

SECTION 6B

THROTTLE CONTROL SYSTEM

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GENERAL DESCRIPTION

Refer to figure 1 for the air-controlled throttle system air line schematic diagram. The air-controlled throttle system provides variable air pressure (0–60 psi) from the treadle valve (fig. 2) to the throttle control assembly (fig. 4) mounted on the engine governor cover.

Under normal operating conditions, at full system pressure, air is supplied to the throttle control circuit from the suspension air reservoir. Air from the suspension air reservoir is routed through a double check valve and the TR-3 accelerator interlock inversion valve, to the accelerator treadle. As the accelerator treadle is depressed, regulated air pressure (0–60 psi) is supplied to the accelerator control slave cylinder on the engine governor cover, to actuate the throttle lever and shaft.

The suspension air reservoir is supplied from the main air supply reservoir through a PR-2 pressure protection valve. This valve does not open until air pressure in the main air supply reservoir builds to 65 psi—a feature designed to protect suspension system air pressure against a severe leak in the main air system. The valve also closes when suspension system pressure drops below 50 psi, to protect the brake system against any drastic drop in suspension system pressure.

When the coach is first started, and the main air reservoir supply pressure is low (below 65 psi), a fast response throttle circuit, in the form of a TR-3 inversion valve connected with the previously mentioned double check valve, is incorporated to bypass the suspension air reservoir and deliver air pressure to the treadle valve from

the main air supply reservoir directly. When main system air pressure builds to a point where the PR-2 valve begins to supply the suspension air system (65 psi). A signal line teed from the suspension tank delivery line to the control port of the TR-3 fast response inversion valve admits line pressure to move the valve piston to close off the supply port from the main air supply reservoir. Air pressure trapped between the double check valve and the inversion valve is released through the exhaust port of the inversion valve, as the double check valve begins to route air from the suspension air reservoir to the throttle control circuit for normal operation.

The throttle system is interlocked with the brake system and door system through an interlock solenoid valve to render the throttle control inoperative whenever the entrance or exit door electrical circuits are energized. When the door control circuit is energized, a signal pressure from the brake interlock solenoid valve cluster is directed to an SV-1 synchro valve in the accelerator interlock valve cluster. The synchro valve, in turn, signals the interlock TR-3 inversion valve to shut off supply air to the accelerator treadle, rendering it inoperative.

SYSTEM MAINTENANCE AND INSPECTION

SYSTEM INSPECTION

1. Inspect all tubing, fittings, and connections within the throttle control system to be sure they are not loose, broken, torn, abraded, or leaking.
2. Inspect the system for moisture accumulation, and check the air dryer to see that it is working properly.

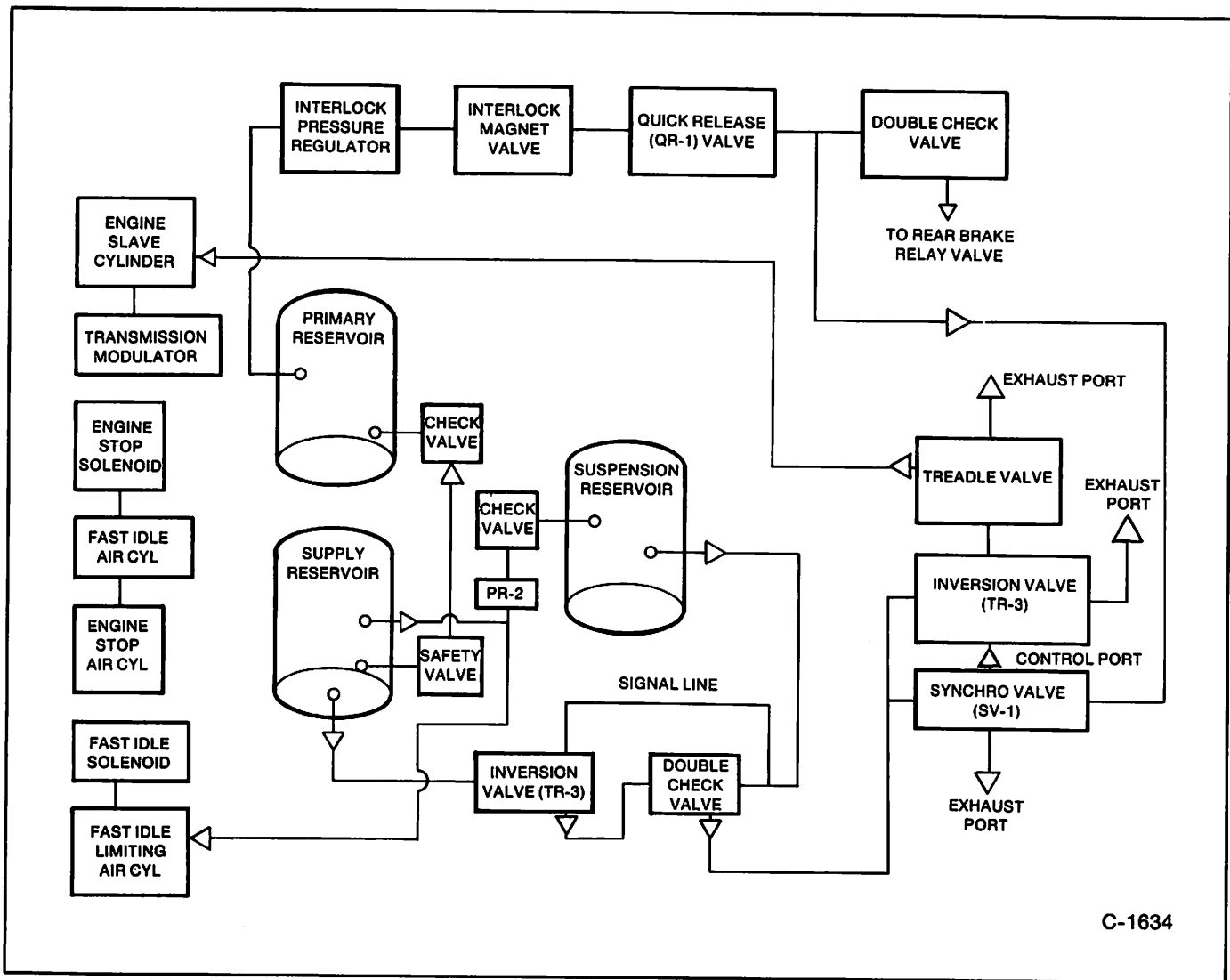


Figure 1—Air Controlled Throttle Air Line Schematic

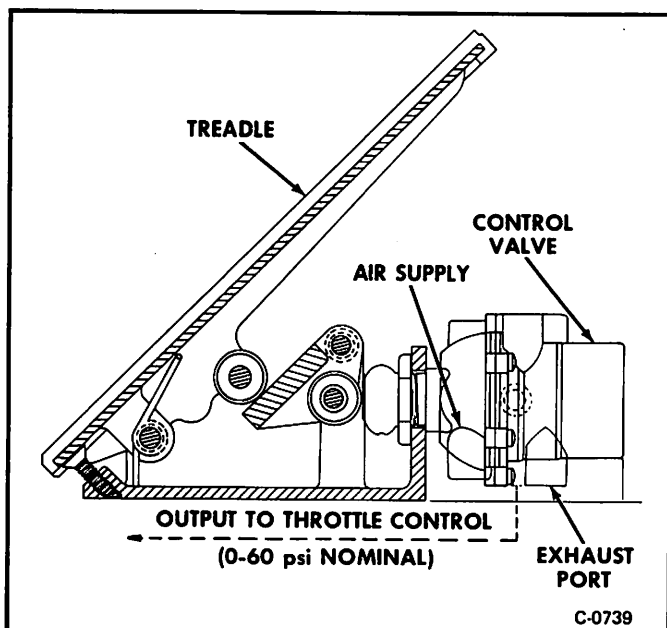


Figure 2—Treadle Valve Operation

TREADLE VALVE ASSEMBLY (FIGURE 3)

1. Check the dust boot on the control valve plunger to be sure it is correctly installed and has no worn areas or tears.
2. Check the area around the treadle to insure that nothing is interfering with treadle operation (rock or foreign material).
3. Check the entire treadle assembly for cleanliness. Make sure that dirt and debris are not allowed to collect and build up on or around the treadle assembly.
4. Pressurize the treadle valve with normal operating air supply.
5. Actuate the treadle valve by depressing the treadle by hand. The action should be smooth without binding, and when the treadle is released, it should return immediately without sticking.
6. Check the rollers on the underside of the treadle and on the transfer tube for freedom of movement.
7. Check all pivot points for freedom of movement, excessive wear, and corrosion.
8. Check all fasteners, fittings, and retaining rings to verify that they are properly installed.

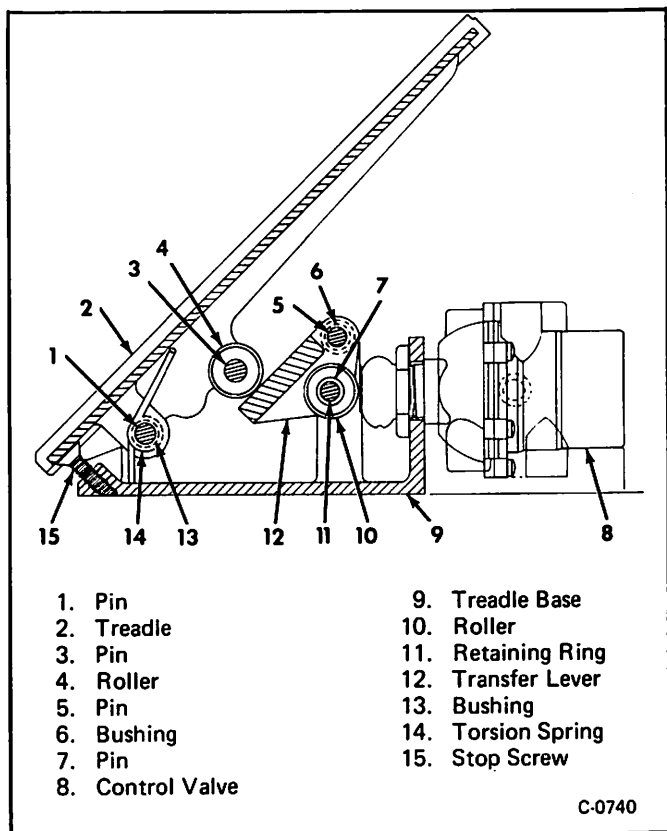


Figure 3—Treadle Valve Assembly

THROTTLE CONTROL ASSEMBLY

1. Check the dust boot on the control cylinder rod end to make sure it is correctly installed and has no tears or worn areas.

2. Check the area around the control cylinder to make sure nothing will interfere with its operation (dirt, debris, loose screws, discarded material, etc.).

3. Check the entire throttle control for cleanliness. Do not let excessive dirt and debris collect and build up on or around the control cylinder.

4. Actuate the treadle valve with normal operating air supply pressure in the vehicle. The control cylinder must operate smoothly and without binding. When the treadle is released, the throttle lever must return quickly to idle position.

5. Check the rod end pivot point for freedom of movement, wear, and corrosion.

6. Check all fasteners and fittings. If the cylinder mounting bolts are loose, refer to "Installation" under "Accelerator Control Slave Cylinder Assembly" later in this section to establish correct placement of the control cylinder.

TREADLE VALVE

The treadle valve assembly (accelerator pedal) (fig. 4) is mounted at right-front of the driver, next to the brake treadle.

Replace parts of the treadle assembly as required by inspection. Major and minor repair kits are available through the normal parts distribution system.

NOTICE: The heel rest stop screw is factory set and sealed: DO NOT adjust it.

DISASSEMBLY, CLEANING AND ASSEMBLY

1. Remove the retaining rings on the treadle heel pivot pin and the transfer lever pivot pins (fig. 3). Remove the pins, treadle, and transfer lever.

2. Remove the actuating rollers from the underside of the treadle and the transfer lever.

3. Pull the dust boot and actuating plunger out of the control valve.

4. Clean all metal parts in a suitable cleaning solvent and air dry them.

5. Clean the bore of the control valve with a clean cloth dampened with solvent. Do not let solvent get into the control valve.

6. Check for excessively worn, damaged, or corroded parts, and replace parts as required.

7. Wipe the dust boot clean and install it and the rod plunger in the control valve, taking care that the dust boot is engaged in the sealing grooves of the control valve and rod plunger.

8. Clean and lubricate all pivot pins with a dry or drying-type lubricant prior to reassembly. Do not use grease or oils as these will attract and retain contaminants.

9. Reinstall the treadle roller and put the treadle back on the treadle base, taking care to engage the torsion spring coils with the heel pivot pin.

10. Reinstall the transfer lever roller and put the transfer lever back on the treadle base, making sure that all retaining rings are installed.

11. If the control valve exhausts air out of the exhaust port when the pedal is depressed; or if the valve operation is sticky or sluggish; or if the body seam leaks excessively, the valve must be repaired and/or replaced.

TESTING TREADLE VALVE OPERATION

Replace treadle parts as required by inspection. Repair kits are available. The heel rest stop screw is factory set and sealed: DO NOT adjust it. There are no required adjustments for the treadle valve assembly.

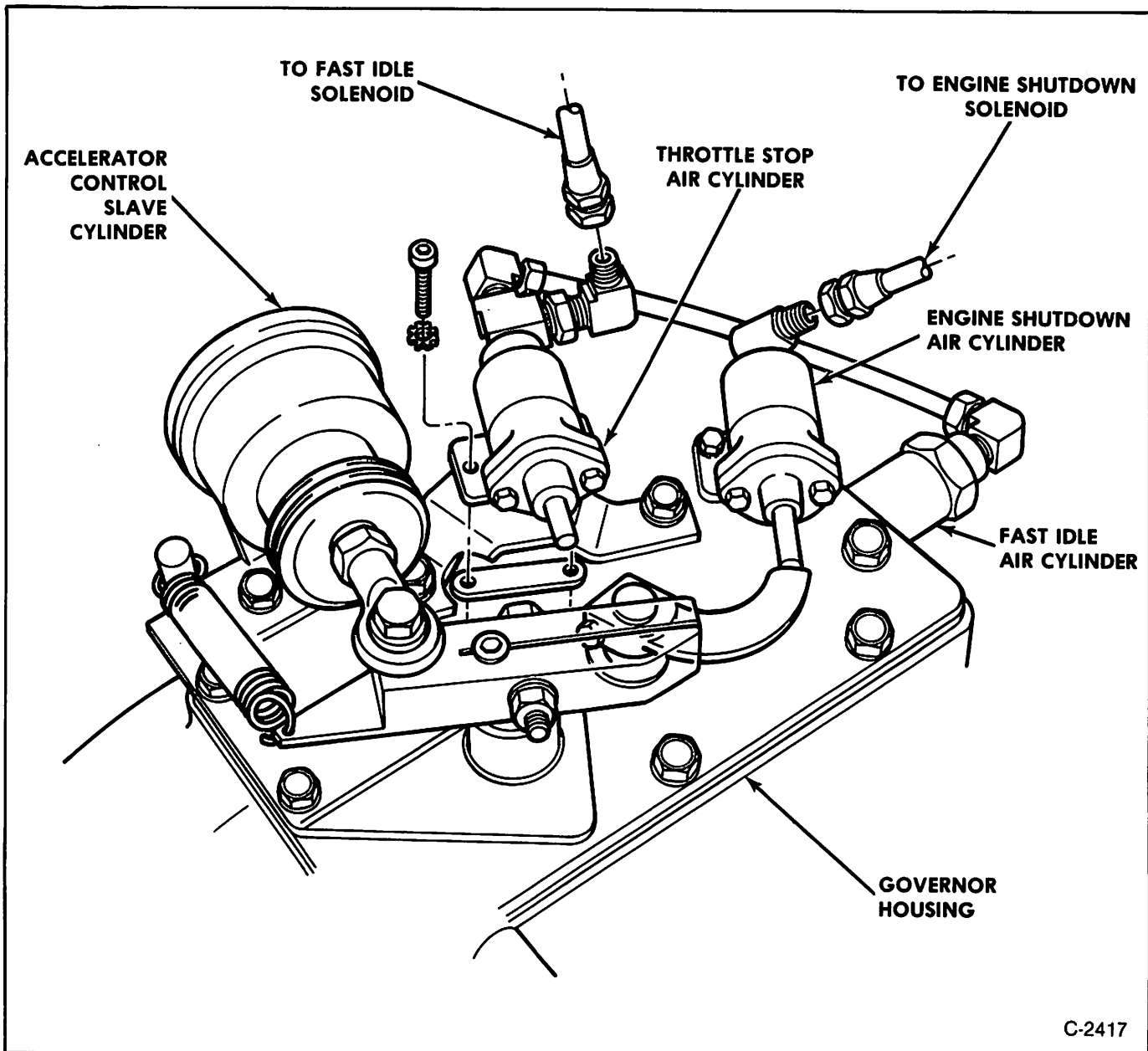
1. Pressurize the treadle valve with the air supply at normal operating pressure.

2. Depress the treadle completely. The engine throttle lever should go to the full throttle position.

3. Release the treadle valve. The engine throttle should immediately move to the idle position.

4. Movement of the valve treadle should be free without sticking or binding.

5. Check the valve and fittings for leakage by applying a soap solution to the exhaust port and all joints.



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Figure 4—Throttle Controls

ACCELERATOR CONTROL SLAVE CYLINDER ASSEMBLY

The accelerator control slave cylinder assembly (fig. 4) is mounted on the engine governor cover. The assembly consists of an accelerator control slave cylinder, throttle lever, return spring, and mounting plate. Air pressure, controlled by the treadle valve assembly mounted at the driver's floorboard, provides a stroke from the accelerator control slave cylinder to regulate the position of the throttle lever.

REMOVAL (FIGURE 5)

NOTICE: DO NOT start the engine at any time during removal or installation of the slave cylinder assembly or damage to the engine and components may result.

1. Place the rear "ENGINE CONTROL" switch and the "START CONTROL" switch in the "OFF" position.

2. Disconnect the air line at the control port of the slave cylinder.

3. Loosen and remove the locknuts (7), washers (6), and bolts (4) which hold the throttle lever (5) clamped to the cylinder piston rod end pin (15) and to the throttle shaft (17). Detach the return spring (10).

4. Remove the two bolts (14), lockwashers (12), and nuts (13) attaching the accelerator control slave cylinder (1) to its mounting plate (3).

SLAVE CYLINDER REPAIR (FIGURE 6)

A cylinder repair kit is available consisting of: O-ring, wear ring, spring, dust boot, U-cup, rod end assembly, and shell.

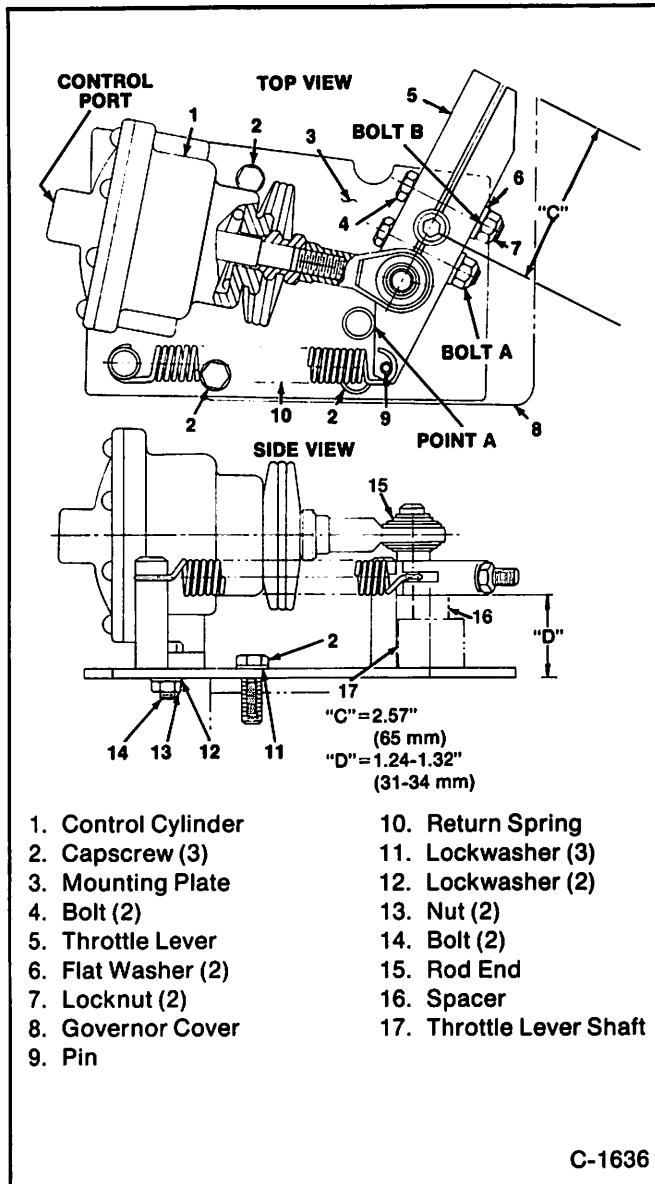


Figure 5—Accelerator Control Slave Cylinder Assembly

Disassembly

1. Remove the eight Phillips-head machine screws (2) which retain the cover (1). Remove the cover.

2. Using a 5/16-inch Allen wrench, hold the piston assembly (3), and loosen and remove the rod end assembly (10) from the piston assembly.

3. Remove the piston, spring (8), O-ring seal (6), and shell (11) from the body (4). Detach the dust boot (9) and alignment spacer (5) from the body. Discard the old seals, spring, wear ring, dust boot, shell, and rod end assembly.

4. Completely clean the cover, piston assembly, spring, and body in a petroleum-based solvent, such as mineral spirits or kerosene, and air dry.

Assembly

1. Insert a new shell (11) into the body (4). Lightly coat the new O-ring seal (6) with silicone lubricant and push it into position.

2. Liberally coat the new U-cup seal (12) and wear ring (7) with silicone lubricant and install them onto the clean piston assembly (3).

3. Install the spring (8) and piston assembly (3) into the body (4). Mount the cover (1) on the body using the eight machine screws (2). Tighten opposite screws to insure uniform flange pressure. Tighten to 24 inch-pounds torque.

4. Install new dust boot (9) on the alignment spacer (5). Slip the spacer on the piston rod and install the boot on the body (4).

5. Using the previously mentioned 5/16-inch Allen wrench to limit rotation of the piston assembly, install the new rod end assembly (10) and torque to 115 inch-pounds.

INSTALLATION (FIGURE 5)

1. Position the throttle lever (5) on the throttle according to the dimensions shown in "C" and "D" in figure 5. The top of the lever should be aligned with the top of the alignment post at point "A" as illustrated.

2. Install the return spring (10) between the pin (9) in the throttle lever and the post on the mounting plate.

3. For proper alignment, the throttle shaft must be at the full idle position with the throttle lever (5) in contact with the alignment post at point "A."

4. Lubricate the rod end of the slave cylinder with high temperature grease (see LUBRICATION, SEC. 0B) and slip the rod end pin into place in the throttle lever. Secure the slave cylinder (1) to the mounting plate (3) using two bolts (14), lockwashers (12), and nuts (13).

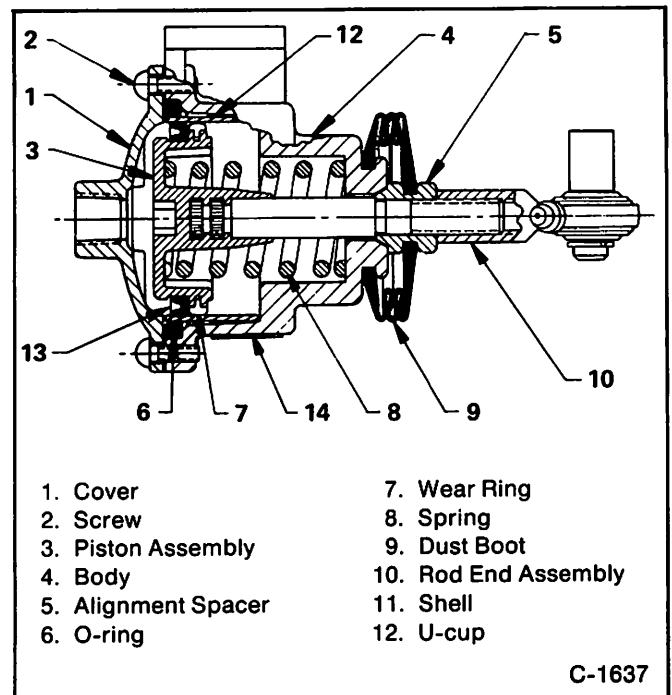


Figure 6—Accelerator Control Slave Cylinder

5. Secure the rod end and throttle shaft to the lever by tightening the locknuts (7) on bolts "A" and "B." Tighten the locknut on bolt "B" to 85 inch-pounds torque. DO NOT tighten the bolt "B" to a torque greater than bolt "A."

6. Check all fasteners to make sure they are tight. Check to see that the slave cylinder operates smoothly without binding.

7. Connect the supply air line to the control port of the slave cylinder, and check the operation of the cylinder while examining for air leaks using a soap and water solution.

8. Set the rear "ENGINE CONTROL" and "START CONTROL" switches on the rear engine compartment control panel to the "NORMAL" position. Check engine idle speed and governed speed settings as specified in the appropriate diesel engine manual.

FAST IDLE

The fast idle system is used to increase engine speed while building up air pressure within the system, to reduce the time required for warming up the engine, and to keep the climate control system functioning when the coach is stopped for an extended period of time.

The system consists of a fast idle solenoid valve, a fast idle air cylinder and a fast idle limiting air cylinder.

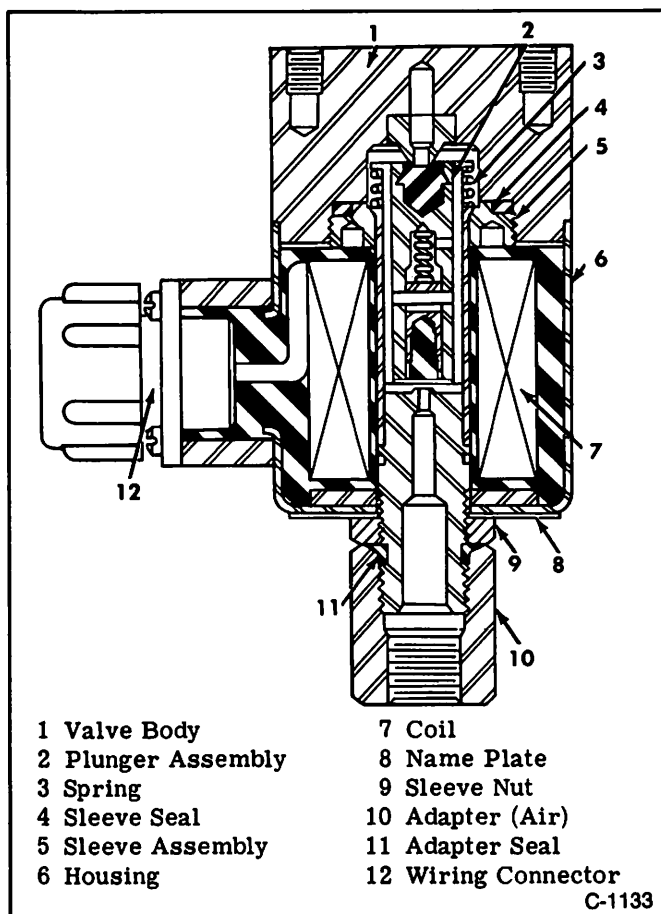


Figure 7—Fast Idle Solenoid Valve

FAST IDLE SOLENOID VALVE

The fast idle solenoid valve (fig. 7) is mounted on the engine bulkhead and supplies air to the fast idle air cylinder and the fast idle limiting air cylinder. When the fast idle switch, located on the driver's right-hand switch panel, is placed in "ON" position and the transmission shift lever is in the "NEUTRAL" position, air pressure is supplied to the fast idle solenoid valve. The valve plunger assembly is moved away from the inlet passage and closes the air exhaust opening, thereby applying air pressure to the fast idle air cylinder and the limiting air cylinder. Refer to "Parking Brake and Fast Idle" wiring diagram in WIRING DIAGRAMS (SEC. 12D) for electrical circuits and connections.

Disassembly (Figure 7)

1. Remove the adapter (10) and seal (11) from the valve assembly, then remove the sleeve nut (9) which holds the housing and coil assembly to the sleeve assembly (5). Remove the nameplate (8).

2. Remove the housing and coil assembly by sliding it off the lower end of the sleeve assembly.

3. Using a spanner wrench nut (special tool J-28602), remove the sleeve assembly (5), plunger (2), and spring (3) from the valve body (1).

4. Separate the plunger and spring from the sleeve and remove the seal (4) from the valve body.

Seals (4) and (11) should be discarded and new seals used when assembling the valve.

Assembly

1. Assemble the spring (3) onto the plunger (2), then insert the plunger into the sleeve assembly (5).

2. Place the new seal (4) into the valve body (1), then screw the sleeve into the body using the previously mentioned spanner wrench nut.

3. Place the housing and coil assembly over the sleeve. Install the nameplate (8) and sleeve nut (9). Tighten the nut only to a point where parts will be solidly seated. DO NOT overtighten the nut to put excessive stress on the sleeve.

4. Place a new seal (11) in the valve assembly and install the adapter (10).

FAST IDLE AIR CYLINDER

The fast idle air cylinder (fig. 4) is installed in the governor housing and operates when the fast idle solenoid admits air to the cylinder. Applied air pressure causes the cylinder spring to extend the plunger and increase engine rpm.

Cylinder Disassembly (Figure 8)

1. Disconnect the air line from the cylinder.

2. Loosen the jam nut (3) and thread the assembly out of the governor housing.

3. Remove the plunger (2) from the cylinder (4).

4. Remove the retainer ring (11) from the end of the cylinder.

5. Remove the inlet plug (12) and O-ring (10) from the cylinder.

6. Remove the piston (7), O-ring assembly (10), and piston spring (9) from the cylinder.

7. Remove the follower retaining ring (5) from the piston, then remove the spring follower (6) and follower spring (8) from the piston.

8. Remove the O-ring (10) from the inlet plug (12) and piston. Discard the O-ring.

Cylinder Assembly (Figure 8)

1. Clean all parts in a suitable cleaning solvent to remove all traces of oil or dirt, then dry.

2. Lubricate the cylinder walls and new O-rings with Lubriplate, or equivalent.

3. Install the follower spring (8) and spring follower (6) into the piston (7) and secure them with the follower retaining ring (5).

4. Install new O-rings (10) in the piston (7) and inlet plug (12).

5. Locate the piston spring (9) in the cylinder, then install the piston assembly and inlet plug. Secure the inlet plug and piston in the cylinder with the retaining ring (11).

6. Install the plunger spring (1) and plunger (2) into the cylinder.

7. Thread the assembly into the governor housing and tighten the jam nut (3).

8. Connect the air line to the cylinder.

THROTTLE STOP AIR CYLINDER (FIGURE 4)

The throttle stop air cylinder (fig. 4) is mounted on the engine governor cover and limits engine rpm when the fast idle air cylinder is energized.

The throttle stop air cylinder operates when the fast idle solenoid is energized to admit air to the cylinder. Applied air pressure causes the cylinder spring to extend the piston rod against the lever on the governor housing and limit engine rpm.

Cylinder Disassembly (Figure 9)

1. Disconnect the air line from the air cylinder.

2. Remove the two bolts which mount the cylinder on the governor cover, then remove the air cylinder.

3. Remove the two cap screws (6) and lockwashers (7) which secure the cylinder cap (4) onto the cylinder (1). Remove the cylinder cap from the piston rod (5).

4. Pull the piston rod assembly out of the cylinder.

5. Clean and inspect components.

Cylinder Assembly

1. Lubricate the piston cup (2) and bore in the cylinder (1).

2. Insert the piston and rod assembly into the cylinder bore, using care to prevent damage to the piston cup (2).

3. Install the cylinder cap (4) onto the cylinder (1). Use lockwashers (7) under the heads of cap screws (6) and tighten the screws to secure the cap on the cylinder.

4. Install the cylinder assembly on the governor cover. Connect the air line to the cylinder.

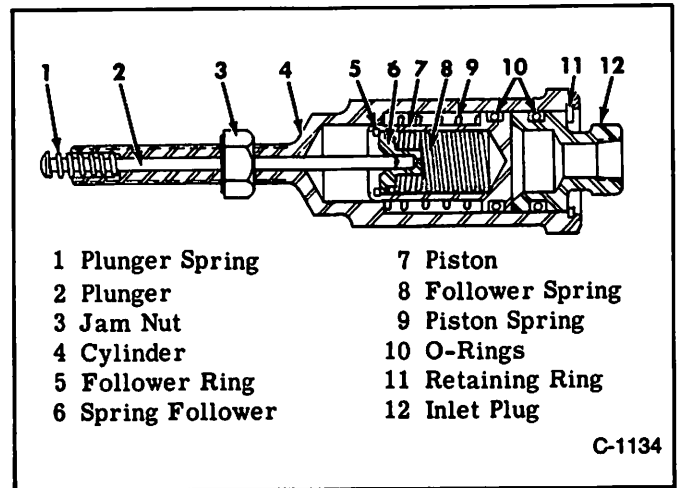


Figure 8—Fast Idle Air Cylinder

ENGINE SHUTDOWN AND EMERGENCY ENGINE SHUTDOWN SOLENOID VALVES

Refer to ENGINE ELECTRICAL (SEC. 6D) for information on these two solenoid valves.

ENGINE SHUTDOWN AIR CYLINDER

The engine shutdown air cylinder is mounted on the governor cover (fig. 4) with the piston lever aligned with the stop lever on the governor shaft. When the engine run switch is rotated to the "ENGINE STOP" position, the engine shutdown solenoid valve is de-energized and the spring within the valve moves the valve plunger to close the exhaust passage and open the air inlet passage within the valve. With air pressure applied to the shut-off air cylinder, the piston pushes the rod out against the governor stop lever and moves the engine injector racks to the "no-fuel" position, thereby stopping the engine.

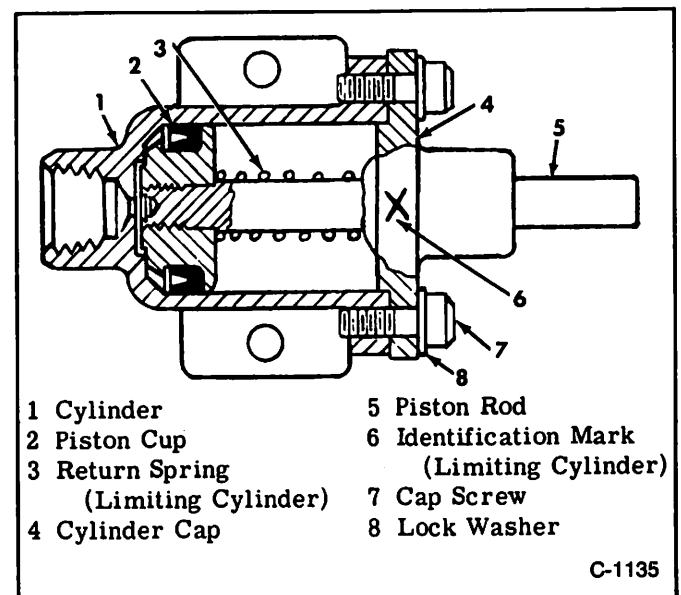


Figure 9—Throttle Stop Air Cylinder

Air Cylinder Disassembly (Figure 10)

1. Disconnect the air line from the air cylinder.
2. Remove the two socket-head screws which attach the air cylinder to the governor cover and remove the cylinder.
3. Remove the two screws and lockwashers (6 and 7) which secure the cap (4) on the cylinder (1). Remove the cap (4) from the piston rod.
4. Pull the piston and rod assembly out of the cylinder.
5. Clean and inspect all components for evidence of wear or damage.

Air Cylinder Assembly

1. Insert the piston and rod assembly into the cylinder bore using care to prevent damage to the piston cup (2).
2. Install the cap (4) onto the cylinder. Use lockwashers (8) under the heads of the cap screws (7) and tighten the screws to secure the cap (4) on the cylinder (1).
3. Install the air cylinder assembly on the governor cover and connect the air line to the cylinder.

TRANSMISSION MODULATOR VALVE

The modulator actuator is installed on right side of the transmission oil transfer plate (fig. 11). Pneumatic pressure variations initiated by throttle movement are transmitted to the modulator actuator. Increasing the throttle setting increases actuator air pressure thereby causing a flexible diaphragm and piston within the actuator to move outward against a pin in the modulator valve body. The pin positions the modulator valve against an opposing spring force to reduce modulator pressure. Reduced modulator pressure and governor pressure causes downshifting within the transmission.

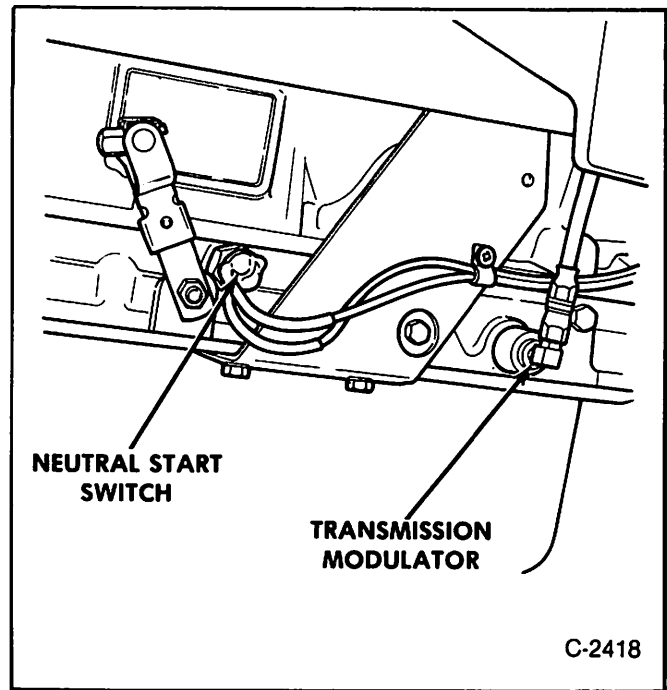


Figure 11—Transmission Modulator

Decreasing the throttle setting will reduce actuator force to less than opposing spring force thus increasing modulator pressure. Increased modulator pressure aids governor pressure in upshifting the transmission.

At the signal valves, modulator pressure (a function of throttle position) and governor pressure (a function of output speed) cause shift and lockup to occur in correct sequence and at the correct time.

The modulator actuator is non-adjustable and requires no maintenance. If the unit fails to function properly, it must be replaced.

FAST RESPONSE THROTTLE

Refer to AIR BRAKE VALVES AND RESERVOIRS (SEC. 5E) for assembly views and repair information on the TR-3 inversion valve and double check valve used in this circuit.

ACCELERATOR INTERLOCK

Refer to AIR BRAKE VALVES AND RESERVOIRS (SEC. 5E) for assembly views and repair information on the SV-1 synchro valve and the TR-3 inversion valve which are connected with the brake interlock cluster to render the accelerator treadle inoperative whenever the entrance and exit doors are in operation.

PRESSURE PROTECTION VALVE AND AIR RESERVOIRS

Refer to AIR BRAKE VALVES AND RESERVOIRS (SEC. 5E) for information relative to the PR-2 pressure protection valve and the air reservoirs that supply air to the throttle control air system.

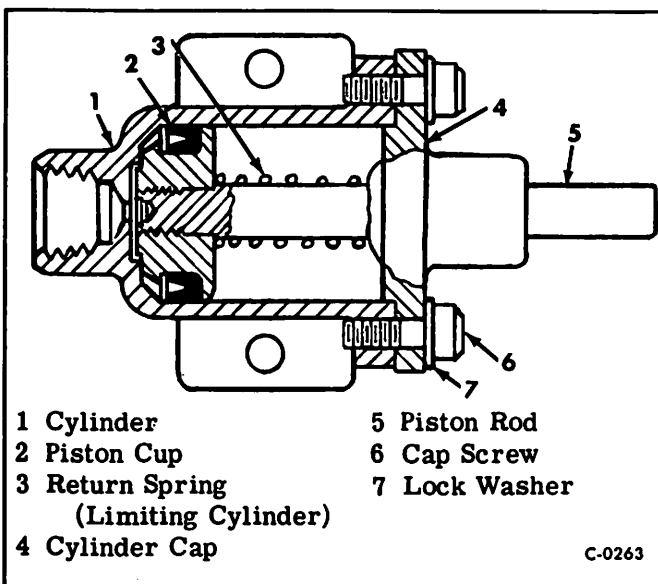


Figure 10—Engine Shutdown Air Cylinder

COMPONENT SPECIFICATIONS

THROTTLE STOP AIR CYLINDER

GM Part No.2425891
VendorA. Schrader's Son
Model3351 SP 50515
Cylinder Bore1 in. (2.5 cm)
Piston Stroke1 in. (2.5 cm)

ACCELERATOR CONTROL SLAVE CYLINDER ASSEMBLY

GM Part No.2065100
VendorWilliams Air Controls
ModelWF 642 F2
Piston Area3.14 sq. in. (20.3 cm²)
Cylinder Stroke5 in. (1.3 cm)
Pressure Range0-60 psi (0-413.7 kPa)
Maximum Operating Pressure150 psi (1034.2 kPa)

ENGINE SHUT-DOWN AIR CYLINDER ASSEMBLY

GM Part No.688285
VendorScovill Schrader Division
Model3351 SP 13
Cylinder Bore1 in. (2.5 cm)
Piston Stroke1 in. (2.5 cm)

ACCELERATOR TREADLE VALVE

GM Part No.2005252
VendorWilliams Air Controls
ModelWM 476 F100
Regulated Delivery Pressure0-60 psi (0-413.7 kPa)
Maximum Operating Pressure150 psi (1034.2 kPa)

TRANSMISSION MODULATION VALVE

GM Part No.2033028
VendorWilliams Air Controls
ModelWM 1775
Pressure Range0-60 psi (0-413.7 kPa)

COMPONENT SPECIFICATIONS (Cont'd)

FAST RESPONSE THROTTLE INVERSION VALVE

GM Part No.2017103
VendorBendix Westinghouse
Model281318
TypeTR-3
Inlet Opens (Descending Pressure)55 psi (379.2 kPa)
Exhaust Opens (Ascending Pressure)70 psi (482 kPa)

FAST RESPONSE THROTTLE DOUBLE CHECK VALVE

GM Part Number2485247
VendorBendix Westinghouse
Model278617
TypeDC-4

FAST IDLE SOLENOID VALVE AND ENGINE SHUT-DOWN SOLENOID VALVE

GM Part Number2005317
VendorSkinner
ModelC4C-170
Voltage24 VDC
Wattage8 Watts
Rated PSI150 psi (1045 kPa)
Operating Positions:
 Port 1Normally Closed
 Port 2Common
 Port 3Normally Open

ACCELERATOR INTERLOCK SYNCHRO VALVE

GM Part Number718458
VendorBendix Westinghouse
Model282472
TypeSV-1

ACCELERATOR INTERLOCK INVERSION VALVE

GM Part Number3902813
VendorBendix Westinghouse
Model280758
TypeTR-3