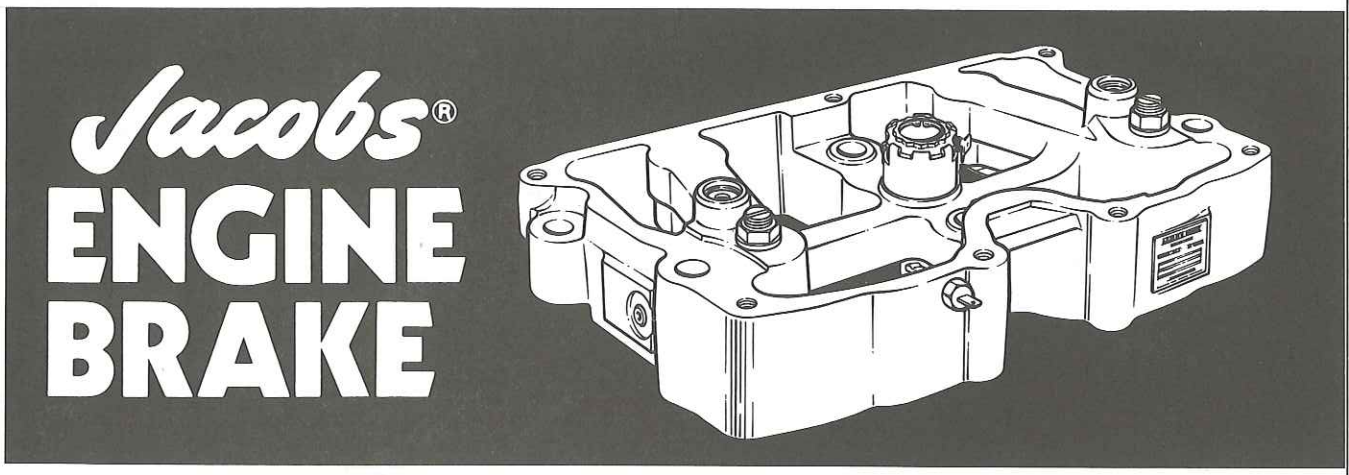
# Installation Manual for MODEL 430




## GENERAL APPLICATION INFORMATION

- **This manual contains installation and maintainance information for the Jacobs Engine Brake Model 430. The Model 430 Jake Brake® Retarder is approved for operation on all Cummins 88/89NT engines, including Fixed Timing (FT), Step Timing (STC) and Electronic Controlled Ignition (ECI). 88/89 NT engines can be identified by CPL number. Any specific application and slave piston clearance setting information is included in this installation manual.**
- **For specific engine – engine brake application information on all Cummins NH/NT Series engines, see the engine brake application guide on page 3 of this manual.**
- **Jacobs Service Letters must always be consulted for additional applications and updated information, which may have become available since this manual was printed.**
- **The information contained in this manual was current at the time of printing and is subject to change without notice or liability.**

## 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.

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.**

**The Jacobs Vehicle Equipment Company**
a Division of The Jacobs Manufacturing Company
Bloomfield, CT 06002

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* PACE is a trademark of the Cummins Engine Co.

# SECTION 1 INTRODUCTION
# ENGINE BRAKE APPLICATIONS GUIDE FOR NH/NT CUMMINS ENGINES

| ENGINE TYPE | CURRENT BRAKE MODELS 425/425A | 430 |
|---|---|---|
| **NH Series 5 1/8 Bore** | | |
| **Small Cam NH** | | |
| Single Entry Turbo or no Turbo | ● | |
| **Small Cam III** | | |
| Single Entry Turbo | ● | |
| Divided Entry Turbo | ● | |
| **Big Cam I** | | |
| Single Entry Turbo | ● | |
| Divided Entry Turbo | ● | |
| **Big Cam II** | | |
| Single Entry Turbo | ● | |
| Divided Entry Turbo | ● | |
| **NTC 475 Twin Turbo (MVT)** | * | |
| **Big Cam III** | | |
| Single Entry Turbo | ● | |
| Divided Entry Turbo | ● | |
| **Big Cam IV** | | |
| Single Entry Turbo | ● | |
| Divided Entry Turbo (MVT) | * | |
| **New Big Cam IV Fixed Timing** | | |
| CPL 0832 | ● | |
| CPL 0796 | ● | |
| CPL 0797 | ● | |
| **New Big Cam IV Step Timing Control** | | |
| CPL 0806 (365/400/444 HP) | * | |
| CPL 0821 (444 HP) | * | |
| CPL 0833 (365-400 HP) | * | |
| CPL 1215 (440 - PLUS RECON) | * | |
| **88/89NT** | | |
| Fixed Timing – CPL 0838 | | ● |
| 0840 | | ● |
| Step Timing – CPL 0827 CPL 1188 | | ● |
| 0910 1210 | | ● |
| 1185 1211 | | ● |
| 1187 1256 | | ● |
| E.C.I. – CPL 1213 | | ● |

| EARLY BRAKE MODELS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20 | 25B | 30 | 30E | 400 | 400H | 401A | 401B | 401C | 420 |
| ● | | | | | | | | | |
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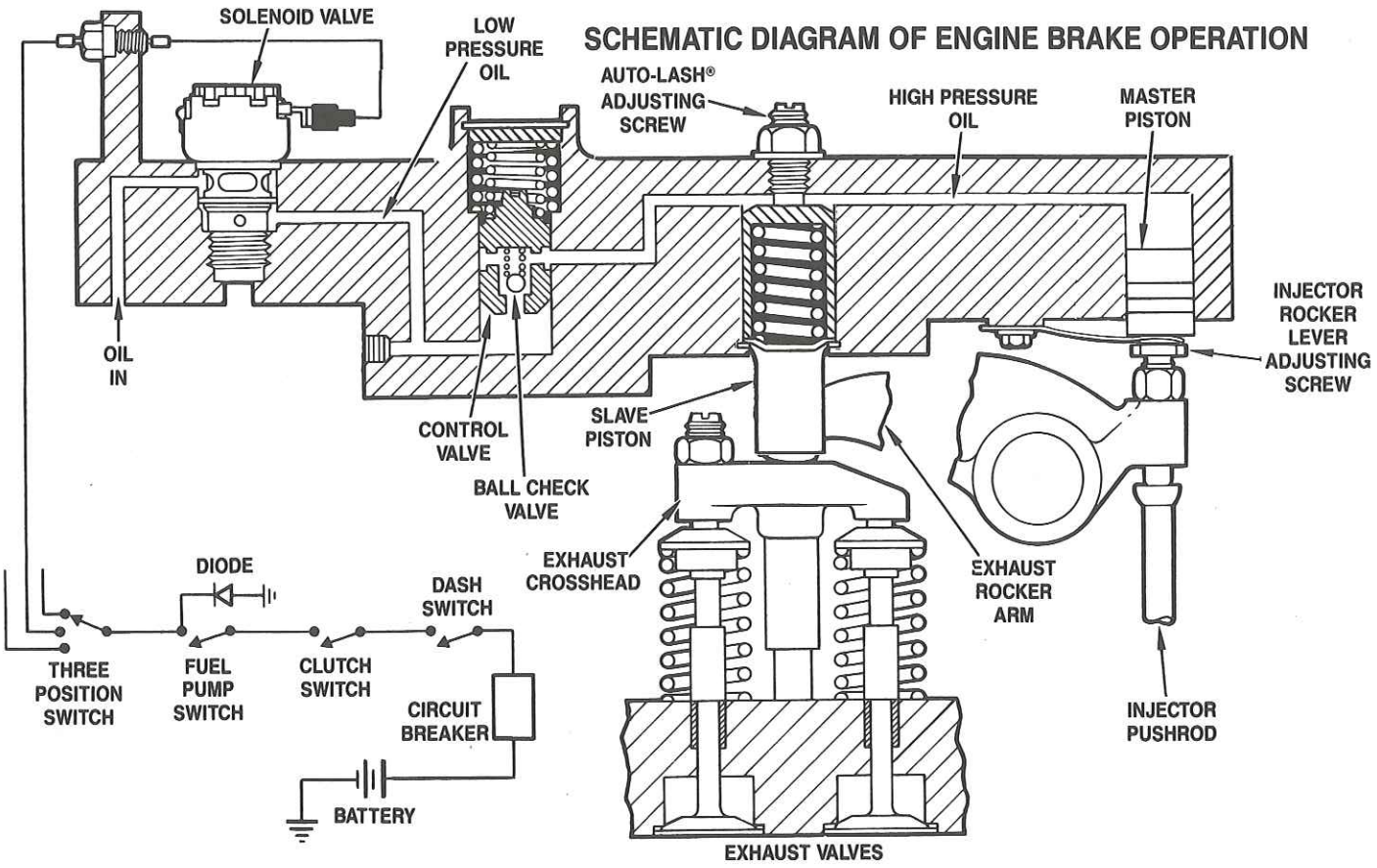
NOTE: THE MODEL 44B HAS BEEN UPGRADED TO THE MODEL 400H. SEE SERVICE LETTER NUMBER 237.

* Applies only to Model 425A Housings with P.N. 016632 (12VDC), 016646 (24VDC) and 016651 (24VDC - dual lead) and all 425A Housings.

- THE MODEL 430 **CAN ONLY** BE USED ON 88/89NT ENGINES
- SLAVE PISTON SETTINGS FOR THE VARIOUS JAKE BRAKE MODELS AND ENGINE BRAKE APPLICATIONS WILL VARY AND ARE DEPENDENT ON:
  1. CPL NUMBER
  2. INJECTOR TIMING
  3. TURBOCHARGER CONFIGURATION
  4. BIG CAM IDENTIFICATION
- REFER TO THE JAKE BRAKE INSTALLATION MANUAL FOR THE SPECIFIC ENGINE BRAKE MODEL FOR SLAVE PISTON ADJUSTMENT INFORMATION.




**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. The energized 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 the injector rocker lever adjusting screw.
3. The injector rocker lever adjusting screw begins upward travel (as in normal injection cycle) forcing the master piston upward and directing high-pressure oil to the slave piston. The ball check valve in the control valve imprisons high-pressure oil in the master-slave piston system.
4. High-pressure oil causes the slave piston to move down, momentarily opening 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. The Engine Brake is most effective at rated engine speeds; therefore, gear selection is very important. Gearing down the vehicle, within the limits of rated engine speed, makes the Engine Brake a more effective retarder. 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® Retarder, read your Jacobs Driver's Manual.

For a video tape presentation on driving with the Jacobs Engine Brake, consult your Jacobs distributor.

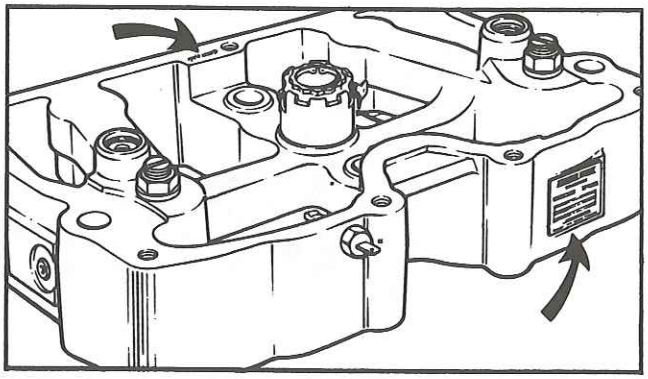
## HOUSING PART NUMBER, MODEL NUMBER AND SERIAL NUMBER

Each housing assembly is identified by an identification tag showing the model and part number of the housing. Later style model 430 housing assembly identification tags also include slave piston clearance settings. The housing serial number is stamped on the top surface of the housing. See illustration below.

| Model No. | Housing Assy No. (Packaged) |
|---|---|
| 430 (12 VDC) | 016007 |
| 430 (24 VDC) | 016009 |
| 430 (12 VDC) STC | 014878 |
| 430 (24 VDC) STC | 015895 |

**Note: Housing assembly numbers 016007 and 016009 were originally designated for fixed timing (FT) applications. These housings are now approved for use on 88/89 NT engines with fixed timing, step timing or ECI.**

**Housing assembly numbers 014878 and 015895 are approved for step timing control (STC) only. Refer to installation manual, section 3 for engine brake adjustment instructions.**



## RECOMMENDED TORQUE VALUES

Exhaust Valve Crosshead Adjusting Screw Locknuts . . . . . 25 lbft (35 N•m)
Rocker Housing Studs . . . . . 70 lbft (95 N•m)
Engine Brake Holddown Nuts . . . . . 60 lbft (80 N•m)
Slave Piston Adjusting Screw Locknuts . . . . . 25 lbft (35 N•m)
Rocker Lever Adjusting Screw Locknuts . . . . . 45 lbft (60 N•m)

## SPECIAL TOOLS

1. Crowfoot Wrench 9/16 in.
2. Crowfoot Wrench 5/8 in.
3. Extra Deep Socket 5/8 in.
4. STC Tappet Setting Tool – Cummins P.N. 3822648

## AUTOMATIC TRANSMISSIONS

For vehicles equipped with automatic transmissions, refer to Jacobs Service Letters or contact your nearest Jacobs distributor.

## JACOBS FEELER GAUGES

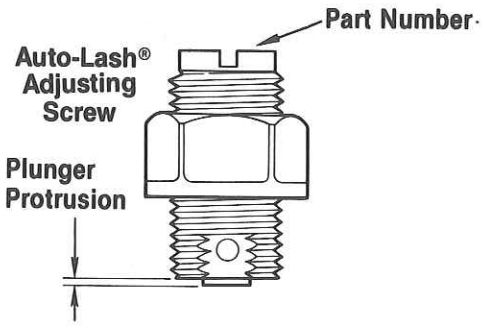
| ENGINE FUEL SYSTEM | FEELER GAUGE P.N. | THICKNESS |
|---|---|---|
| Fixed Timing | 016560 | .024 in. |
| Step Timing | 016683 | .046 in. |
| E.C.I. | 015877 | .030 in. |
| Step Timing (FOR EARLIER ENGINE BRAKE MODEL 430 ST) | 016704 | .040 in. |

## GENERAL CHARACTERISTICS

There are several models of Jacobs Engine Brakes designed to fit various Cummins NH series engines. It is important that the correct engine brake model is selected to fit the particular Cummins Engine. Consult Jacobs installation manuals and service publications for selection of the correct engine brake application, by Cummins CPL number.

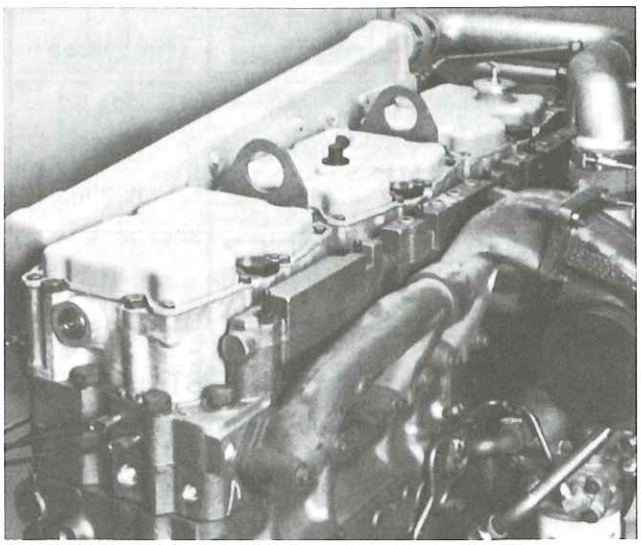
**STEP TIMING CONTROL-** The engine step timing control (STC) valve on earlier engine brake applications was connected to the rear engine brake housing. **THIS CONNECTION IS NO LONGER REQUIRED FOR ANY MODEL 430 ENGINE APPLICATIONS.** The STC interface group is no longer included in the engine brake kit. Additional information can be found in section 3 of this manual.

**AUTO-LASH® ADJUSTING SCREW** — The model 430 Jake Brake contains Auto-Lash adjusting screws which are used for setting the slave piston clearances. The Auto-Lash adjusting screws in the model 430 are different than the screws used in other brake models. The model 430 Parts Manual part number 015627 should be consulted for correct part number identification.



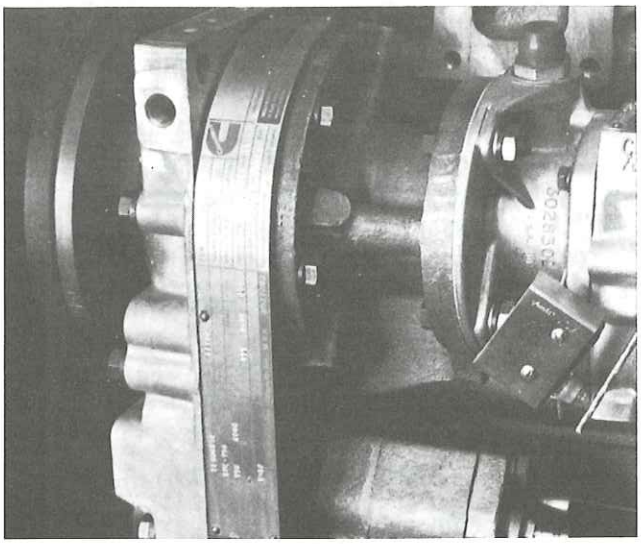

**CUMMINS "C" BRAKE™** — The "C" Brake is offered for application on the 88NT series engines. The "C" Brake is similar to the Jacobs Engine Brake. However, none of the parts is interchangeable with the Jacobs Engine Brake. In the event that a Jacobs Engine Brake Model 430 is installed in place of the Cummins "C" Brake, the crossheads, injector adjusting screws, holddown bolts, and housing assemblies must be replaced.

## ENGINE PREPARATION

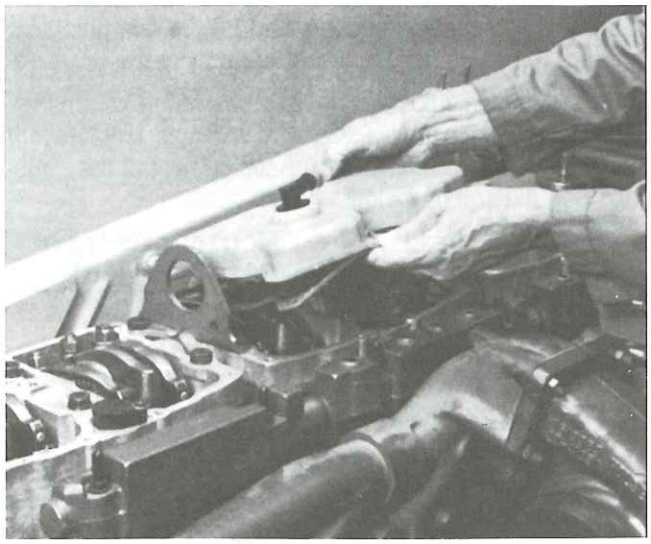


Before installing the engine brake the engine identification must be established to insure that the correct model engine brake is installed on the engine. The engine used for this installation manual is an NTC-350 fixed timing.

**NOTE:**
**Rocker lever housings do not have to be removed for Model 430 engine brake installation.**



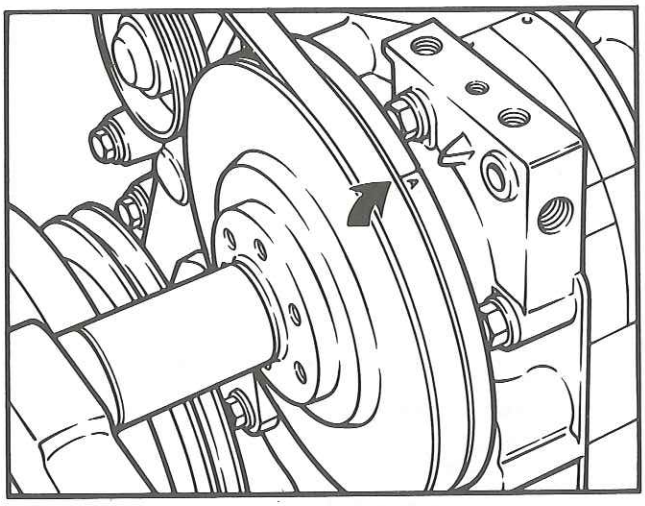
Prior to engine brake installation, check engine CPL number. Verify that engine is correct for engine brake model being installed. The engine identification is on the serial number plate located on the engine gear case mounting flange.



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

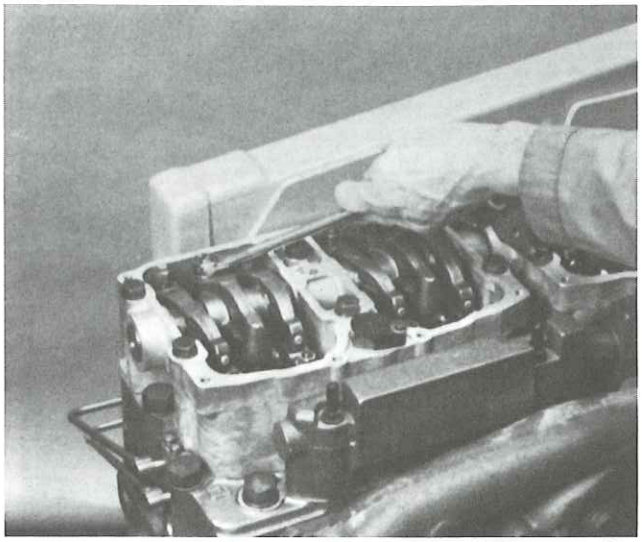
### INJECTOR AND VALVE SET POSITION

It is advisable at this time to prepare the engine for injector, valve and slave piston adjustments that will be done later on.

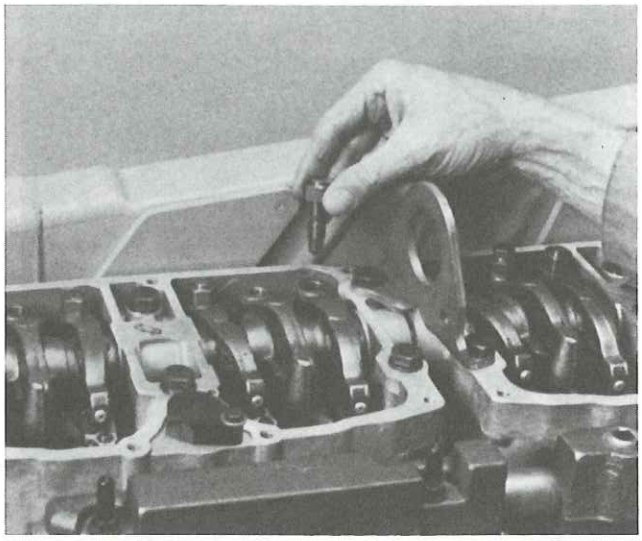


The following instructions are from the Cummins Service Manual.

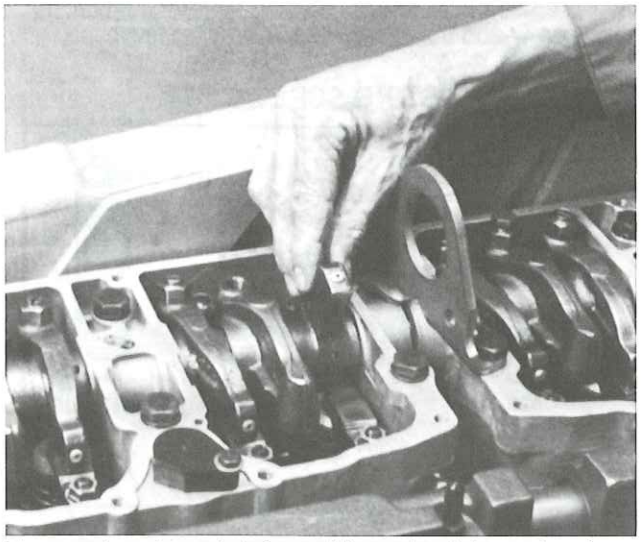
1. Turn the crankshaft in the direction of rotation until the "A" mark is aligned with the pointer on the gear cover.
2. When "A" mark is aligned with the pointer, the intake and exhaust valves should be closed for cylinder number 5. The injector plunger for cylinder number 3 must be at the top of its travel; if not, turn the crankshaft another 360 degrees and realign the "A" 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.



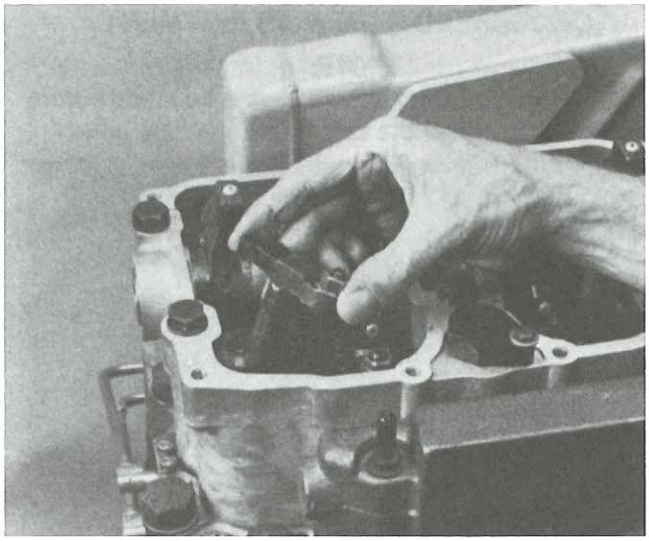
Loosen the locknuts on the exhaust and injector rocker lever adjusting screws.



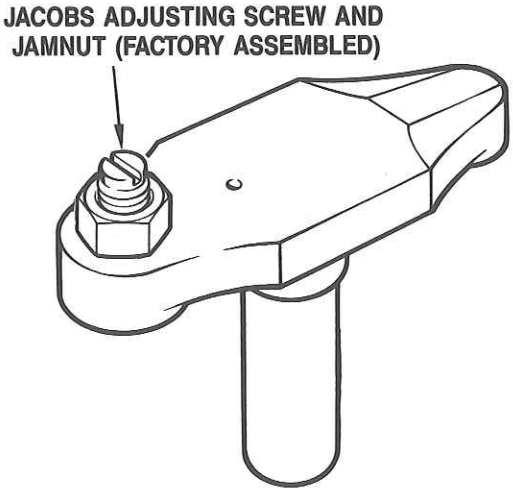
Remove adjusting screws from exhaust and injector rocker levers.



Move exhaust push tube aside and rotate rocker lever upward.



Remove the Cummins exhaust crossheads.



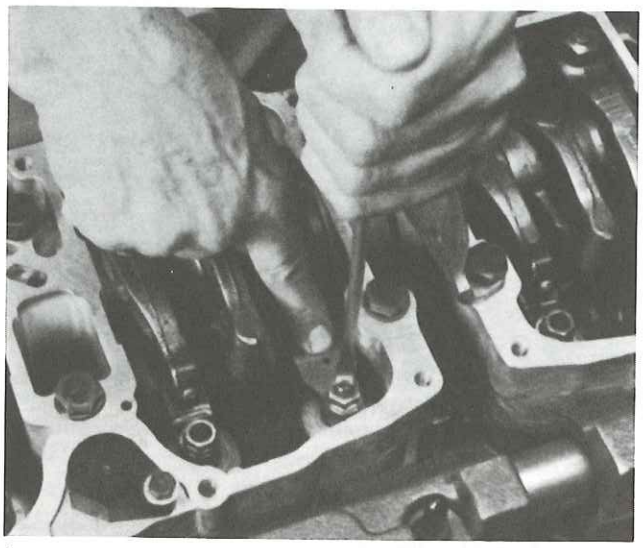

**JACOBS CROSSHEAD ASSEMBLY**

**Note:**

**Jacobs crosshead assemblies shipped after November, 1988 have a Jacobs adjusting screw and jamnut installed. DO NOT use the Cummins adjusting screw and locknut for these crossheads.**

## CROSSHEAD SCREW ADJUSTMENT

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

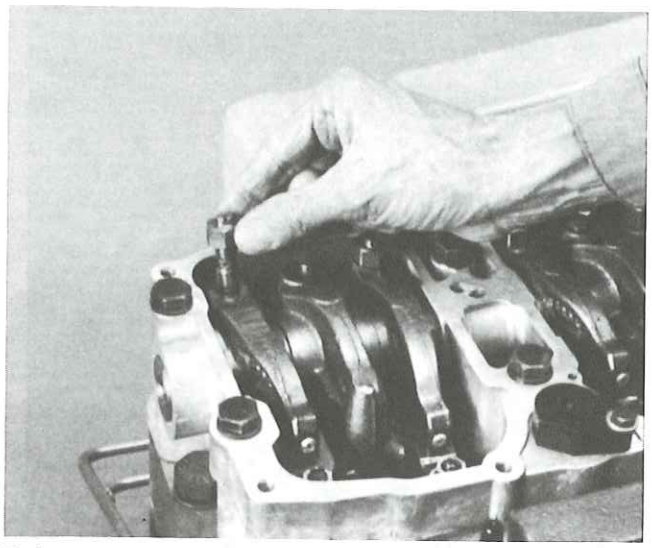


Install Jacobs crossheads and adjust as follows:

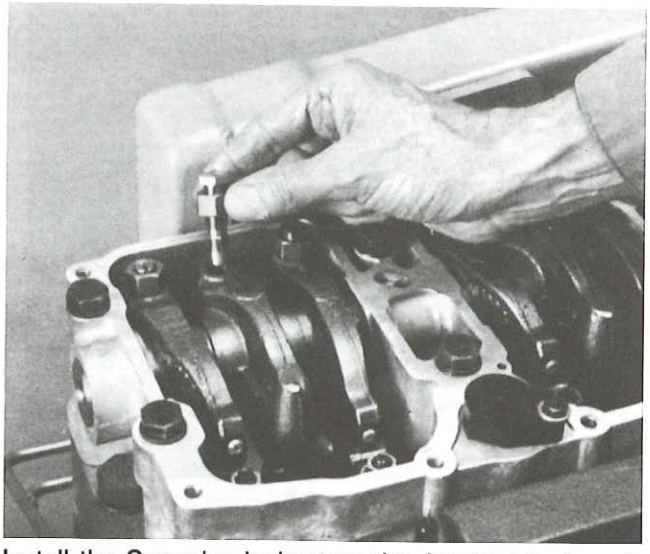
1. Lubricate the valve stems and the crosshead guide with clean lube oil.
2. Install the crossheads onto the crosshead guides. The adjusting screw must be toward the exhaust manifold.
3. Hold the crosshead down against the valve stem that is nearest the push rod. Turn the adjusting screw clockwise until it touches the valve stem.
4. Hold the screw in this position and tighten the locknut to 25 lbft (35 N•m).

**NOTE:**
**When ST-669 Torque Wrench Adapter is used, tighten locknut to 22 lbft (30 N•m).**

5 Continue adjustment of the remaining exhaust valve crossheads following the same procedure.

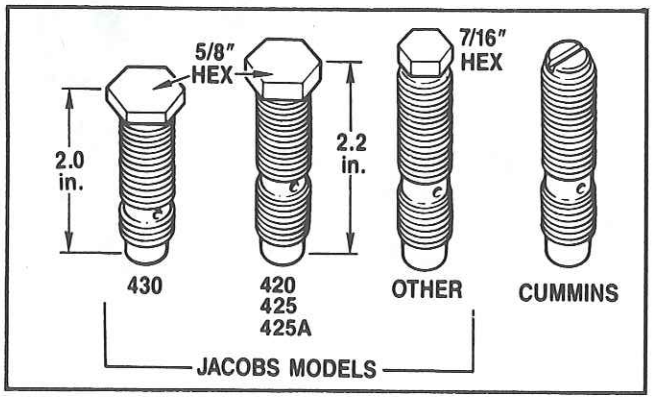


Reinstall the Cummins exhaust rocker adjusting screw and locknut into rocker lever. Locate adjusting screw into pushtube socket.



Install the Cummins locknut on the Jacobs injector adjusting screw and install into injector rocker lever.

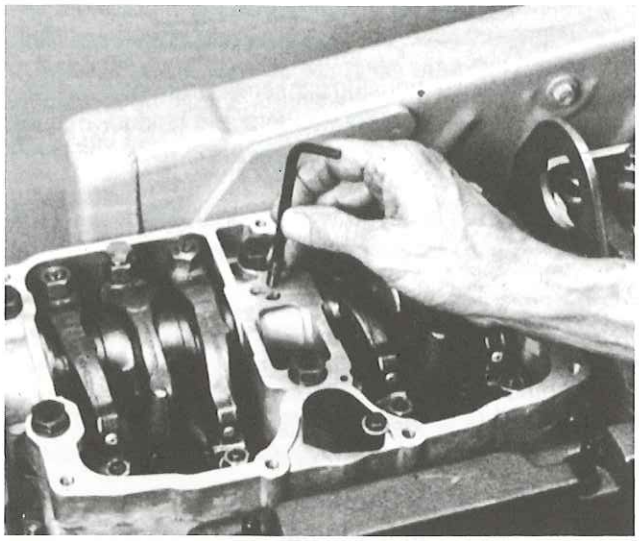
## INJECTOR ADJUSTING SCREWS



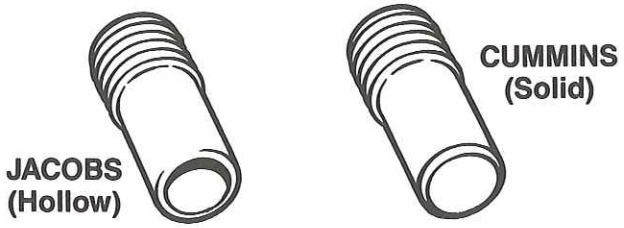
**The Jacobs hex head screws used in the Model 420, 425, 425A and 430 have a larger top surface than the screws used in other Jacobs models. However, the Model 430 screws are shorter than the other screws.**

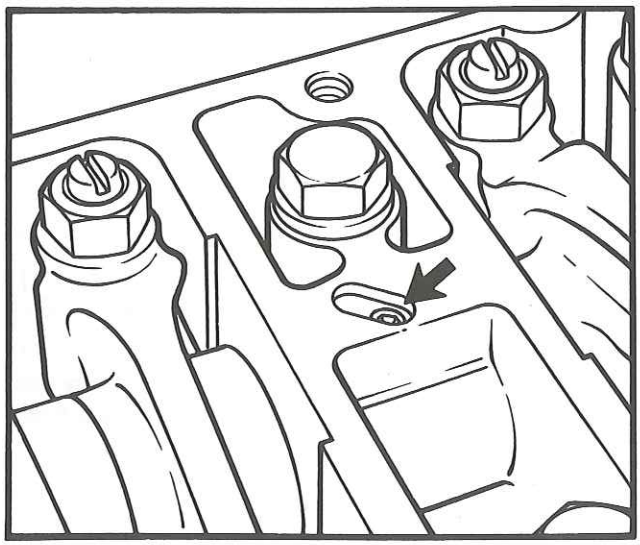
⚠ CAUTION

**THESE SCREWS ARE NOT INTERCHANGEABLE. INSTALLATION OF THE WRONG SCREW WILL RESULT IN ENGINE AND ENGINE BRAKE DAMAGE.**

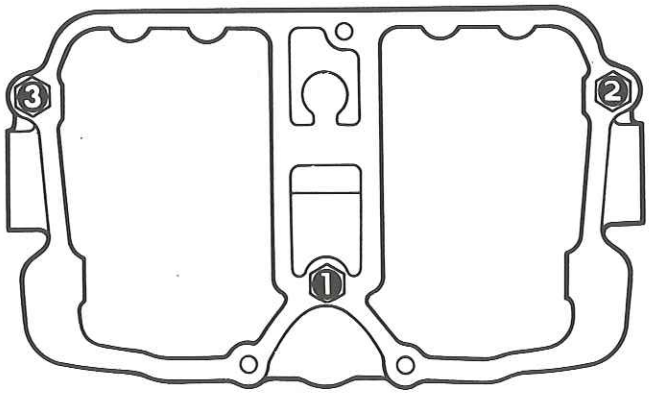


Remove the Cummins solid rocker shaft locking screw and install the Jacobs hollow oil supply screw from kit.



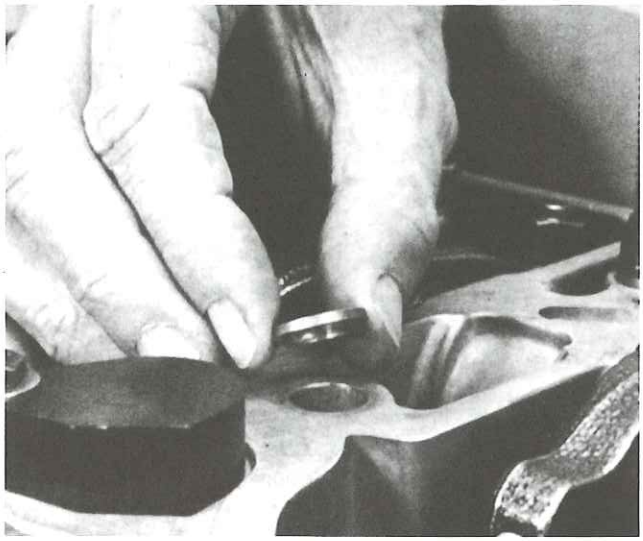
Be sure top of screw is below the flat surface on rocker housing.




Remove the rocker housing capscrews from positions 1, 2 and 3 of each rocker housing.

**NOTE:**

**Do not remove all six capscrews at the same time. If this is done, the rocker gasket seal will be disturbed and a new rocker gasket must be installed.**



Install special steel washers from kit into each holddown bolt hole. Put leading edge of washer into hole and press in firmly until washer is seated. **DO NOT** use flat washers that were used with the rocker housing capscrews.

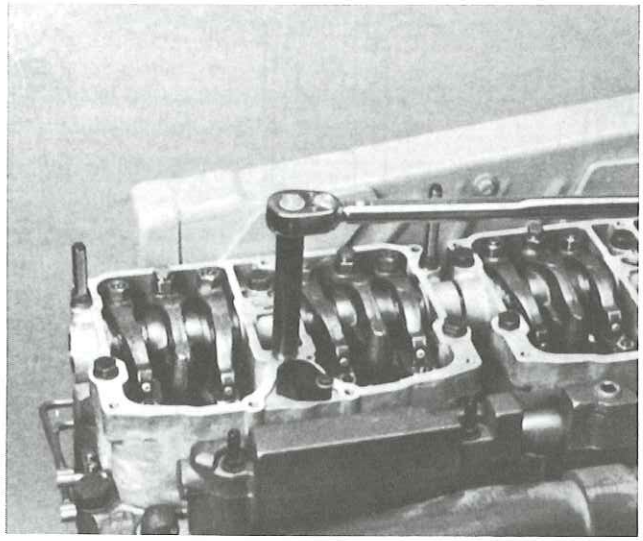
**NOTE:**

**DO NOT use special steel washers at positions 2 and 5 of the front housing if the fan brace is located on top of the rocker housing.**

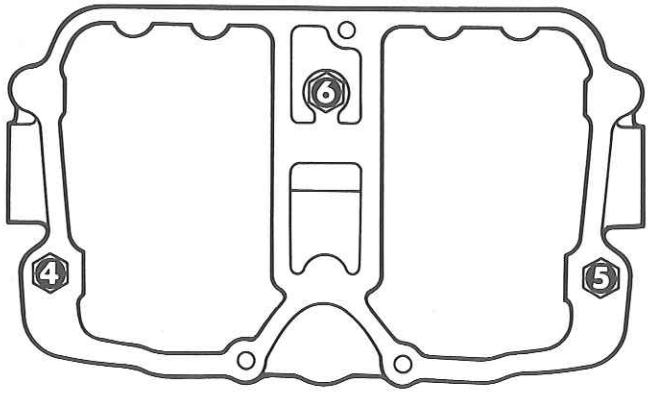
**Refer to the illustration on page 10 for proper stud location and torque sequence.**

⚠ CAUTION

**USE OF POWER TOOLS MAY RESULT IN OVERTIGHTENING OF HOLDDOWN STUDS. ENGINE AND ENGINE BRAKE FAILURE MAY RESULT.**



Tighten studs in sequence to 30 lbft (40 N•m) then retorque to 70 lbft (95 N•m).




Remove the rocker housing capscrews from positions 4, 5 and 6. Install special steel washers and holddown studs. Torque to 30 lbft (40 N•m) then retorque to 70 lbft (95 N•m).

Refer to diagram for location of optional length studs that may be required for accessory equipment.

## STUD LOCATION AND TORQUE SEQUENCE

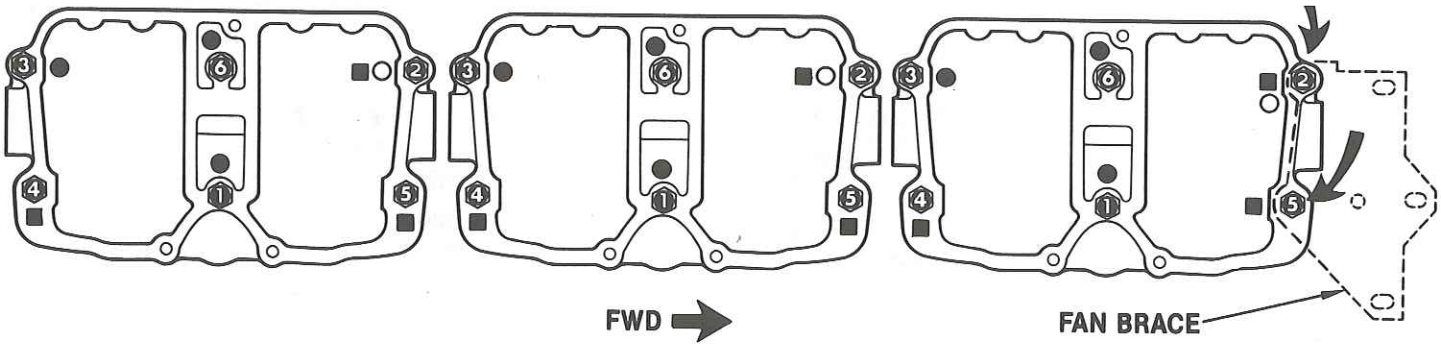
There are 18 extension studs of three different lengths and up to 6 spacers supplied in the stud and spacer groups. Refer to the Jacobs Model 430 Parts Manual for various available combinations.

**NOTE: The studs used with the Model 430 are of different lengths than the studs used for other engine brake models. These studs are not interchangeable.**

Stud and spacer locations and torquing sequences for the most common installations are as follows:

- ● PN 015633 STUD 7″ (9)
- ■ PN 015635 STUD 8-¼″ (9)
- ○ PN 001234 Spacer (3)
  PN 015637 STUD 8-¾″ (Optional for special applications)

SPECIAL STEEL WASHERS, P.N. 002514 ARE USED ON THE ALUMINUM ROCKER HOUSINGS TO PREVENT DISTORTION OF THE HOLES. IF THE FAN BRACE IS POSITIONED ON TOP OF THE ROCKER HOUSING THE TWO SPECIAL STEEL WASHERS ARE NOT REQUIRED AT POSITIONS 2 AND 5.




Tighten studs in sequence first to 30 lbft (40 N•m) then retorque to 70 lbft (95 N•m)

## VALVE AND INJECTOR ADJUSTMENT

### Setting the STC Overhead

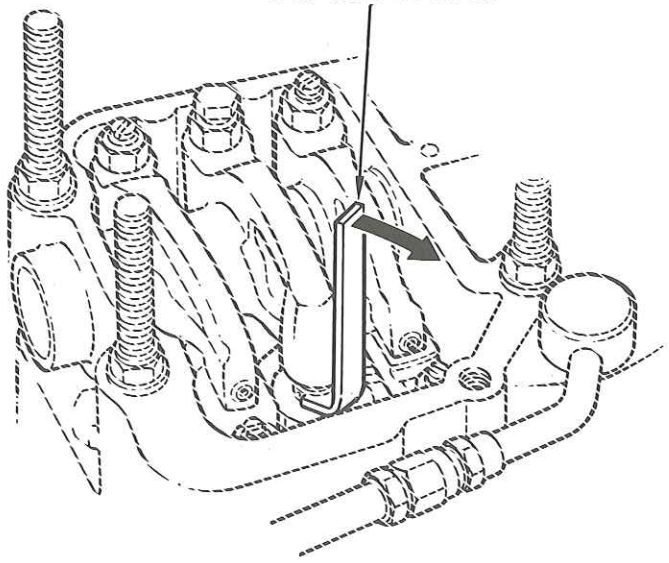
For STC equipped engines a special STC tappet tool, ST-3822648, must be used to prevent compressing the tappet spring while setting the injector overhead. Compression of the tappet spring defeats the top stop feature and can result in premature injector train and camshaft wear.

The tappet tool is equipped with a small locating pin designed for insertion into the top of the STC tappet. Each tappet contains four evenly spaced holes to ensure that at least one hole is easily accessible. Rotate the engine to the cylinder to be set. See "Injector and Valve Set Position" instructions on page 6.

Place the tool on the upper surface of the injector so that the tool straddles the top of the tappet (See illustration below). Rotate the tool around the tappet until the locating pin can be inserted into one of the four holes. Apply thumb pressure to the tool handle to hold the tappet piston in the maximum extended position while setting the injector rocker lever set screw to 5 or 6 lbin. Excessive force on the tool can break the locating pin off in a tappet hole.

The tool must be removed before barring the engine to prevent damaging a tappet or the tool.

STC TAPPET TOOL



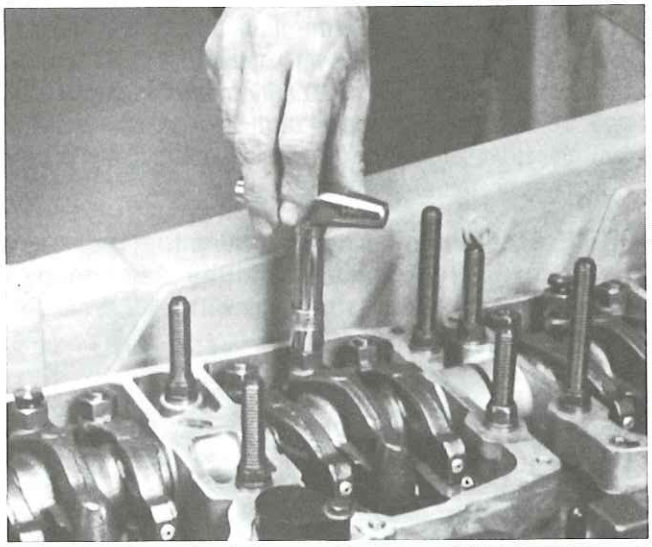
Refer to "Injector and Valve Set Position" on page 6. With the engine set at the proper position, adjust the injectors and valves according to the sequence shown in the chart (next column).

## INJECTOR AND VALVE SET POSITION

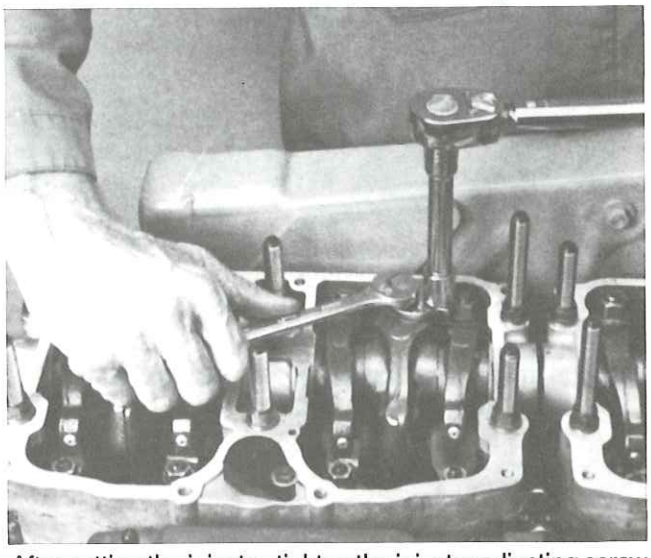
| Bar in Direction of Rotation | Pulley Position | Set Cylinder | |
|---|---|---|---|
| | | Injector | Valve |
| START | A | 3 | 5 |
| Adv. To | B | 6 | 3 |
| Adv. To | C | 2 | 6 |
| Adv. To | A | 4 | 2 |
| Adv. To | B | 1 | 4 |
| Adv. To | C | 5 | 1 |

**Note: For setting the injectors on fixed timing or step timing engines, the Cummins injector torque wrench, Cummins PN 3376592 may be used. This wrench is preset to 6 lbin.**

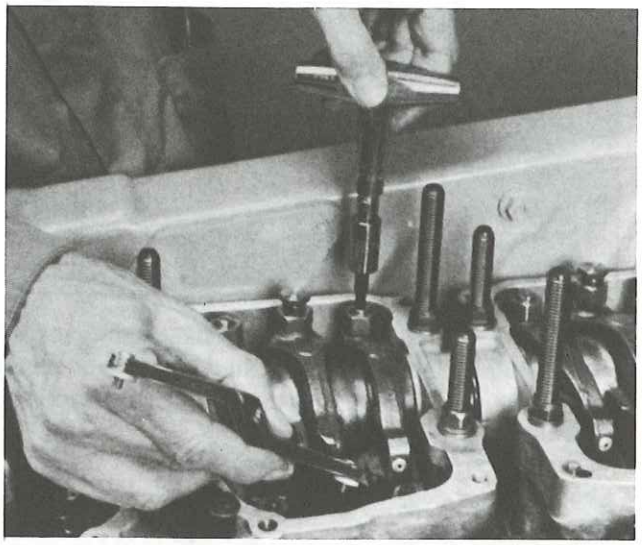
## SETTING THE INJECTOR (Fixed Timing Control)



Using the Cummins injector adjusting tool, PN 3376592, set the injectors to 6 lb. in. (0.7 N•m). Follow the sequence in the previous chart.

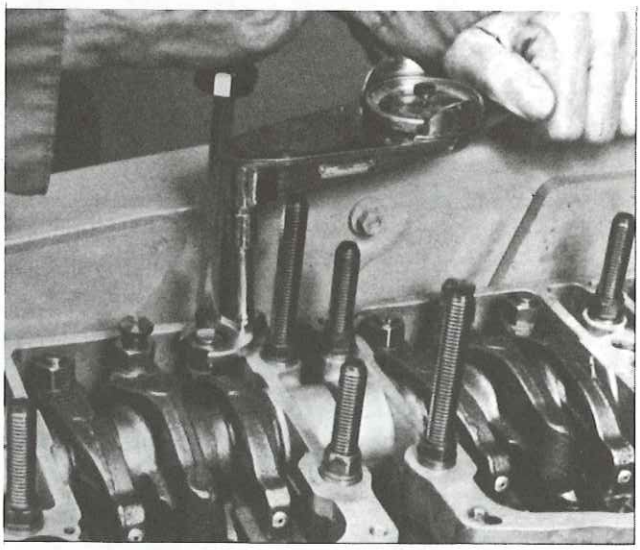


After setting the injector, tighten the injector adjusting screw locknut to 45 lbft (60 N•m).



Following the sequence in the chart, adjust the exhaust and intake valves. Set exhaust valve clearance to 0.023 in. and intake valve clearance to 0.011 in. Insert the proper feeler gauge between the rocker arm and crosshead of the cylinder to be adjusted. Turn the adjusting screw in until a light drag is felt on the feeler gauge.

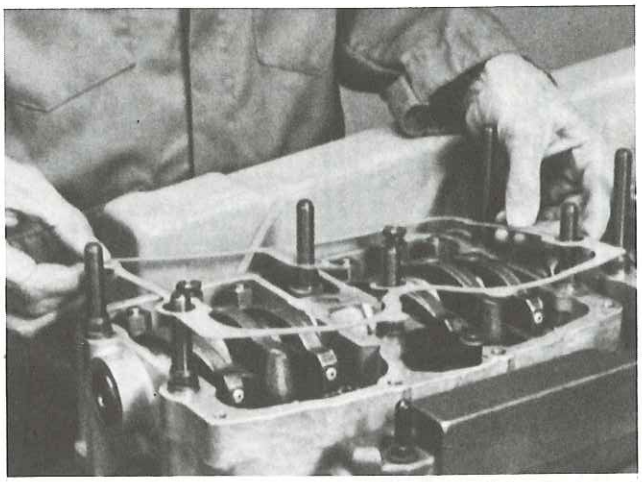
**NOTE: The Cummins injector adjusting tool may be used to adjust the valves. With the feeler gauge inserted, turn the adjusting screw in until it clicks.**



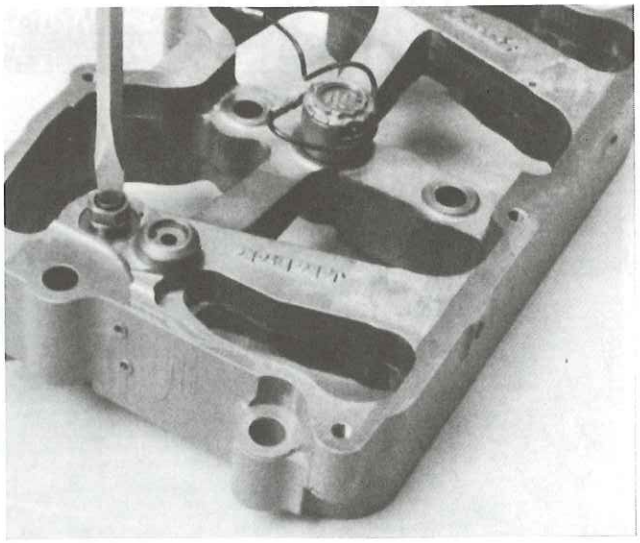
Hold the adjusting screw in this position and tighten locknut to 45 lbft (60 N•m).

**NOTE:**

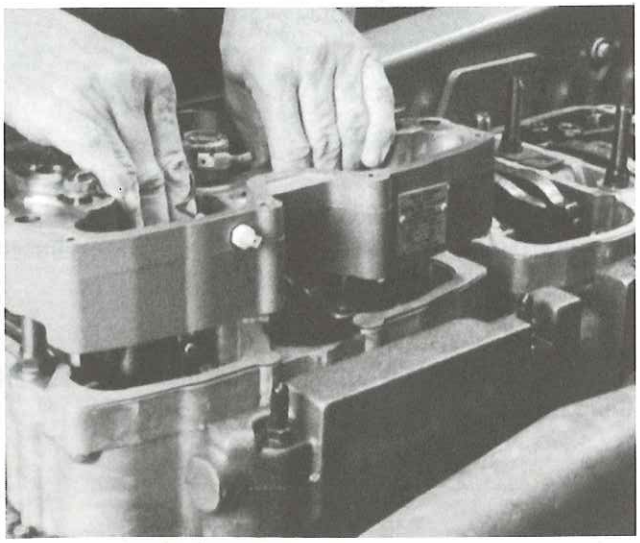
**Check the engine data plate for possible variations to the valve and injector adjustments.**



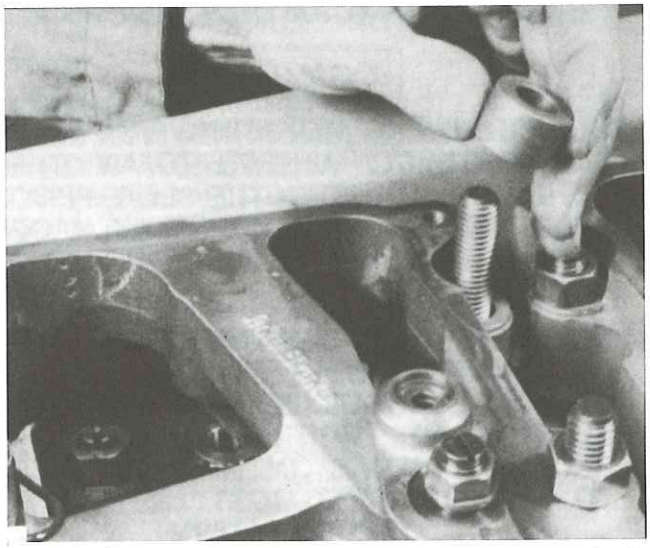
Check rocker housing surface to make sure it is clean and smooth. Install Jacobs gasket on rocker housing. Make sure slot for oil supply aligns with slot in rocker housing. If it does not, turn gasket over.



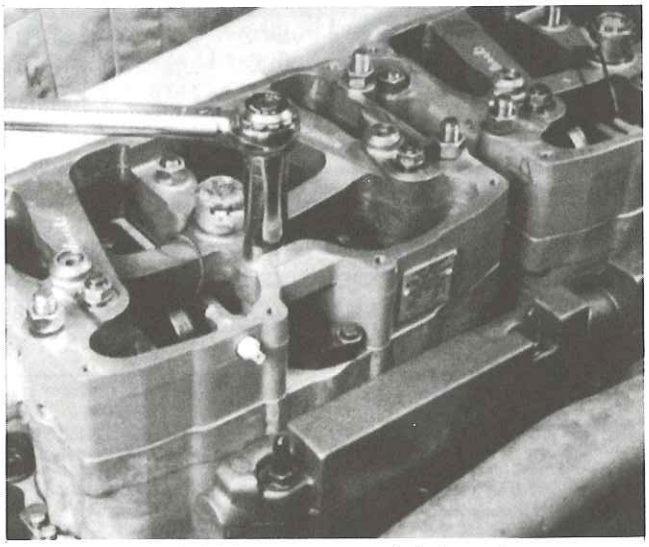
Before placing brake units on engine, loosen and back out the slave piston adjusting screw until slave piston is seated in its bore.



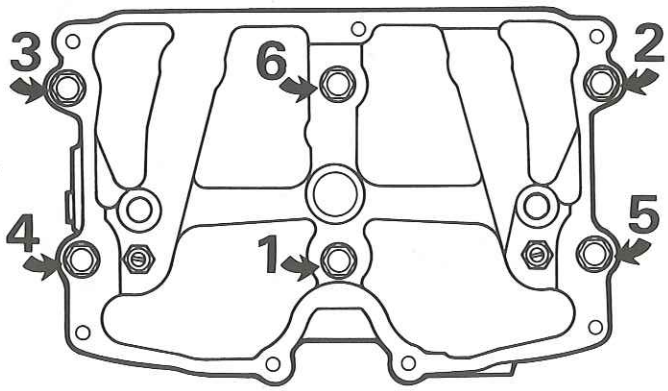
Install engine brake units on engine. Units must go into place without rocker lever interference.



Install Jacobs spacers and Cummins brackets as required. See STUD LOCATION AND TORQUE SEQUENCE on page 10 for spacer positions on housings.



Install Jacobs holddown nuts and tighten in sequence shown below to 30 lbft (40 N•m) then retorque to 60 lbft (80 N•m).




⚠ CAUTION

**USE OF POWER TOOLS MAY RESULT IN OVER-TIGHTENING OF HOLDDOWN NUTS. ENGINE BRAKE HOUSING FAILURE MAY RESULT.**

## SLAVE PISTON ADJUSTMENT PROCEDURE

⚠ 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.**

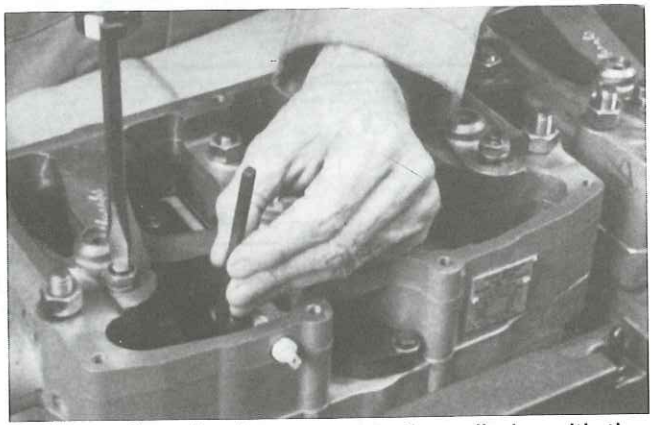
**SLAVE PISTON ADJUSTMENT MUST BE MADE WITH THE ENGINE STOPPED AND COLD (STABILIZED WATER TEMPERATURE OF 140°F (60°C) or below). EXHAUST VALVES ON THE CYLINDER TO BE ADJUSTED MUST BE IN THE CLOSED POSITION.**

| E.B. MODEL AS SHOWN ON HSG NAME TAG | HSG ASSY P.N. (PKGD) | AUTO-LASH ADJUSTING SCREW P.N. | SLAVE CLEARANCE WAS | SLAVE CLEARANCE NOW | HSG. IDENT. TAG |
|---|---|---|---|---|---|
| 430 FT (12V) | 016007 | 016012 | .018 | .024 | RED |
| 430 FT (24V) | 016009 | 016012 | .018 | .024 | RED |
| 430 ST (12V) | 014878 | 015790 | .034 | .040 | PLAIN |
| 430 ST (24V) | 015895 | 015790 | .034 | .040 | PLAIN |

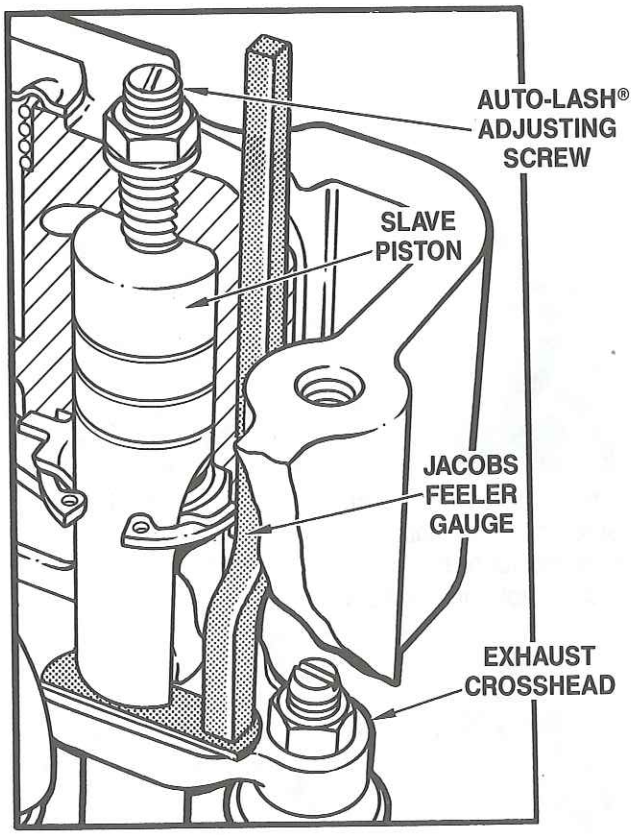
Use this table in conjunction with the engine application chart for proper application and adjustment information.

Current model 430 housings with P/N's 016007 and 016009 contain Auto-Lash® adjusting screw, P/N 016012. Set the slave piston clearances as shown on housing nameplate below.

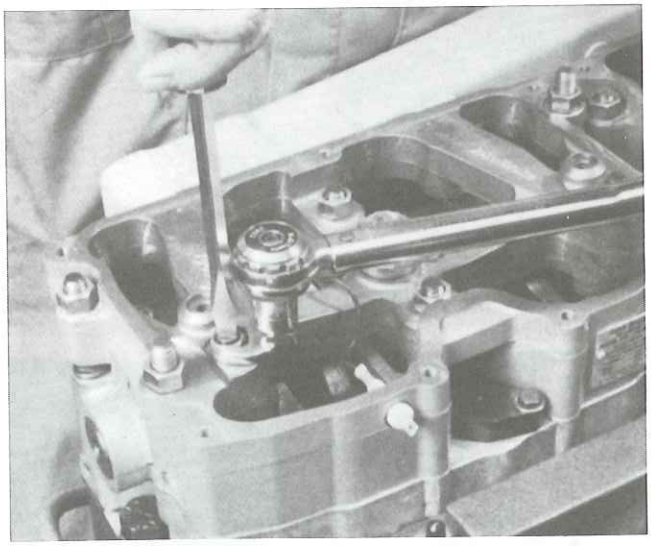




Back out the adjusting screw on the cylinder with the exhaust valves closed and insert the correct Jacobs feeler gauge between the slave piston and crosshead. Be sure to use the correct gauge for your application.

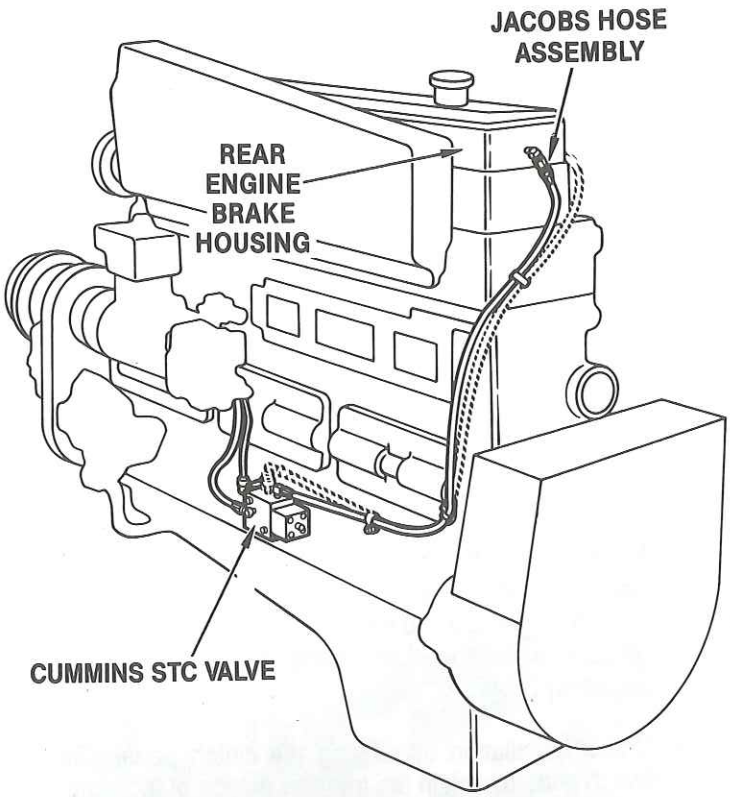


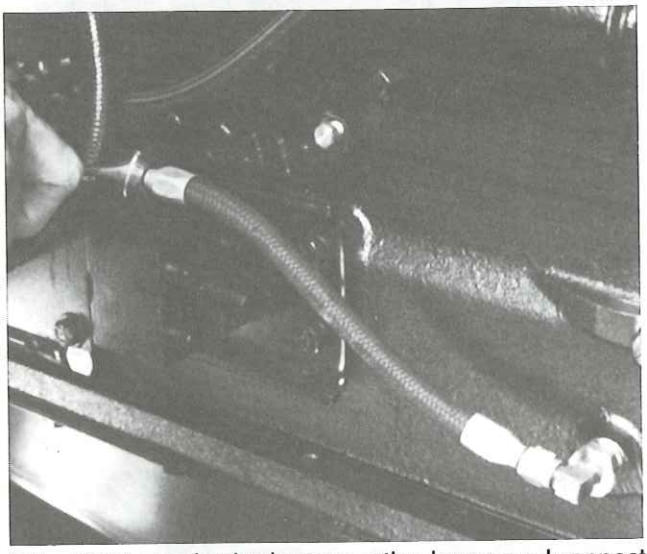

Turn the adjusting screw in, until a light drag is felt on the feeler gauge.



Tighten the locknut to 25 lbft (35 N•m). Continue turning engine in direction of rotation and set slave piston clearance on the remaining cylinders in firing order.

**NOTE:**
**If crowfoot wrench is used, tighten locknut to 22 lbft (30 N•m).**



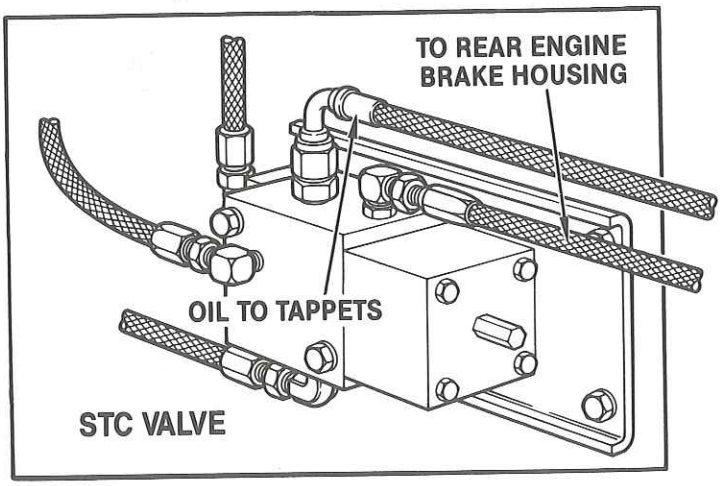
If the STC to engine brake connection is removed connect the STC valve to the engine block as shown.

## EARLIER APPLICATIONS WITH STEP TIMING CONTROL

Earlier applications required that the STC valve be connected to the rear engine brake housing as shown. This connection is no longer required with any application on 88 NT engines with the STC feature. Engines currently operating with the STC connection may remain intact or if desired, removed.

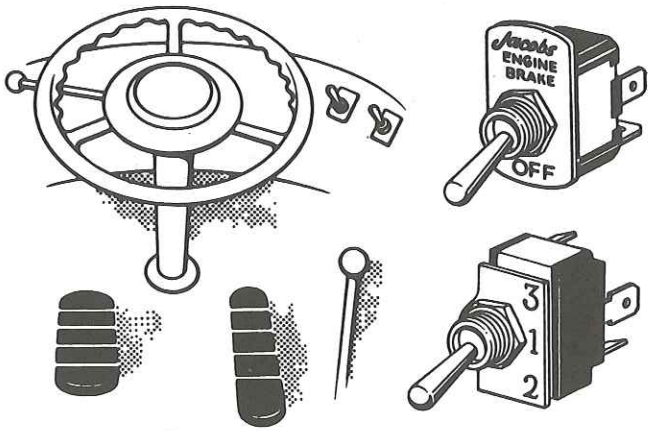
To disconnect the system, remove the hose from the STC valve to the brake housing and plug the housing with Jacobs P.N. 014506 plug. Connect the STC valve to the engine block with a suitable hose as shown.

Recent testing shows no adverse affects with or without the STC to engine brake connection.



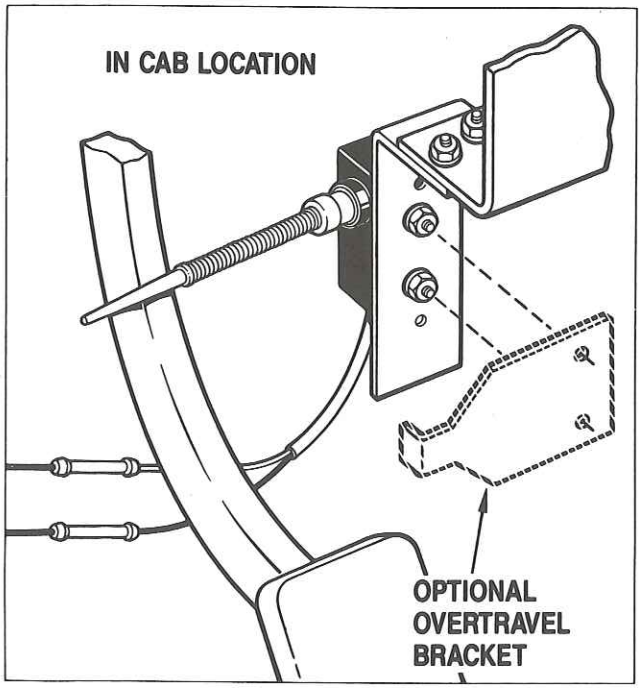
# SECTION 4 ELECTRICAL SYSTEM INSTALLATION

## DASH SWITCHES

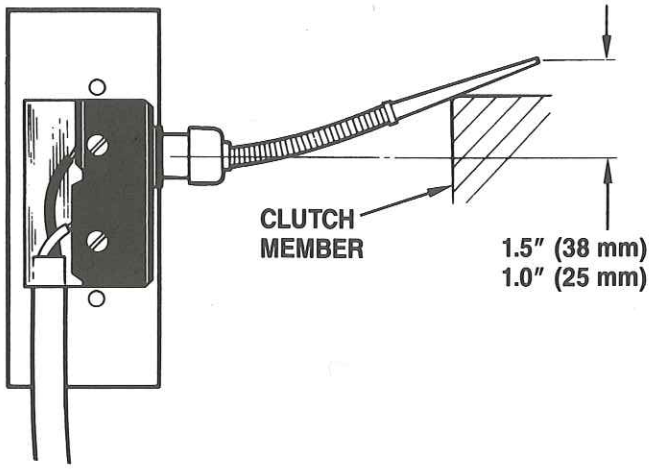



Install the two dash switches in a convenient location in the cab. Carefully measure and cut all harnesses to proper length. Thread wires through the loom provided. Install receptacles at locations shown in wiring diagram furnished in the kit.

## CLUTCH SWITCH




1. Mount the clutch switch in the most convenient or accessible location possible. Locations may include in cab under dash, under floor wheel well location, or in the area of the bell housing.
2. Install this switch with the switch actuator arm in contact with the clutch pedal arm or other clutch member.

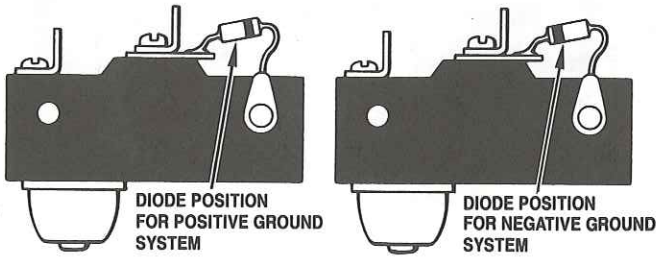



3. Adjust the switch by moving the switch along the mounting bracket. The actuator arm should be deflected 1.0 - 1.5 inches (25 - 38 mm), measured at the tip of the actuator, when the clutch pedal is in the up (clutch engaged) position.
4. Check installation by moving the clutch pedal. The switch should 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. Black lead to power source.

The optional overtravel bracket should be used when the clutch switch is installed in the wheel well location or a location where a build up of road contamination (ice, mud, etc) can stick to the actuator arm.

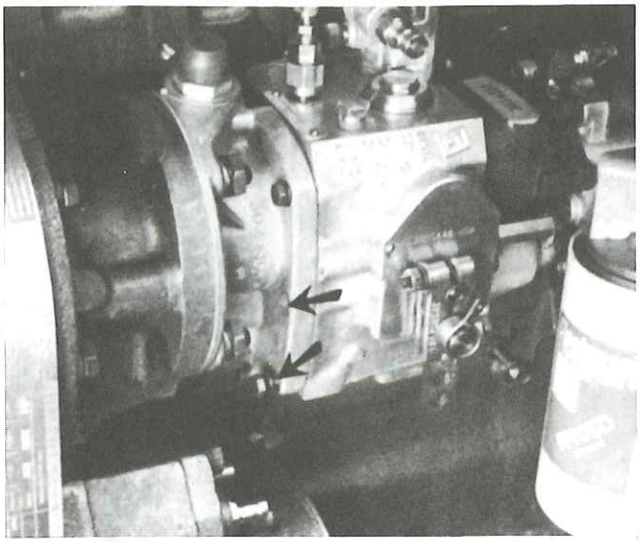
For vehicles with automatic transmissions, refer to Jacobs service letters or contact your nearest distributor.

## FUEL PUMP SWITCH

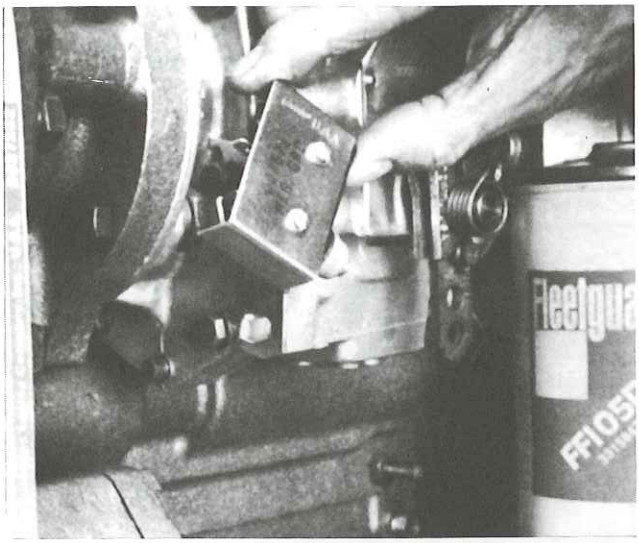



**NOTE:**

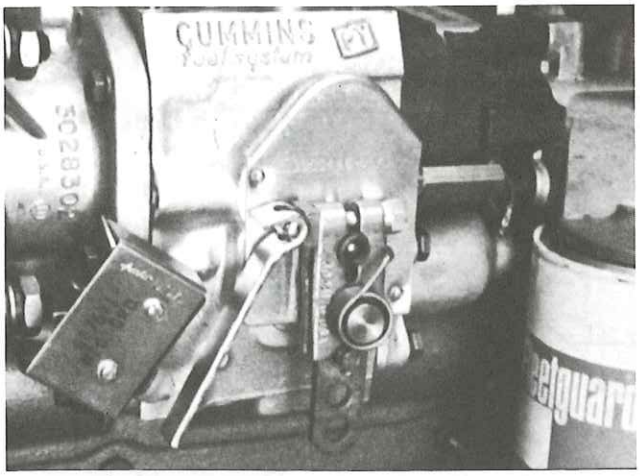
**The fuel pump switch contacts are protected against arcing by a small diode connected between the load side switch terminal and ground. The Engine Brake must be connected to the load side terminal. If the vehicle has a positive ground electrical system, reverse the direction of the diode.**



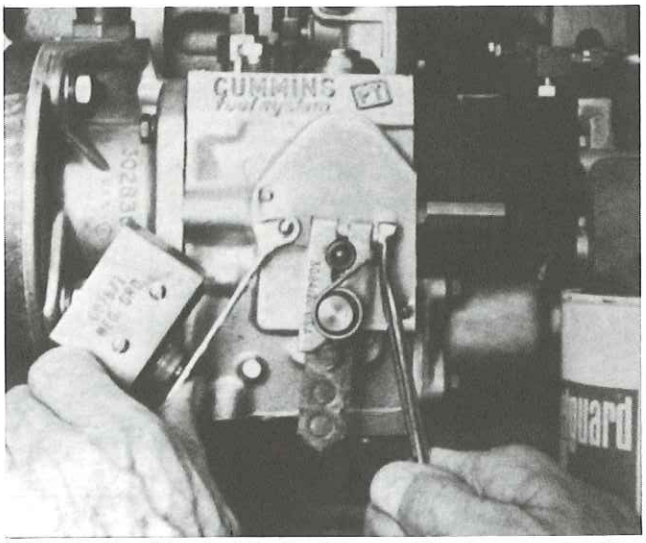
Loosen the lower capscrew on the fuel pump housing and remove the center capscrew as shown.



Install the Jacobs fuel pump switch. The slotted area in the switch bracket is for easier installation and for minor bracket adjustments. Tighten the cap screws.



Remove Cummins nut, washers and cap screw and install the Jacobs tee bolt, guide, actuating lever and nut. Install parts in correct order as shown.

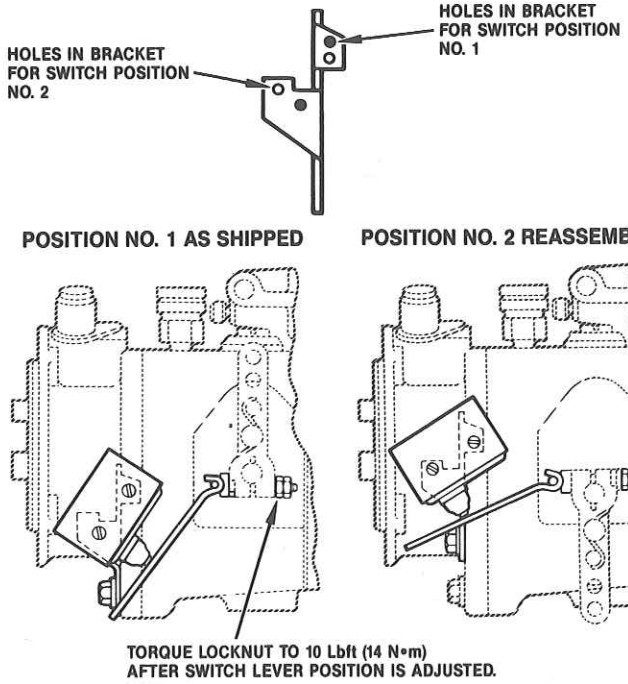


With the throttle shaft in the idle position, move actuating arm until switch actuates. Hold in this position and tighten nut to 10 lbft (14 N•m).

⚠ CAUTION

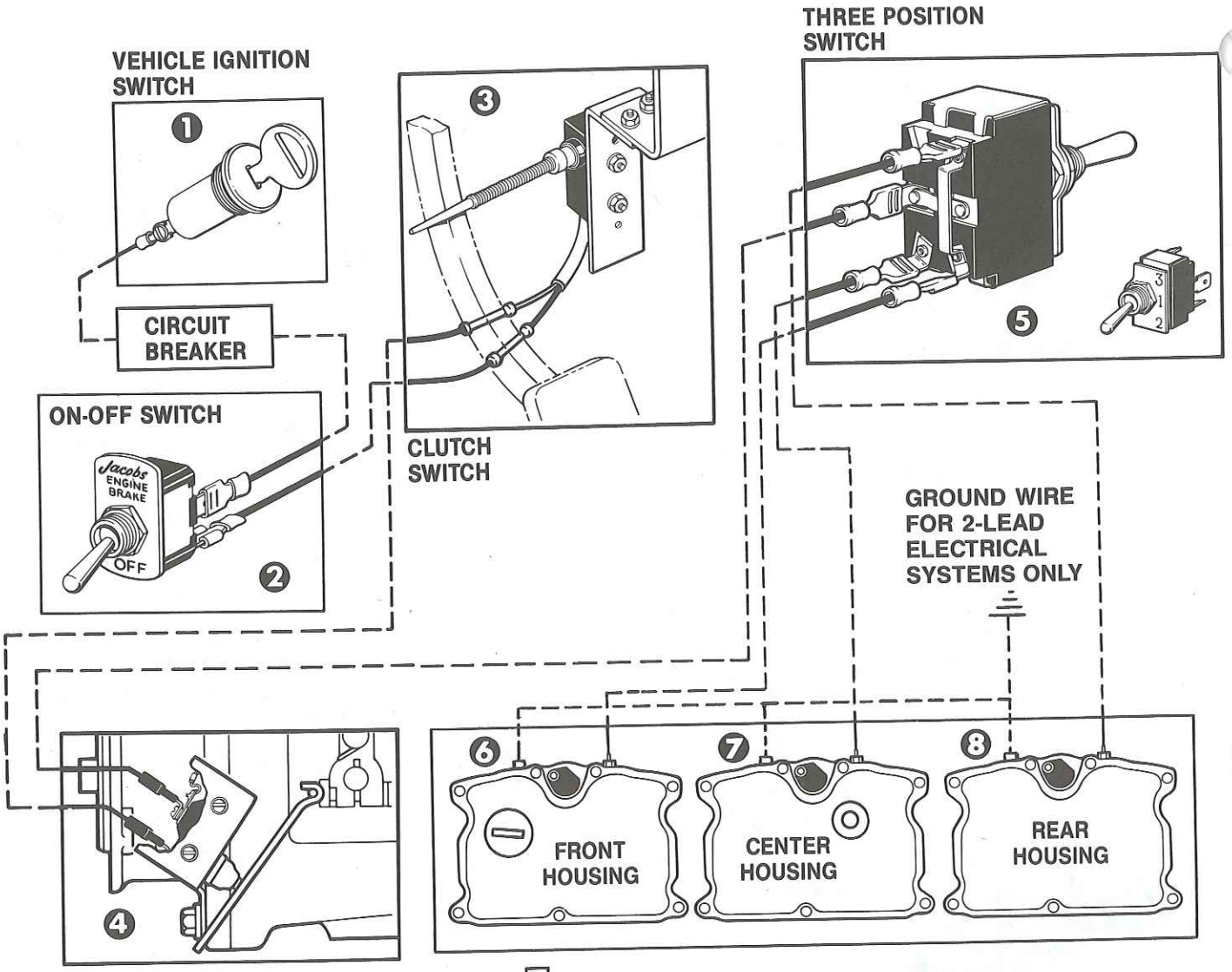
**DO NOT BEND ACTUATING ARM TO ADJUST SWITCH. BENDING THE ARM WILL RESULT IN PREMATURE FAILURE OF THE ARM AND LOSS OF ENGINE BRAKING.**

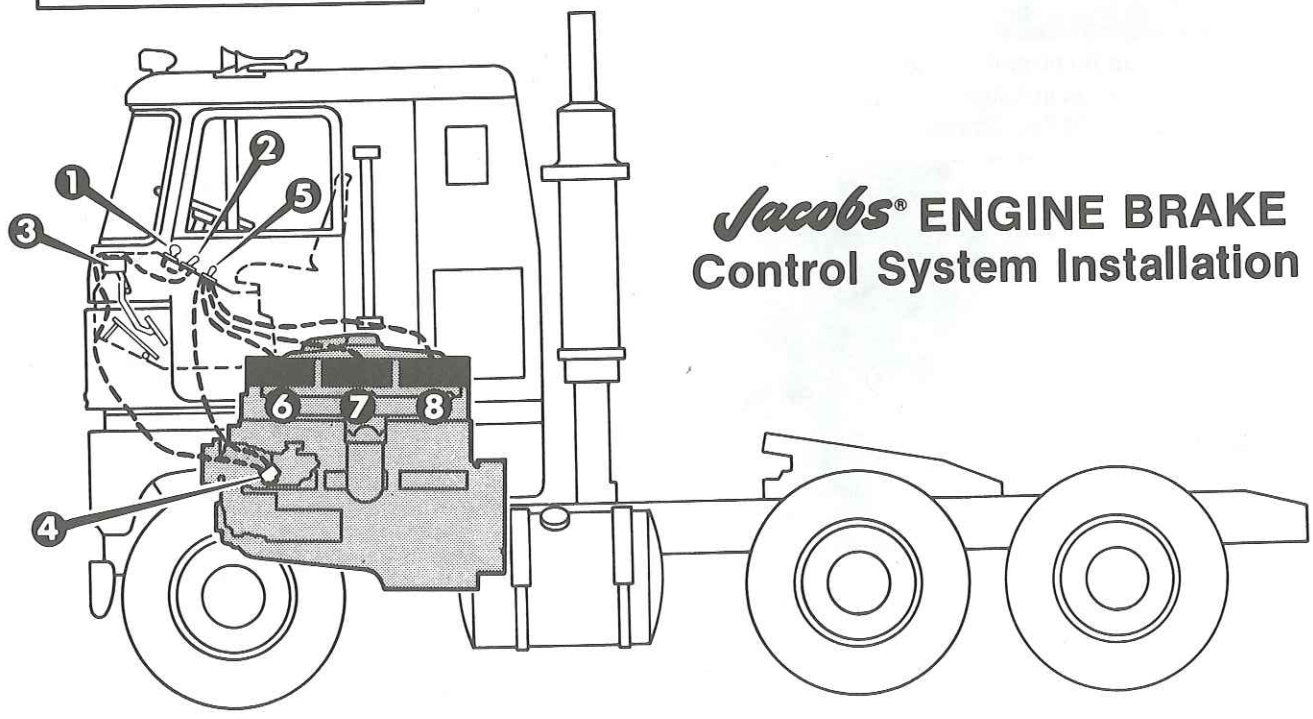
**ALTERNATE SWITCH AND THROTTLE LEVER POSITIONS.**




⚠ CAUTION

**CHECK THE FUEL PUMP THROTTLE SHAFT TO ENSURE THAT THE THROTTLE PEDAL WILL MOVE THE SHAFT TO THE FULL FUEL POSITION AFTER INSTALLING THE ACTUATING ARM.**



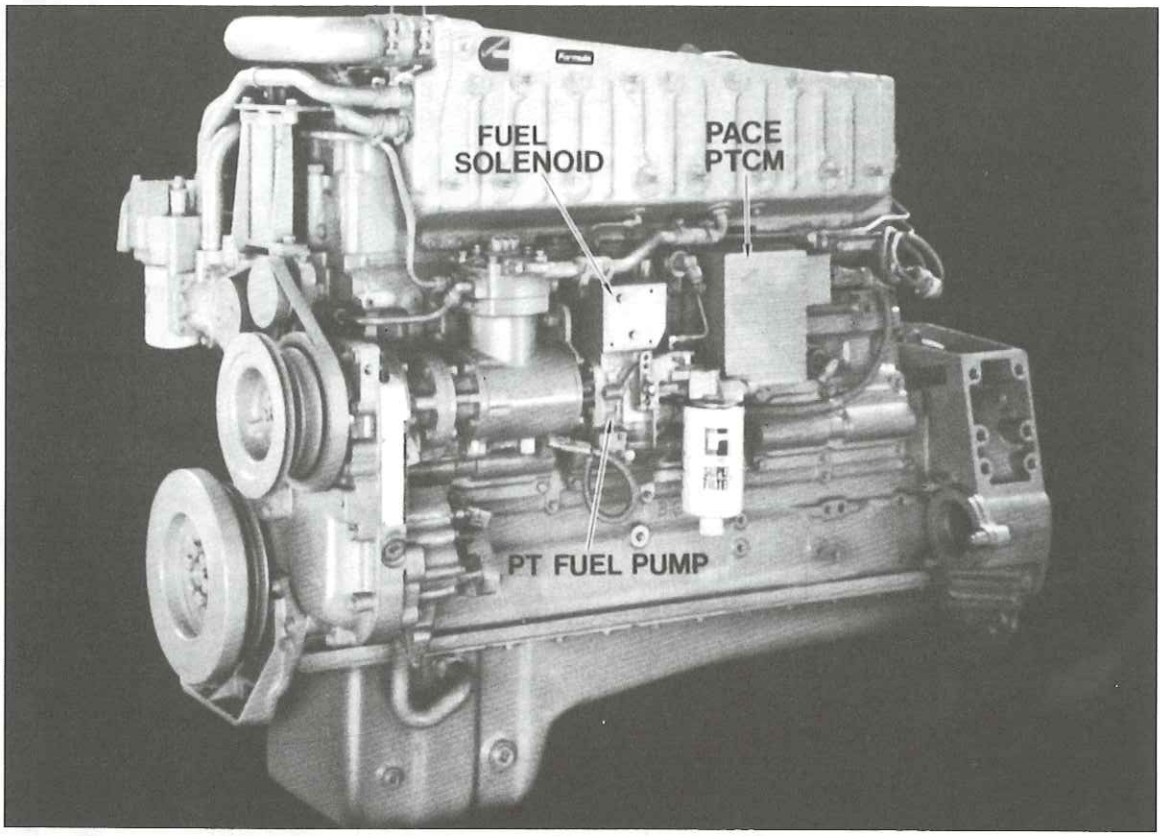

## *Jacobs*® ENGINE BRAKE
## Control System Installation

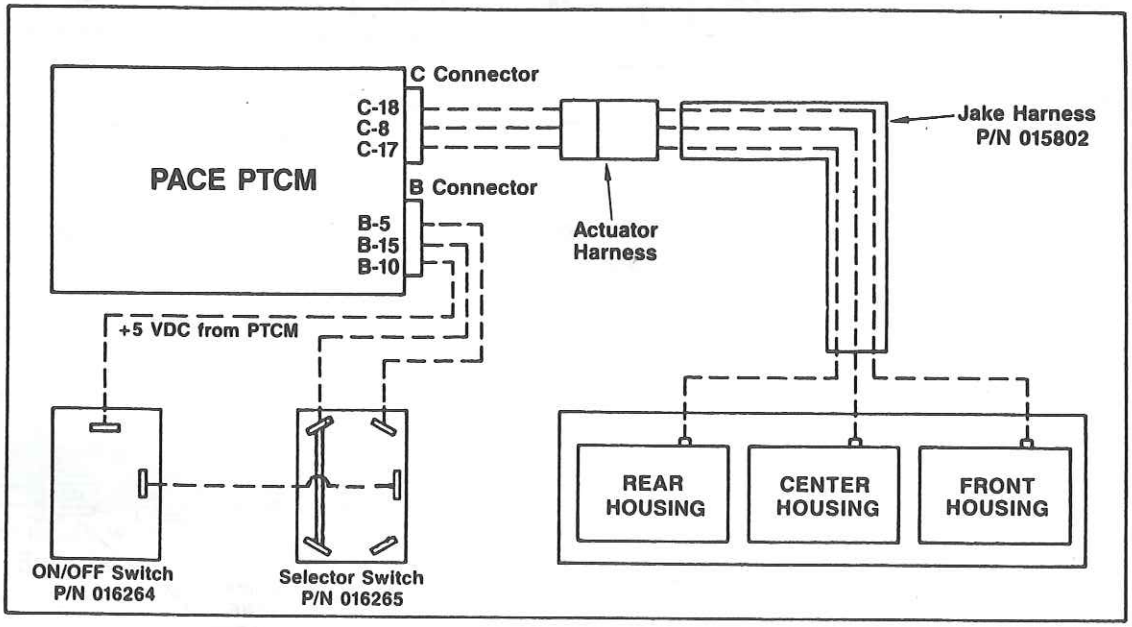
## PACE Jake Brake® Interface
## NT Cummins Engines

The Cummins PACE Electronic Fuel Control System requires the following components for proper engine brake operation:

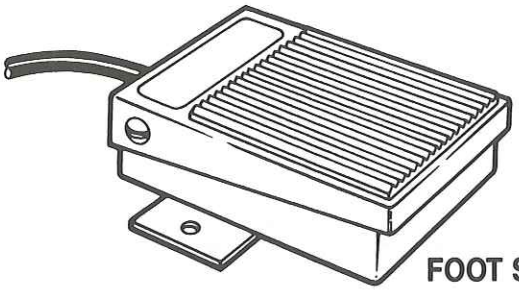
1. Jacobs P.N. 015802 wire harness used to connect the engine brake to the electronic controls.
2. P.N. 016440 solenoid valves. Standard equipment on engine brakes shipped after Oct. 17, 1988.
3. Special dash switches as shown in diagram.

The Jacobs harness is connected to the PACE PTCM C connector harness and to the three engine brake housings. The B connector is connected to the dash switches as shown in the diagram. With this system, no clutch switch is required.



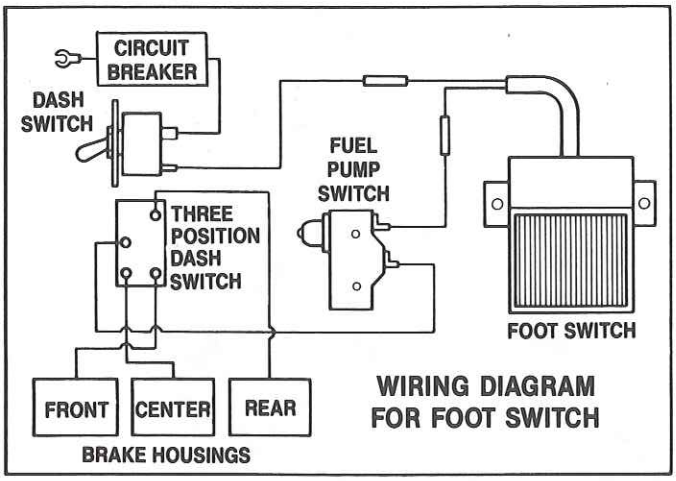



Jacobs offers three different systems for Engine Brake control. Besides the standard semi-automatic system, the customer has the choice of two added options: fully automatic control with a "low speed" shut-off or fully manual control with a "Foot Switch".



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.



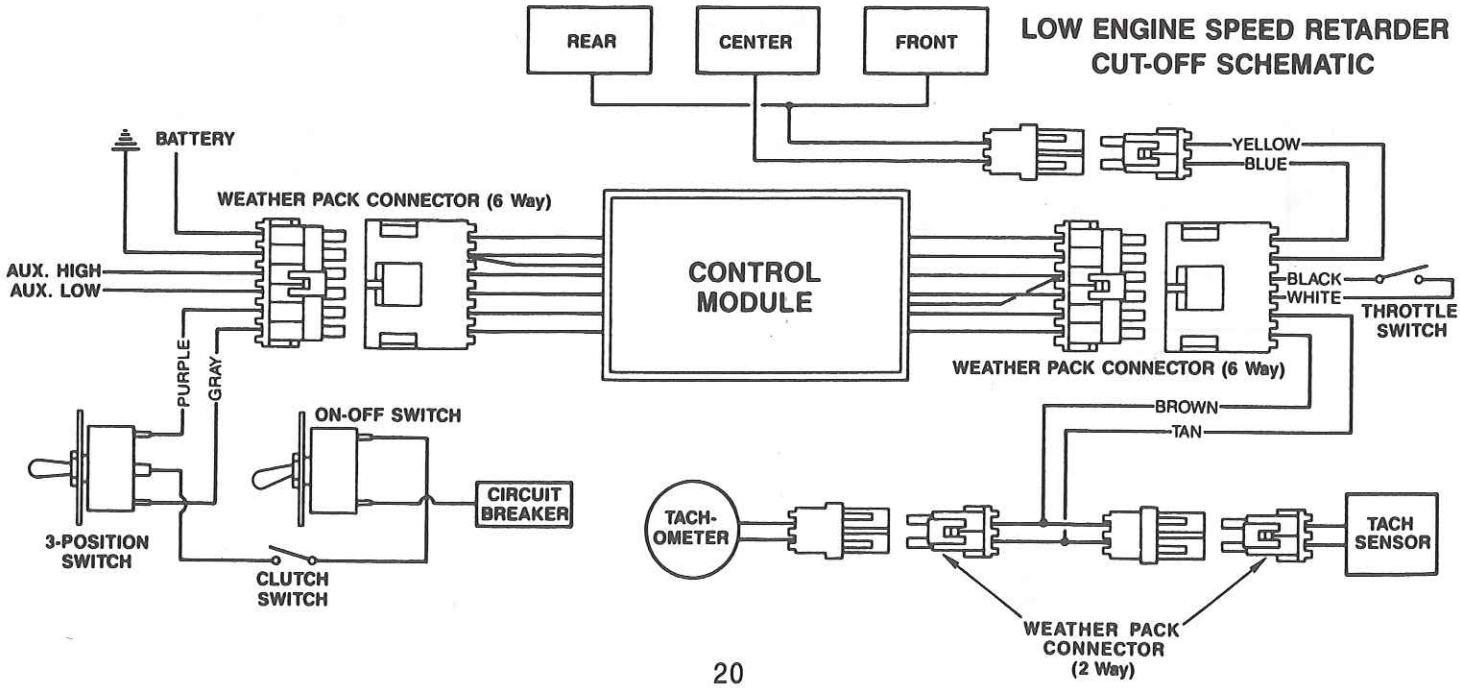

WIRING DIAGRAM FOR FOOT SWITCH

## 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 "slip seat" operations where several drivers may operate one vehicle.


CONTROL MODULE

The kit consists of a low speed retarder cut-off module 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.




LOW ENGINE SPEED RETARDER CUT-OFF SCHEMATIC

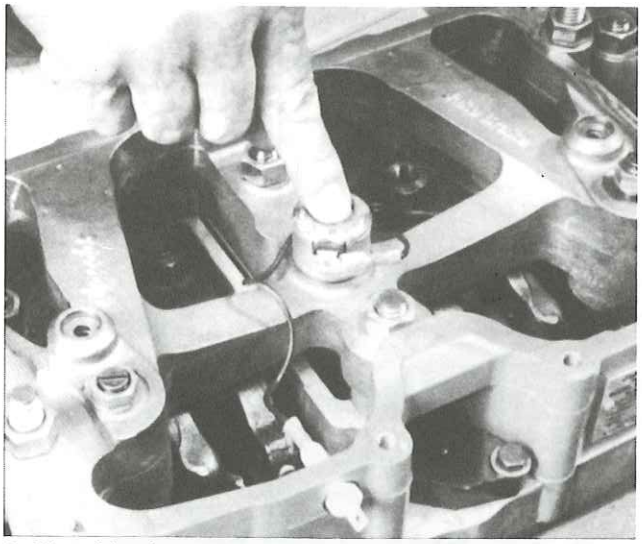
# SECTION 5 ENGINE BRAKE OPERATION CHECK

The Jacobs Engine Brake installation is now complete. The following procedures and adjustments should be made.

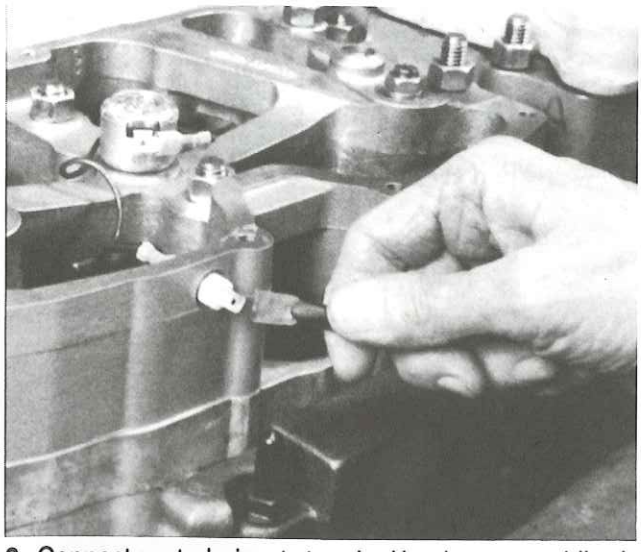
⚠ WARNING

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

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

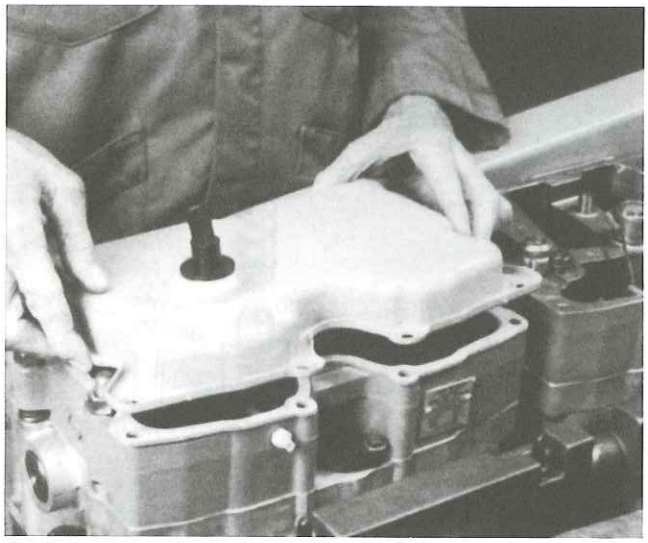


1. Bleed brake units and check their operation. Start engine and allow to run 5 to 10 minutes. Accelerate engine to approximately 1800 rpm. Release throttle and then manually depress each solenoid armature. Repeat this procedure five or six times to permit engine oil to fill the brake housing passages completely.

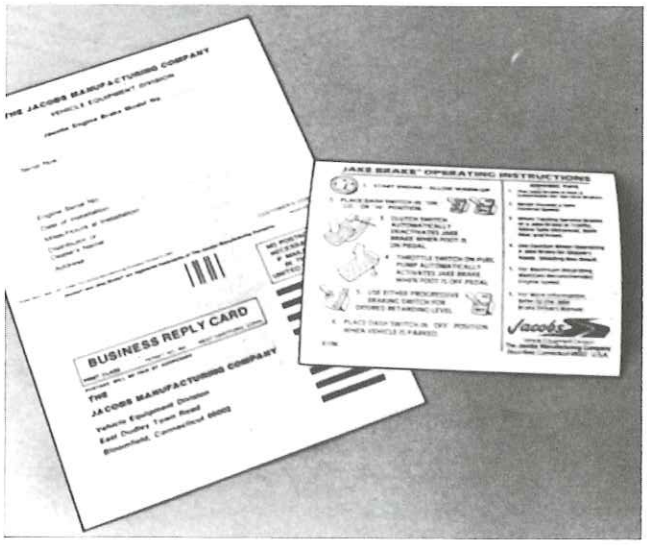


2. Connect control wires to terminal leadout assemblies in Engine Brake housings.

3. 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.

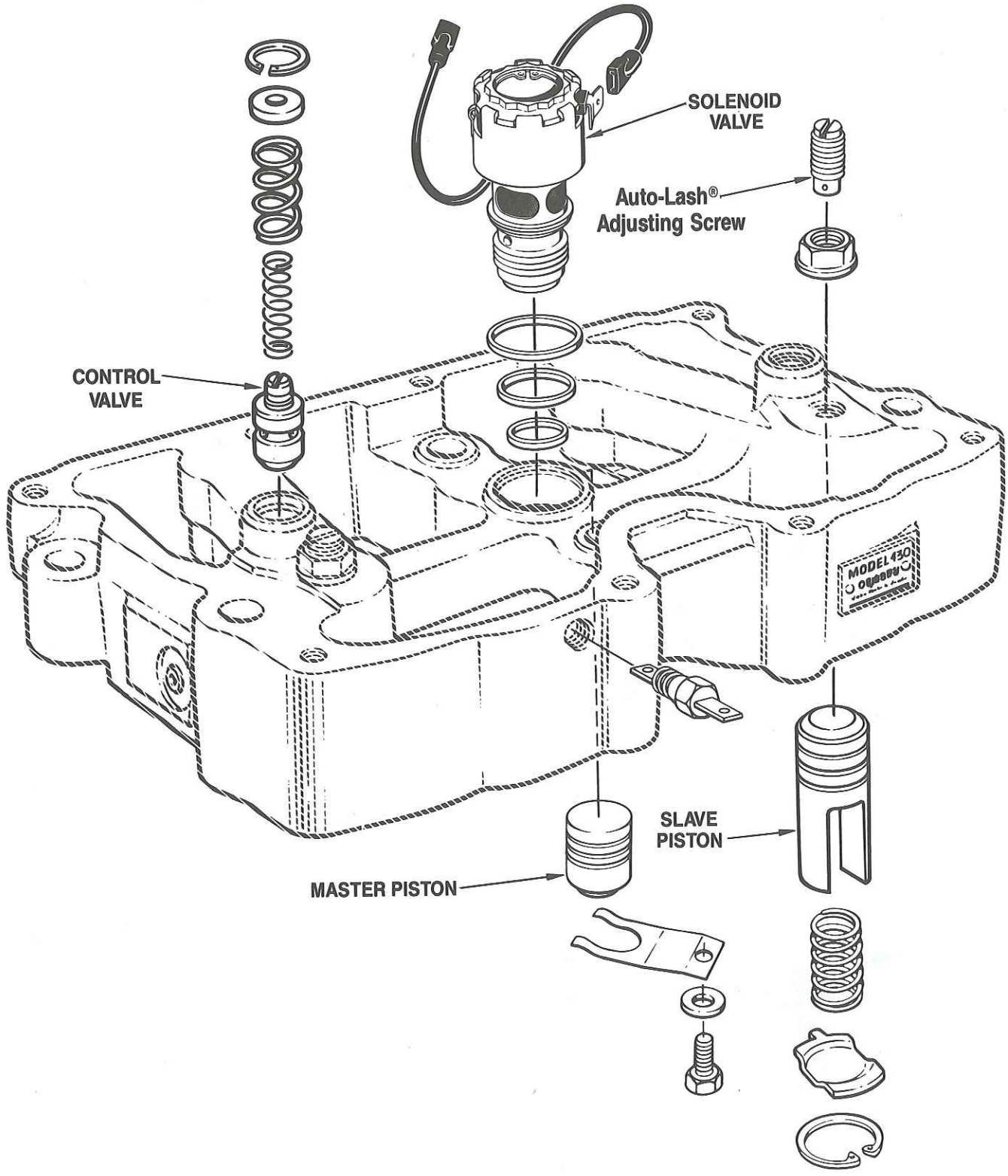


4. Using new Cummins gaskets, replace rocker housing covers and all previously removed parts.




Attach the **OPERATING INSTRUCTION** decal in a convenient location on the dash.

Complete and mail the Engine Brake Warranty card.




EXPLODED VIEW OF THE JACOBS MODEL 430 ENGINE BRAKE

⚠ WARNING

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

The Jacobs Engine Brake is a relatively trouble-free 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.

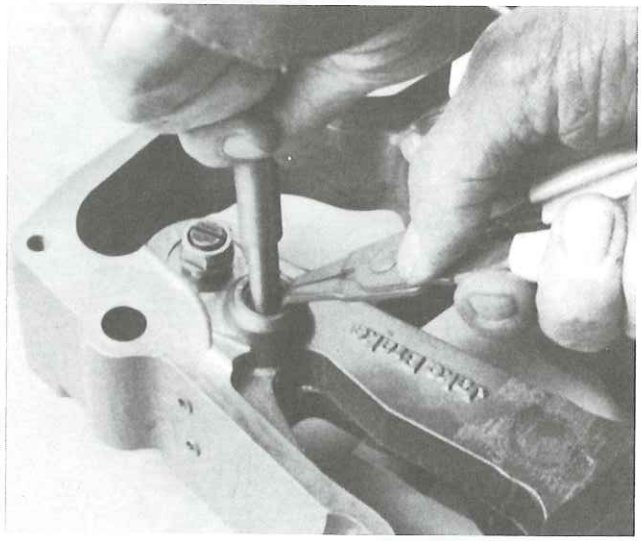
This section will cover how to properly remove, clean and reinstall engine brake components. Use an OSHA-approved cleaning solvent when washing parts. Be sure to coat parts with clean engine oil when reinstalling them.

## CONTROL VALVE

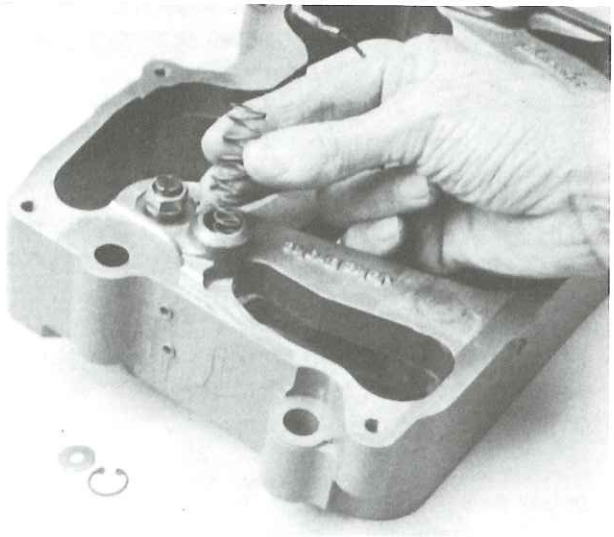
⚠ WARNING

**REMOVE CONTROL VALVE COVERS CAREFULLY.**

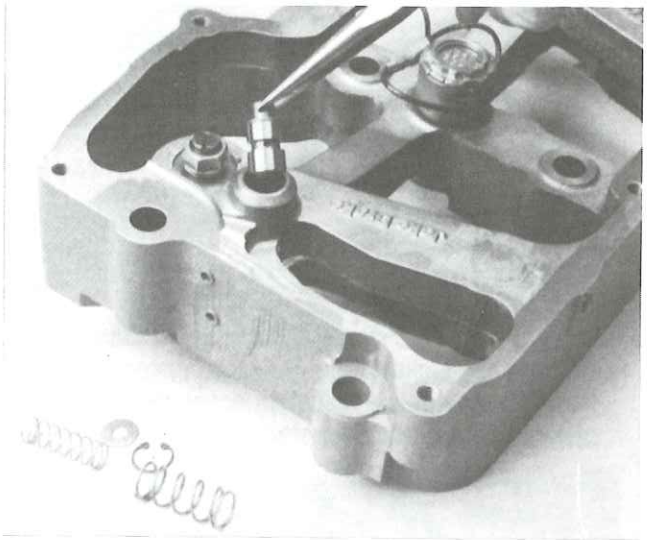
**CONTROL VALVE COVERS ARE UNDER LOAD FROM THE CONTROL VALVE SPRINGS. REMOVE WITH CARE TO AVOID PERSONAL INJURY.**



1. Press down on control valve cover to relieve spring pressure.
2. Remove retaining ring using retaining ring pliers.



3. Slowly remove cover until spring pressure ceases, then remove the two control valve springs.



4. Using needle-nose pliers, reach into the bore and grasp the stem of the control valve. Pull valve straight up and out of its bore.
5. Wash the control valves with approved cleaning solvent. Push a wire though 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. 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. Holding the valve by the stem, let the valve drop into its bore. If binding occurs or if the ball is stuck in the valve, the control valve should be replaced.

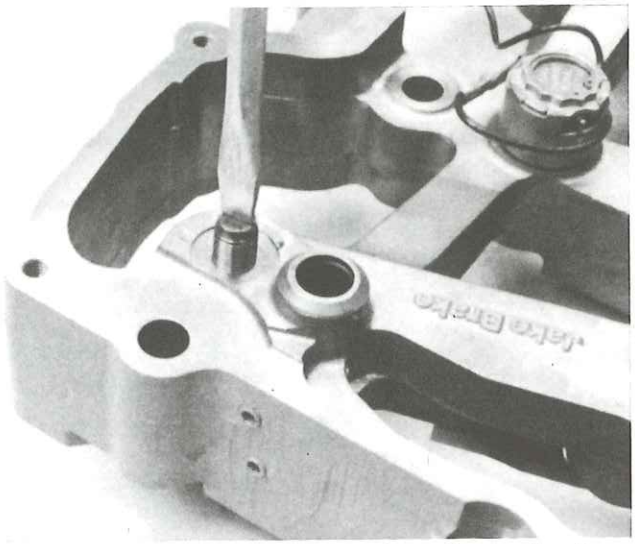
## SLAVE PISTON

**⚠ WARNING**

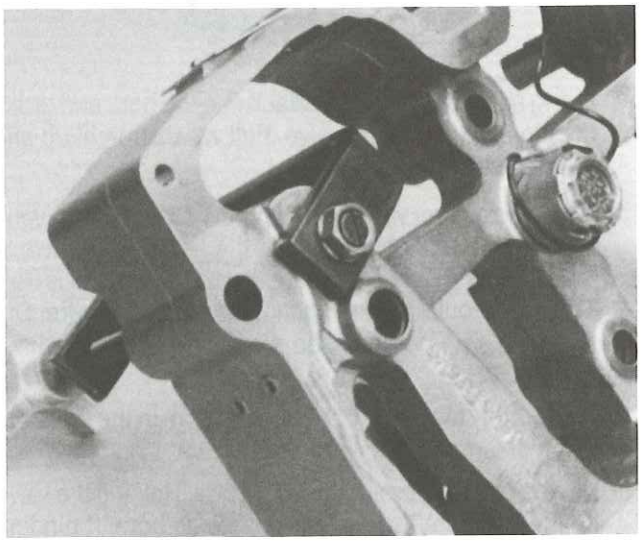
**WEAR SAFETY GLASSES.**

**REMOVE SLAVE PISTON CAREFULLY.**

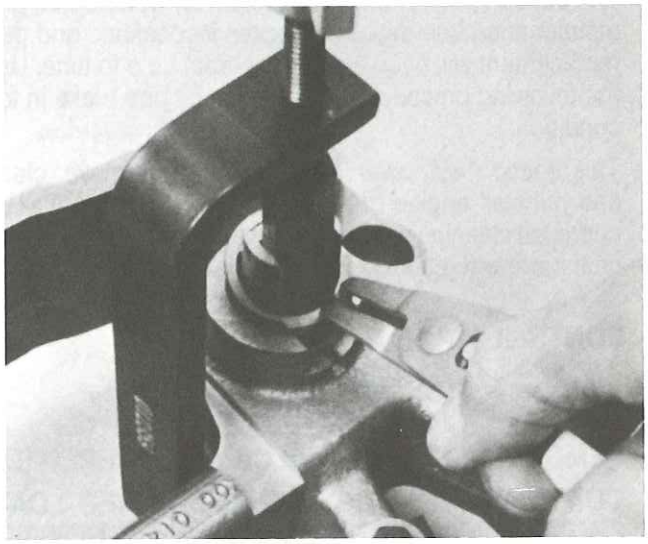
**THE SLAVE PISTON IS RETAINED BY SPRINGS THAT ARE UNDER HEAVY COMPRESSION. IF THESE INSTRUCTIONS ARE NOT FOLLOWED AND PROPER TOOLS NOT USED, THE SPRING COULD BE DISCHARGED WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY.**



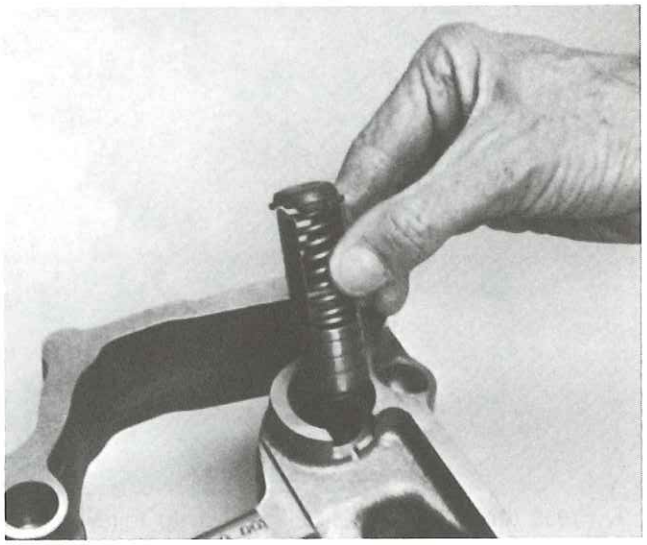
1. Remove the locknut from the slave piston adjusting screw. Back out the adjusting screw until the slave piston is fully retracted (screw is loose).



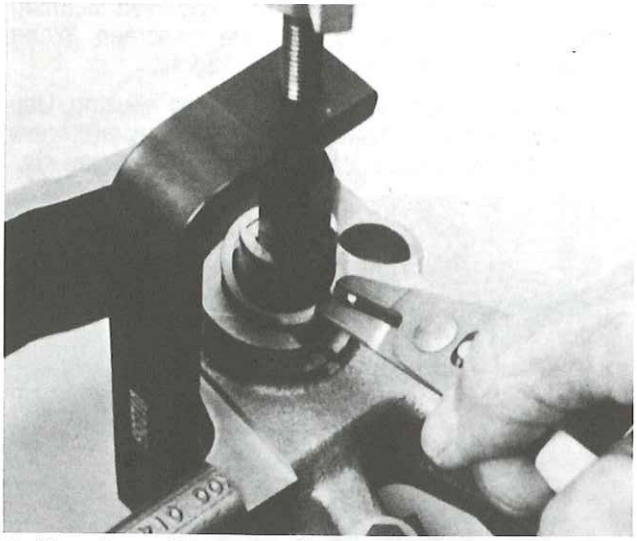
2. Use the slave piston clamp fixture and the following procedure to remove and replace the slave piston.
3. Place the hole in the clamp fixture over the slave piston adjusting screw. Replace locknut. Snug tighten to hold fixture securely.
4. While holding the fixture in position, screw the holder down over the slave piston until the retainer is contacted.
5. Turn the handle slowly until the retainer is depressed about 0.040" (1 mm) relieving pressure against the retaining ring.



6. Remove the retaining ring. Use retaining ring pliers. Back out the holder until the springs are loose. Remove the fixture.



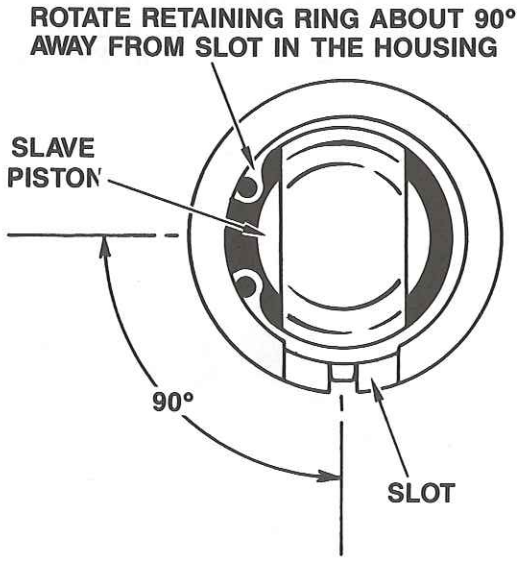
7. Remove all components, ensuring there is no binding or burrs. Clean in an approved cleaning solvent, or replace as necessary.



8. Use 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.

**NOTE:**
**Be sure components are reassembled in proper order.**

9. Compress the slave piston and springs down until the retainer is about 0.040 inch (1mm) below the retaining ring groove. Reinstall the retaining ring. Be sure the retaining ring is fully seated in the groove.

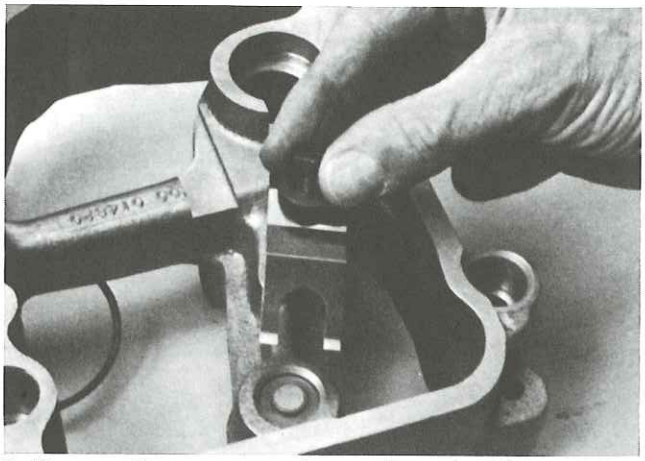



⚠ CAUTION

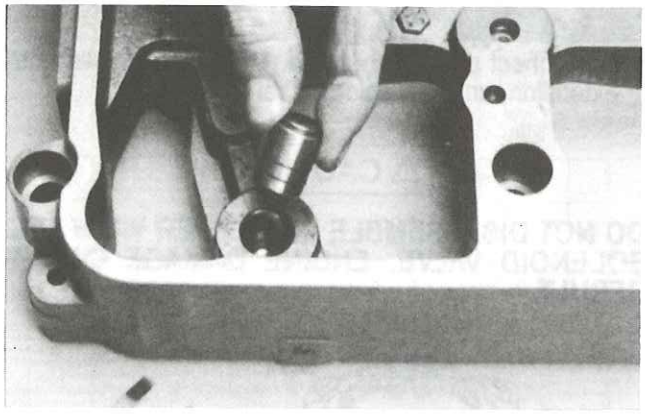
**DO NOT LEAVE OPEN PORTION OF RETAINING RING ALIGNED WITH OPENING IN HOUSING AS THIS WILL PERMIT THE SPRING RETAINER TO BECOME LOOSE WHEN THE ENGINE BRAKE IS OPERATING. SERIOUS ENGINE DAMAGE WILL RESULT.**

10. Remove the clamp fixture slowly to insure proper seating of retaining ring.

## MASTER PISTON



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



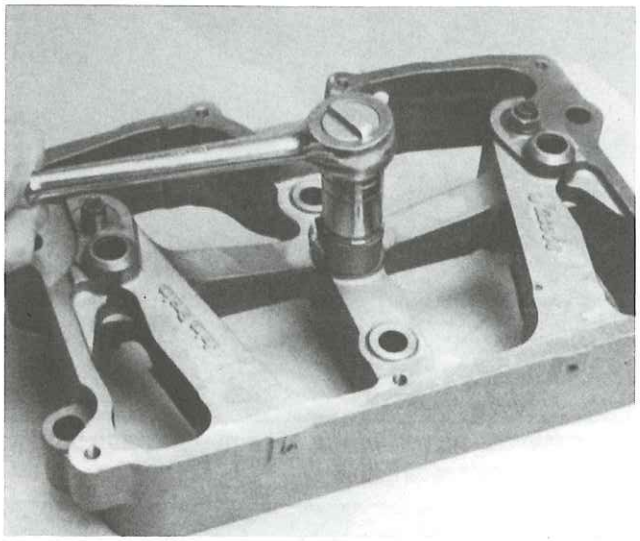
2. Remove master piston from its bore using needle nose pliers to initially pull the piston out if necessary. If binding occurs, check for burrs or contaminants in lube oil.

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

**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 illustration.

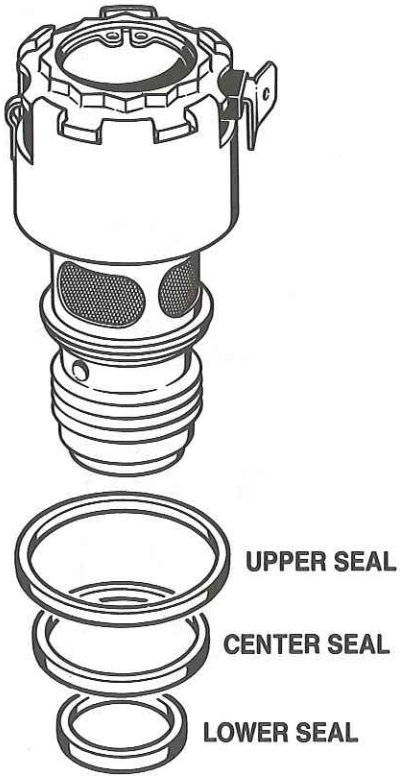
## SOLENOID VALVE



1. Disconnect solenoid harness. Using 7/8″ socket and extension, unscrew solenoid valve.

⚠ CAUTION

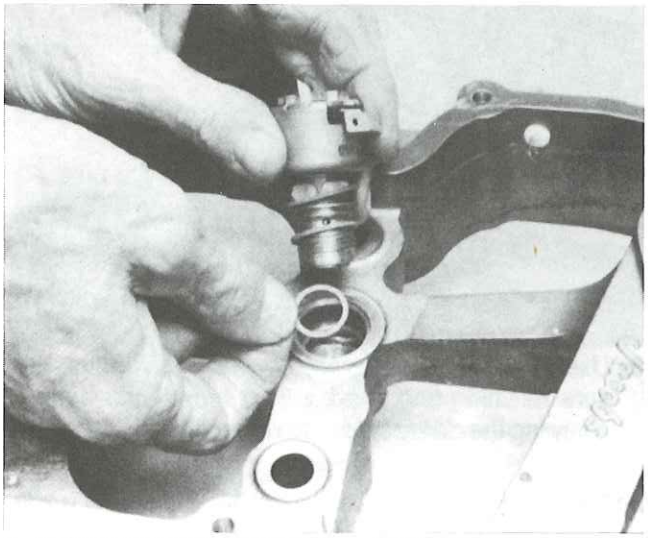
**DO NOT DISASSEMBLE OR TAMPER WITH THE SOLENOID VALVE. ENGINE DAMAGE COULD RESULT.**




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

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.

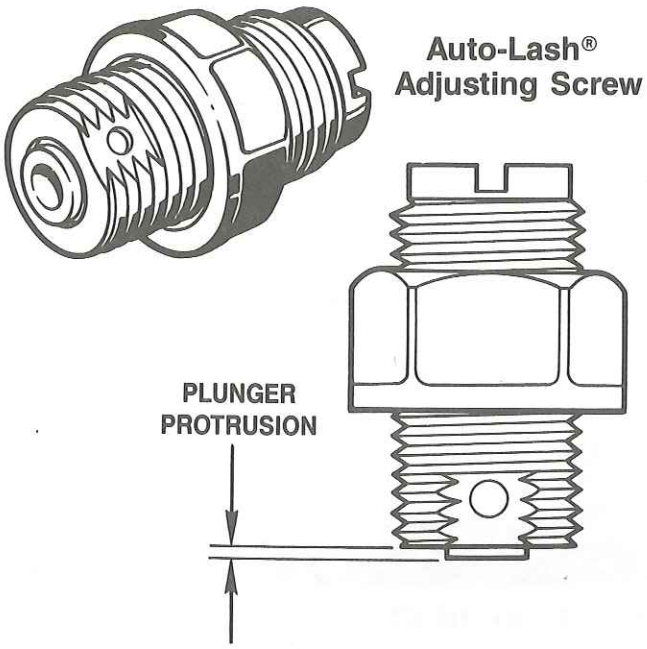


4. Using new solenoid seal rings, coat them with clean lube oil. Install the upper and center seal ring on the solenoid body and the lower seal ring into the bottom of the solenoid bore in the housing.

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 Auto-Lash adjusting screw locknut and remove adjusting screw from housing.




2. Inspect the Auto-Lash adjusting screw. The plunger should protrude from the bottom of the screw. Approximately 12 lbs. (53N) 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.

⚠ CAUTION

**DO NOT DISASSEMBLE OR TAMPER WITH THE Auto-Lash® ADJUSTING SCREW. ENGINE DAMAGE COULD RESULT.**

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