3.5. PARK BRAKE OPERATION

The parking brake system employs a cable actuated, drum-style, driveline parking brake (see FIGURE 30). When tension is applied to the brake cable, brake shoes are expanded inside of the drum, effectively locking the drive wheels. When tension is removed from the brake cable, springs retract the brake shoes, releasing the drum and unlocking the drive wheels. Refer to manual S04044 for more complete information on the driveline parking brake drum assembly.

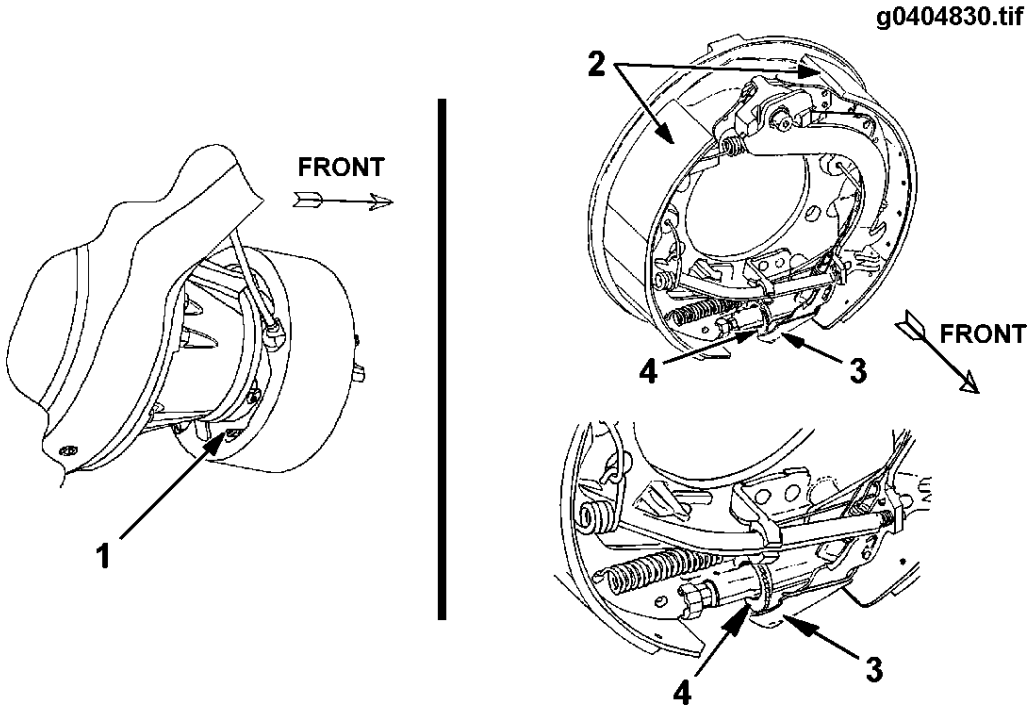

Figure 30 Driveline Parking Brake

1. ADJUSTMENT ACCESS WINDOW (DRUM MOUNTED)
2. BRAKE SHOES (DRUM REMOVED)
3. ADJUSTING LEVER (DRUM REMOVED)
4. STAR WHEEL (DRUM REMOVED)

POWERED PARKING BRAKE

The parking brake cable tension is controlled by a Spring Apply Hydraulic Release (SAHR) canister. Refer to FIGURE 31, FIGURE 21 (See Figure 21, page 33), and FIGURE 22 (See Figure 22, page 34). The state of the SAHR canister is hydraulically and electronically controlled by the HCU/ECU. The other components of the powered parking brake system are: the dash switch, the Pressure Supply Valve (PSV), the Cut-Off Valve, and the Travel Switch. Refer to FIGURE 32 (See Figure 32, page 50).

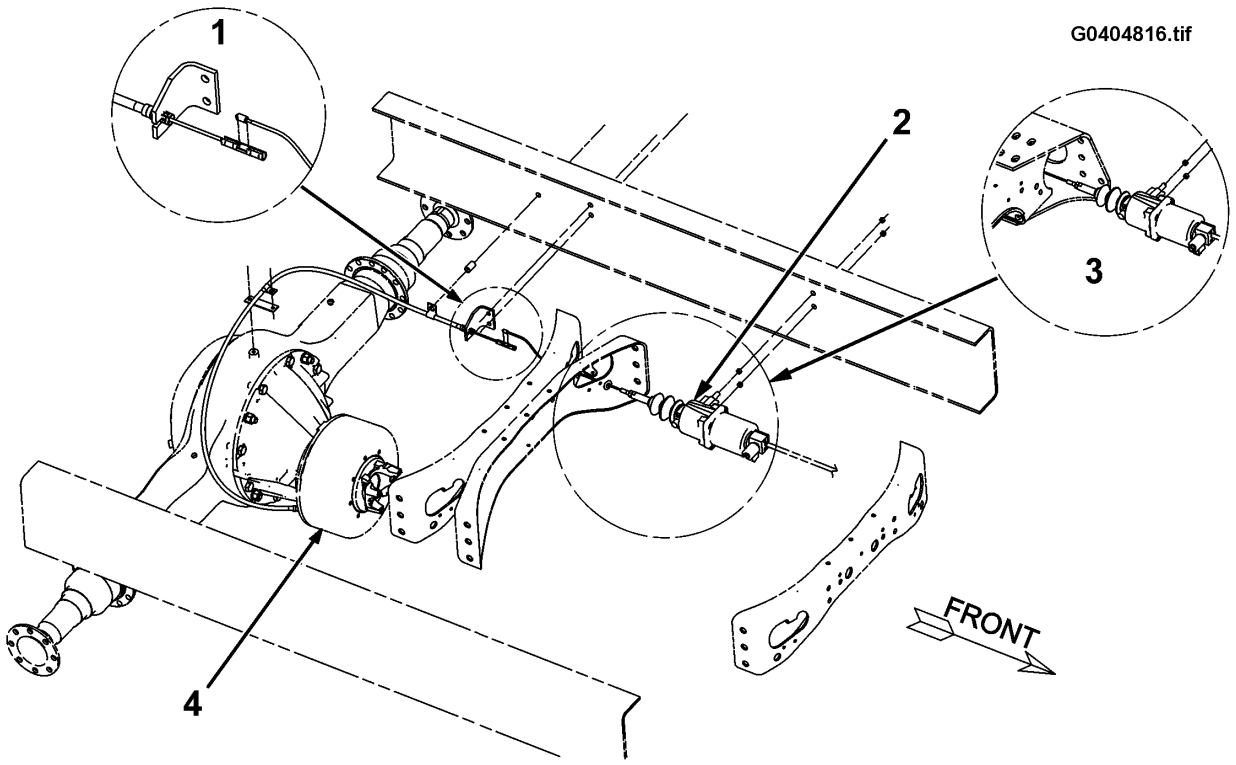

Figure 31 Location of SAHR Canister and Related Components

1. CONNECTION AT BRAKE CABLE UNION
2. SAHR CANISTER
3. CABLE ROUTING WITH ALTERNATE CROSSMEMBER
4. DRIVELINE PARKING BRAKE DRUM

The parking brake dash switch has three switch states (positions): apply (out), neutral (center), and release (in). The switch is spring-loaded to return to the neutral (center) position after either of the other positions is selected. A resistor network in the switch assembly allows the ECU to detect the position of the switch by sensing a change in the resistance value of the switch circuit. The resistor network also allows the ECU to detect malfunctions in the switch circuit.

When the ECU detects the switch 'apply' actuation, it sets both the PSV and the cut-off valves to their non-energized states (normally open). This condition provides an open brake fluid connection between the SAHR canister and the HCU reservoir. With no pressurized fluid at the SAHR canister, the internal springs are used to retract the SAHR shaft, applying tension to the brake cable; which, in turn, applies the parking brake. The travel switch on the SAHR canister is used to indicate the shaft position to the ECU. If the shaft position does not indicate a properly applied parking brake, the ECU will generate a fault code and turn on the SERVICE PARK BRAKE indicator.

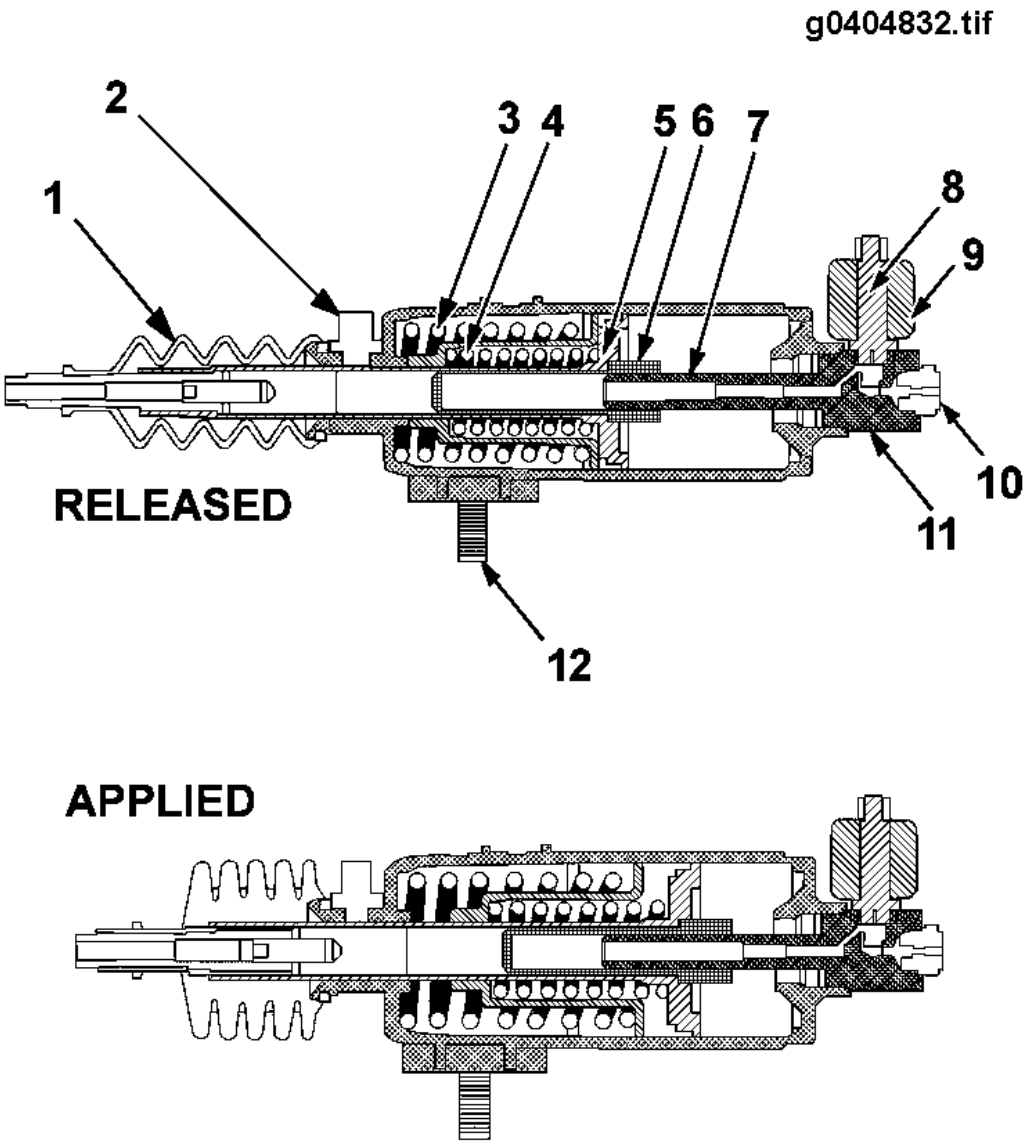

Figure 32 SAHR Canister Components/Operation

1. RUBBER BOOT
2. TRAVEL SWITCH
3. OUTER SPRING
4. INNER SPRING
5. OUTPUT SHAFT END PLATE
6. CYLINDER, PART OF MANIFOLD/CARTRIDGE ASSEMBLY
7. PISTON, PART OF MANIFOLD/CARTRIDGE ASSEMBLY
8. CUT-OFF VALVE CORE, PART OF MANIFOLD/CARTRIDGE ASSEMBLY
9. CUT-OFF VALVE COIL
10. THREAD SAVER FITTING
11. MANIFOLD/CARTRIDGE ASSEMBLY (PISTON/CYLINDER)
12. SAHR MOUNTING STUD

When the parking brake is released using the dash switch, the ECU electronically controls the PSV and the cut-off valves as follows. First, the PSV is energized to route brake fluid from the pressurized primary accumulator circuit to the SAHR canister. The cut-off valve remains non-energized (open) long enough for the pressurized brake fluid to overcome the force of the internal springs and extend the SAHR shaft. Once the travel switch indicates that the shaft has extended, the ECU energizes (closes) the cut-off valve, preventing the pressurized brake fluid from leaving the SAHR canister. After a short delay the ECU returns the PSV to its non-energized state so that the parking brake line is again open to the HCU reservoir. This allows the parking brake line to be unpressurized even though the SAHR canister is pressurized (park brake released). With the SAHR shaft extended, the brake cable is no longer under tension and the parking brake is released. The travel switch on the SAHR canister is used to indicate the shaft position to the ECU. If the shaft position does not indicate a properly released parking brake, the ECU will generate a fault code and turn on the SERVICE PARK BRAKE indicator.

When the parking brake is in its released state (SAHR canister pressurized), small reductions of pressure may occur over a period of time. To prevent the pressure from dropping far enough to allow a partial parking brake application; the ECU commands the PSV and cut-off valve to repressurize the SAHR canister whenever the travel switch indicates that the SAHR shaft has moved beyond a preset limit. If system leakage requires the SAHR canister to be replenished too frequently, the HCU/ECU will enter the ’backup mode’ and generate a fault code. The ’backup mode’ is described in the following paragraph. In this condition the HCU/ECU will also turn on the SERVICE PARK BRAKE indicator.

The system has a safety function (backup mode) to ensure that the parking brake will not apply unexpectedly if the cut-off valve fails. When the cut-off valve fails it assumes its ’normally open’ state. When the ECU detects a cut-off valve failure, it uses the PSV as a backup. To provide pressurization of the SAHR canister (to keep the park brake released), the ECU energizes the PSV. The energized PSV routes pressurized brake fluid from the primary accumulator circuit to the SAHR canister continuously to keep the parking brake in its ’applied’ state. The parking brake line is pressurized continuously during the backup mode. When the ECU detects the cut-off valve malfunction, it will generate a fault code and turn on the SERVICE PARK BRAKE indicator. The parking brake circuit is placed in the backup mode any time SERVICE PARK BRAKE indicator is turned on.

A travel switch mounted on the SAHR canister monitors the action of the park brake shaft and cable. The state of this switch is read by the ECU to determine:

- if the parking brake is applied (ECU will send a signal to the ESC requesting it to turn on the PARK BRAKE indicator.)
- if overtravel of the brake cable is occurring (possible worn brake shoes or stretched/broken cable)
- if undertravel of the brake cable is occurring (possible frozen park brake or cable).

The ECU also monitors the status of the park brake switch, and the current flow to the cut-off and pressure supply solenoid valves used to route brake fluid between the HCU and the SAHR canister. If any fault condition is detected, the ECU will send a signal to the ESC requesting it to turn on the SERVICE PARK BRAKE indicator, and place the park brake circuit in the backup mode. In addition, a diagnostic code will be generated by the ECU and stored in memory. Retrieval of the diagnostic codes is explained in Section 5, DIAGNOSIS AND TROUBLESHOOTING (See DIAGNOSTICS AND TROUBLESHOOTING, page 69).

DYNAMIC PARKING BRAKE FUNCTION

This function is controlled by the ECU. The ECU is constantly monitoring vehicle speed. If it detects a parking brake apply signal while vehicle speed is above 2 mph, it uses the ATC and ABS valves to apply the rear service brakes. After the vehicle has come to a safe stop, the driveline parking brake is applied as described above.

PARKING BRAKE SAFETY INTERLOCKS

The parking brake apply/release input signal to the ECU is normally provided by the dash mounted park brake switch as described above. However, because the HCU/ECU is electronically controlled, various interlocks can be used to control the parking brake and even override the park brake switch. The following interlock functions are used to verify that safe conditions exist before allowing the parking brake to be applied or released.

- When the park brake is applied, driver cannot “drive” against the park brake. When the parking brake is applied the ECU sends a J1939 message to the engine control module to reduce engine torque.
- The parking brake applies automatically when the key is turned off and the vehicle is stopped. If the key is turned off while the vehicle is moving (more than 2 mph), the park brake is prevented from coming on. The ECU electronically monitors the vehicle speed and the position of the ignition key; and will apply the parking brake only when the correct conditions exist.
- The parking brake is released when the dash switch is pressed, ONLY when all of the following conditions are met. The ECU detects these conditions electronically and responds to the dash switch only when the correct conditions exist.
  - — The foot brake must be applied.
  - — The ignition key must be in the “On” position.
  - — There must be no major brake system faults.
  - — If the vehicle is equipped with the optional “Auto Apply” feature, the shifter must be in a position other than PB.

4. SYSTEM MAINTENANCE

This section contains general maintenance information and procedures. There is no regularly scheduled maintenance required for the Full Power Brake system.

During bleeding, special tools may be required. Because the Master Cylinder (MC) system is isolated from the wheel caliper system, brake pedal feel does not indicate properly bled brakes. Air can still exists in the lines between the HCU and the calipers. Insure that ALL NECESSARY bleeding procedures have been properly performed after any repairs that require disconnecting brake lines. If lines are disconnected in both the MC circuit and the wheel caliper circuits; then, both bleeding procedures must be performed. If the SAHR (parking brake) circuit is opened, the SAHR bleed procedure must be performed. If the HCU is removed or replaced, all three bleed procedures must be performed.

WARNING – The full power brake system is a pressurized system that achieves pressures of up to 2320 psi. This pressure IS NOT reduced by switching the ignition off or removing battery power. Prior to servicing this system, the depressurization procedures MUST BE PERFORMED EXACTLY AS PRESENTED. Failure to depressurize the system may result in property damage, personal injury or death.