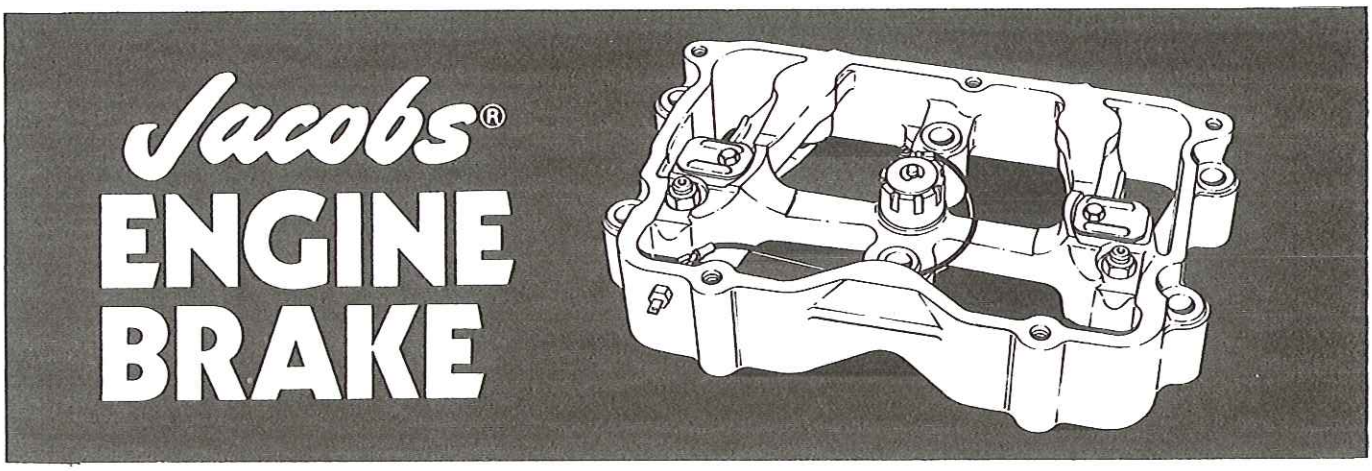
Installation Manual for



Models 400H, 400, 44B, 44E, 30E and 25B

GENERAL APPLICATION INFORMATION

MODELS 400H-400-25B

- **400H** — **APPROVED** FOR USE ON ALL BIG CAM I, II, AND III CUMMINS NT ENGINES EQUIPPED WITH HT3B TURBOCHARGER, TWIN TURBO NTC-475, NTE AND SMALL CAM (CPL 0437) ENGINES. **NOT APPROVED** FOR BIG CAM IV (LFC) AND NTE PHASE II ENGINES.
- **400** — **APPROVED** FOR USE ON ALL BIG CAM I, II, AND III CUMMINS NT ENGINES EQUIPPED WITH T46, ST-50 AND VT-50 TURBOCHARGERS, **NOT APPROVED** FOR BIG CAM IV (LFC) AND NTE PHASE III ENGINES.
- **25B** — **APPROVED** FOR USE ON ALL NH-NT CUMMINS SMALL CAM ENGINES. THE ONLY EXCEPTION TO THIS IS THE NT-240 SMALL CAM (CPL 0437) THAT REQUIRES THE MODEL 400H.

FORMER MODELS 44E, 44B, 30-30E AND SN MODELS

- **44E** — USED ON NTE AND NT-240 SMALL CAM (CPL-0437) CUMMINS ENGINES. REPLACED BY MODEL 400H
- **44B** — USED ON TWIN TURBO NTE 475 CUMMINS ENGINES. REPLACED BY MODEL 400H.
- **30E** — USED ON BIG CAM I ENGINES EQUIPPED WITH T46, ST-50 AND VT-50 TURBOCHARGERS. REPLACED BY MODEL 400
- **30** — USED ON EARLY BIG CAM I ENGINES EQUIPPED WITH T46, ST-50 AND VT-50 TURBOCHARGERS. REPLACED BY MODEL 400
- **SN MODELS** DESIGNATE ENGINE BRAKES EQUIPPED WITH SPRAY NOZZLES. FOR USE ON CUMMINS NHH 80° TILT ENGINES. (S.N. ENGINE BRAKE KITS ARE NO LONGER AVAILABLE).

JACOBS SERVICE LETTERS SHOULD BE CONSULTED FOR ADDDITIONAL APPLICATIONS AND UP-DATE INFORMATION.

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.

Do not work on this equipment when mentally or physically fatigued. Always wear eye protection.

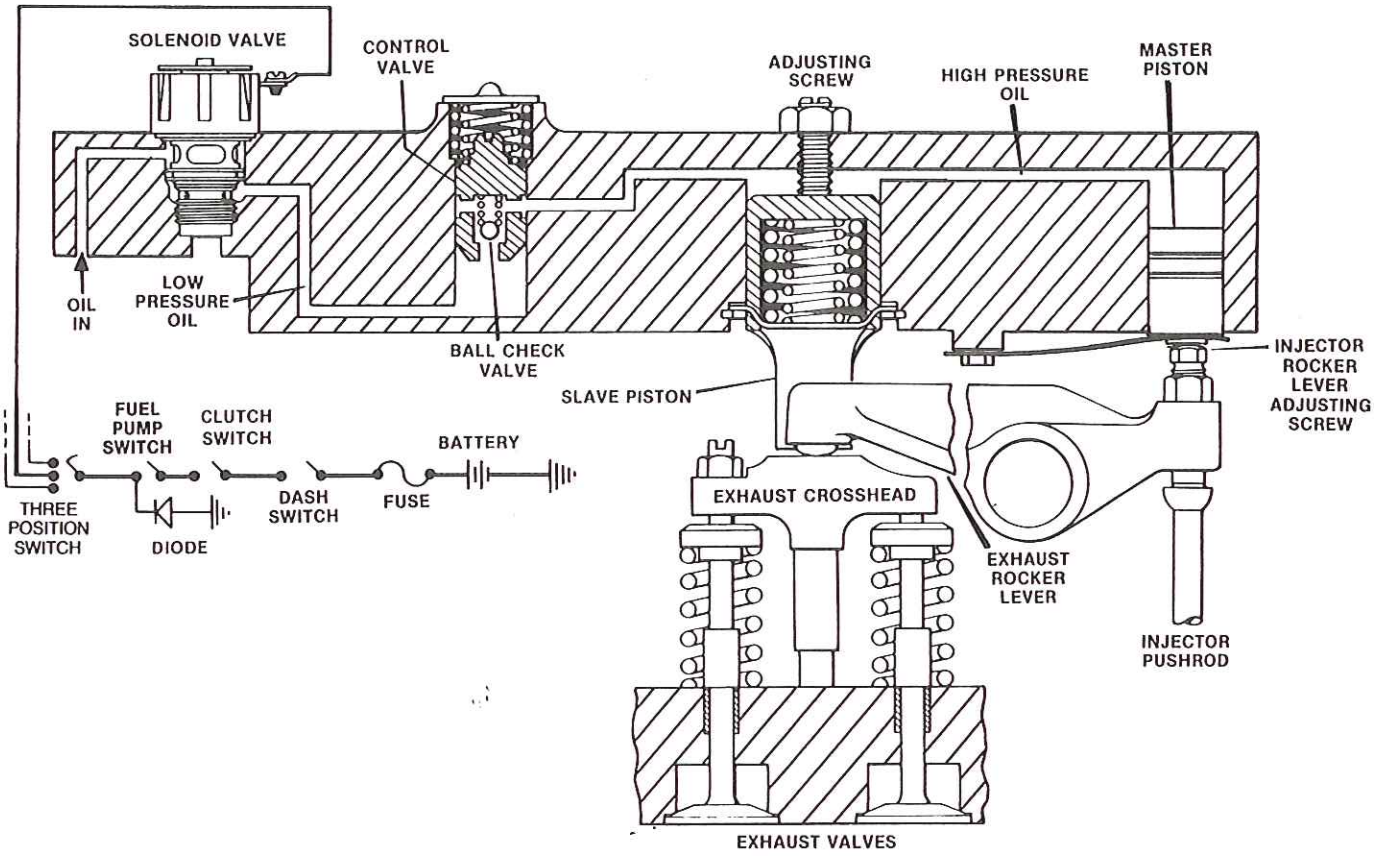
Fuels, electrical equipment, exhaust gases and moving parts present potential hazards that could result in personal injury. Take care when installing an engine brake. Always use correct tools and proper procedures as outlined in this manual.

THE JAKE BRAKE 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.

JAKE BRAKE™
Saves a Truckload

The Jacobs Manufacturing Company

SCHEMATIC DIAGRAM OF ENGINE BRAKE OPERATION



THEORY OF OPERATION — Simply stated, energizing the Engine Brake effectively converts a power-producing diesel engine into a power-absorbing air compressor. This is accomplished through motion transfer using a master-slave piston arrangement which opens 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 stroke, the effect being a net energy loss since the work done in compressing the cylinder charge is not returned during the expansion process.

EXHAUST BLOWDOWN — Referring to the schematic drawing, exhaust blowdown occurs as follows:

1. Energizing the solenoid valve permits engine lube 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 injector rocker arm adjusting screw.
3. The injector rocker arm adjusting screw begins upward travel (as in 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 imprisons high-pressure oil in the master-slave piston system.
4. The slave piston under the influence of the high-pressure oil flow moves down, momentarily opening one of the exhaust valves, while the engine piston is near its top dead center position, releasing compressed cylinder air to the exhaust manifold.
5. Compressed air escapes to atmosphere completing a compression braking cycle.

METHOD OF DRIVING A VEHICLE EQUIPPED WITH A JACOBS ENGINE BRAKE

It is easy to learn the proper method of driving a vehicle equipped with a Jacobs Engine Brake. Since the Engine Brake is most effective at rated engine speeds, gear selection is very important. Gearing down the vehicle, within the limits of rated engine speed, makes the Engine Brake a more effective retarder. Obviously, maximum retarding occurs with the selection of the lowest gear that prevents exceeding rated engine speed.

Each Engine Brake kit contains a progressive switch that provides two, four, or six cylinder operation of the Engine Brake. This switch provides the operator with greater flexibility in selecting the amount of retarding needed for various road and load conditions.

For more information on driving with the Jake Brake, read your Jacobs Drivers Manual.

To get a detailed presentation on driving with the Jacobs Engine Brake, consult your Jacobs distributor.

JACOBS ENGINE BRAKE HOUSING PART NUMBER IDENTIFICATION

Each engine brake housing assembly is identified by a name tag which shows the specific model number and part number. The part number on the name tag identifies to the factory the component makeup of the housing. Packaged housing assemblies sometime carry a completely different part number than the housing assembly. The packaged part number must be used when ordering replacement housing assemblies. ,

This installation manual should be used in conjunction with the Jacobs Parts Manual (Form #2087) when specific replacement part information is required. The parts manual can be obtained from your Jacobs distributor.

The following tabulation can be used as a reference when determining proper housing assembly nonmenclature.

Model No.	Housing Assembly No. (Tag)	Packaged Housing Assembly No. (Order by these numbers)
400H	013363	013363
400	012317	012318
44B	010053	010103
25B	002083	011894
30E	009918	009917

The following Dual Lead (DL) Housings are available for direct earth electrical systems.

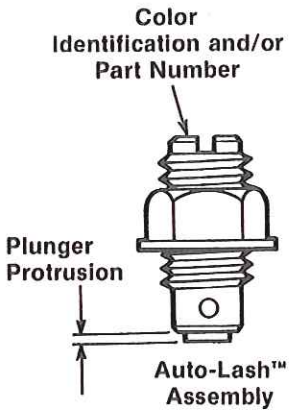
400 DL	012319	012320
44E DL	010054	010104
25 DL	002192	012287
30E DL	007563	007608

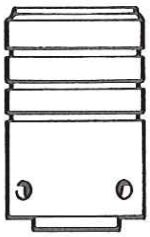
MODEL IDENTIFICATION

Model 400H & 400—Contain automatic lash adjusting screws (Auto-Lash™) to provide optimum exhaust valve operation during engine braking. (See Auto-Lash™ description below.) Each model uses a different Auto-Lash™. If proper Auto-Lash™ is not used engine damage will result.

Model 44B & 44E—Contain Auto-Lash™ adjusting screws and pressure relief master pistons. The Auto-Lash™ adjusting screws provide optimum exhaust valve operation during engine braking and the pressure relief master pistons prevent excessive brake housing pressures. (During transient operation) See description below.

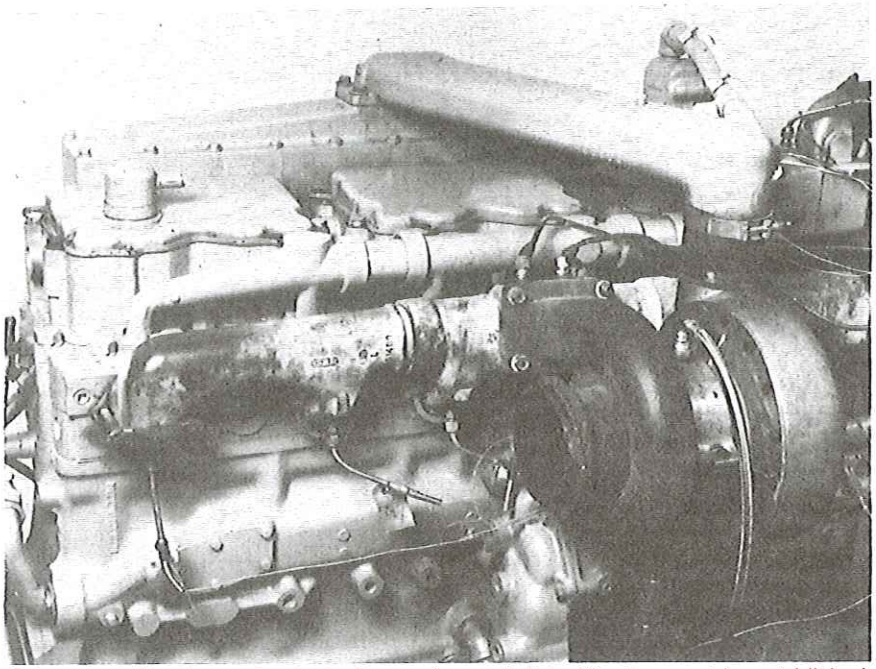
Model 25B—Contains NO Auto-Lash™ or pressure relief master pistons as in the Model 400 & 44B. The master piston is larger in diameter than the Model 400 & 44B and is designed for use on Cummins NH/NT Small Cam engines only. One exception to this is the NT-240 Small Cam Cummins CPL #0437 that requires the Model 44B.



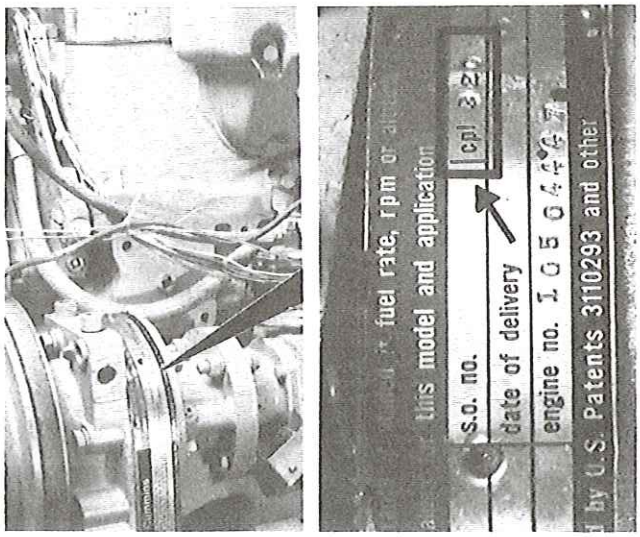


Pressure Relief Master Piston Required for Model 44B & 44E

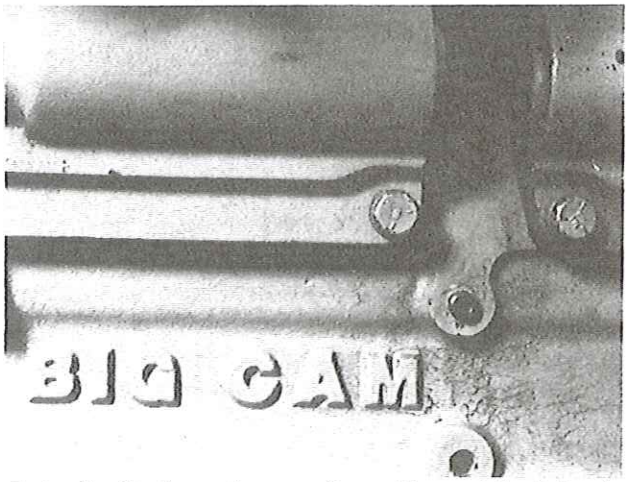
	Model 400H	Model 400	Model 44B	Model 44E
Color Ident.	NA	Yellow	White	Red
Plunger Protrustion	.028	.009	.028	.023
Part Number	013197	009329	010249	009327



Prior to installing the engine brake the engine model identification must be established to insure that the correct model engine brake is installed on the proper engine.



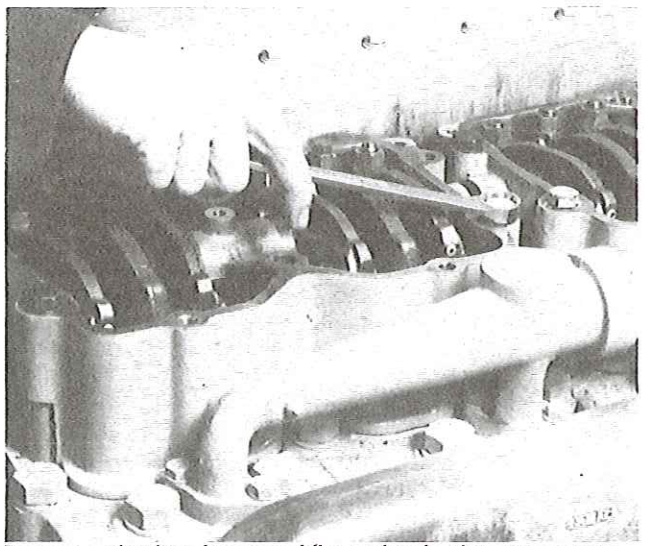
The engine model identification is on the serial number plate located on the engine gear case mounting flange.



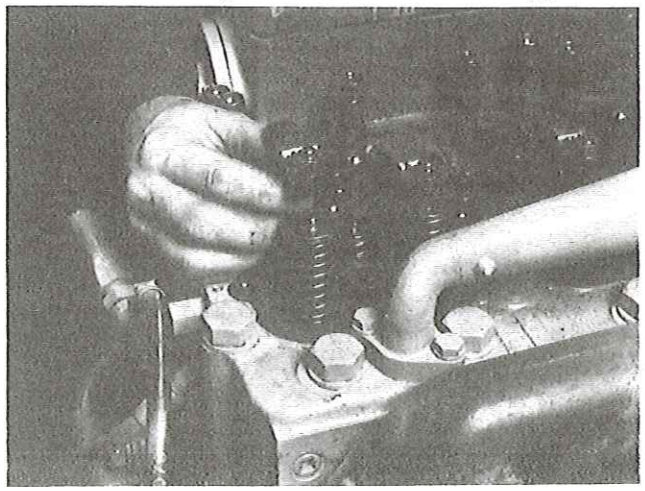
Engine identification as far as small cam - big cam is located under the cam follower housings. It is mandatory to determine this so that

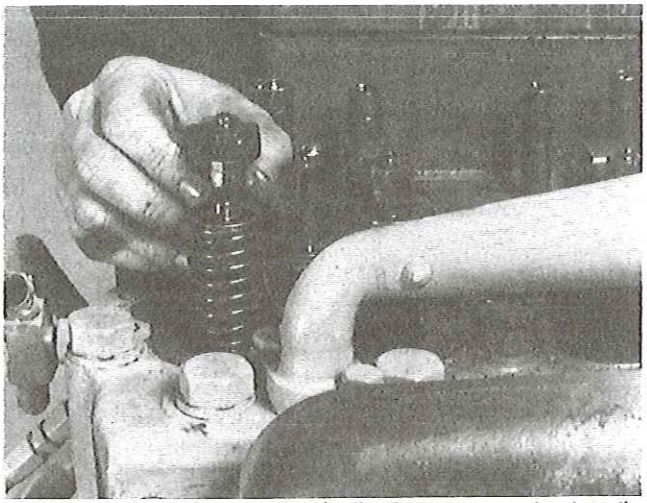
ENGINE PREPARATION

Clean engine thoroughly and begin by removing the rocker housing covers.



Remove rocker housing assemblies and rocker housing gaskets.

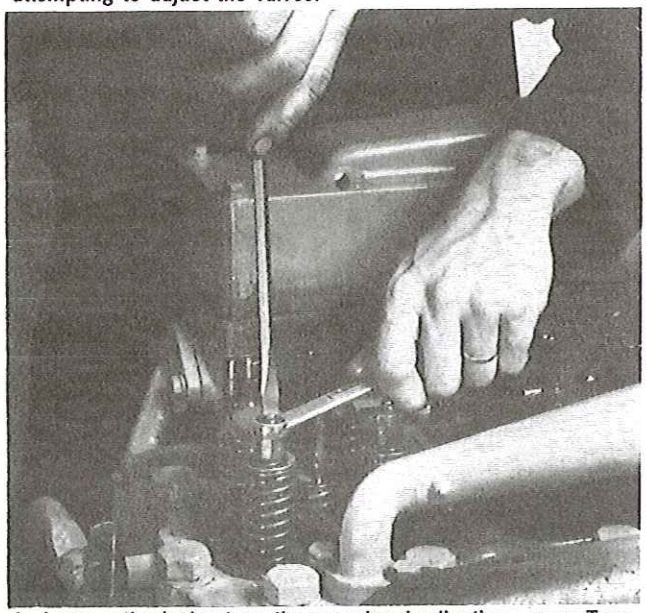




Remove the Cummins crosshead adjusting screws and re-install into the Jacobs crossheads supplied in kit. Install new crossheads on exhaust side of head. Adjust the screws as follows:

CROSSHEAD SCREW ADJUSTMENT

NOTE: Crosshead adjustment should always be made before attempting to adjust the valves.



1. Loosen the locknut on the crosshead adjusting screw. Turn the adjusting screw out at least one turn.

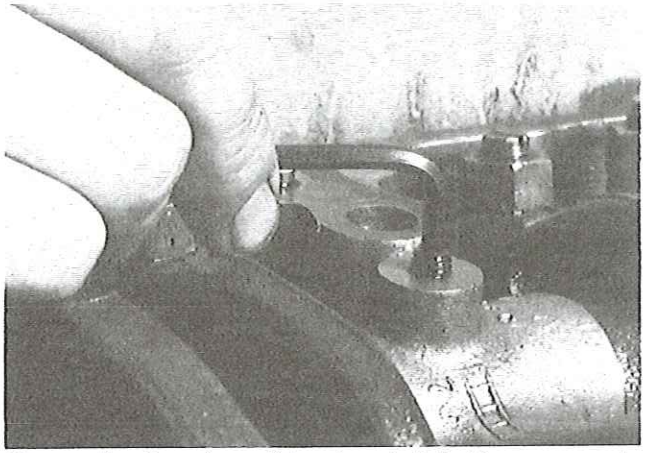
2. Hold the crosshead down against its mating valve stem. Turn the adjusting screw back in until it touches the valve stem. Hold the adjusting screw in this position and tighten the locknut.

3. Tighten the adjusting screw locknut to 25 to 30 lb. ft. (34 to 41 N•m) torque.

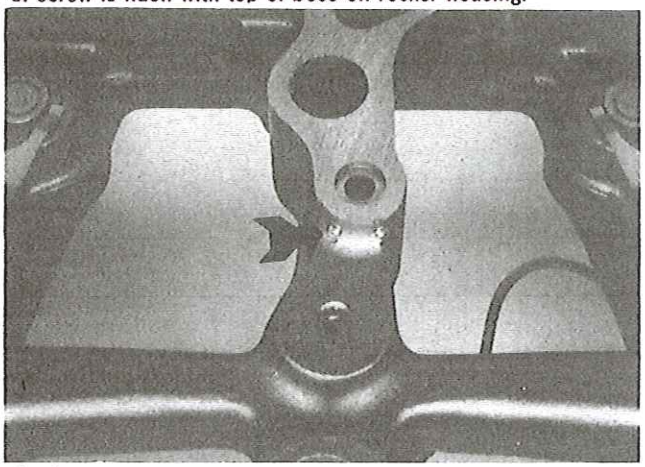
NOTE: When ST-669 Torque Wrench Adapter is used, tighten the locknut to 22 to 26 lb. ft. (30 to 35 N•m) torque.

4. Check the clearance between the crosshead and valve spring retainer with a wire gauge. There must be a minimum of 0.025 inch (0.64 mm) clearance.

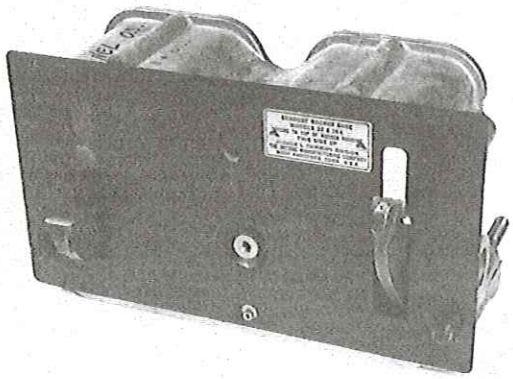
Note: With new crossheads and guides, advance adjusting screw one-third of one hex to straighten stem in its guide and to compensate for slack in thread. With worn crossheads and guides, it may be necessary to advance the screw as much as ½ hex in order to straighten the stem in its guide.



Remove the Cummins solid rocker shaft locking screw and install the Jacobs hollow oil supply screw from kit. Be sure top of screw is flush with top of boss on rocker housing.

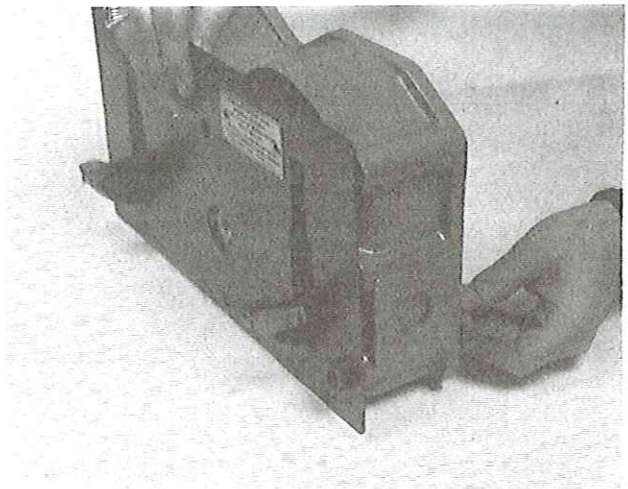


On Cummins **NHH 80° TILT ENGINE,** a special Cummins spray nozzle screw is used. This screw is designed to insure proper lubrication to the upper cylinder area. To lubricate this area, a special **SPRAY NOZZLE BRAKE HOUSING (SN)** is used. This special housing has a built-in spray nozzle (see photo) which replaces the Cummins spray nozzle screw.

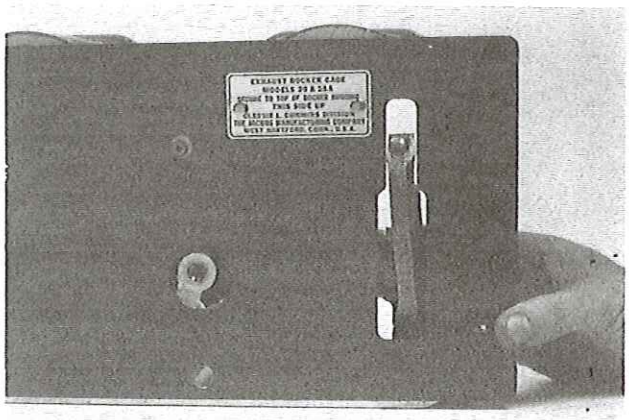


All current production Cummins **NH/NT** engines have preground exhaust rocker levers. If they are not ground, the following grinding procedure must be used:

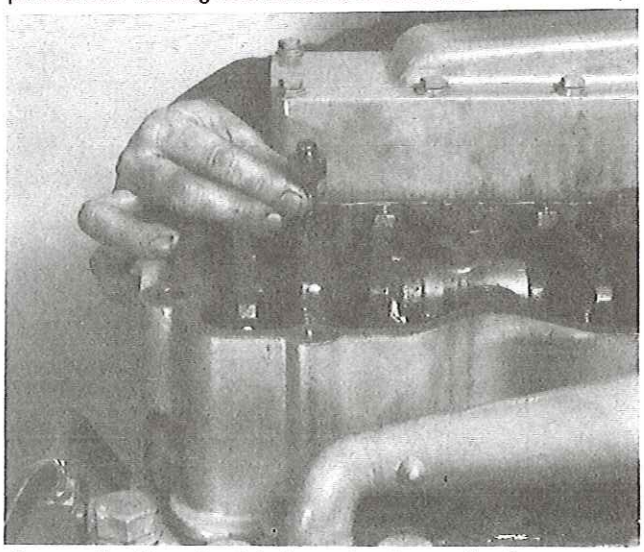
Remove adjusting screws from exhaust rocker levers. Orient rocker housings as shown with flat side on work bench. Orient rocker lever gauge with Name Plate side out, gauging slots upward and insert rocker lever feet through wide slot. Gauge must be assembled to top of rocker housing. Secure gauge by installing two ½x13 cap screws through rocker housing into captive nuts on gauge. Tighten securely but not heavily with wrench.



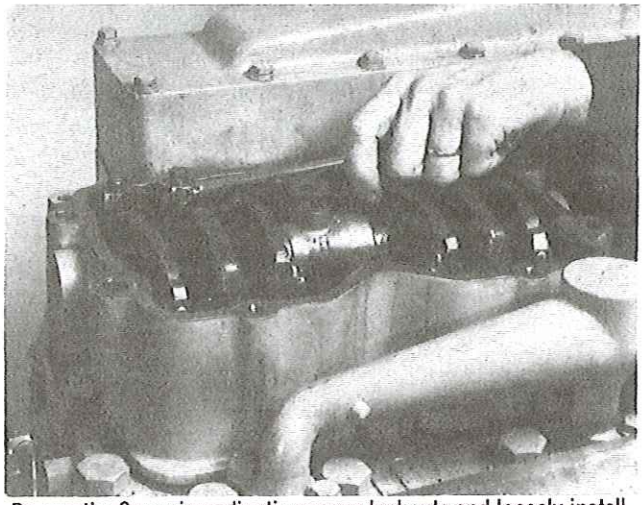
Grind both sides of the exhaust rocker lever lightly. (Do not draw temper of rocker lever foot.)



Continue grinding until the rocker lever foot fits the gauge slot. Remove gauge. Remove burrs from rocker lever foot and clean rocker assembly thoroughly. Using new Cummins gaskets, place rocker housing assemblies back on heads.

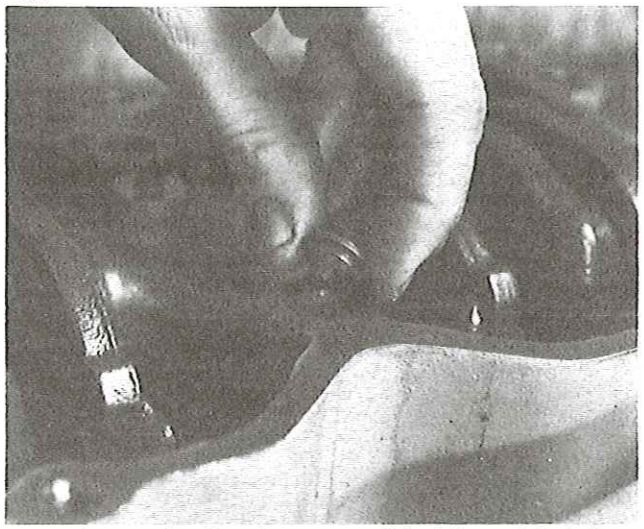


Remove the Cummins injector rocker lever adjusting screws and replace with Jacobs adjusting screws provided in kit. Use either the ½" or 5/8" diameter thread depending on size of screws removed from engine.



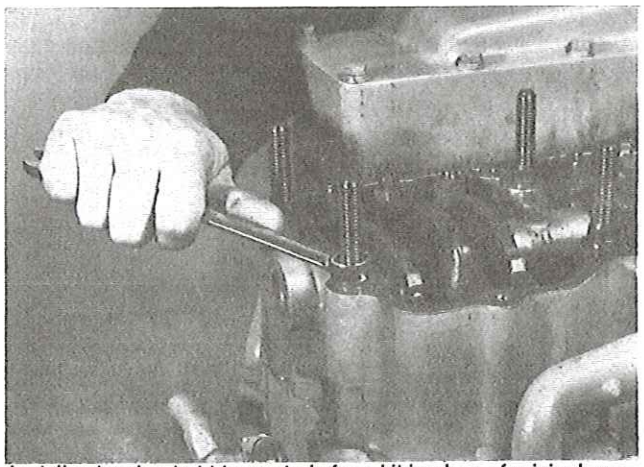
Re-use the Cummins adjusting screw locknuts and loosely install the Jacobs adjusting screws.

NOTE: These screws have a hex head instead of a screwdriver slot.



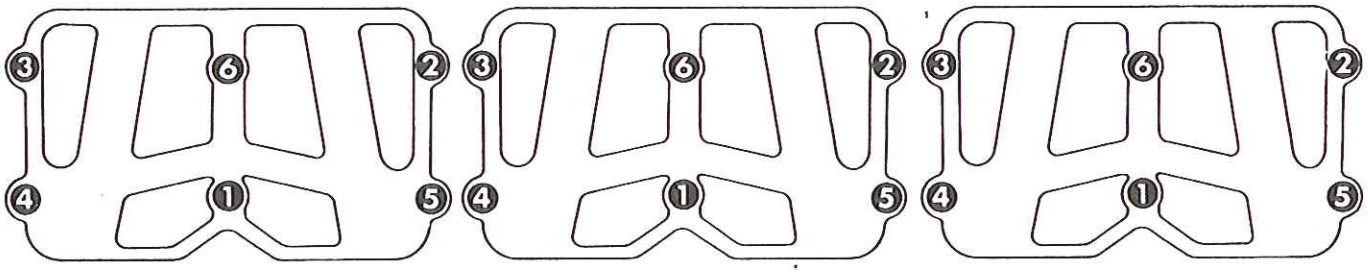
If aluminum rocker housings are used, install special steel washers supplied in kit into each holddown bolt hole, 6 per rocker housing. Insert pilot end of washer into hole as shown.

DO NOT USE SPECIAL WASHERS ON CAST IRON ROCKER HOUSINGS.



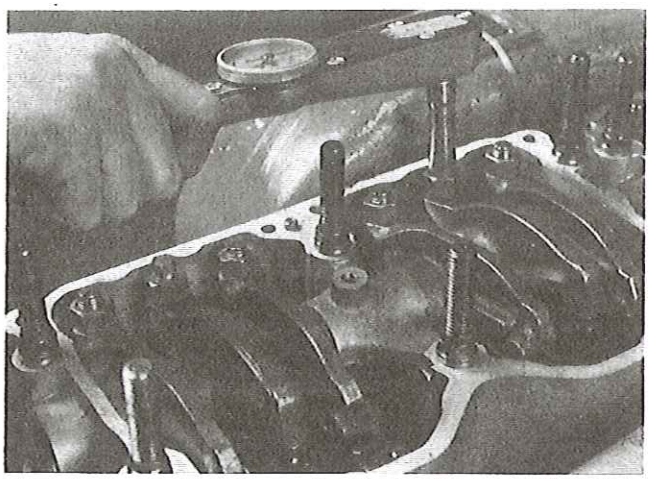
Install extension holddown studs from kit in place of original cap screws. **DO NOT USE THE FLAT WASHERS ORIGINALLY USED WITH ROCKER HOUSING CAP SCREWS.** If engine is equipped with an engine mounted fan bracket refer to instructions on page 9

18 extension studs and spacers are supplied in the kit. There are three different sized studs. Stud and spacer locations must be selected for the specific engine to allow for lifting bracket and fan support reinstallation.

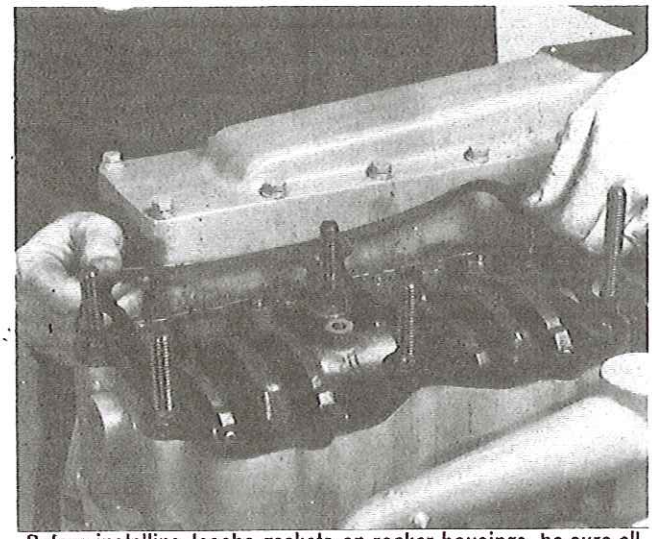


Tighten studs to 65-75 lb. ft. (88-102 N•m).

FWD

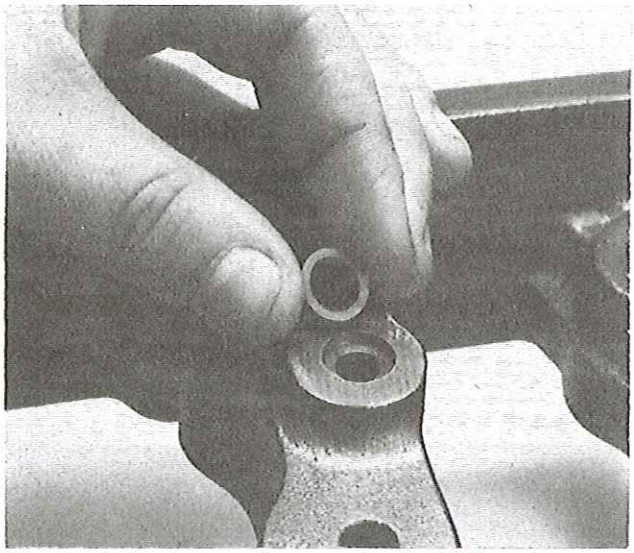


Adjust valves and injectors as described in the current Cummins Engine Publications.

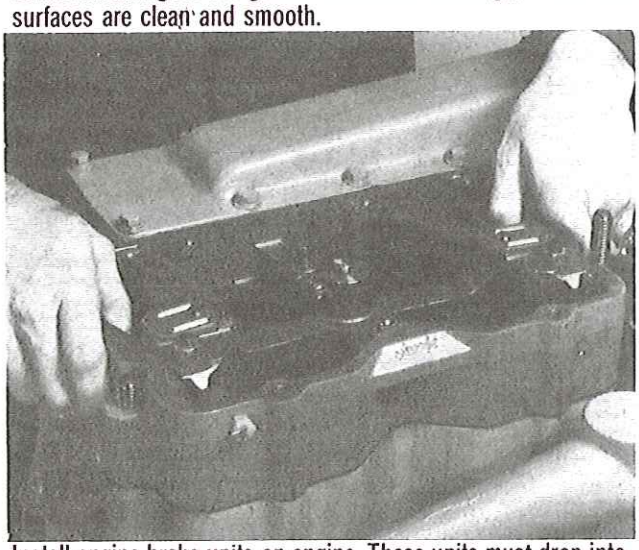


Before installing Jacobs gaskets on rocker housings, be sure all surfaces are clean and smooth.

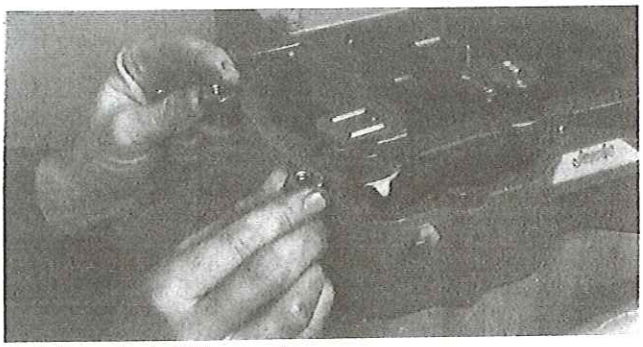
INSTALLATION OF BRAKE UNITS ON ENGINE



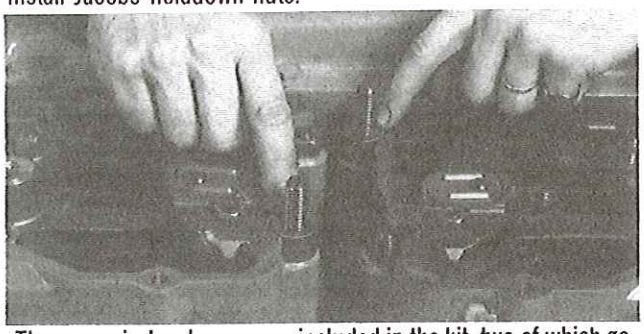
Prior to placing brake units on engine, install the rubber seal from kit in the hole located in center of web on the bottom of engine brake. Use a little grease if necessary to hold seal in place.



Install engine brake units on engine. These units must drop into place without interference of rocker levers.



Install Jacobs holddown nuts.



There are six Jacobs spacers included in the kit, two of which go at the locations shown.

Torque holddown nuts to 55-60 lb.ft. (75-81 N•m) following sequence on page 7.

SLAVE PISTON ADJUSTMENT PROCEDURE (All NTE Engines Excluded)

⚠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.**

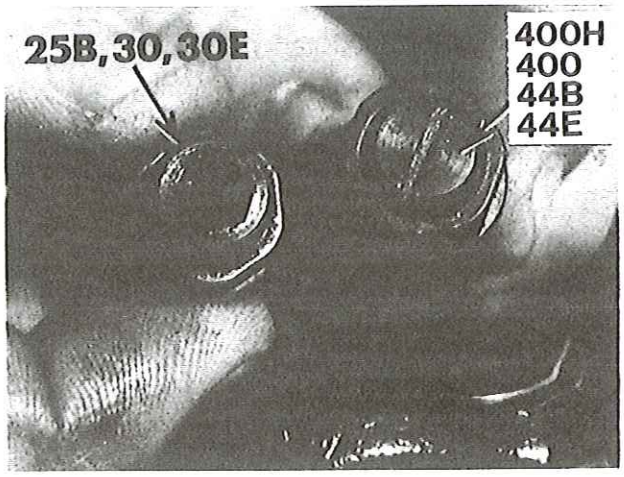
Slave piston adjustment must be made with the engine stopped and cold. The exhaust valves on the cylinder to be adjusted must be in the closed position.

Valve Set Mark Alignment

1. Turn the crankshaft in the direction of rotation until "A" or the 1-6 "VS" mark is aligned with the pointer on the gear cover.
2. When 1-6 "VS" mark is aligned with the pointer, the intake and exhaust valves should be closed for cylinder number 5. The injector plunger for cylinder number 3 must be at the top of its travel; if not, turn the crankshaft another 360 degrees and realign the valve set mark with the pointer.
3. When the valves are closed the rocker levers for cylinder number 5 will be loose. Valve set marks used for this instruction were chosen for convenience. With experience any valve set mark may be used as a starting point.

Injector and Valve Set Position

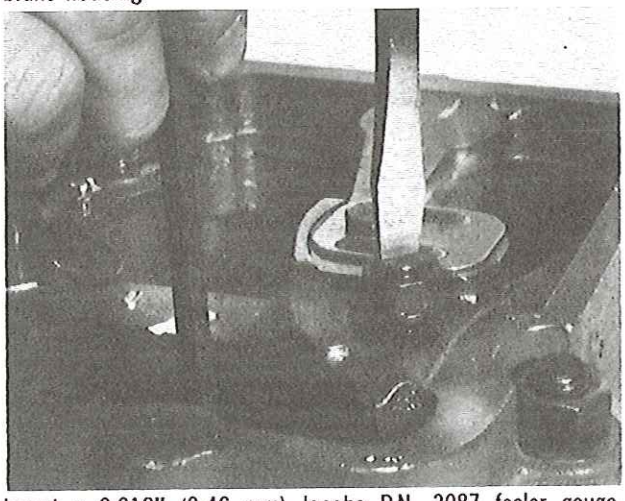
Bar in Direction of Rotation	Pulley Position	Set Cylinder Injector	Valve
Start	A or 1-6 VS	3	5
Adv. To	B or 2-5 VS	6	3
Adv. To	C or 3-4 VS	2	6
Adv. To	A or 1-6 VS	4	2
Adv. To	B or 2-5 VS	1	4
Adv. To	C or 3-4 VS	5	1



NOTE: The slave piston adjusting screw in the Models 25B, 30 & 30E engine brake is a solid screw and requires a hex head socket wrench for adjustment.

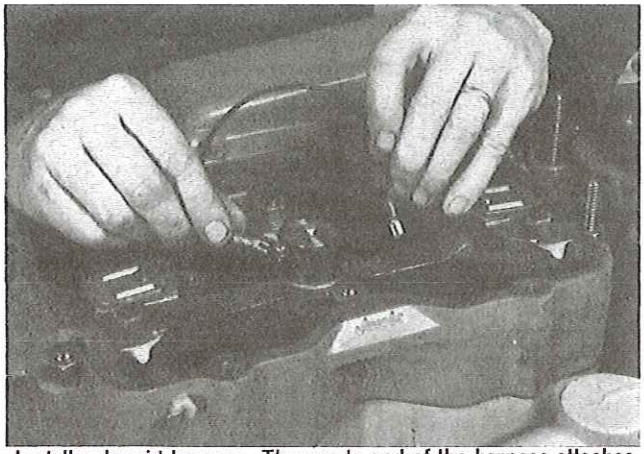
The slave piston adjusting screw used in the Model 400H, 400, 44B & 44E contains an automatic lash adjuster and requires a screw driver for adjustment. Adjustment procedure and clearances for all models contained in this manual are the same.

Loosen the locknut and back off the slave piston adjusting screw on the cylinder with the exhaust valves closed. Back out the adjusting screw until the slave piston bottoms in the engine brake housing.

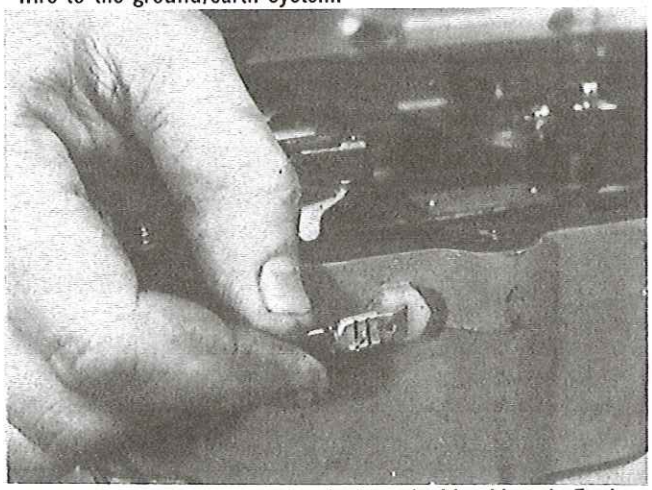


Insert a 0.018" (0.46 mm) Jacobs P.N. 3087 feeler gauge between the slave piston and the crosshead. Turn the adjusting screw in until a light drag is felt on the feeler gauge.

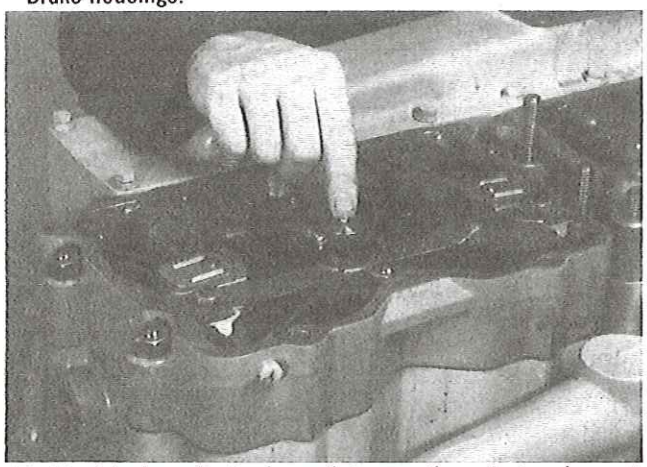
Tighten the locknut to 30-40 lb. ft. (41-54 N•m). Continue turning engine in direction of rotation and set slave piston clearance on



Install solenoid harness. The spade end of the harness attaches to the solenoid and the other end attaches to the inside terminal of the leadout assembly in the brake housing. Some applications use a 2-wire dual lead solenoid valve. Either solenoid harness can be connected to the vehicle electrical system and the other wire to the ground/earth system.



Connect control wires to electrical terminal bushings in Engine Brake housings.



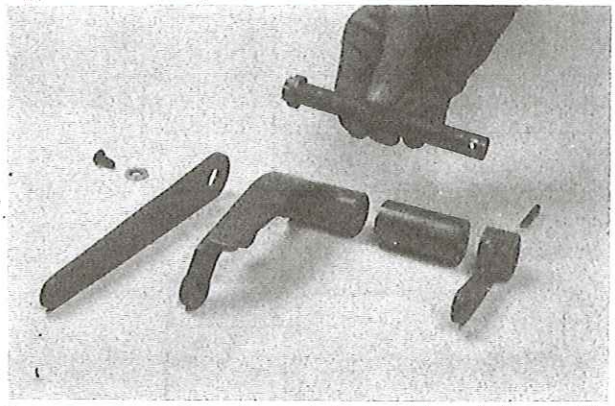
To bleed brake units for immediate operation, start engine and allow to run several minutes. Accelerate engine to approximately 1800 rpms, release throttle **and then** manually depress solenoid armature. This procedure should be done five or six times to permit the engine oil to fill the brake housing passages.

WHENEVER ENGINE IS RUNNING AND THE VALVE COVERS ARE REMOVED, THERE IS SIGNIFICANT OIL SPLASH IN THE ENGINE BRAKE AREA. IT IS RECOMMENDED THAT EYE PROTECTION BE WORN AND THAT THERE IS NO FACIAL EXPOSURE OVER ENGINE BRAKE AREA. PLACE RAGS OVER THE CONTROL VALVE COVERS TO PREVENT EXHAUST OIL LEAKAGE DOWN ON ENGINE.

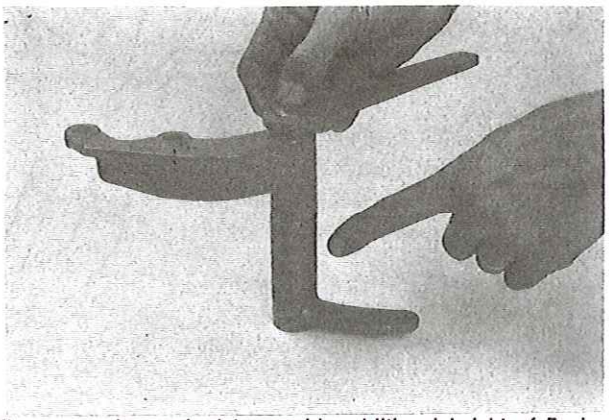
Using new Cummins gaskets, replace rocker housing covers and all previously removed parts.

MODIFICATION OF COMPRESSION RELEASE ASSEMBLY

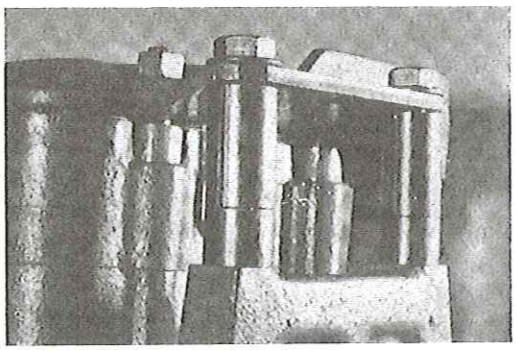
If engine is equipped with compression release, with or without fan support brackets, it will be necessary to substitute special extension studs in the front three locations of the rocker housing over cylinders 1 and 2 and to modify the compression release assembly as shown below. Special long studs are supplied in the compression release modification kit.



Remove compression release shaft assembly and disassemble. Using new shaft and spacer assemble components as shown.

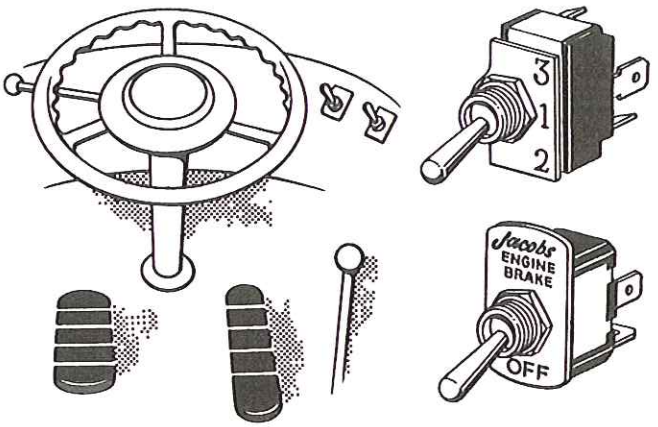


The spacer is required to provide additional height of Engine Brake.



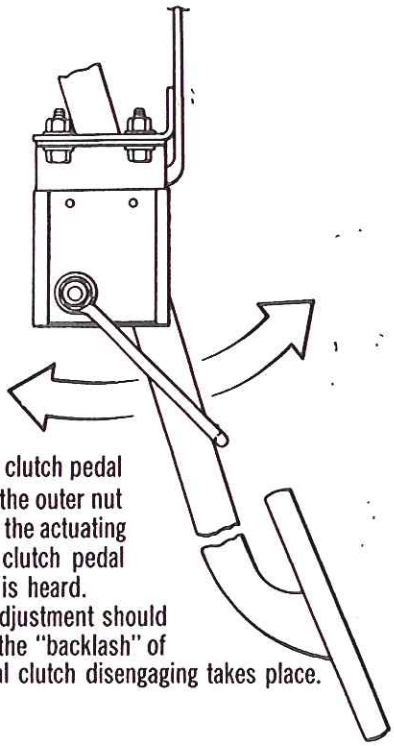
Reinstall compression release assembly on engine using spacers furnished in kit to give correct height to release assembly and fan bracket support.

DASH SWITCHES



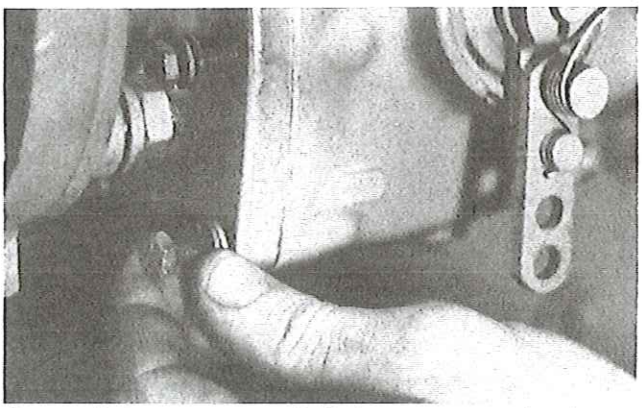
Install the two dash switches in a convenient location in the cab. Carefully measure and cut all harnesses to proper length and install receptacles at the locations shown in the wiring diagram furnished in the kit.

CLUTCH SWITCH

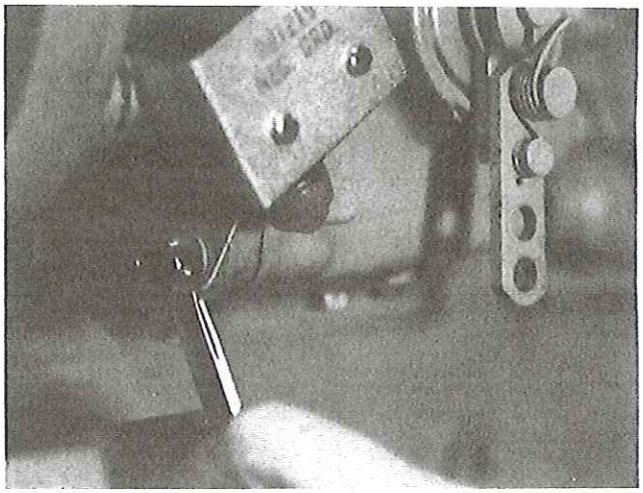


To adjust the switch, have the clutch pedal in a relaxed position. Loosen the outer nut on the switch assembly. Bend the actuating arm so that it contacts the clutch pedal arm and an audible "click" is heard. Tighten the outer nut. This adjustment should allow the switch to work on the "backlash" of the clutch pedal before actual clutch disengaging takes place.

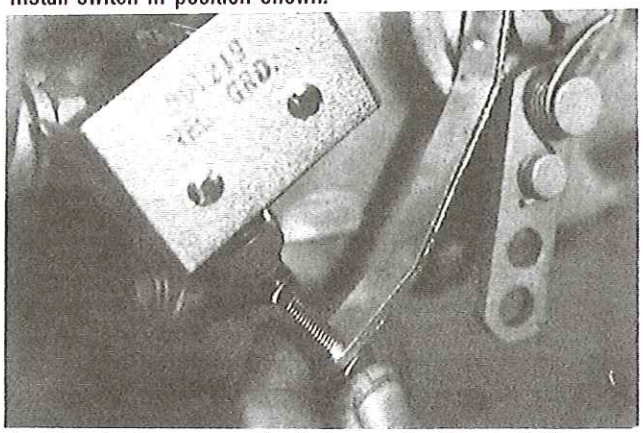
FUEL PUMP SWITCH



Remove the two screws from the fuel pump governor housing as



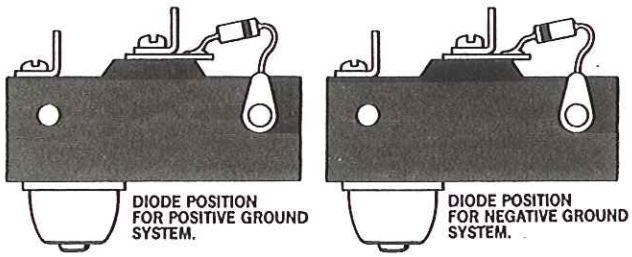
Install switch in position shown.



Install actuating arm on the fuel pump throttle shaft. The arm may be bent or manipulated so as to obtain the proper position for switch contact.

Proper adjustment of the switch is obtained by adjusting the screw in the actuating arm to a point where an audible "click is heard when the throttle arm moves to an idle fuel position.

⚠CAUTION Check the fuel pump throttle shaft to insure that the throttle pedal will move the shaft to the full fuel position after installing the actuating arm.

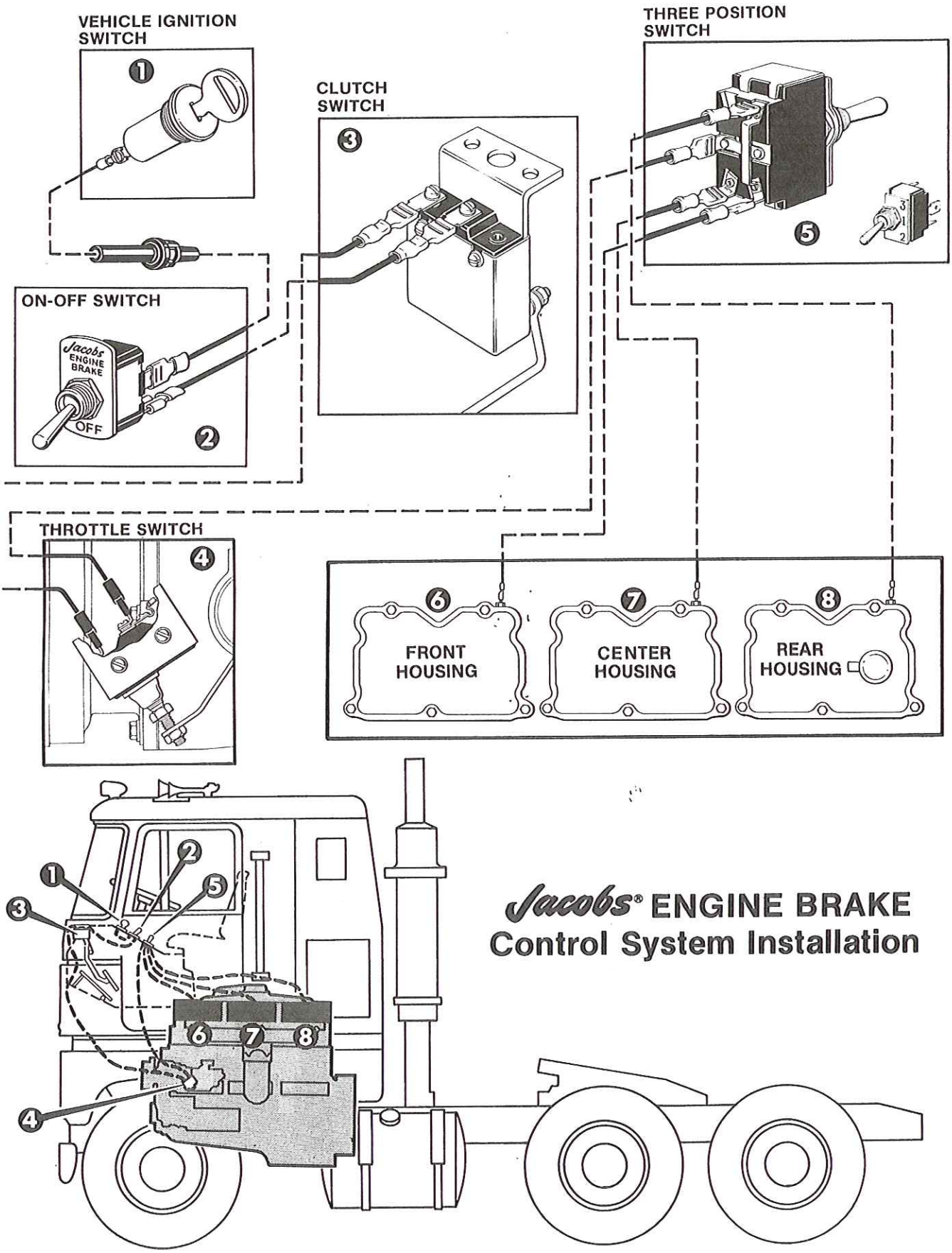


NOTE: The throttle switch contacts are protected against arcing by a small diode connected between the load side switch terminal and ground. The Engine Brake must be connected to the load side terminal. If the vehicle has a positive ground electrical system, reverse the position of the diode.

Be sure that all the wiring is neatly installed and properly tied off. Avoid routing wires where chafing, mechanical interference, etc. will take place.

REMEMBER! Of all engine brake problems, 75% are electrically related.

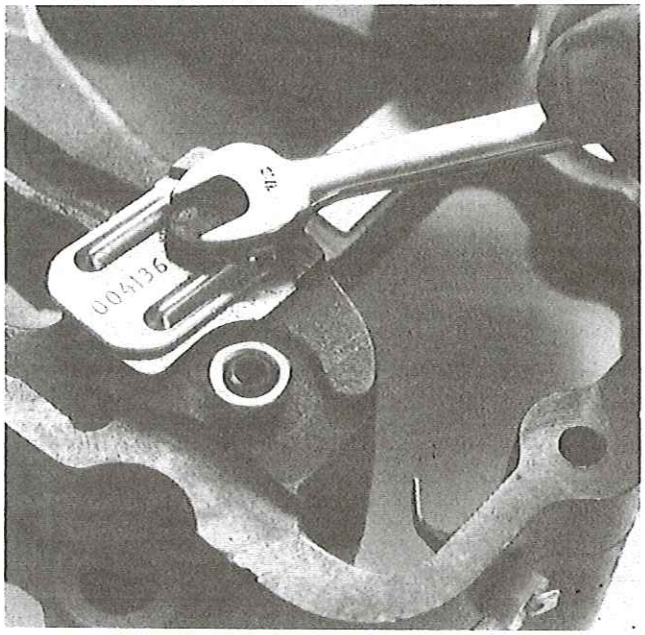
For vehicles with automatic transmissions refer to Jacobs


VEHICLE IGNITION SWITCH
1
CLUTCH SWITCH
3
THREE POSITION SWITCH
5
ON-OFF SWITCH
Jacobs ENGINE BRAKE
OFF
2
THROTTLE SWITCH
4
6
FRONT HOUSING
7
CENTER HOUSING
8
REAR HOUSING
Jacobs® ENGINE BRAKE
Control System Installation

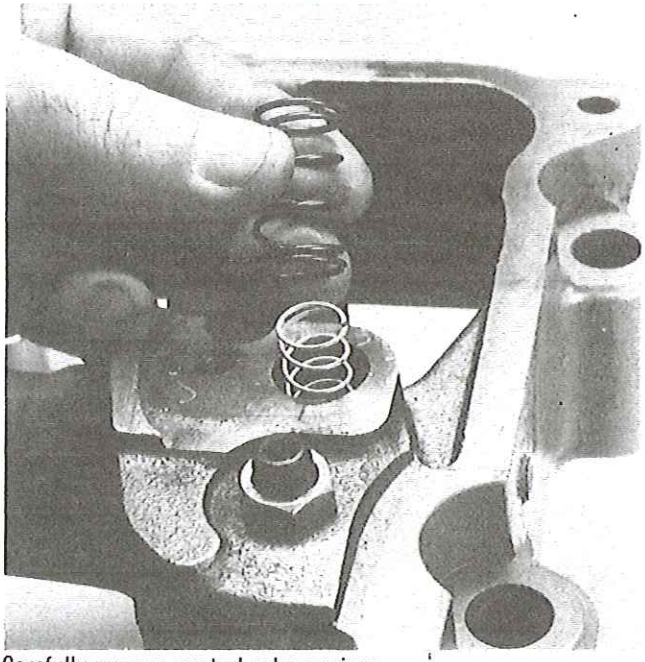
⚠CAUTION NEVER REMOVE ANY ENGINE BRAKE COMPONENTS WITH ENGINE RUNNING.

The Jacobs Engine Brake is a relatively trouble free and maintenance free device. It does require, from time to time, periodic inspections and part replacement. Use the following procedures to keep your engine brake in good condition.

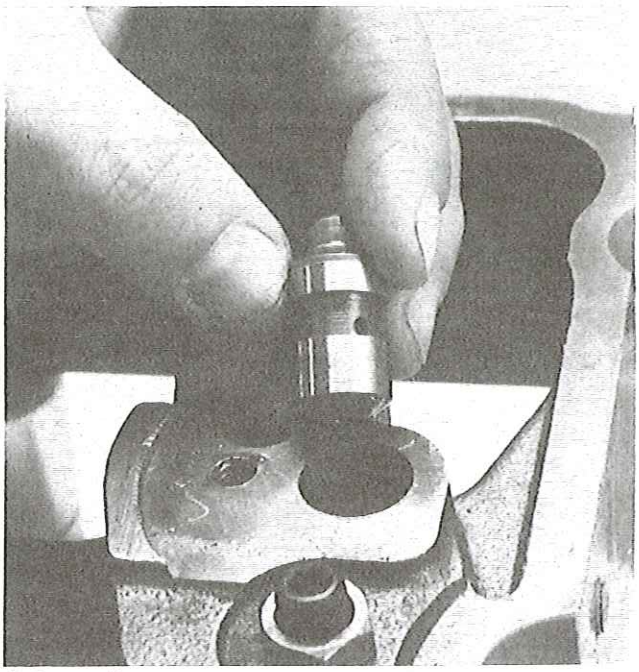
REMOVAL OF CONTROL VALVE



⚠WARNING Remove capscrew slowly from cover plate as the stop springs are under pressure. Inspect or replace springs as necessary.

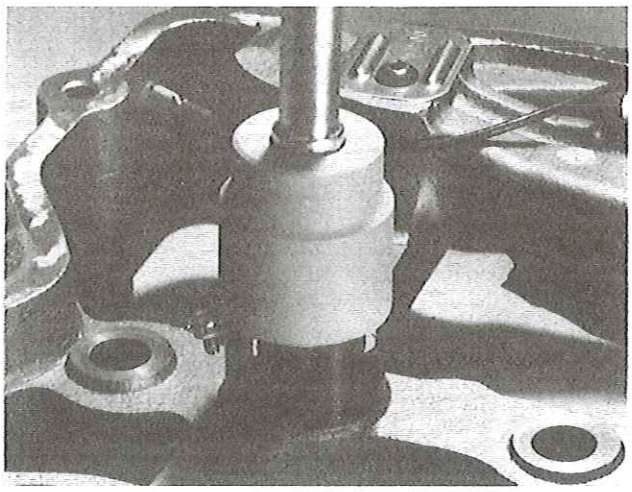


Carefully remove control valve springs.

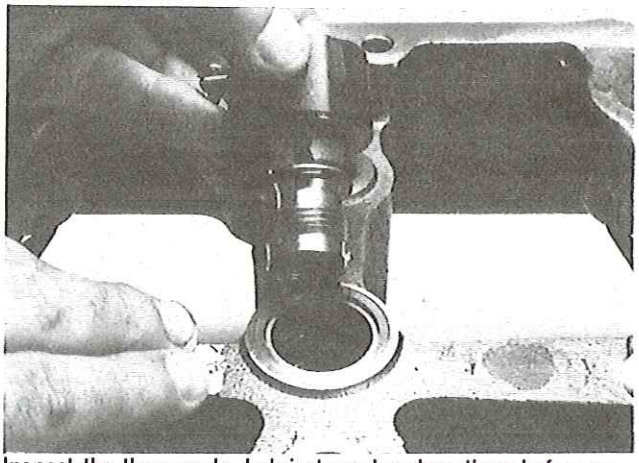


Using needle nose pliers or fingertips, pull control valve carefully and straight up and out of its bore. If binding occurs, clean or replace as necessary.

REMOVAL OF SOLENOID VALVE

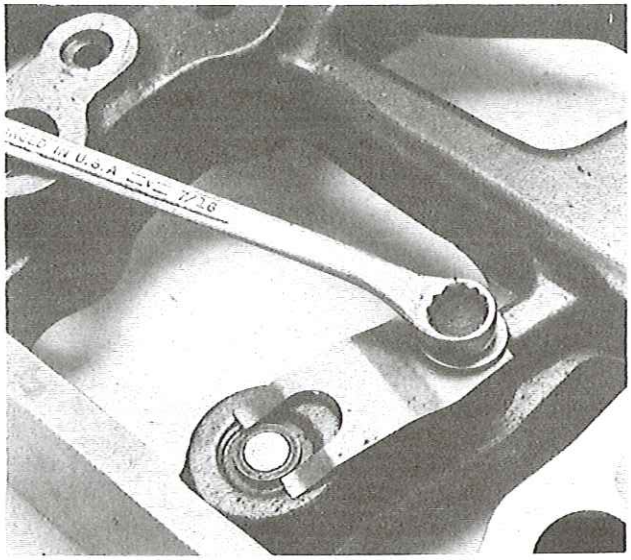


Disconnect solenoid harness. Using new Jacobs socket remove solenoid valve.

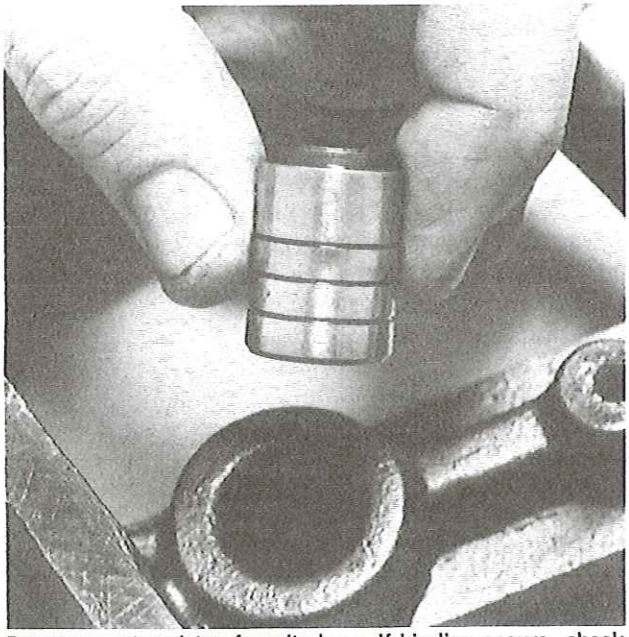


Inspect the three seals. Lubricate and replace them before reassembly. Discard them if they appear "worn." When replacing

REMOVAL OF MASTER PISTON



Remove capscrew and flat spring from housing.

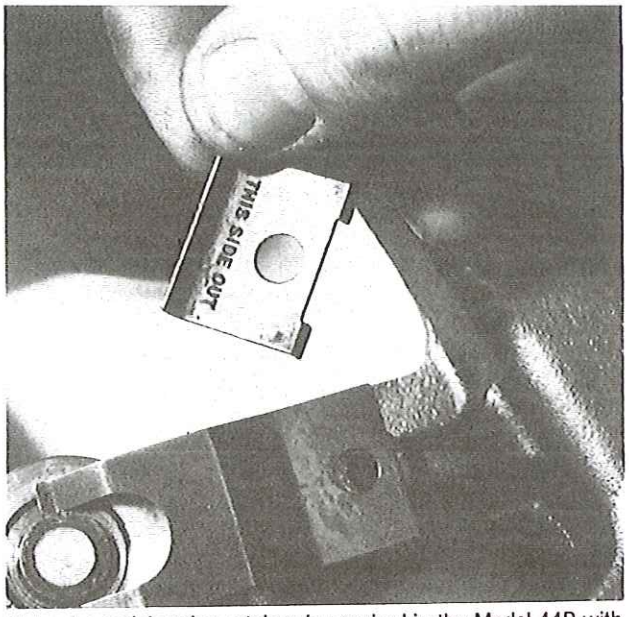


Remove master piston from its bore. If binding occurs, check for burrs or contaminates in lube oil. Replace or clean as necessary.

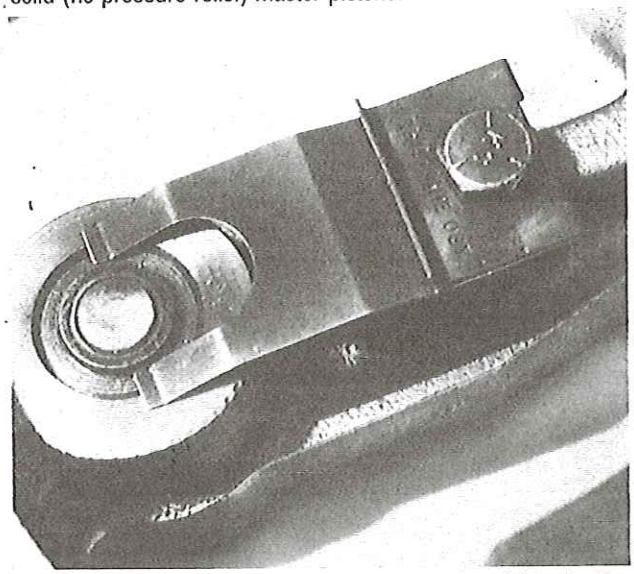
Pressure Relief **Solid**

Note the difference between the solid and the pressure relief master pistons. The Model 44B & 44E only requires use of the pressure relief master piston.

⚠CAUTION **No attempt must be made to readjust or tamper with the pressure relief master piston. It has been preset at the factory. Changes could result in engine damage.**



Note: A special spring retainer is required in the Model 44B with pressure relief master pistons. Position the spring retainer as shown. A flat round washer is used in the Models 400, 25B, 30 & 30E with solid (no pressure relief) master pistons.

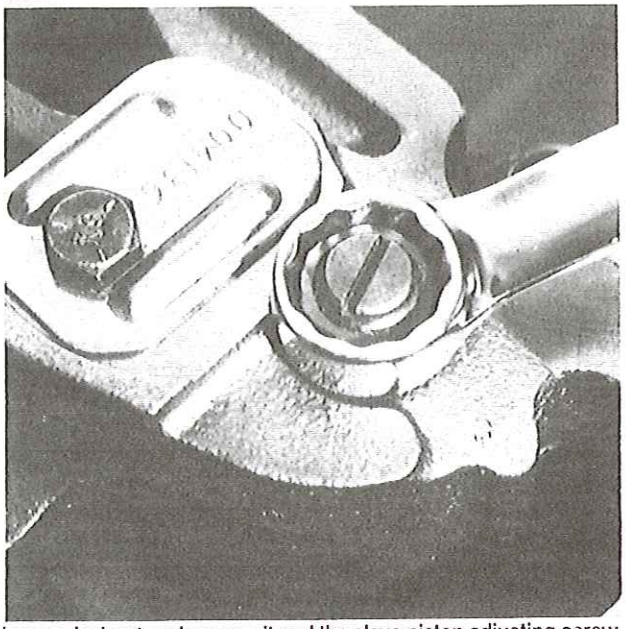


Reassemble in same order, being careful that when tightening the capscrew, the two tabs of the spring do not interfere with the sides of the center raised portion of the master piston.

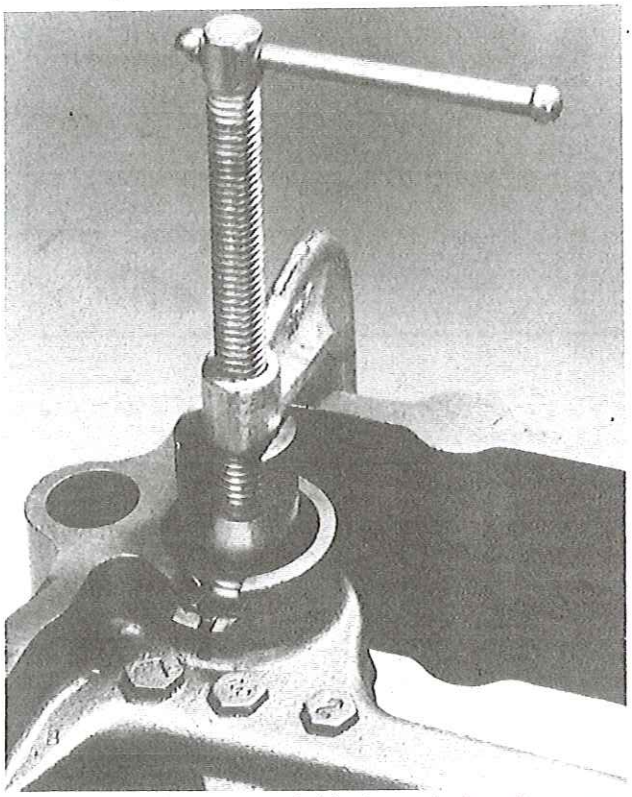
REMOVAL OF SLAVE PISTON

⚠WARNING

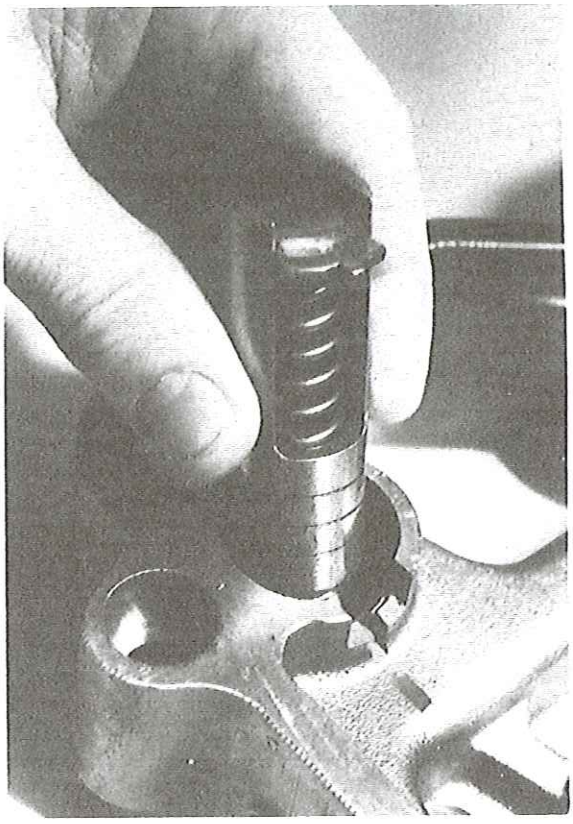
THE SLAVE PISTON IS RETAINED BY A SPRING THAT IS UNDER HEAVY COMPRESSION. IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED AND PROPER TOOLS NOT USED, THE SPRING COULD BE DISCHARGED WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY. SAFETY GLASSES SHOULD BE WORN.



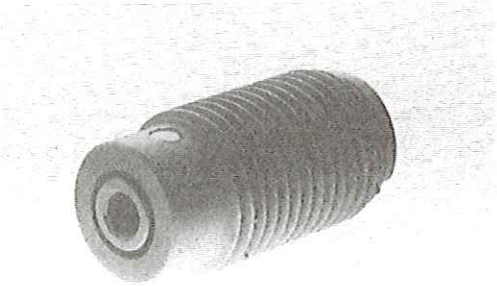
Loosen locknut and remove it and the slave piston adjusting screw from housing.



Using an arbor press, or any suitable clamp, slowly apply pressure to the retainer and remove the snap ring. Continue loosening until all pressure has been relieved from the slave piston spring.



Remove the retainer, spring and slave piston. Check for binding or burrs. Clean or replace as necessary. Reassemble all parts using same procedure as when removed.



Slave piston adjusting screw (Auto-Lash™). (Typical). Standard for Models 400H, 400, 44E, 44B. Optional on 30E engine brakes. See Page 3 for proper identification.

⚠CAUTION **No attempt must be made to readjust or tamper with the adjusting screw. Changes could result in engine damage.**

RECOMMENDED TORQUE VALUES

Exhaust Valve Crosshead Adjusting Screw Locknuts	25-30 lb.ft. (34-41 (N•m)
Rocker Housing Studs	65-75 lb.ft. (80-102 N•m)
Engine Brake Holddown Nuts	55-60 lb.ft. (75-81 N•m)
Slave Piston Adjusting Screw Locknuts (3/8")	15-18 lb.ft. (20-24 N•m)
Slave Piston Adjusting Screw Locknuts (1/2")	30-40 lb.ft. (41-54 N•m)

SPECIAL INSTRUCTIONS FOR 2 ENGINE BRAKE HOUSING INSTALLATIONS

Certain applications require use of 2 engine brake housings instead of 3. Adhere to the information in this manual with the following changes:

1. Install the two Engine Brake housings on cylinders 1 & 2, and 5 & 6. The center cylinders are to be left free.
2. Adjust the slave pistons on cylinders 1, 2, 5, 6 to .018″ (.46mm) clearance.
3. Connect the dash switch for No. 1 position to the housing on cyls. 5 & 6 and for No. 2 position to the housing on cyls. 1 & 2.
4. Install wiring as shown below.