

Ether Start Fluid Cylinder Replacement

Replacement (See Fig. 1)

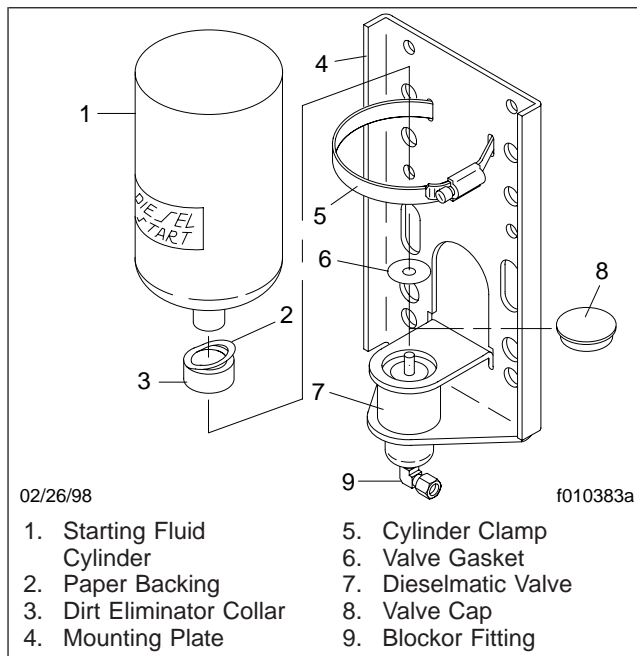


Fig. 1, KBI Ether Start System

1. Park the vehicle, apply the parking brakes, and chock the tires.
2. Tilt the hood.

⚠ WARNING

Service starting fluid systems only in a well-ventilated area away from sparks and open flames. The ethyl ether in these systems is flammable and toxic. Wear protective gloves and glasses, and avoid breathing ether fumes. Failure to take these precautions could result in personal injury or property damage.

3. Remove the old cylinder.
 - 3.1 Clean all dirt from the neck of the cylinder and the top of the Dieselmatic® valve before removing the cylinder.
 - 3.2 Loosen the cylinder clamp.
 - 3.3 Pry the dirt eliminator collar off the neck of the cylinder.
 - 3.4 Unscrew the cylinder from the Dieselmatic valve.

NOTE: If not replacing the cylinder immediately, place the valve cap in the valve to prevent dirt or other debris from entering the system.

4. Remove the old dirt eliminator collar from the valve assembly.
5. Replace the Dieselmatic valve gasket. Spread the new gasket with a light film of clean oil.
6. Place a new dirt eliminator collar, adhesive-side up, on the valve assembly. Peel off the collar's paper backing to expose the adhesive.
7. Install the new cylinder.
 - 7.1 Place the new cylinder into the Dieselmatic valve and hand tighten it firmly.
 - 7.2 Slide the dirt eliminator collar up so it sticks to the cylinder.
 - 7.3 Tighten the clamp around the cylinder 60 lbf-in (680 N-cm).
8. If the ambient temperature is below 40°F (4°C), test the starting fuel system.
9. Lower the hood, and remove the chocks from the tires.

Troubleshooting

Use the following procedures to check for most common problems that may prevent starting fluid delivery.

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EMPTY FLUID CYLINDER (See Fig. 1)

1. Remove the old cylinder.
 - 1.1 Clean all dirt from the neck of the cylinder and the top of the Dieselmatic® valve before removing the cylinder.
 - 1.2 Loosen the cylinder clamp.

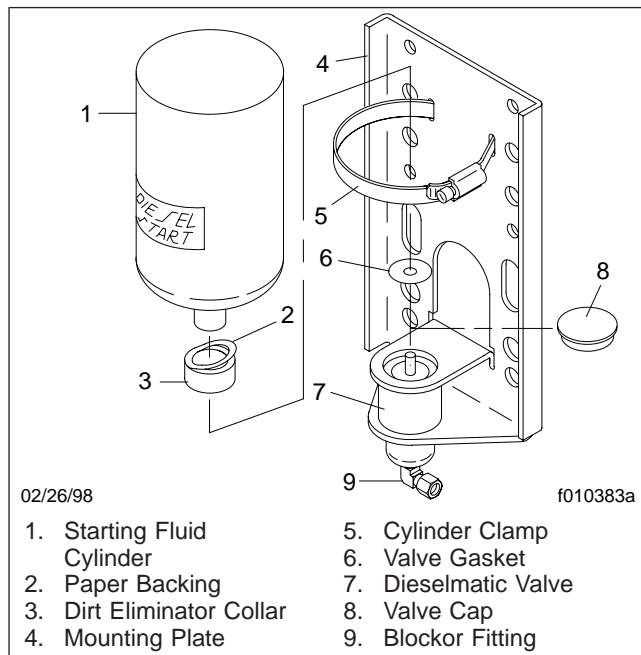


Fig. 1, KBI Ether Start System

- 1.3 Pry the dirt eliminator collar off the neck of the cylinder.

- 1.4 Unscrew the cylinder from the Dieselmatic valve.
 - 1.5 Remove the cylinder from the mounting plate. Cover the top of the valve after the cylinder is removed.
 - 1.6 Remove the old dirt eliminator collar from the valve assembly.
2. Weigh the cylinder to see if it is empty. See **Table 1** for the weight of each cylinder size.

Ether Cylinder Weights		
Cylinder Size: oz (g)	Weight	
	Empty: oz (g)	Full: oz (g)
21 (595)	16 (455)	37 (1050)
18 (510)	15 (425)	33 (935)
8 (225)	10 (285)	18 (510)

Table 1, Ether Cylinder Weights

3. Replace the Dieselmatic valve gasket. Spread the new gasket with a light film of clean oil.
4. Check that the fluid cylinder has at least 120 psi pressure at 68°F (20°C).
5. If the cylinder is good, install it; if not, replace it.
 - 5.1 Place a new dirt eliminator collar, adhesive-side up, on the valve assembly. Peel off the collar's paper backing to expose the adhesive.
 - 5.2 Place the new cylinder into the Dieselmatic valve and hand-tighten it firmly.
 - 5.3 Slide the dirt eliminator collar up so it sticks to the cylinder.
 - 5.4 Tighten the clamp around the cylinder 60 lbf-in (680 N-cm).

ELECTRICAL PROBLEMS

1. Check for a blown fuse, and for loose wiring connections, shorts, and broken wires.
2. Check that the black ground wire from the valve assembly is connected to the engine temperature sensor, and that the ground wire from the sensor is connected to a good ground.

Troubleshooting

3. Check that the second wire from the valve assembly is connected to the "M" terminal of the starter.

WARNING

When testing the starting fluid system, wear protective gloves and glasses, and spray the vaporized ether into a container. Failure to do so could result in personal injury.

4. Test the valve.
 - 4.1 Remove the starting fluid cylinder.
 - 4.2 If the ambient air temperature is over 40°F (4°C), remove the black ground wire from the engine temperature sensor, and ground it.
 - 4.3 Crank the starter, and look for the valve plunger (see Fig. 2) to move up and stay up while the starter is cranked.

CAUTION

Do this test only two times. Activating the starting fluid system in this manner more than twice could result in damage to the system.

5. If the plunger does not move, disconnect both valve assembly wires and momentarily touch the leads across battery terminals. If the valve plunger still does not move up, replace the valve.
6. If the valve operates correctly, check the engine temperature sensor.
 - 6.1 Connect the appropriate wire to the "M" terminal of the starter.
 - 6.2 Remove the sensor from the engine water jacket, and chill it to below freezing for at least ten minutes.
 - 6.3 Install the sensor, grounding it at a good ground.
 - 6.4 Connect the black ground wire from the valve assembly to the sensor.
 - 6.5 Crank the engine, and look for the valve plunger to move up and stay up while the starter is cranked.

CAUTION

Do this test only two times. Activating the starting fluid system in this manner more than twice could result in damage to the system.

7. If the plunger does not move, replace the sensor.

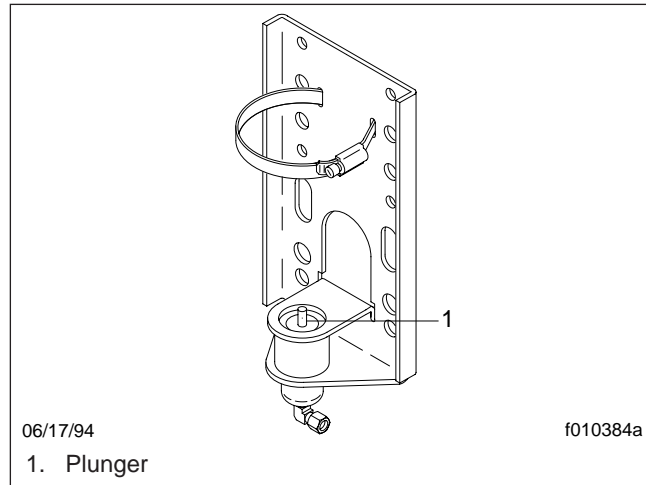


Fig. 2, Valve Plunger

CLOGGED ETHER NOZZLE

1. Disconnect the ether tubing from the nozzle, and cover the nozzle fitting.
2. Disconnect the black ground wire from the engine temperature sensor, and ground it.

WARNING

When testing the starting fluid system, wear protective gloves and glasses, and spray the vaporized ether into a container. Failure to do so could result in personal injury.

3. Start the engine, and look for ether to spray from the tubing.

CAUTION

Do this test only two times. Activating the starting fluid system in this manner more than twice could result in damage to the system.

4. If no ether sprays from the tubing, disconnect the tubing at the Blockor® fitting in the base of the cylinder assembly. See Fig. 1.

5. Start the engine, and look for ether to spray from the Blockor fitting in the base of the cylinder assembly.



CAUTION

Do this test only two times. Activating the starting fluid system in this manner more than twice could result in damage to the system.

6. If ether sprays from the fitting, but not from the tubing, check for kinks or blockages in the ether tubing and the nozzle. Repair or replace the tubing and nozzle, as needed.

If no ether sprays from the fitting or tubing, check the Blockor fitting for blockages. Repair or replace the fitting, as needed.

Description	Torque: lbf-in (N·cm)
Cylinder Clamp	60 (680)

Table 1, Ether System Torques

General Information

Jacobs engine brake housings are installed on the engine rocker housings. Model 760A (used on Detroit Diesel Series 60 11.1-liter engines) and Model 765 (used on Detroit Diesel Series 60 12.7-liter engines) have three engine brake housings that operate two cylinders each. Each engine brake housing has a solenoid valve, control valves, ball check valves, master pistons, and slave pistons. See [Fig. 1](#).

Engine brake controls consist of: dash switches and a clutch switch. The clutch switch is mounted under the dash. The engine brake is activated when the dash switches are on and the clutch and throttle pedals are released. The dash switches enable the driver to operate the engine brake partially or fully.

The engine brake can be operated at one-third, two-thirds, or full capacity (two, four, or six cylinders).

When activated, the engine brake converts a power-producing diesel engine to a power-absorbing air compressor. This is accomplished by motion transfer through a master-slave piston arrangement which opens the engine cylinder exhaust valves near the top of the normal compression stroke, releasing the compressed cylinder charge to exhaust. The blowdown of compressed air to atmospheric pressure prevents the return of energy to the engine piston on the expansion (power) stroke. This results in a net energy loss because the work done in compressing the cylinder charge is not returned during the expansion process. Exhaust blowdown occurs as follows (see [Fig. 2](#)):

1. Activating the engine brake energizes the solenoid valve, allowing engine oil to flow under pressure through the control valve to both the master piston and the slave piston.
2. Oil pressure causes the master piston to move down, coming to rest on the injector rocker arm roller.
3. The injector rocker arm begins upward travel (as in the normal injection cycle) forcing the master piston upward and creating a high-pressure oil flow to the slave piston. The ball check valve in the control valve holds the high-pressure oil in the master-slave piston system.
4. When the engine piston is near top dead center, the slave piston moves down under the influence of the high-pressure oil flow. This momentarily opens the exhaust valves, releasing compressed cylinder air to the exhaust manifold.
5. At the bottom of its stroke the slave piston separates from the valve in the slave piston reset adjusting screw, allowing high-pressure oil to flow into the accumulator. This reduces the pressure in the high-pressure circuit, permitting the slave piston to retract and the exhaust valves to close in preparation for the normal exhaust valve cycle. The oil pressure reserved in the accumulator ensures that the hydraulic circuit is fully charged for the next cycle.
6. Compressed air escapes to the atmosphere completing a compression braking cycle.

01.02

Jacobs Engine Brake, Models 760A and 765

General Information

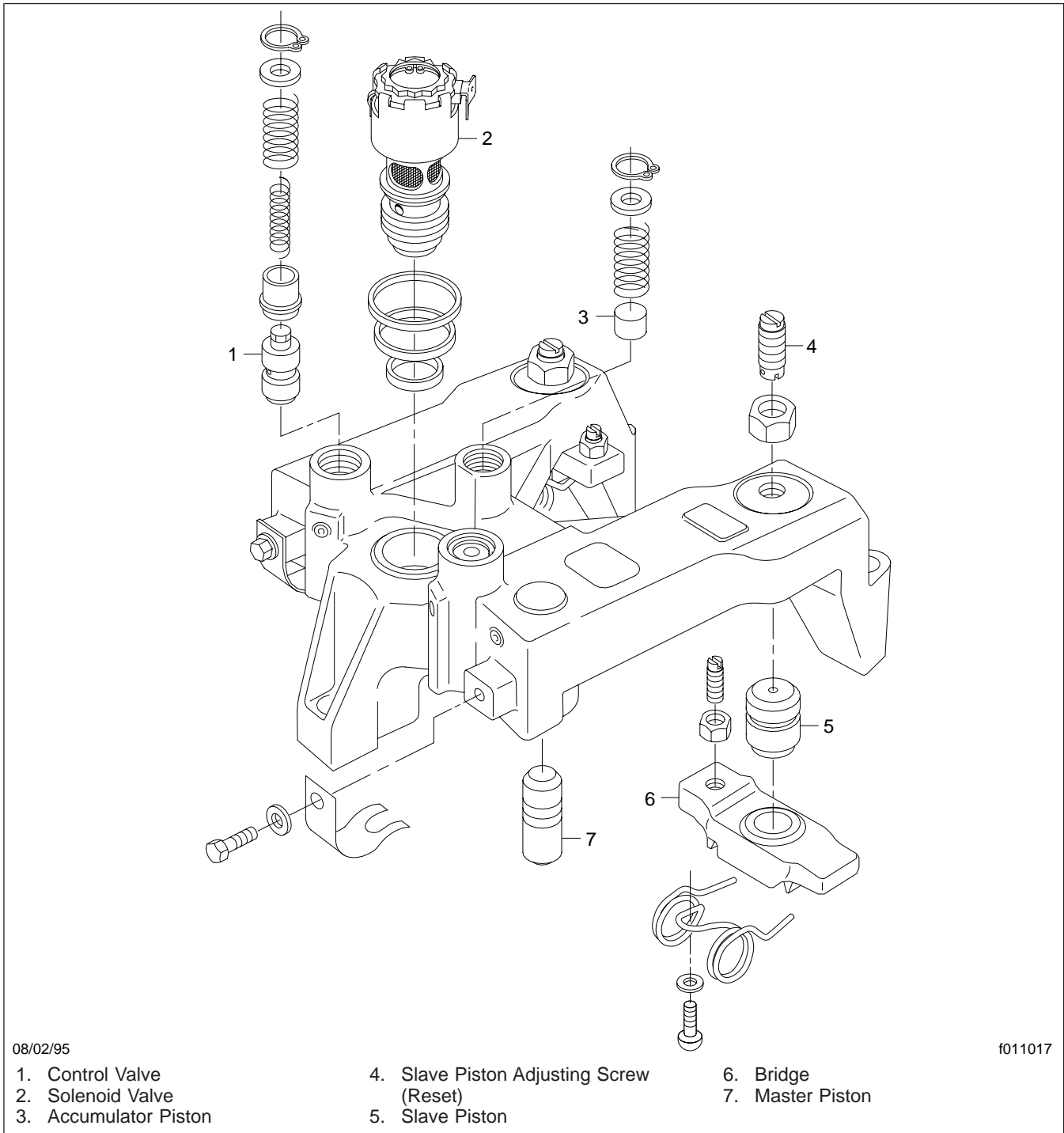


Fig. 1, Model 760A or 765 Housing Assembly (exploded view)

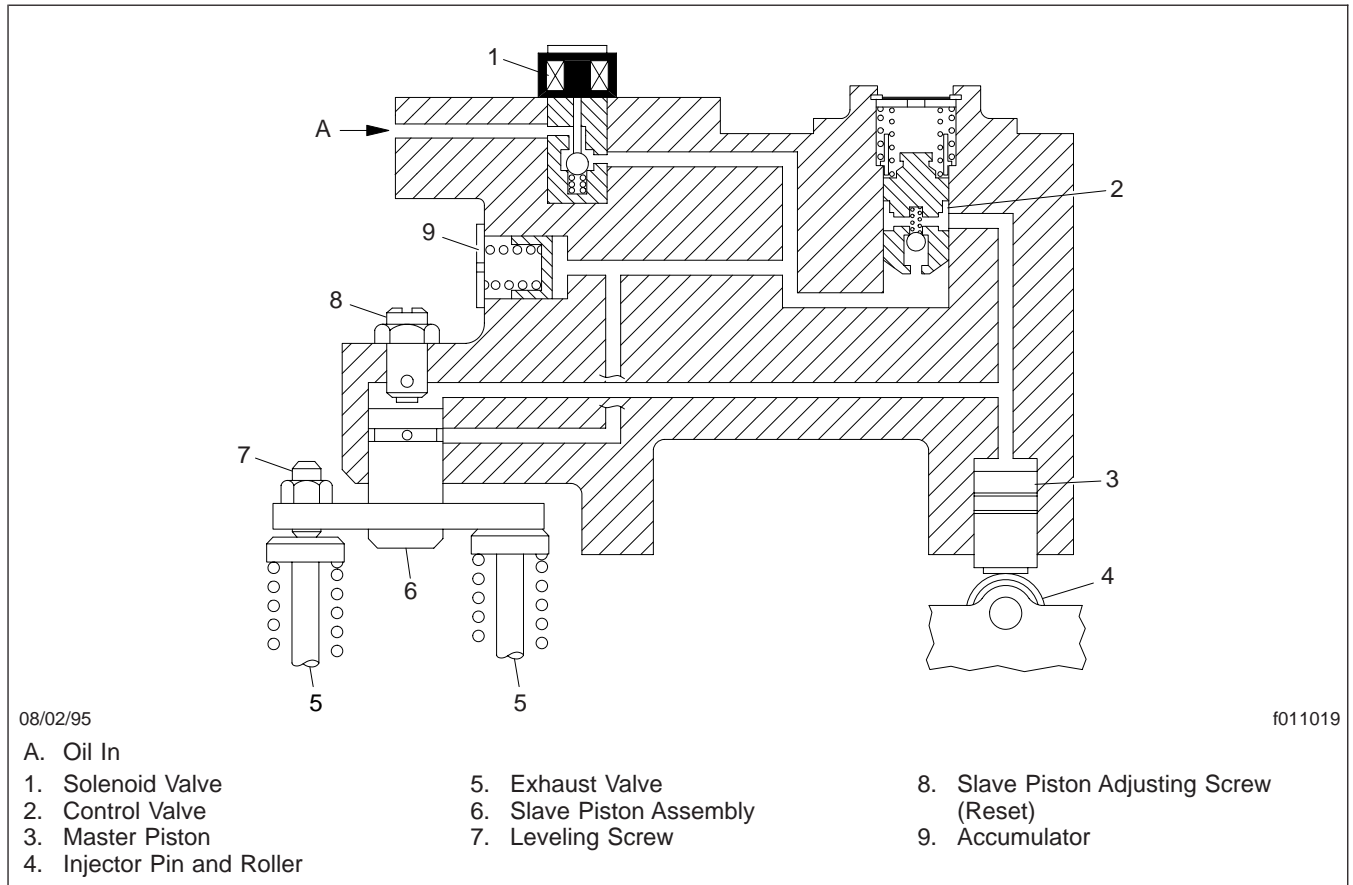


Fig. 2, Cross-Section View of Engine Brake Housing

Accumulator Removal, Inspection, and Installation

Removal

⚠ WARNING

The accumulator spring is under strong compression. Be careful when removing the retaining ring and cover. Wear safety glasses. If the spring is accidentally released, personal injury could result.

1. Remove the engine brake housing from the vehicle. For instructions, refer to [Subject 130](#).
2. Push down on the accumulator cover and remove the retaining ring. See [Fig. 1](#).

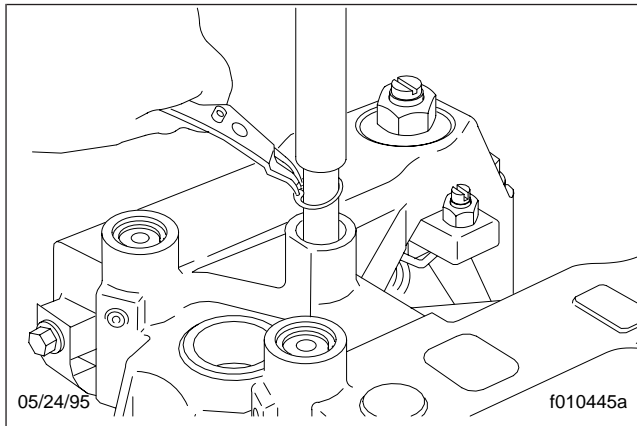


Fig. 1, Remove the Retaining Ring

3. Remove the cover and spring. See [Fig. 2](#).

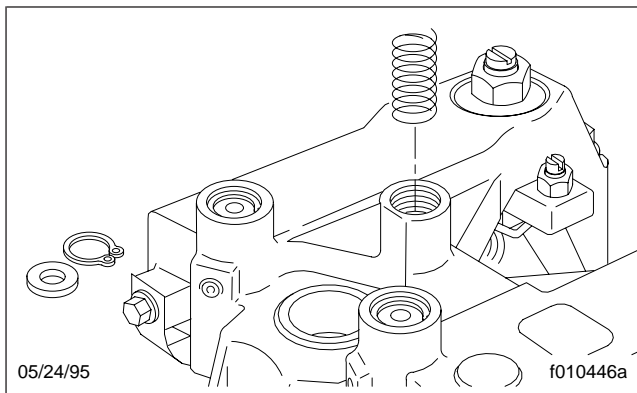


Fig. 2, Remove the Spring

4. Using a magnet, remove the piston from the accumulator bore. See [Fig. 3](#).

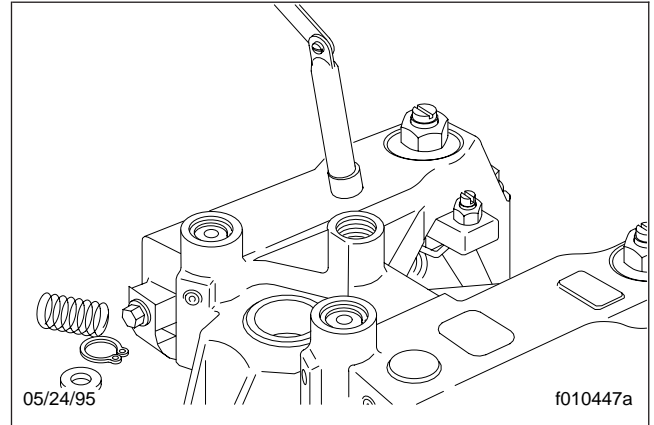


Fig. 3, Remove the Piston

Inspection

Inspect the parts for wear and damage. Replace parts as needed.

Installation

1. Install the piston, spring, cover, and retaining ring.
2. Install the engine brake housing. For instructions, refer to [Subject 130](#).

Solenoid Valve Removal and Installation

Removal

1. Park the vehicle, apply the parking brakes, and chock the tires.
2. Disconnect the batteries.
3. Tilt the hood.
4. Wipe the engine brake housing area clean, and remove the valve cover. For instructions, refer to the engine manufacturer's service literature.
5. Disconnect the solenoid harness.
6. Using a 7/8-inch socket and extension, unscrew the solenoid valve. See Fig. 1.

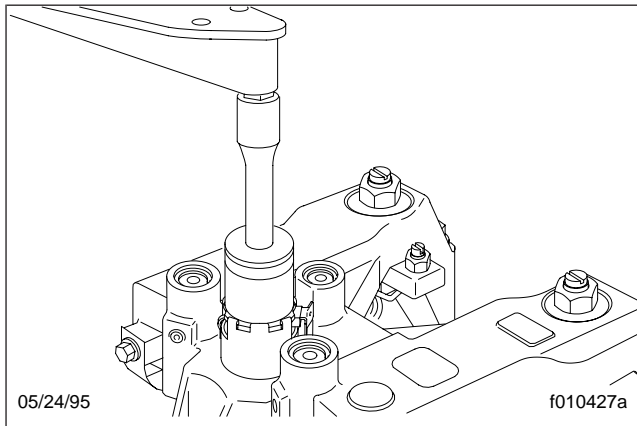


Fig. 1, Unscrew the Solenoid Valve

CAUTION

Do not disassemble or tamper with the solenoid valve. Engine damage could result.

7. Remove and discard the three rubber seal rings. See Fig. 2. If the lower ring stays in the bottom of the solenoid bore in the housing, remove it with a piece of wire.
8. Wash out the solenoid valve with a cleaning solvent that meets OSHA guidelines. Use a brush to clean the oil screen.
9. Dry the valve with compressed air.
10. Using clean paper towels, clean out the solenoid valve bore in the housing. Do not use rags, since they can leave lint and residue, which can plug the oil passageways.

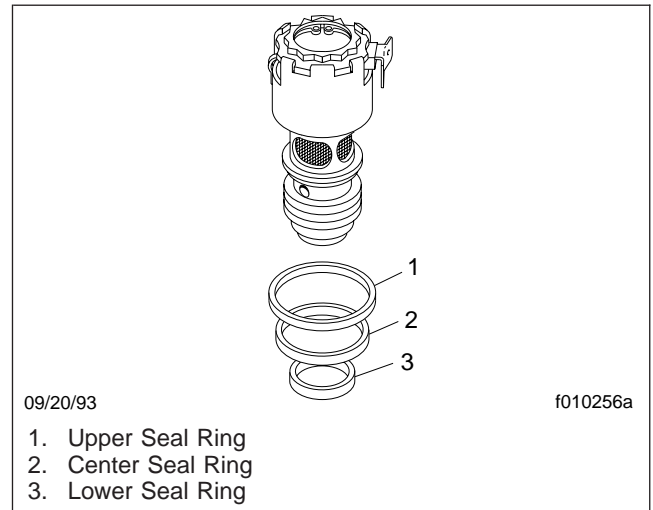


Fig. 2, Solenoid Seal Rings

Installation

1. Coat a new set of solenoid seal rings with clean lubricating oil. Install the upper and middle seal rings on the solenoid body and the lower seal ring into the bottom of the solenoid bore in the housing. See Fig. 3.

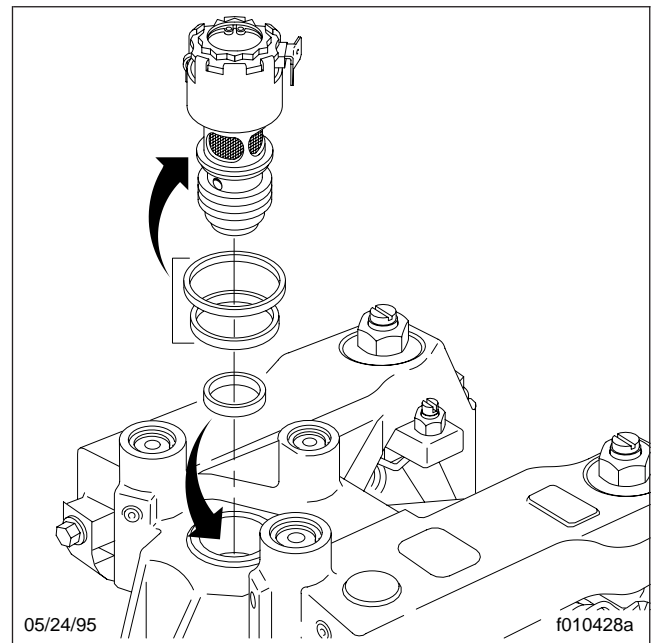


Fig. 3, Install the Seal Rings

Solenoid Valve Removal and Installation

2. Make sure the seals are seated properly and not twisted. Carefully screw the solenoid into the housing without unseating the seals.
3. Tighten the valve to the torque shown on the top of the solenoid.
4. Connect the solenoid harness.
5. Install the valve cover. For instructions, refer to the engine manufacturer's service literature.
6. Close the hood, connect the batteries, and remove the chocks from the tires.

Control Valve Removal, Inspection, and Installation

Removal

WARNING

Never remove any engine brake component with the engine running. Hot oil spray may cause personal injury.

1. Park the vehicle, apply the parking brakes, and chock the tires.
2. Disconnect the batteries.
3. Tilt the hood.
4. Wipe the engine brake housing area clean, and remove the valve cover. For instructions, refer to the engine manufacturer's service literature.
5. Press down on the control valve cover to relieve spring pressure. See **Fig. 1**.

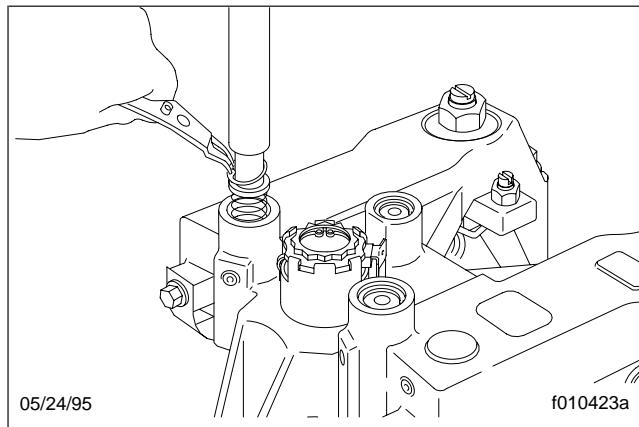


Fig. 1, Press the Control Valve Cover

6. Remove the retaining ring using retaining ring pliers.
7. Slowly remove the cover until the spring pressure is released; then, remove the two control valve springs and the collar. See **Fig. 2**.
8. Using needle nose pliers, reach into the housing bore and grasp the stem of the control valve. Remove the control valve. See **Fig. 3**.

Inspection

1. Wash the control valves with a cleaning solvent that meets OSHA guidelines.

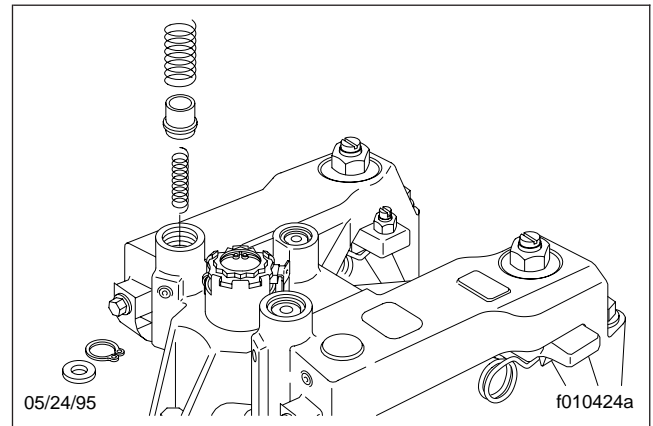


Fig. 2, Remove the Springs and the Collar

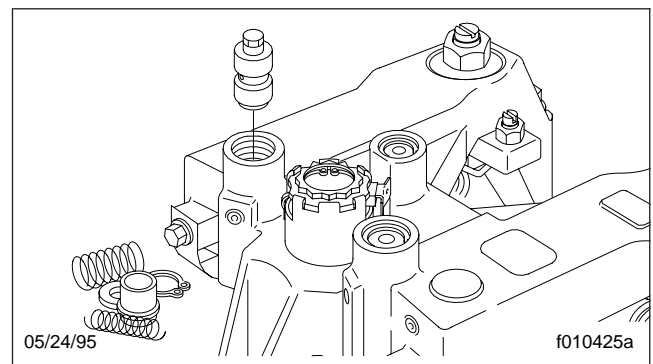


Fig. 3, Remove the Control Valve

2. Push a wire through the hole in the base of the valve to make sure the ball check is free. The ball should lift with light pressure on the wire.
3. Dry the valve with compressed air and wipe it clean with a paper towel.
4. Using clean paper towels, thoroughly clean the control valve bore in the housing.
5. Dip the control valves in clean lubricating oil. Holding the valve by the stem, let the valve drop into its bore. If it binds or if the ball is stuck in the valve, replace the control valve.

Installation

IMPORTANT: Be sure to coat all parts with clean lubricating oil before installing them.

1. Install the control valve reversing the removal procedure.