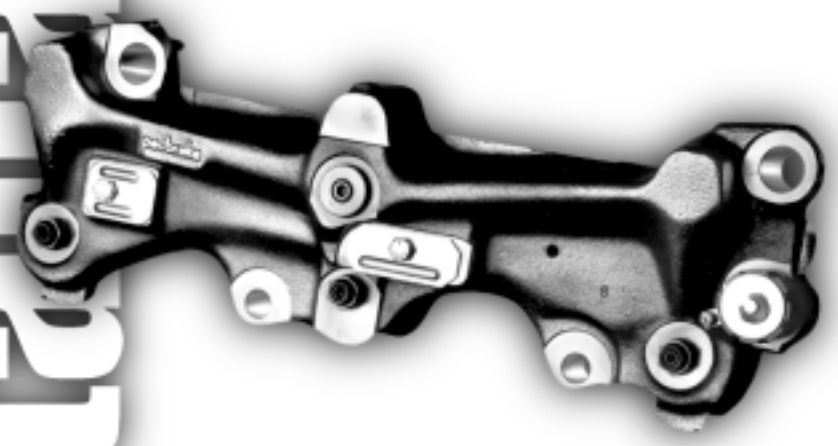
Installation



ENGINE BRAKES

P-36

Application:

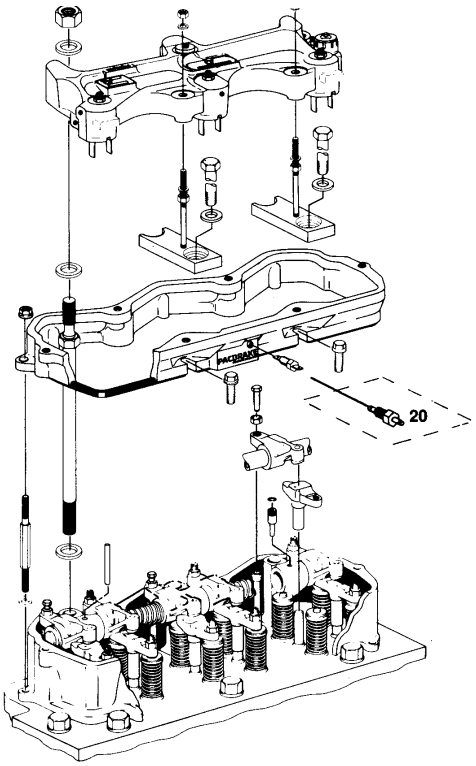
CATERPILLAR 3406 TRUCK ENGINES

PACBRAKE ENGINE BRAKES

BACKGROUND

P34605 HOUSING ASSEMBLY GROUP FRONT
DISTRIBUTOR BODY MARKED FRONT

P34610 HOUSING ASSEMBLY GROUP REAR
DISTRIBUTOR BODY MARKED REAR



The model P-36 uses a unique distribution system that allows a free flow of oil between the master and the slave pistons. (All drillings between master and slave radiate 360˚(around the centre of the brake housing to a distributor body). This free flow of oil means there is less restriction to the opening and closing of the engine exhaust valves during engine brake operation. This translates into a more precise engine exhaust valve operation and less tendency to float, particularly at higher RPM's, timing and full stroke are important: the exhaust valves are operated by the engine brake at a rate of 17.5 times per second and open only .070. The result is higher turbo pressure, yielding higher braking power. Moreover, with the exceptionally long stroke of the master piston (.400 on the Cat as opposed to .140 on the Cummins) special care must be taken to align the housings with the rocker arm adjusting screws and prevent distortion of the housing that the Cummins units are not subject to. Therefore, a number of mounting changes have been made over conventional design to ensure long life and minimum wear.

Note: The P-36 Engine Brake is designed to run and give maximum performance at 2100 RPM.

BEFORE STARTING

Identify the engine model. The P-36 Engine Brake is designed for 3406 applications.

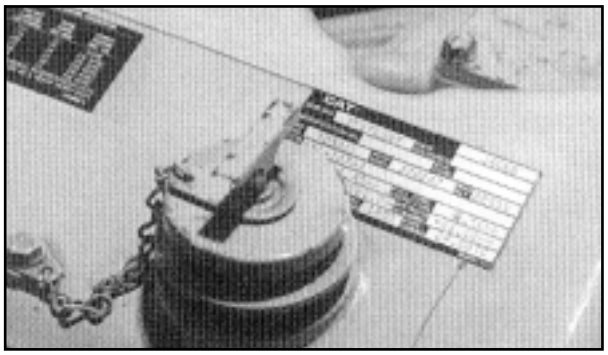
Examine the valve cover. An identification tag is attached to the valve cover showing all the necessary information.

NOTE 1: Early 3406 Engines prior to Ser.# 92U17820 require special fuel lines and may require a special turbo to manifold crossover pipe if equipped with a low mount turbo. These items are available through Caterpillar Distributors.

NOTE 2: The P-36 kit is packaged as a basic kit without most wiring and switch components.

An electrical group must be ordered separately and will have the items necessary for the specific application. i.e. Mechanical, PEEC II or PEEC III.

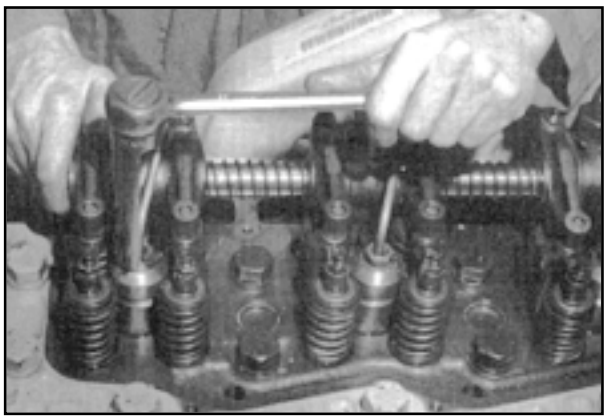
(See step #40)



ENGINE PREPARATION

1-3

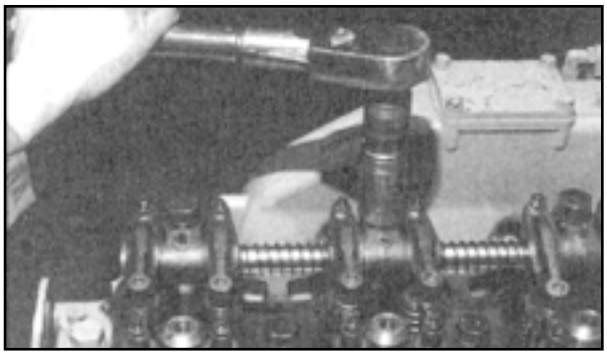
1. Thoroughly clean the top of the engine, and remove the crossover pipe and rocker covers.
2. Loosen and remove the fuel lines, placing them in a protective bag.
3. Loosen the intake and exhaust rocker arm adjusting screw lock-nuts.



4

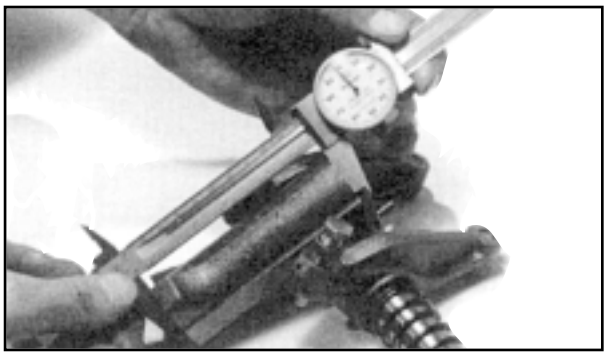
Remove the front rocker shaft group from the engine.

NOTE 1: No more than three rocker assembly head bolts should be removed at one time.



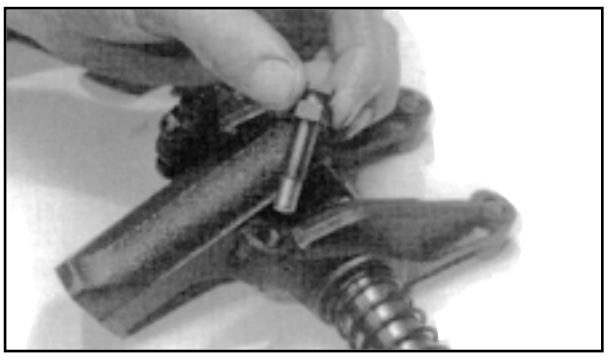
NOTE 2: At this time, for all engines with serial numbers prior to 7FB-39279, a measurement of the two end pedestals must be made using a vernier caliper or a micrometer. The height of each pedestal must be recorded. If more than a .005 difference is noted, then it is recommended that the top face of the higher pedestal, be machined down to the same height as the shorter of the two.

Alternatively, shimming may be used. SEE NOTE: at 20.



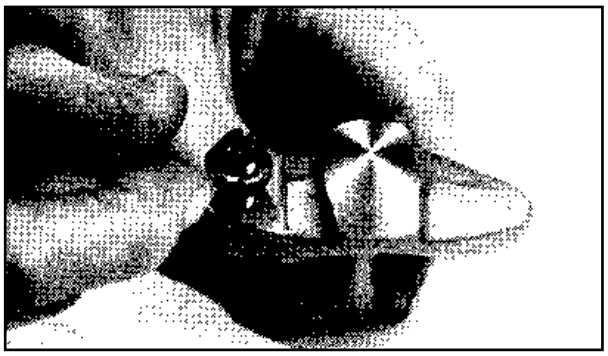
5

Remove the Caterpillar exhaust rocker arm adjusting screws and replace them with the hardened hexhead Pacbrake screws. Reuse the Caterpillar lock-nuts



6

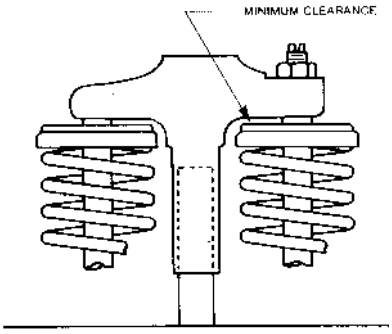
Remove the exhaust valve crossheads. Remove the crosshead adjusting screws and locknuts, then loosely install them into the Pacbrake crosshead.



OVERHEAD ADJUSTMENTS

7

Apply clean oil to the crosshead bore. Install on the engine and adjust according to the Caterpillar manual.



8

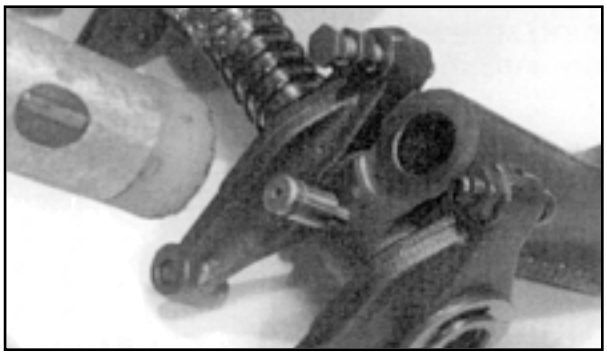
CAUTION! After cross-head installation and adjustment it is imperative that a clearance check is made between the underside of the cross-head on the adjusting screw side and the top of the valve rotocoil.

9

Each rocker arm assembly has a front and rear dowel pin. Remove the front pin. Locate and lubricate the Pacbrake oil supply adapter and install it leaving a slight gap (approximately .020) between the rocker arm pedestal and the main body of the oil supply adapter. This ensures that the adapter is neither bent nor broken upon mating with the uneven surface of the pedestal.

10

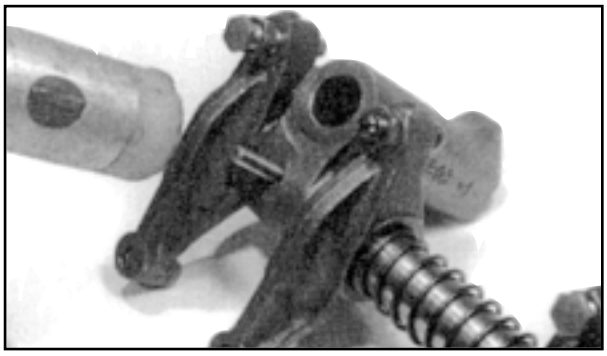
Remove the rear locating pin and replace it with the longer Pacbrake pin, taking care that the rounded end is up. This pin should be lightly driven until it stops on the bottom inside of the rocker shaft.



NOTE 1: This locating pin, as it is fitted into the milled groove on the undersurface of the housing, ensures proper alignment of the housing with the rocker arm shaft. CAUTION! The studs do not provide this alignment. Adverse wear to the master piston bore will result if you leave this important step out.

NOTE 2: If for any reason the engine should be run with the Pacbrake housings un-installed, each adapter and the locating pin should be replaced with original Caterpillar dowels.

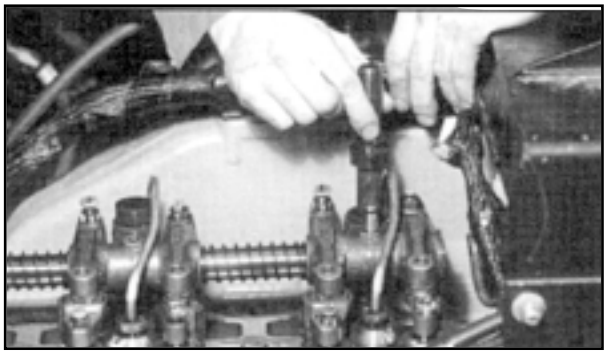
NOTE 3: 9&10 are easier to do with the rocker shaft installed on the engine. This allows the use of a slide hammer pin extractor, and also ensures bore alignment when installing the new parts.



11

Using air pressure, remove oil trapped in the holddown bolt holes.

CAUTION: Eye protection must be worn.



12

Re-install the front rocker assembly taking care to ensure that the push-tubes are in place.

13

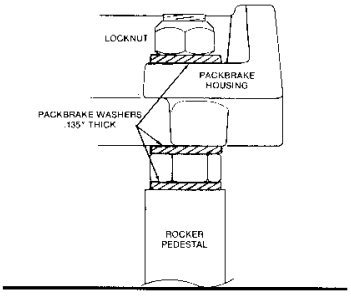
Install the two Pacbrake studs complete with Pacbrake washers in the outside locations on the rocker shaft. Re-use the Caterpillar bolt and washer in the center locations.

NOTE 1: Caterpillar recommends the use of 6V4876 molykote paste on the threads and between the washer and the underside of the bolt head and stud hex.

NOTE 2: There are 12 washers in this kit, all the same thickness, Ensure that 8 of them are correctly positioned here, one below and one above the hex on all 4 Pacbrake studs, (see diagram).

14

Center the rocker assembly and snug the studs and bolts firmly. Starting with the center bolt, torque evenly the bolts as well as the studs to 200 lbs.ft. (270 N.m). Torque them again to 330 lbs.ft. (450 N.m) in 50 lb. (70 N.m) increments.



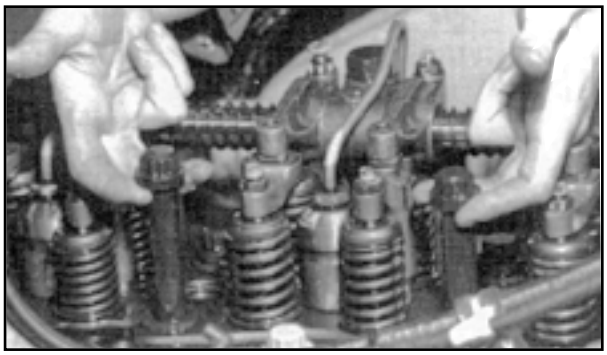
15

Repeat steps 4 through 14 on rear.

16

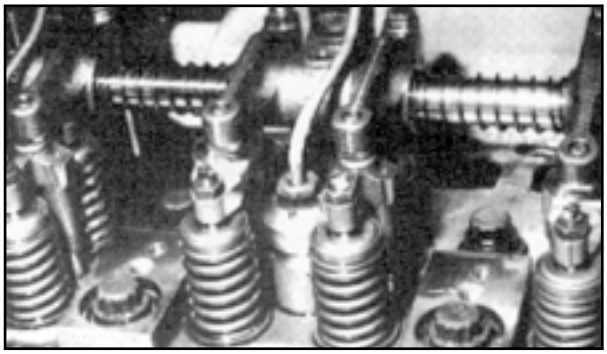
Remove Cat head bolts (see illustration for location) on the front of the engine.

Repeat the oil blow-out procedure on the engine. Lubricate the threads of the Caterpillar bolts and their bearing surfaces.



17

Install the Pacbrake support base in these locations reusing the Cat head bolts and washers, and torque to 330 lb.ft. (450 N.m).



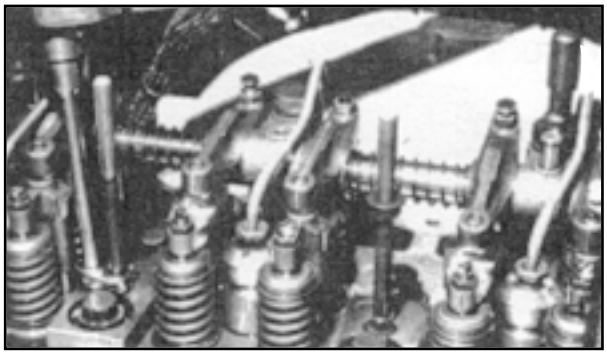
18

A) Install the housing support studs into the support bases (hex nut end into base) and using a 9/16 crowfoot wrench, torque to 50 lb.ft. (70 N.m).

B) Install the 7/16 NF nuts and washers on the studs.
CAUTION: Run the nuts to the bottom of the threads. This is necessary to prevent interference with the installation of the housing later.

19

Repeat steps 16 through 18 on rear.



20

Set intake and exhaust valves at this time according to the Caterpillar manual.

NOTE: If a shim is used to correct a low pedestal, it must be added now, directly above the stud hex and below the hardened steel washer, prior to installing the brake housing.

21

Re-install fuel tubes and torque to Caterpillar specifications (35 lb.ft. 50 N.m).

BRAKE HOUSING INSTALLATION

22

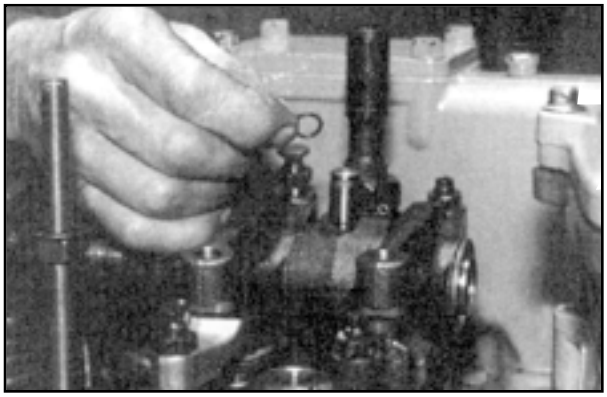
Before installing engine brake housings note that each housing is designated FRONT or REAR. This designation is marked clearly on the distributor body centered in each housing.

23

Install and lubricate the oil supply adapter o-ring. Lubricate the housing oil supply adapter bore.

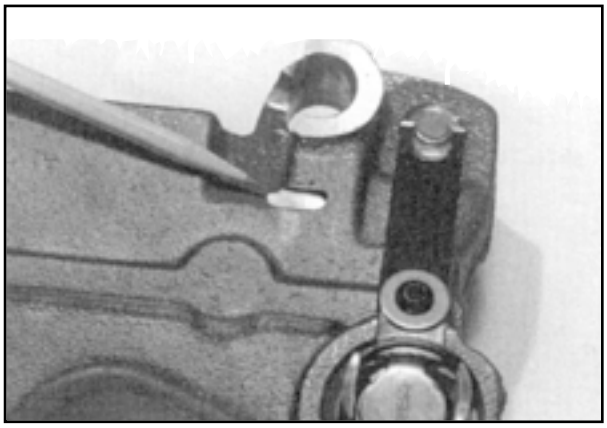
24

Install the front housing over the studs and oil supply adapter taking care that the housing is held level to minimize possible damage to the oil supply o-ring.



25

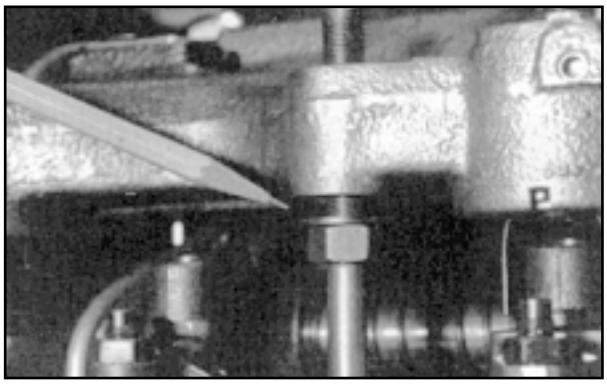
Ensure that the housing is fully down and that the location pin has engaged with the milled locating groove on the undersurface of the housing.



26

Install the 3/4 N.F. nuts with the remaining Pacbrake washers on the housing holddown studs.

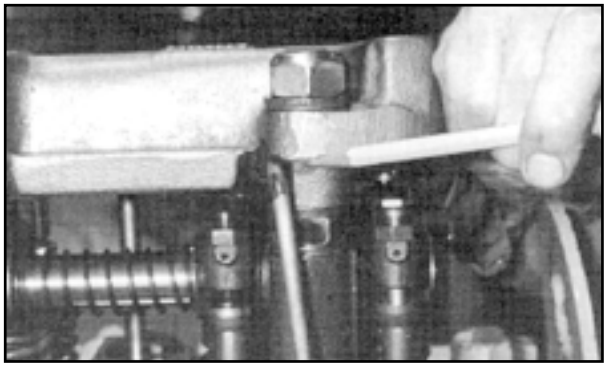
CAUTION: Before torquing, take care that the 7/16 N.F. support bracket nuts and washers are not in contact with the housing. Check once again that the location pin is properly engaged in the groove.



27

From the turbo side of the engine, starting with the left holddown nut, torque both evenly in two steps to 50 lb.ft. (70 N.m). Then to 100 lb.ft. (140 N.m).

NOTE: Fuel lines must not come in contact with any part of the engine or engine brake components. Engine damage from fuel contamination could result.



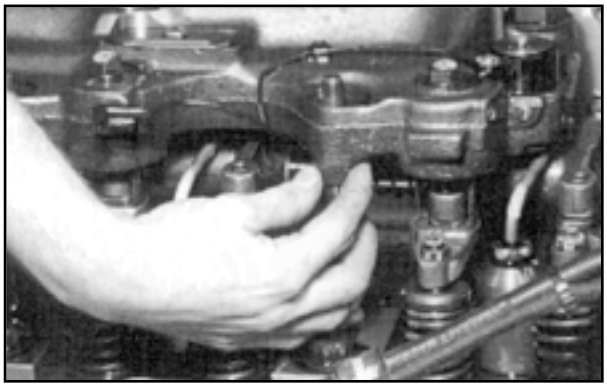
28

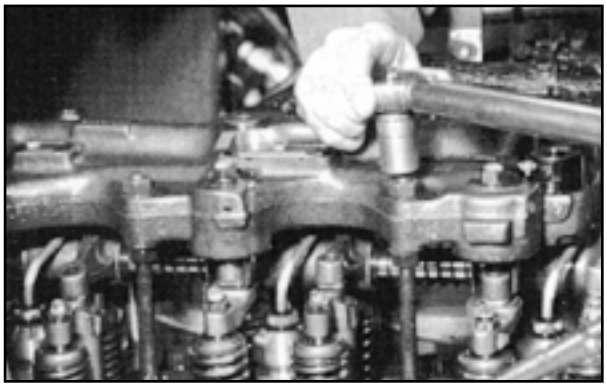
Repeat steps 23 through 27 on rear of engine.

29

Turn the support bracket nuts with the washers up under the housings as tight as possible using fingers only. Install upper washers and nuts and torque to 50 lb.ft. (70 N.m).

CAUTION: The support brackets fix the housing at the height already determined when you torqued the housing at the rocker arm pedestals. It is important that the housing is not forced up or down from this position. Also be aware that the flat washers used on the support bracket studs can momentarily stick to the housing should you remove the engine brake. (These washers could drop into the engine, so exercise care in their removal).



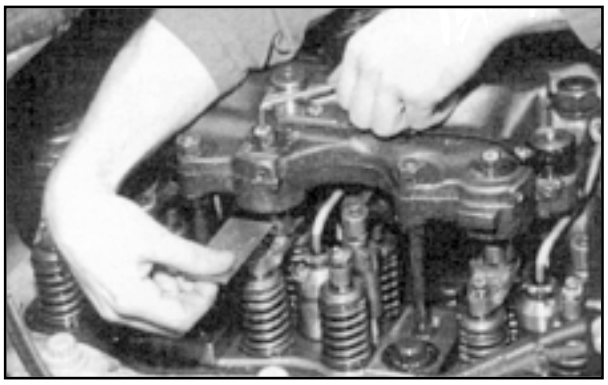


SLAVE PISTON ADJUSTMENT PROCEDURE

30

Slave piston adjustment can now be performed at any location that the exhaust crosshead is loose to the touch (has no pressure applied by a rocker arm). Insert a Pacbrake feeler gauge (see chart below) between the slave piston feet and the crosshead. Turn the Paclash adjusting screw down until a slight drag is felt on the feeler gauge and torque the lock-nut to 25 lb.ft. (35 N.m). Re-check the clearance.

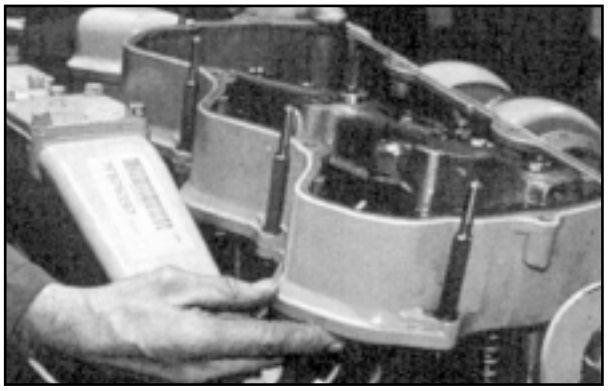
ENGINE TYPE	ADJUSTMENT	GAUGE#
3406	.060	P7446
3406B prior 1991	.080	P34670
3406 B+C		
1991 to present	.070*	P13184
*460 HP	.090	P18488



31

Install Caterpillar valve cover bases with the four studs and washers (short threaded ends down) on each base located as shown. Use the Caterpillar screws in the other locations.

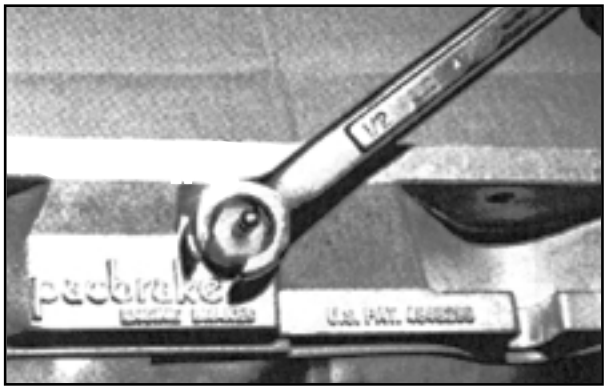
CAUTION: Ensure proper clearance is obtained between #3 and #6 Pacbrake crossheads and the cover bases. Cover base material may have to be removed.



FINAL ASSEMBLY AND ENGINE CHECKS

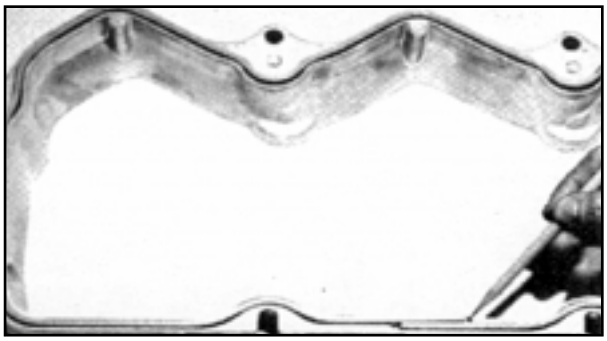
32

Two types of terminal lead-out bushings are used with the Pacbrake spacer. Both types are installed in the same manner. Apply clean lube oil to the seal ring and tighten until seated.



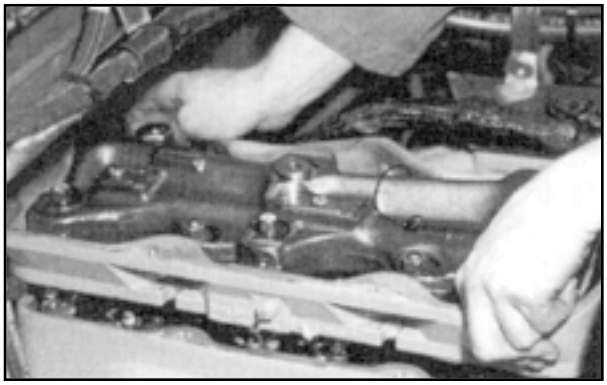
33

Install the Pacbrake gaskets in the spacers, leaving a gap of approximately 1/8" at each end to allow for expansion. Pacbrake gaskets are pre-cut to the appropriate length, so that cutting is not necessary.



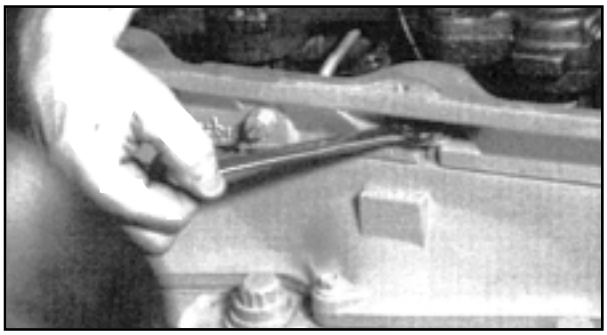
34

Install the spacers over the base mounting studs.



35

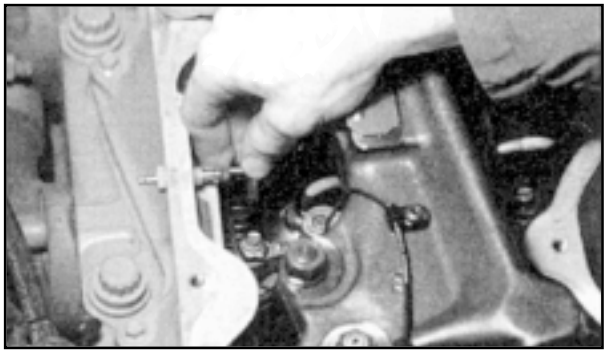
Install the Pacbrake serrated nuts and capscrews in the proper locations and tighten evenly to 13 lb.ft. (18 N.m).



36

Install the solenoid wire on the spacer lead-out terminal.

NOTE: We recommend that you double check your installation to this point, then start the engine and idle 5 to 10 minutes.

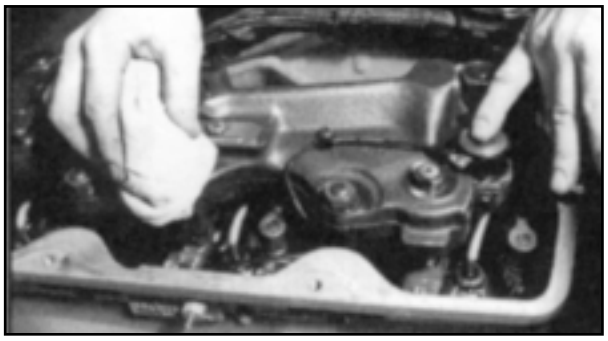


37

With the engine running hold a clean rag over the control valve covers (located on the engine brake housing) to catch oil spray. Depress the solenoid 5 or 6 times to purge the air from the engine brake housings.

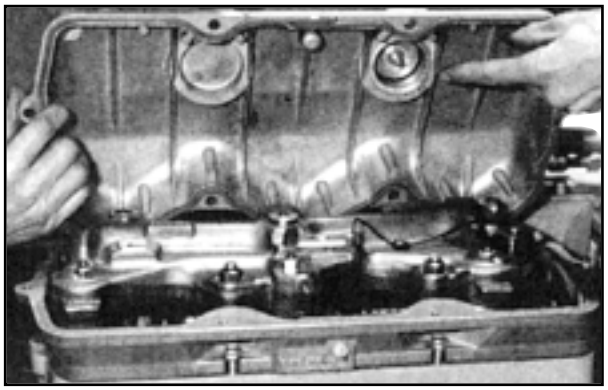
NOTE: With solenoids depressed, slave and master piston movement can also be checked.

A final check for abnormal oil or fuel leaks should be performed.



38

Before installing Caterpillar valve covers, check for interference at oil filler or breather locations. If interference is found, remove cover material (away from the engine) to ensure the necessary clearance.



39

Install valve covers and torque holddown screws to 13 lb.ft. (18 N.m). Relocate breather pipe and install the breather pipe extension hose supplied.

CONTROL SYSTEM INSTALLATION

40

Electrical wiring varies with each 3406 electrical system. Engines can have mechanical, PEEC II, or PEEC III systems and each type requires a different wiring group. The P-36 kit is packaged as a basic kit without most wiring and switch components.

PLEASE ORDER P-36 KITS AS FOLLOWS:

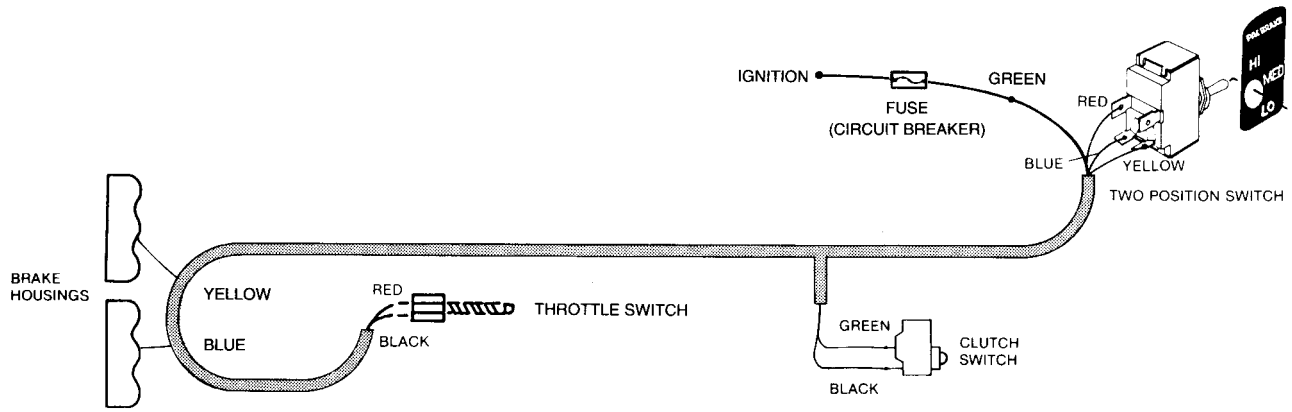
ENGINE TYPE	BASIC KIT		ELECTRICAL GROUP
1. Mechanical	P34616	Plus	P34617
2. PEEC II	P34616	Plus	P34618
3. PEEC III	P34616	Plus	P34619

Refer to the schematics for the correct installation of the electrical groups.

NOTE: For vehicles having automatic transmissions please consult your Pacbrake distributor.

WIRING SCHEMATIC - MECHANICAL GROUP P34617

(Harness P813-CT included)



THROTTLE SWITCH INSTALLATION

Remove the idle adjusting screw from the fuel pump and replace it with the throttle switch supplied in the Pacbrake kit. Adjust according to Caterpillar specifications. Tighten the locknut to 5 lb.ft. (7 N.m). OVER TIGHTENING COULD CAUSE BREAKAGE.

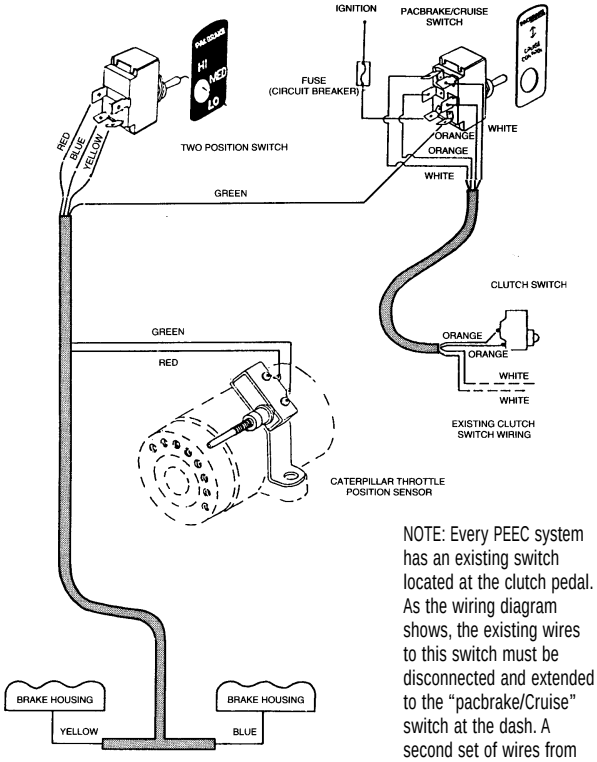
CAUTION: Internal type fuel pump switch must be wired correctly. Connect the red wire (from the Hi, Lo, Off switch) to the silver coloured (Diode) terminal.

NOTE 1: The throttle switch used on the 3406 engine (pt. #8920) differs from that used on the 3406 B and C engines (pt. #P17470). The fuel pump threads are not the same.

NOTE 2: An optional switch (pt. #13373) is available, that can be substituted in the event, it is inconvenient to replace the idle screw, or the truck has a positive ground system. (Switch not included in the kit).

WIRING SCHEMATIC - PEEC II GROUP P34618

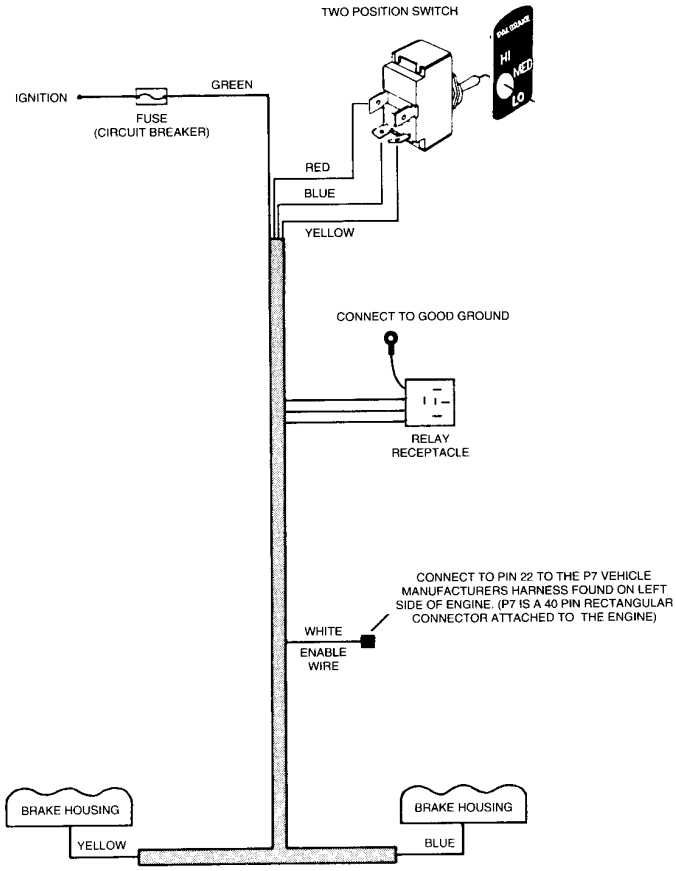
(Harness P832-CT included)



NOTE: Every PEEC system has an existing switch located at the clutch pedal. As the wiring diagram shows, the existing wires to this switch must be disconnected and extended to the "pacbrake/Cruise" switch at the dash. A second set of wires from the dash switch are then routed back to the clutch switch. (Harness included).

WIRING SCHEMATIC - PEEC III GROUP P34619

(Harness P826-CT included)



PEEC THROTTLE SWITCH INSTALLATION INSTRUCTIONS

1. Install the Pacbrake switch and bracket assembly in the location shown, using the existing mounting bolt.
2. Select the appropriate threaded hole in the face of Caterpillars position sensor and with the spacer and two shake-proof washers mount the actuating arm.
3. With the sensor in the idle position set the actuating arm so it has the switch in the closed "clicked" position and lock the 1/4 - 20 capscrew. Torque to 125 lb. in. (14.2 N.m). Operate the throttle to insure the switch is being actuated each time the throttle returns to the idle position and insure no interference exists between idle and full throttle.

Phone: (604) 882-0183 Fax: (604) 882-9278 E-mail: info@pacbrake.com USA: 250 H St. Box 1822 Blaine WA 98231-1822 Canada: 19594 96 Ave. Surrey BC V4N 4C3
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