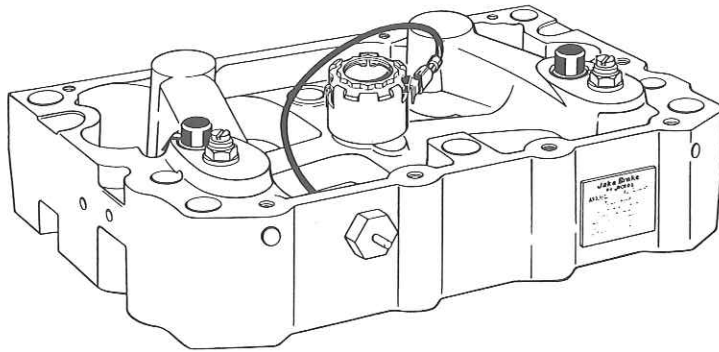




Installation Manual for Models 440 and 440A Engine Brakes



The Model 440 *Jake Brake*® engine retarder is designed for use on Cummins 91 N14 STC engines, and Cummins N14 CPL 1580 (N14-430E CELECT and N14-460E CELECT)

The Model 440A *Jake Brake* engine retarder is designed for use on the Cummins 91 N14 CELECT* engines.

*CELECT is a trademark of Cummins Engine Company

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**See Jacobs Driver's Manual
for proper engine brake
driver techniques**

The *Jake Brake* Retarder is a vehicle slowing device, not a vehicle stopping device. It is not a substitute for the service braking system. The vehicle's service brakes must be used to bring the vehicle to a complete stop.



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SAFETY PRECAUTIONS

The following symbols in this manual signal potentially dangerous conditions to the mechanic or equipment. Read this manual carefully. Know when these conditions can exist. Then take necessary steps to protect personnel as well as equipment.



This symbol warns of possible personal injury.



This symbol refers to possible equipment damage.

NOTE:

Indicates an operation, procedure or instruction that is important for correct service.

Fuels, electrical equipment, exhaust gases and moving engine parts present potential hazards that could result in personal injury. Take care when installing an engine brake. Always wear eye protection. Always use correct tools and proper procedures as outlined in this manual.

SECTION 1

TOOLS REQUIRED

1. 7/16 in. 12 point socket for housing hold-down capscrews
2. 0.023 in. *Jacobs* feeler gauge, P/N 017685

NOTE:

No engine conversion parts are required for Model 440 and 440A installations on N14 Cummins STC or CELECT engines.

SECTION 2

ENGINE PREPARATION

Remove the three rocker lever covers and gaskets. See Fig. 1. Save the gaskets.

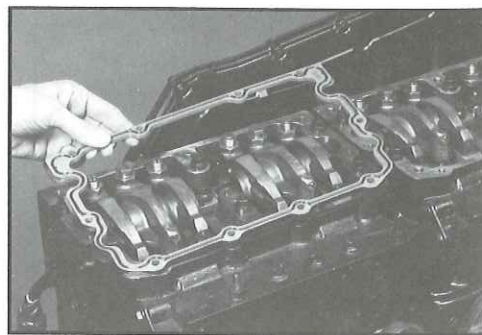


Fig. 1

Remove the pipe plug from the center web of each rocker lever housing (Fig. 2). This is the oil supply for the engine brake housing.

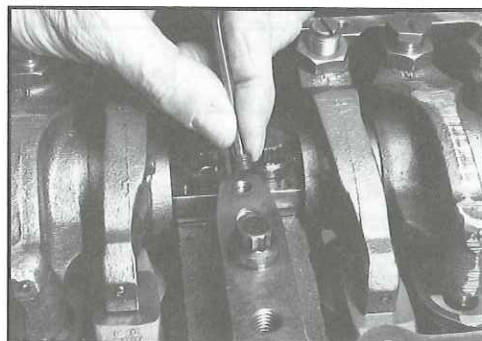


Fig. 2

Place a Jacobs gasket on each of the three rocker lever housings (Fig. 3). The part number on the gasket must be facing up.

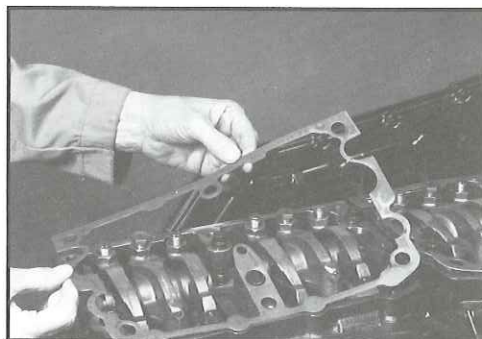


Fig. 3

SECTION 3

ENGINE BRAKE HOUSING INSTALLATION

Before installing the housings, back out the slave piston adjusting screws (Auto-Lash) until the slave piston bottoms in the housing bore (screw is loose).

Install the three engine brake housings on the rocker lever housings. Install the six capscrews with washers into each housing (Fig. 4). Tighten the capscrews in steps, following the pattern illustrated in Fig. 5. First tighten to 35 lbft. (48 N·m), then to 70 lbft. (95 N·m).



Fig. 4

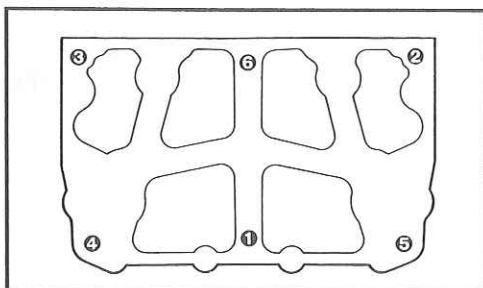


Fig. 5



Do not use power tools. Use of power tools may result in overtorquing of capscrews. Engine brake housing failure may result.

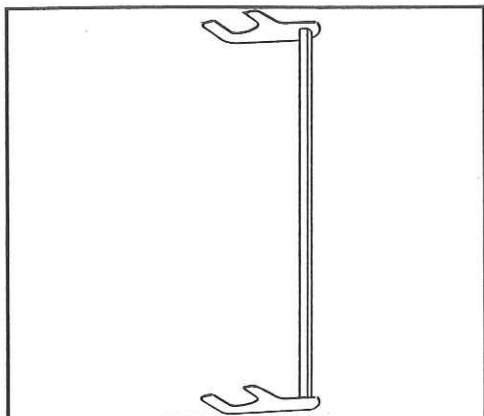


Fig. 6

CAUTION

Slave piston adjustment must be made with the feeler gauge positioned under both feet of the slave piston. Incorrect adjustment can cause engine damage.

SLAVE PISTON ADJUSTMENT

Adjust the slave piston clearance with the engine stopped and cold. Stabilized water temperature of 140° (60 °C) or below. Exhaust valves on the cylinder to be adjusted must be in the closed position.

The Jacobs feeler gauge, P/N 017685, has .023 in. feeler stock on both ends. One end can be used on cylinders 1, 3 and 5; the other end can be used for cylinders 2, 4 and 6. See Figs. 6 and 7.

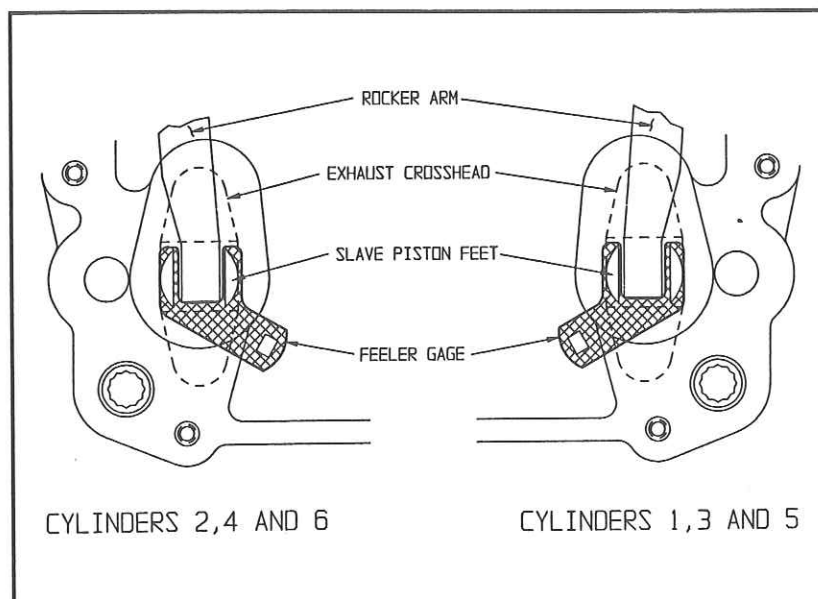


Fig. 7

On cylinders with the exhaust valves closed (crossheads loose), install one end of the feeler gauge under both feet of the slave piston. Turn slave piston adjusting screw (Auto-Lash) in clockwise (CW) until a slight drag is felt on the feeler gauge. Hold the adjusting screw and tighten the locknut to 25 lbft. (35 N·m).

Continue adjusting the remaining slave pistons where the exhaust valves are closed. Rotate the engine crankshaft about 180° to adjust the remaining slave pistons.

SECTION 4

ELECTRICAL SYSTEM INSTALLATION MODEL 440 - 91 N14 STC ENGINE

Dash Switch

Install the dash switches in a convenient location in the cab. Install receptacles at locations shown in wiring diagram furnished in the kit. See Fig. 8.

NOTE:

Vehicle OEM installed control system components may differ from Jacobs supplied parts

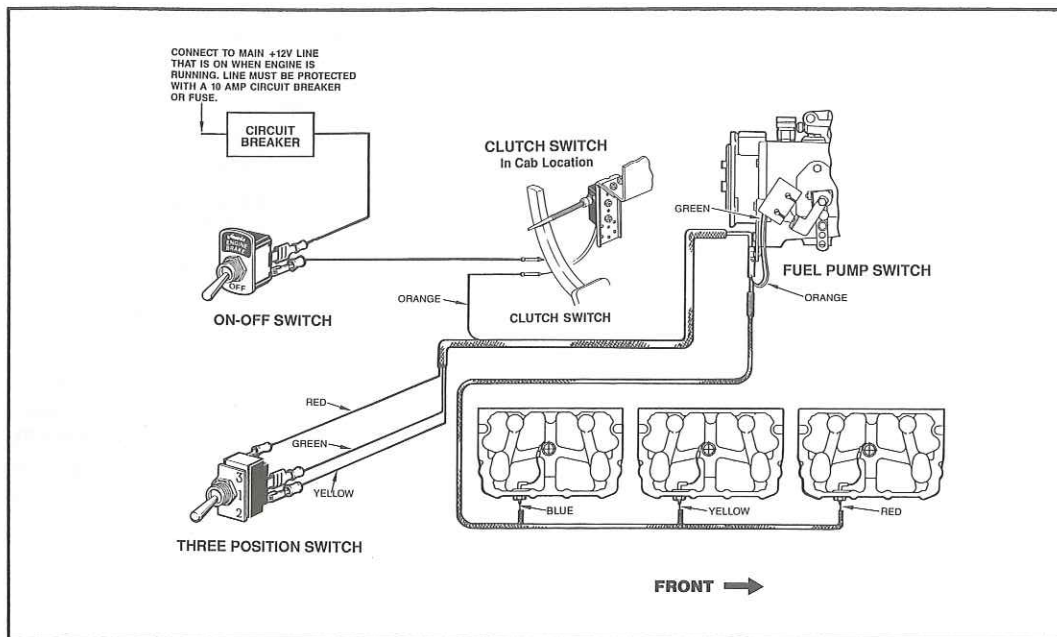


Fig. 8

Model 440 - 91 N14 STC Engine Wiring Diagram

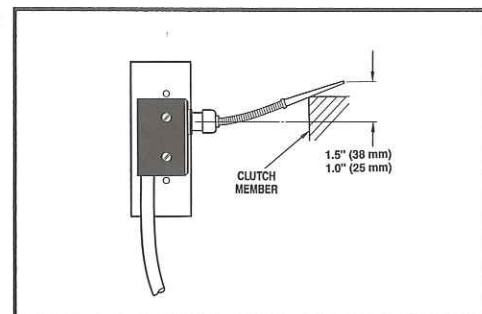
NOTE:

For CPL 1580, See Page 7

Clutch Switch

1. Mount the clutch switch in the most accessible location possible. Locations may include in cab under dash, under floor wheelwell location, or in the area of the clutch bell housing.
2. Install this switch with the switch actuator arm in contact with the clutch pedal arm or other clutch member (Fig. 9).
3. Adjust the switch by moving the switch along the mounting bracket. The actuator arm should be deflected 1.0 - 1.5 in. (25 - 38 mm), measured at the tip of the actuator, when the clutch pedal is in the up (clutch engaged) position.
4. Check installation by moving the clutch pedal. The switch should click in the freeplay motion of the clutch pedal before actual clutch disengagement takes place.
5. Cut wires to proper length and secure them with ties. Connect the wires, as shown in the wiring diagram (Fig. 8).

Fig. 9



Exceeding 1.5 in. deflection of the actuator arm may cause switch damage, resulting in engine brake malfunction.

Fuel Pump Switch

NOTE:

The fuel pump switch contacts are protected against arcing by a small diode connected between the load side switch terminal and ground (Fig. 10). The engine brake must be connected to the load side terminal. If the vehicle has a positive ground electrical system, reverse the direction of the diode.

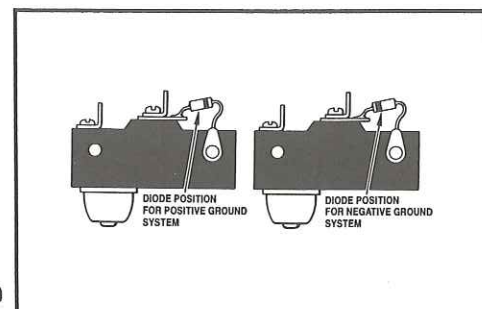


Fig. 10

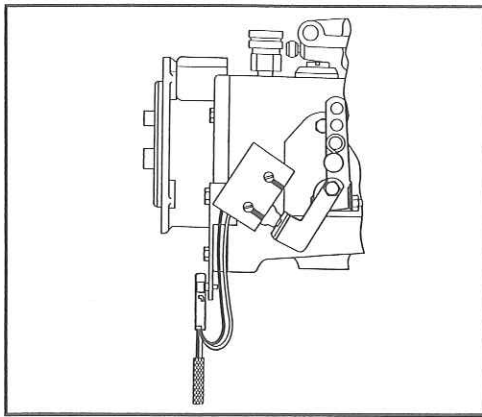


Fig. 11

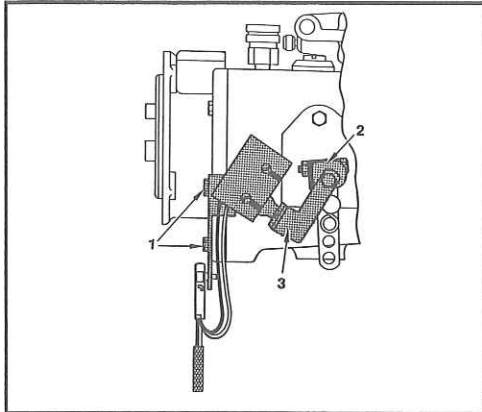


Fig. 12

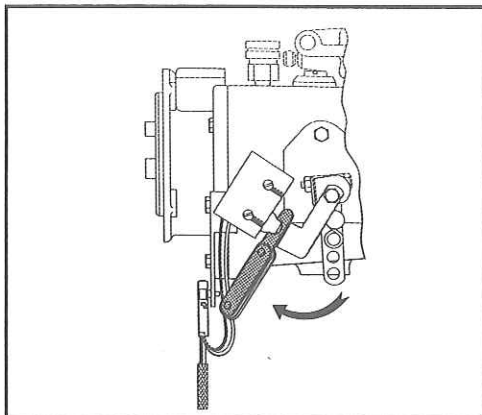


Fig. 13

1. The pump switch actuating arm can be installed on pumps that have the throttle lever in either the up (Fig. 11) or down (Fig. 12) position.

2. Refer to Fig. 12. Attach the switch bracket and harness assembly to the fuel pump housing with the two screw and washer assemblies (1). Torque the screws to 10 lbft. (14 N·m). Assemble the clamp (2) and actuating lever (3) to the throttle lever.

3. Move the throttle to the low idle position and insert a .050 in. (1.27 mm) feeler gauge between the switch plunger and actuating lever (Fig. 13). Push the switch lever against the switch plunger until the plunger bottoms. Tighten the capscrew to 7 lbft. (10 N·m)

WARNING

After installing the actuating arm, check the fuel pump throttle shaft to be sure the throttle pedal will move the shaft to the full fuel position. Failure to do so may result in restricted engine control. If restricted movement is found, correct the problem and readjust the

4. Route harnesses and connect to components as shown in Fig. 8. Remove protective covering from connector (4) in Fig. 12. Secure the connector to the switch mounting bracket by pressing the clip attached to the connector into hole at lower leg of bracket.

NOTE:

See parts manual for P/N information.

MODEL 440 - OPTIONAL CONTROLS FOR 91 N14 STC ENGINES

Foot Switch

The foot switch (Fig. 14) is installed on the cab floor within easy reach of the operator's left foot. After installation, light pressure on the top plate is all that is needed to operate the Jake Brake. The throttle switch remains in the system to ensure that fueling and engine braking do not occur at the same time.

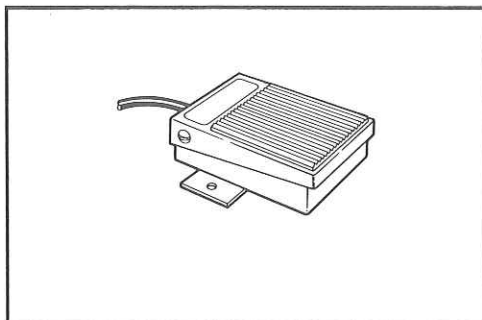


Fig. 14

Low Engine Speed Retarder Cut-off System

The low engine speed retarder cut-off system is a fully automatic engine brake control system that senses engine speed (RPM) and electrically deactivates the engine brake at speeds below approximately 900 RPM. The low speed cut-off feature provides added driver convenience in frequent stop/start operations. Additionally, the low speed cut-off feature is useful for operations where several drivers may operate one vehicle.

The kit consists of a low speed retarder cut-off module (Fig. 15) and wiring harnesses. The module can be mounted in the engine compartment on the firewall or other convenient location. Complete instructions are included in the kit.

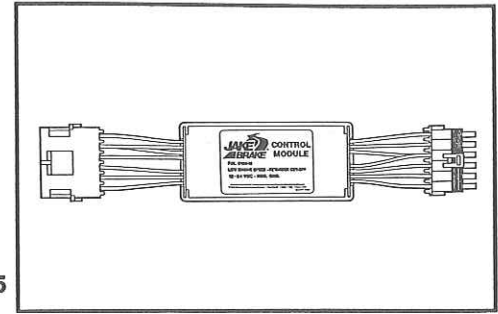


Fig. 15

NOTE:

The 91 N14 CELECT engine incorporates a low speed cut-off feature for the engine brake. Therefore the addition of the Jacobs low engine speed retarder cut-off system is not required on CELECT engines.

SECTION 5 ELECTRICAL SYSTEM INSTALLATION

MODEL 440A - 91 N14 CELECT ENGINE

CELECT style engines require an on off dash switch (Fig. 16) that has gold plated contacts. A relay is also required for these applications. Install the dash switches in a convenient location on the dashboard. The fuel pump switch or clutch switch is not required for application to CELECT engines.

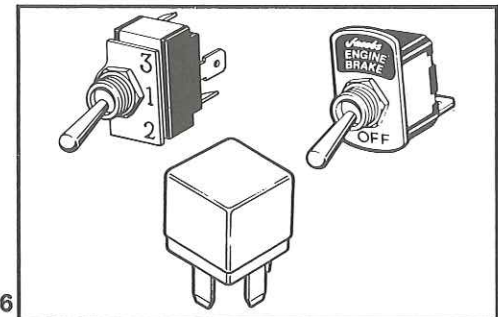


Fig. 16

Connect the wiring as shown in the diagram (Fig. 17).

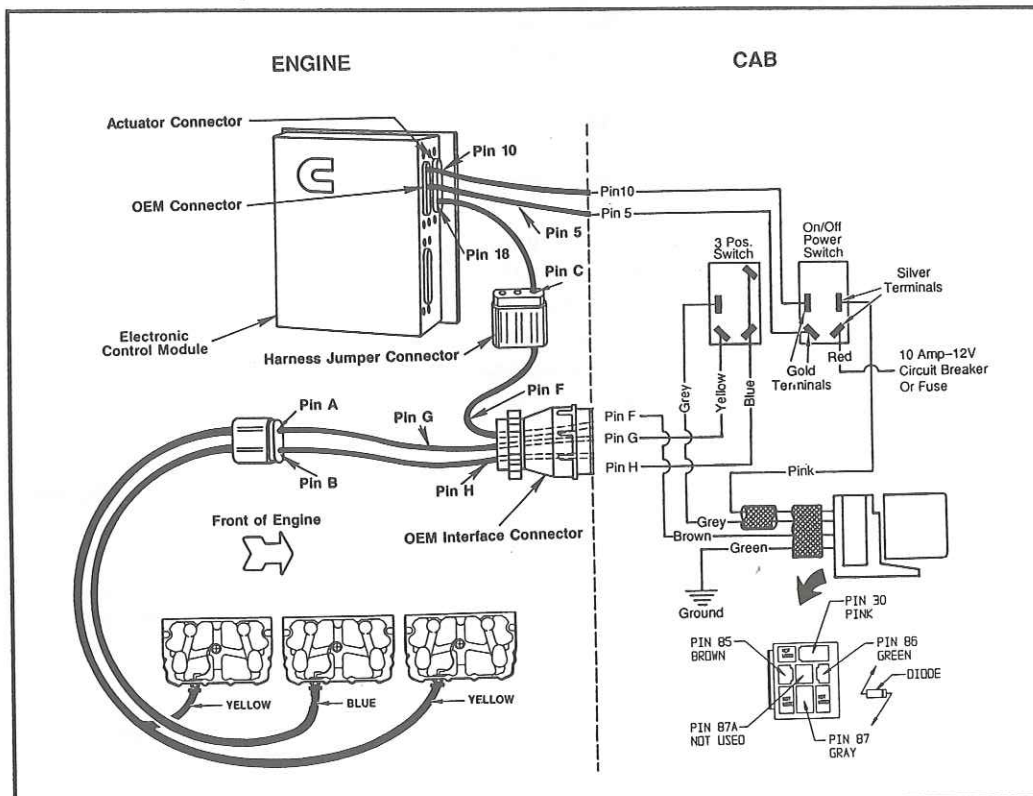


Fig. 17

Model 440A - 91 N14 CELECT Engine Wiring Diagram,
and Model 440 on CPL 1580

SECTION 6

ENGINE BRAKE OPERATIONAL CHECK

That completes the Jacobs Engine Brake installation. The following procedures should now be followed.

Connect control wires to electrical connector in engine brake housings (Fig. 18).

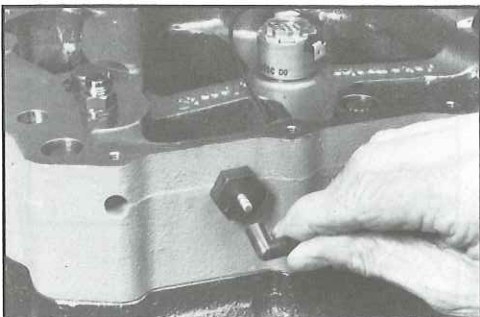


Fig. 18



Wear eye protection; do not expose your face over engine area. Take precautions to prevent oil leakage onto the engine. When engine is running and valve covers are removed, oil splashing in the engine brake area could cause personal injury.



Fig. 19

To bleed brake units and check their operation, start engine and allow to run 5 to 10 minutes. With the engine brake switch off, accelerate engine to approximately 1800 rpm. Release throttle and manually depress each solenoid armature (Fig. 19). Repeat this procedure five or six times to permit engine oil to fill the brake housings.

For Model 440A (CELECT Engines) and Model 440 on CPL 1580.

To check the electrical system on CELECT engines, leave engine running. Put selector switch in position 1 and turn the on/off switch to on. The CELECT low speed shut off prevents the engine brake from coming on at idle. Accelerate engine to approximately 1800 RPM and release the throttle. In position one, the center solenoid should operate. Repeat this procedure for position 2 and 3. In position 2 the front and rear solenoids should operate; in position 3, all three solenoids should operate. Shut down engine.

For Model 440 (STC Engines):

With the engine shut down, check electrical system by turning on ignition switch and the ON-OFF dash switch. Move the three-position dash switch from 1 to 2 and then 3. In position 1, only the center housing solenoid valve should activate. In position 2, only the front and rear housing solenoids should activate. In position 3, all three housing solenoids should activate.

Reinstall the Cummins rocker lever cover gaskets (Fig. 20), replace rocker covers and all previously removed parts. Torque capscrews to 9 lbft. (12 N•m).

Attach the warning decal in a convenient location on the dash.

Complete and mail the Engine Brake Warranty card.



Fig. 20

SECTION 7

ENGINE BRAKE MAINTENANCE

The Jacobs Engine Brake is a relatively trouble and maintenance-free device. However, inspections and part replacement will need to be made from time to time. Use the following procedures to keep the engine brake in top condition.

This section will cover how to properly remove, clean and reinstall engine brake components. Use an OSHA-approved cleaning solvent when washing parts. Be sure to coat parts with clean engine oil when reinstalling them.



Never remove any engine brake component with engine running. Personal injury may result.

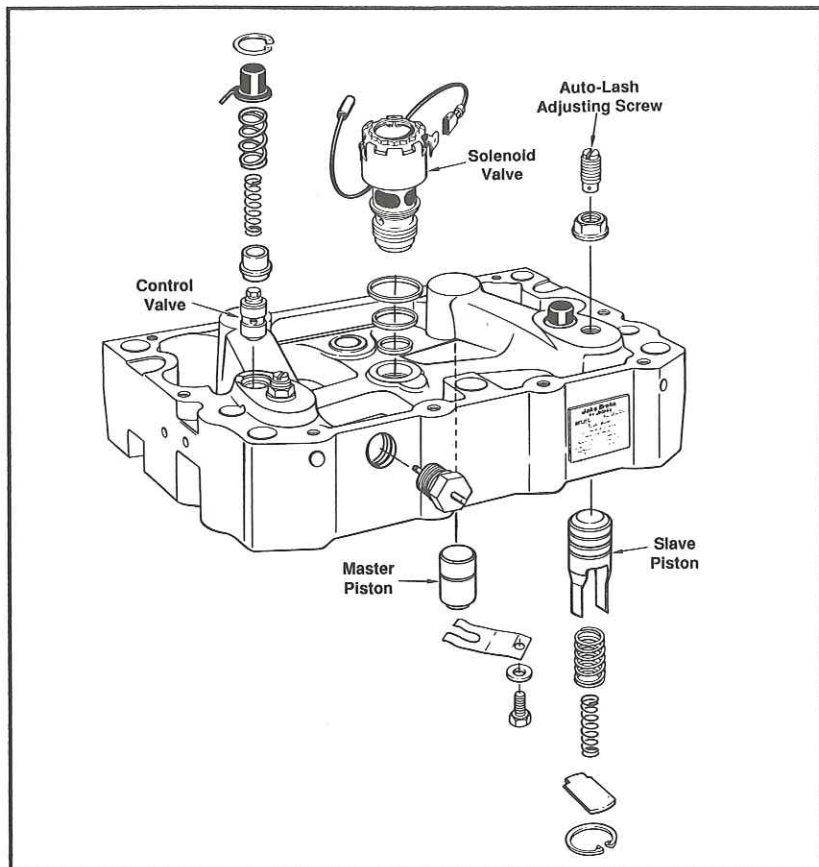


Fig. 21

Exploded View of Model 440/440A Engine Brake Housing Assy.



Remove control valve covers carefully. Control valve covers are under load from the control valve springs. Remove with care to avoid personal injury.

Control Valve

1. Press down on control valve cover to relieve spring pressure.
2. Remove retaining ring using retaining ring pliers, as shown in Fig 22.
3. Slowly remove the cover until spring pressure ceases, then remove the two control valve springs and collar.

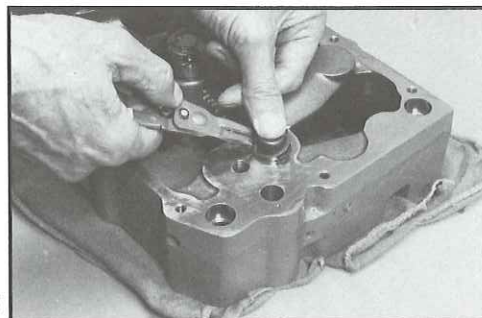


Fig. 22

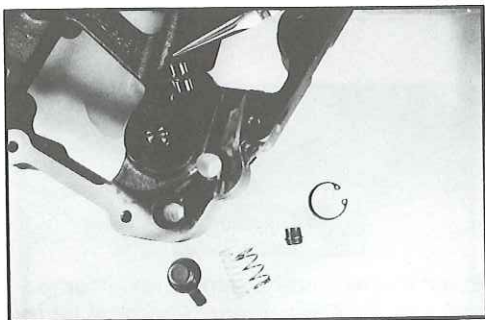


Fig. 23



Wear safety glasses.

Remove slave piston carefully. The slave piston is retained by springs that are under heavy compression. If these instructions are not followed and proper tools not used, the spring could be discharged with enough force to cause personal injury.

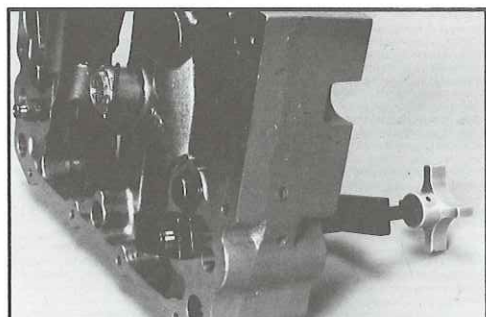


Fig. 24

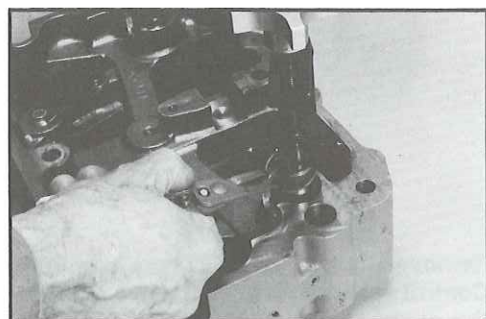


Fig. 25



Fig. 26

4. Using needle-nose pliers, remove the control valve (Fig. 23).
5. Wash the control valves with approved cleaning solvent. Push a wire through the hole in the base of the valve to the distance required to insure that the ball check is free. The ball should lift with light pressure on the wire. If the ball is stuck, replace the control valve. Dry the valve with compressed air and wipe clean with a paper towel.

Thoroughly clean the control valve bore in the housing, using clean paper towels. Dip the control valves in clean lube oil and replace the valve into its bore. If binding occurs, replace the control valve.

Slave Piston

1. Remove the locknut from the slave piston adjusting screw (Auto-Lash). Back out the adjusting screw until the slave piston is fully retracted (screw is loose).
2. Place the hole in the Jacobs slave piston tool over the slave piston adjusting screw (Fig. 24).
3. Turn the handle slowly until the retainer is depressed about 0.040" (1 mm) relieving pressure against the retaining ring.
4. Remove the retaining ring with retaining ring pliers (Fig. 25). Back out the holder until the springs are loose. Remove the tool.
5. Remove all components, ensuring there is no binding or burrs. Clean in an approved cleaning solvent, or replace as necessary.

NOTE:

Be sure components are reassembled in proper order. See Fig. 26.

6. Use clamp fixture to reinstall piston and springs. Be sure retaining ring is placed on the retainer before screwing the clampholder down over the slave piston.

7. Compress the slave piston springs down until the retainer is about 0.040 inch (1 mm) below the retaining ring groove. Reinstall the retaining ring. Be sure the retaining ring is fully seated in the groove. Rotate retaining ring about 90° away from slot in housing (Fig. 27).



Do not leave open portion of retaining ring aligned with opening in housing as this will permit the spring retainer to become loose during engine brake operation. Serious engine damage will result.

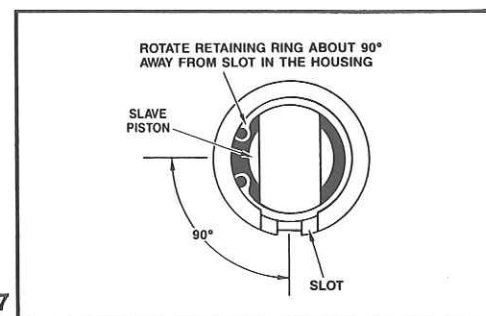


Fig. 27

8. Remove the clamp fixture slowly to insure proper seating of retaining ring.
9. Assemble adjusting screw (Auto-Lash) and nut, do not tighten.

Master Piston

1. Remove the screw, washer and master piston spring from the bottom of housing.
2. Remove master piston from its bore (Fig. 28) using needle nose pliers to initially pull the piston out, if necessary. If binding occurs, check for burrs or contaminants in lube oil.

Clean in an approved solvent. Inspect the hard face surface. Pitted, chipped, cracked or galled pistons should be replaced.

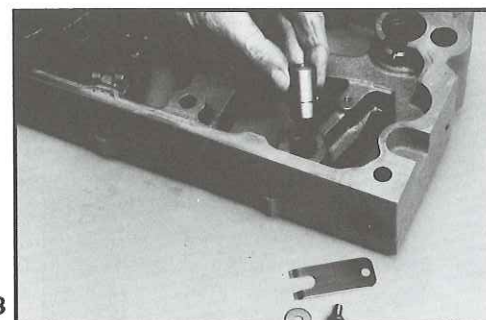


Fig. 28

NOTE:

If hard facing is damaged, inspect the corresponding rocker arm adjusting screws for excessive wear or pitting. Replace, if damaged.

3. Reassemble in reverse order. When tightening the capscrew, make certain the two spring tabs do not interfere with the sides of the master piston center raised portion. See Fig. 29. Torque the capscrew to 8 lbft. (11 N•m).

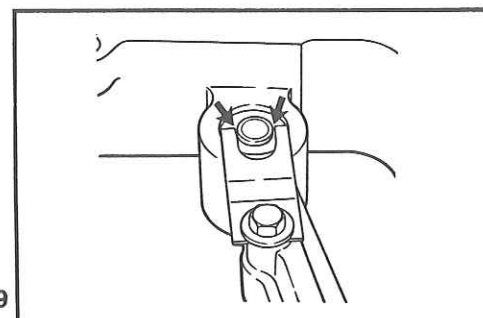


Fig. 29

NOTE:

The tabs should be equally spaced from the raised piston area.



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

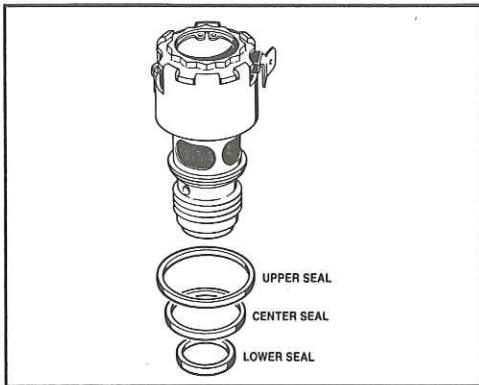


Fig. 30

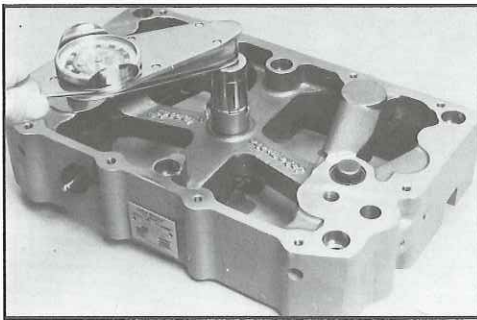


Fig. 31



Do not disassemble or tamper with the adjusting screw. Engine damage could result.

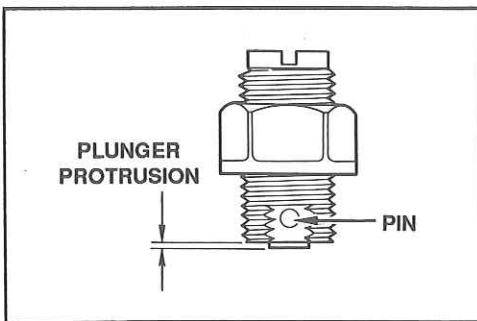


Fig. 32

Solenoid Valve

1. Disconnect solenoid harness. Using 7/8" socket and extension, unscrew solenoid valve.
2. Remove and discard the three rubber seal rings (Fig. 30). If the lower ring stays in the bottom of the housing solenoid bore, remove with a seal pick.
3. Wash out the solenoid valve with approved cleaning solvent. Use a brush to clean the oil screen. When clean, dry the valve with compressed air.

Clean out the solenoid valve bore in the housing. Use clean paper towels. Never use rags, as they may leave lint and residue which can plug the oil passageways.

4. Using new solenoid seal rings, coat them with clean lube oil. Install the upper and center seal ring on the solenoid body and the lower seal ring into the bottom of the solenoid bore in the housing.
5. Be sure the seals are seated properly and carefully screw the solenoid into housing without unseating the seals. Torque the valve to 60 lbin. (7 N·m). Be careful not to twist the seals while installing.

Auto-Lash® Adjusting Screw

1. Loosen the slave piston adjusting screw locknut and remove slave piston adjusting screw (Auto-Lash) from housing.
2. Inspect the adjusting screw. The plunger should protrude from the bottom of the screw (Fig. 32). Approximately 12 lbs. (53 N) force is required to move the plunger. Be sure the retaining pin is fully seated in its hole.
3. Clean in an approved cleaning solvent or replace the entire screw, as necessary. The screw assembly is not to be serviced in the field.