

Tune-up Kit for Model 349A Jake Brake® P/N 019461

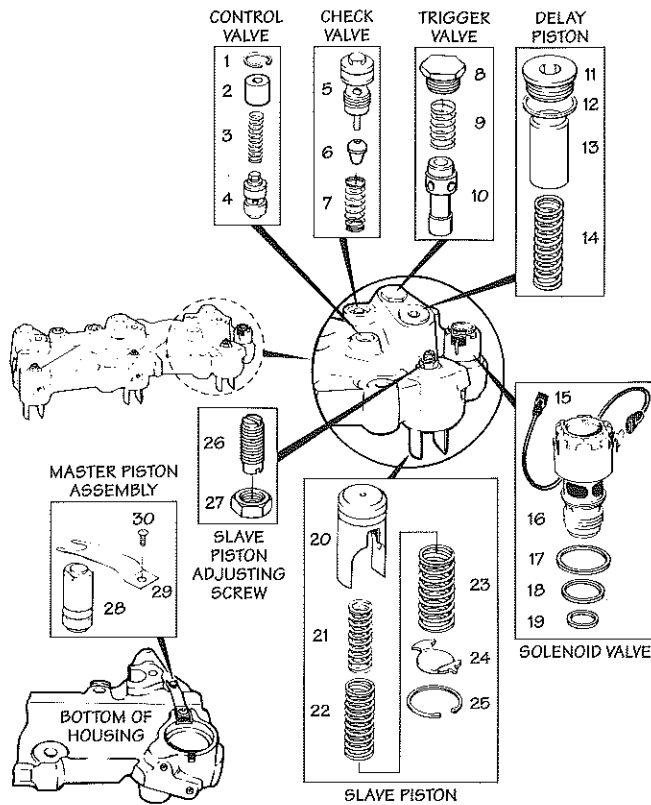


FIG. 1

Illus. No.	Part No.	Description	Qty./Hsg.
1	020513	Control valve retaining ring	3
2	020361	Control valve spacer/cover	3
3	011823	Control valve spring	3
4	011930	Control valve	3
5	019956	Check valve assembly	3
6	018644	Check valve	3
7	018534	Check valve spring	3
8	016709	Trigger cap	3
9	016706	Trigger spring	3
10	016710	Trigger valve	3
11	016860	Delay piston cap*	3
11	015316	Delay piston cap**	3
12	016861	Seal ring***	3
13	015476	Delay piston	3
14	015786	Delay piston spring	3
15	017775	Solenoid harness (14")	1
15	015843	Solenoid harness (15")	1
16	016440	Solenoid assembly	1
17	001081	Upper seal ring	1
18	001082	Center seal ring	1
19	001083	Lower seal ring	1
20	018251	Slave piston	3
21	011433	Inner slave piston spring	3
22	007832	Center slave piston spring	3
23	007833	Outer slave piston spring	3
24	005610	Spring retainer	3
25	005611	Retaining ring	3
26	018168	POWER-LASH® assembly	3
27	011395	Hex jam nut	3
28	018305	Master piston assembly	3
29	015805	Flat spring	1
30	003790	Buttonhead screw	1
NI	002411	"O" ring	2
NI	017657	Terminal leadout	2
NI	019472	Installation instructions	1

* For housing S/N J004366 and below only

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*** For use with P/N 016860, delay piston cap, only

NOTE: Parts included in the Tune-up kit are listed in **bold**.

For additional information on the Model 349A engine brake, refer to the Installation Manual, P/N 018312.

Use OSHA-approved cleaning solvent for cleaning parts. Original parts to be reused should be inspected for wear and replaced as required. Wear safety glasses where indicated.

Access Engine Brake

1. Thoroughly clean engine.
2. Remove accessory equipment to gain access to rocker lever covers and remove covers.
3. Disconnect electrical connections at the spacer.
4. Remove engine brake housing capscrew, nuts, and washers. Remove housings.

5. Remove "O" rings from oil supply adapter and remove terminal leadout assemblies. Discard "O" rings and lead out assemblies.

Disassemble Housings

1. **Check Valve:** Remove the check valve (5, 6) and spring (7). Inspect all parts for damage or wear and replace as necessary.
2. **Delay Piston:** Remove the delay piston cap (11) slowly. Use a magnet to remove delay piston (13) and spring (14). If piston is scored or damaged in any way, replace it.



REMOVE THE CHECK VALVES (5, 6) BEFORE REMOVING THE DELAY PISTON CAPS (11). THIS RELIEVES PRESSURE IN THE PLENUM CHAMBER SO THAT THE DELAY PISTON CAPS CAN BE SAFELY REMOVED.

3. **Trigger Valve:** Remove the trigger cap (8) and spring (9). Remove the trigger valve (10). Inspect the trigger parts for damage or wear and replace if necessary.
4. **Slave Piston:** Remove the hex jam nut (27) on the slave piston adjusting screw (POWER-LASH®) (26). Back out the adjusting screw until the slave piston (20) is fully retracted (screw is loose). Install the slave piston removal tool. Turn the tool handle in to relieve the spring pressure. Using retaining ring pliers, rotate the retaining ring (25) to the slot in the housing and remove the retaining ring. Turn the tool handle out to relieve the spring force and remove the retainer (24), springs (21, 22, 23) and slave piston (20).



REMOVE THE SLAVE PISTON (20) CAREFULLY. THE SLAVE PISTON IS RETAINED BY SPRINGS (21, 22, 23) THAT ARE UNDER HEAVY COMPRESSION. IF THE FOLLOWING INSTRUCTIONS ARE NOT FOLLOWED AND PROPER TOOLS NOT USED, THE SPRINGS COULD BE DISCHARGED WITH ENOUGH FORCE TO CAUSE PERSONAL INJURY.

5. **Control Valve:** Press down on the control valve spacer/cover (2) to relieve spring pressure. Remove the retaining ring (1) using retaining ring pliers. Slowly remove the cover until spring pressure ceases, then remove the control valve spring (3).



REMOVE THE CONTROL VALVE SPACER/COVER (2) CAREFULLY. CONTROL VALVE COVER IS UNDER LOAD FROM THE CONTROL VALVE SPRING.

NOTE:

HOUSINGS MADE BEFORE AUGUST, 1994, HAVE TWO CONTROL VALVE SPRINGS.

Using needle-nose pliers, remove the control valve (4).

6. **Master Piston:** Remove the buttonhead screw (30) and flat spring (29). Remove the master piston assembly (28). Inspect all parts for damage or wear and replace if necessary. If the master piston hard-face surface is scored or damaged, the corresponding rocker arm adjusting screw, master piston assembly, flat spring and buttonhead screw must ALL be replaced.

NOTE:

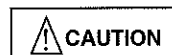
DO NOT CHANGE THE ADJUSTMENT OF THE MASTER PISTON. FINAL ADJUSTMENT IS DONE ON THE ENGINE.

7. **Solenoid Valve:** Disconnect the solenoid harness (15). Use a 7/8" socket and extension to remove the solenoid assembly (16). Remove and discard the three rubber seal rings (17, 18, 19). If the lower ring (19) stays in the bottom of the housing solenoid bore, remove it with a seal pick.

Wash out the solenoid assembly (16) with approved cleaning solvent. Use a brush to clean the oil screen. When clean, dry valve with compressed air. Clean out the solenoid valve bore in the housing. Use clean paper towels.

NOTE:

DO NOT USE SHOP RAGS AS THEY MAY LEAVE LINT OR RESIDUE WHICH CAN PLUG PASSAGeways.



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

Clean Housings

1. Only after removing the check valves (6), remove the plenum end caps and 3/8" pipe plugs located at the sides and rear of the housings. Do not remove any of the smaller 1/16" pipe plugs from the housings.



DO NOT REMOVE THE PLENUM CAP OR THE THREE 3/8" PIPE PLUGS FROM THE HOUSING WITHOUT FIRST REMOVING THE CHECK VALVES. THE PLENUM IS UNDER HIGH PRESSURE AND PERSONAL INJURY MAY RESULT IF THE PROPER PROCEDURES ARE NOT FOLLOWED.

2. Place the housings in a cleaning solvent tank with clean fluid. The fluid should flow in through the plenum end cap and out through the check valve bores. Allow the housings to dry thoroughly.
3. Using a cleaning nozzle, blow pressurized air through the plenum to ensure that no debris remains stuck to the inside surfaces of the housings.



WEAR PROPER EYE PROTECTION WHEN USING PRESSURIZED AIR. DIRECT THE AIR AWAY FROM ANY PEOPLE.

4. Repeat steps 2 and 3.

Assemble Housings

1. **Solenoid Valve:** Reinstall the solenoid (16) using new seal rings. Seat the lower seal ring in the base of the solenoid valve bore. Wipe clean lube oil into and around the bore. Place the upper and center seal rings on the solenoid valve body.

Be sure the seals are seated properly and carefully screw the solenoid into the housing without unseating the seals. Tighten the valve to 110 lb.-in. (12.5 N•m). Be careful not to twist the seals while installing.

2. **Master Piston:** Reinstall the master piston (28) and replace the master piston flat spring (29) and buttonhead screw (30). Tighten the buttonhead screw to 60 lb.-in. (7 N•m).
3. **Control Valve:** Thoroughly clean the control valve bore in the housing using clean paper towels. Dip the new control valve (4) in clean lube oil and place the valve into its bore.

NOTE:

DO NOT USE SHOP RAGS AS THEY MAY LEAVE LINT OR RESIDUE WHICH CAN PLUG PASSAGEWAYS.

4. **Slave Piston:** Reassemble the slave piston (20), springs (21, 22, 23), retainer (24), POWER-LASH® (26), and hex jam nut (27) using the Jacobs slave piston tool. Rotate the slave piston retaining ring (25) 90° from the slot in the housing to ensure that it is properly seated.
5. **Trigger Valve:** Replace the trigger valves (10) using a new cap (8) and spring (9). Tighten the cap (8) to 35 lb.-ft. (48 N•m).
6. **Delay Piston:** Reinstall the spring (14), delay piston (13) and cap (11). If the housing was originally equipped with a copper seal (12), use a new copper seal (12). Housings with serial numbers J004367 and up do not use a copper seal.

Clean the oil from the cap threads and apply Loctite 271 (or equivalent) before installing. Tighten the delay piston cap (11) to 65 lb.-ft. (88 N•m).
7. **Check Valve:** Replace all parts in the order shown in Fig. 1. Tighten the check valve assembly (5) to 35 lb.-ft. (48 N•m).

NOTE:

THE CHECK VALVE ASSEMBLY (5) CONTAINS A THREE-PIECE SEAL. DO NOT ATTEMPT TO REMOVE THE SEAL. IF THE SEAL IS DAMAGED, REPLACE THE COMPLETE CHECK VALVE ASSEMBLY.

Brake Housing Installation

NOTE:

REFER TO THE MODEL 349A INSTALLATION MANUAL (P/N 018312) FOR MORE DETAILED INSTRUCTIONS.

1. Install a new "O" ring on the oil supply adapter. Place a small amount of grease on the adapter.

NOTE:

THE HOUSINGS ARE MARKED FRONT AND REAR. THE FRONT HOUSING MUST BE INSTALLED ON THE FRONT THREE CYLINDERS AND THE REAR HOUSING ON THE REAR THREE CYLINDERS.

2. Place the housing over the studs and install the two support tubes between the housing and support bases.
3. Install the Jacobs washers and the hex head bolts through the housing and support tubes and into the support bases. Hand tighten only.
4. Install the two flanged screws with washers at the rocker shaft location.
5. Tighten the flanged screws at the rocker shaft locations to 60 lb.-ft. (82 N•m). Tighten the hex head bolts at the support base locations to 60 lb.-ft. (82 N•m). Tighten the two flanged screws at the rocker shaft locations to 120 lb.-ft. (163 N•m).
6. Follow the same procedure for installing the engine brake housing on the other three cylinders.

Adjustment Procedures

1. Make adjustments in the following order: engine intake/exhaust valves, engine brake slave pistons, and finally engine brake trigger valves.

Exhaust/Intake Valve Clearance Adjustment

1. Adjustments must be made with the engine stopped and cold with established water temperature of 140° F. (60° C.) or below.
2. Adjust the valve clearances to Caterpillar specifications. Refer to the sequence in Chart 1. After the exhaust valve clearance is set, the slave piston clearance can be set following the sequence in the same chart.

Valve and Slave Piston Adjustment Sequence

Engine Position	Set Intake Valve Cylinder	Set Exhaust Valve Cylinder	Slave Piston Cylinder
Cylinder 1 TDC	1, 2, 4	1, 3, 5	1, 3, 5
Cylinder 6 TDC	3, 5, 6	2, 4, 6	2, 4, 6

CHART 1

- Set intake valve clearance to 0.015" (0.38 mm). Hold the adjusting screw and tighten the locknuts to 22 lb.-ft. (30 N•m).
- Set the exhaust valve clearance to 0.030" (0.76 mm). Use a 1/2" open-end torque wrench for turning the rocker adjusting screw. Hold the adjusting screw and tighten the locknut to 22 lb.-ft. (30 N•m).

Slave Piston Adjustment

- Exhaust valves on the cylinder to be adjusted must be closed.
- Insert a Jacobs 0.018" feeler gage between the slave piston feet and bridge.
- Turn the POWER-LASH® assembly in until a slight drag is felt on the feeler gage. Hold the POWER-LASH assembly in position and tighten the locknut to 25 lb.-ft. (35 N•m). Continue the slave piston adjustments following the sequence in the above chart.

Trigger Valve Adjustment

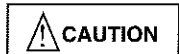
The trigger valve travel adjustment is set according to the settings shown in Chart 2:

Trigger Adjustments

Cylinder Number	Pre-91 Model Year	1991 and later 3406B/C	
	3406B	400 HP	All Others
1	0.100"	0.130"	0.100"
2, 3, 4, 5, 6	0.100"	0.095"	0.100"

CHART 2

After the valves and slave pistons are adjusted on all cylinders, the trigger valves should be adjusted using the trigger adjusting group (P/N 018196).



MAKE THIS ADJUSTMENT CAREFULLY AND ACCURATELY TO ASSURE MAXIMUM ENGINE BRAKE PERFORMANCE AND TO PREVENT POSSIBLE ENGINE DAMAGE. THE JACOBS TRIGGER ADJUSTMENT GROUP IS REQUIRED FOR THIS ADJUSTMENT.

- Remove the cap and spring from the trigger valve on the cylinder to be adjusted. Do not remove trigger valve. The first trigger adjustment should be made on the cylinder last adjusted for the slave piston lash.
- Install the dial indicator assembly into the trigger valve bore. Hand tighten, metal to metal contact only. The indicator extension will contact the trigger valve and push the master piston down slightly.

NOTE:

THE MASTER PISTON MUST NOT COME IN CONTACT WITH THE EXHAUST ROCKER ADJUSTING SCREW AT THIS TIME.

- Set the indicator to zero.
- Rotate the engine crankshaft slowly in the direction of rotation. The exhaust rocker adjusting screw will contact the master piston and the dial indicator needle will begin to move. Record the maximum travel of the indicator.

NOTE:

TRAVEL MUST BE SET ACCORDING TO THE TRIGGER ADJUSTMENT CHART ABOVE.

- Use the following procedure to adjust the trigger travel. The indicator travel must be within ± 0.003 " of the specific trigger adjustment as shown in the chart.

If necessary to further adjust trigger travel:

- Remove the dial indicator/adaptor assembly and insert a long, 5/32" hex key wrench through the trigger valve bore and into the master piston assembly.
- Insert the Jacobs master piston holding wedge (P/N 018279) between the master piston and exhaust rocker adjusting screw. Push the wedge in until the master piston bottoms in its bore. This will prevent the master piston from turning while the trigger adjustment is being made.
- Push down on the hex key wrench. This unlocks the adjusting screw from the hex pin.

- D. Refer to the original recorded travel found in Step 4 (above) and adjust by pressing the hex key wrench against spring pressure. Maintain pressure while turning clockwise (to decrease travel) or counterclockwise (to increase travel). Each hex (60°) equals approximately 0.005" of trigger travel.
- E. Remove the hex key wrench. The adjusting screw must be locked.

NOTE:

SPRING PRESSURE ON THE HEX PIN SHOULD LOCK THE ADJUSTING SCREW IN POSITION WHEN PRESSURE ON THE HEX KEY WRENCH IS REMOVED. IF ADJUSTING SCREW IS NOT LOCKED (SCREW CAN TURN), ROTATE THE SCREW SLIGHTLY UNTIL THE HEX PIN SNAPS INTO THE ADJUSTING SCREW. THE SCREW IS NOW LOCKED IN POSITION.

Reinstall the dial indicator assembly. Recheck the travel by rotating the engine crankshaft back and forth. Repeat the setting procedure if necessary.

- F. Replace the trigger spring and cap. Tighten the cap to 35 lb.-ft. (47 N•m).
- G. Continue the adjustment of the remaining cylinders in the engine firing order. Recheck the torque on all six trigger caps.

Spacer Installation

1. Install the spacers on top of the valve cover bases.
2. Reuse the four Caterpillar lower base capscrews at the four stud locations and the two Jacobs serrated capscrews at the other two locations. Tighten all capscrews to 10 lb.-ft. (14 N•m).

3. Replace the terminal leadouts in the spacers.
4. Connect the new solenoid harnesses to the solenoid valves and the terminal leadouts.

The Jacobs engine brake housing installation is now complete. Recheck the housing installation to be certain no foreign objects have been left behind and all correct clearance requirements have been met.

Bleed/Operation Check



WEAR EYE PROTECTION AND DO NOT EXPOSE YOUR FACE OVER THE ENGINE AREA. WHENEVER THE ENGINE IS RUNNING AND THE VALVE COVERS ARE REMOVED, OIL SPLASHING IN THE ENGINE COULD CAUSE PERSONAL INJURY. TAKE PRECAUTIONS TO PREVENT OIL LEAKAGE DOWN ONTO THE ENGINE.

1. Start the engine and allow it to run 5 to 10 minutes.
2. With the engine at low idle, manually depress the solenoid disc several times in succession until the master pistons move out of the housing and the engine brake begins to operate. Normal oil evacuating from the control valve covers should be free of air bubbles before replacing the valve covers. This permits oil to fill the brake housing passages and readies the brake for operation.
3. Inspect the installation for oil/fuel leakage or component interference. If either is found, the problem must be corrected at this time.