JAKE BRAKE®

Models C336/336A

INSTALLATION

Application and adjustment information is contained page 3 of this manual and in the Jacobs Application Information Guide, P/N 020995.

Information in this manual was current at the time of printing and is subject to change without notice or liability. Jacobs service literature should be consulted for additional applications and updated information.

Table of Contents

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.

⚠ WARNING

THIS SYMBOL WARNS OF POSSIBLE PERSONAL INJURY.

⚠ CAUTION

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 use correct tools and proper procedures as outlined in this manual.

⚠ WARNING

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.

Section 1: Introduction

Brake Identification

Each engine brake housing assembly has an identification tag showing model number, part number and installation location marked FRONT and REAR. The serial number is located above the identification tag.

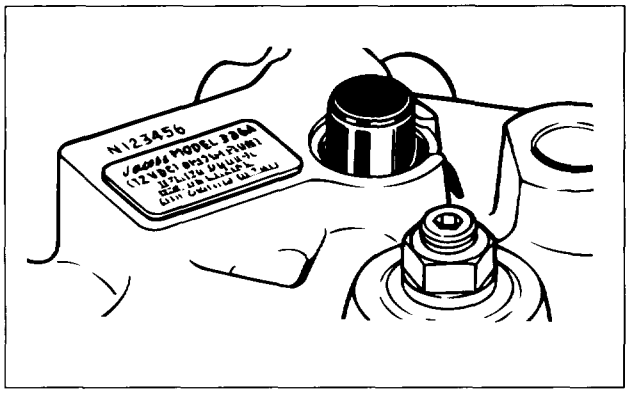


FIG. 1

Special Tools and Parts

- 3/8" flex socket, 1/4" drive (for spacer capscrews)

Jacobs

- Parts Manual, P/N 014895 (for replacement parts information)
- Slave piston lash adjusting gage, P/N 018989, **336A only**
- Slave piston lash adjusting gage, P/N 014763, **C336 only**

Caterpillar

- 3306 Engine Maintenance Manual
- Rocker Bracket O-ring seal, Caterpillar P/N 5P5598
- Valve cover gasket, Caterpillar P/N 8S1605
- Rear rocker bracket, Caterpillar P/N 7C7011 (required for direct injection engines with serial number prior to 63Z05471; see note on page 5)
- 1/2" Exhuast push tubes, Caterpillar P/N 118-9719 (required on 9TL and 7RJ 3306 Engines with Model 336A engine brake installations. These push tubes are identified by a red stripe.)

Recommended Torque Values

Jacobs Parts

Spherical locknuts	25 lb.-ft. (35 N•m)
Cover spacer capscrews	15 lb.-ft. (20 N•m)
Valve cover capscrews	13 lb.-ft. (18 N•m)
Housing mounting capscrews (see manual for torquing sequence)	150 lb.-ft. (200 N•m)
Slave piston adjusting screw locknuts	25 lb.-ft. (35 N•m)

Caterpillar Parts

Rocker arm adjusting screw locknuts	25 lb.-ft. (35 N•m)
Cylinder head capscrews	185 lb.-ft. (252 N•m)
Valve cover capscrews	13 lb.-ft. (18 N•m)\

Application Information

Brake Model	Engine Model/ Model Year	Slave Lash	Adjusting Tool P/N
336A	9TL & 7RJ, 3306C (with 1/2" diameter exhaust push tubes)	0.135"	018989
C336	9TL & 7RJ, 3306C	0.035"	014767
C336	63Z3300 & greater, 5KD & 13Z, 3306B; 76R6115 & greater, 3306	0.035"	014767

Section 2: Engine Preparation

Remove accessory components and the valve cover. Remove and discard the gasket.

Crankshaft Position

Set the engine so that Cylinder No. 1 is at top dead center (TDC) compression as follows:

1. Remove the plug from the timing hole in the flywheel housing.

   NOTE:
   ON SOME APPLICATIONS, THE CATERPILLAR ENGINE TURNING TOOL CAN BE INSTALLED IN THE FLYWHEEL HOUSING (SEE FIG. 2).

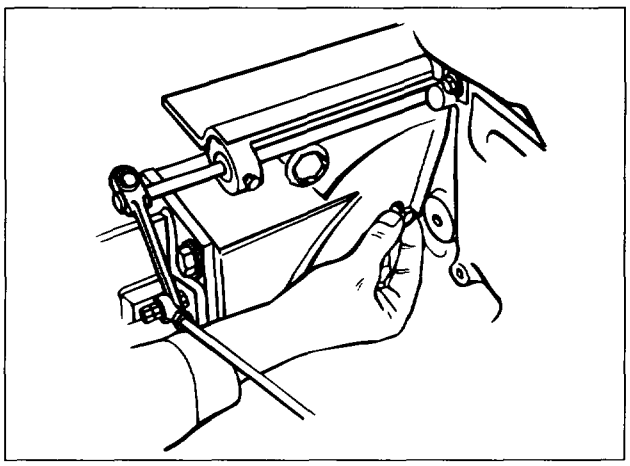


FIG. 2

2. Rotate the crankshaft in the direction of rotation until a 3/8" - 16 NC bolt 2" (50.8 mm) long can be turned into the flywheel through the timing hole in the flywheel housing. No. 1 piston should now be on top center. The inlet and exhaust valves for number 1 cylinder will be closed (rocker arms loose), if number 1 piston is on the compression stroke.

3. If number 1 piston is to be on the compression stroke, remove the timing bolt and rotate the crankshaft counterclockwise 360°. Install the timing bolt. The number 1 piston is now at top center on the compression stroke.

4. Remove the timing bolt and replace the plug in the timing hole. Make a mark on the vibration damper and engine as shown in Fig. 3.

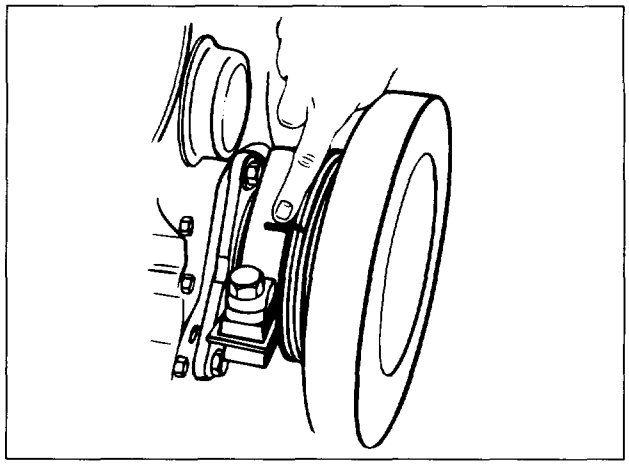


FIG. 3

5. Loosen all exhaust and inlet rocker arm adjusting screw locknuts.

Remove the rocker shaft capscrews and the rocker shaft assembly.

NOTE:
THE FUEL INJECTOR LINES FOR CYLINDERS 4, 5 AND 6 HAVE BEEN REMOVED FOR ILLUSTRATION PURPOSES ONLY. IT IS NOT NECESSARY TO REMOVE FUEL LINES FOR ENGINE BRAKE INSTALLATION.

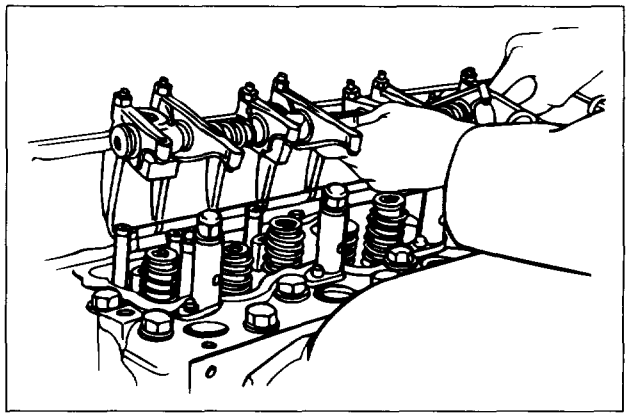


FIG. 4

Alternative Method

1. Remove timing pin cover from the side of the fuel injection pump housing.

2. Install 6V 4186 timing pin in the fuel injection pump housing as shown in Fig. 4. **Slowly** rotate the crankshaft counterclockwise until the timing pin goes into the slot in the fuel pump camshaft. The number 1 piston is now at top dead center of the compression stroke. Proceed to Step 5 above.

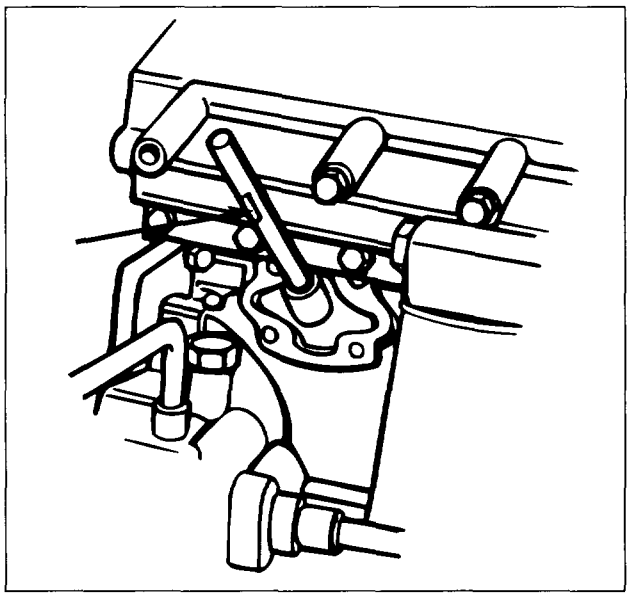


FIG. 5

Oil Supply Fitting

NOTE:
IF THE CATERPILLAR REAR ROCKER BRACKET IS NOT TAPPED FOR THE JACOBS OIL SUPPLY FITTING, THE REAR BRACKET MUST BE REPLACED WITH THE CATERPILLAR BRACKET, P/N 7C7011. IF THE BRACKET IS TAPPED (SEE FIG. 6), IT IS NOT NECESSARY TO REPLACE THE REAR BRACKET (STEPS 1 - 3).

1. Remove the retainer ring, washer, spring and washers from the rear end of the rocker shaft. Make note of the number of washers used at the rear end of the shaft (see Fig. 6). Remove the rocker arm.

2. Remove the pin from the original rear support bracket with a hammer and a punch (Fig. 7). Remove the rear support bracket from the shaft.

3. Install the Caterpillar rear support bracket, P/N 7C7011, on the rocker shaft. Make sure that the hole in the rear support bracket is in alignment with the hole in the rocker shaft and the flat side of the bracket is facing the rear end of the shaft.

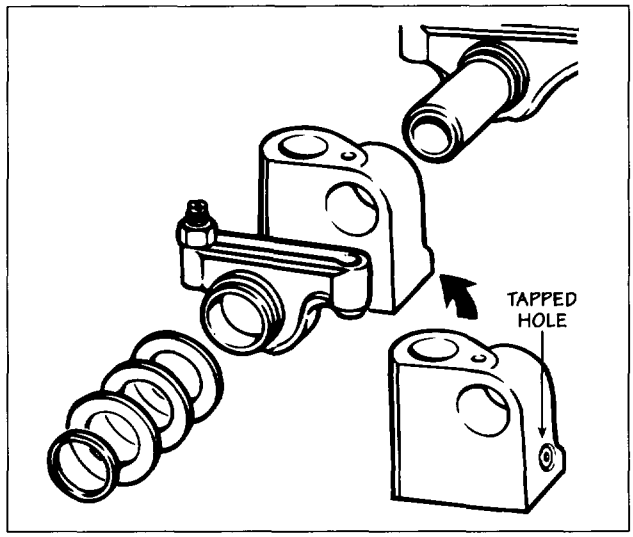


FIG. 6

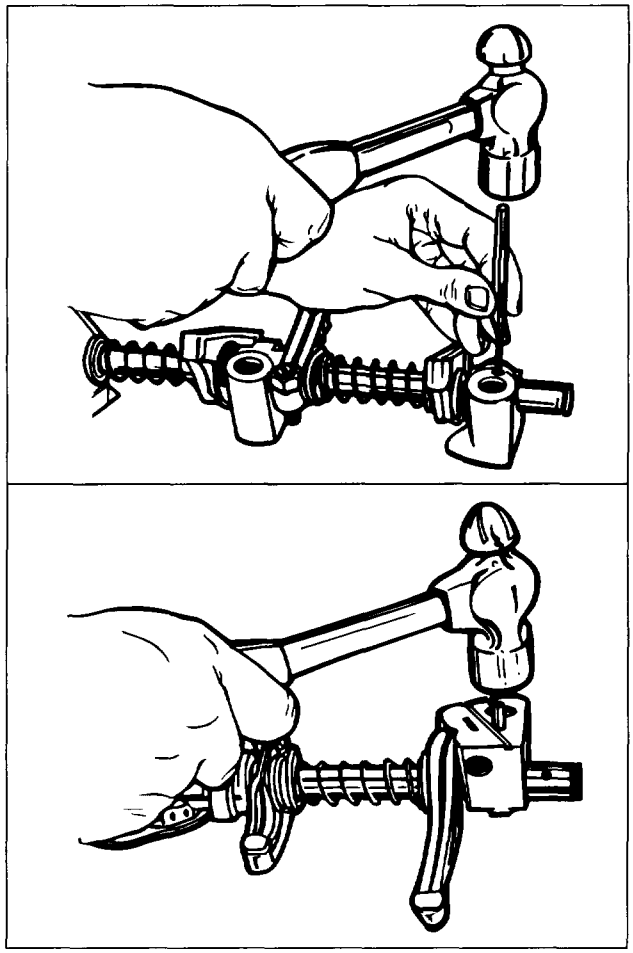


FIG. 7

4. Put the pin in position in the bracket.

5. Install the pin through the bracket and shaft with a hammer.

6. Pin must extend 0.3878" (9.60 mm) from the bottom side of the bracket (see Fig. 8).

   NOTE:
   ON THE BRACKETS THAT ARE TAPPED, REMOVE THE PLUG.

7. Install a new Caterpillar O-ring seal in the rear support bracket (see Fig. 8).

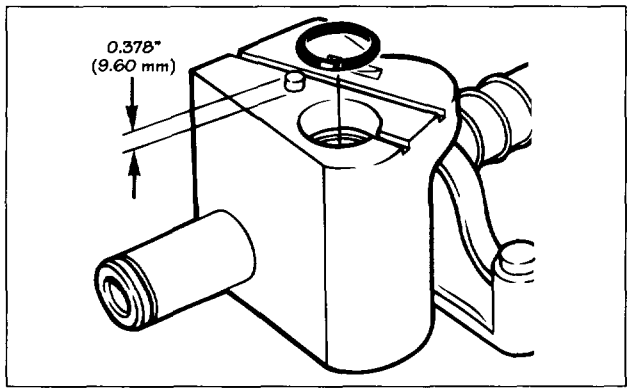


FIG. 8

8. Install the rocker arm, original number of washers, spring, washer and retainer ring on the rocker shaft.

9. Install the Jacobs oil supply fitting in the rear bracket as shown in Fig. 9. Turn all the way in until contact is made with the bracket. Back out the fitting until the hole is located vertically with respect to the bracket. Do not install rocker shafts at this time.

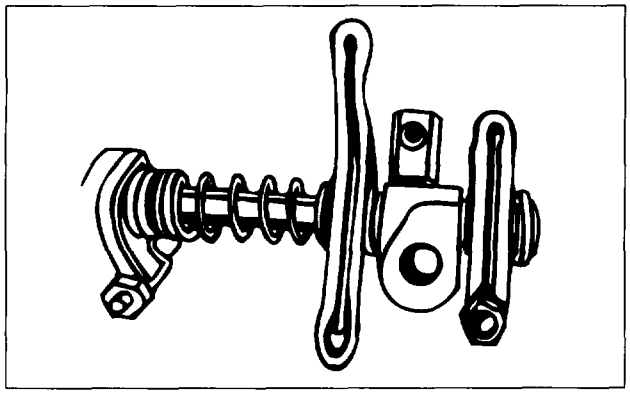


FIG. 9

Exhaust Rocker Adjusting Screw Replacement

Remove the exhaust rocker arm adjusting screws and replace with Jacobs screws. The Jacobs screws (B) have hex socket heads; Caterpillar screws (A) have a screwdriver slot (see Fig. 10). Turn the screw all the way in from the bottom of the rocker arm.

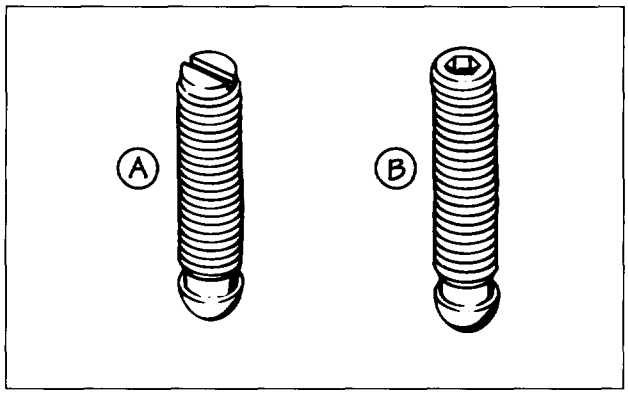


FIG. 10

Install the Jacobs spherical nuts onto each exhaust rocker adjusting screw. Turn the nuts all the way down to contact the rocker arm (Fig. 11).

⚠CAUTION

THE SPHERICAL NUTS USED ON C336 AND 336A MUST NOT BE INTERCHANGED. USE OF THE WRONG SPHERICAL NUT COULD RESULT IN ENGINE/ENGINE BRAKE DAMAGE.

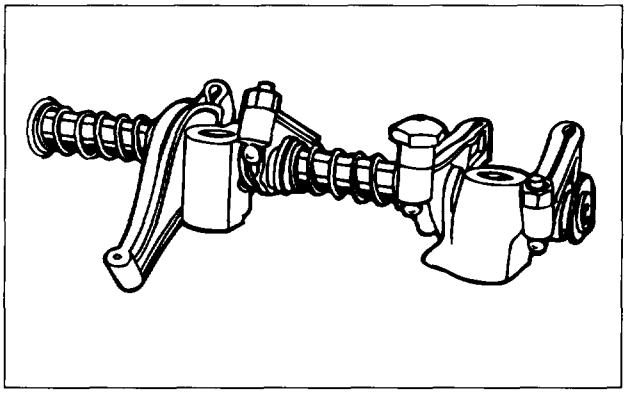


FIG. 11

Valve Cap Installation

Apply engine oil inside the valve cap and to the valve spring retainer rotor. Install the valve cap on each of the exhaust valves.

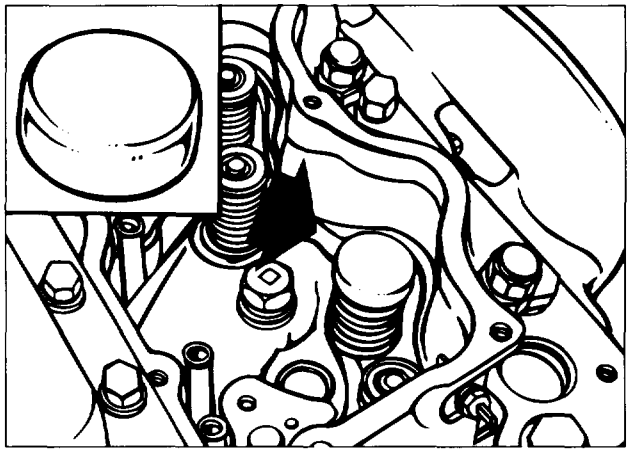


FIG. 12

Spacer Installation

Install the terminal leadout assemblies in the spacer. Use a 6 point, 7/16" box-end wrench to tighten the leadout assemblies until they are seated in the spacer.

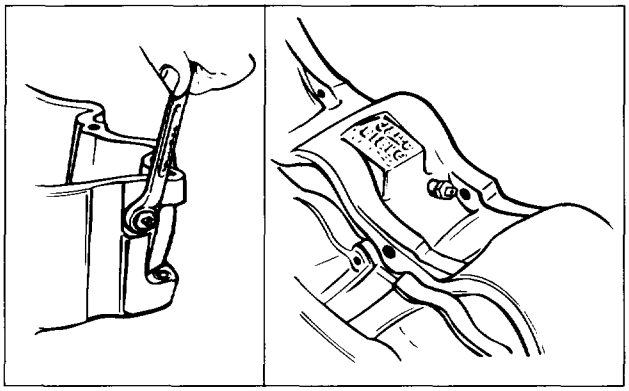


FIG. 13

Install the Jacobs gasket. Install the valve cover spacer.

NOTE:
IF INTERFERENCE BETWEEN THE SPACER AND THE INJECTOR FUEL LINES EXISTS, LOOSEN THE FITTINGS AND SUPPORT CLAMPS TO REPOSITION FUEL LINES.

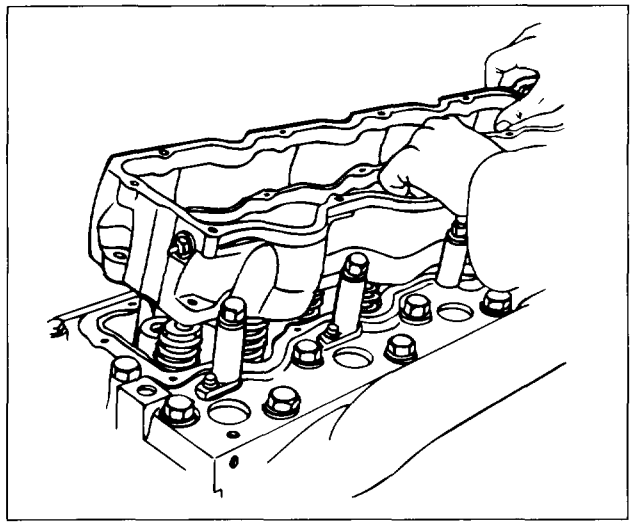


FIG. 14

NOTE:
PLACE TOWELS AROUND THE PUSHROD HOLES (SEE FIG. 15) TO PREVENT SCREWS FROM DROPPING INTO ENGINE.

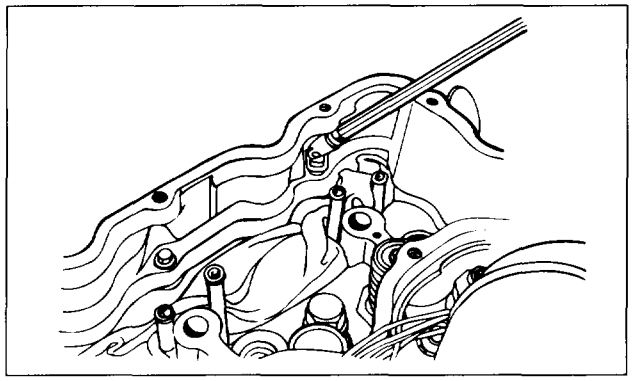


FIG. 15

Install the spacer capscrews and tighten capscrews from the center to the ends of the spacer in the sequence shown in Fig. 16. Torque to 15 lbft. (20 N•m).

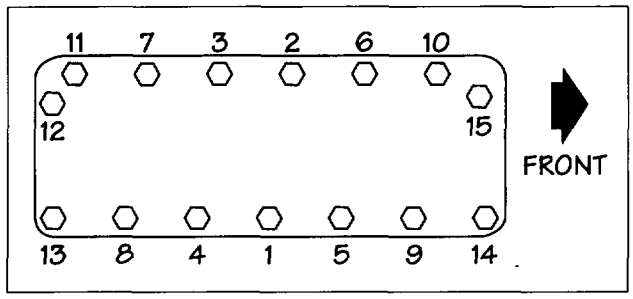


FIG. 16

Rocker Shaft Installation

⚠ WARNING

COVER THE HOLES WITH A TOWEL TO PREVENT OIL SPRAY AND WEAR EYE PROTECTION (SEE FIG. 17).

Blow out the rocker shaft capscrew holes

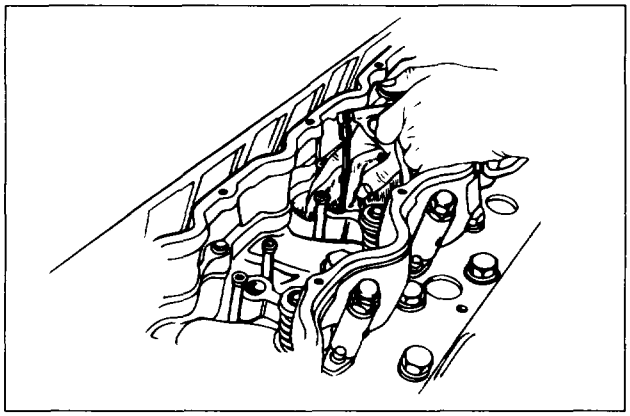


FIG. 17

NOTE:
WHEN INSTALLING THE MODEL 336A, LARGER DIAMETER (1/2") EXHAUST PUSH TUBES (CATERPILLAR P/N 118-9719) MUST BE INSTALLED IN PLACE OF THE EXISTING EXHAUST PUSH TUBES.

Set the rocker shaft assembly in place and line up the rocker adjusting screws with the pushrods (see Fig. 18).

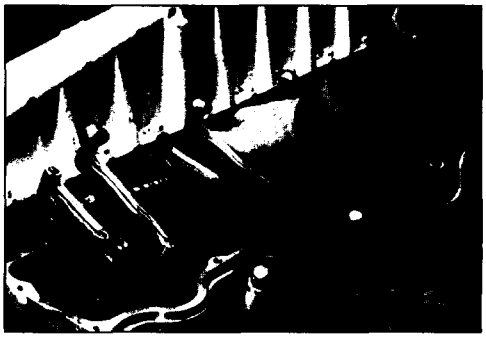


FIG. 18

Install the rocker shaft capscrews and tighten in sequence as shown in Fig. 19 to the following torques:

115 lb.-ft. (155 N•m)
150 lb.-ft. (200 N•m)
150 lb.-ft. (200 N•m) - final torque check

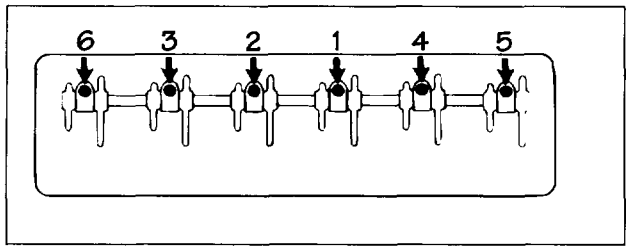


FIG. 19

Intake and Exhaust Valve Adjustments

With the number one piston set at TDC compression (set earlier; see page 3), set the intake and exhaust valves for each cylinder as indicated in the following table:

Engine Setting	Set Exhaust Valve on Cyl.	Set Inlet Valve on Cyl.
Cyl. 1 TDC	1, 3, 5	1, 2, 4
Cyl. 6 TDC	2, 4, 6	3, 5, 6

Set intake clearance to 0.015" (0.38 mm) (see Fig. 20). Set exhaust valve clearance to 0.025" (0.64 mm).

NOTE:
A 3/16" HEX KEY WRENCH IS REQUIRED FOR TURNING THE EXHAUST ROCKER ADJUSTING SCREW (SEE FIG. 21).

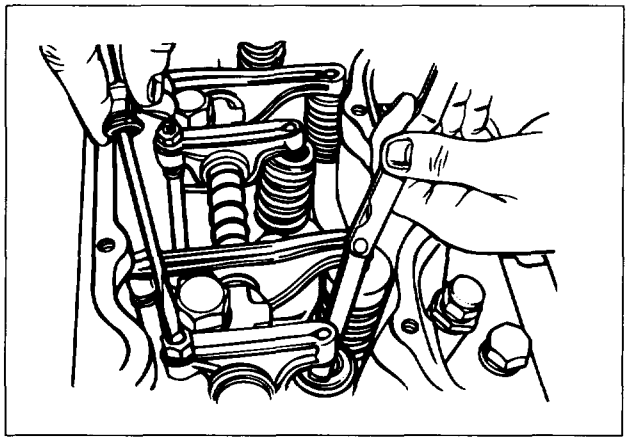


FIG. 20

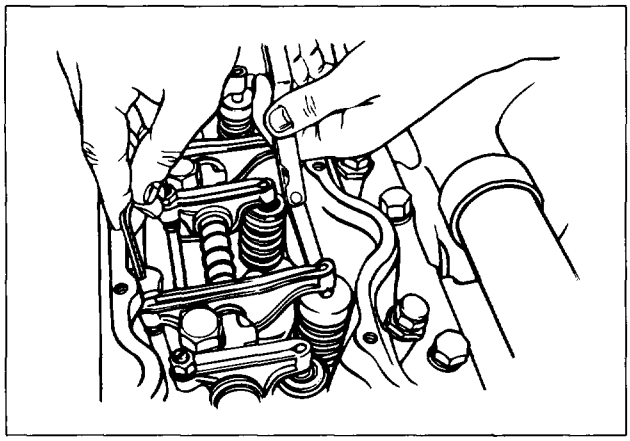


FIG. 21

Rotate the crankshaft 360° in the direction of rotation to cylinder 6 TDC compression. Refer to the alignment mark on the vibration damper made earlier. Adjust the remaining intake and exhaust valves as in the table on the previous page.

After setting the valves, hold the adjusting screws and torque the locknuts to 25 lb.-ft. (35 N•m).

NOTE:
FOR TORQUING THE SPHERICAL LOCKNUT ON CYLINDER 1, IT MAY BE NECESSARY TO ALTER A CROWFOOT WRENCH TO PROVIDE CLEARANCE BETWEEN THE LOCKNUT AND THE JACOBS SPACER (FIG. 22).

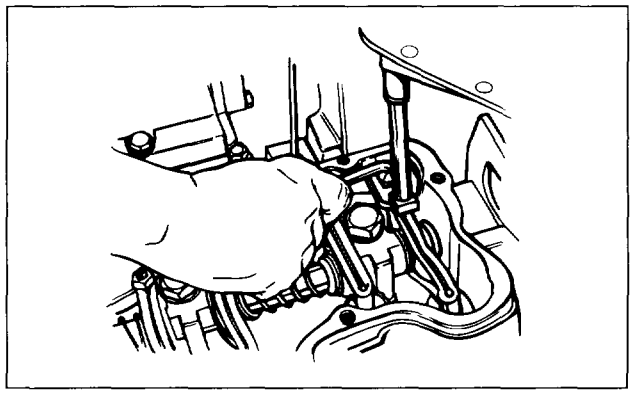


FIG. 22

Section 3: Brake Housing Installation

Remove the four cylinder head capscrews and washers from the positions shown. Leave the center capscrew in place.

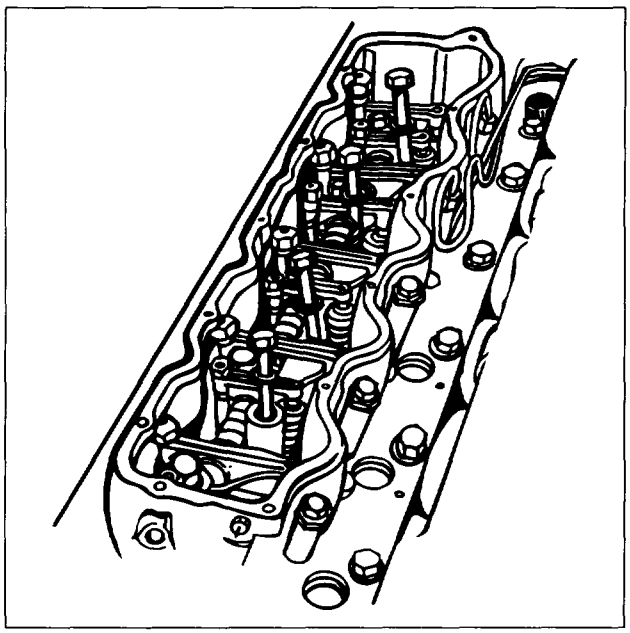


FIG. 23

⚠ CAUTION

TO PREVENT POSSIBLE CYLINDER HEAD DISTORTION, DO NOT REMOVE THESE CAPSCREWS UNTIL THE ROCKER ARM CAPSCREWS HAVE BEEN TIGHTENED.

Using an air gun, blow out the oil from the four cylinder head capscrew holes.

⚠ WARNING

COVER THE HOLES WITH A TOWEL TO PREVENT OIL SPRAY AND WEAR EYE PROTECTION.

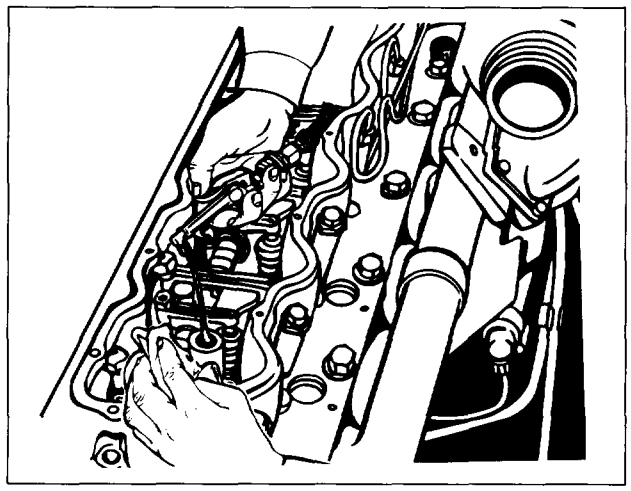


FIG. 24

With Tube Supports

Install a housing support at each of the four bolt hole locations.

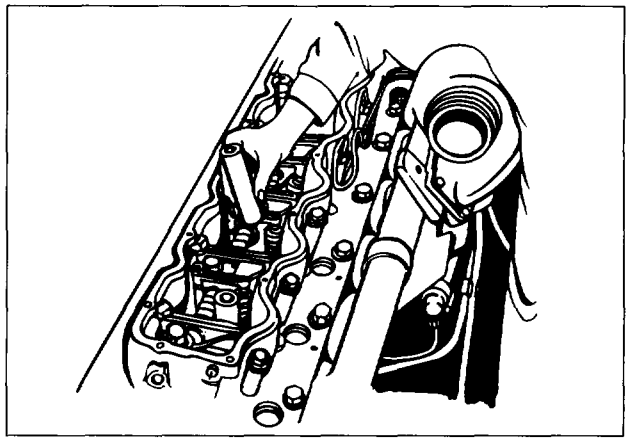


FIG. 25

Lubricate the seal rings and install on the Jacobs oil supply feed tube. Install the tube into the hole in the oil supply fitting located in the rear rocker shaft support bracket (Fig. 26).

FIG. 26

NOTE:
THE OIL SUPPLY FEED TUBE IS SHORTER THAN THE OIL SUPPLY JUMPER TUBE AND HAS NO SNAP RING GROOVE.

Set the **rear** housing in place (Fig. 27), making sure that the oil supply feed tube enters the hole in the bottom of the housing.

Coat the capscrew threads and both faces of the related washers with a moly lube (Caterpillar P/N 6V4876 or G-N metal assembly paste or equivalent) prior to assembly.

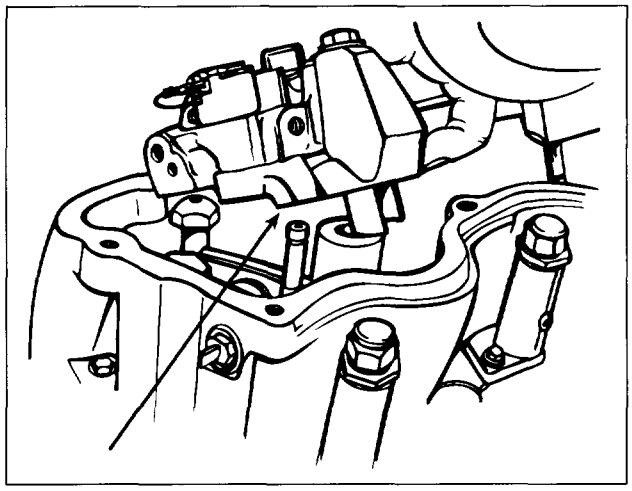


FIG. 27

Install the washers from the cylinder head capscrews on the Jacobs capscrews and install them through the housing, supports, and into the cylinder head. Position the housing so that the slave pistons are centered over the valve caps. Hand tighten the capscrews (Fig. 28).

NOTE:
THE CAPSCREWS SHOULD BE HAND TIGHTENED ONLY TO PERMIT ALIGNMENT OF HOUSINGS.

(Skip to Page 10, Figure 33)

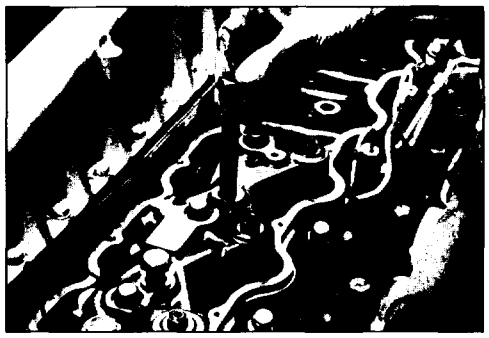


FIG. 28

With Threaded Supports

Coat the four support studs threads with moly lube (Caterpillar P/N 6V4876 or G-N metal assembly paste or equivalent).

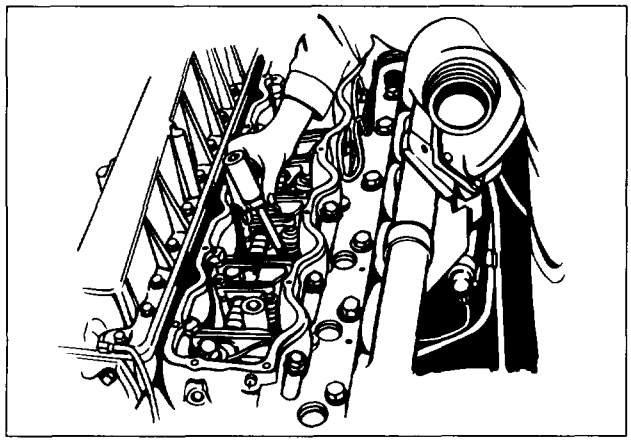


FIG. 29

Install the Caterpillar cylinder head washers onto the support studs, and install the studs in the cylinder head capscrew holes. Tighten studs evenly using the following increments:

115 lb.-ft. (155 N•m)
185 lb.-ft. (250 N•m)
185 lb.-ft. (250 N•m) - final torque check

Lubricate the seal rings and install on the Jacobs oil supply feed tube. Install tube into the hole in the oil supply fitting located in the rear rocker shaft support bracket (Fig. 30).

NOTE:
THE OIL SUPPLY FEED TUBE IS SHORTER THAN THE OIL SUPPLY JUMPER TUBE AND HAS NO SNAP RING GROOVE.

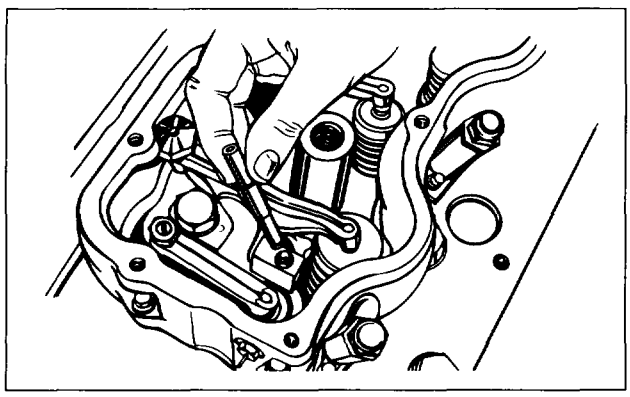


FIG. 30

Set the **rear** housing in place (Fig. 31), making sure that the oil supply feed tube enter the hole in the bottom of the housing.

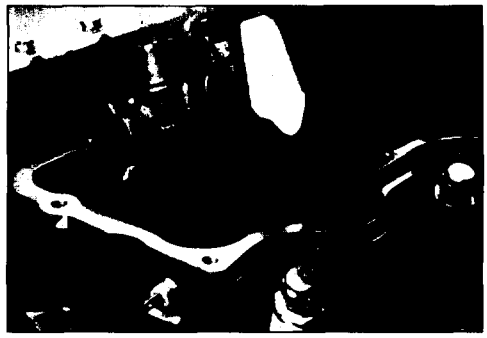


FIG. 31

Install the Jacobs washer to the Jacobs hex head bolt. Install the washer and bolt through the housing and into the support stud. Position the housing so that the slave piston is centered over the cap valves. Hand tighten the hex head bolt.

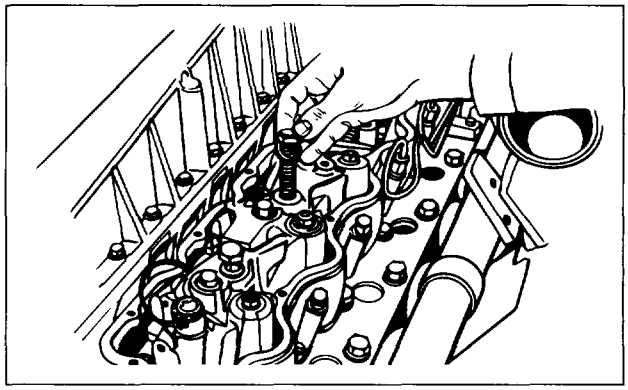


FIG. 32

Lubricate and install the oil seal rings on the jumper tube. Insert the E-ring into the groove. Insert the tube into the front housing all the way to the E-ring (Fig. 33).

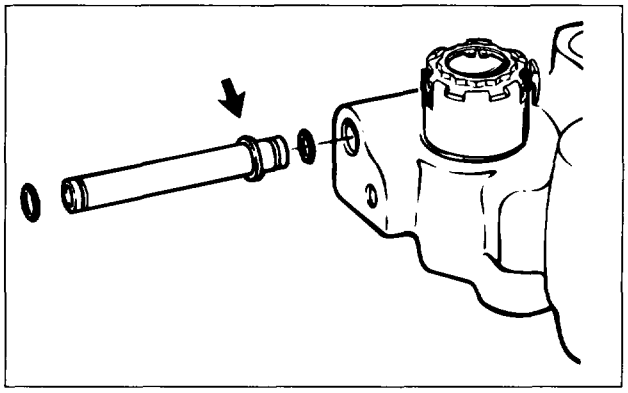


FIG. 33

Install the front housing following the same procedures as the rear housing installation.

Align the front and rear housings so that the upper tube can be extended from the front housing and inserted into the rear housing (Fig. 34).

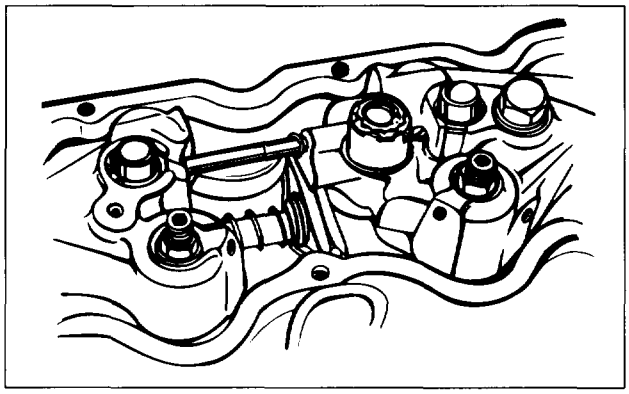


FIG. 34

Tighten the housing capscrews evenly using the following increments:

60 lb.-ft. (82 N•m)
120 lb.-ft. (163 N•m)
150 lb.-ft. (200 N•m)
150 lb.-ft. (200 N•m) - final torque check

Slave Piston Adjustment

⚠ CAUTION

THE FOLLOWING ADJUSTING PROCEDURE MUST BE STRICTLY ADHERED TO. ANY OTHER METHOD OF ADJUSTING THE SLAVE PISTON CLEARANCE IS NOT AUTHORIZED BY JACOBS AND MAY RESULT IN SERIOUS ENGINE AND/ OR ENGINE BRAKE DAMAGE.

SLAVE PISTON ADJUSTMENT MUST BE MADE WITH THE ENGINE STOPPED AND COLD. THE EXHAUST VALVE ON THE CYLINDER TO BE ADJUSTED MUST BE IN THE CLOSED POSITION. FOLLOW THE SEQUENCE INDICATED IN THE FOLLOWING TABLE.

Slave Piston Adjustment

Set Engine	Set Clearance on Cyl. No.
Cyl 1 TDC Comp	1, 3, 5
Cyl 6 TDC Comp	2, 4, 6

With the exhaust valves closed (rocker arms loose), turn in the slave piston adjusting screw until the slave piston contacts the valve stem cap (Fig. 35).

NOTE:
IT MAY BE DIFFICULT TO "FEEL" THE CONTACT WITH THE VALVE CAP. USE A FLASHLIGHT TO VISUALLY SEE THE SLAVE PISTON CONTACT THE VALVE CAP.

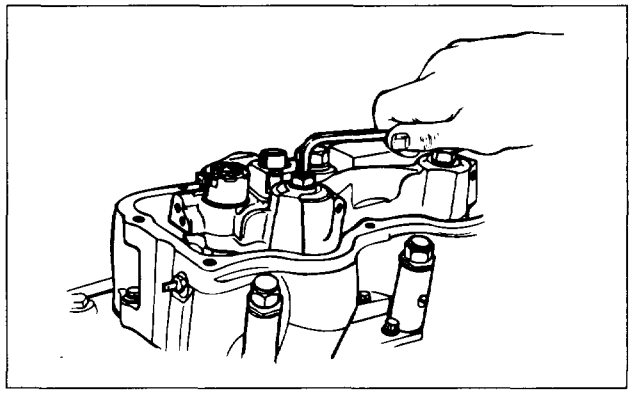


FIG. 35

Model C336 Only

Place the Jacobs lash adjusting gage, P/N 014767, over the adjusting screw and nut so that the "A" mark is in line with the wrench handle.

From this position, hold the gage in place and turn the adjusting screw out (counterclockwise) until the wrench handle lines up with the "B" mark on the gage. This will provide a slave piston clearance of 0.035" (0.89 mm).

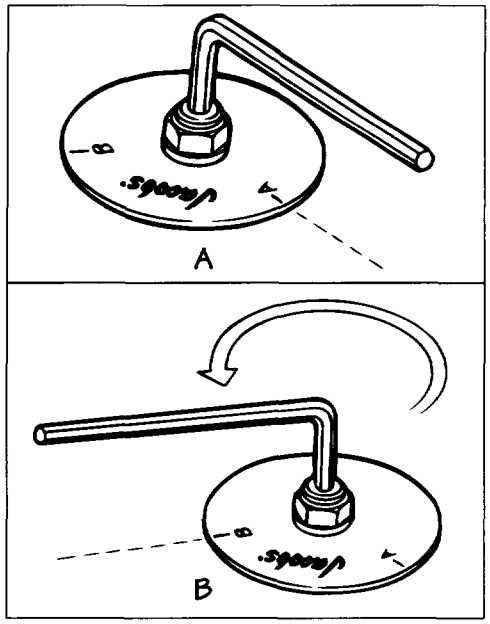


FIG. 36

Model 336A Only

Place the Jacobs slave piston adjusting gage, P/N 018989, (0.135") between the valve cap and slave piston foot. Turn the adjusting screw clockwise until a slight drag is detected (see Fig. 37).

⚠CAUTION

BE SURE TO USE THIS PROCEDURE AND SET THE CLEARANCE TO 0.135". ANY OTHER SETTING WILL CAUSE ENGINE DAMAGE.

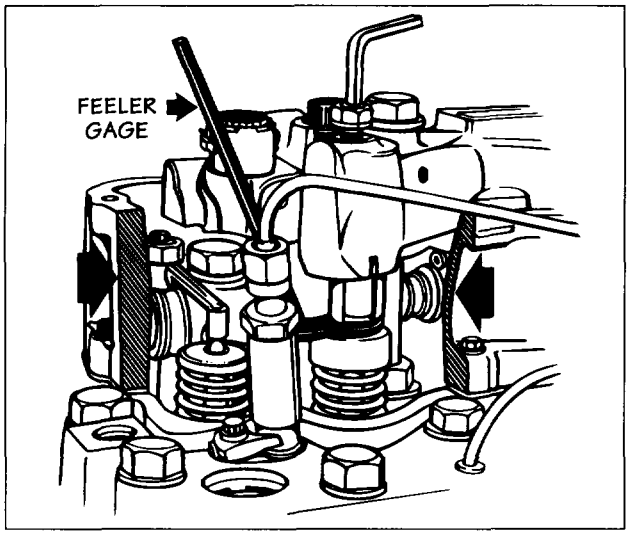


FIG. 37

⚠CAUTION

BE SURE THAT THE FEELER GAGE IS FULLY ENGAGED UNDER ***BOTH*** SLAVE PISTON FEET. FAILURE TO PROPERLY USE THIS TOOL MAY RESULT IN INCORRECT SLAVE LASH WHICH WILL LEAD TO POOR PERFORMANCE AND/OR ENGINE/ENGINE BRAKE DAMAGE (SEE FIG. 38).

Hold the adjusting screw and torque the locknut to 25 lb.-ft. (35 N•m) (see Fig. 39). Continue adjusting the remaining slave pistons following the sequence in the table on page 11.

Connect the solenoid lead wires to the terminal lead outs in the valve cover spacer (see Fig. 40).

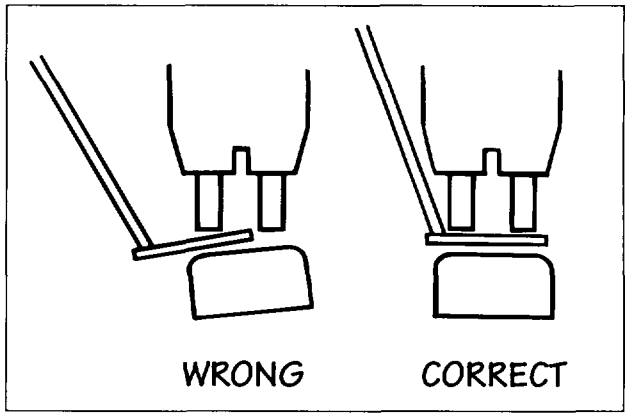


FIG. 38

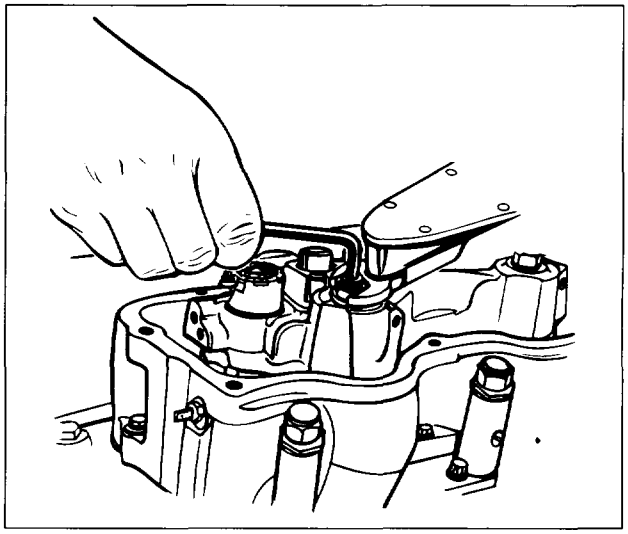


FIG. 39

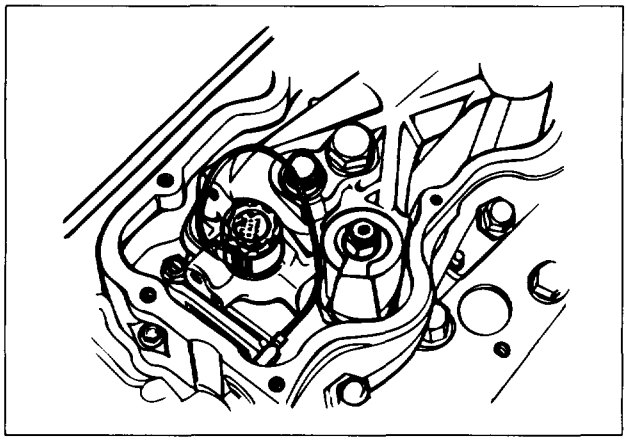


FIG. 40

Section 4: Electrical System Installation

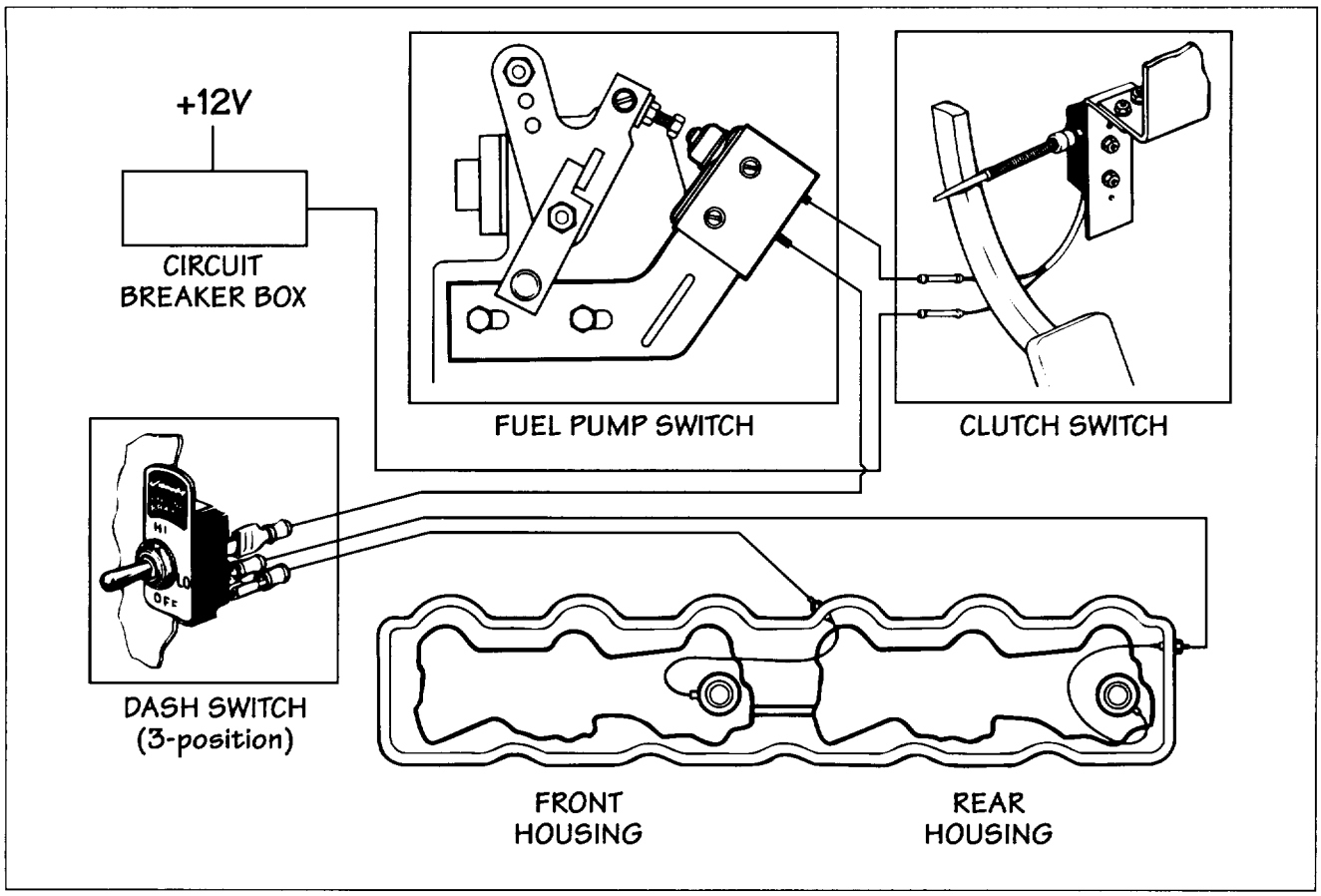


FIG. 41

NOTE:
VEHICLE OEM INSTALLED CONTROL SYSTEM COMPONENTS MAY DIFFER FROM JACOBS SUPPLIED PARTS.

Dash Switch

Install the dash switch in a convenient location in the cab. Carefully measure and cut all harnesses to the proper length. Thread wires through the loom provided. Install receptacles at locations shown.

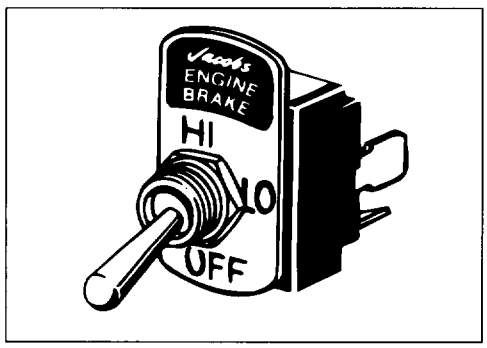


FIG. 42

Clutch Switch

1. Mount the clutch switch in the most convenient or accessible location possible. Locations may include in the cab under the dash, under the floor wheel well location, or in the bell housing area.

2. Install this switch with the switch actuator arm in contact with the clutch pedal arm or other clutch member.

3. Adjust the switch by moving the switch along the mounting bracket. The actuator arm should be deflected 1" to 1-1/2" (25 - 38 mm), measured at the tip of the actuator, when the clutch pedal is in the up (clutch engaged) position.

⚠CAUTION

EXCEEDING 1-1/2" DEFLECTION OF THE ACTUATOR ARM MAY CAUSE SWITCH DAMAGE, RESULTING IN ENGINE BRAKE MALFUNCTION.

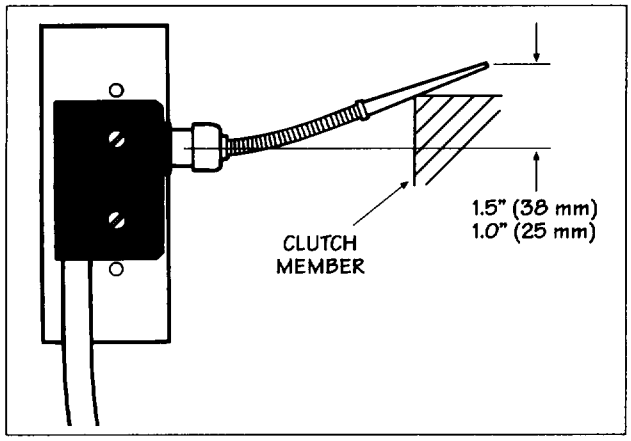


FIG. 43

4. Check the 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 the wires to the proper length and secure them with ties. Connect the wires as shown in the diagram.

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. THE ENGINE BRAKE MUST BE CONNECTED TO THE LOAD SIDE TERMINAL. IF THE VEHICLE HAS A POSITIVE GROUND ELECTRICAL SYSTEM, THE DIRECTION OF THE DIODE MUST BE REVERSED.

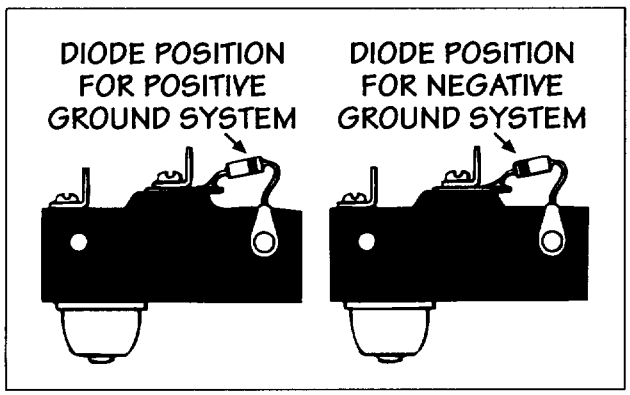


FIG. 44

Install the switch bracket onto the fuel pump housing (see Fig. 45).

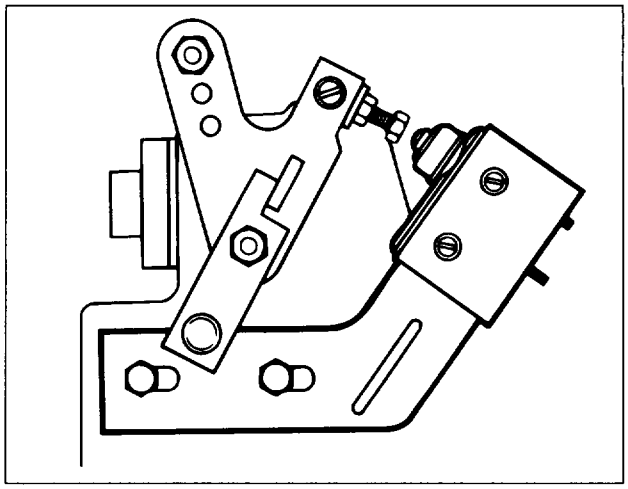


FIG. 45

1. Install the capscrew and nuts onto the actuating lever and install the lever onto the fuel control arm. Position the switch bracket so that the head of the capscrew contacts the switch squarely. Holding the fuel pump lever in the idle position, adjust the actuating lever screw and nut so that the switch activates. Hold the screw in this position and tighten the locknut.

2. Rotate the fuel pump lever to be sure the switch activates only in the idle position and that the arm moves through its full travel with no restriction.

3. Cut wires to their proper length and secure them with ties. Connect as shown in the diagram.

Optional Controls

Foot Switch

The foot switch 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. Complete instructions are included in the kit.

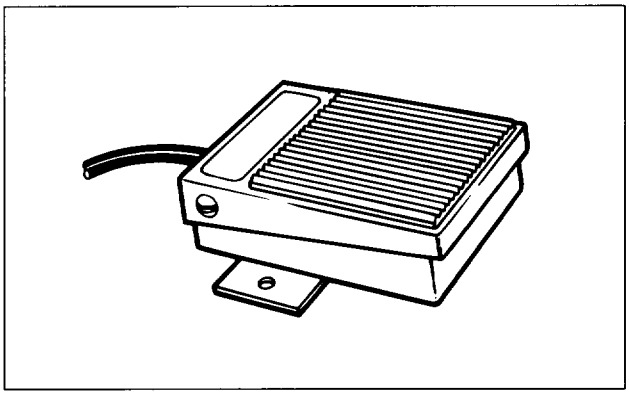


FIG. 46

Low Engine Speed Retarder Cutoff System

The low engine speed retarder cutoff 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 cutoff feature provides added driver convenience in frequent stop/start operations. Additionally, the low speed cutoff feature is useful for operations where several drivers may operate one vehicle.

The kit consists of a low speed retarder cutoff module and wiring harnesses. The module can be mounted in the engine compartment on the firewall or any other convenient location. Complete instructions are included in the kit.

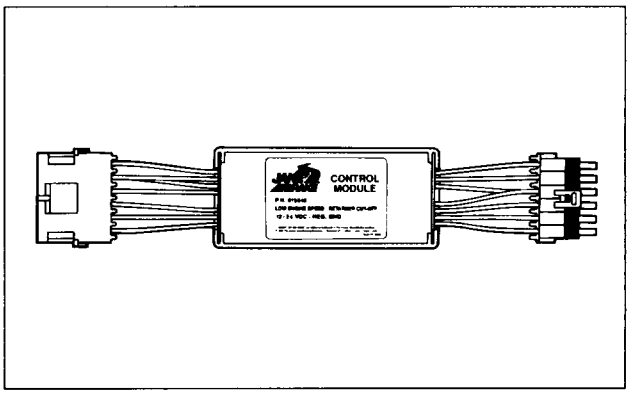


FIG. 47

Section 5: Brake Operation Check

The Jacobs engine brake installation is now complete. The following procedures and adjustments should be made.

⚠ WARNING

WEAR EYE PROTECTION AND DO NOT EXPOSE YOUR FACE OVER THE ENGINE AREA. TAKE PRECAUTIONS TO PREVENT OIL LEAKAGE DOWN ON THE ENGINE.

WHENEVER THE ENGINE IS RUNNING AND THE VALVE COVERS ARE REMOVED, OIL SPLASHING IN THE ENGINE BRAKE AREA COULD CAUSE PERSONAL INJURY.

Connect the control wires to the terminal lead out assemblies in the spacer. With engine shut down, check the electrical system by turning on the ignition switch and moving the Jacobs dash switch from OFF to LO to HI. In LO, only the rear brake housing solenoid valve should activate. In HI, both front and rear solenoids should activate.

Start the engine and allow to run 5 to 10 minutes. Accelerate the engine to approximately 1800 RPM. Release the throttle and then manually depress each solenoid armature (Fig. 48). Repeat this procedure five or six times to permit engine oil to fill the brake housing passages completely. While depressing the solenoid armature, visually check the master and slave pistons for operation.

Check the oil supply feed tube and jumper tube for leakage and repair if necessary.

Note that the later-style solenoids can only be activated by pushing on the pin in the top. A 3/16" diamter or smaller tool can be used to do this.

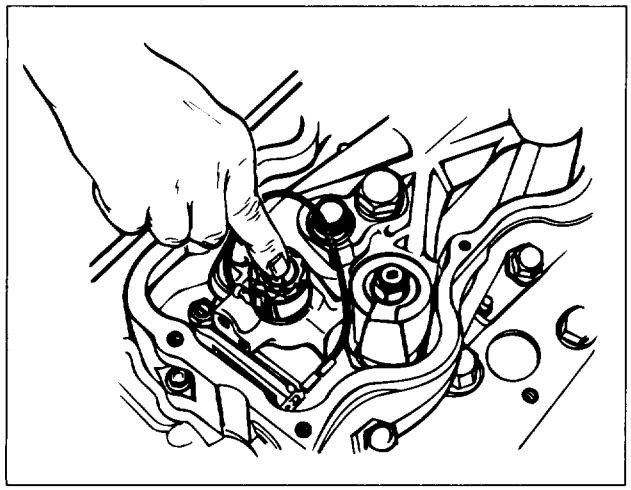


FIG. 48

Valve Cover Installation

Place the Caterpillar gasket on the spacer and install the valve cover. Torque capscrews in sequence (see Fig. 49) to 13 lb.-ft. (18 N•m).

Reinstall the accessory components.

Some engines may require the addition of the venting hose extension to permit the breather pipe to clear engine components (see Fig. 50).

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

Complete and mail the engine brake warranty card.

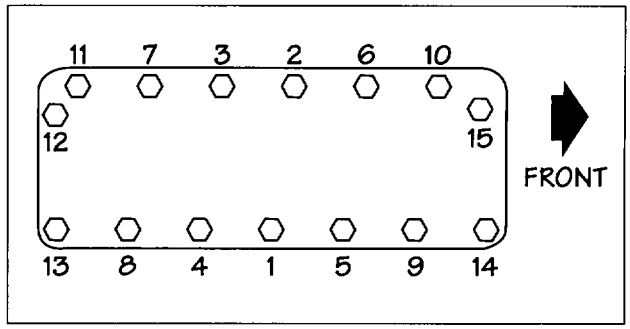


FIG. 49

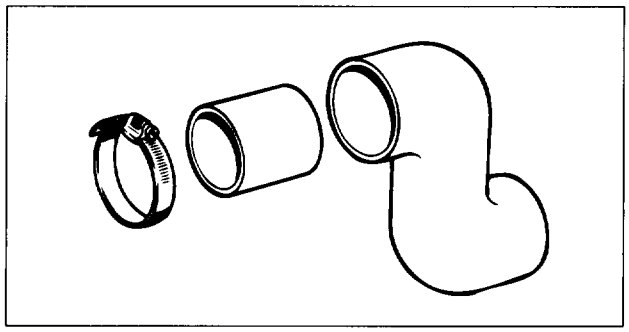


FIG. 50

Section 6: Engine Brake Maintenance

Theory of Operation

Energizing the engine brake effectively converts a power-producing diesel engine into a power-absorbing air compressor. This is accomplished by opening the cylinder exhaust valves near the top of the normal compression stroke, releasing the compressed cylinder charge to exhaust.

The blow down of compressed air to atmosphere prevents the return of energy to the engine piston on the expansion stroke. The effect is a net energy loss, since the work done in compressing the cylinder charge is not returned during the expansion process.

Exhaust blow down of the braking cylinder is accomplished by utilizing the exhaust cam motion of another cylinder.

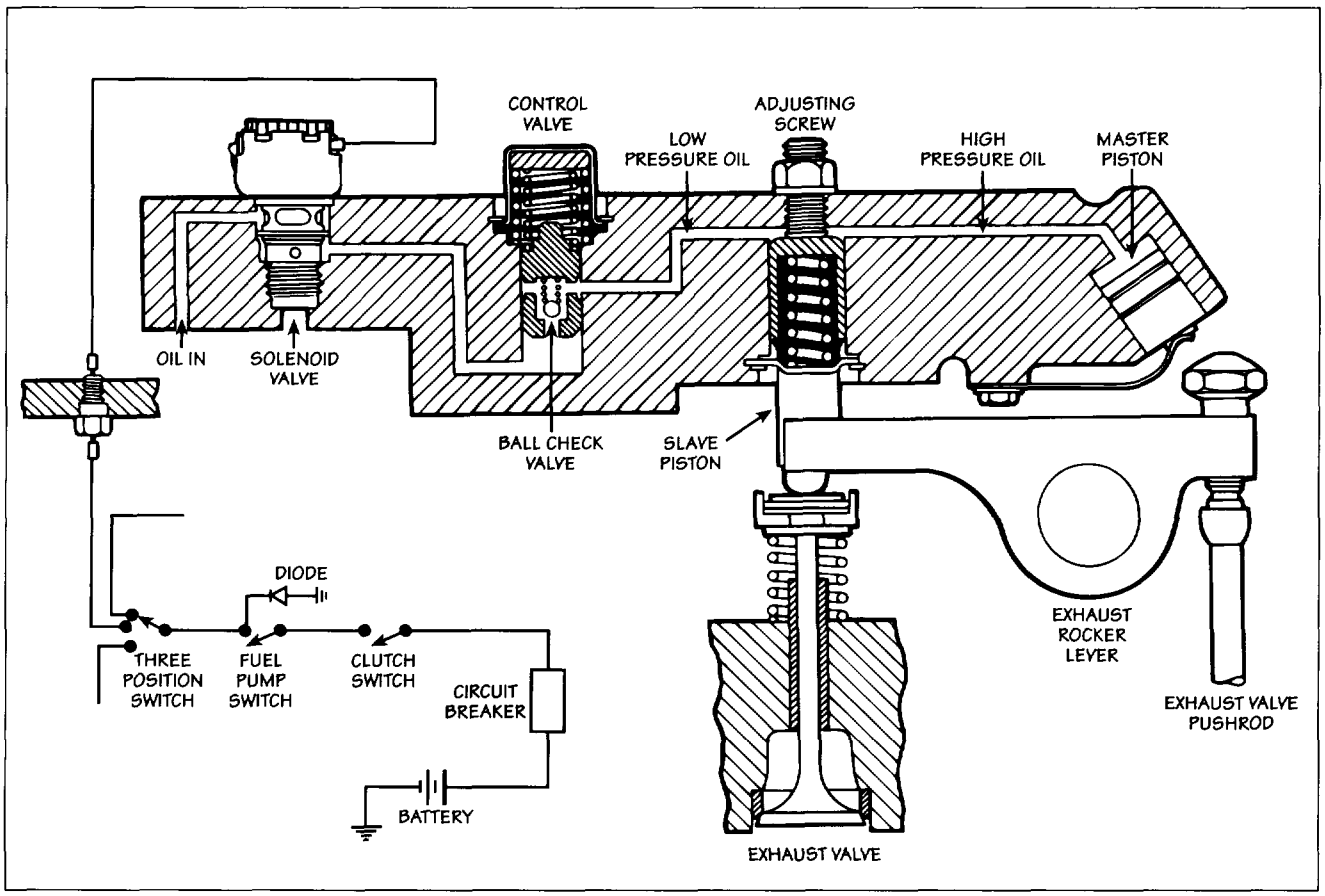
Energizing the solenoid valve permits engine lube oil to flow under pressure through the control valve to both the master piston, slave piston and accumulator.

Oil pressure causes the master piston to move down, coming to rest on the corresponding exhaust rocker arm. The exhaust rocker arm moves up (as in a normal exhaust cycle), forcing the master piston upward and creating a high pressure oil flow to the slave piston of the braking cylinder. The ball check valve in the control valve traps high pressure oil in the master/slave piston system.

Reacting to the high pressure oil flow, the slave piston moves down, momentarily opening the exhaust valves at a predetermined amount of slave stroke. The exhaust valve is forced open prior to top dead center position, releasing the compressed cylinder air to the exhaust manifold. Compressed air escapes into the atmosphere (usually through the turbocharger), completing a compression braking cycle.

⚠ WARNING

NEVER REMOVE ANY ENGINE BRAKE COMPONENT WITH ENGINE RUNNING. PERSONAL INJURY MAY RESULT.



SCHEMATIC DIAGRAM OF ENGINE BRAKE OPERATION

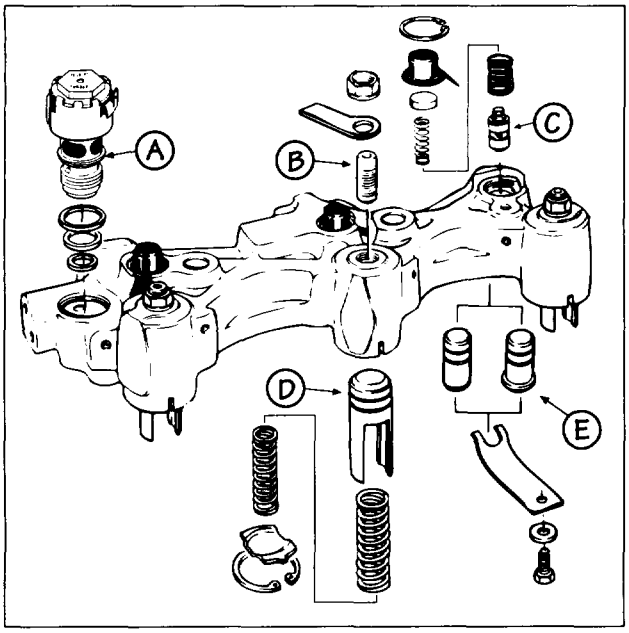


FIG. 51

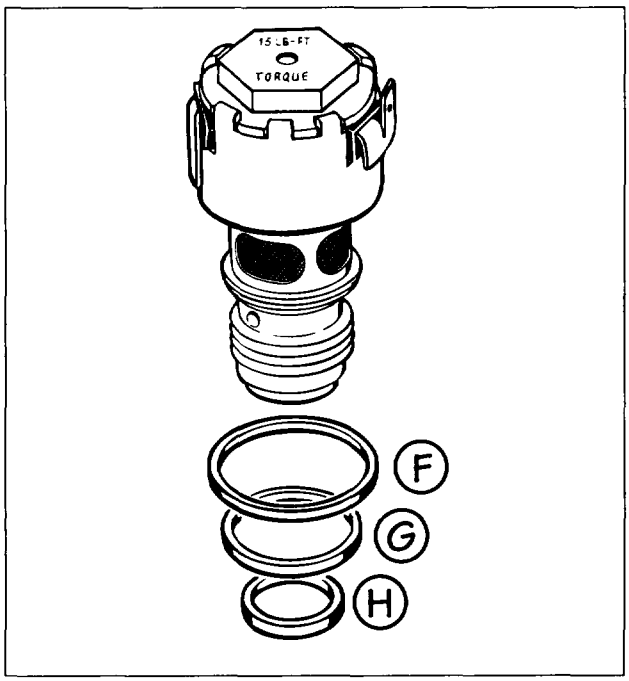


FIG. 52

Solenoid Valve

Refer to Fig. 51, part labeled "A".

⚠CAUTION

DO NOT DISASSEMBLE OR TAMPER WITH THE SOLENOID VALVE. ENGINE DAMAGE COULD RESULT.

1. Disconnect the solenoid harness. Using 7/8" socket and extension or 3/4" socket on later-style solenoids (see Fig. 52), unscrew the solenoid valve.

2. Remove and discard the three rubber seal rings. If the lower ring stays in the bottom of the housing solenoid bore, remove it with a seal pick.

3. Wash out the solenoid valve with an approved cleaning solvent. Use a brush to clean the oil screen. Clean and dry the valve with compressed air. Replace the oil screen if necessary.

4. 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.

5. Reinstall the solenoid using new seal rings. Seat the lower seal ring (H, Fig. 52) in the base of the solenoid valve bore. Wipe clean lube oil into and around the bore. Place the upper and center seal rings (F, G) on the solenoid valve body. Be sure the seals are seated properly.

6. Carefully screw the solenoid into the housing without unseating the seals. Torque the valve to 10 lb.-ft. (14 N•m) for earlier-style solenoids; torque the valve to 15 lb.-ft. (20 N•m) for later-style solenoids (see Fig. 52). Be careful not to twist the seals while installing.

Control Valve

Refer to Fig. 51, part labeled "C".

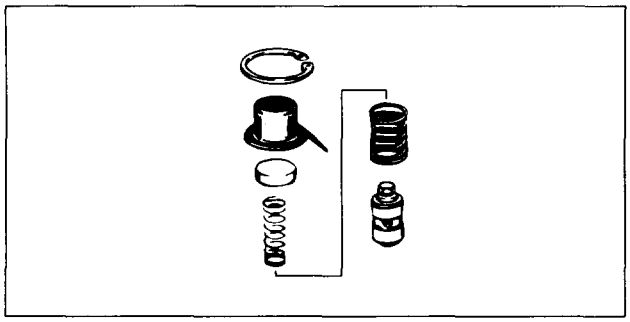


FIG. 53

⚠ WARNING

REMOVE THE CONTROL VALVE COVERS CAREFULLY. THE COVERS ARE UNDER LOAD FROM THE CONTROL VALVE SPRINGS.

1. Apply pressure on the control valve cover, and remove the retaining ring using retaining ring pliers.
2. Slowly remove the cover until spring pressure ceases, then remove the two control valve springs and control valve shim.
3. Using needle-nose pliers, remove the control valve.
4. Clean the control valve bore in the housing using clean paper towels.
5. Wash the control valve with an approved cleaning solvent. Push a wire through the hole in the base of the valve to make sure that the ball check is free. The ball should lift with light pressure on the wire. If the ball is stuck or there is no spring pressure, replace the control valve. Dry the valve with compressed air, and wipe clean with a paper towel.
6. Dip the control valve in clean lube oil. Drop the valve into its bore. If binding occurs, the control valve should be replaced.
7. Reassemble the parts reversing the removal procedure. Rotate the retaining ring ears 90° from the housing drain slot after installation.

Slave Piston

Refer to Fig. 51, part labeled "D".

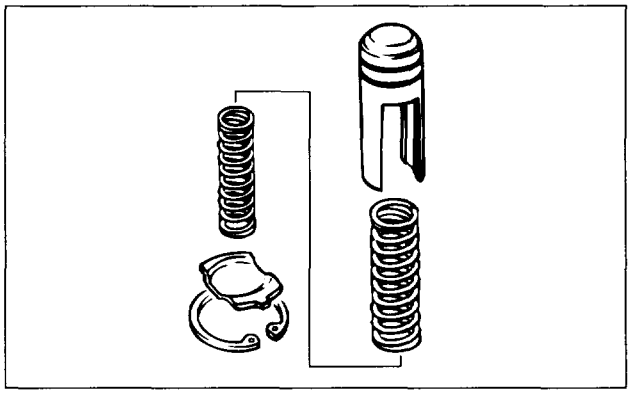


FIG. 54

⚠ WARNING

WEAR SAFETY GLASSES. REMOVE THE SLAVE PISTON CAREFULLY AS IT IS RETAINED BY SPRINGS THAT ARE UNDER HEAVY COMPRESSION. IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED AND PROPER TOOLS NOT USED, THE SPRINGS WILL BE DISCHARGED WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY.

1. Remove the locknut on the slave piston adjusting screw. Back out the adjusting screw until the slave piston is fully retracted (screw is loose).
2. Use the slave piston clamp fixture and the following procedure to remove and replace the slave piston.

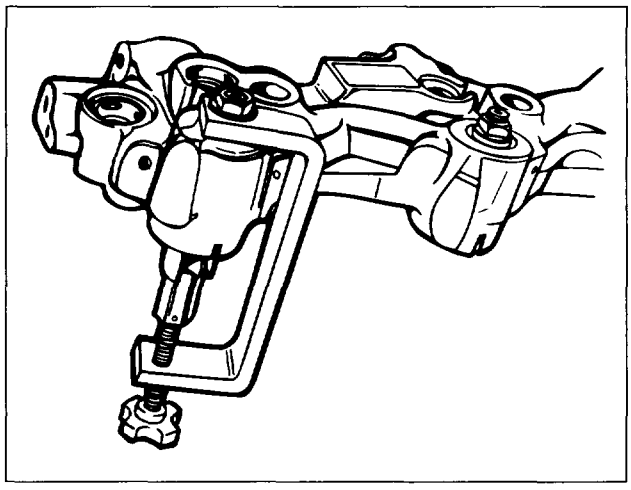


FIG. 55

3. Place the hole in the clamp fixture over the slave piston adjusting screw. Replace locknut. Snug tighten to hold fixture securely.

4. While holding the fixture in position, screw the holder down over the slave piston until the retainer is contacted.

5. Turn the handle slowly until the retainer is depressed about 0.04" (1 mm), relieving pressure against the retaining ring.

6. Remove the retaining ring using retaining ring pliers.

7. Back out the holder until the springs are loose and remove the fixture.

8. Remove all components. Check that there is no binding or burrs. Clean in an approved cleaning solvent or replace as necessary.

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

10. Compress the slave piston springs until the retainer is about 0.04" (1 mm) below the retaining ring groove. Reinstall the retaining ring. Be sure the retaining ring is fully seated in the groove.

11. Rotate the retaining ring about 90° in either direction.

12. Remove the clamp fixture slowly to ensure proper seating of retaining ring.

Master Piston

Refer to Fig. 51, part labeled "E".

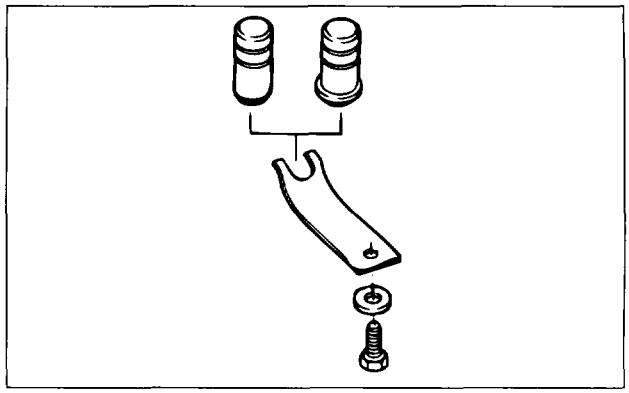


FIG. 56

NOTE:
IF THE MASTER PISTON HARD FACING IS DAMAGED, INSPECT THE CORRESPONDING ROCKER ARM ADJUSTING SCREW SPHERICAL NUTS FOR EXCESSIVE WEAR OR PITTING. REPLACE IF DAMAGED.

1. Remove the screw, washer and master piston spring from the bottom of the housing.

2. Remove the master piston from its bore using needle nose pliers. If binding occurs, check for burrs or contaminants in lube oil. Clean in approved solvent. Inspect the hard face surface. Pitted, chipped, cracked or galled pistons should be replaced.

3. Reassemble the parts reversing the removal procedure.

NOTE:
THE TABS SHOULD BE EQUALLY SPACED FROM THE RAISED PISTON AREA.

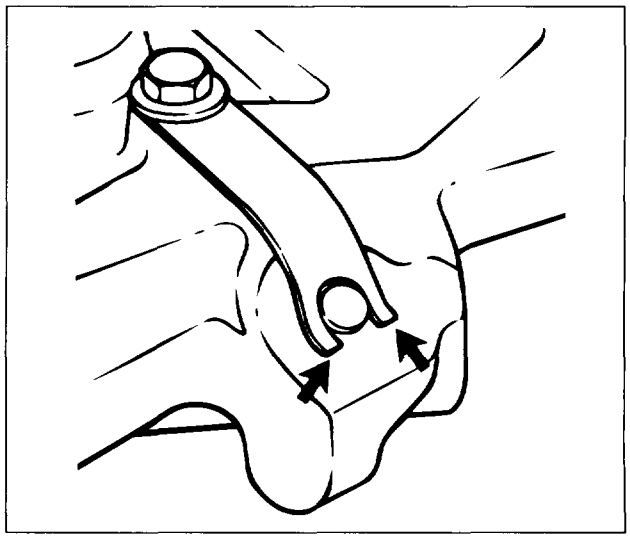


FIG. 57

Exhaust Valve Stem Cap

C336 only (prior to October 1, 1992)

Refer to Fig. 58, part labeled "J".

The exhaust valve stem cap assembly consists of two parts. It is not necessary to disassemble the parts. Inspect the assembly for excessive wear at various contact surfaces. Replace the valve cap assembly if excessive wear is apparent. When installed, the valve stem cap should fit snugly around the exhaust valve spring retainer.

336A - C336 (after October 1, 1992)

Refer to Fig. 58, part labeled "K".

This part can be used interchangeably with the part mentioned above ("J").

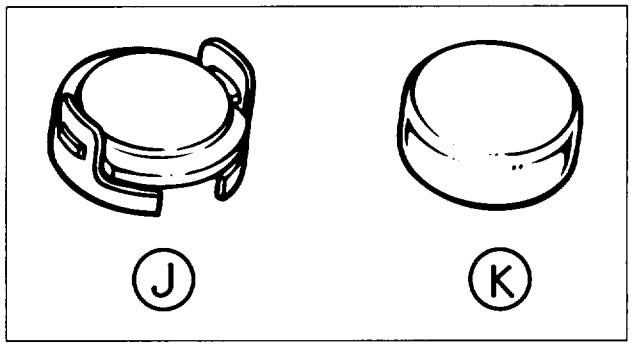


FIG. 58

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