SERVICE MANUAL

LOADER BACKHOE

580C

9-66018

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

LOADER BACKHOE

580C

9-66018

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

SERVICE MANUAL

LOADER BACKHOE

580C

9-66018

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TYPE 1-4

SERVICE MANUAL

LOADER BACKHOE

580C

9-66018

1. Trim along dashed line.
2. Slide into pocket on Binder Spine.

TYPE 1-4

Piston Rings (Cont'd.)

	U.S. Value	Metric Value
No. 3 Oil Control Ring	Two Piece	
End gap in 4.000 I.D. (101.600mm I.D.) sleeve	.013 to .023"	.330 to .584mm
Maximum Serviceable Limit	.033"	.838mm
Side clearance	.0020 to .0035"	.051 to .089mm
Maximum Serviceable Limit	.005"	.127mm

Piston Pin

Type	Full Floating	
O.D. of pin	1.2495 to 1.2498"	31.737 to 31.745mm
Fit in piston	.0002 to .0010"	.005 to .025mm
Fit in rod bushing	.0004 to .0015"	.010 to .038mm

Connecting Rod

Bushing	Replaceable Bronze	
Bushing I.D. installed (ream to size)	1.2502 to 1.2504"	31.755 to 31.760mm
Maximum Serviceable Limit	1.2510"	31.775mm
Bearing liners	Replaceable	
Journal I.D. without bearing liners	2.4002 to 2.4007"	60.965 to 60.978mm
Bearing oil clearance	.0010 to .0040"	.025 to .102mm
Undersize bearings for service	.002,.010,.020,.030"	.051,.254,.508,.762mm
Side clearance	.005 to .011"	.127 to .279mm

Crankshaft

Type	Hardened Steel Balanced	
Main bearing liners	Replaceable	
End play, center main bearing cap	.001 to .015"	.025 to .381mm
Center main bearing thrust surface thickness	.1025 to .1045"	2.603 to 2.654mm
Connecting rod journal std. O.D.	2.2480 to 2.2490"	57.099 to 57.125mm
.002" (.051mm) O.D. undersize, grind to	2.2460 to 2.2470"	57.048 to 57.074mm
.010" (.254mm) O.D. undersize, grind to	2.2380 to 2.2390"	56.845 to 56.871mm
.020" (.508mm) O.D. undersize, grind to	2.2280 to 2.2290"	56.591 to 56.617mm
.030" (.762mm) O.D. undersize, grind to	2.2180 to 2.2190"	56.337 to 56.363mm
Connecting rod journal maximum taper	.001"	.025mm
Journals out-of-round	.0005"	.013mm
Undersize main bearing liners for service	.002,.010,.020,.030"	.051,.254,.508,.762mm
Main bearing oil clearance	.0012 to .0042"	.031 to .107mm

INTERVAL	SERVICE	INSTRUCTIONS
Every 100 hours of operation	Change engine oil.	
	Grease rear axle bearings.	
	Grease seat post.	
	Grease brake pedals and shaft bearings on power shuttle machines.	
	Grease brake pedals and clutch shaft on mechanical shuttle machines.	
	Check tire condition and pressure.	Section 6229
	Check battery fluid level.	Section 8005
	Check transaxle oil level.	
	Check mechanical shuttle oil level.	
	Check power steering oil level.	
	Clean spark arresting muffler if so equipped.	Section 2051
Every 200 hours of operation	Change engine oil filter.	Section 2555
	Check fan belt tension.	Section 8007
Every 500 hours of operation	Grease universal joints.	
	Lubricate hydraulic pump shaft.	Section 4005
	Replace fuel filters.	Section 3010
	Check brake master cylinder fluid level.	
	Repack front wheel bearings.	Section 5021
	Inspect Roll-Over Protection Structure.	Section 9061
	Change hydraulic oil filter.	Section 4002
	Clean hydraulic reservoir breather.	Section 4002
Every 1000 hours of operation or once a year, whichever occurs first	Change hydraulic oil.	Section 4002
	Change power shuttle oil, if so equipped.	Section 6202
	Replace power steering oil filter.	Section 5005
	Change mechanical shuttle oil, if so equipped.	
	Change transaxle oil.	
	Clean transaxle breather.	

GENERAL INFORMATION

Before making any repairs or adjustments on an engine, a mechanic or technician must properly diagnose the trouble.

Locating the trouble and repairing it is only part of the job, a technician must find and eliminate the cause of the trouble as well. Too many repairs are made with no thought to removing the causes that made the repair necessary.

For any engine to start or perform properly, three main requirements must be present:

1. FUEL
2. COMPRESSION
3. COMBUSTION

When any of these requirements are not present or limited by some mechanical reason, the engine will not start and will fail to operate properly throughout the power range.

FUEL. Fuel system problems can be present anywhere from the fuel tank, through the filters and injection pump as well as the injectors. Correct injection pump timing is important in the overall fuel system performance.

COMPRESSION. Compression on an engine is related to the "breathing function". Proper compression is affected by the air cleaner condition, muffler restriction, valve condition and operation including proper valve adjustment, cylinder head gaskets, condition of sleeves, rings, pistons, camshaft, and camshaft timing.

COMBUSTION. Combustion is the result of adequate compression to develop enough heat in the air charge on the compression stroke to fire the fuel being injected into the engine cylinders. Proper spray pattern and atomization of the fuel by the injector is very important. Timing the fuel injection pump to the engine to a precise degree BTDC is a vital requirement for proper combustion.

The engine diagnosis contained in the following pages covers many trouble symptoms, the causes, and what will be necessary to repair or eliminate the problem. Under each symptom are listed the most common and reoccuring problems progessing to the not so common problems. Locate your problem symptom in the diagnosis chart and refer to the pages listed for the probable causes and remedies.

ENGINE KNOCKS

Low and High RPM (Cont'd)

8. Bent Connecting Rod

A bent connecting rod will cause piston slap from scoring due to misalignment. The engine will run rough because of incomplete combustion and emit white exhaust smoke from the bad cylinder. Remove engine oil pan and inspect connecting rods for alignment. A comparison of piston heights at Top Dead Center with cylinder heads removed may quickly indicate a bent rod condition. A difference of .020 inch in connecting rod can cause a noticeable miss at low RPM and cold engine conditions.

9. Valve Spring Weak

Weak valve springs will allow the valves to float at high speed. Broken valve springs will not close valve completely and valve could hit the piston doing internal engine damage. Always check and test valve springs when doing a valve job. Damping coils on spring should be assembled against the cylinder head.

10. Piston Pin or Bushing Worn

Piston pin or bushing knock will increase with speed. When grounding out the cylinder (cracking injector line) the knock will be twice as bad. Due to combustion, every other revolution will keep the piston pin and bushing tight giving no knock. Remove and inspect piston assembly producing the knock.

11. Camshaft Bearing Worn

A camshaft bearing knock is not a very sharp sounding knock. The knock will be only at one-half of crankshaft speed and will not become worse at different engine speeds. Low oil pressure could result from worn bearings and excessive oil clearance from lack of replacing cam bearing at engine overhaul.

12. Crankshaft End Play Excessive

Excessive crankshaft end play will be indicated by one thudding sound when increasing RPM and one thud when decreasing RPM. Due to the angle of the teeth on crank gear and cam gear, as speed changes it pushes the crankshaft back and forth. Check crankshaft end play with a dial indicator.

13. Foreign Material In Cylinders

Foreign material such as pieces of broken valve, bolts, nuts, washers, or pieces of castings, in the cylinder will cause a noise everytime the piston comes to Top Dead Center. The noise will not change by shorting out the cylinder. Due to the metal-to-metal contact, the vibration can be felt on the side of the engine. Remove cylinder heads and inspect.

14. Cylinder Ridge Not Removed

When performing an engine overhaul and installing new rings, the cylinder ridge must be removed. If the ridge was not removed, it would cause the engine to knock on all cylinders as the top piston ring hits the ridge on every stroke. If the top ring continued to hit the ridge, it would cause ring land breakage between top and second ring, causing piston and sleeve scuffing and scoring. Remove heads and check for cylinder ridge.

15. Improper Use of Ether (Low RPM)

Spraying either into the engine air intake without cranking the engine, will cause one or more cylinders to receive a large amount of ether due to open valves. Then, when the engine is cranked, volatile, uncontrolled explosions will occur in these cylinders breaking ring lands and damaging the piston. Be sure engine is cranking before using ether. Remove cylinder heads and inspect pistons for damage.

16. Camshaft End Play Excessive

Excessive camshaft end play will be indicated by one thudding sound when increasing engine speed and one thud when decreasing speed, but will not be as pronounced as crankshaft end play. Due to the angle of the teeth on crank gear and cam gear, as engine speed changes, it pushes and pulls the camshaft back and forth. Excessive camshaft end play can be caused by worn thrust washer, loose cam gear, or broken or missing camshaft thrust spring. Remove front timing cover and check camshaft end play with a dial indicator.

LOW ENGINE OIL PRESSURE

Internal Problems (Cont'd)

11. Internal Oil Passage Leak

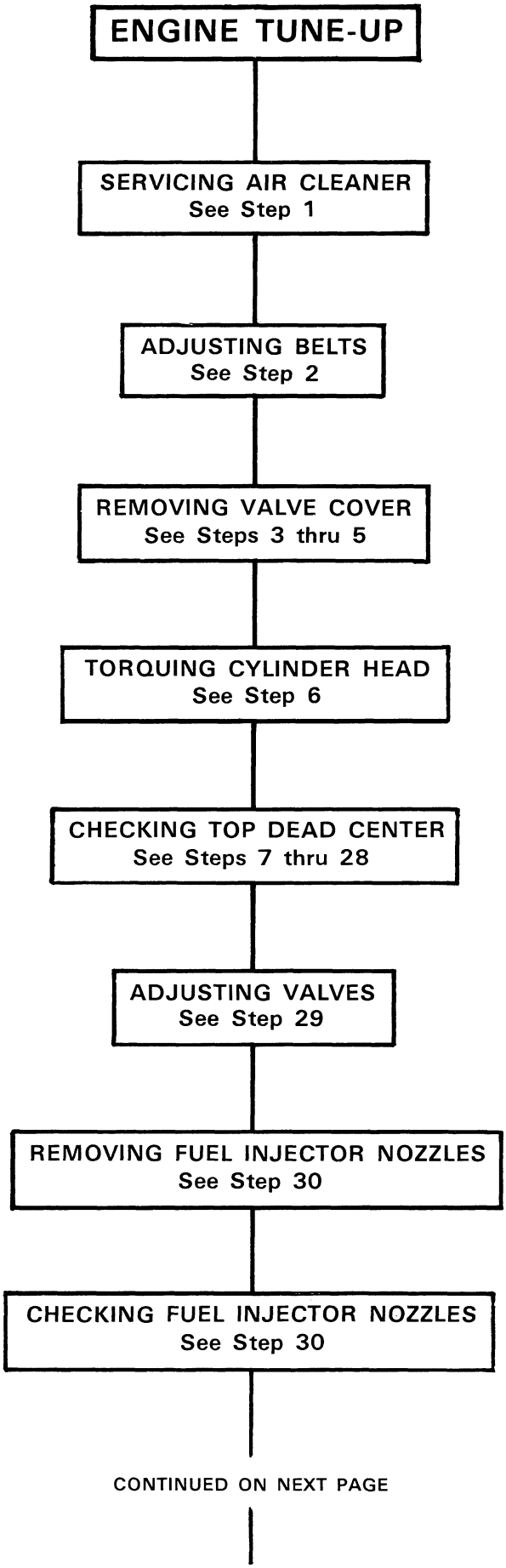
A crack, missing plug, or bad "O" ring could cause an internal oil gallery leak resulting in low oil pressure readings. Another possible leak is the "O" ring that seals between the engine oil pump and oil gallery. If such leakage is suspected, attach air pressure to the oil gallery and watch for leaks with oil pan removed.

12. Key In Oil Pump Gear Worn

The key in the oil pump drive gear could become worn and shear. Remove oil pan and oil pump, disassemble oil pump and inspect.

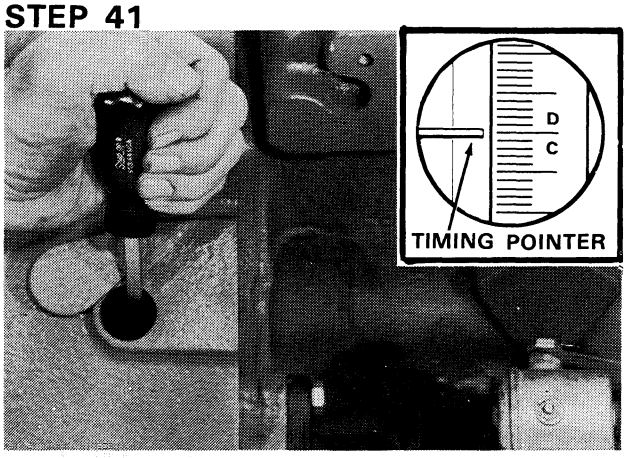
13. Camshaft Bearing Worn

A camshaft bearing knock is not a very sharp sounding knock. The knock will be only at one-half of crankshaft speed and will not become worse at different engine speeds. Low oil pressure could result from worn bearings and excessive oil clearance from lack of replacing cam bearing at engine overhaul.



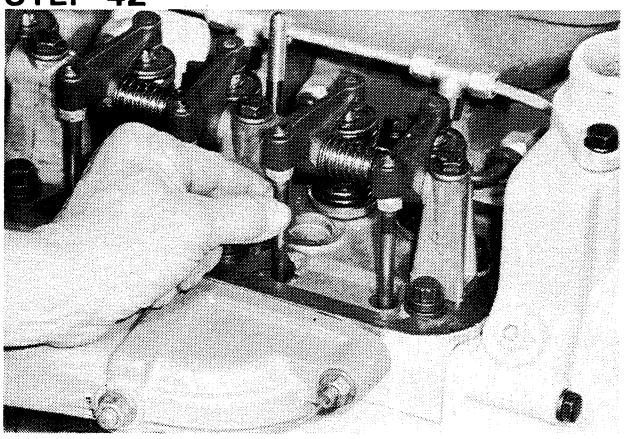
CONTINUED ON NEXT PAGE

STEP 41



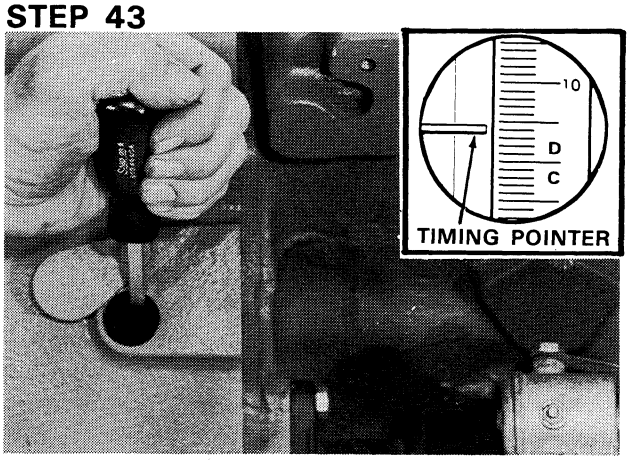
Crank engine clockwise until TDC mark on flywheel is in line with timing pointer as seen through the flywheel housing timing hole.

STEP 42



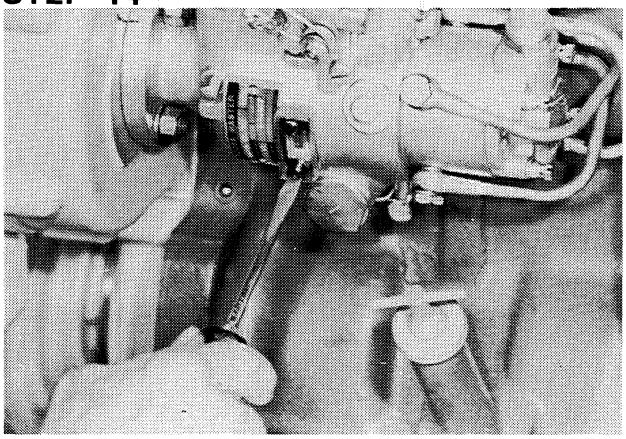
Both push rods of No. 1 cylinder should be loose when No. 1 cylinder is on TDC of compression stroke. If both push rods are tight, crank engine 360^0 and again check push rods.

STEP 43



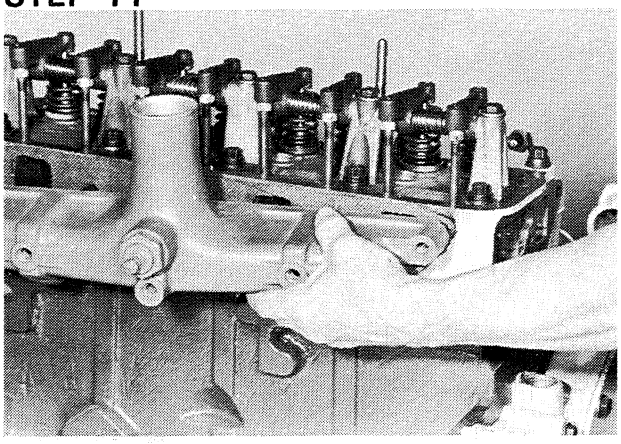
Crank engine counter-clockwise (as viewed from the flywheel end) past the specified pump timing; then crank engine clockwise until the timing pointer is in line with the specified pump timing mark on the flywheel. This procedure will remove the slack from the valve train and will insure correct pump timing. *NOTE:* Refer to engine data decal on engine valve cover or Operator's Manual for specified fuel pump timing.

STEP 44



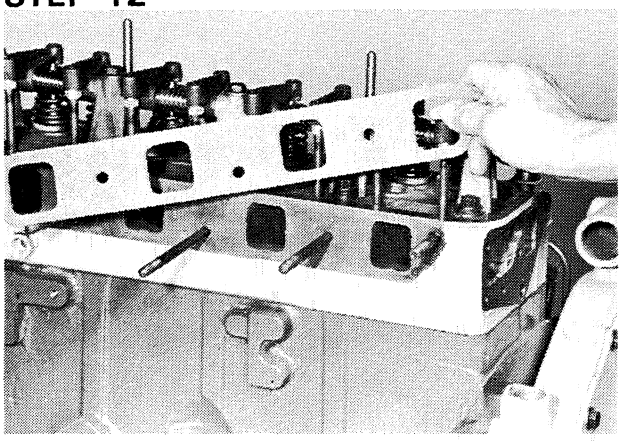
Remove the timing window cover from injection pump.

STEP 11



Remove intake manifold.

STEP 12

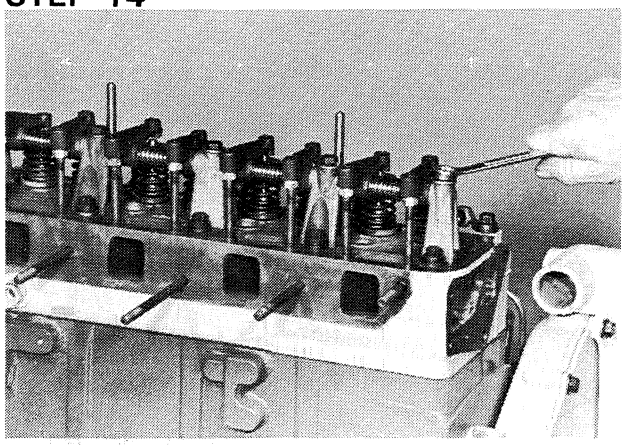


Remove intake manifold gasket.

STEP 13

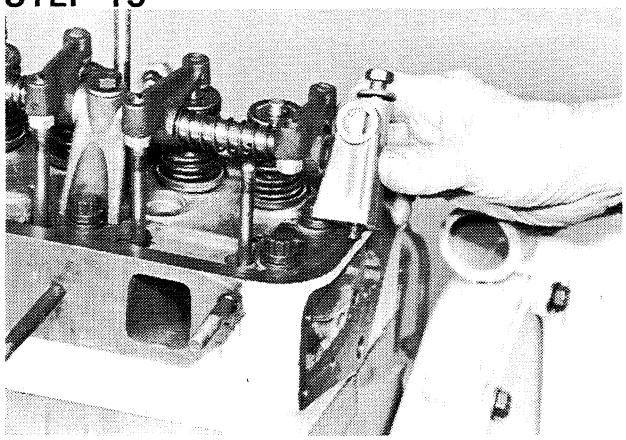
Cylinder head ready for rocker arm disassembly.

STEP 14



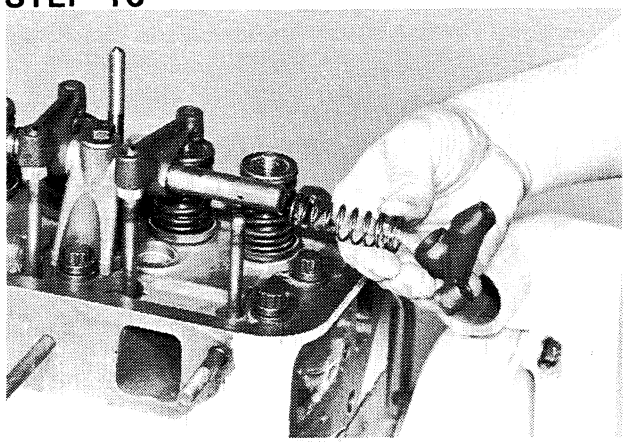
Loosen front and rear rocker arm assembly bracket bolts.

STEP 15



Remove brackets and bolts.

STEP 16



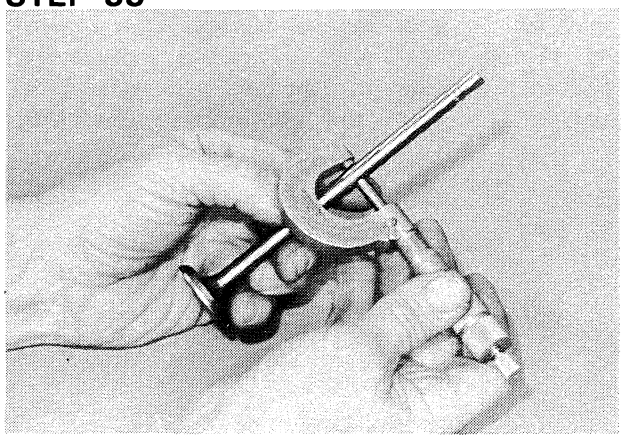
Rocker arm and spring will fall off each end due to spring pressure.

STEP 54 (CONT)

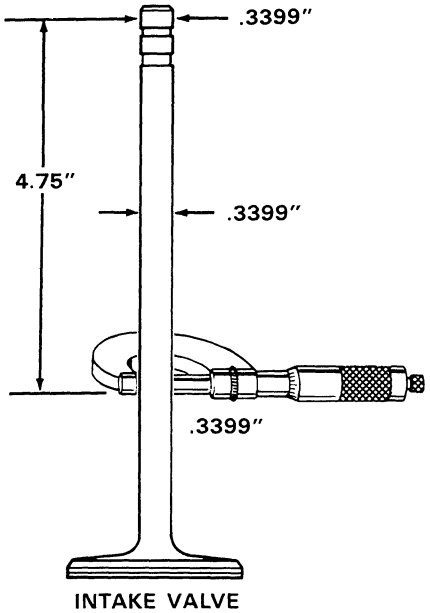
WORN RETAINER GROOVE WORN STEM TIP

NOTE: IF EITHER OF THESE CONDITIONS EXIST, REPLACE THE VALVES.

STEP 55

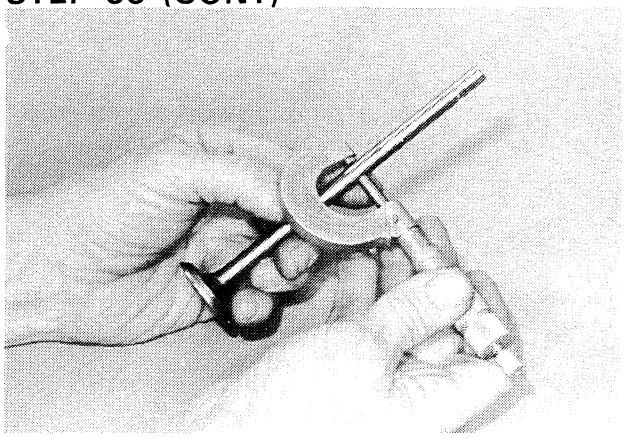


Check intake valve stem diameter at three points along the stem. If stem diameter is less than .3399", the valve must be replaced.

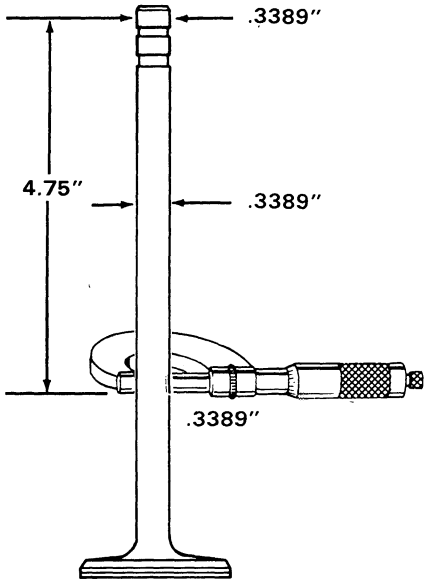


INTAKE VALVE

STEP 55 (CONT)



Check exhaust valve stem diameter at three points along the stem. If stem diameter is less than .3389", the valve must be replaced.



EXHAUST VALVE

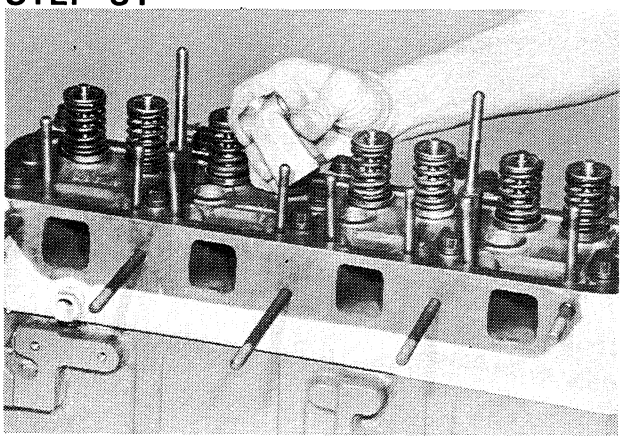
Rocker Arm Assembly

STEP 80

Flush the rocker arm shafts to remove any residual material. Inspect shafts for worn spots on the bottom side of shaft. Replace the shafts if a worn condition exists. Coat all parts with HDM #30 oil.

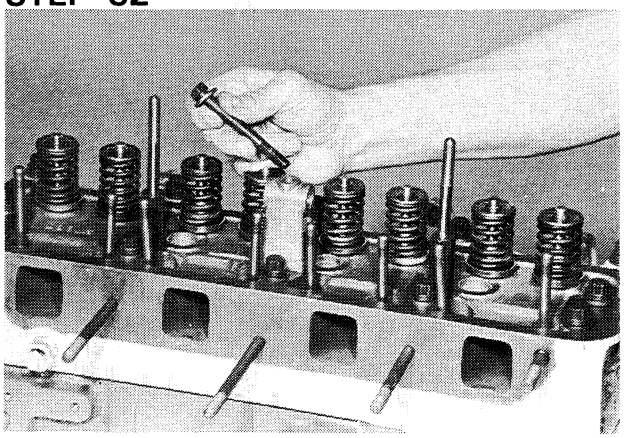
IMPORTANT: Before installing the rocker arm assembly on the cylinder head, the location of the special drilled bolt must be determined for rocker arm lubrication. Prior to engine serial number 2072089, the drilled bolt must be located in the center rocker arm mounting bracket. After engine serial number 2072089, the drilled bolt must be located in the rear rocker arm mounting bracket.

STEP 81



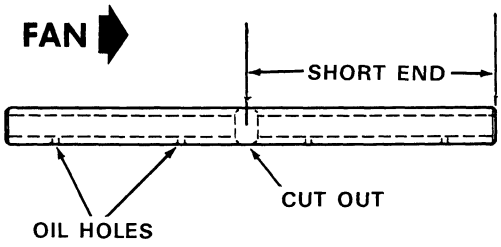
Install center rocker arm bracket on cylinder head.

STEP 82



Install bolt and washer (drilled or undrilled, see Step 80) into the center bracket.

STEP 83

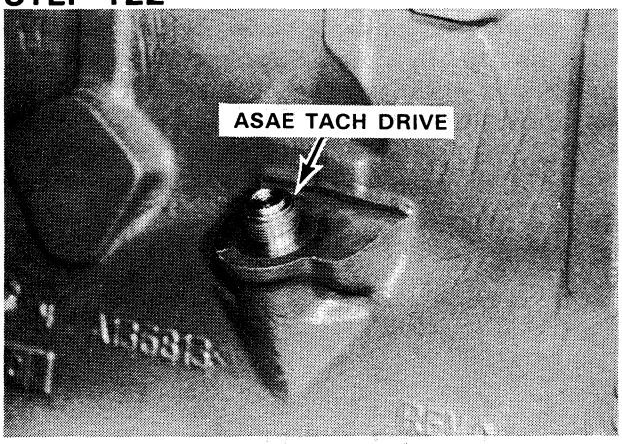


Install the front rocker arm shaft into the intermediate bracket. *NOTE:* The front shaft is installed with the short end of the shaft (from the cut-out) towards the front of the engine. The rear shaft is installed with the short end of the shaft (from the cut-out) towards the rear of the engine. On shafts with oil holes drilled only on one side, point the oil holes downward and on shafts with oil holes drilled on both sides, align the holes in a horizontal plane.

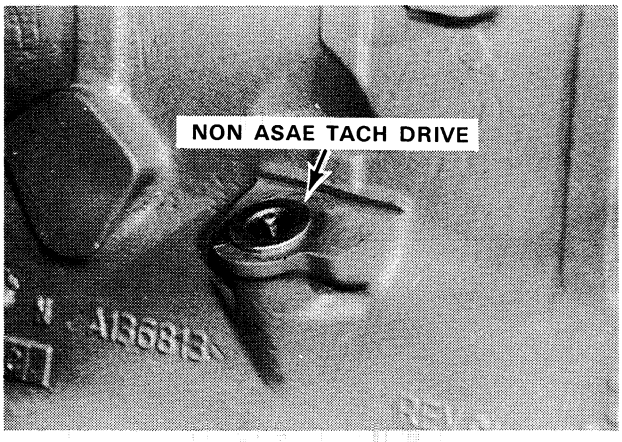
Camshaft, Valve Train and Backlash

REMOVAL

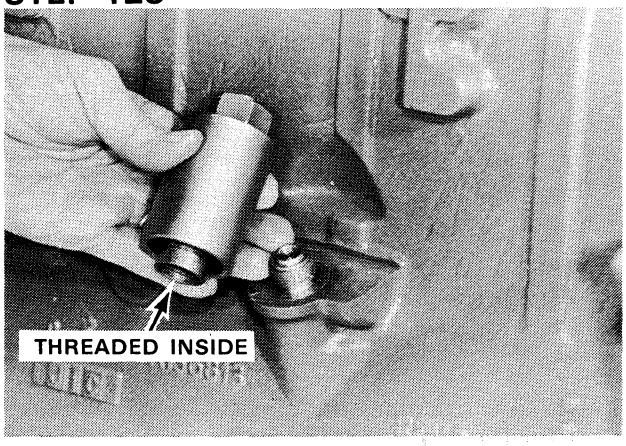
STEP 122



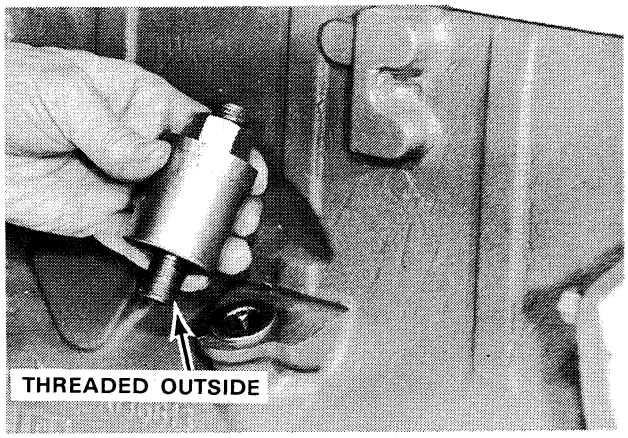
Before the camshaft can be removed from the engine, the tachometer drive must be removed.



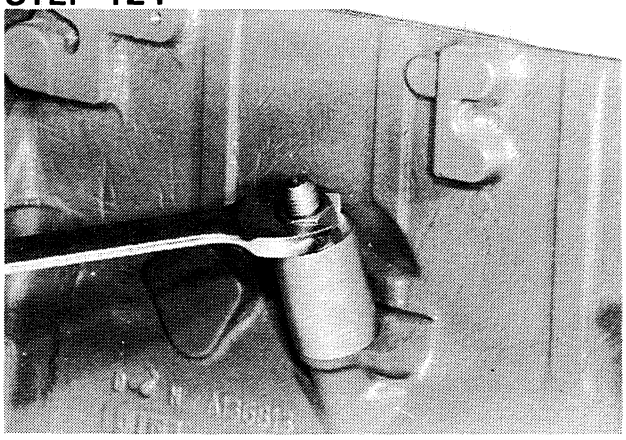
STEP 123



To remove the tachometer drive, a special tool must be made. Refer to specifications for making special tools, found on page 5.

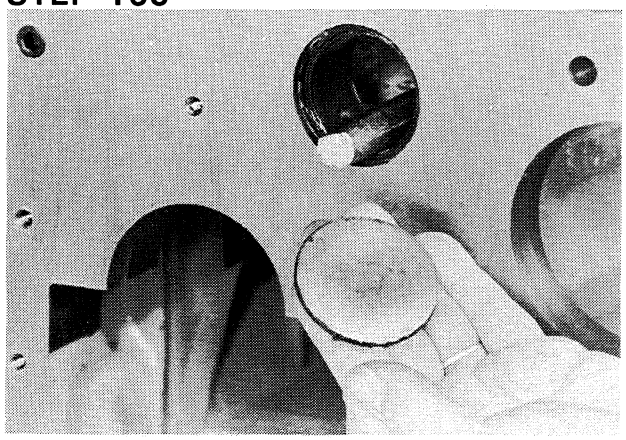


STEP 124



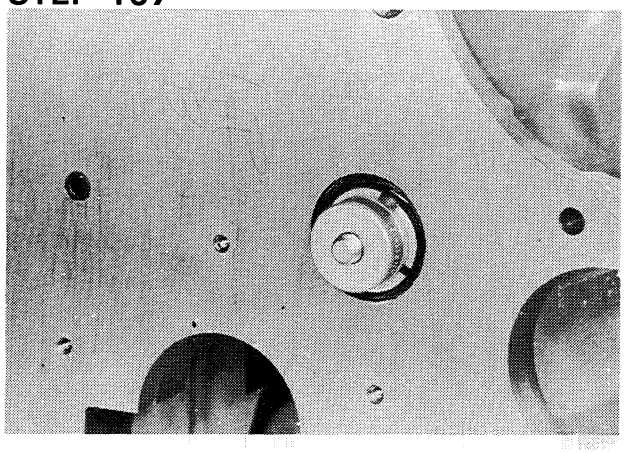
Screw the tool into or onto the tachometer drive and pull drive from engine.

STEP 166



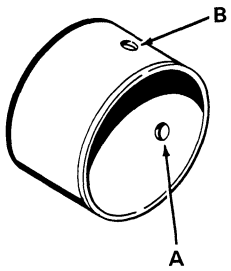
Remove cup plug from engine block by inserting a rod into the block and then tap plug out.

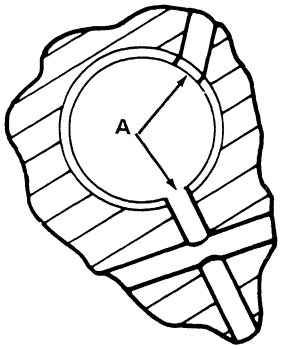
STEP 167

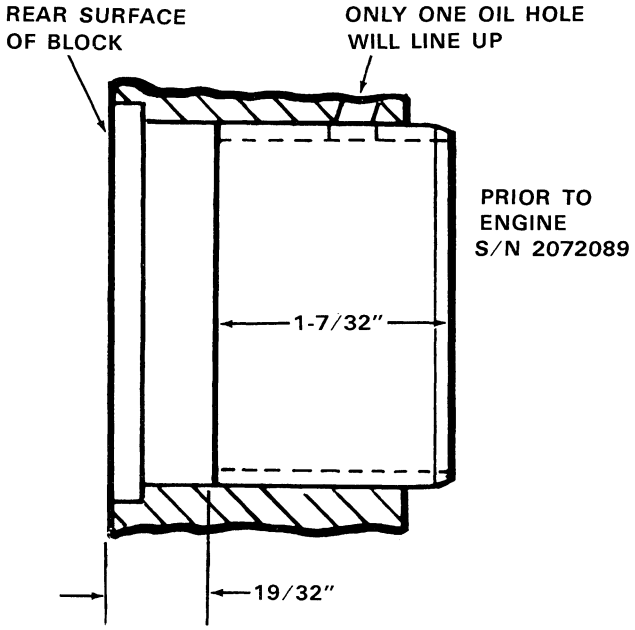


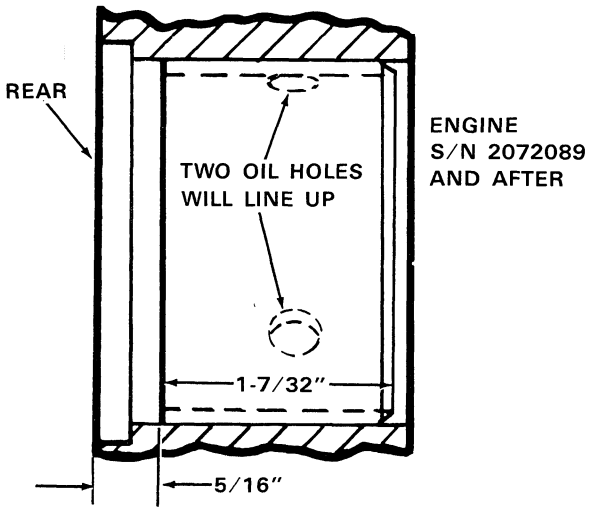
Install the rear bushing on the puller (with oil holes aligned) and pull bushing into the block. The camshaft bushing kit includes a 1-7/32" wide width rear camshaft bushing.

REAR BUSHING
WIDE WIDTH





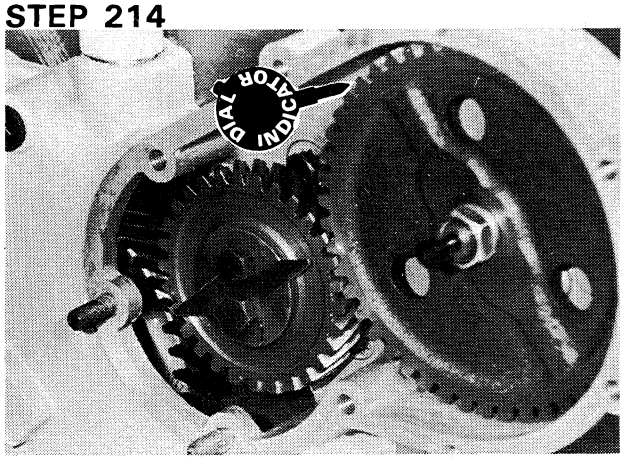




The 1-7/32 wide width rear bushing is used in place of the 15/16" wide rear bushing prior to serial number 2072089. The two oil holes are offset to one side and should face towards the front of the engine when installed. On engines prior to serial number 2072089, only one of the rear bushing oil holes must line up with the oil hole in the block when the bushing is installed to a depth of 19/32". The other rear bushing oil hole will not line up as it is not required for engine lubrication. On engines prior to serial number 2072089, the 1-7/32" wide width rear bushing will protrude inside the block approximately 1/4" when installed. THIS IS NORMAL.

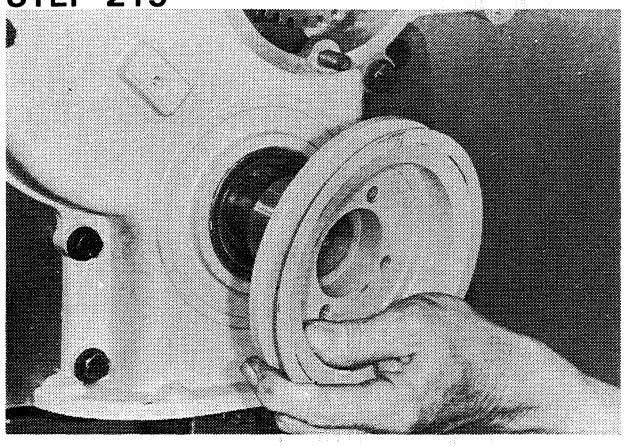
On engines, serial number 2072089 and after, the two oil holes in the rear bushing must line up with the two oil holes in the block when the bushing is installed to a depth of 5/16".

STEP 214



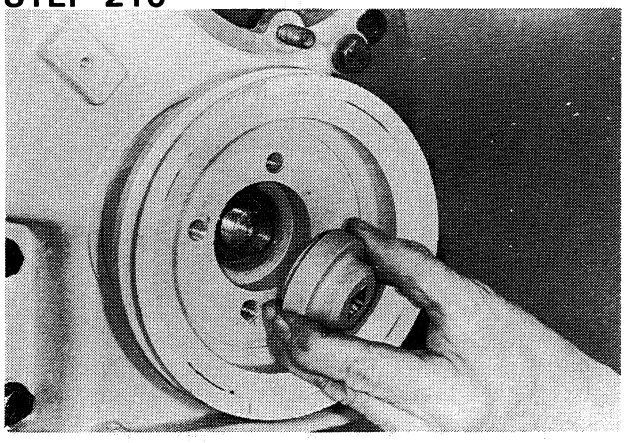
Holding idler gear with a screw driver, check injection pump drive gear back lash. Backlash must not exceed .007". If backlash exceeds .007", replace the gears.

STEP 215



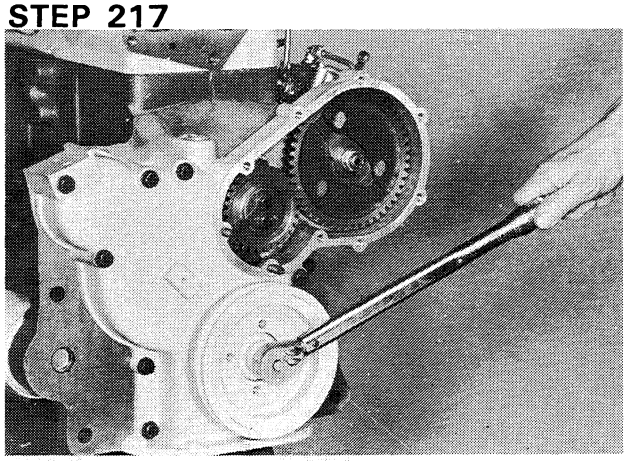
Coat seal area of front pulley with HDM#30 oil, align crankshaft key way and start pulley on crankshaft.

STEP 216



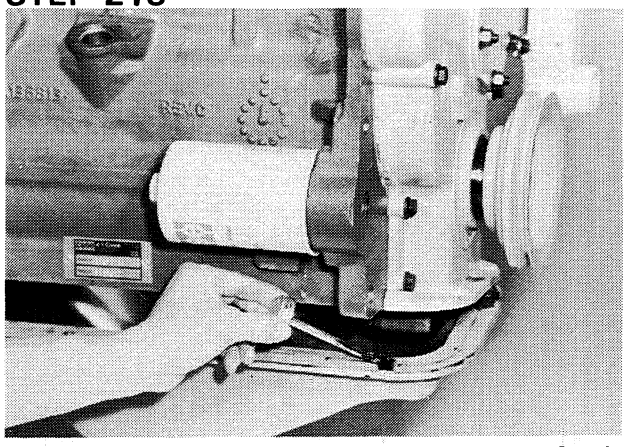
Install pulley retaining nut.

STEP 217



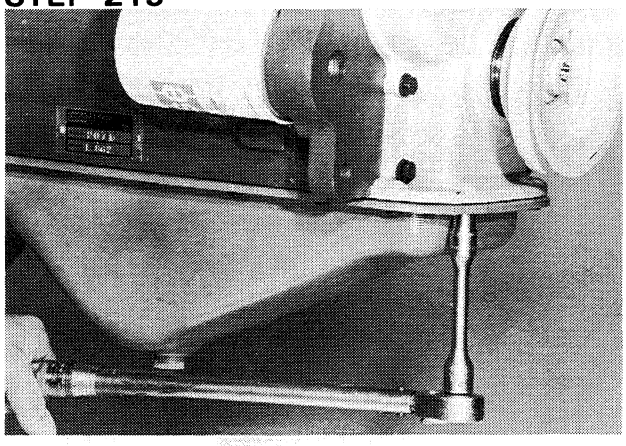
Draw pulley on crankshaft with pulley nut and final torque nut 125 to 135 ft. lbs.

STEP 218



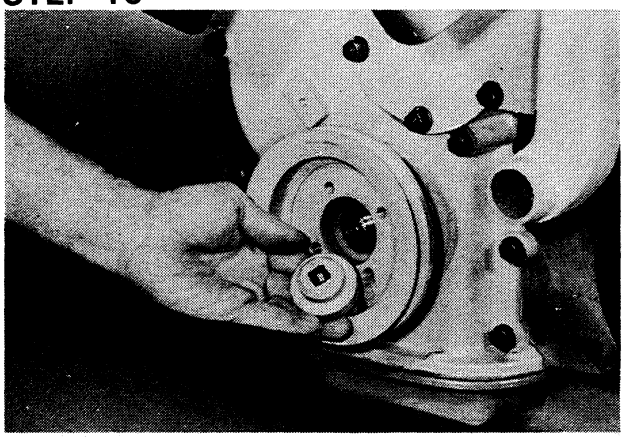
Install engine oil pan and new gasket. Apply #2 Permatex on both sides of gasket at the front and rear portions only.

STEP 219



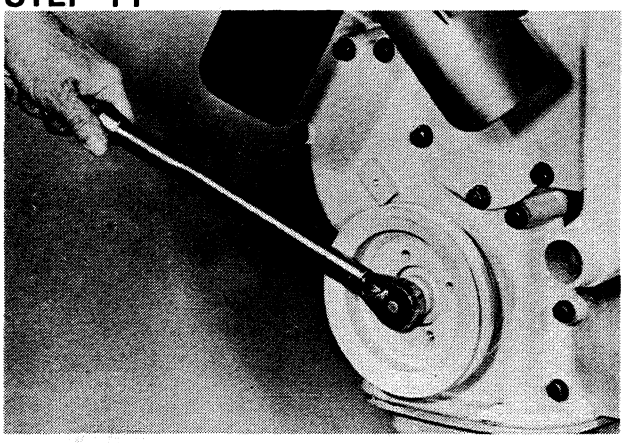
Torque retaining bolts 10 to 12 ft. lbs. on the stamped steel oil pan. On the cast iron oil pan, torque the long rear bolts 15 to 20 ft. lbs. and the remaining bolts, 24 to 28 ft. lbs.

STEP 10



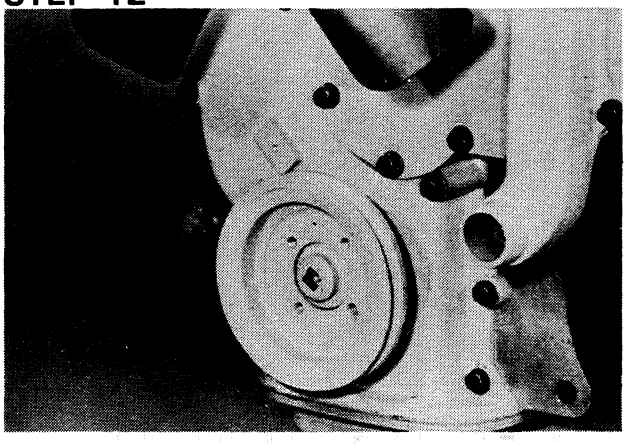
Install crankshaft pulley retaining nut.

STEP 11



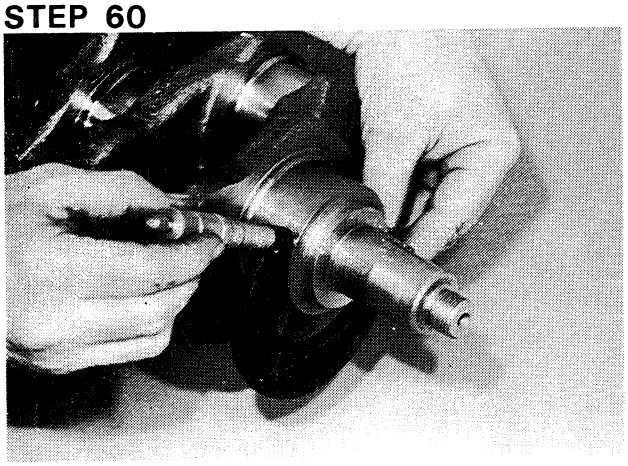
Torque crankshaft pulley retaining nut 125 to 135 ft. lbs.

STEP 12



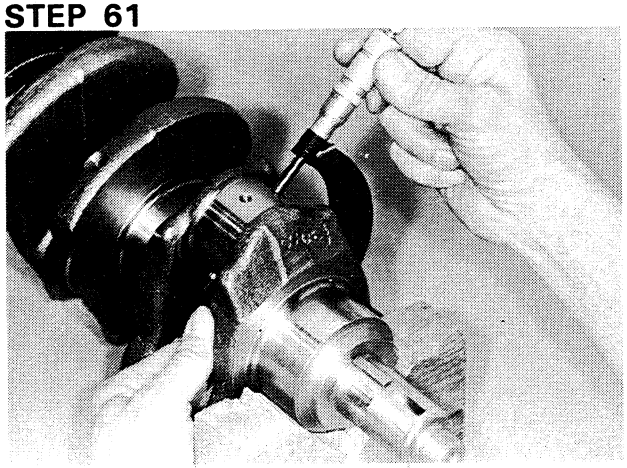
Crankshaft pulley installed on engine. Connect belt to pulley.

STEP 60



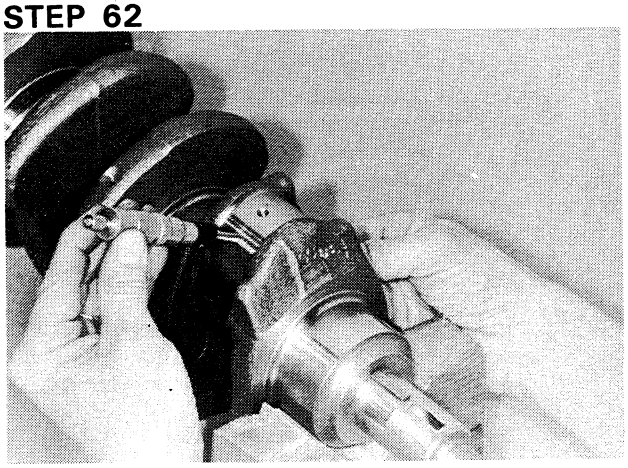
Recheck main bearing journals 90° from the first measurements for out-of-roundness. If out-of-roundness exceeds .0005", the journals must be reground and undersize liners used.

STEP 61



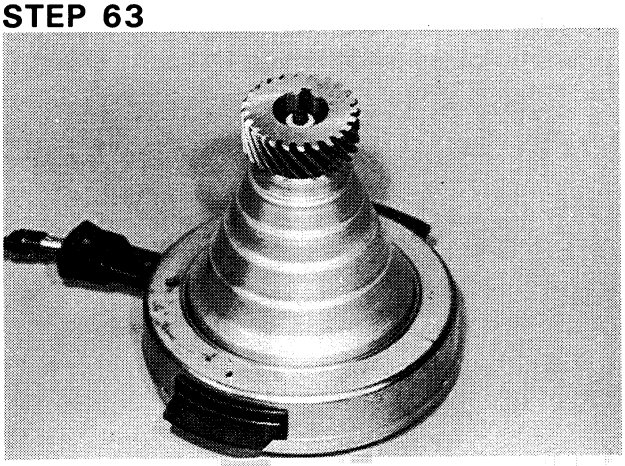
Measure the connecting rod journals. Measure front and rear of each journal, checking taper. If taper exceeds .001", the journals must be refinished.

STEP 62



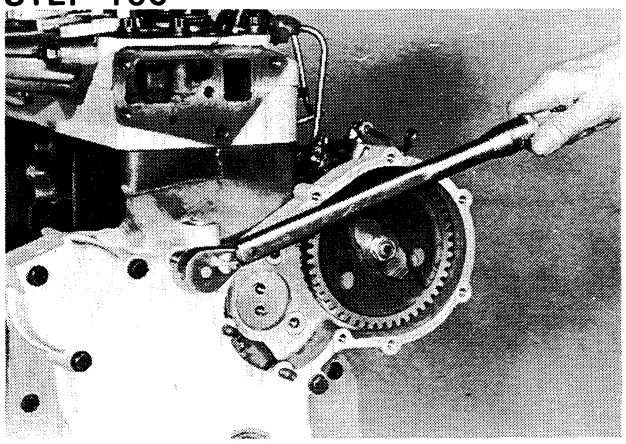
Recheck rod journals 90° from the first measurements for out-of-roundness. If out-of-roundness exceeds .0005", the journals must be refinished.

STEP 63

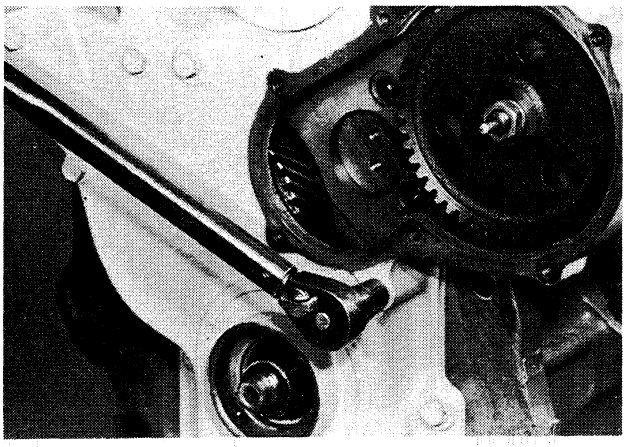


Heat crankshaft gear, using a gear and bearing heater, to facilitate assembling gear on crankshaft.

STEP 106

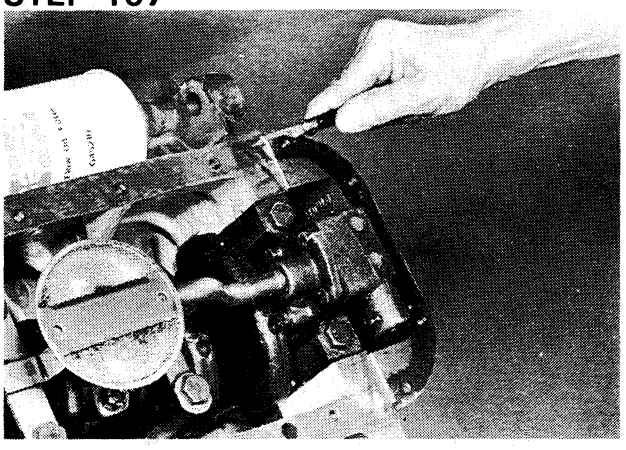


Torque aluminum timing gear cover mounting bolts, 25 to 30 ft. lbs.



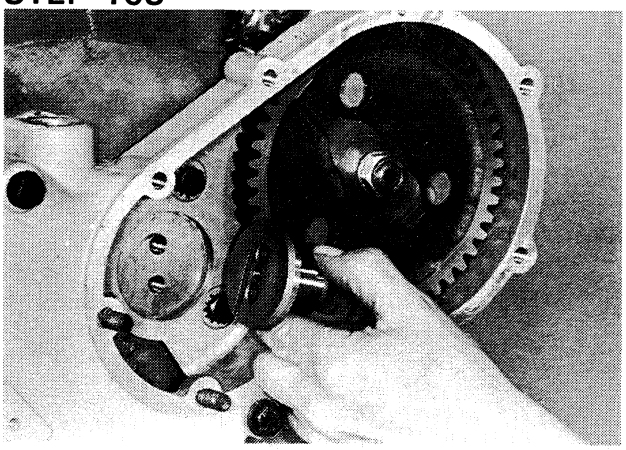
Torque cast iron timing gear cover mounting bolts, 35 to 42 ft. lbs.

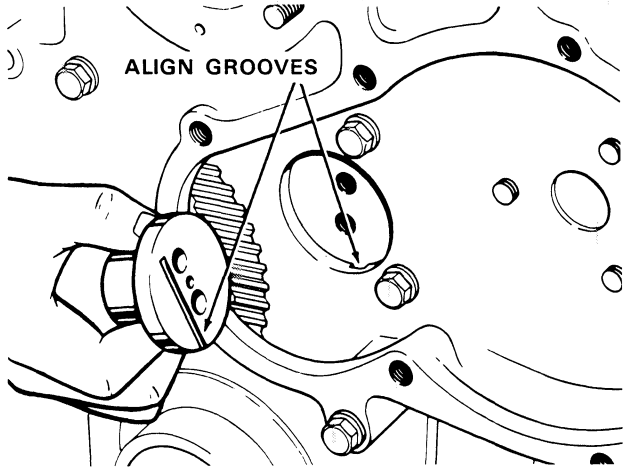
STEP 107



Cut off excess gasket material from bottom of timing gear cover gasket.

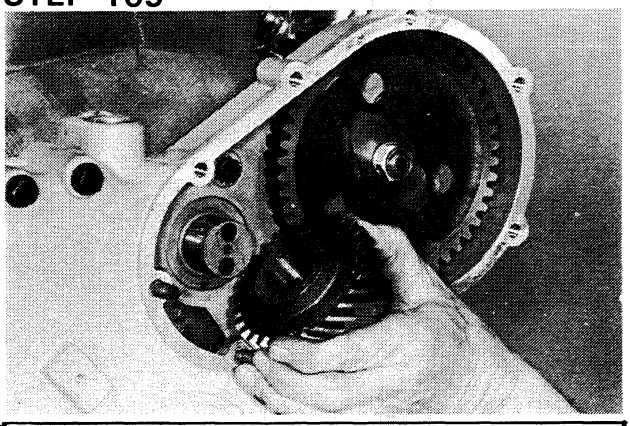
STEP 108

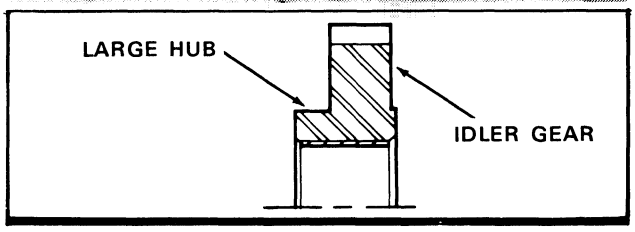




Install idler gear shaft in engine block with oil groove aligned with groove in block.

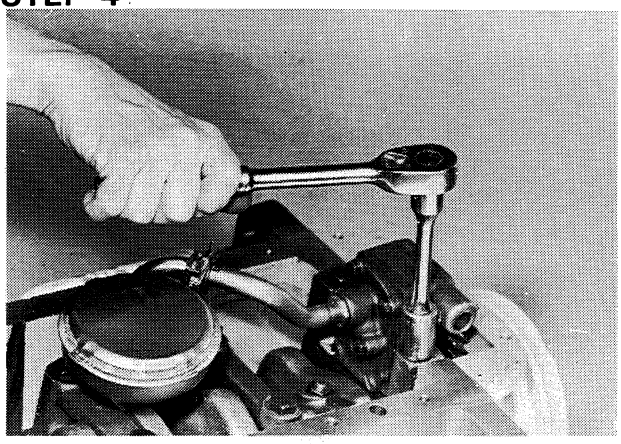
STEP 109



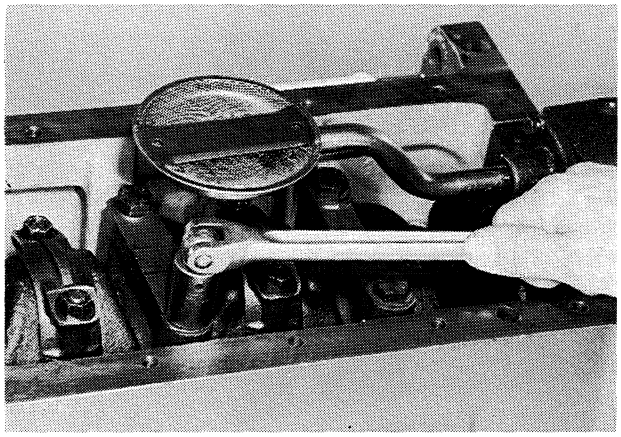


Install idler gear on shaft with large hub side toward engine block.

STEP 4

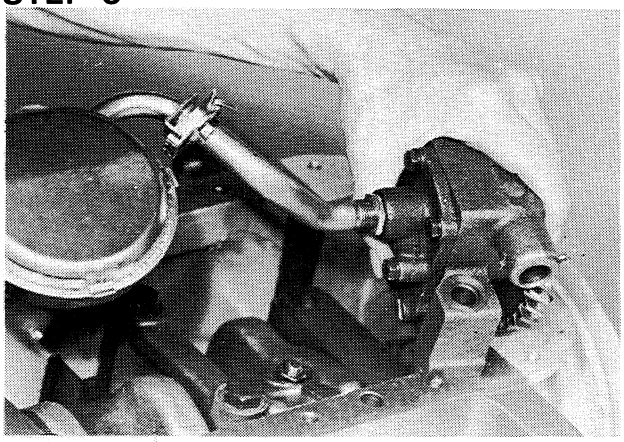


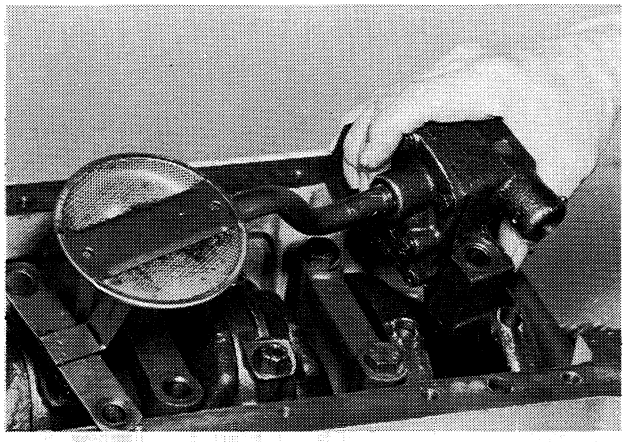
Remove oil pump mounting bolts.



If equipped, loosen oil pump suction tube bracket bolts from main bearing cap and then remove oil pump mounting bolts.

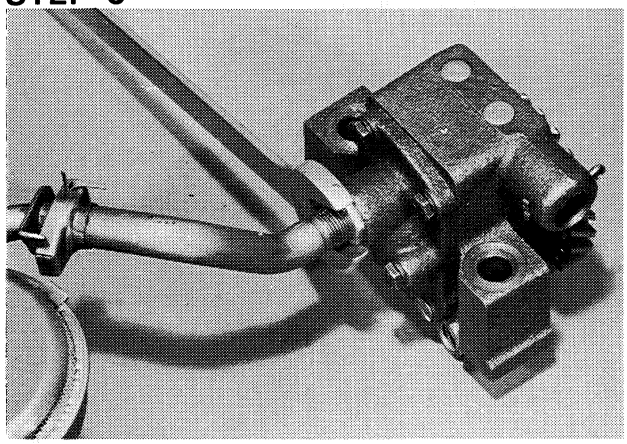
STEP 5



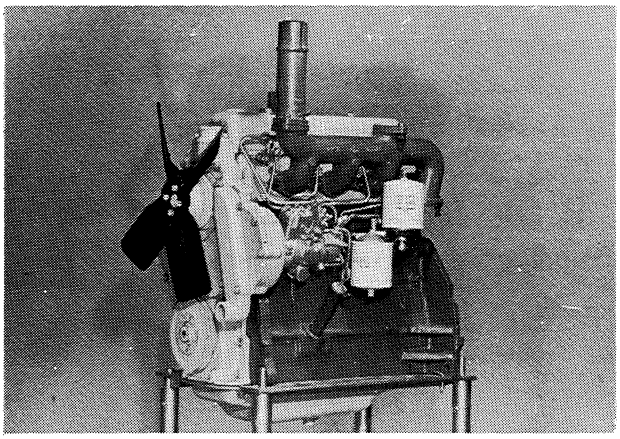


Remove oil pump from engine.

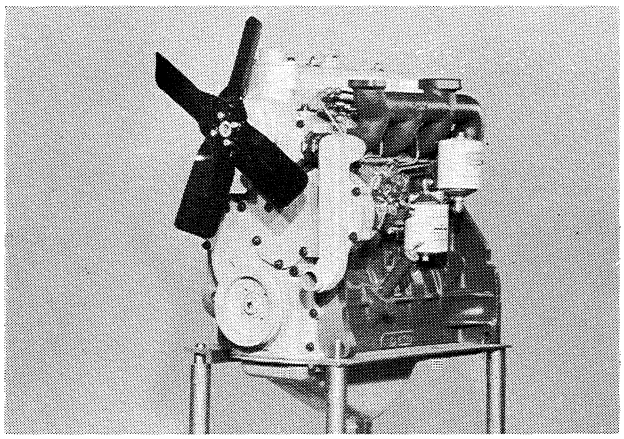
STEP 6



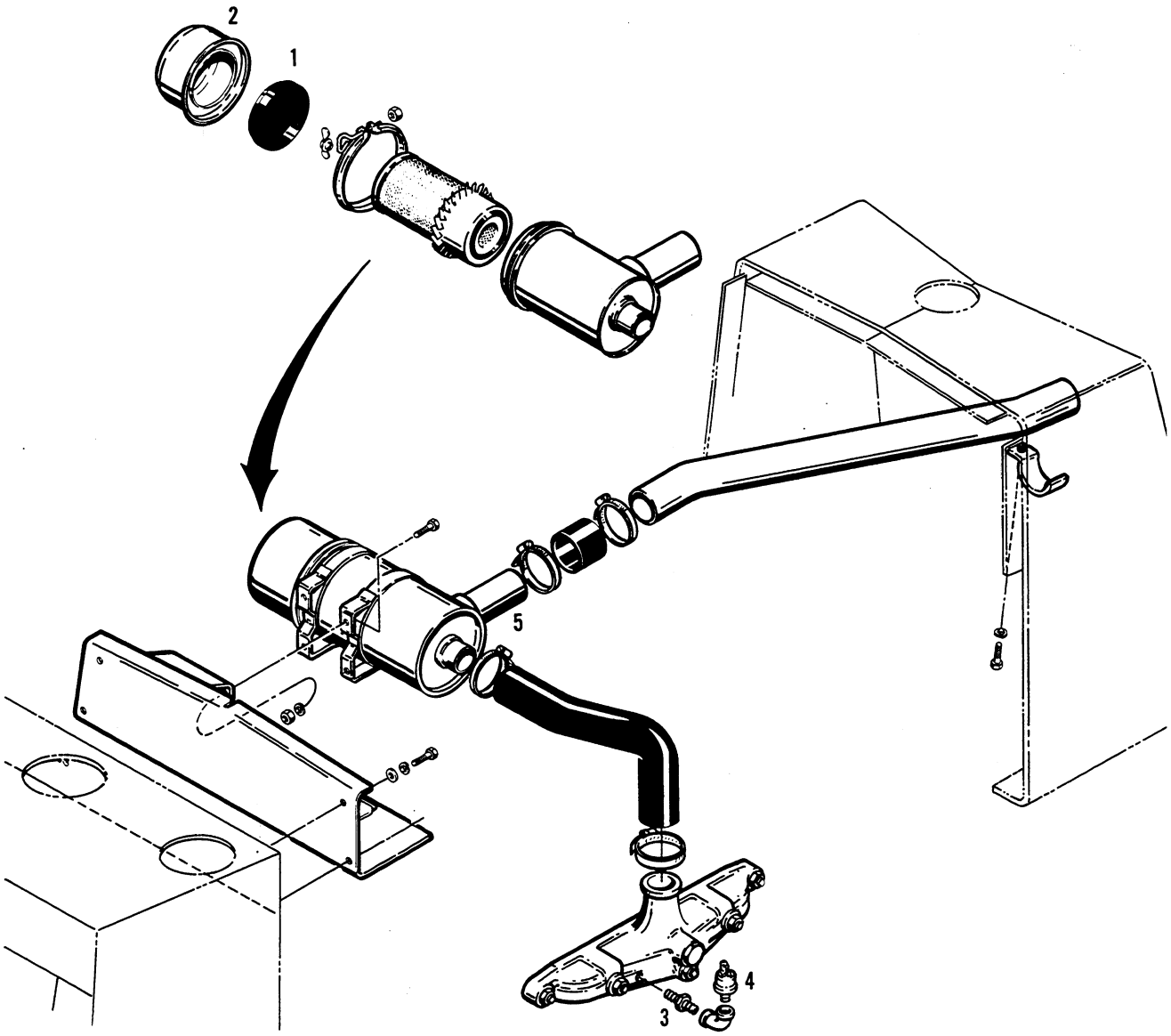
Remove suction tube from oil pump.



188 DIESEL ENGINE



207 DIESEL ENGINE



1. BAFFLE
2. DUST CUP
3. SAFETY FILTER
4. FILTER RESTRICTION LIGHT SWITCH
5. FILTER BODY INTAKE TUBE

751621

Figure 1 - Air Cleaner Installation

THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

SAFETY PRECAUTIONS

CAUTION *Add coolant to the radiator only when the engine is stopped or slowly idling. To avoid being scalded when the pressure-type filler cap is being removed, turn the cap slowly to the first stop position to relieve pressure before removing the cap.*

Relieve the system pressure by turning the radiator cap counter-clockwise to the FIRST stop. This will allow a gradual reduction in pressure and minimize coolant loss.

NEVER pour cold coolant into a hot engine. The engine block or the cylinder head may crack by the sudden contraction caused by the difference in temperature between the metal and the coolant.

CLEANING THE COOLING SYSTEM

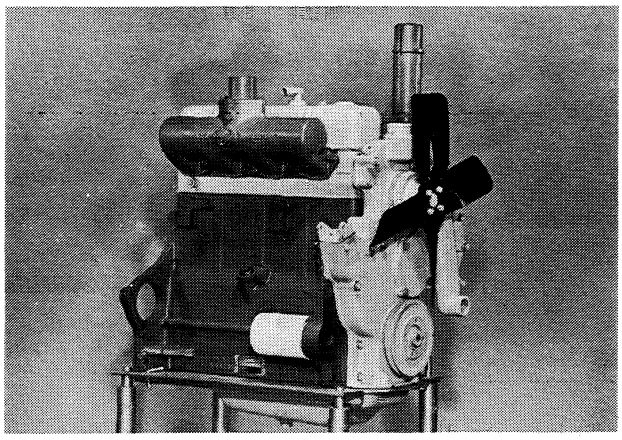
It is recommended that the cooling system be cleaned at least once a year. In areas where water containing scale forming minerals is all that is available, clean the system more often.

1. While the coolant is still hot, open the radiator drain valve and the engine block drain valve.

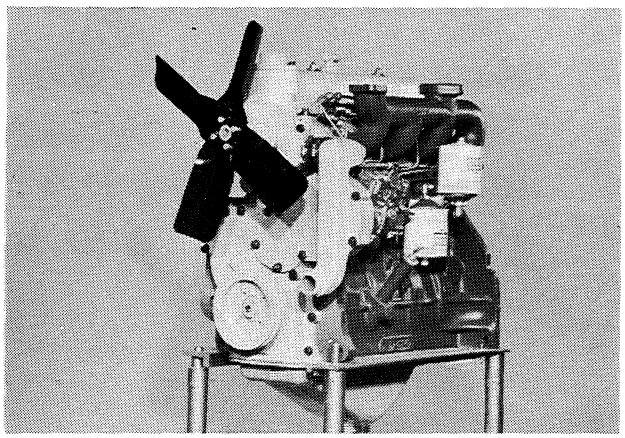
2. Add any nationally known commercial brand cleaner marketed by a reputable manufacturer. Follow the directions provided with the cleaner.

3. After draining the cleaning solution, flush the system with clean water before refilling for operation.

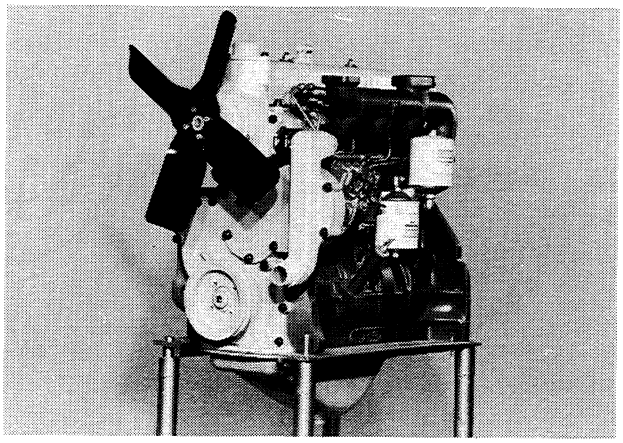
NOTE: Always use only a nationally recognized brand of High Boiling Point Ethylene base anti-freeze, that does not contain a stop-leak additive.



188 DIESEL ENGINE



207 DIESEL ENGINE

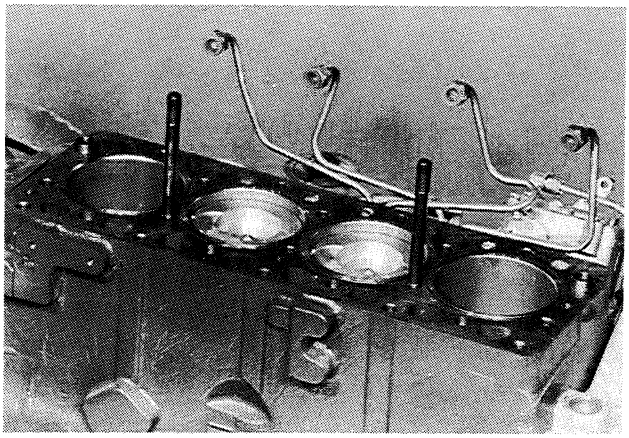


207 DIESEL ENGINE

CYLINDER BLOCK, SLEEVES, PISTONS AND RODS

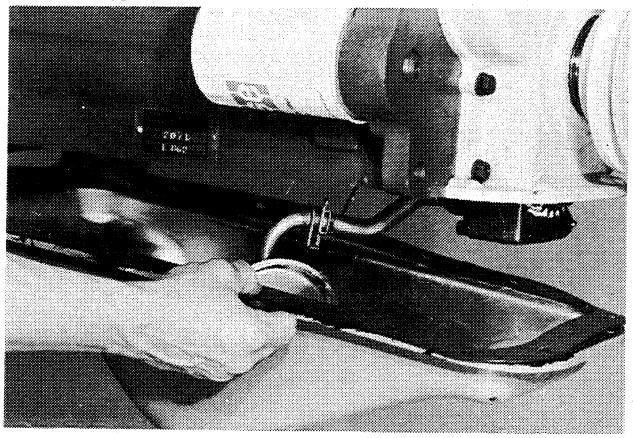
Removal

STEP 1



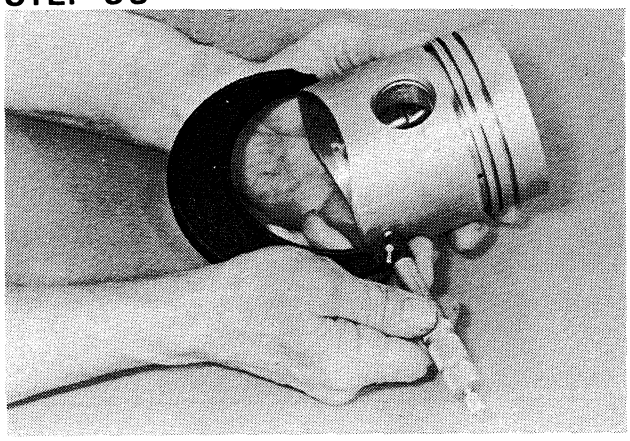
Remove the cylinder head and manifolds from the engine block. Refer to section 2015 for removal.

STEP 2



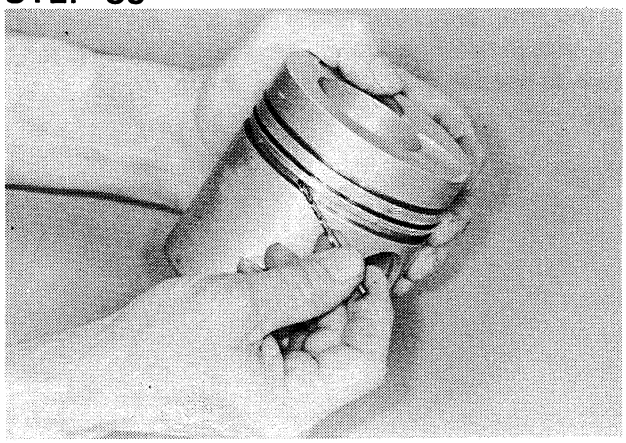
Remove drain plug from oil pan and drain engine crankcase oil. Remove oil pan.

STEP 38



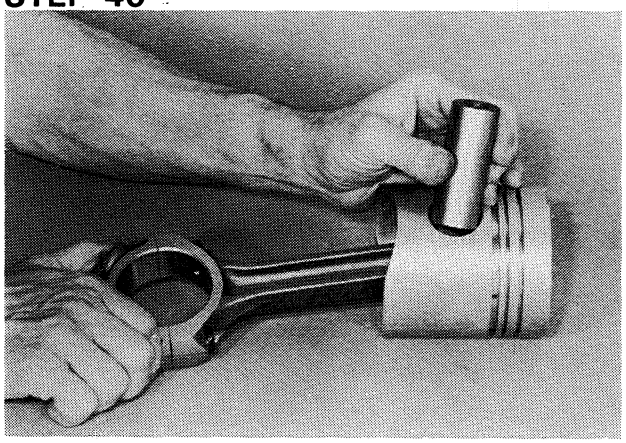
Measure the diameter of the piston across the thrust face at the bottom of the piston, perpendicular to the piston pin holes. If the diameter is less than 3.9940", replace the piston.

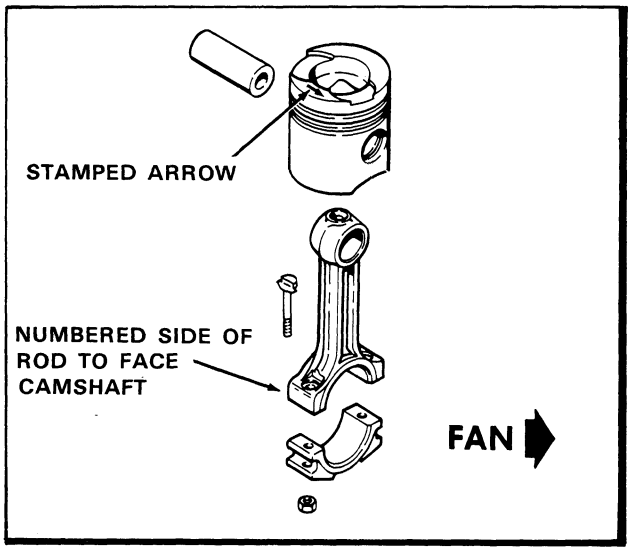
STEP 39



Clean the piston oil holes with a small drill or fine wire.

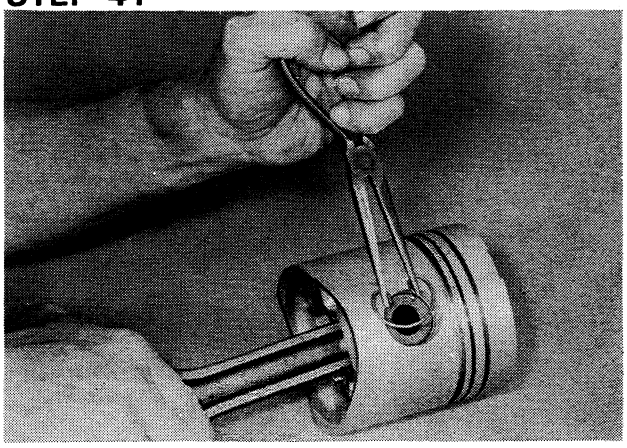
STEP 40





Assemble the connecting rod to the piston. Make sure the numbered side of rod is towards the arrow side of piston. Use hand pressure only to install the piston pin.

STEP 41

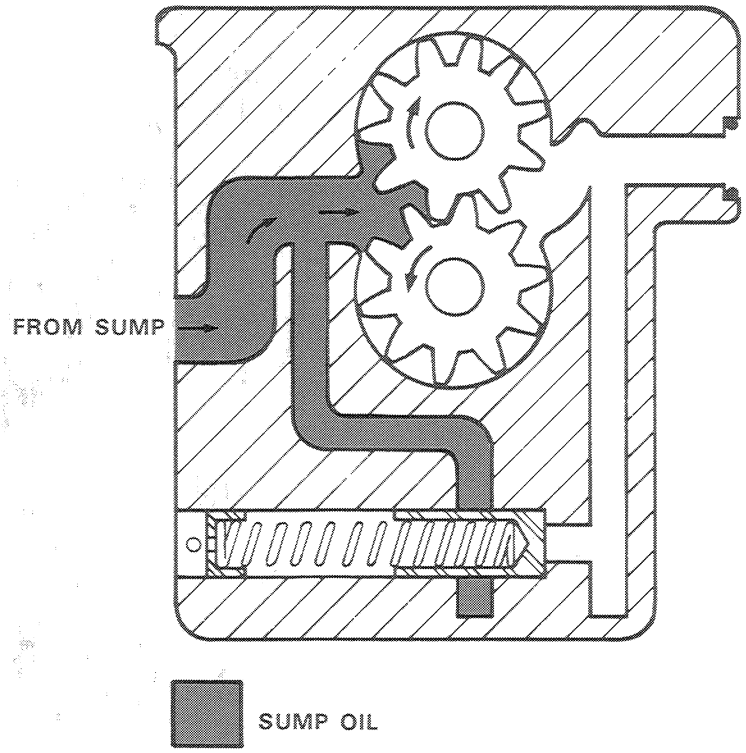


Install the piston pin retaining rings.

ENGINE OIL PUMP FLOW

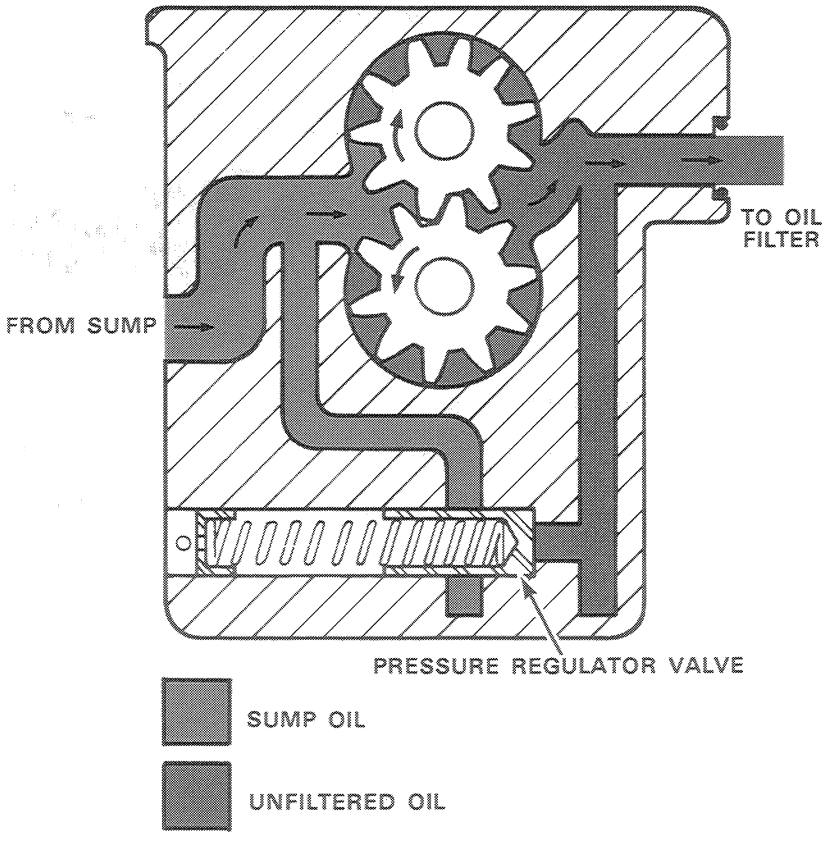
STEP 1

Oil is drawn from the engine oil sump by the pump gears through the suction pickup tube and enters the pump cavity.



STEP 2

The oil is forced by the pump gears through internal passages to the pressure relief valve where it dead heads. The oil then flows to the engine oil filter.



GENERAL INFORMATION

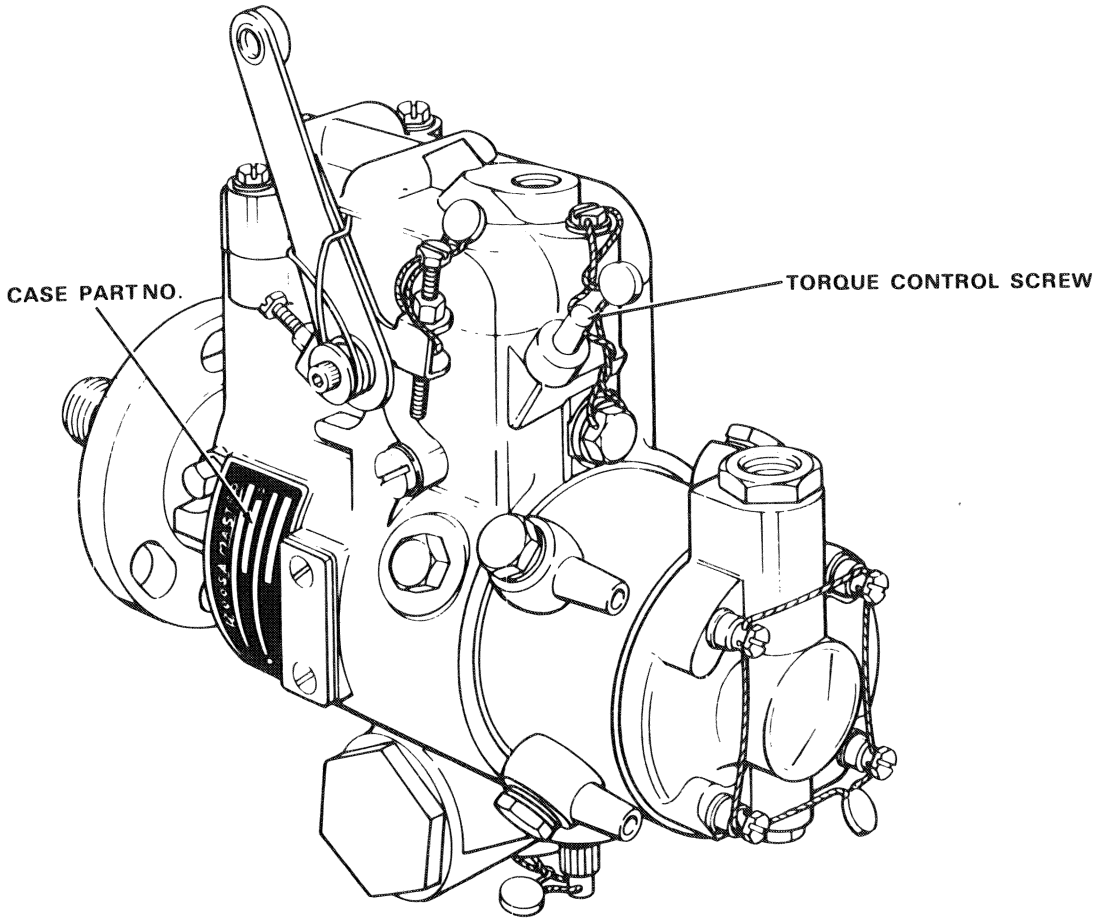
The Roosa Master Model DB fuel injection pump is an extremely compact and precision unit incorporating a high pressure injection pump, a mechanical variable speed centrifugal type governor, vane type fuel transfer pump and is self-lubricated by the fuel.

The function of the fuel pump is to deliver accurately metered quantities of fuel under high pressure to the fuel injectors. This delivery must be accomplished with accurate timing in relation to the engine firing order and for a very definite period of time in relation to load and engine speed requirements.

To meet these rigid requirements, the Model DB Injection Pump is manufactured to unusually close tolerances. While the pump cannot be considered delicate, the precision with which it is manufactured can be compared to that of a fine watch.

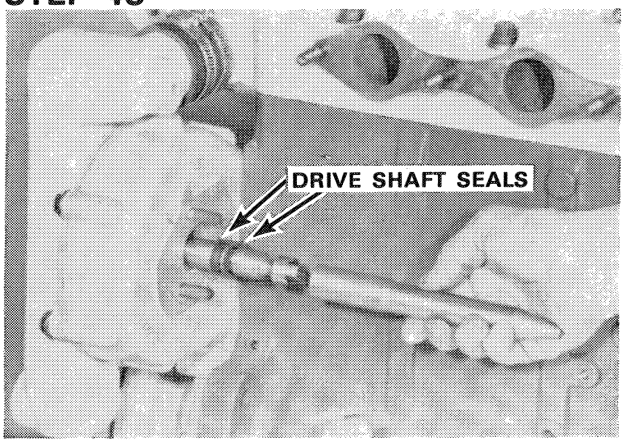
It is therefore doubly important that you take extra precautions to prevent the entry of dust or similar abrasives when you perform service work that involves the fuel injection pump or other components of the fuel system.

Some pumps are equipped with an external factory adjusted torque control screw. This screw, which is wired and sealed to prevent unauthorized changes, provides improved engine lugging ability by delivering maximum torque from rated speed down through peak torque speed.



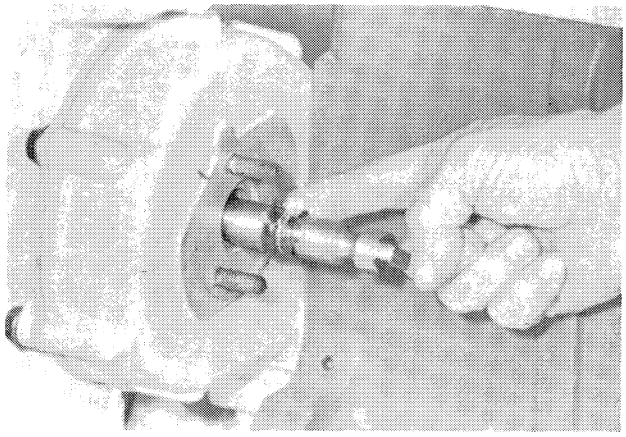
THIS SAFETY ALERT SYMBOL INDICATES IMPORTANT SAFETY MESSAGES IN THIS MANUAL. WHEN YOU SEE THIS SYMBOL, CAREFULLY READ THE MESSAGE THAT FOLLOWS AND BE ALERT TO THE POSSIBILITY OF PERSONAL INJURY OR DEATH.

STEP 43



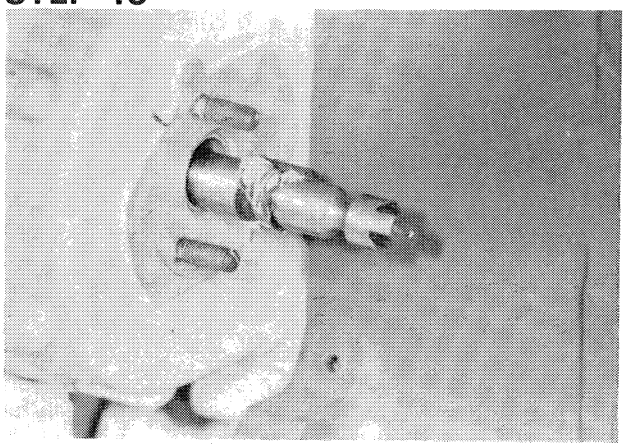
Slide sleeve tool CD322 over pump drive shaft and install seals in their respective grooves on the shaft.

STEP 44



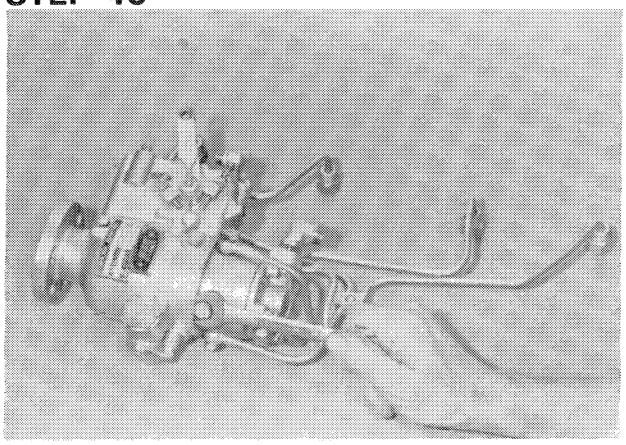
Thoroughly lubricate the two seals with lubriplate to avoid damage and facilitate ease of installation.

STEP 45



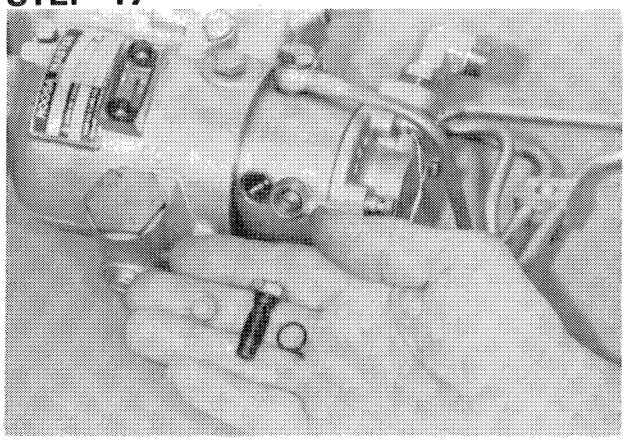
Drive shaft seals installed.

STEP 46



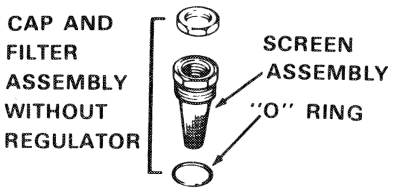
If replacing pump, remove the high pressure line connector bolts and lines from the pump.

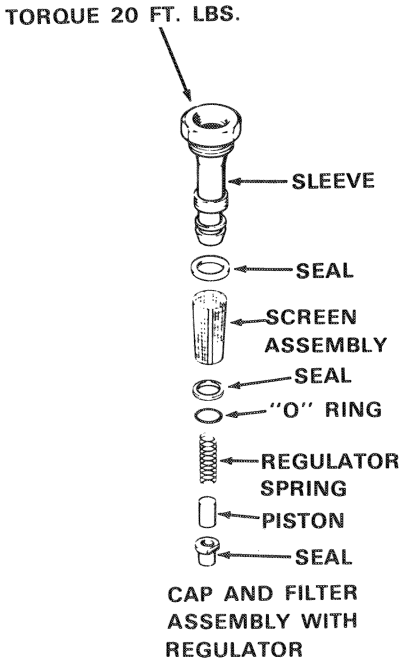
STEP 47

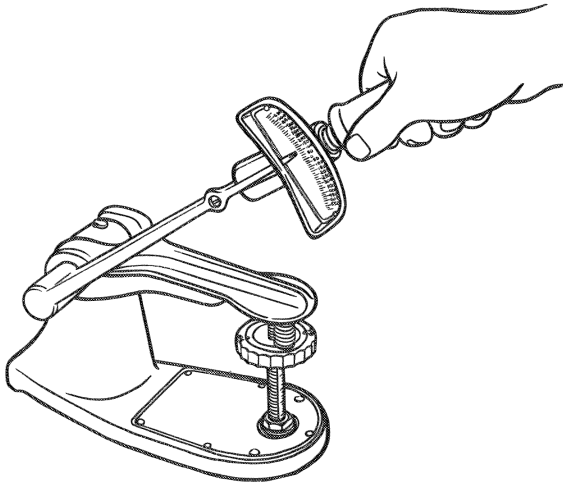


When installing fuel line connector bolts into the high pressure fuel lines, be sure that two new copper washers are used on each connection. Make sure washers are in place on each side of connector before tightening connector bolts. ***IMPORTANT: Do not tighten connector bolts without the washers in place because pump seizure could result due to connector bolt going too deep into pump body.***

STEP 91



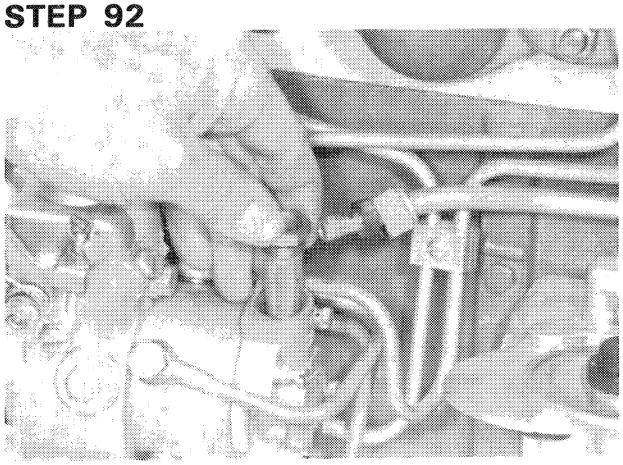




Assemble filter components if removed. Replace damaged parts. Inspect regulator spring for the following:

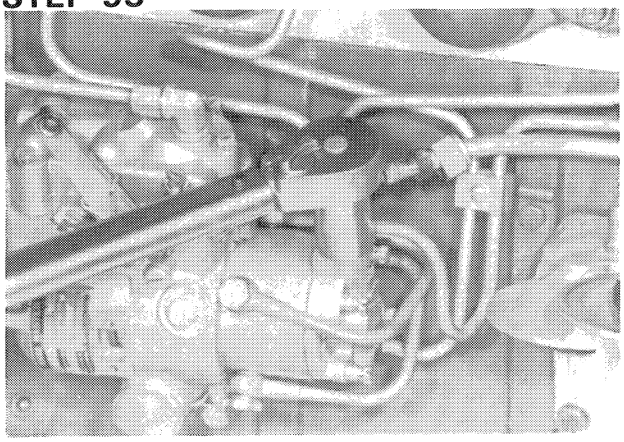
Free Length ..... .633" to .667"
Rate ..... 10 lbs./inch
Color Ident. ..... One end red; one end green

STEP 92



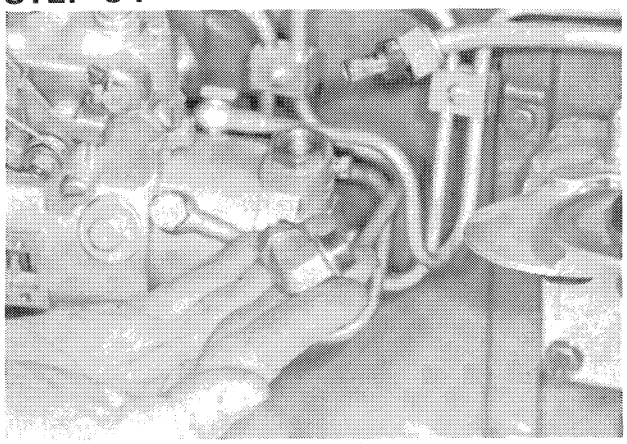
Install inlet filter assembly in fuel pump.

STEP 93



Torque inlet filter assembly 20 ft. lbs.

STEP 94



Install elbow in fuel pump inlet.

GENERAL INFORMATION

The fuel injector is a closed end (injector valve does not project through an opening in the injector tip) differential pressure, hydraulically operated hole type injector.

The fuel injectors are located in the cylinder head - one for each cylinder. It is the function of the fuel injector to direct a metered quantity of fuel received from the injection pump to the combustion chamber. Each charge of fuel must be delivered into the combustion chamber with a definite spray pattern to insure complete combustion and efficient engine performance.

IMPORTANT: *The injector body and valve is a mated assembly, accurately lapped to a very close fit for precise metering of fuel to each cyliner. The body or valve cannot be installed individually for service. If it is necessary to replace either the valve or body, replace the complete assembly.*

IMPORTANT: *Do not mix valves and bodies while disassembling the injector.*

INJECTOR BODY - Houses the injector parts in their correct position in the cylinder head. The part of the injector body which projects into the cylinder head is Teflon coated to pevent sticking.

INJECTOR VALVE - Controls the flow of fuel from the injector.

VALVE GUIDE - Supports and guides the movement of the valve in the body.

OPENING PRESSURE CONTROL SPRING - Controls fuel pressure necessary to lift the valve from its' seat.

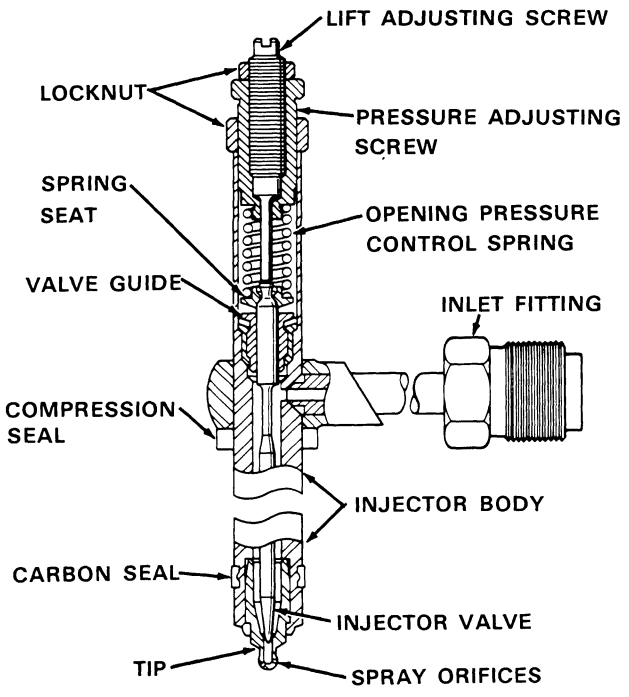
PRESSURE ADJUSTING SCREW - Compresses the opening pressure control spring to maintain a predetermined spring pressure on the valve.

LIFT ADUSTING SCREW - Controls the valve travel distance.

INJECTOR TIP - Contains the valve seat and four spray orfices which direct the fuel spray in the combustion chamber.

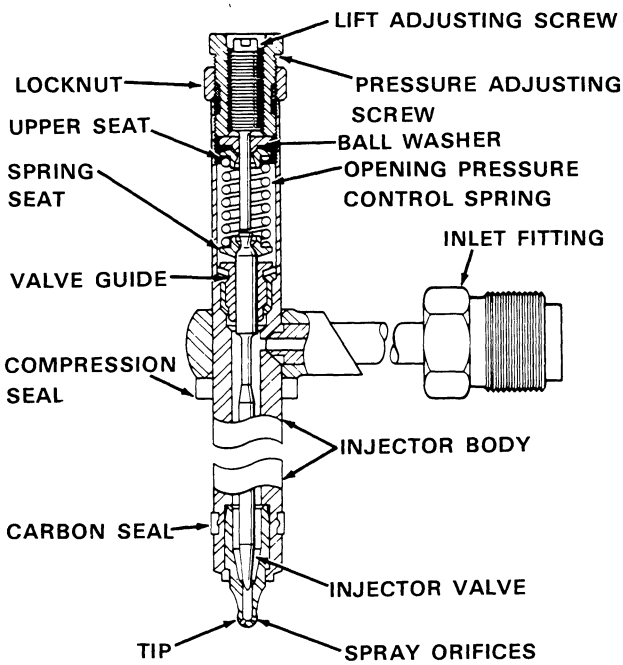
CARBON SEAL - Prevents carbon accumulation in the cylinder head openings.

COMPRESSION SEAL - A nylon seal under the inlet fitting that prevents engine compression leakage.



A50970 A51234 A51987

A140827 A140828 A140829 A154542



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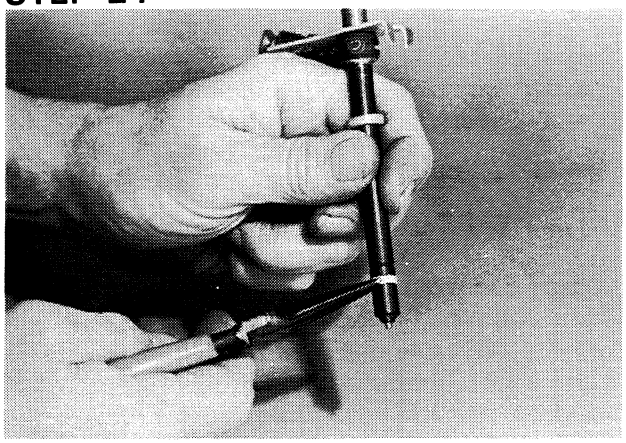
SERVICING INJECTORS

Disassembly

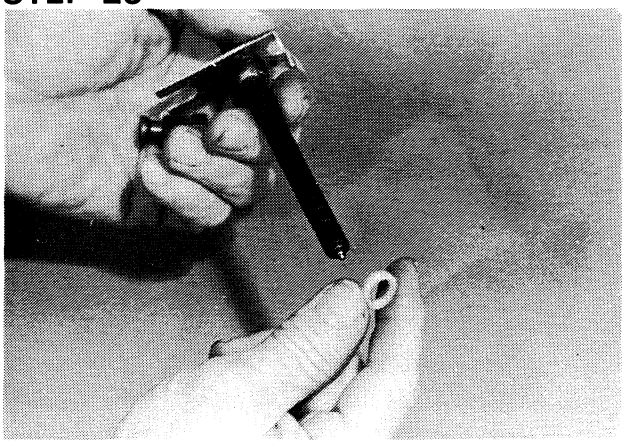
Because the injector contains closely fitted parts which are precision ground and finished, dirt is its' greatest enemy. Exercise utmost care in keeping the work area and tools clean. Handle all parts carefully to avoid damage.

STEP 24



Remove and discard carbon dam seal.

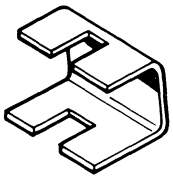
STEP 25

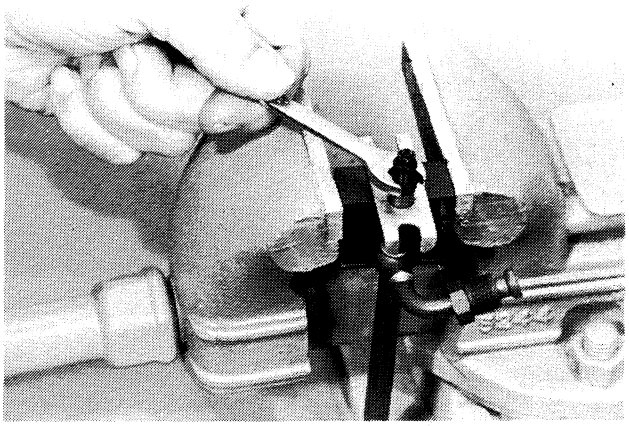


Remove and discard compression seal.

STEP 26

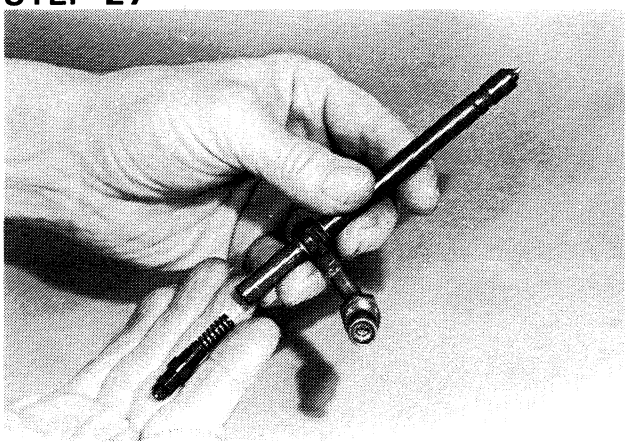
INJECTOR HOLDING TOOL 66-0147





Place injector in the holding tool Bacharach Part No. 66-0147 and secure the tool in a vise. Loosen the pressure adjusting screw locknut.

STEP 27



While holding the injector body in one hand, invert it and back out the pressure adusting screw, allowing the spring and spring seat to fall into your other hand.

THROTTLE ADJUSTMENTS

Engine Speeds

Low idle	725 ± 25 rpm (r/min)
High idle	2250 ± 20 rpm (r/min)

Hand Throttle Adjustment

1. Engage parking brake and place four speed transmission in Neutral.
2. Check low and high idle speeds using a suitable tachometer.
   a. Start engine and run at low idle. Disconnect throttle rod at throttle lever on injection pump.
   b. Hold throttle lever against low idle and high idle stops on injection pump and note engine speed.
   c. If necessary, adjust engine speeds as instructed in Section 3012.
3. Adjust length of throttle rod so throttle lever on injection pump moves an additional 1/16"-1/8" (1.6-3.2 mm) after contacting the low idle stop on the injection pump.
4. Check to see that the throttle lever on the injection pump moves an additional 1/16"-1/8" (1.6-3.2 mm) after contacting the high idle stop on the injection pump. Adjust the hand throttle stop bolt, Figure 1, as required.

Accelerator Pedal Height

1. Check to see that hand throttle linkage is properly adjusted.
2. Place hand throttle in full throttle position. Adjust length on pedal clevis rod as required to obtain 1/16"-1/8" (1.6-3.2 mm) clearance between the pedal and pedal stop.

FUEL TANK REMOVAL AND INSTALLATION

1. Remove engine as instructed in Section 2050.
2. Drain the right and left-hand hydraulic reservoirs.
3. Remove tube between hydraulic oil filter and reservoir manifold tube.
4. Remove tube connected to hydraulic filter inlet and filter assembly from the machine.
5. Remove manifold between reservoirs.
6. Drain fuel from tank.
7. Remove fuel filler cap, filler neck grommet and wire from fuel level sending unit.
8. Remove nuts and washers from bottom of fuel tank straps.
9. Lower fuel tank and swing bottom of tank toward the front at the same time to remove the tank.
10. Reverse steps 1 through 9 to install the fuel tank. It is recommended that fuel drained from tank be filtered before it is returned to the tank.

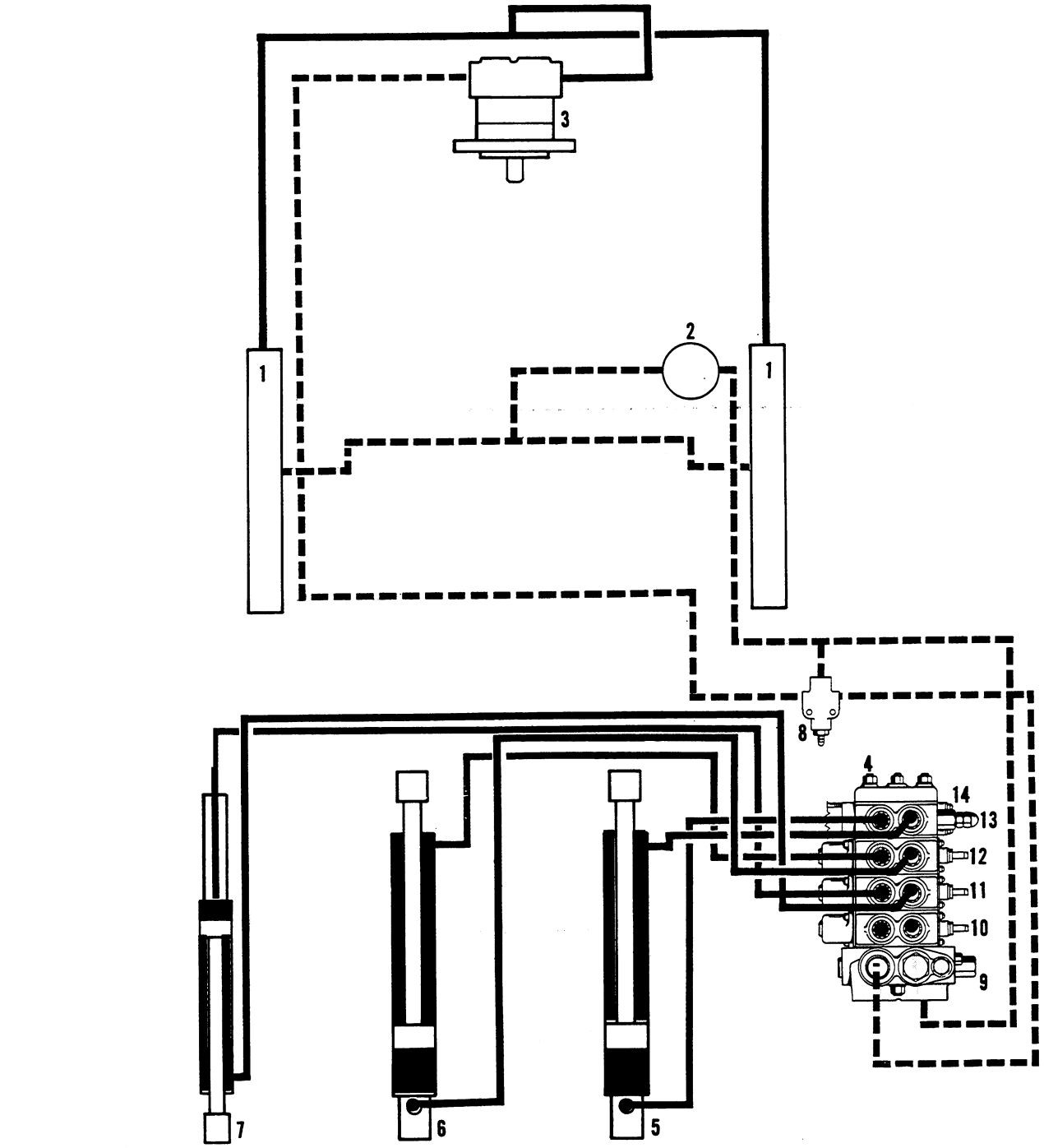


Figure 3 - 3 Point Hitch Hydraulic Diagram

SYMPTOM	POSSIBLE CAUSE	REMEDY
Spool will not stay in detent position	Worn or missing detent parts.	Disassemble detent mechanism and repair as required.
Load drops as control lever is moved to power position	Leaking load check valve.	Remove control valve and inspect load check valve parts including poppet seat. Also refer to page 4002-11.

CYLINDERS

SYMPTOM	POSSIBLE CAUSE	REMEDY
Sluggish or no movement	Worn piston packing.	Check cylinder packing instructed under Poor Operation of a Single Circuit, page 4002-9.
	Loose piston bolt.	Remove cylinder and repair as required.
	Hoses not properly connected.	Refer to hydraulic diagrams and check connections against diagram. Reconnect hoses as required.
Excessive cylinder bushing wear	Failure to lubricate pivot points as specified.	Lubricate pivot points daily or more often if operating in severe conditions.
Excessive cylinder packing wear	Contaminated oil.	Flush the complete hydraulic system as instructed on page 4002-7.
	Incorrect main relief valve pressure setting.	Check and adjust pressure setting as instructed in this section.
Bent piston rod	Failure to lubricate pivot pins as specified.	Lubricate fittings daily or more often if operating in severe conditions.
	Incorrect main relief valve pressure setting.	Check and adjust pressure setting as instructed in this section.

TESTING SECONDARY RELIEF VALVES WITH A HAND PUMP

General

The following circuits are protected by secondary relief valves: loader bucket, boom, dipper, swing and backhoe bucket. The pressure setting of these relief valves can be checked on or off the machine with the hand pump set up as illustrated in Figure 8 and using the additional parts illustrated in Figures 9 and 10 as required.

The hoses and hose fittings in Figure 8 are listed in the Flexible Hose Lines and Reusable Fittings catalog SPS 124. The remaining parts can be ordered in the usual manner.

The fittings illustrated in Figures 9 and 10 are available in a complete hand pump fittings and gauge kit from the Nuday Co. Refer to Service Tool Catalog SPS 179-Revised for more information and mailing address.

The pressure setting for each relief valve is listed on page 4002-3. The original relief valves in the Case backhoe control valve have a nominal pressure setting stamped in the top of the valve cartridge. DO NOT use this figure when checking or setting a relief valve; use the pressure settings listed on page 4002-3.

Checking Pressure Setting, Control Valve Installed

1. The oil in the hand pump should be at room temperature, preferably 70°-80° F (21°-26.7° C). Also be sure the pump reservoir is filled with Case TCH Fluid.

2. Lower all buckets and/or attachments to the floor. Then move control lever for relief valve being tested to relieve circuit pressure.

3. Break the line between the cylinder and control valve for the relief valve being tested at any convenient connection.

   a. If checking a loader bucket or boom relief valve, break line at a connection that leads directly to the control valve.

   b. When checking swing relief valves, hand pump must be connected to tube to the swing section.

4. Refer to Figure 9 for the necessary parts and connect hand pump to line to control valve. Do not tighten connection at this time.

5. The hand pump must be operated against a solid column of oil. Operate hand pump to bleed air from line and tighten hose connection.

6. Actuate hand pump to build up pressure until the relief valve opens. Make several checks to obtain an accurate check.

7. Compare test reading with specified setting on page 4002-3 and adjust as required.

Checking Pressure Setting, Control Valve Removed

With the control valve removed the hand pump can be easily connected to the valve. Refer to Figure 10 to determine the adapter required and install in the port next to the relief valve being tested. Check setting as instructed in steps 5 and 6 above.

Relief Valve Adjustment

Loader Control Valve

The relief valves are adjusted by removing or adding shims. The shims are installed between the plug and spring guide.

1. Remove plug from end of relief valve. If control valve is installed, use a magnet and remove spring guide/poppet assembly to be sure all shims are removed.

2. Add shims to increase pressure setting or remove shims to decrease the pressure setting.

3. Install spring guide/poppet assembly and shims.

(Continued on page 4011-29)

BREAK IN OF REBUILT OR NEW PUMP

1. Start engine and run at half throttle for three minutes.
2. With the engine running at half throttle, hold bucket control lever in Rollback to open the main relief valve for five seconds. Then return control lever to Neutral for five seconds. Repeat this cycle for three minutes.
3. Increase engine speed to full throttle and repeat step 2.
4. Stop engine and check for leaks.

IDENTIFYING CAUSES OF PUMP FAILURE

Particular attention should be paid to the following information if the pump has a short service life. Any or all causes may be found in a pump that has had a long service life.

Wear Caused by Fine Particles

The particles that cause abrasive wear are usually not visible to the human eye. The filter used on this machine removes particles over 40 microns in size. A micron equals 1/1000 millimeter or .0000394 inches. Improper service procedures and failure to follow the prescribed maintenance schedule can be the cause of abrasive wear.

Wear Plate

A narrow band with a sandblasted appearance will be evident around the bores in the wear plate. The edges of the lubrication slots will be rounded and the ends enlarged.

Gears

A sandblasted appearance will be evident at the base of the teeth at each end. The bearing surface will have a dull finish as if sanded with fine sandpaper. A groove in seal lip area of the driveshaft may also be apparent.

Gear Housing

The gear track will have a sandblasted appearance on the inlet side.

Wear Caused by Metal Particles

Metal particles usually result from wear or insufficient flushing after a component failure. Wear may be gradual or sudden depending on the quantity and size of the particles.

Wear Plate

Circular scratches or grooving will be apparent near the outer edges. Depending on quantity and size of the particles, the entire surface may be heavily grooved.

Gears

The bearing surfaces will have many small grooves. The severity of the grooving will depend on the amount of contamination and operating pressure.

Gear Housing

The gear track will be grooved by particles large enough to be caught between the tips of the gear teeth and the housing.

Aeration or Cavitation

This type of failure is rare and careful investigation is required to pinpoint it. Aeration occurs when air is mixed with the oil. Air can enter the system through a small leak in the suction line.

Cavitation is usually the result of the pump suction being restricted.

Aeration and cavitation erode and pit the thrust plates and gear housings. Damage will be apparent on the suction side of the gear housing and on the high pressure (outlet) side of the thrust plates. As the air or vapor bubbles in the oil are compressed to pump discharge pressure they collapse. This collapse is called an implosion. The force of the implosion removes metal from the thrust plates and the gear housings.

A pump cavitating or operating on aerated fluid is usually noisy. It makes a sound like

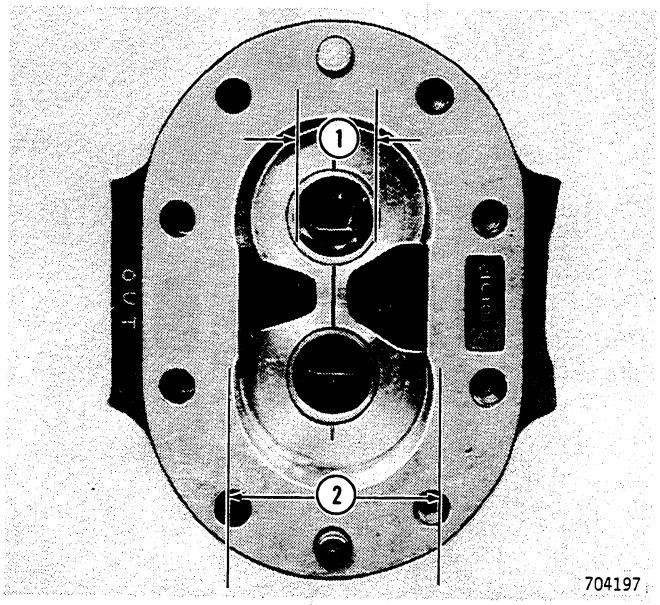
Inspection

Body

1. Check the sealing surface for nicks and burrs. If nicks or burrs are noted, remove with a piece of crocus cloth or flat India stone.

2. Clean the body in cleaning solvent and make sure all passages are free of foreign matter.

3. Using an inside micrometer, measure the gear bores. If either bore diameter exceeds 2.1253" (54 mm), the body must be replaced.



1. 0.8777" (22.3 mm) 2. 2.1253" (54 mm)

Figure 21

4. Using a depth micrometer, measure the depth of the gear bores. If either bore depth exceeds 1.5155" (38.5 mm) the body must be replaced.

5. Using an inside micrometer, measure the diameter of the gear bushings. If either bushing exceeds 0.8777" (22.3 mm) in diameter the body must be replaced.

Gears

1. Measure the diameter of both gears. If either gear has a diameter less than 2.1203" (53.8 mm) the gears must be replaced.

2. Measure the diameter of the gear journals. If the diameter of a journal is less than 0.8737" (22.2 mm) the gears must be replaced.

3. Measure the thickness of both gears. If one gear measures less than 1.5110" (38.3 mm) the gears must be replaced.

   NOTE: The thickness of the gears must measure the same within 0.0005" (0.013 mm).

4. Check gear faces and journals for scoring. Replace the gear set if heavy scoring is evident. The gear teeth should have sharp corners and not rounded.

End Cover

NOTE: DO NOT remove the seal package from the end cover. These parts are not serviceable items.

1. Use a lint free cloth moistened with cleaning solvent and clean end cover. Do not submerge in cleaning solvent or dry with compressed air.

2. Check the sealing surface for nicks and burrs. If nicks or burrs are noted, remove with a piece of crocus cloth or flat India stone.

3. Using an inside micrometer, measure the bushing diameter. If either bushing exceeds 0.8777" (22.3 mm) in diameter the end cover must be replaced.

4. Inspect the shaft seal for cracks, deterioration and other defects.

5. If the pump has been disassembled because of low output and the pump body and gears are found to be serviceable, it can be assumed that the seal package is probably defective, requiring end cover replacement.

Oil Flow - Lift Spool Actuated

In Figure 5 the lift spool is moved into the valve body which:

a. Blocks the open center passage. With open center blocked, all oil from the pump flows to the spool being actuated.

b. As pressure in the open center pasage increases, the load check poppets open, permitting oil to flow to the A port. From the A port, oil is directed to the rod end of the lift cylinders causing the loader arm to lower.

c. Simultaneously, the B port is opened to the return passage, allowing oil displaced from the closed end of the lift cylinders to return to the reservoir.

When the spool is returned to neutral, oil is locked between the control valve and lift cylinders, preventing further movement of the loader frame.

To raise the loader frame, the spool is moved out of the valve body and oil flow is reversed.

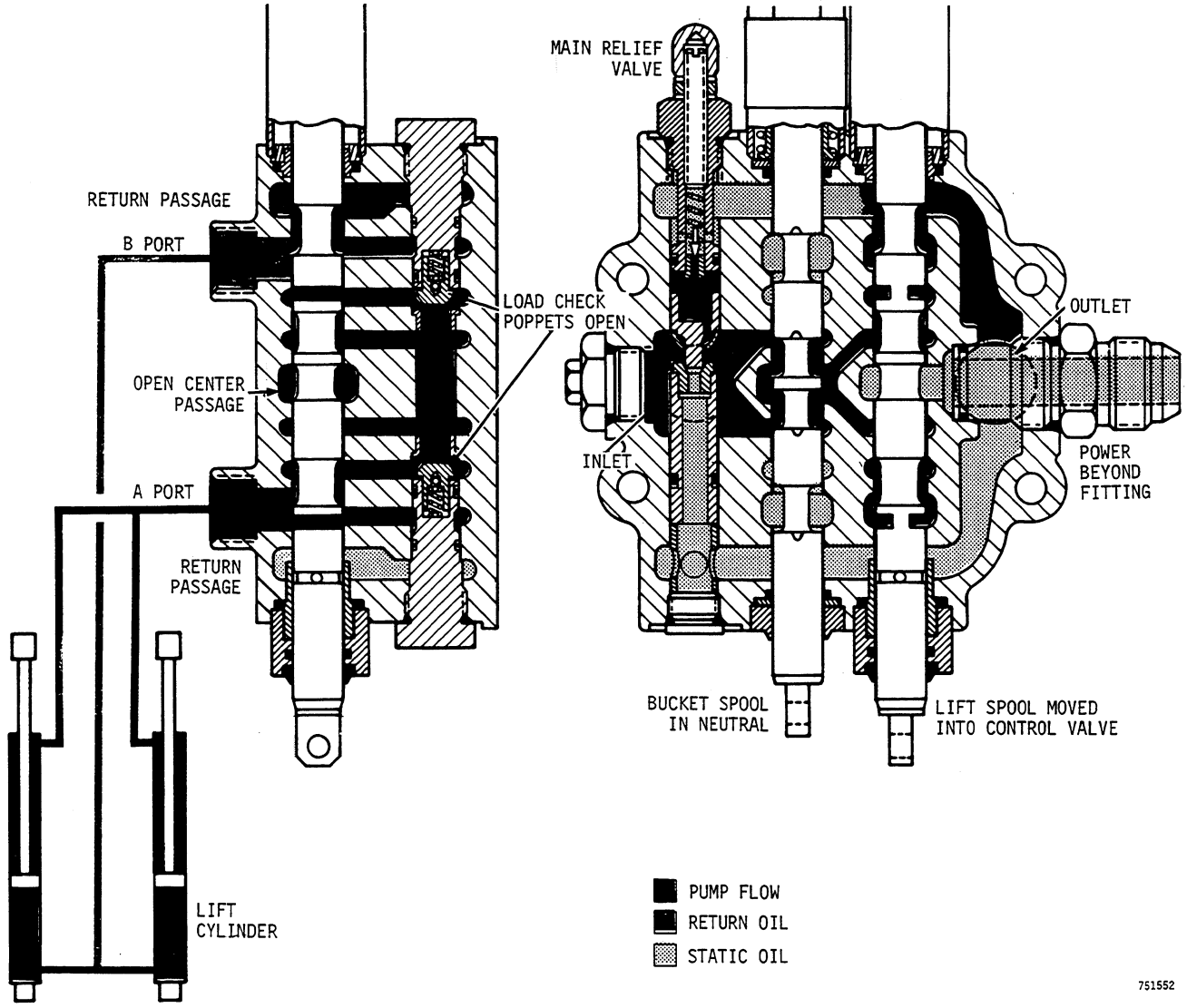


Figure 5 - Oil Flow - Lift Spool Actuated

3. Install backup rings and new O-rings on relief valve and install in valve body. After the control valve is assembled, check the pressure setting as instructed in Section 4002.

Main Relief Valve

1. Press new poppet seat into seat sleeve if seat was removed.

2. Install backup ring and new O-ring on the seat sleeve. Then install the seat sleeve and drain sleeve in the valve body. Push the drain sleeve into valve body until two or three threads are visible, then screw plug with new O-ring into valve body. The seat sleeve is now properly positioned.

3. Place poppet and spring in relief valve bore.

4. Assemble the relief valve cartridge.

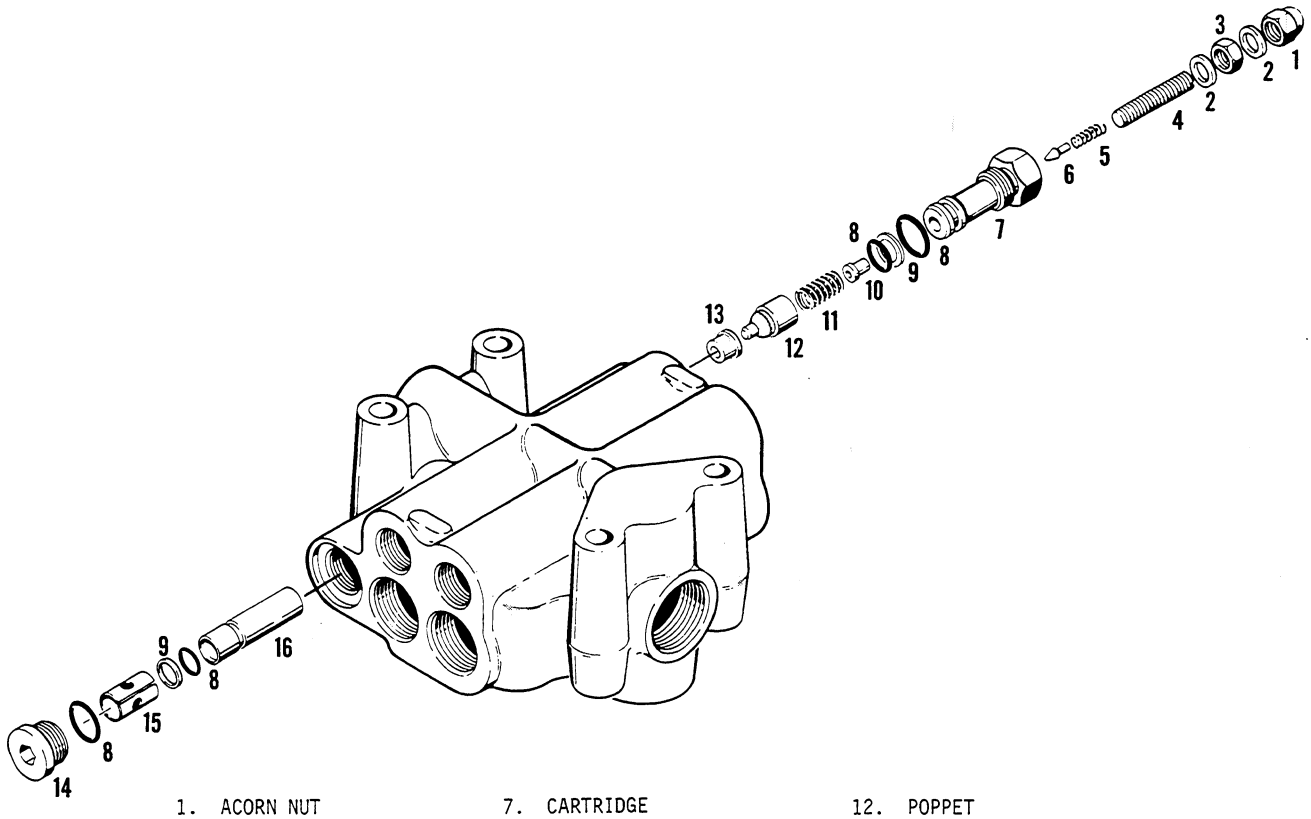
   a. Press new pilot plunger seat into cartridge if the seat was removed.

   b. Place the pilot plunger and spring in cartridge.

   c. Screw adjusting screw into cartridge. Then install seal washer, lock nut, seal washer and acorn nut. Do not tighten parts on adjusting screw at this time.

5. Install backup rings and new O-rings on the cartridge and screw cartridge into valve body until tight.

6. Check and adjust relief valve setting as instructed in Section 4002 after the control valve is installed.

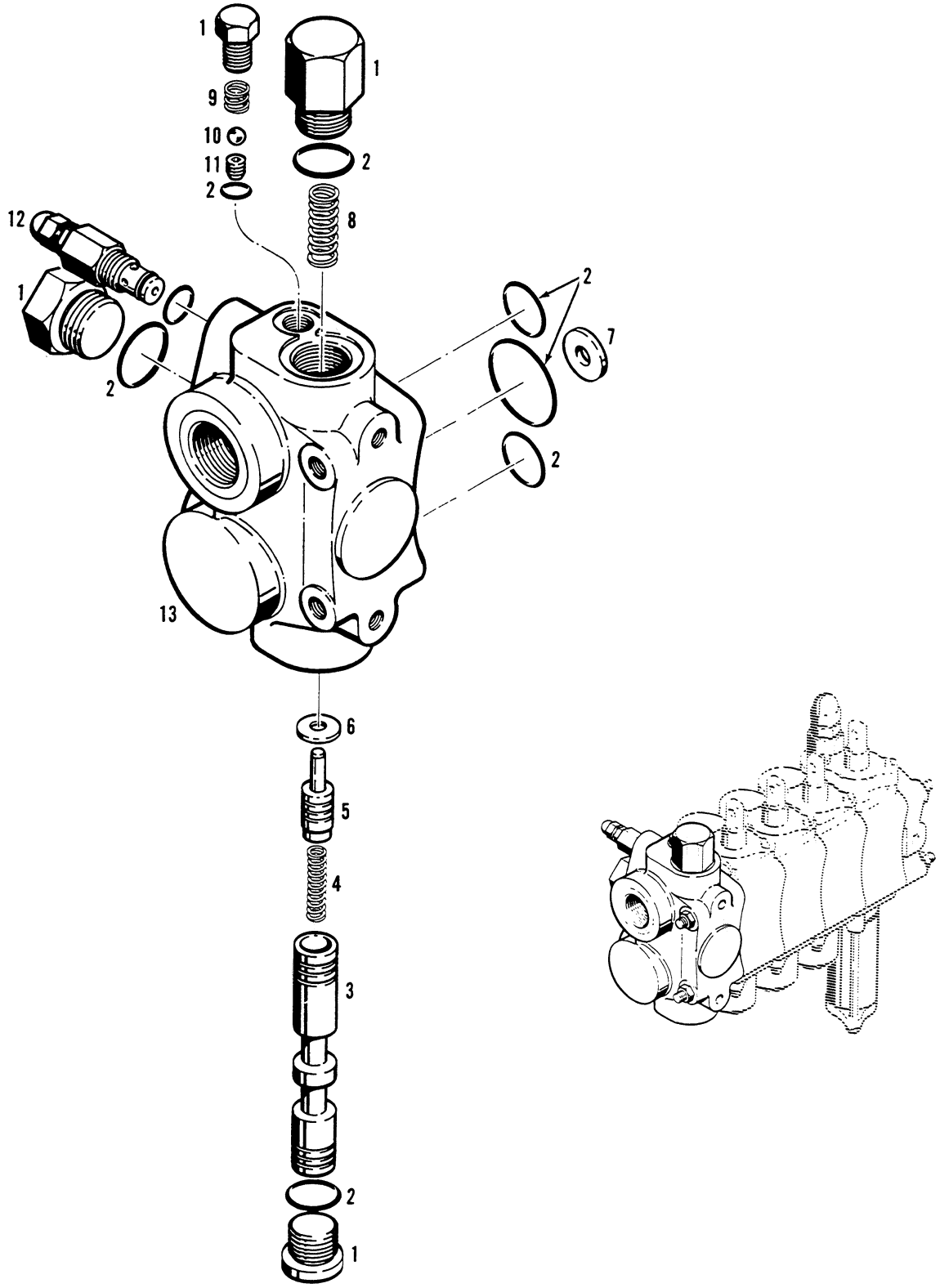


1. ACORN NUT
2. WASHER
3. JAM NUT
4. ADJUSTING SCREW
5. PLUNGER SPRING
6. PILOT PLUNGER
7. CARTRIDGE
8. O-RING
9. BACKUP RING
10. PILOT PLUNGER SEAT
11. POPPET SPRING
12. POPPET
13. POPPET SEAT
14. PLUG
15. DRAIN SLEEVE
16. SEAT SLEEVE

751603

Figure 17 - Main Relief Valve

EXPLODED VIEWS



1. PLUG
2. O-RING
3. COMPENSATING SPOOL
4. PLUNGER SPRING
5. PLUNGER
6. WASHER
7. ORIFICE PLATE
8. SPOOL SPRING
9. CHECK VALVE SPRING
10. CHECK BALL
11. ORIFICE SCREW
12. MAIN RELIEF CARTRIDGE
13. HOUSING

751564

Figure 3 - Exploded View of Inlet Section

Hydraulic Fittings (Steel)

Dash Size	Tube O.D. Hose I.D.	Thread Size	37° Flare Torque		Straight Thread O-ring Torque	
			Ft-lbs	N m	Ft-lbs	N m
4	1/4"	7/16"-20	6-12	8-16	12-19	16-25
5	5/16"	1/2"-20	8-16	11-21	16-25	22-33
6	3/8"	9/16"-18	10-25	14-33	25-40	34-54
8	1/2"	3/4"-16	15-42	20-56	42-67	57-90
10	5/8"	7/8"-14	25-58	34-78	58-92	79-124
12	3/4"	1-1/16"-12	40-80	54-108	80-128	108-174
14	7/8"	1-3/16"-12	60-100	81-135	100-160	136-216
16	1"	1-5/16"-12	75-117	102-158	117-187	159-253
20	1-1/4"	1-5/8"-12	125-165	169-223	165-264	224-357
24	1-1/2"	1-7/8"-12	210-250	258-338	250-400	339-542

740314

SPANNER WRENCH SET

Spaner wrench set, part no. D44110 contains the necessary wrenches to remove and install glands on Case manufactured cylinders. The wrench set is available through Service Parts Supply.

BOOM CYLINDER

Removal

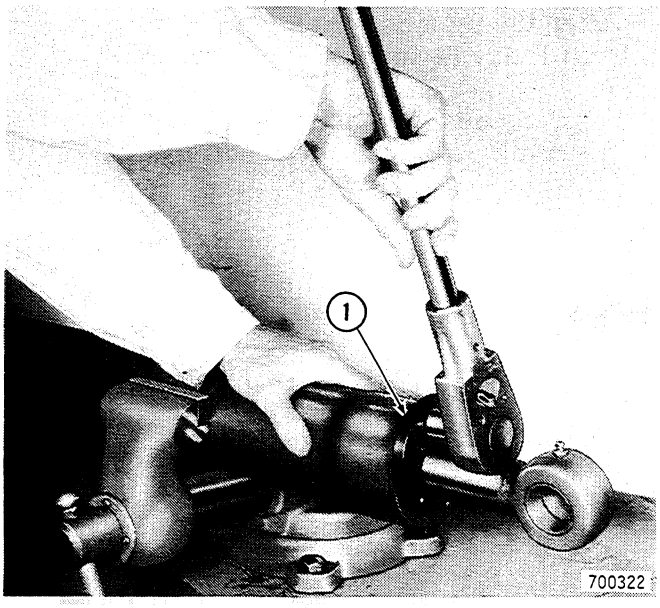
1. Completely retract the dipper and bucket and lower boom so bucket rests on the floor. Move boom control lever in both directions to equalize circuit pressures.

2. Remove the cylinder pivot pin retaining bolts and nuts. Disconnect hoses at cylinder and close openings with clean caplugs.

3. Have lifting equipment or another person available to aid in removing the cylinder. Remove the pivot pin at closed end of cylinder. Then work cylinder off the rod eye pin. If necessary, remove pin retaining hardward on eye end of opposite cylinder and drive pin out of rod eye.

Disassembly

1. Secure cylinder in a vise using care not to distort the cylinder. Use a spanner wrench and unscrew gland, Figure 11.

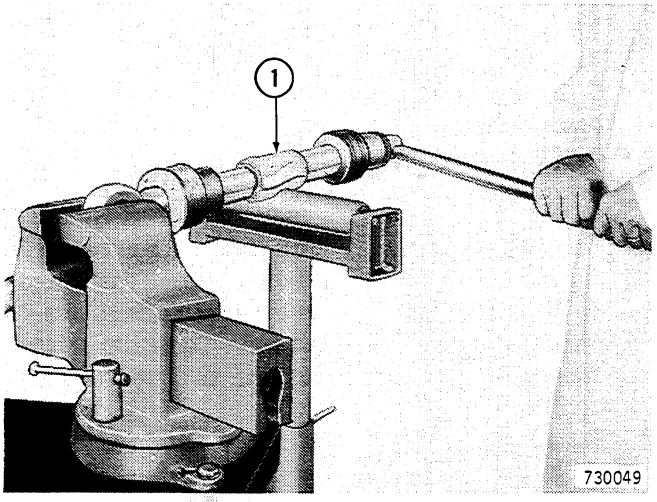


1. SPANNER WRENCH

Figure 11 - Removing Gland

2. Carefully pull the piston rod from the cylinder. Pull rod straight out to prevent damage to the cylinder wall.

3. Secure piston rod eye in a vise and support piston end as shown in Figure 12 and remove piston bolt.



1. PROTECT ROD WITH CLOTH

Figure 12 - Removing Piston Bolt

4. Remove piston from piston rod. Then separate piston halves. Remove the vee rings and adapter rings from the outer piston half. Remove wear ring from inner piston half.

5. Remove gland from piston rod. If necessary, the gland may be driven off the rod with a soft hammer. Refer to Figure 14 and disassemble gland.

Inspection

Refer to page 4090-6.

Assembly

1. Refer to Figure 14 and assemble the gland. The U-cup seal may be very difficult to install. Use as much care as possible not to cut the seal lips. Use a blunt tool, preferably wood or plastic, and push seal into place. Make sure seal lips are to the inside.

NOTE: If a new gland is being installed, stamp the cylinder part number on the face of the new gland.

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Inspection of Working Sections

1. Discard all O-rings and replace with new parts.

2. Clean parts in cleaning solvent and dry with moisture free compressed air.

3. Inspect the spool and spool bore for scoring or other defects that would result in excessive spool leakage. If the spool or its bore is defective, the entire section must be replaced.

4. Inspect the machined surfaces of the valve sections for burrs and nicks. Use a flat India stone and remove any nicks or burrs, Figure 11. Move the stone in a circular motion and keep it flat at all times. Do not stone a section that has not been completely disassembled. Thoroughly wash the valve section in cleaning solvent to remove all traces of grit.

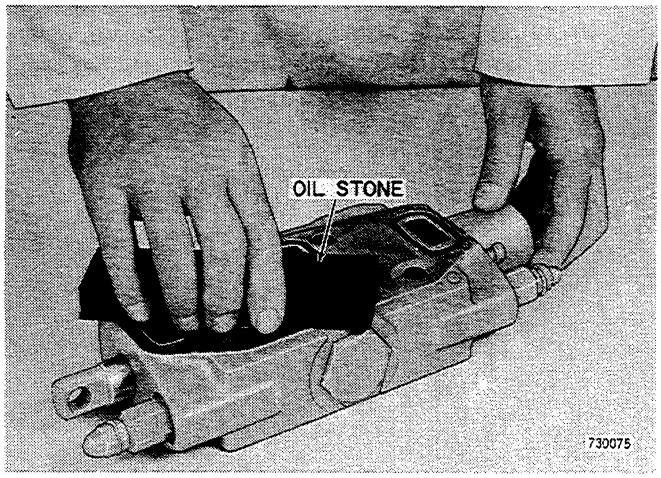


Figure 11 - Stoning a Valve Section

5. Check springs for distortion and signs of cracking. Replace if either condition is evident. If spring testing equipment is available, check all springs against specifications on page 4107-2.

Assembly of Working Sections

1. Refer to Figure 13 or 14. Install new O-rings on load check valve plugs and lubricate with clean hydraulic oil. Hold the valve section upright and install a load check valve and spring. Place check valve plug on special tool and install plug. Push plug down until it bottoms. Then position plug so slot points toward the spool. Install the remaining valve, spring and plug in the same manner.

2. Install the secondary relief valve cartridges using new O-rings and torque to 65-85 foot-pounds (85-115 N m). If assembling the boom section, make sure the relief valve stamped 1000 or marked during disassembly is installed in the top of the valve section.

3. Install new O-ring in groove at top of spool bore. Then press or drive in wiper, lip to the outside, in recess at top of spool bore until it bottoms.

4. Place new O-ring and the O-ring retainer on spring end of spool. Secure spool in a soft jawed vise and place centering spring and spring guides on spool. Compress spring as instructed under disassembly and secure parts in place with snap ring.

5. Lubricate spool and spool bore with clean hydraulic oil and install spool from bottom of valve section.

6. Install spring cap and torque to 20-30 foot-pounds (27-41 N m).

7. Swing section only: Refer to Figure 14 and place anticavitation valves and springs in bores on rear of valve. Install new O-rings on plugs and install plugs.

Assembling Control Valve

1. Place a small amount of clean grease in the O-ring recesses (4) in each valve section. Then place new O-rings in each recess.

2. Install the four tie bolts in the inlet section. Then place inlet section on bench with tie bolts up.

3. Install the working sections in the sequence established during disassembly. Make sure shims used between the valve sections are in place before the next section is installed.

Continued on page 4107-22

Removal

1. Cab equipped models: Remove the backhoe from the tractor. All other models: Removal of the backhoe from the tractor will provide additional working space, but the control valve can be removed (with some difficulty) with the backhoe attached.

2. Lower the stabilizers to the floor or raise the stabilizers and tie the stabilizers together with heavy wire or chain, or blockup mounting frame if backhoe has been removed.

3. If the backhoe is not removed, remove the operator's seat.

4. With the engine shut off, move the stabilizer control levers in both directions to equalize circuit pressure. Then disconnect linkage from the spools.

5. Disconnect hoses and tubes from the control valve and close openings with clean caplugs. Then remove the nuts and washers from the mounting bolts.

6. Remove control valve and spacer from mounting plate.

Disassembly

NOTE: Tag or otherwise identify parts as they are removed to assure proper assembly.

1. Remove the check valves:

   a. Remove the check valve plug. The plug is staked and may be difficult to remove. Squirting oil on the threads will be helpful.

   b. With the plug removed, the remaining parts in the check valve assembly should be easily removed. Reach into the plunger bore with a piece of wire and remove the seat.

   c. To remove O-ring from plunger bores, use a long sharp pointed instrument. Refer to Figure 5 for O-ring location.

2. Remove the spools:

   a. Unscrew the spool cap. Cap is torqued to 35-40 foot-pounds (47-54 N m).

   b. Grasp the spool at the cap end and pull from bore.

3. Remove bushing and O-ring from cap end of spool bore (if they did not come out with the spool).

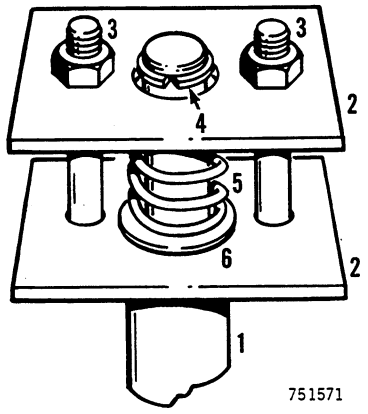
4. Remove O-ring from opposite end of spool bore.

5. Remove the spool centering spring:

   a. Place spool in a SOFT JAWED vise.

   b. Compress the spring using two shop made retainer plates as shown in Figure 4.

   c. Remove snap ring. Release spring, then remove washers, spacer, and centering spring.



1. SPOOL
2. COMPRESSOR PLATE
3. BOLT AND NUT
4. SNAP RING
5. SPRING
6. WASHER

Figure 4 - Compressing Centering Spring

Inspection

1. Discard O-rings. Clean all other parts in cleaning solvent. Dry with moisture free compressed air.

SPECIFICATIONS

Rated pump output	6.7 U.S. gpm at 1800 psi at full throttle (25 l/min at 12 410 kPa at full throttle)
Reservoir capacity	1 U.S. quart (0.9 liter)
System capacity	3 U.S. quarts (2.8 liters)
Type of oil	Case TCH Fluid
Relief valve pressure setting	2000 ± 100 psi at full throttle (13 789 ± 689 kPa at full throttle)

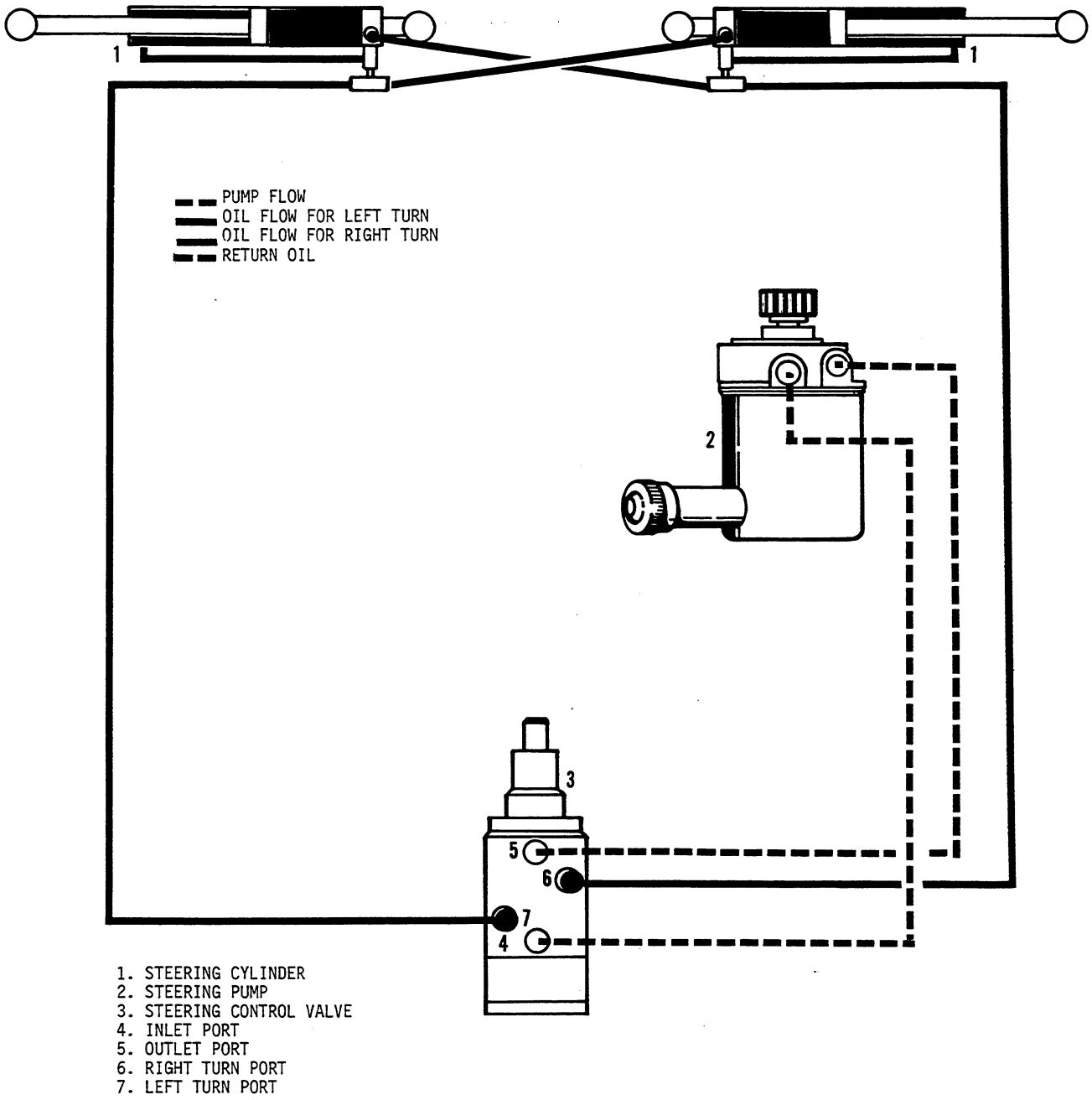


Figure 1 - Steering Hydraulic Diagram

Oil Flow, Right and Left Turn, Engine Running

1. As the steering wheel starts turning, several actions occur almost simultaneously:

   a. The spool starts to move into the valve (right turn) or out of the valve (left turn) allowing oil from the steering pump to charge the metering section.

   b. The rotor and commutator, which are connected to the input shaft through the drive link and torsion bar, resist turning because of cylinder pressure required to overcome the steering forces.

   c. Continued rotation of the steering wheel (even slight movement) moves the spool farther into or out of the valve, opening ports to the steering cylinders, and passages between the metering section and control valve section. At the same time, the rotor and commutator turn, directing oil to the control valve section and steering cylinders.

2. When the steering cylinders reach the end of their travel, a hydraulic stop is created because the metering section can no longer discharge oil and the steering wheel can no longer be turned. If the steering wheel is held against this hydraulic stop, the relief valve in the steering pump opens and diverts oil to the reservoir.

3. When the operator stops turning the steering wheel, the spring action of the torsion bar returns the spool to neutral, blocking the passages to the cylinders and the front wheels hold their last position, straight ahead or turned right or left.

6. Using the middle of the torsion bar as a gauge, place torsion bar between small O.D. thrust washer and spool as shown in Figure 15.

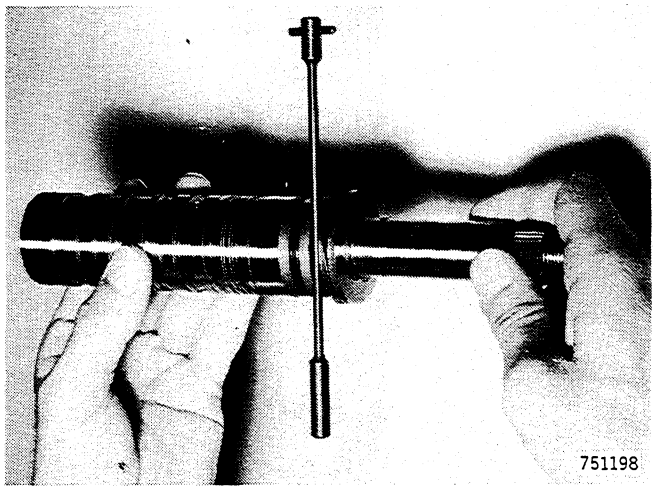


Figure 15

7. Stand spool assembly on input shaft. Make sure torsion bar remains in place.

8. Drop drive ring into spool and align with spool. If the drive ring does not engage the shaft, rotate the shaft as required so drive ring will drop onto shaft. Make sure drive ring is seated against input shaft and remove torsion bar.

9. Place spacer on torsion bar and start torsion bar into input shaft. Align holes in shaft and torsion bar and use drift punch to maintain alignment.

10. Install retaining pin and tap lightly several times to start pin into torsion bar. Place spool assembly in press and press pin into place. Use a relatively larger diameter 1/2" drive socket for shaft support, Figure 16. Then use drift punch and drive pin in until about 1/32" (0.793 mm) below the shaft O.D.

11. Secure valve body in vise as illustrated in Figure 17. Make sure top of body is up (locate alignment mark made during disassembly).

12. Slide spacer all the way onto the spool and install spool assembly in valve body. The spool is easily installed if it is lowered straight into the valve body. Do not force the spool into place.

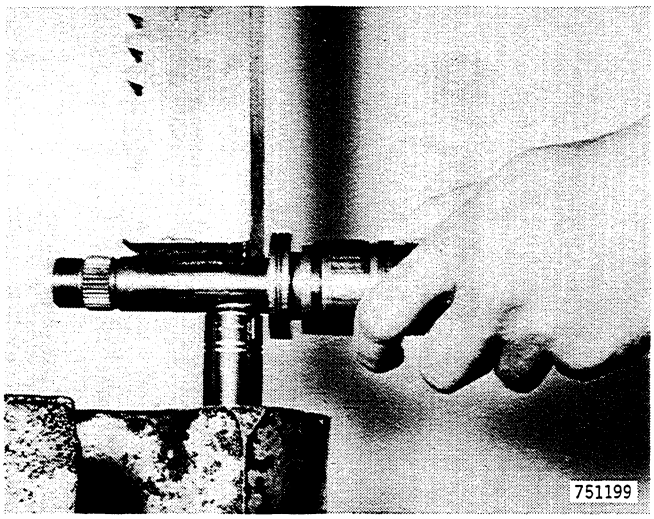


Figure 16

13. Coat cover O-ring with clean grease and place O-ring in groove in cover.

14. If the input shaft or cover were not replaced, the cover can be installed using the original shims. If a shim is damaged replace it with a new shim of equal thickness.

    a. Place shims on top of large O.D. thrust washer and install cover.

    b. Align mark on cover and valve body and install cap screws finger tight.

    c. Install a worm drive hose clamp around body pilot and cover.

    d. Tighten clamp to center cover on body and torque cap screws to 18-22 foot-pounds (24-30 N m). Then proceed to step 16.

15. If the input shaft or cover was replaced, the following procedure must be used to properly position the spool in the valve body.

    a. Place original shim pack on top of large O.D. thrust washer. If a shim is damaged replace it with one of equal thickness. Then install cover. If original cover is being used, align marks made during disassembly. Then install cap screws finger tight.

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POWER SHUTTLE OPERATION

General

The power shuttle is a torque converter driven forward/reverse transmission that allows the operator to change directions without bringing the machine to a complete stop. Shifts to change direction must be made at engine speeds below 1500 rpm (r/min) to prevent unnecessary damage to the power shuttle.

The power shuttle consists of a planetary gear set, multiple disc forward and reverse clutches, control valve, pump and the necessary internal passages and external fluid lines.

Refer to Figure 1. The cresent type pump pumps oil to the control valve and regulator valve built into the control valve. The regulator valve maintains system pressure. The oil not required for lubrication or clutch application flows from the control valve to the torque converter relief valve which maintains converter inlet pressure and diverts any excess oil to the shuttle oil pan. The front bearing is also lubricated by oil at converter pressure. Oil from the converter is directed to the oil cooler and back to the oil pan.

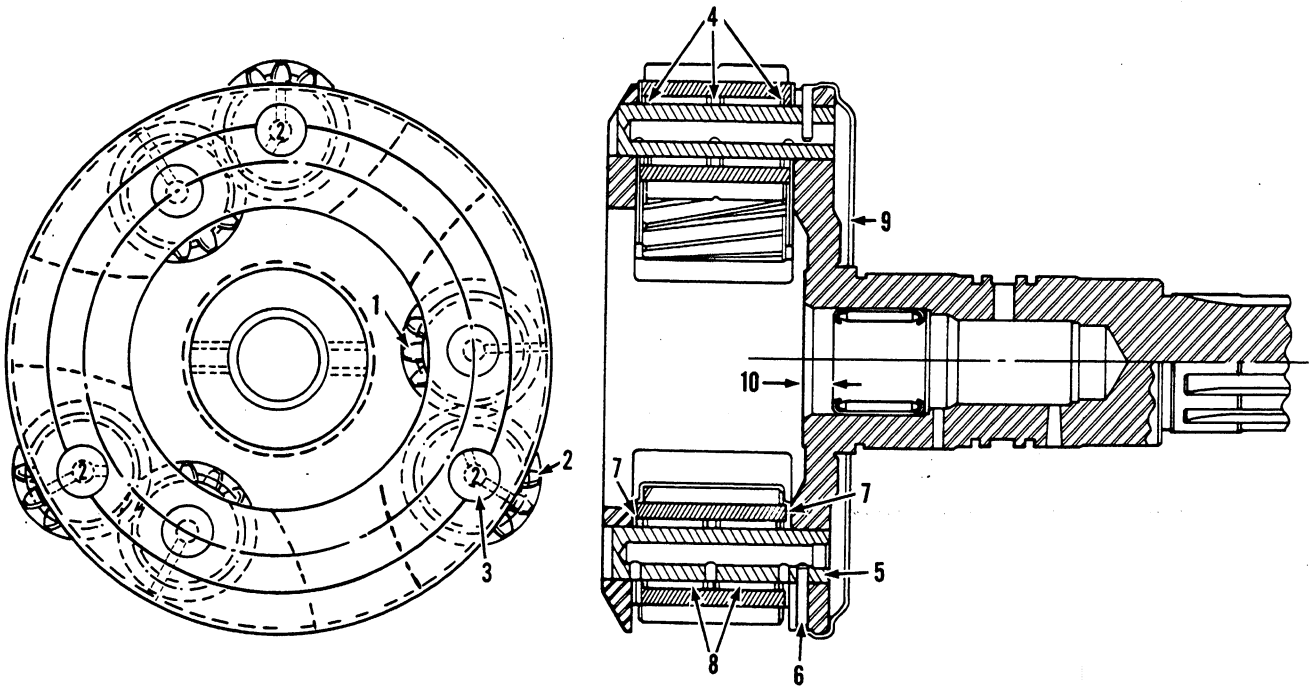
A solenoid controlled clutch cutout function is built into the control valve and is discussed on page 6202-8.

With the control valve in Neutral, Figure 1, oil flow from the pump is blocked at the control valve. Oil continues to flow to the torque converter and through lubrication passages in the shuttle case and input and output shafts.

TROUBLE SHOOTING CHART

NOTE: The following problems and possible causes are not listed in order of importance or occurence.

PROBLEM	POSSIBLE CAUSE	REMEDY
External oil leak	Adapter to shuttle case cap screws loose.	Remove shuttle. Check for damaged gasket and tighten cap screws.
	Oil line connections loose.	Tighten as required.
	Damaged or worn control valve O-ring.	Remove control valve and replace O-ring.
	Loose control valve cover or damaged gasket.	Replace cover gasket if necessary and tighten cover cap screws.
	Worn or damaged rear seal.	Replace seal.
	Loose bearing retainer cap screws or damaged gasket.	Replace gasket as required and tighten cap screws.
Low or no oil pressure	Damaged torque converter.	Replace converter.
	Regulator valve in control valve sticking.	Remove control valve, disassemble and check for cause.
	Broken or weak regulator valve spring.	Remove control valve, disassemble and repair as required.
	Low oil level.	Fill to proper level.
	Worn pump.	Remove shuttle and replace pump.
High oil pressure	Regulator valve in control valve sticking.	Remove control valve, disassemble and check for cause.
High oil temperature	Internally or externally plugged oil cooler.	Unplug oil cooler as required.
	Low oil level.	Fill to the proper level.
	Operating at converter stall.	Use clutch cutout. Refer to Operator's Manual.
Control lever does not remain in position position.	Control arm detent spring broken.	Replace spring.
	Control arm detent ball corroded and sticking.	Clean and lubricate ball, spring and bore in shuttle case.
High stall speed with tinny sound	Converter blades damaged.	Replace converter.



1. INNER PINION GEAR (PLAIN TEETH)
2. OUTER PINION GEAR (NOTCHED TEETH)
3. PINION SHAFTS STAMPED WITH NUMBER 2 MUST BE INSTALLED IN OUTER PINION GEARS
4. NEEDLE BEARING SPACER (3 PER PINION GEAR)
5. PINION SHAFT
6. PINION SHAFT RETAINING PIN
7. THRUST WASHER (2 PER PAIR OF PINION GEARS
8. NEEDLE BEARINGS (48 PER PINION GEAR)
9. OIL COLLECTOR RING
10. 5/16" (7.9 mm)

751637

Figure 15

24. With the clutch discs compressed, use a feeler gauge and measure the space between the pressure plate and top surface of the snap ring groove, Figure 35. Record this measurement.

25. Install the necessary select fit snap ring(s), Figure 36, to obtain a clearance of .011 to .046" (.279 to 1.17 mm). These snap rings have a free diameter of 5-11/16" (144.5 mm) and are color coded as follows; green, .050"-.054" (1.27-1.37 mm), orange, .074"-.078" (1.88-1.98 mm), and white, .096"-.100" (2.44-2.54 mm). The color code is not always easily visible, therefore, check ring thickness with micrometer as required. It is sometimes necessary to use two of the thinner snap rings to obtain the proper clearance.

Figure 36

26. Install Woodruff key in input shaft and lubricate bore of forward clutch hub with clean oil. Install hub on shaft with the open side away from gear on shaft. Press hub onto shaft until seated against gear.

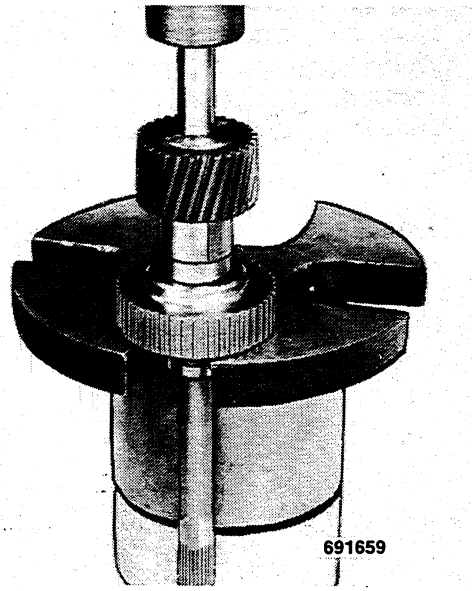


Figure 37

27. Install hub retaining snap ring, Figure 38.

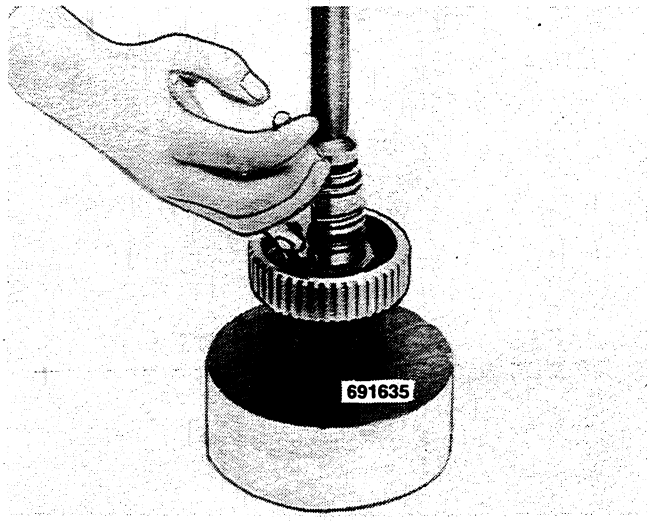
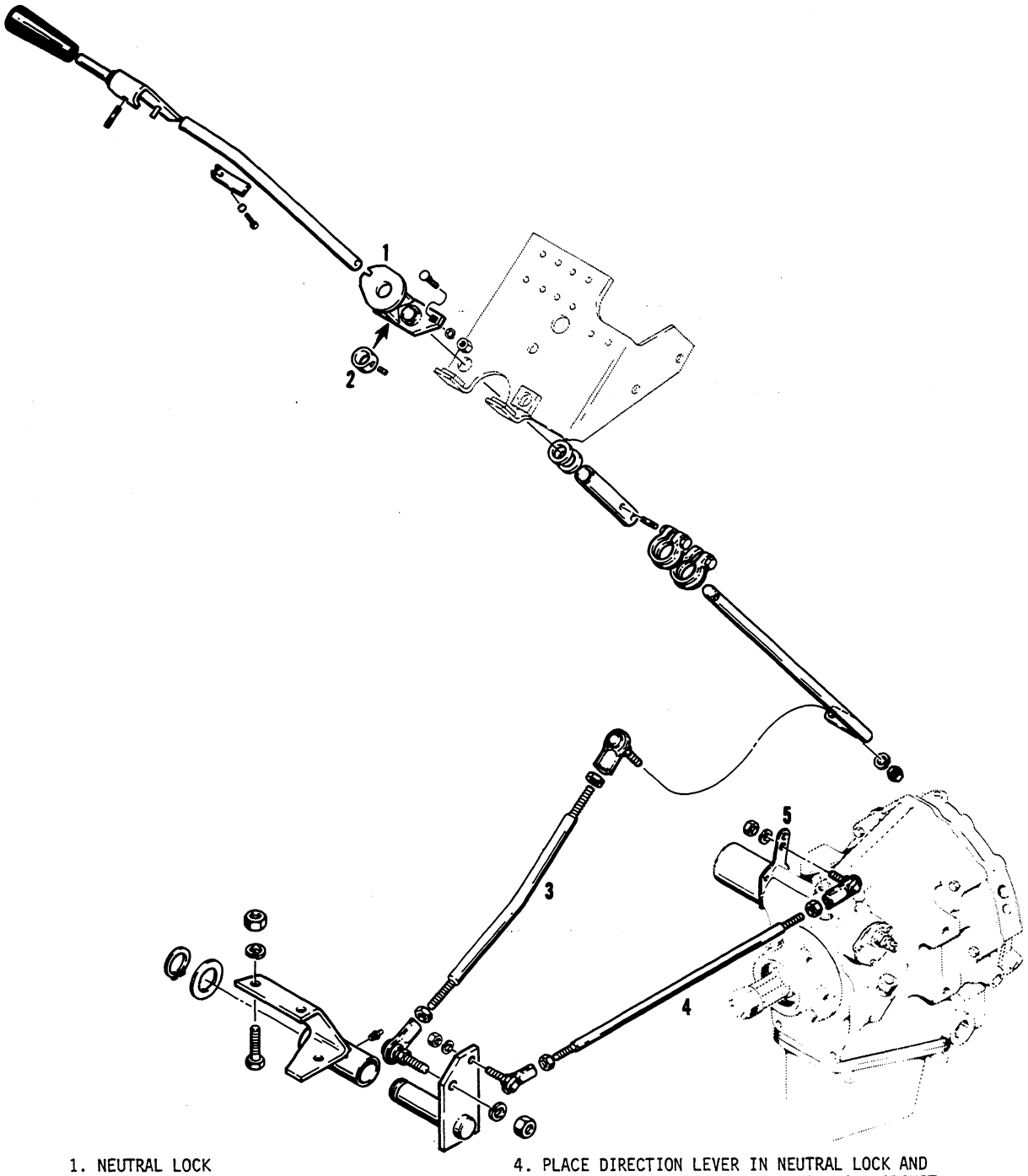


Figure 38

28. Install two new metal sealing rings in grooves in input shaft, Figure 39 and lock ends of rings together. Then in-



1. NEUTRAL LOCK
2. WHEN UPPER AND LOWER SHAFTS ARE ASSEMBLED, POSITION COLLAR TO OBTAIN 1/32"-3/32" (0.8 mm-2 mm) SHAFT FREE PLAY.
3. INSTALL BALL JOINTS ON ROD FINGER TIGHT. THEN POSITION BALL JOINTS AS SHOWN AND TIGHTEN LOCK NUTS.
4. PLACE DIRECTION LEVER IN NEUTRAL LOCK AND SHUTTLE CONTROL ARM IN NEUTRAL, AND ADJUST LENGTH OF ROD AS REQUIRED.
5. SHUTTLE CONTROL ARM.

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Figure 1 - Power Shuttle Control Installation

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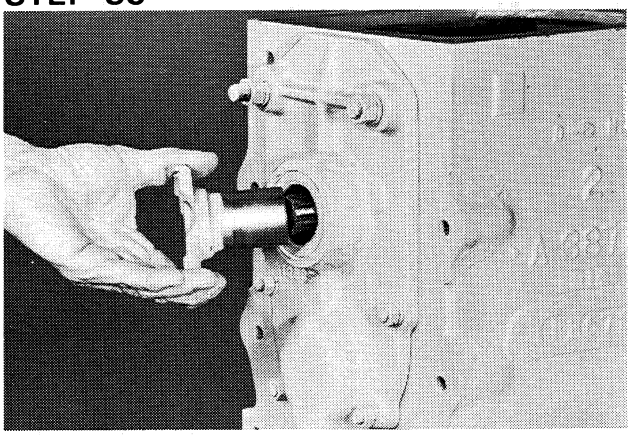
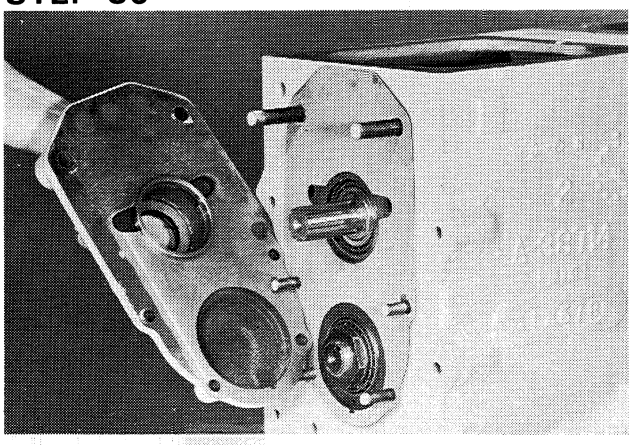
STEP 35



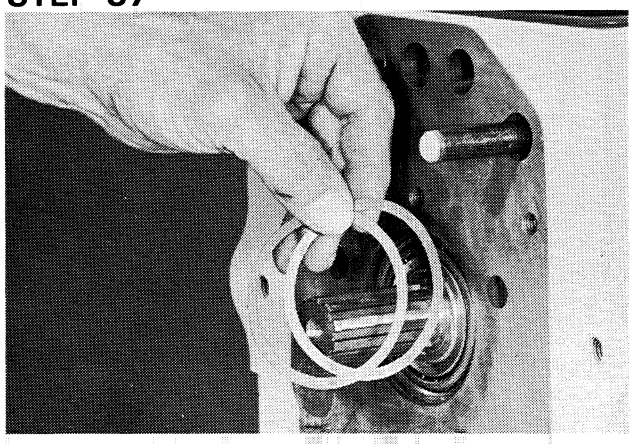
Remove the mainshaft yoke.

STEP 36



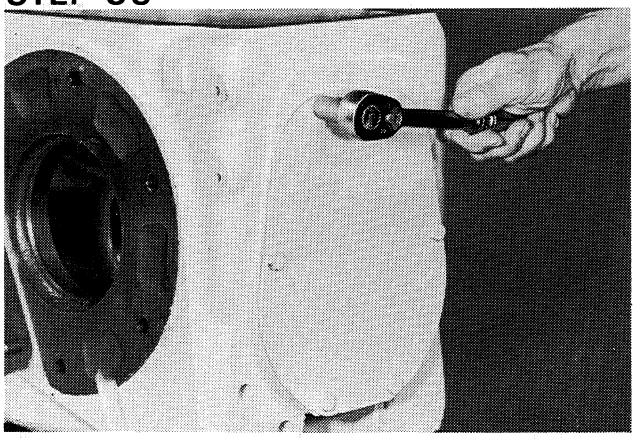
Remove the transaxle front cover.

STEP 37



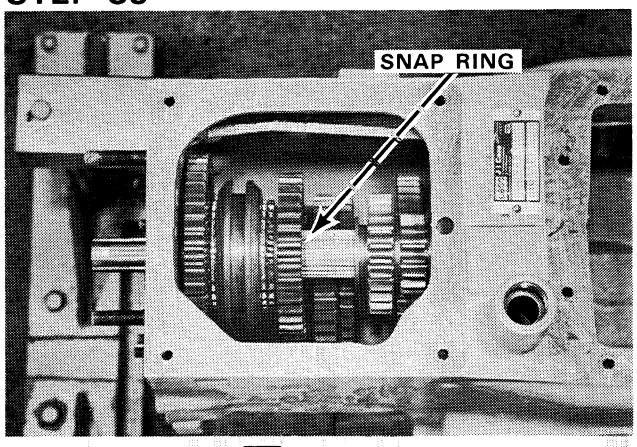
Remove the mainshaft front bearing shim pack. *IMPORTANT:* Retain the shim pack for later installation procedure.

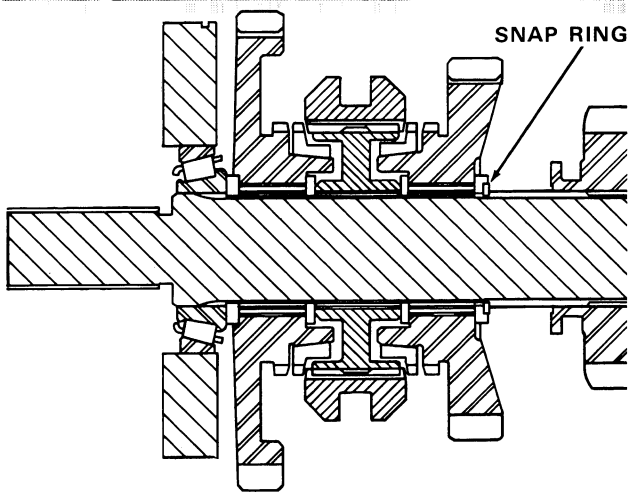
STEP 38



Remove the transaxle rear cover.

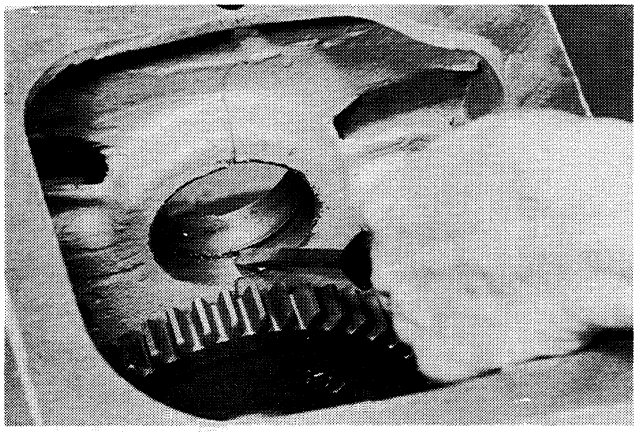
STEP 39





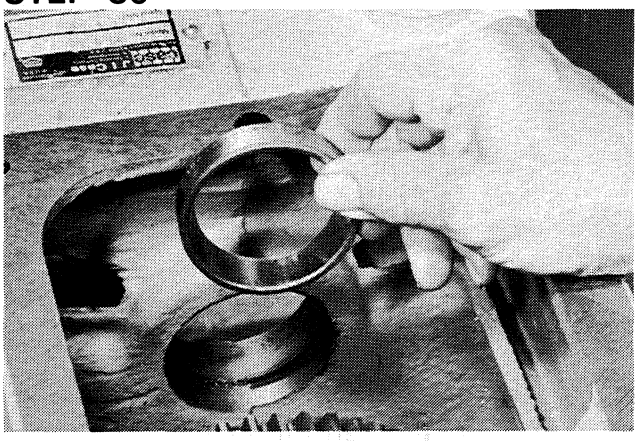
Before the mainshaft and gears can be removed, the front bearing cup and cone must be unseated. Unseating of bearing will allow access to the captive snap ring. This snap ring must be partially removed before the mainshaft can be removed.

STEP 79



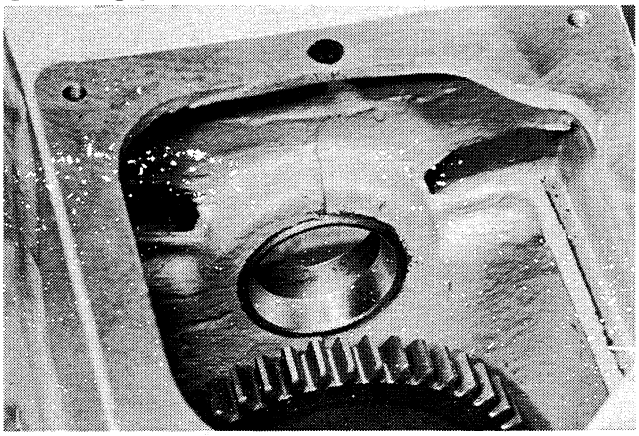
Install rear mainshaft bearing cup snap ring in case groove.

STEP 80



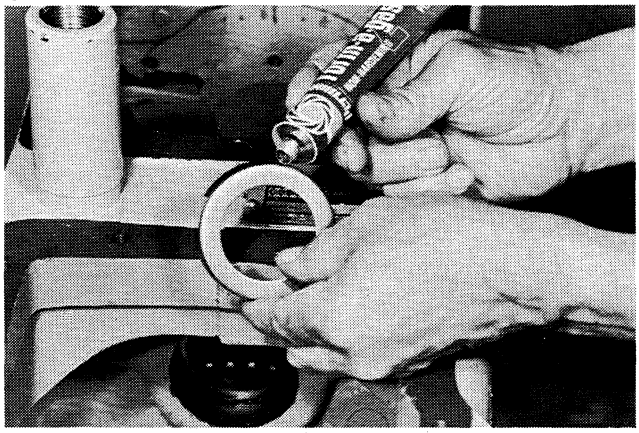
Install rear bearing cup (small I.D. rearward) into case until cup seats against the snap ring.

STEP 81



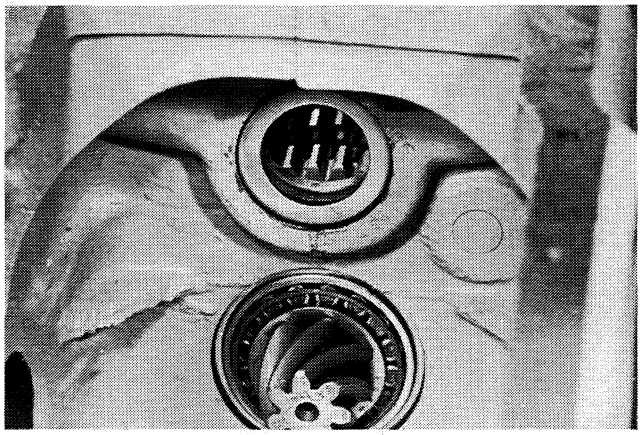
Rear bearing cup installed in transaxle case.

STEP 82



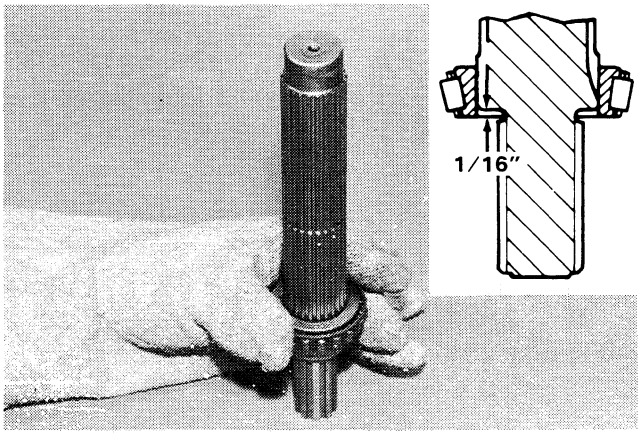
Apply #2 Permatex to the outside surface of the rear bearing oil cup.

STEP 83



Align oiling cup notches with case openings and press cup into case until it is flush with case.

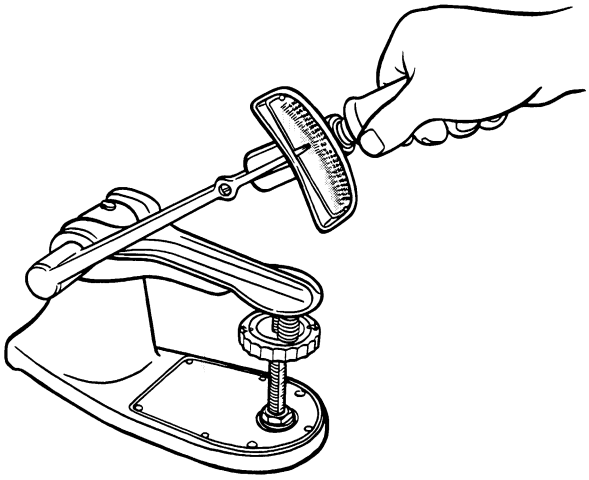
STEP 84



Heat front bearing cone and install on mainshaft so that it extends 1/16" passed step on shaft end.

Assembly

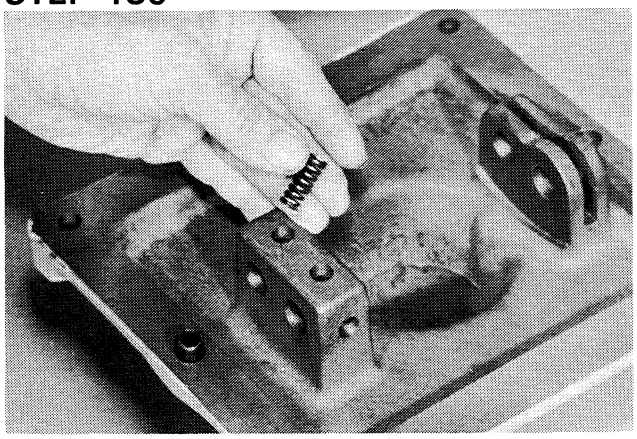
STEP 129



Inspect the detent springs. springs must meet the following specifications:

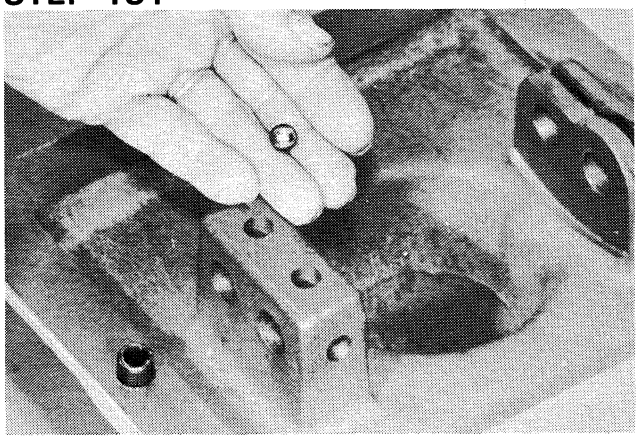
Free length ..... Optional
O.D. ..... Work in .390" bore
Compress to .812" ..... 28 to 45 lbs.
Wire dia. ..... .072"

STEP 130



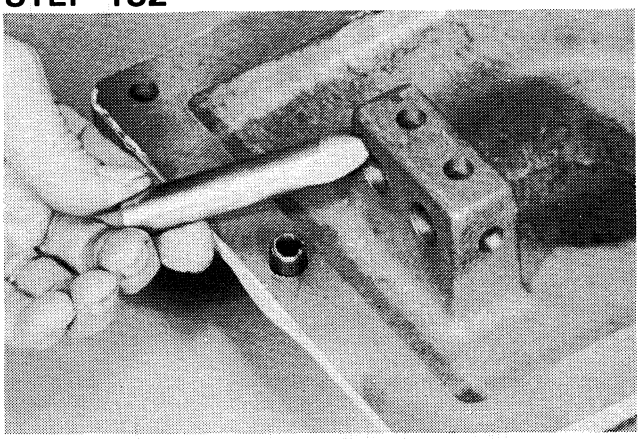
Install detent spring in 1st and 2nd housing bore.

STEP 131



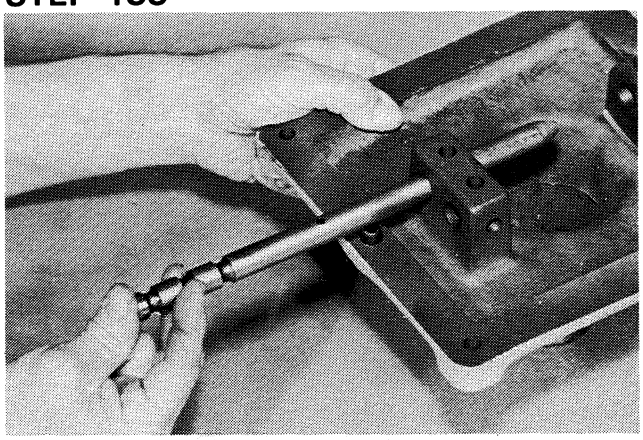
Install steel detent ball in cover on top of spring.

STEP 132



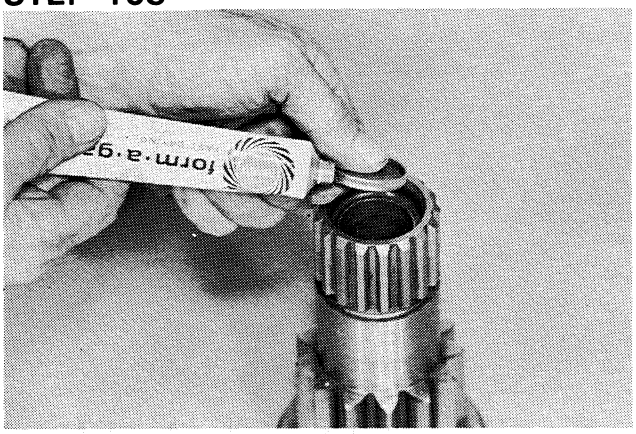
Install pilot sleeve to compress detent spring and ball. Refer to Page 5 for sleeve specifications.

STEP 133



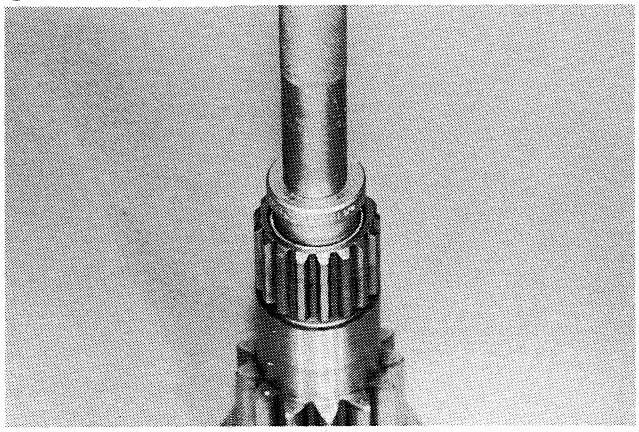
Install 1st and 2nd shift rail (rail with 5/8" lands between detent slots) part way into cover.

STEP 168



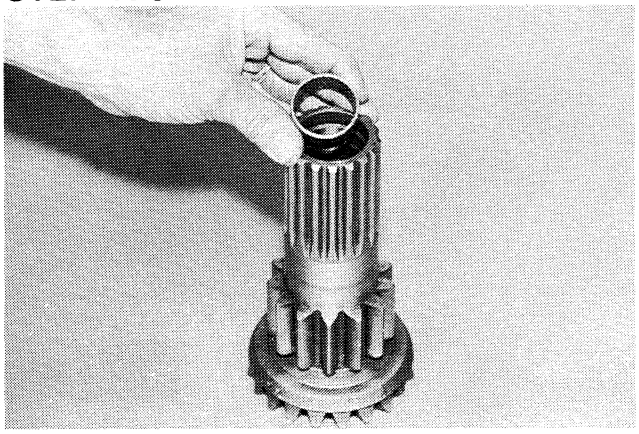
Apply #1 Permatex to the O.D. of a new cup plug.

STEP 169



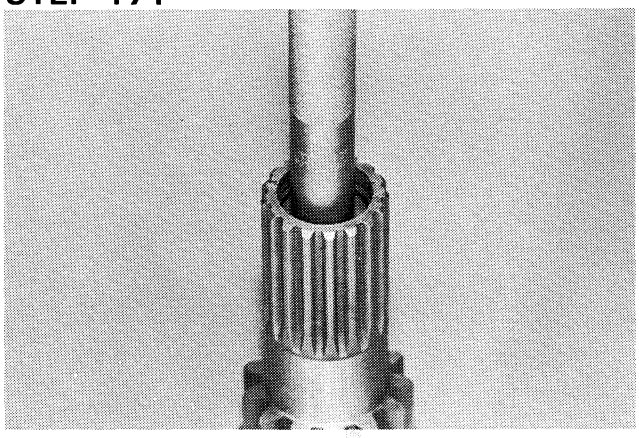
Drive cup plug into L.H. side gear until it bottoms in gear bore.

STEP 170



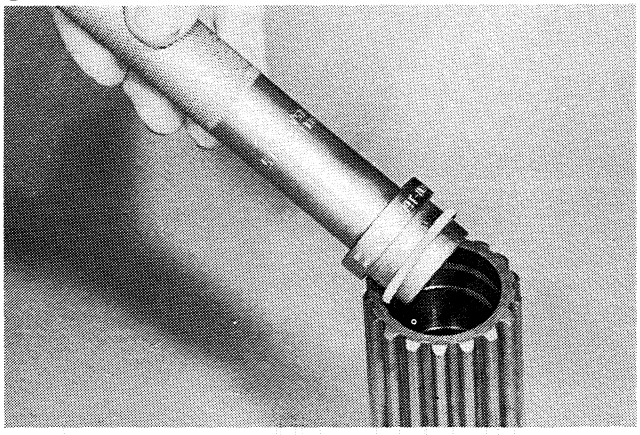
Place new bushing in R.H. side gear.

STEP 171



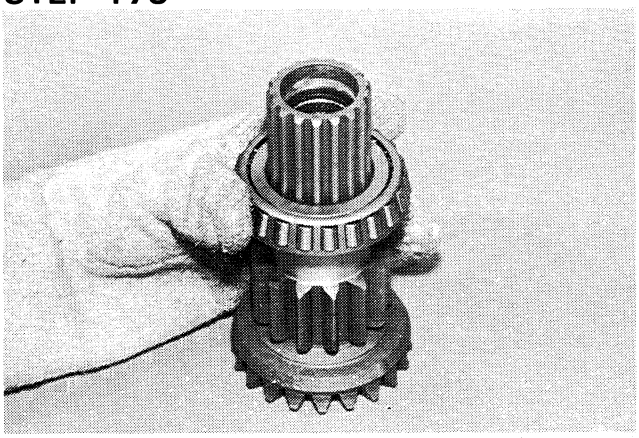
Press bushing in until the outer edge is even with the shoulder or step in the side gear.

STEP 172



Using A44602 oil seal driver, press new seal (lip inward) until it bottoms on gear shoulder.

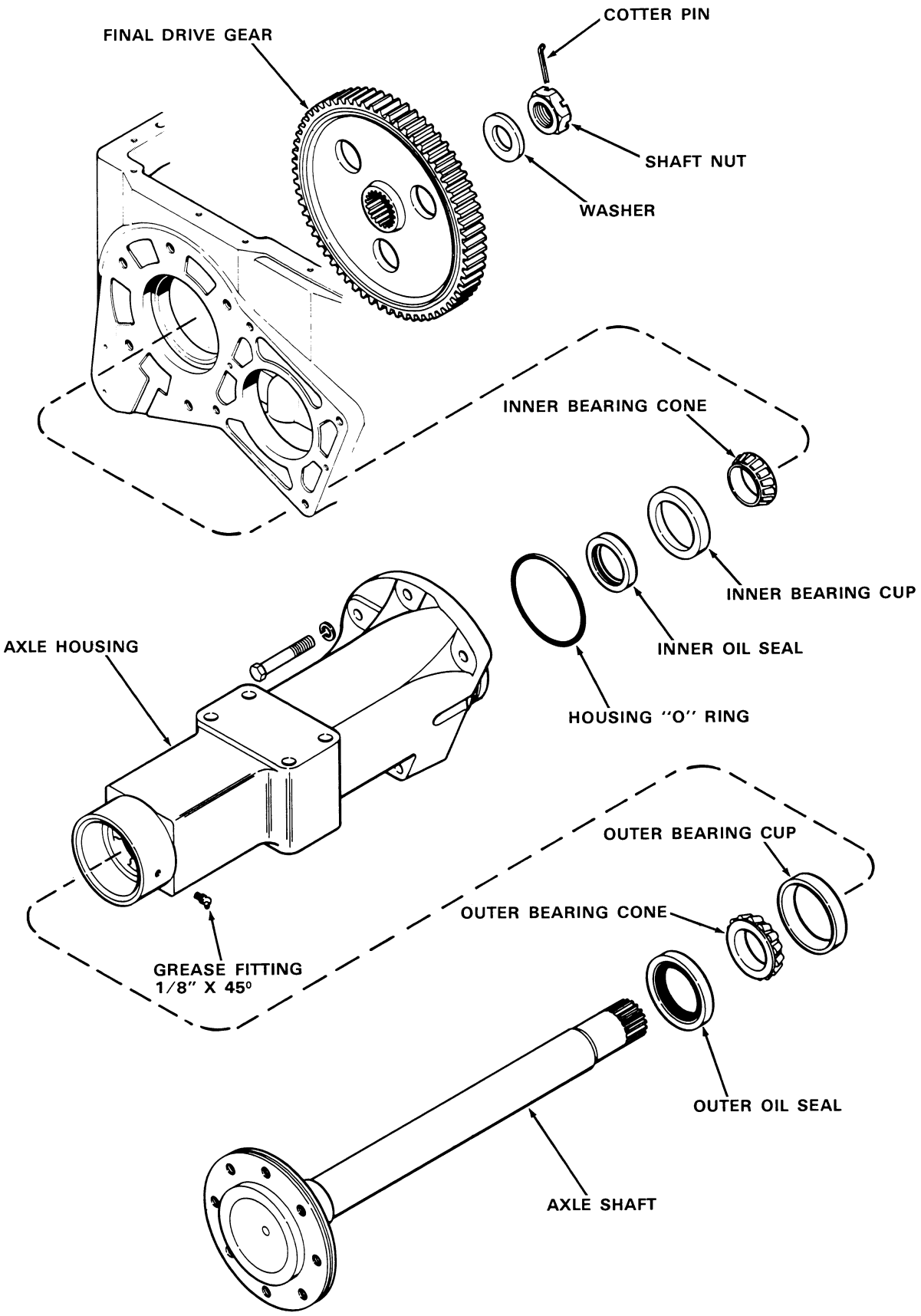
STEP 173



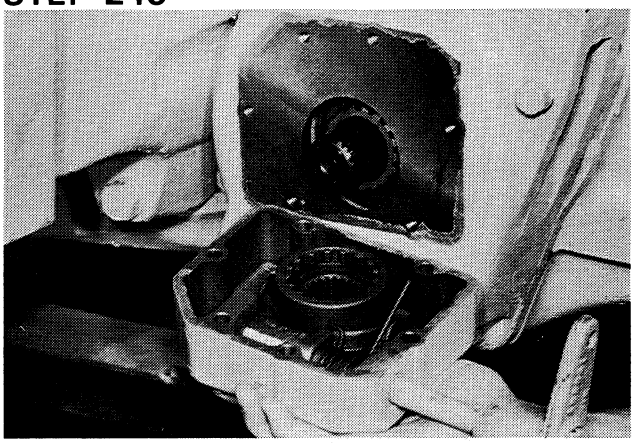
Heat bearings and install on R.H. and L.H. side gears until they bottom on the spur gear.

CAUTION *Always wear asbestos gloves to prevent burning your hands when handling heated parts.*

Axle Shaft and Housing Installation

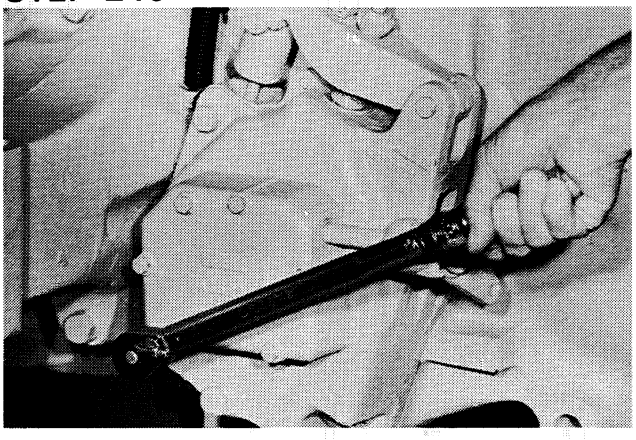


STEP 245



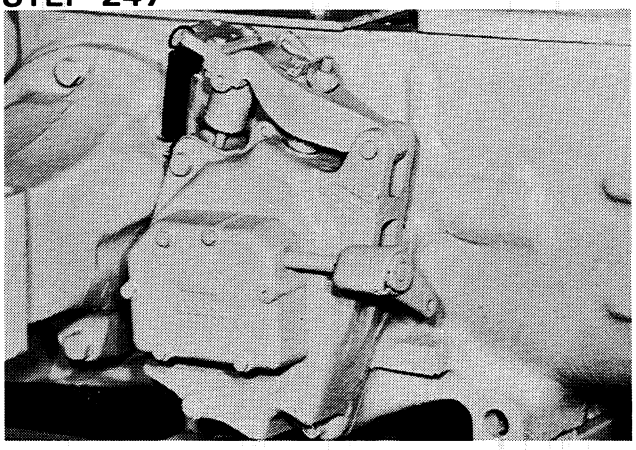
Install differential lock on R.H. brake housing, engaging actuating collar splines with differential cross shaft splines.

STEP 246



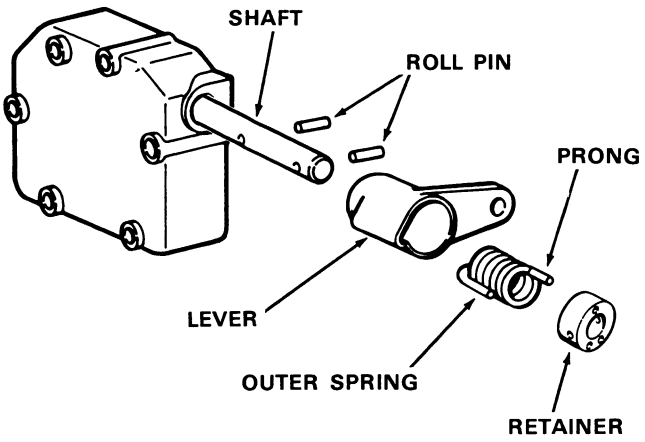
Install cover retaining bolts and torque bolts 17 to 21 ft. lbs.

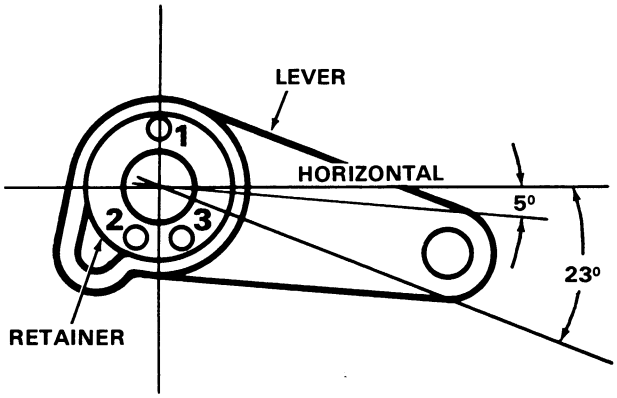
STEP 247



Differential lock assembly installed on R.H. brake housing.

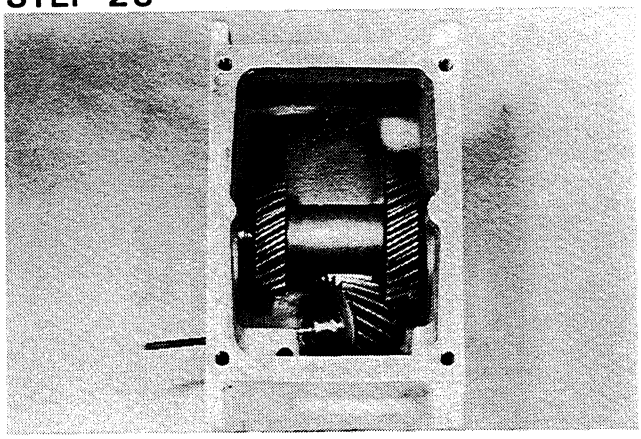
STEP 248





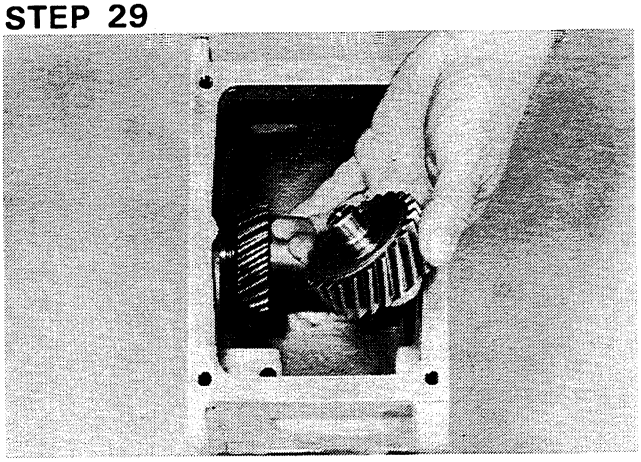
With the outer spring prong in No. 1 hole of spring retainer, move lever upwards to remove all slack from lever. The lever should fall into the below horizontal 5° to 23° tolerance that the diff. lock requires. If not, the retainer is to be removed and turned 180° so holes 2 and 3 are at the top. The spring is then to be used with holes 2 or 3 to achieve the 5° to 23° below horizontal tolerance.

STEP 28



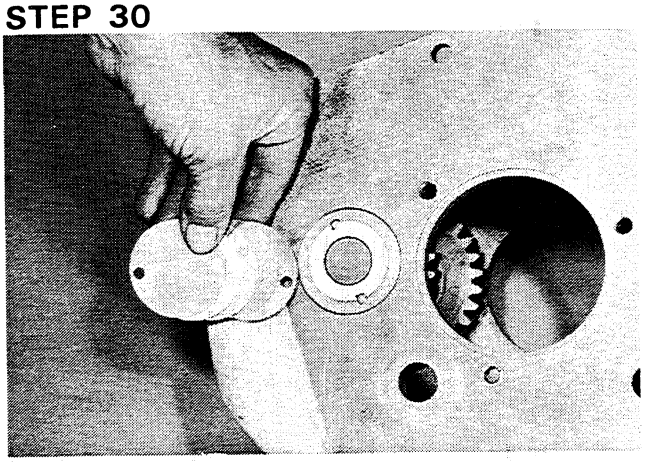
Synchronizer, shuttle gear and output shaft removed from shuttle box.

STEP 29



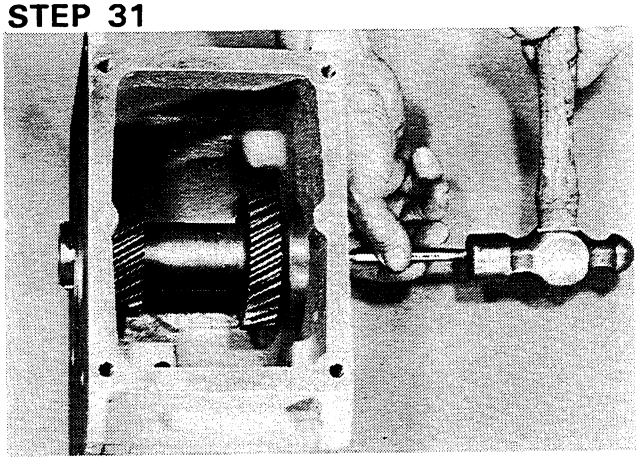
Remove threaded rod from idler shaft and lift out shaft.

STEP 30



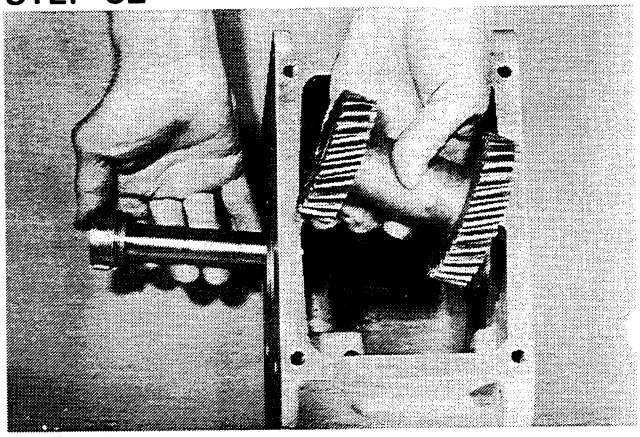
Remove the countershaft collar shims.

STEP 31



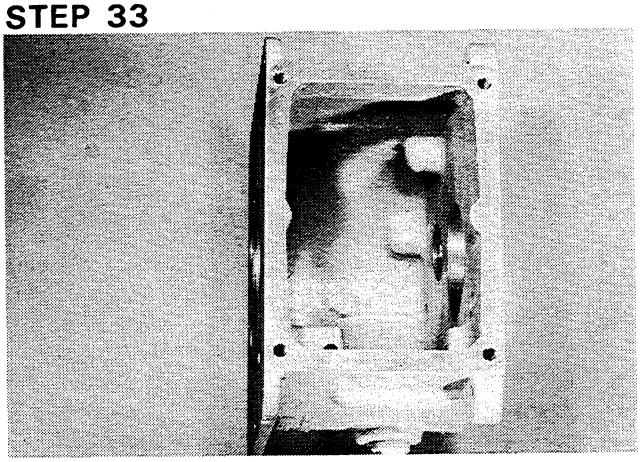
Drive the countershaft from shuttle box.

STEP 32



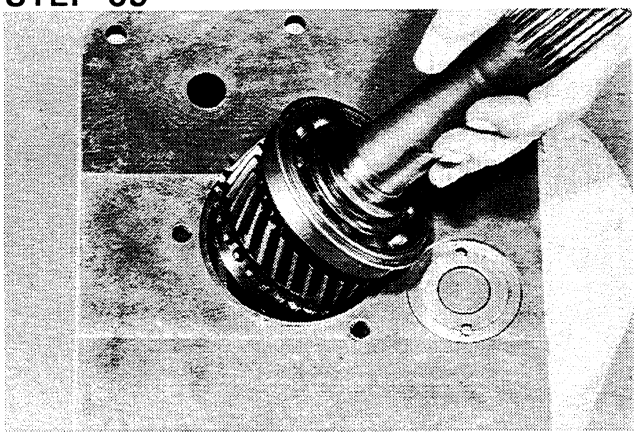
Remove countershaft gear cluster.

STEP 33



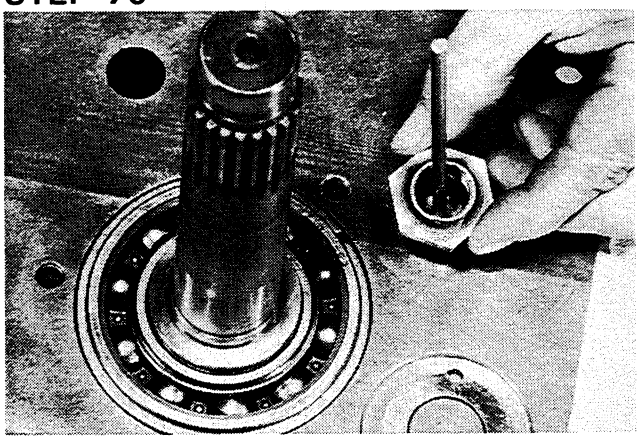
Shuttle box completely disassembled.

STEP 69



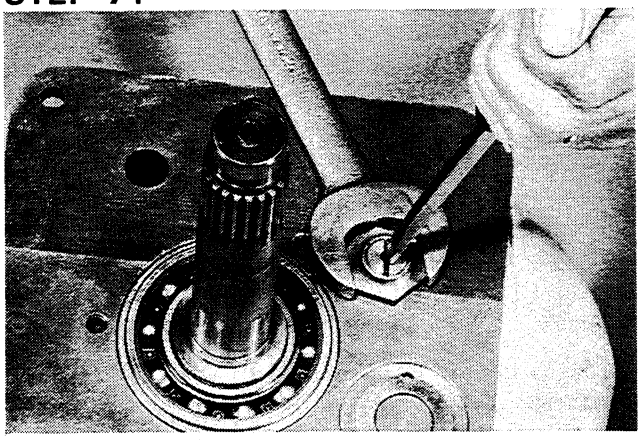
Install input shaft in shuttle housing opening.

STEP 70



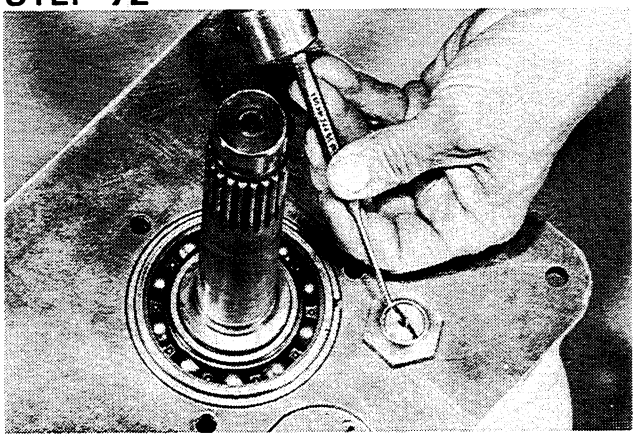
Raise and pull reverse idler gear and shaft into position. Install shaft retaining locknut.

STEP 71



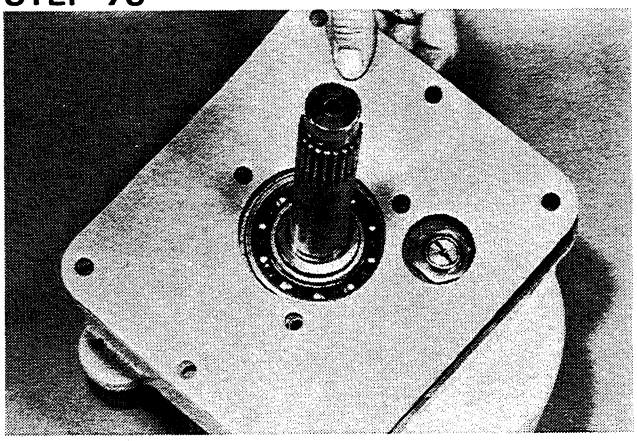
Remove threaded rod and tighten locknut securely.

STEP 72



Stake the thin portion of locknut into shaft slot.

STEP 73

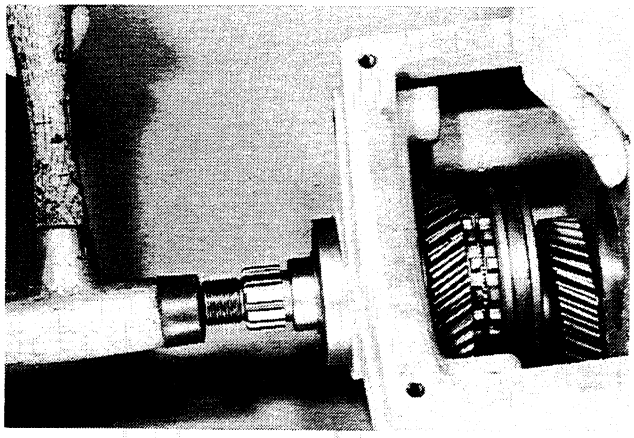


Install a new housing gasket.

STEP 74

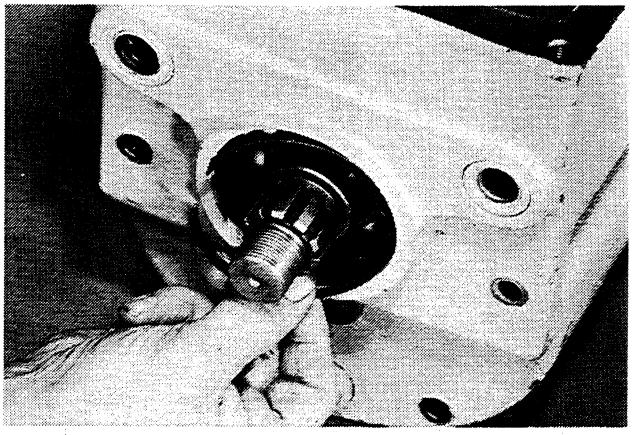
Press a new oil seal in clutch throwout spindle until it bottoms.

STEP 113



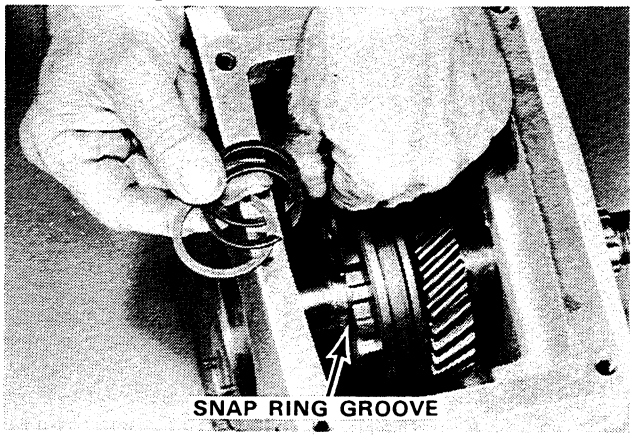
Drive output shaft into housing bore until bearing makes contact with inner retainer snap ring.

STEP 114



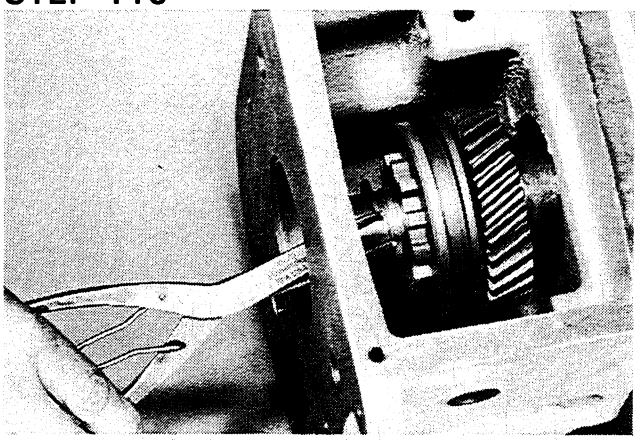
Install outer bearing retainer snap ring in housing groove.

STEP 115



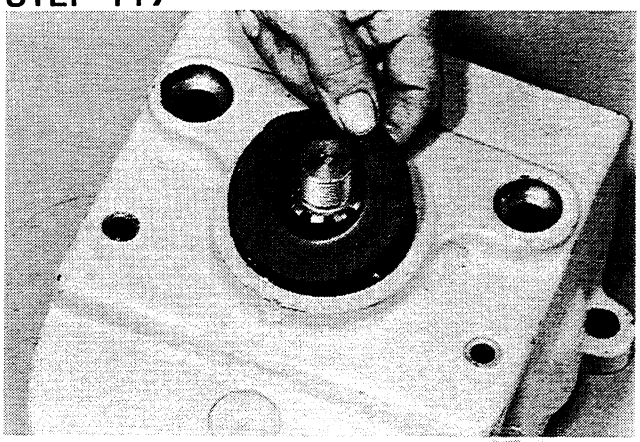
Select a snap ring that will provide a minimum amount of gear backlash. *NOTE:* Snap rings are provided in .076", .080", .083", .087" .091" thicknesses.

STEP 116



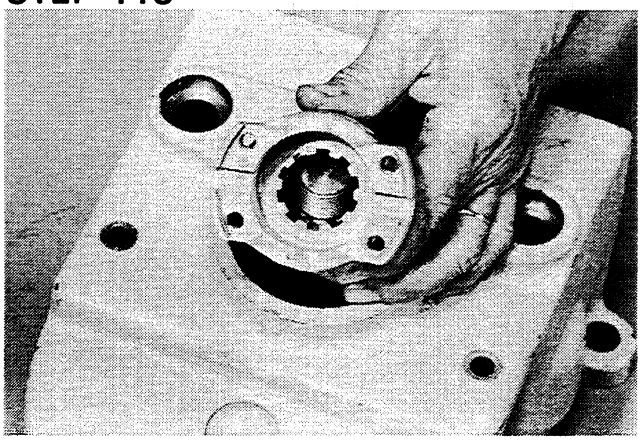
Install selected snap ring, Step 114, on range output shaft.

STEP 117

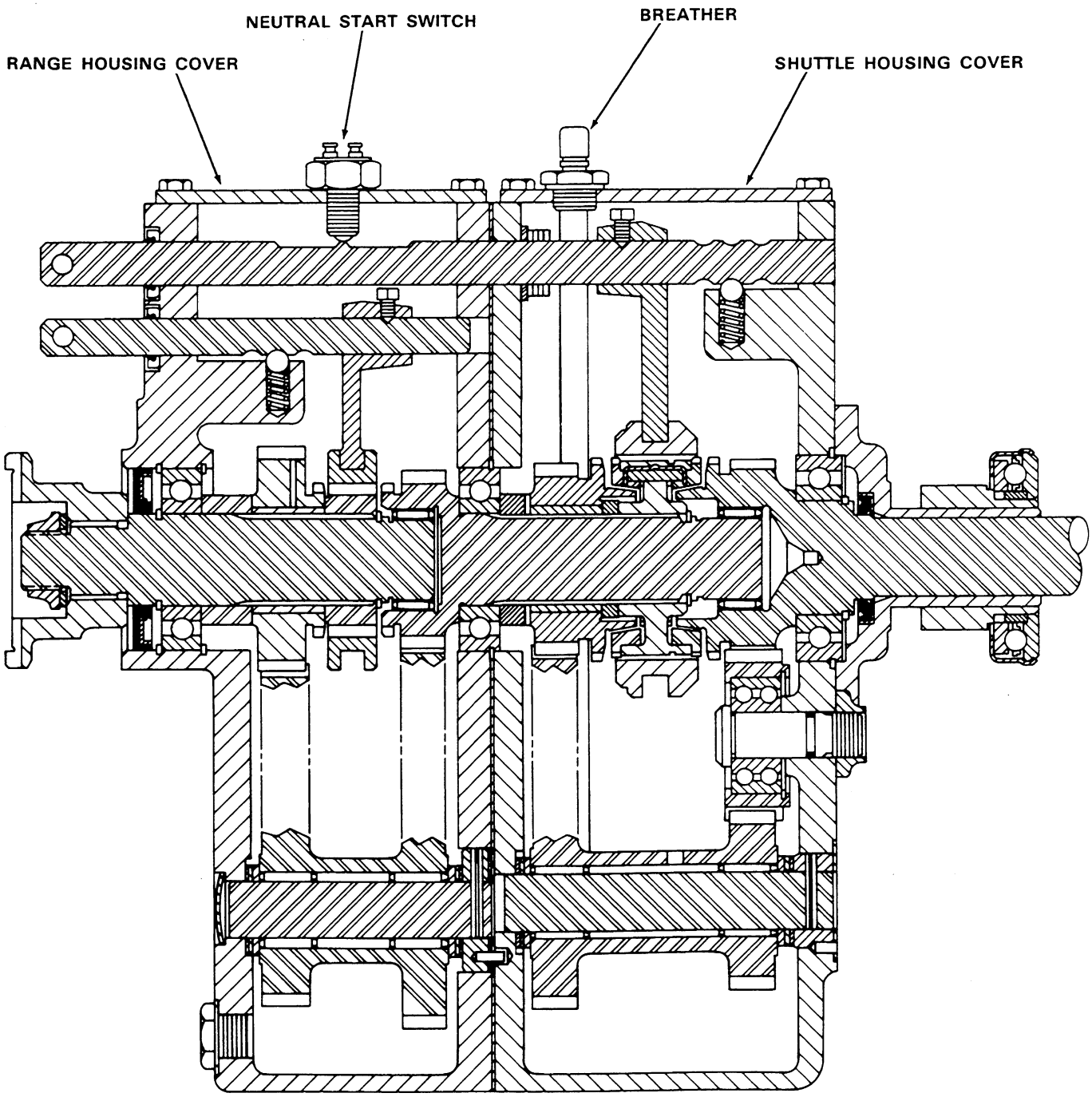


Press a new seal assembly in housing bore, until seal face is .190" below housing face.

STEP 118



Install range output shaft yoke. *NOTE:* Coat yoke O.D. sealing surface with clean TCH oil.



NOTE: The CASE CORPORATION reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

4. Remove air from the brake system at the vent screw on each hydraulic brake cylinder on the transaxle. See Removing Air From the Brake System in this section.

5. If the brakes on the transaxle have been disassembled and assembled, loosen the ratchet-type adjusting nut on both hydraulic brake cylinders. Then push the brake pedals down slowly to adjust the brakes. Release the brake pedals. Do this procedure until the ratchet-type adjusting nuts stop turning.

6. Push the brake pedals down with a foot on each brake pedal. Use equal pressure to hold the brake pedals in position. Have a second person check to see if the brake pedals are within 1/4 inch (6 mm) of being even with each other. Shorten the master cylinder push rod of the high brake pedal as required.

7. Push both brake pedals down with a foot on each brake pedal. Neither brake pedal must come closer than 1 inch (25 mm) to the floor plate. If a brake pedal comes closer than 1 inch (25 mm), start the engine and move the machine forward about 15 feet (4.5 m) with some pressure on each brake pedal. Then move the machine in reverse approximately the same distance. Do this three times in both directions. Then push the brake pedals down as many times as needed until the ratchet- type adjusting nuts on the hydraulic brake cylinders on the transaxle stop turning.

REMOVING AIR FROM THE BRAKE SYSTEM

When the brake lines have been disconnected and reconnected, air must be removed from the brake system. Use a pressurized brake fluid tank to remove the air. A vent screw is located on the front of each hydraulic brake cylinder on the transaxle.

1. Make the pressurized brake fluid tank ready for use according to the manufacturer's instructions.

2. Connect the line from the pressurized brake fluid tank to the filler opening on the right-hand master cylinder. Open the valve on the pressurized brake fluid tank.

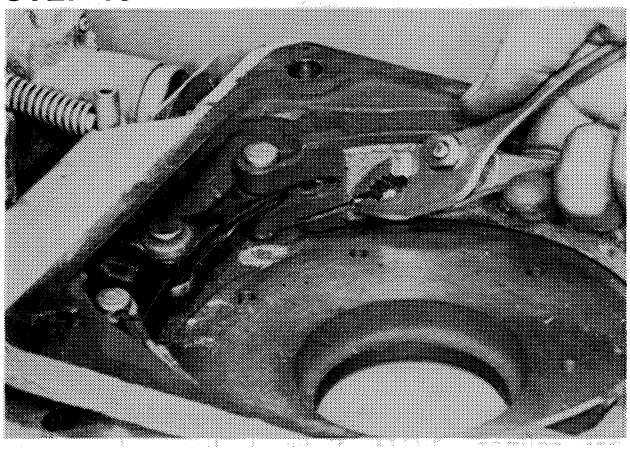
3. Loosen the vent screw on the hydraulic brake cylinder on the right side of the transaxle. Look for air bubbles in the brake fluid that flows from the vent screw. When the brake fluid is clear and there are no air bubbles, close the vent screw.

4. Close the valve on the pressurized brake fluid tank. Disconnect the pressurized brake fluid tank from the right-hand master cylinder.

5. To remove air from the brake system for the left-hand wheel, connect the pressurized brake fluid tank to the left-hand master cylinder. Do steps 3 and 4. Use the vent screw on the hydraulic brake cylinder on the left side of the transaxle.

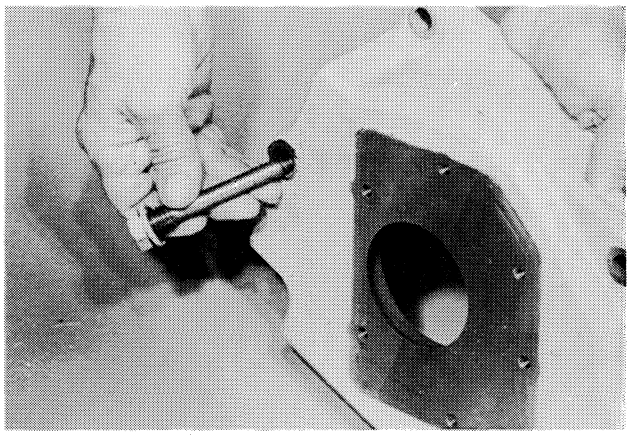
Brake Lining Removal

STEP 18



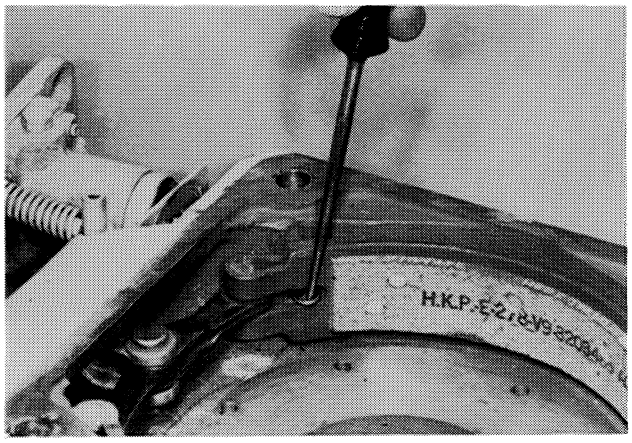
Remove cotter pins securing band and link clevis pins.

STEP 19



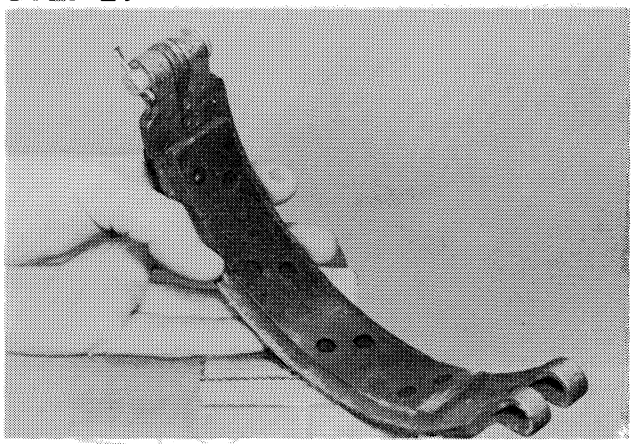
Remove brake band anchor bolt.

STEP 20



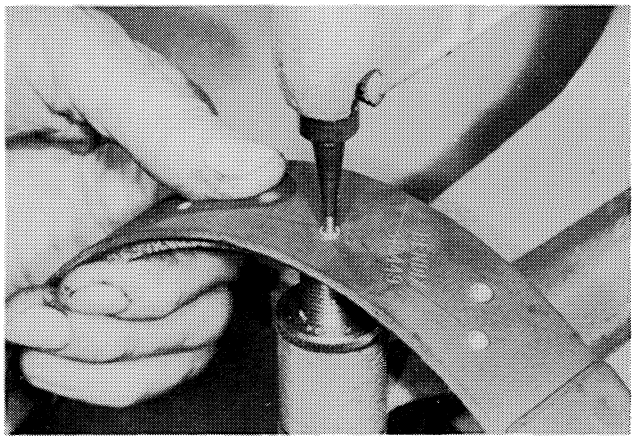
Unhook band return springs and remove bands from brake housing.

STEP 21



Visually check bands and linings for excessive wear, warpage, loose linings or oil saturation. If warpage is evident, replace the complete band and lining.

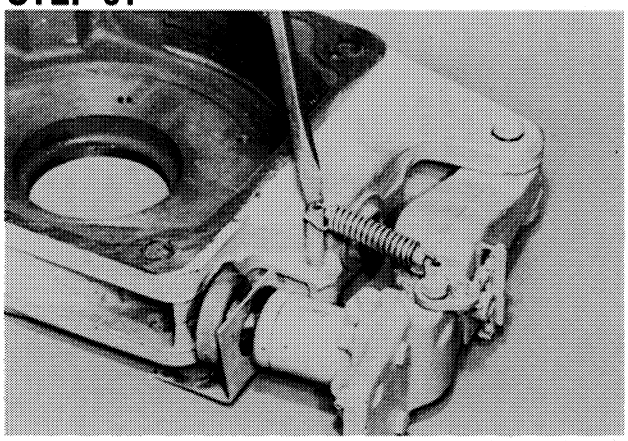
STEP 22



Put the brake band on CAS 10520 Brake Rivet Tool. Push the rivets out of the lining.

IMPORTANT: *You must use the correct punch and the thick end of the adjusting sleeve to push the rivets out of the brake lining.*

STEP 61

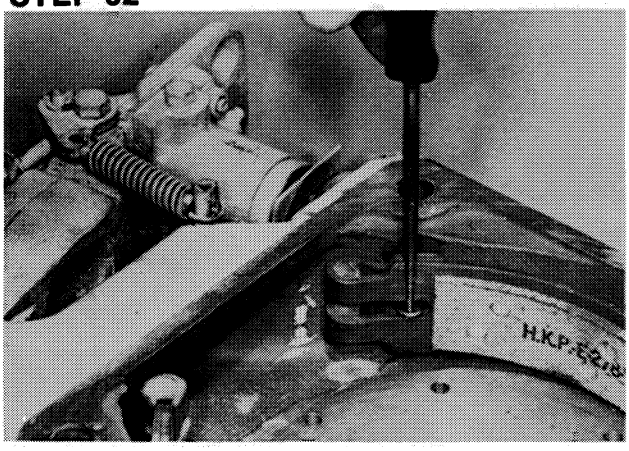


Install cam return spring and rod.

Cam return spring specifications:

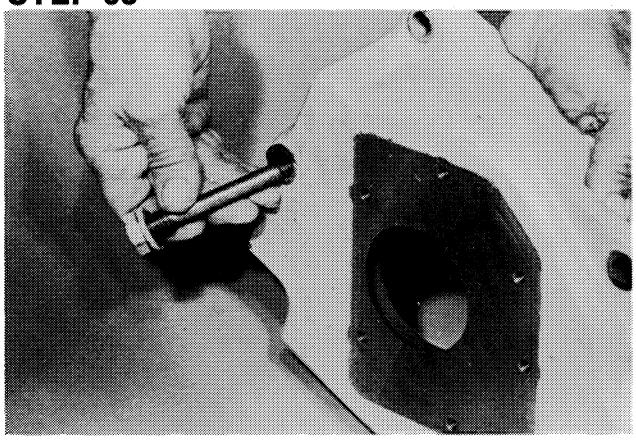
Free length	2.09"
O.D.	.54"
Wire dia.	.086"
No. of coils	15-3/4
Extend to 2.34"	14 lbs.

STEP 62



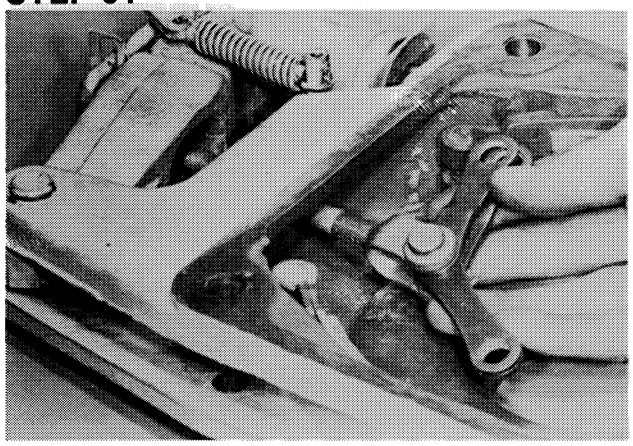
Place brake bands in housing and attach band retractor springs to the band ears.

STEP 63



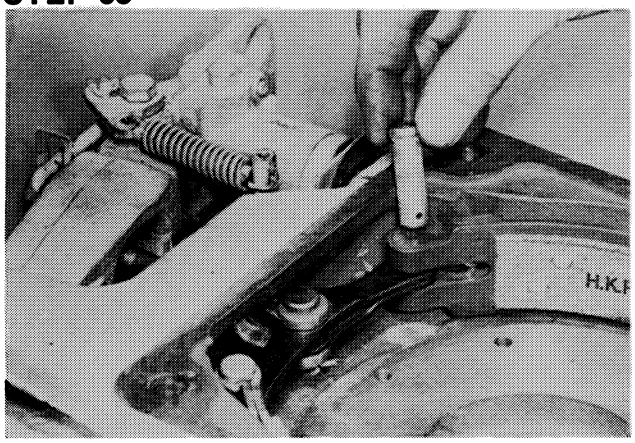
Align pivot ends of bands and install anchor bolt.

STEP 64



Install actuating rod with inner and outer band links attached to rod.

STEP 65



Align bands with attaching links and install retaining clevis pins.

PROBLEM	POSSIBLE CAUSE	REMEDY
Low or Unsteady Charging Rate	All of reasons under Alternator Fails to Charge.	
Excessive Charging Rate. Lights Burning Out	Improper or loose connections on alternator and regulator.	Check for proper connections and tighten if necessary.
	Faulty regulator.	Refer to Alternator and Voltage Regulator Testing in Section 8007.
Batteries Require Too Frequent Filling	Faulty regulator permitting excessive charging rate.	Refer to Alternator and Voltage Regulator Testing in Section 8007.
Noisy Alternator	Defective or badly worn belts.	Replace belts.
	Misaligned or defective pulleys.	Align fan and alternator pulleys.
	Loose pulley.	Check for sheared key or worn keyway, if used. Tighten pulley nut.
	Worn bearings.	Replace bearings.
	Shorted rectifier diodes.	Refer to Component Tests in Section 8007.
Continuity Test Shows No Voltage Through Wire Harness	Harness plugs not fully engaged.	Make sure plugs are fully engaged.
	One or more studs on plug broken.	Replace harness.
	Incorrect wiring.	Check wiring diagram, Section 8003.
	Open or shorted wire in harness.	Replace harness.

THIS PAGE FOLDS OUT

The information on this page applies only to Figure 2.

WIRING COLOR KEY

1. Red
2. Yellow-White
3. Yellow
4. Purple
5. Light Green
6. White
7. Yellow-Black
8. Purple-Red
9. Pink
10. Gray
11. Orange
12. Black
13. Red-Black
14. White-Orange
15. Purple-White
16. Light Blue
17. Blue

COMPONENTS

A. Illumination Light
B. R.H. Turn Signal, Refer to Figure 4 or 5
C. Not Used
D. Hyd. Oil Filter Warning Light
E. Air Cleaner Warning Light
F. Alt. Warning Light
G. Eng. Oil Pressure Warning Light
H. L.H. Turn Signal, Refer to Figure 4 or 5
I. Trans. Oil Temp.
J. Voltmeter
K. Eng. Water Temp.
L. Fuel Level Gauge
M. Battery
N. Turn Signal Switch, Refer to Figure 4 or 5
O. Turn Signal and 4 Way Flasher, Refer to Figure 4 or 5
P. Horn Button, See Section 8015
Q. Connects to Inst. Cluster
R. Key Switch
S. Connects to Key Switch
T. Starter Button
U. Clutch Cutout Control
V. Light Switch
W. Flood Light Switch
X. Flasher Switch
Y. Rotating Beacon Switch
Z. Air Filter and Hydraulic Oil Filter Restriction Warning Light Check Switch

AA. Flood Light, Turn Signal & Brake Light 15 Amp Circuit Breaker, Refer to Figure 4 or 5
BB. Clutch Cutout and Return-to-Dig 10 Amp Circuit Breaker
CC. Backup Alarm & Lights 15 Amp Circuit Breaker, Refer to Figure 4 or 5 & Section 8015
DD. Heater and Defroster 15 Amp Circuit Breaker, Refer to Section 8015
EE. Wipers and Rotating Beacon 15 Amp Circuit Breaker, Refer to Figure 4 or Section 8015
FF. Horn and Rotating Beacon 15 Amp Circuit Breaker, Refer to Section 8015
GG. Relay Powers Circuits Controlled by Circuit Breakers DD, EE and FF
HH. Relay Powers Circuits Controlled by Circuit Breakers AA, BB and CC
II. Instrument Cluster
JJ. Return-to-Dig Circuit Diode
KK. Neutral Start Switch
LL. Trans. Temp. Sender
MM. Clutch Cutout Circuit Diode
NN. Connects to Trans. Clutch Cutout Solenoid
OO. Connects Upper and Lower Power Shuttle Harness Together
PP. Warning Switch Circuit Diode (Air Filter Restriction Indicator)
QQ. Warning Switch Circuit Diode (Hydraulic Oil Filter Restriction Indicator)
RR. Brake Pedal Actuated Clutch Cutout Switch
SS. Floor Mounted Clutch Cutout Switch
TT. Connects to Light Harness, Refer to Figure 4 or 5 or Section 8015
UU. Engine Oil Pressure Sender
VV. Connects from Engine Harness to Main Harness
WW. 40 Amp Circuit Breaker
XX. Hydraulic Oil Filter Restriction Indicator Switch
YY. Fuel Level Sender
ZZ. Return-to-Dig Switch

AAA. Starter
BBB. Engine Water Temp. Sender
CCC. Air Filter Restriction Indicator Switch
DDD. Alternator
EEE. Connects to Bucket Spool Detent

TABLE OF CONTENTS

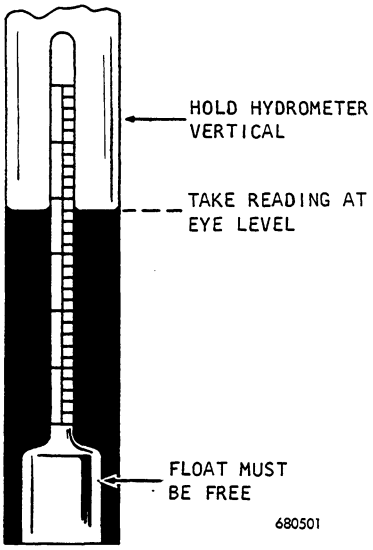


Figure 2 - Checking Specific Gravity

3. Repeat steps 1 and 2 for the remaining cells.

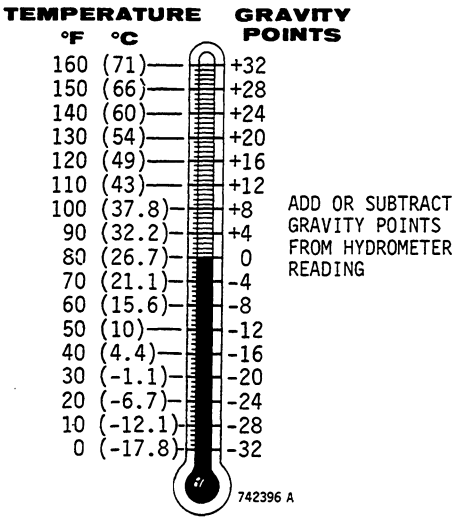


Figure 3 - Temperature Compensation

Interpretation Of Hydrometer Readings

1. The state of charge can be determined by comparing readings to the Specific Gravity Table.

2. If all cells read between 1.200 and 1.260 and the variation between the high and low cell is less than 30 gravity points, the battery is good. It may be necessary to charge the battery prior to putting the battery in service.

3. If all cells read between 1.200 and 1.260 and the variation between the high and low cell is 30 gravity points or more, fully charge battery and recheck specific gravity. If the variation is still 30 gravity points or more after charging, the battery is defective and must be replaced.

State of charge	Specific gravity, 80° F. (26.7° C)	Electrolyte freezes approx.
100%	1.260	-75° F. (-59° C)
75%	1.230	-38° F. (-39° C)
50%	1.200	-17° F. (-26° C)
25%	1.170	1° F. (-17° C)
Discharged	1.110	19° F. (-7.2°C)

750165

Figure 4 - Specific Gravity Table

Capacity (Load) Test

The capacity of a battery is the battery's ability to furnish current and maintain a minimum necessary voltage. If a battery passes the Capacity Test, it is in satisfactory condition. It may, however, need charging to bring it to peak performance.

Test Conditions

The test should not be performed if the electrolyte temperature is below 80° F. (26.7° C) or if the battery's state of charge is less than 75%. Charge the battery as required to meet test conditions.

Test Procedure

1. Refer to Figure 5. Turn the control knob of the tester to the OFF position.

2. Turn the voltmeter selector switch to 8 volts for a 6 volt battery, or to 16 volts for a 12 volt battery.

3. Connect the positive test leads to the positive battery post and the negative test leads to the negative battery post.

4. Turn the control knob clockwise until the ammeter reading is exactly three times the ampere hour rating of the battery. (Example: 180 amperes for a 60 AH battery.) If the ampere hour rating is not known, adjust control knob until ammeter indicates 200 amperes.

INTERPRETING RESULTS OF TEST

1. Rated current draw and no-load speed indicates normal condition of the cranking motor.

2. Low free speed and high current draw indicates:

   a. Too much friction--tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

   b. Shorted armature. This can be further checked on a growler after disassembly.

   c. Grounded armature or fields. Check further after disassembly.

3. Failure to operate with high current draw indicates:

   a. A direct ground in the field terminal or field windings.

   b. "Frozen" bearings (this should have been determined by turning the armature by hand).

4. Failure to operate and no current draw indicates:

   a. Open field circuit. This can be checked after disassembly by inspecting internal connections and testing circuit with a test lamp.

   b. Open armature coils. Inspect the commutator for badly burned bars after disassembly.

   c. Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

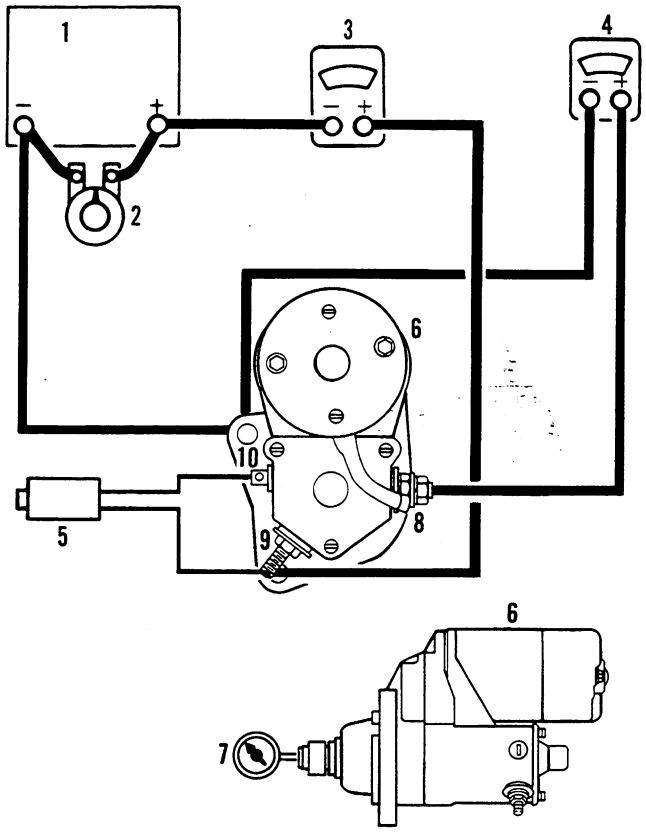
5. Low no-load speed and low current draw indicates:

   a. High internal resistance due to poor connections, damaged leads, dirty commutator and causes listed under No. 4.

6. High free speed and high current draw indicates shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

No-Load Test Procedure

1. Connect the starter and ammeter to a fully charged 12 battery as shown in Figure 1.



1. 12 VOLT BATTERY
2. CARBON PILE
3. AMMETER
4. VOLTMETER
5. REMOTE STARTER SWITCH
6. STARTER
7. HAND HELD TACHOMETER
8. MOTOR TERMINAL
9. BATTERY TERMINAL
10. SWITCH TERMINAL

Figure 1

2. See Figure 1. Connect the voltmeter to the motor terminal and the mounting flange on the starter.

3. Connect the remote starter switch to the battery terminal and the switch terminal.

4. Be sure the carbon pile is in the Off position. Connect the carbon pile to the battery posts.

   NOTE: Step 5, step 6 and step 7 must be done rapidly. Do not run the starter for more than 30 seconds at one time. After the starter has run for 30 seconds you must let the starter cool for two minutes.

5. Hold the button on the remote starter switch in. Then turn the carbon pile control until the voltmeter shows 11 volts.

6. Check the starter drive speed using the hand held tachometer. Make a record of the starter drive speed.

7. Look at the ammeter and make a record of the ammeter indication.

8. Release the button on the remote starter switch. Then turn the carbon pile control to the Off position.

Explanation of the No-Load Test Results

1. If the current draw and the starter drive speed were as specified, the starter is good.

2. Low starter drive speed and high current draw are indications of too much friction caused by:

   a. Worn or damaged bearings.

   b. A bent armature shaft.

   c. Loose pole shoes in contact with the armature.

   d. A damaged armature winding. Disassemble the starter and check the armature on an armature tester using the manufacturer's instructions.

   e. Damaged field coil. See Field Coil Tests on page 8006A-11.

3. Starter drive does not turn and high current draw are indications of:

   a. A broken connection at the motor terminal.

   b. Damaged field coil. See Field Coil Tests on page 8006A-11.

   c. Damaged bearing(s).

4. Starter drive does not turn and the current draw is zero are indications of:

   a. An open field circuit. Disassemble the starter and inspect the field coil connections.

   b. An open armature winding. Disassemble the starter and check for burnt commutator bars. Check the armature on an armature tester.

12. Put the starter drive housing in a vise as shown in Figure 39. Put the lock washers and flat washers on the screws that hold the starter drive housing and starter solenoid housing together. Put new O-rings on the screws if necessary. Put a small amount of grease on the O-rings. Then install and tighten the screws that hold the starter drive housing and starter solenoid housing together.

Figure 39

13. Install the armature in the starter solenoid housing.

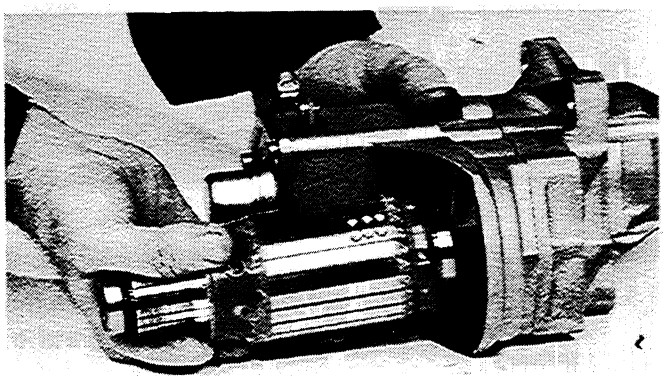


Figure 40

14. Install the field frame housing. Engage the tab on the field frame with the notch in the starter solenoid housing.

Figure 41

15. Install the brush holder on the commutator.

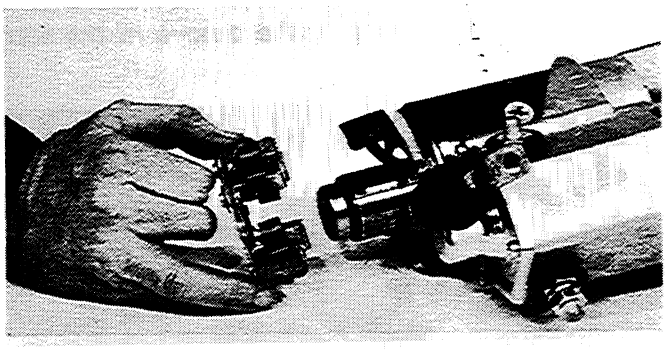


Figure 42

16. Use a pair of needle nose pliers to pull a brush spring away from one of the brushes in the brush holder. Push the brush down and put the brush spring on top of the brush. Repeat this step for the other brush in the brush holder.

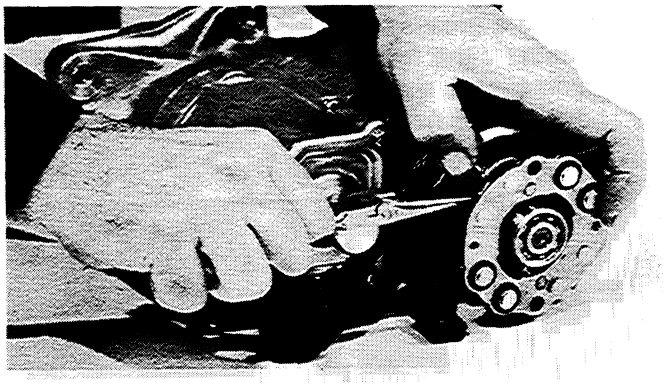


Figure 43

Test No. 2 - Voltage Regulator Setting

1. Remove ground cable from battery. Install battery post adapter, Figure 1, on negative battery post and connect cable to adapter.

   NOTE: Before completing step 2, close switch on Sun adapter or turn switch nut up several turns on Snap-on adapter.

2. Connect test ammeter to adapter as indicated in Figure 1.

3. Disconnect wire from alternator output terminal and connect the 1/4 ohm resistor between the output terminal and wire.

4. Connect positive voltmeter lead to the alternator output terminal and negative lead to the alternator frame.

5. Start engine and run at 3/4 throttle for a few minutes to allow component temperatures to stabilize.

6. With the engine running at full throttle, observe the voltmeter. The voltmeter should indicate 14.2 volts (slightly lower at temperatures above 80° F. (26.7° C) or slightly higher at temperatures below 80° F. (26.7° C.) for all machines.

   a. If the voltage reading was less than 14.2 volts the regulator is defective and must be replaced.

   b. A voltage reading over 14.2 volts may be caused by a poor ground between the regulator and the alternator frame or a defective regulator. Make repairs as required.

7. After completing the test, remove the 1/4 ohm resistor and connect wire to output terminal.

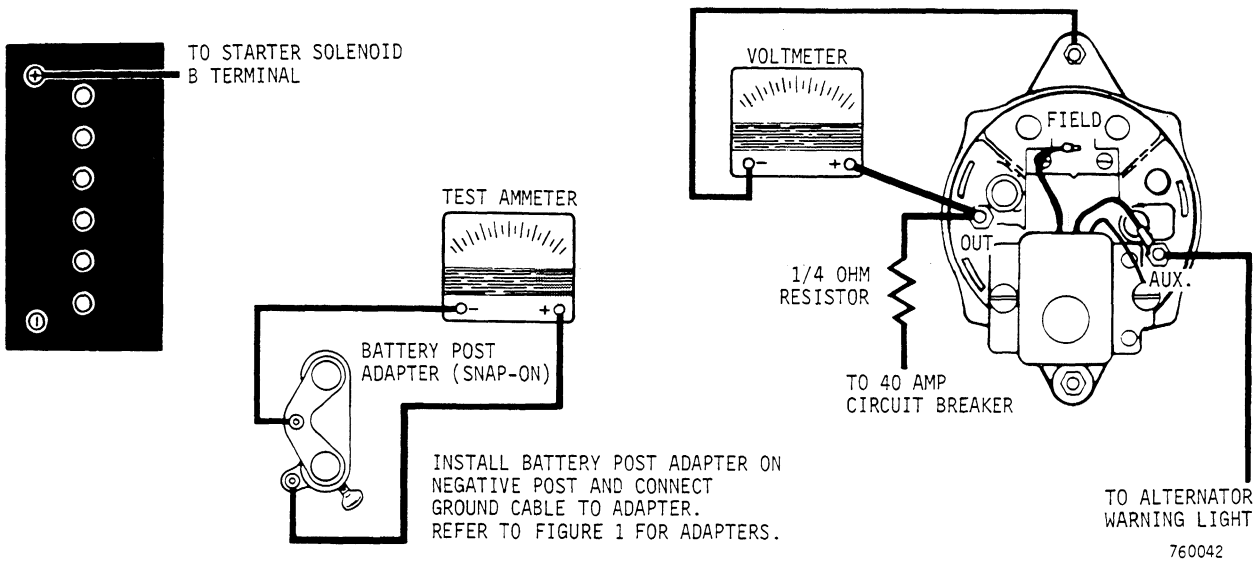
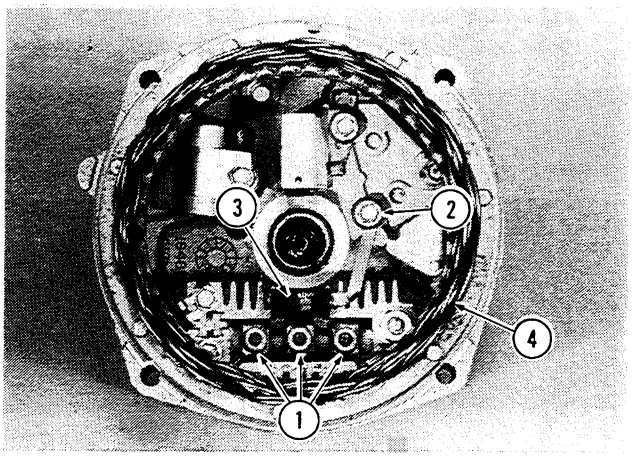


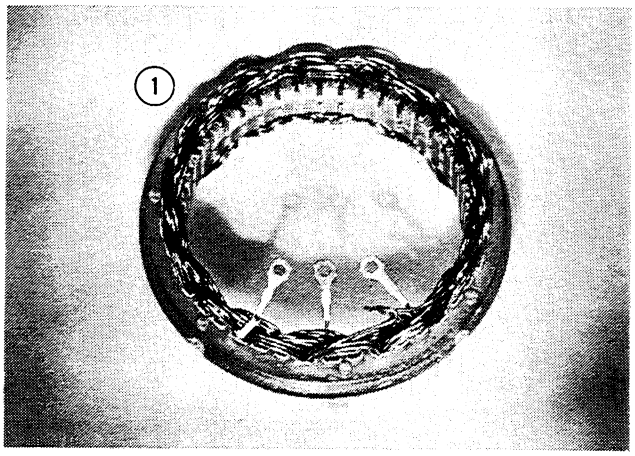
Figure 3 - Voltage Regulator Setting Test Hookup

4. Remove nuts from rectifier bridge terminals and insulated screw from long leg of diode trio. Then remove stator and diode trio from rear housing.



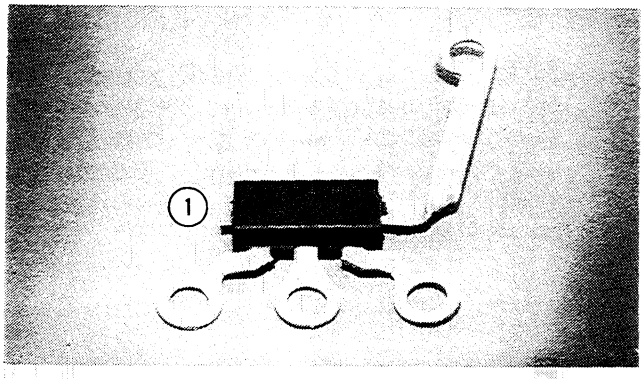
1. Nut
2. Insulated Screw
3. Diode Trio
4. Stator

Figure 18



1. Stator

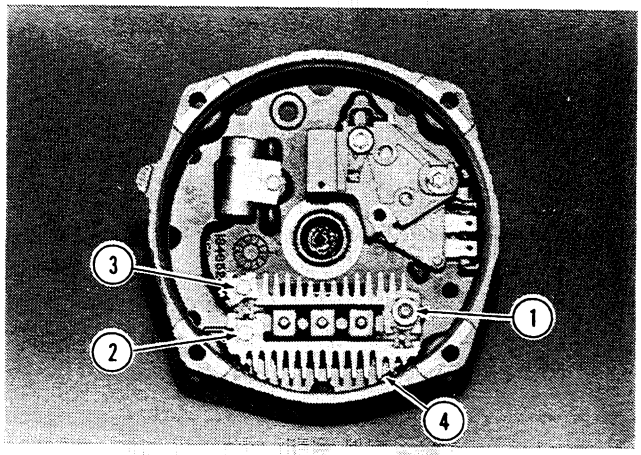
Figure 19



1. Diode Trio

Figure 20

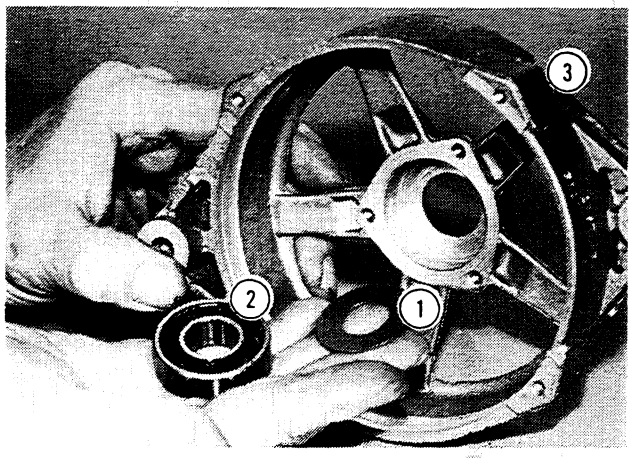
5. Remove nut from Bat terminal, rectifier bridge retaining screw and condenser lead screw. Then remove rectifier bridge from rear housing.



1. Bat Terminal Nut
2. Rectifier Bridge Screw
3. Condenser Lead Screw
4. Rectifier Bridge

Figure 21

11. Install flat washer and bearing in front housing. Sealed side of bearing must be toward washer. If original bearing is being used, fill bearing 1/4 full of Texaco RB grease or equivalent. Overfilling may result in overheating and early bearing failure. After bearing has been installed, fill cavity made by the bearing and bearing retainer with the specified grease.



1. Flat Washer
2. Bearing
3. Front Housing

Figure 50

12. Install bearing retainer in front housing using new cap screws. Use a hammer and punch and bend flange on screw heads down to lock them in place.

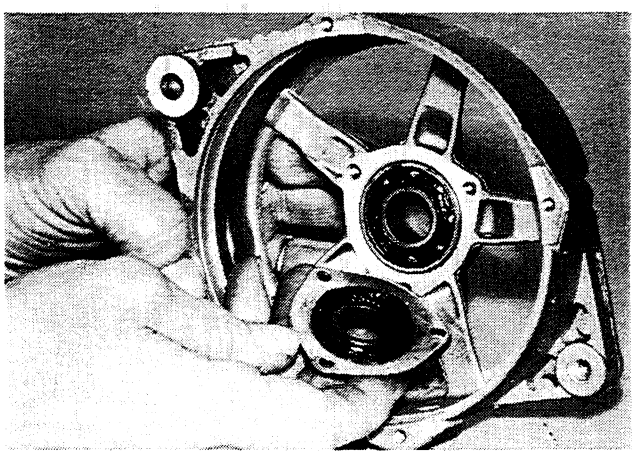


Figure 51

13. Installl rotor in front housing and fan spacer on rotor shaft.

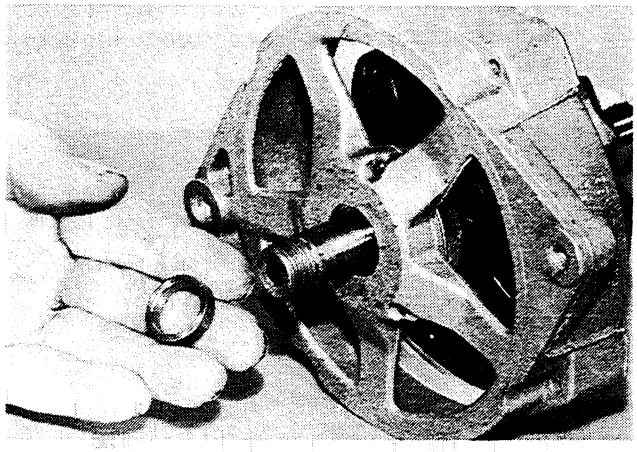


Figure 52

14. Install fan and pulley on rotor shaft.

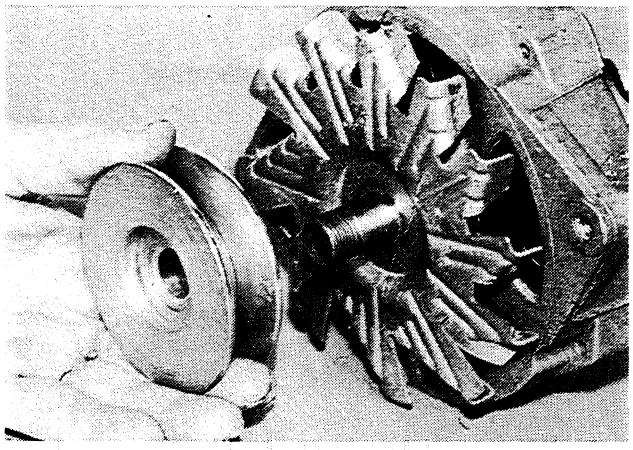


Figure 53

15. Secure pulley in place with lock washer and nut. Torque nut to specification on page 8007-3.

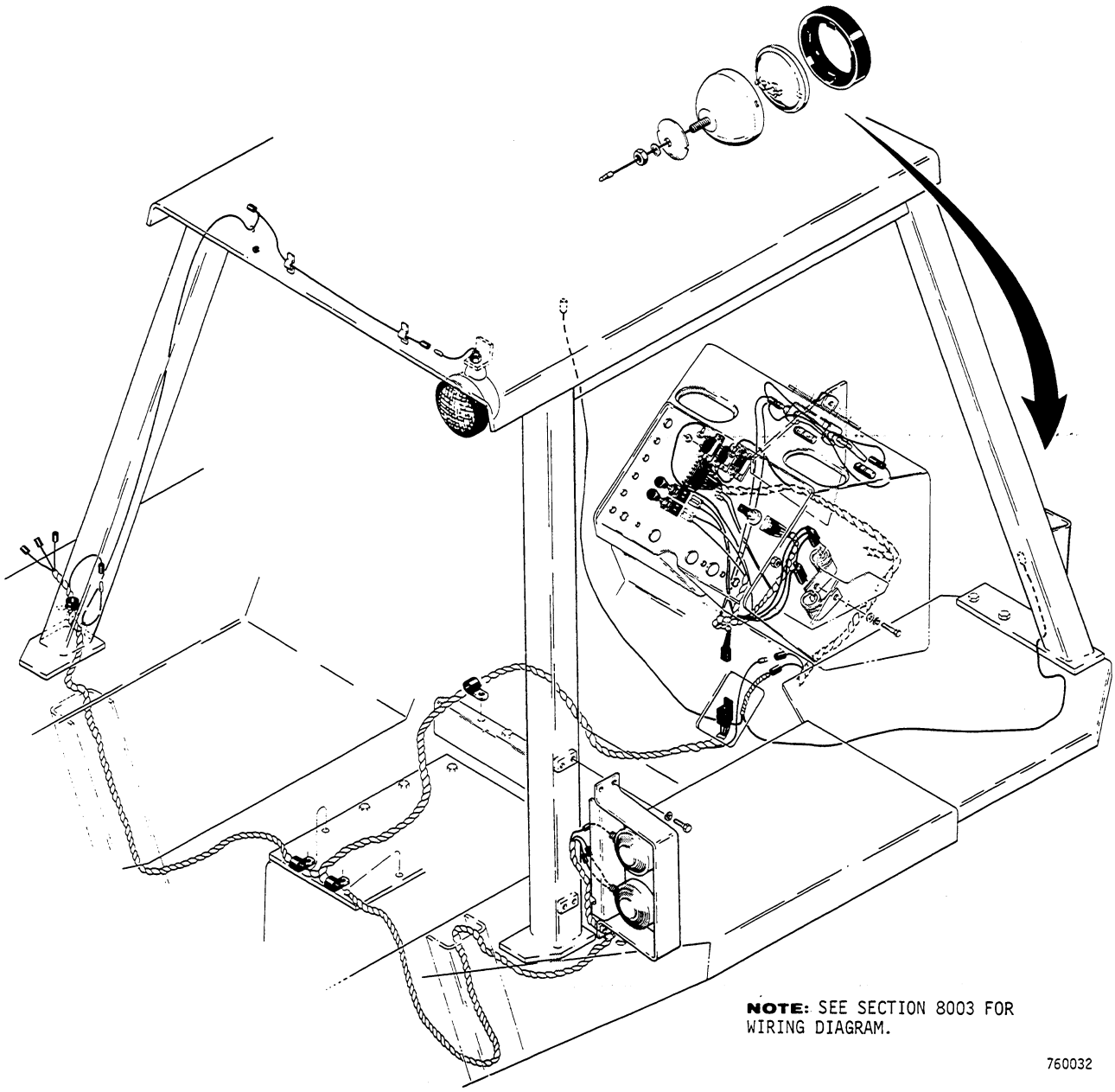


Figure 6 - Canopy Lights with Dual Rear Floodlights

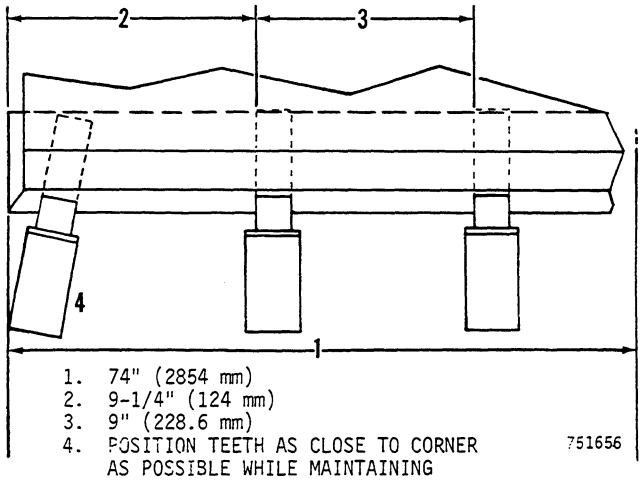
BUCKET TEETH

Tooth Shank Removal and Installation

1. Remove all shank welds using carbon arc rod or an acetelyne cutting torch.

2. Remove shank and grind off any remaining weld on the cutting edge.

3. Refer to Figures 3 and 4 for location and weld specifications. Use a weld rod meeting A.W.S. specification E-7018 and weld shank to cutting edge.



1. 74" (2854 mm)
2. 9-1/4" (124 mm)
3. 9" (228.6 mm)
4. POSITION TEETH AS CLOSE TO CORNER AS POSSIBLE WHILE MAINTAINING OVERALL DIMENSION.

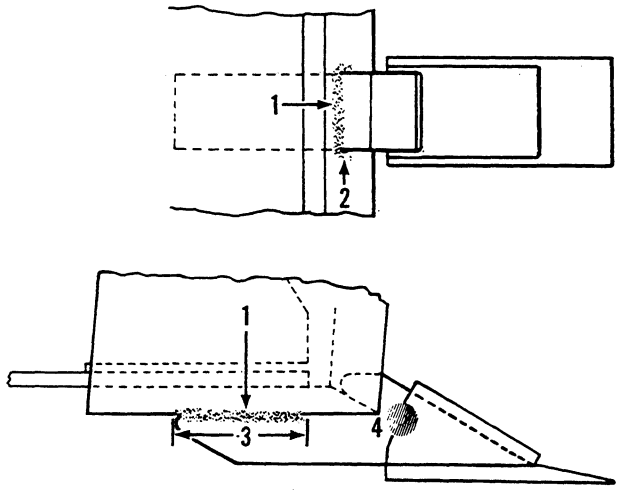
751656

Figure 3

Tooth Replacement

1. Refer to Figure 4. Use a suitable tool and raise the peened portion on each side of the tooth and remove tooth from shank. The peened area may be heated with a torch to aid in removal.

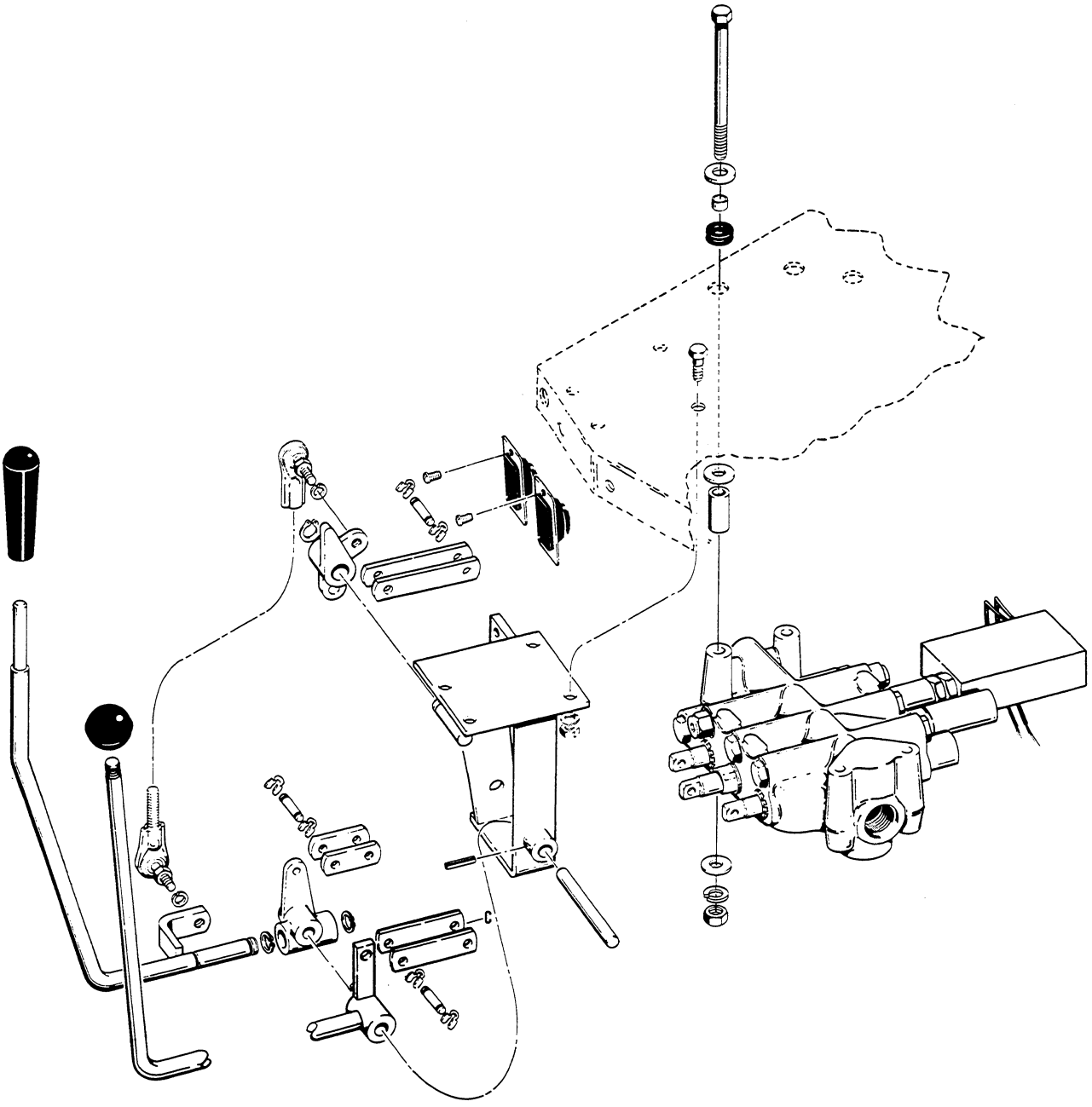
2. Slide the new tooth onto the shank as far as it will go and peen each side into depression in shank.



1. 3/8" (9.5 mm) FILLET - TWO PASS WELD
2. WRAP CORNER 3/8" (9.5 mm)
3. 2-1/2" (63.5 mm)
4. PEENED DOWN PORTION

760394

Figure 4



NOTE: SPACER USED IN PLACE OF CLAM SPOOL LEVER ON TWO SPOOL VALVE CONTROL LEVER INSTALLATION.

751664

Figure 13 - Control Lever Installation

Installation

1. Attach chain hoist to swing tower and position swing tower to boom. Then install the boom pivot pins. Secure pins in place with pin retaining hardware.

2. Position a boom cylinder to the swing tower and install the pivot pin. Coat one side of a washer with grease and position on outside of swing tower ear. Make sure hole in pin and cylinder are aligned and drive pin in until holes are aligned. Secure pin in place with bolt. Repeat for the remaining boom cylinder.

3. Back the tractor into position to mount the swing tower to the mounting frame. Install the upper and lower swing tower pivot pins and secure in place with snap rings.

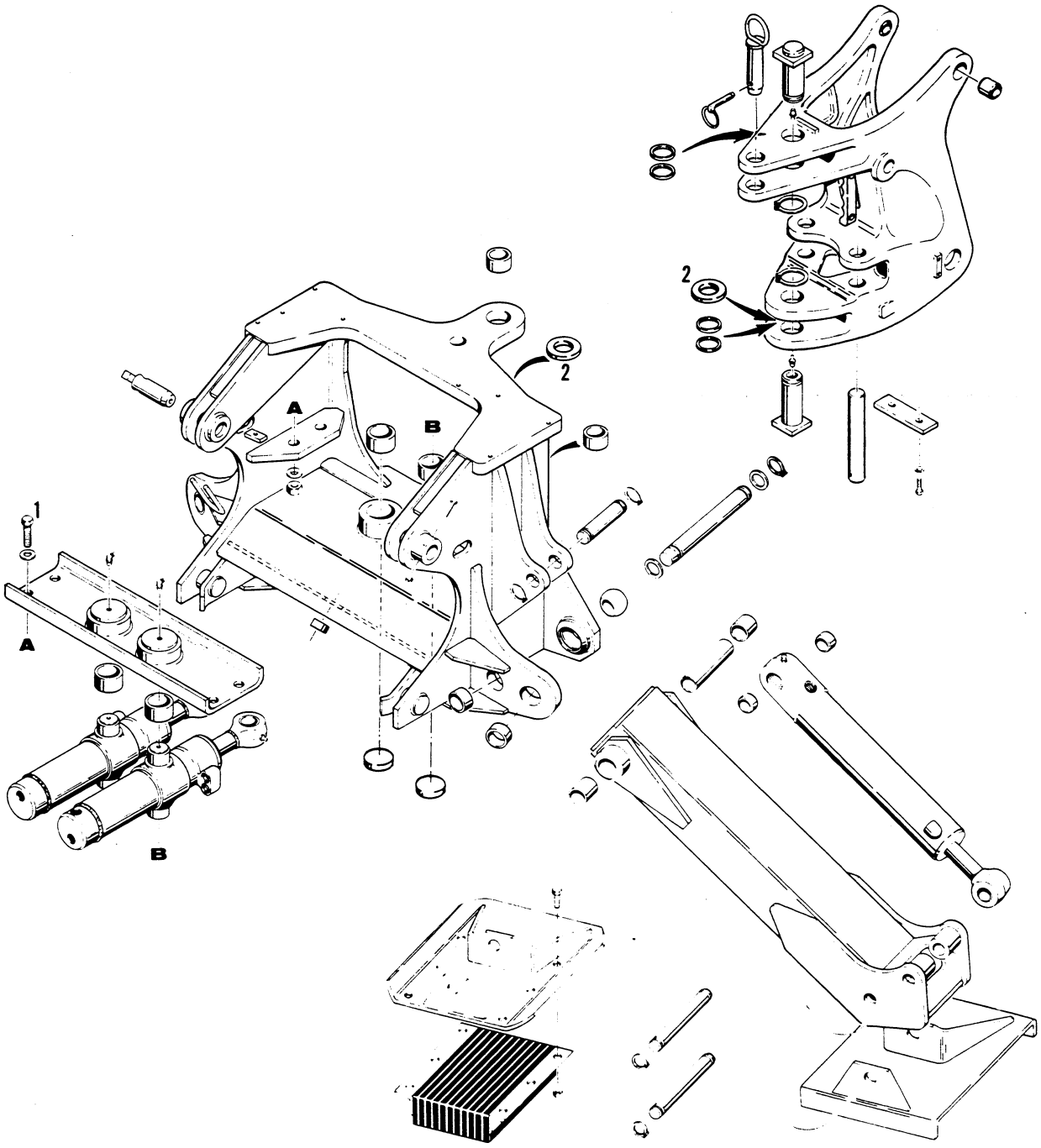
4. Remove chain hoist and rod from swing tower.

5. Align swing cylinder rod eyes with swing tower and install pivot pins through bottom of swing tower. Secure pins in place with pin retainer.

6. Install boom latch mechanism.

7. Connect hoses to control valve and tubes. If hoses and ports were not identified, refer to Figures 15 and 17 for proper connections.

8. Reinstall front cover on control tower.



1. TORQUE TO 520-640 FOOT-POUNDS (705-867 N m)
2. PIVOT BEARING WASHER. REFER TO PAGE 9100-15.

Figure 11 - Mounting Frame, Swing Cylinders and Stabilizers