. See **Group 42** of the *Acterra® Workshop Manual* to replace any damaged parts.

DANGER

Do not loosen or remove the parking brake clamp ring 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.

- 22.5 On all parking brake installations, make sure the end cover cap or dust plug is securely snapped into place. See **Fig. 11.8**.

NOTE: On most MGM parking brake chambers equipped with an integral release bolt, an end cover cap is installed over the release bolt.

- 22.6 Check for rusted connections, missing snap rings, and damaged camshaft grease seals. Have damaged or missing parts repaired or replaced.

23. Inspect the air brake lines.

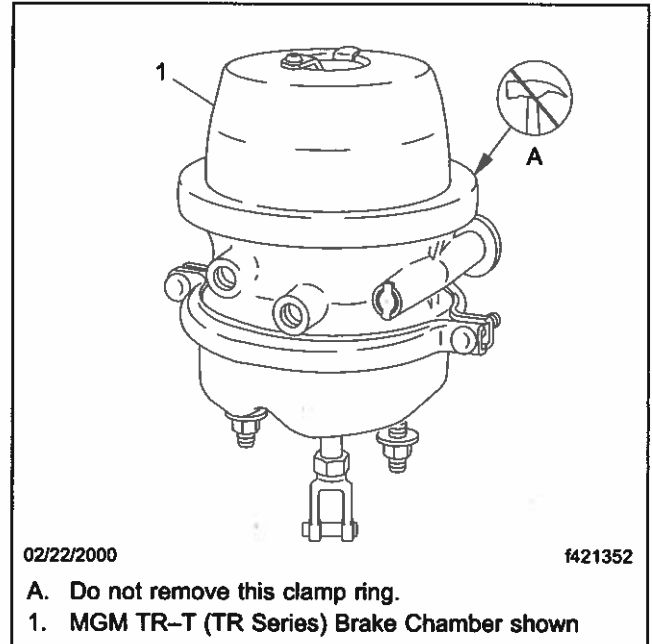


Fig. 11.8, Parking Brake Chamber Clamp

- 23.1 Check the clearance between the hoses and the exhaust manifold or other hot spots. Excessive heat will cause material in the hoses to deteriorate rapidly or become brittle. Provide at least 6 inches (150 mm) of clearance. More clearance is recommended if the hose is located above the heat source.
- 23.2 Check for kinks, dents, or swelling of the hoses. If damaged, have the hose replaced with the same size and type.

NOTE: Do not route the hose on top of anything likely to be stepped on.

- 23.3 Check for damage to hoses located near moving parts, such as drivelines, kingpins, suspensions, and axles. If moving parts are catching or pinching the lines, correct as needed.
- 23.4 Check for hose damage caused by abrasion. If abraded, have the hose replaced. Check for the cause of abrasion, such as loose or damaged hose clamps. Have the clamps repaired or replaced as needed.

Pretrip and Post-Trip Inspections and Maintenance

- 23.5 Observe the hose cover condition, especially hoses exposed to water splash and ice. If dried out or ragged (the wire or liner is showing through the cover), have the hose(s) replaced.
- 23.6 Inspect the air tubing, especially tubing made of nylon. In cold weather, nylon tubing is sensitive to damage, such as nicks or cuts. Have nicked or cut tubing replaced, even if it is not leaking.
- 23.7 Check for kinked or twisted hoses. A seven-percent twist in the hose can reduce its life by up to 90 percent. A twisted hose under pressure tends to untwist, which may loosen the fitting. Reconnect hoses that are twisted.

NOTE: The front brake lines flex continuously in vehicle operation, so they require special examination. Give particular attention to the areas near where they connect to the front air brake chambers. This inspection requires two people, one in the driver seat and another to inspect the brake line connections at the wheels.

- 23.8 Both wheel air lines must be inspected with the emergency brake set, engine idling, air pressure at 80 to 90 psi (550 to 620 kPa), and the brake pedal held down.
- 23.9 Turn the wheels to full lock in one direction and inspect both air lines where they connect to the air chambers, then turn the wheels to full lock in the other direction and inspect both lines. If a hose is leaking, have it replaced.

IMPORTANT: ABS-equipped vehicles operating in regions where especially corrosive ice removal chemicals are used may experience higher than normal rotor corrosion. Tone rings should be routinely inspected for corrosion. Severe corrosion of the integral ABS tone ring may cause the ABS warning lamp in the dash to illuminate due to false wheel speed readings. If the ABS warning lamp illuminates at any time other than at vehicle start-up, have the problem repaired immediately.

24. Inspect the slack adjusters.

- 24.1 **Meritor Slack Adjusters:** Check the boot for cuts, tears, or other damage. Have it replaced if necessary.

- 24.2 **Gunite Slack Adjusters:** Inspect the slack adjuster for any signs of damage. If damaged, have the slack adjuster replaced.

Inspect the slack adjuster boot for cuts or tears. If the boot is damaged, have it replaced. See [Fig. 11.9](#).

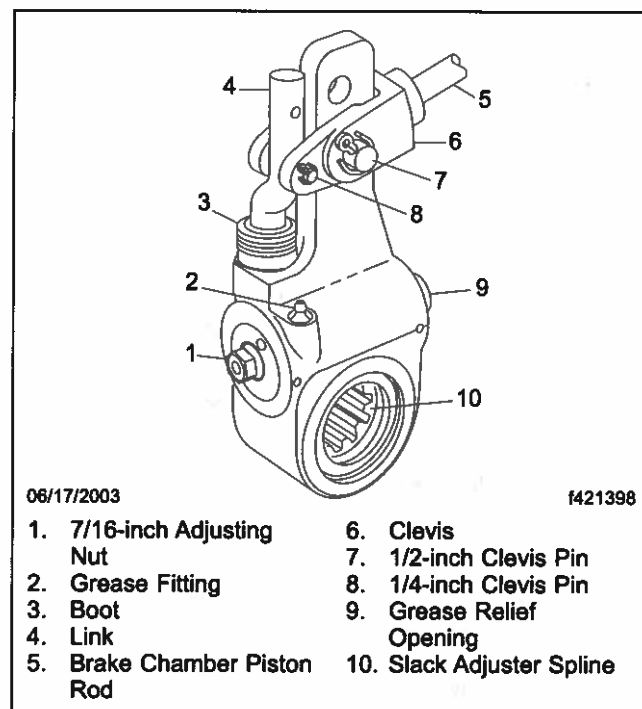


Fig. 11.9, Gunite Automatic Slack Adjuster

- 24.3 **Haldex Slack Adjusters:** Inspect each slack adjuster and anchor strap for damage. See [Fig. 11.10](#). Have any damaged components replaced.

25. Check the air brake system for proper operation.

- 25.1 Check the air governor cut-in and cut-out pressures as follows.

Run the engine at fast idle. The air governor should cut out the air compressor at approximately 120 psi (827 kPa). With the engine idling, apply the brake pedal several times. The air governor should cut in the air compressor at approximately 100 psi (689 kPa). If the air governor does not

Pretrip and Post-Trip Inspections and Maintenance

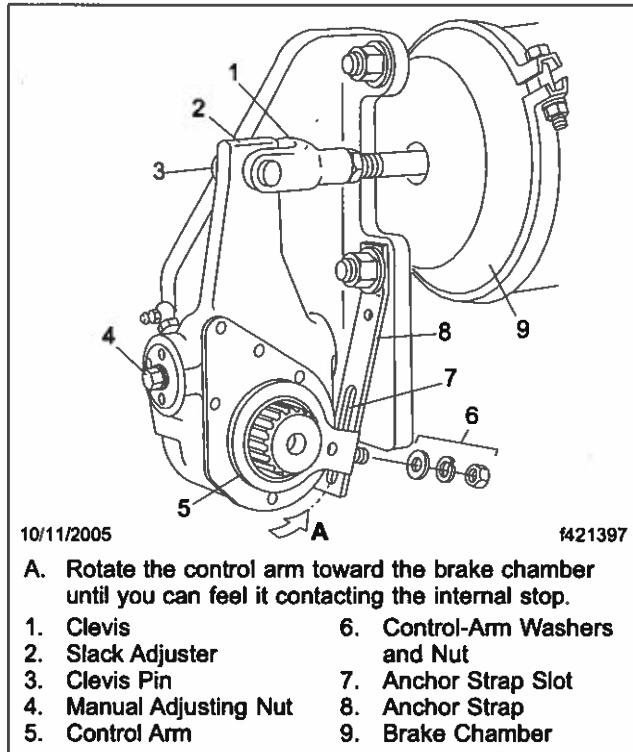


Fig. 11.10, Haldex Automatic Slack Adjuster

cut in and out as described above, it must be adjusted to these specifications. If the air governor cannot be adjusted or repaired, replace it before operating the vehicle.

- 25.2 Check the air pressure buildup time as follows.

With the air system fully charged to 120 psi (827 kPa), 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.

- 25.3 Check the air pressure reserve as follows.

With the air system fully charged to 120 psi (827 kPa), stop the engine and note the air pressure. Then make one full brake application and observe the pressure drop. If it drops more than 25 psi (172 kPa), all areas of leakage must be eliminated before operating the vehicle.

- 25.4 Check the air leakage in the system as follows.

With the parking brake (spring brake) applied, the transmission out of gear, and the tires chocked, charge the air system until cut-out pressure of 120 psi (827 kPa) is reached.

With the service brakes released, shut down the engine, wait 1 minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

Charge the air system until cut-out pressure of 120 psi (827 kPa) is reached. With the parking brakes released and the service brake applied, shut down the engine, wait 1 minute and note the air pressure gauge reading. Observe the air pressure drop in psi (kPa) per minute.

If leakage exceeds the limits shown in **Table 11.4**, repair all areas of leakage before driving the vehicle.

| Maximum Allowable Service Brake Air Leakage | | |
|---|-------------------------------------|---------|
| Description | Air Leakage in psi (kPa) Per Minute | |
| | Released | Applied |
| Truck or Tractor Only | 2 (14) | 3 (21) |
| Truck or Tractor w/Single Trailer | 3 (21) | 4 (28) |
| Truck or Tractor w/Two Trailers | 5 (35) | 6 (42) |

Table 11.4, Maximum Allowable Service Brake Air Leakage

26. *Test the service brakes.*

When starting to move the vehicle and before picking up speed, test the brakes with the foot pedal and parking brake control valve (yellow knob) to be sure they will bring the vehicle to a safe stop.

Pretrip and Post-Trip Inspections and Maintenance

Weekly Post-Trip Inspection and Maintenance

WARNING

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

1. *Inspect the batteries and battery cables.*
 - 1.1 Access the batteries. Be sure the battery hold-down is secure. If it is loose, tighten the hold-down bolts; if it is broken, replace it.
 - 1.2 If the battery is equipped with a built-in hydrometer, examine the hydrometer. If a green dot shows in the sight glass, the battery is sufficiently charged.

If the sight glass is dark, the charge is low and the battery must be recharged.

If the sight glass is clear, the battery has a low level of electrolyte and must be replaced.
2. *Check the level of the wheel bearing lubricant in the hub cap at each end of the front axle.*

If needed, fill the hubs to the level indicated on the hub cap. See **Group 35** of the *Acterra® Maintenance Manual*, for recommended lubricants.

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

3. *Examine the steering components.*

See **Fig. 11.11**. If repairs are needed, see **Group 46** of the *Acterra® Workshop Manual* for instructions, or take the vehicle to an authorized Sterling dealer.
 - 3.1 Check the mounting bolts and pitman arm nut for tightness.
 - 3.2 Check the drag link nuts for missing cotter pins.
 - 3.3 Inspect the steering drive shaft and steering linkage for excessive looseness, or other damage.

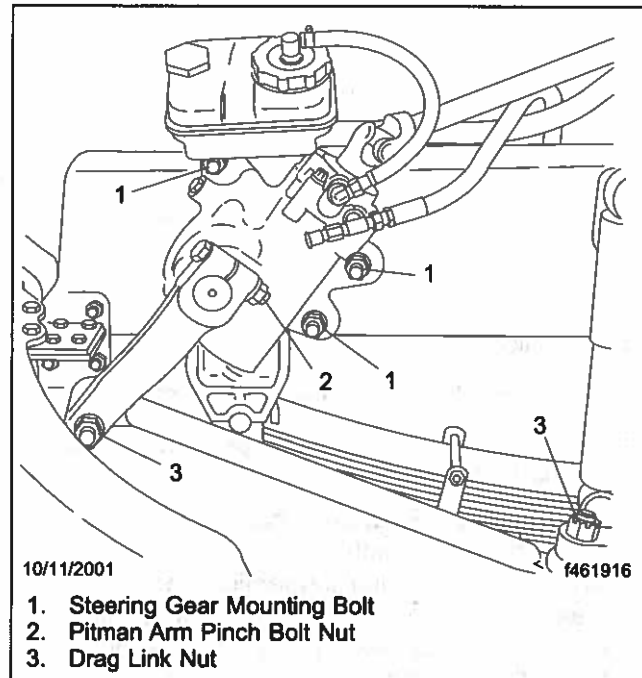


Fig. 11.11, Steering Gear Fasteners

- 3.4 Tighten loose nuts and have damaged parts replaced as needed.
4. *Check the condition of the serpentine drive belt.*

Look for signs of glazing, wear (frayed edges), damage (breaks or cracks), or oil contamination. If a belt is glazed, worn, damaged, or oil soaked, have the belt replaced, following the instructions in **Group 01** of the *Acterra® Workshop Manual*.
5. *Check the drive belt for proper tension.*

Use your index finger to apply force at the center of the belt free-span. See **Fig. 11.12**. There is no adjustment for belt tension on engines with automatic belt tensioners. If there is not proper tension, have the belt tensioner replaced. See **Group 01** of the *Acterra® Workshop Manual* for instructions, or take the vehicle to an authorized Sterling dealer.
6. *Inspect the seat belts and tether belts.*

WARNING

Inspect and maintain seat belts as instructed below. Worn or damaged seat belts could fail

Pretrip and Post-Trip Inspections and Maintenance

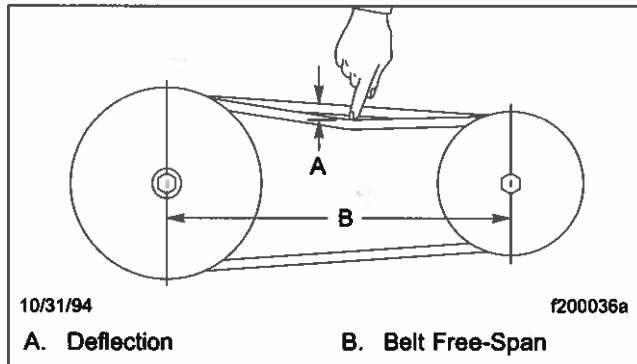


Fig. 11.12, Checking Belt Tension

during a sudden stop or crash, possibly resulting in serious injury or death.

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

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

- 6.1 Check the web for fraying, cuts, or extreme wear, especially near the buckle latch plate and in the D-loop guide area.
- 6.2 Check the web for extreme dirt or dust and for severe fading from exposure to sunlight.
- 6.3 Check the buckle and latch for operation and for wear or damage.
- 6.4 Check the Komfort Latch for function and cracks or other damage.
- 6.5 Check the web retractor for function and damage.
- 6.6 Check the mounting bolts for tightness and tighten any that are loose.

Monthly Post-Trip Inspection and Maintenance

WARNING

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

1. *Clean the batteries.*

- 1.1 Remove any corrosion from the hold-down and the top of the battery.

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.

- 1.2 Use a soda solution to neutralize the acid present, then rinse off the soda solution with clean water.
- 1.3 If the battery posts or cable terminals are corroded, disconnect the terminals from the posts. Clean them with a soda solution and a wire brush. After cleaning, connect the terminals to the battery posts, then apply a thin coat of petroleum jelly to the posts and terminals to help retard corrosion.
2. *Inspect the radiator and heater hoses, including the clamps and support brackets.*
 - 2.1 Make sure the radiator inlet and outlet hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.
 - 2.2 Make sure the heater hoses are pliable and are not cracking or ballooning. Replace hoses that show signs of cracking, weakening, or ballooning.
 - 2.3 Tighten hose clamps as necessary, but do not overtighten, as hose life can be adversely affected.

Pretrip and Post-Trip Inspections and Maintenance

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

IMPORTANT: Replace all hoses, including heater hoses, at the same time. Service-type knitted or braided yarn-reinforced neoprene hose is acceptable. Silicone hoses having an extended service life can be substituted for the reinforced neoprene type. See the Freightliner *Service Parts Catalog* or contact your Sterling Dealer.

3. Check the steering wheel for excessive play.

- 3.1 Start the engine. With the front tires straight ahead, turn the steering wheel until motion is observed at the front wheels.
- 3.2 Align a reference mark on a ruler, then slowly turn the steering wheel in the opposite direction until motion is again detected at the wheels.
- 3.3 Check the lash (free play) at the rim of the steering wheel. See local/federal regulations for acceptable ranges of lash.

If there is excessive lash, check the steering system for wear or incorrect adjustment of the linkage and steering gear before operating the vehicle.

4. Check the brake lining wear on all vehicles, including those with automatic slack adjusters. Proper brake operation is dependent on periodic maintenance and inspection of the brake linings.

- 4.1 Check that brake linings are free of oil and grease.
- 4.2 Inspect the thickness of the brake linings. If the axle assembly is equipped with a dust shield or backing plate, remove the inspection plugs. If *any* brake linings are worn to less than approximately 1/4 inch (6.4 mm) at the thinnest point, have the linings replaced on *all* brake assemblies on that axle. See **Group 42** of the *Acterra® Workshop Manual* for lining replacement instructions and camshaft end-play inspection.

- 4.3 Check the brake drums for wear and cracks.

- 4.4 Check that the inspection plugs in the dust shields or backing plates, if so equipped, are installed.

12

Cab Appearance

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| Cab Washing and Polishing | 12.1 |
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Cab Appearance

Cab Washing and Polishing

To protect the finish of your new vehicle, follow these guidelines carefully:

- During the first 30 days, rinse your vehicle frequently with water. If the vehicle is dirty, use a mild liquid soap. Do not use detergent.
- During the first 30 days, do not use anything abrasive on your vehicle. Brushes, chemicals, and cleaners may scratch the finish.
- During the first 120 days, do not wax your vehicle.

To extend the life of your vehicle's finish, follow these guidelines:

- Avoid washing your vehicle in the hot sun. Always use water. After the cab is completely washed, dry it with a towel or chamois.
- Do not dust painted surfaces with a dry cloth, as this will scratch the paint.
- Do not remove ice or snow from a painted surface with a scraper of any sort.
- To prevent damage to the finish, wax it regularly. If the finish has become dull, before waxing, remove oxidized paint using a cleaner specifically designed for this purpose. Remove all road tar and tree sap before waxing. Sterling recommends that a quality brand of cleaner or cleaner-polish and polishing wax be used.
- Do not let diesel fuel or antifreeze stand on a painted surface. If either should occur, rinse the surface off with water.
- To prevent rust, have any nicks or other damage on the finish touched up as soon as possible.
- Park your vehicle in a sheltered area whenever possible.

Care of Fiberglass Parts

Wash unpainted fiberglass air fairings and shields monthly with a mild detergent, such as dishwashing liquid. Avoid strong alkaline cleansers.

Apply a wax specifically designed for fiberglass.

Care of Chrome Parts

To prevent rust, keep chrome parts clean and protected at all times. This is especially important during winter driving and in coastal areas where there is exposure to salt air.

When cleaning chrome parts, use clean water and a soft cloth or sponge. A mild detergent may also be used.

Sponge gently, then rinse. If necessary, use a non-abrasive chrome cleaner to remove stubborn rust or other material. Do not use steel wool.

To help protect the chrome after cleaning, apply a coat of polishing wax to the surface. Never use wax on parts that are exposed to high heat, such as exhaust pipes.

Dashboard Care

Periodically wipe the dashboard with a water-dampened cloth. A mild detergent can be used, but avoid using strong detergents.



CAUTION

Do not use Armor-All Protectant®, STP Son-of-a-Gun®, or other equivalent treatments. These cleaners contain vinyl plasticizers that can cause stress crazing in the interior plastic panels, which can result in cracking of the panels.

Vinyl Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Harsh cleaning agents can cause permanent damage to vinyl upholstery. To preserve the upholstery and prevent damage, carefully review the following sections for recommended cleaning procedures. Waxing or refinishing improves soil resistance and cleanability for all vinyls. Any hard wax, such as that used on automobiles, may be used.

Ordinary Dirt

Wash the upholstery with warm water and mild soap, such as saddle or oil soap. Apply soapy water to a large area and allow to soak for a few minutes, then rub briskly with a cloth to remove the dirt. This can be repeated several times as necessary.

If dirt is deeply imbedded, use a soft bristle brush after applying the soap.

If dirt is extremely difficult to remove, wall-washing preparations normally found around the home can be used. Powdered cleaners, such as those used for sinks and tiles, are abrasive and must be used with caution as they can scratch the vinyl or give it a permanent dull appearance.

Chewing Gum

Harden the gum with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Any remaining traces of gum can be removed with an all-purpose light oil (peanut butter will also work) and wiped off.

Tars, Asphalts, and Creosote

Tars, asphalts, and creosote stain vinyl after prolonged contact. They should be wiped off immediately and the area carefully cleaned, using a cloth dampened with naphtha.

Paint, Shoe Heel Marks

Paint should be removed immediately. Do not use paint remover or liquid-type brush cleaner on vinyl. An unprinted cloth, dampened with naphtha or turpentine may be used. Use care to prevent contact with parts of the upholstery that are not vinyl.

Sulfide Stains

Sulfide compounds, such as those found in eggs and some canned goods, can stain after prolonged contact with vinyl. These stains can be removed by placing a clean, unprinted piece of cloth over the spotted area and pouring a liberal amount of 6 percent hydrogen peroxide onto the cloth. Allow the saturated cloth to remain on the spot for 30 to 60 minutes. For stubborn spots, allow the hydrogen-peroxide saturated cloth to remain on the area overnight. Use caution to prevent the solution from seeping into the seams or it will weaken the cotton thread.

Nail Polish and Nail Polish Remover

Prolonged contact with these substances causes permanent damage to vinyl. Careful blotting immediately after contact minimizes damage. Do not spread the liquid during removal.

Shoe Polish

Most shoe polishes contain dyes which penetrate vinyl and stain it permanently. Shoe polish should be wiped off as quickly as possible using naphtha or lighter fluid. If staining occurs, try the procedure used for sulfide stains.

Ball Point Ink

Ball point ink can sometimes be removed if rubbed immediately with a damp cloth, using water or rubbing alcohol. If this does not work, try the procedure used for sulfide stains.

Miscellaneous

If stains do not respond to any of the treatments described above, it is sometimes helpful to expose the vinyl to direct sunlight for up to 30 hours. Mustard, ball point ink, certain shoe polishes, and dyes often bleach out in direct sunlight leaving the vinyl undamaged.

Velour Upholstery Cleaning

To prevent soiling, frequent vacuuming or light brushing to remove dust and dirt is recommended. Spot clean with a mild solvent or an upholstery shampoo, or the foam from a mild detergent. When using a solvent or a dry-cleaning product, follow the instructions carefully and clean only in a well-ventilated area. Avoid any product that contains carbon tetrachloride or other toxic materials. With either method, pretest a small area before proceeding. Use a professional upholstery cleaning service when extensive cleaning is needed.

Grease and Oil-Based Stains

Dampen a small absorbent cloth with dry-cleaning solvent or spot remover. Apply the cloth carefully to the spot from the outer edge to the center. Pat and blot the spot with a clean, dry cloth. Repeat several times, as necessary, turning the cloths so that the stain does not redeposit on the fabric.

Sugar and Water-Based Stains

Apply water-based detergent or cleaner, working in circular motions. Pat and blot as dry as possible. Repeat if necessary before drying thoroughly.

Cab Appearance

Chewing Gum or Wax

Harden the gum or wax with an ice cube wrapped in a plastic bag, then scrape it off with a dull knife. Excess wax can be absorbed by placing a thick white blotter over the wax and heating with a warm (not hot) iron. Remove the remainder by using the procedure for grease and oil-based stains.

Mildew

Brush the dry fabric with a soft brush. Sponge with detergent, and blot. If the fabric is colorfast, dilute a teaspoon of bleach in one quart (one liter) of cool water. Apply with a swab, directly on the mildew stain. Dab repeatedly with clear, cool water, and blot dry.

13

In an Emergency

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In an Emergency

Hazard Warning Lights

The hazard warning lights switch is located either on the turn signal lever or on top of the steering column. Press the switch to turn on the hazard warning lights. Press the switch again to turn off the hazard warning lights.

Fire Extinguisher

A fire extinguisher is located in the cab by the driver's door.

Emergency Kit, Optional

An optional emergency kit is located in the cab. The kit includes one or more of the following: a first aid kit, a reflective vest, a triangular reflector, and a flare kit.

If there is an emergency while driving, cautiously pull off the road. Turn on the hazard warning lights. Place the flares and reflector along the side of the road to alert other drivers that an emergency situation exists.

WARNING

Use extreme care when placing flares in emergency situations that involve exposure to flammable substances such as fuel. An explosion or fire could occur causing serious personal injury.

Emergency Starting With Jumper Cables

When using jumper cables, use the following instructions.

WARNING

Batteries release explosive gas. Do not smoke when working around batteries. Put out all flames and remove all sources of sparks or intense heat in the vicinity of the battery. Do not allow the vehicles to touch each other. Do not lean over the batteries when making connections, and keep all other persons away from the batteries. Failure to follow these precautions could lead to severe personal injury as a result of an explosion or acid burns.

CAUTION

Make sure both 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 battery manufacturer's instructions when charging deep-cycle batteries.

On vehicles equipped with optional jump-start posts, attach the positive cable clamp to the positive post instead of to the battery, and attach the negative cable clamp to the negative post.

CAUTION

Connecting the jumper cables to the vehicle frame rail or to the engine block can cause severe damage to the engine wiring.

On vehicles without jump-start posts, the positive cable clamp can be attached to the starter positive lug terminal.

1. Apply the parking brakes and turn off the lights and all other electrical loads.
2. Connect an end of one jumper cable to the positive terminal of the booster battery (or jump-start post if equipped) and connect the other end of the cable to the positive terminal of the discharged battery (or jump-start post if equipped).

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 to the negative jump-start post or the starter ground lug. The starter ground lug (Fig. 13.1) is the best location. Do not use the frame rail or the engine block as a ground.

NOTE: It may be easier to access the starter ground lug by routing the jumper cable underneath the vehicle. If the starter ground lug is not

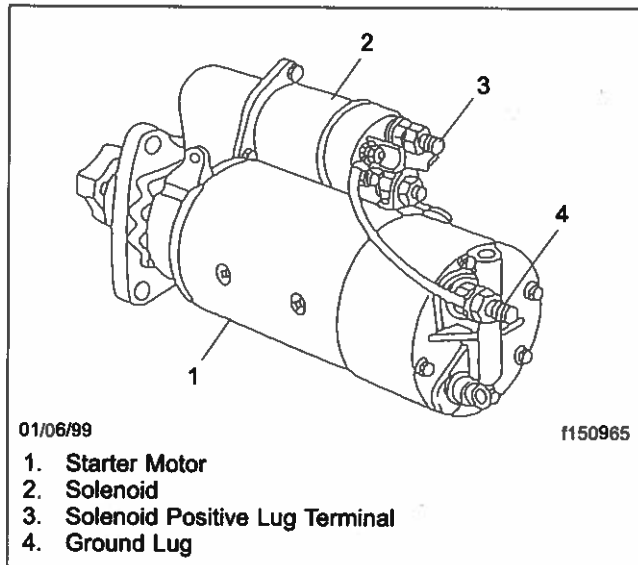


Fig. 13.1, Delco Remy 42-MT Starter

accessible, connect to the negative battery post of the discharged battery.

! WARNING

On vehicles with Mercedes-Benz AGS transmissions, make sure the current gear indicator displays "N" before starting the vehicle. If the transmission starts in gear, it could cause an accident resulting in death, serious personal injury, or property damage.

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

! WARNING

Do the next step exactly as instructed and do not allow the clamps of one cable to touch the clamps of the other cable. Otherwise, a spark could occur near a battery, possibly resulting in

severe personal injury from explosion and acid burns.

7. Disconnect the grounded cable from the vehicle, then disconnect the other end of the cable from the negative terminal of the booster battery.
8. Disconnect the remaining cable from the newly charged battery or jump-start post first, then disconnect the other end.

Towing

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

! WARNING

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

Front Towing Hookup

1. Disconnect the battery ground cables.

! CAUTION

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

2. Remove both drive axle shafts. On dual drive axles, if the vehicle is to be lifted and towed, remove only the rearmost drive axle shafts.

On vehicles equipped with an air fairing, remove both the forward and rearmost drive axle shafts if there is insufficient towing clearance.

3. Cover the ends of the hubs with metal plates or plywood cut to fit the axle opening, and drilled to fit the axle shaft studs. This prevents lubricant from leaking out and will keep contaminants from getting into and damaging the wheel bearings and axle lubricant.

In an Emergency

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

4. On dual drive axles, if the vehicle is to be lifted and towed, chain the forward rear-axle assembly to the vehicle frame. Use protection to keep the chains from damaging the frame.
5. Remove the bumper extension and chrome bumper if equipped. Remove the bumper fairing if equipped.
6. On vehicles equipped with an air fairing, adjust the trim tab to the lowest position.

CAUTION

Do not pass a sling (for example, a rope or chain) from one tow hook to another to fasten for towing (see Fig. 13.2). Known as reeving, this practice is not permissible in most industrial applications of towing and hoisting. Reeving can overload the hooks and result in damage to the vehicle.

7. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
8. On vehicles equipped with an air fairing, measure the distance from the ground to the bumper, or from the ground to a frame bracket.
9. Lift the vehicle and secure the safety chains. If extra towing clearance is needed, remove the front wheels.

WARNING

Failure to lower the vehicle could result in the air fairing striking an overhead obstruction, such as a bridge or overpass, and causing vehicle damage or personal injury.

10. On vehicles equipped with an air fairing, repeat the measurement taken in step 8. The difference between the two measurements must not exceed 14 inches (36 cm). If necessary, lower the vehicle.

11. Connect the clearance lights, taillights, and signal lights. Connect any special towing lights required by local regulations.

WARNING

Failure to chock the tires or connect the 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.

12. Chock the tires on the disabled vehicle and connect the towing vehicle's air brake system to the vehicle being towed. Then, release the spring parking brakes and remove the chocks.

Rear Towing Hookup

CAUTION

Using a rear towing hookup on a vehicle equipped with a roof fairing could cause damage to the cab structure.

1. Place the front tires straight forward and secure the steering wheel in this position.
2. Disconnect the battery ground cables.

CAUTION

Failure to protect the frame rails from the chains could cause damage, leading to eventual frame failure.

3. On dual drive axles, using protection to keep the chains from damaging the vehicle frame, chain the forward-rear drive axle to the frame.
4. Attach the towing device. Due to the many variables that exist in towing, positioning the lifting and towing device is the sole responsibility of the towing-vehicle operator.
5. Lift the vehicle and secure the safety chains. If extra clearance is needed, remove the bumper extension if equipped.
6. Connect the clearance lights, taillights, and signal lights. Also connect any special towing lights required by local regulations.

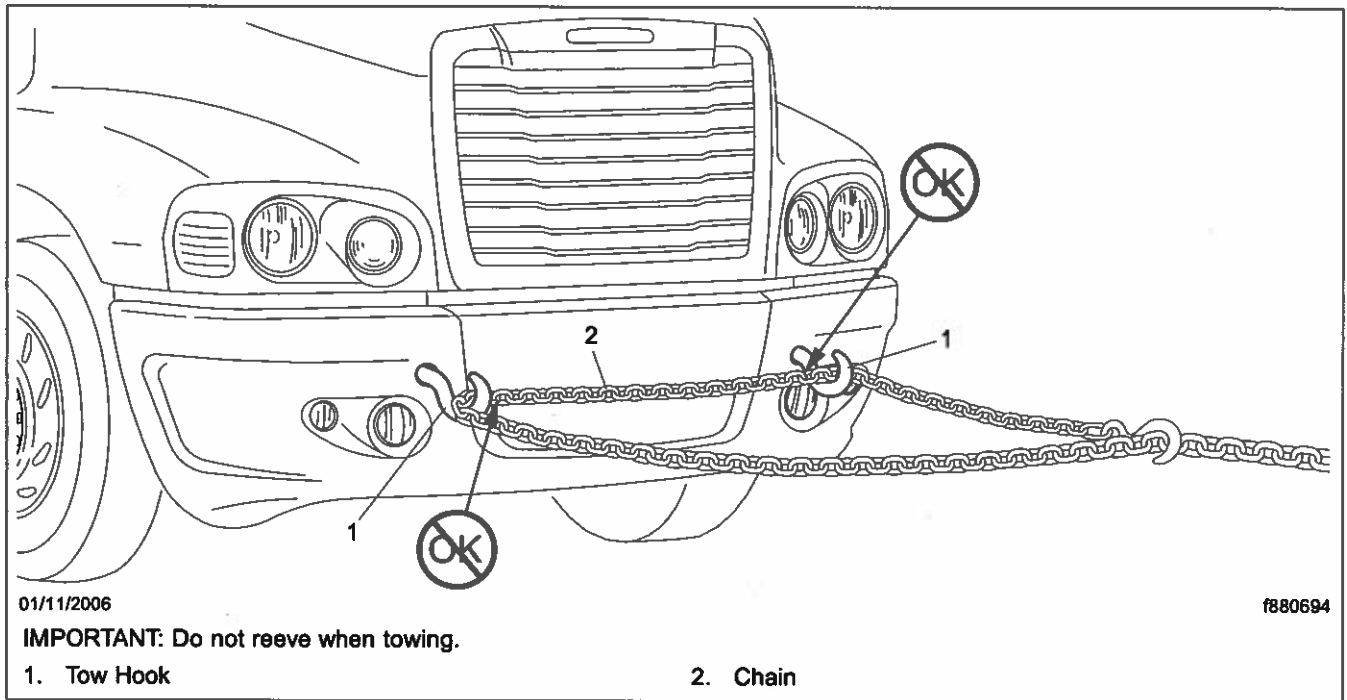


Fig. 13.2, Reeving

Fire in the Cab

The incidence of fire in medium-duty trucks is rare, according to data from the National Highway Traffic Safety Administration. Federal Motor Vehicle Safety Standard #302 limits the flammability of specified materials used inside the cab, but despite this, most materials will burn. The cab of this vehicle contains urethane foam, which is of concern in this respect.

WARNING

Urethane foam is flammable! Do not allow any flames, sparks, or other heat sources such as cigarettes or light bulbs to contact urethane foam. Urethane foam in contact with such heat sources could cause a serious, rapid fire, which could result in death, severe burns, or gas poisoning, as well as damage to the vehicle.

In Case of a Cab Fire

As quickly as possible, bring the vehicle to a safe stop, apply the parking brake, turn off the ignition, and get out of the vehicle.

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