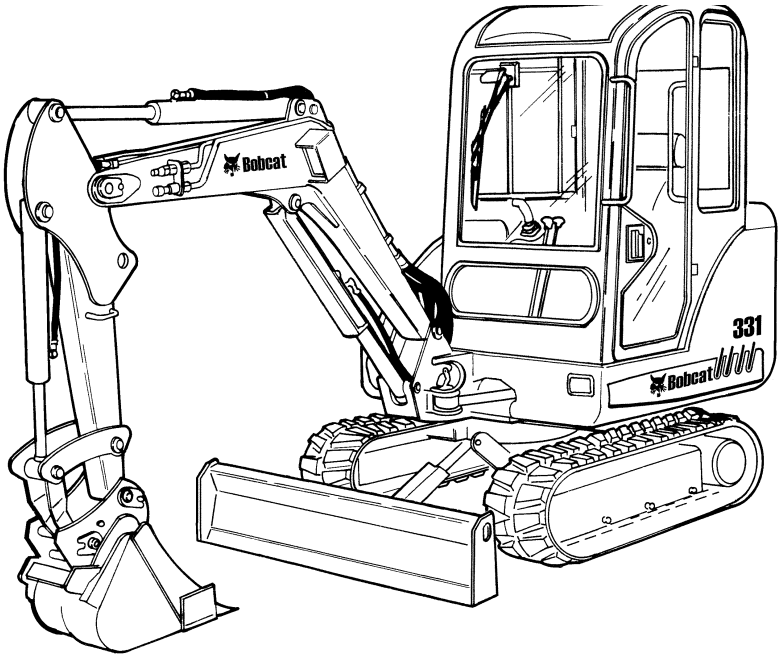
331
331E
334

Bobcat®

Service Manual

331 - S/N 234313000 & Above
331E - S/N 234412000 & Above
334 - S/N 234513000 & Above
(G Series)



6903830 (10-09) Printed in U.S.A.

SAFETY INSTRUCTIONS

Safety Alert Symbol

This symbol with a warning statement means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.

WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

W-2003-0903

IMPORTANT

This notice identifies procedures which must be followed to avoid damage to the machine.

I-2019-0284

DANGER

The signal word DANGER on the machine and in the manuals indicates a hazardous situation which, if not avoided, will result in death or serious injury.

D-1002-1107

WARNING

The signal word WARNING on the machine and in the manuals indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

W-2044-1107

The following publications provide information on the safe use and maintenance of the Bobcat machine and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the machine is in safe operating condition.
- The Operation & Maintenance Manual delivered with the machine or attachment contains operating information as well as routine maintenance and service procedures. It is a part of the machine and can be stored in a container provided on the machine. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat dealer.
- Machine signs (decals) instruct on the safe operation and care of your Bobcat machine or attachment. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat dealer.
- An Operator's Handbook fastened to the operator cab. It's brief instructions are convenient to the operator. The handbook is available from your dealer in an English edition or one of many other languages. See your Bobcat dealer for more information on translated versions.
- The AEM Safety Manual delivered with the machine gives general safety information.
- The Service Manual and Parts Manual are available from your dealer for use by mechanics to do shop-type service and repair work.
- The Compact Excavator Operator Training Course is available through your local dealer or at **www.training.bobcat.com** or **www.bobcat.com**. This course is intended to provide rules and practices of correct operation of the Bobcat excavator. The course is available in English and Spanish versions.
- Service Safety Training Courses are available from your Bobcat dealer or at **www.training.bobcat.com** or **www.bobcat.com**. They provide information for safe and correct service procedures.
- The Bobcat compact excavator Safety Video is available from your Bobcat dealer or at **www.training.bobcat.com** or **www.bobcat.com**.

LIFTING AND BLOCKING THE EXCAVATOR

Procedure

Always park the machine on a level surface.

⚠ WARNING

AVOID INJURY OR DEATH

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.

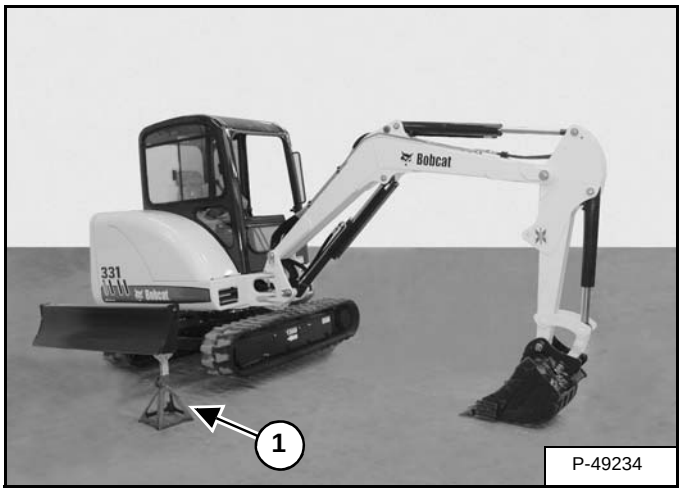
W-2003-0807

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W-2017-0286

Figure 10-10-1



Raise one side of the machine (approximately four inches) using the boom and arm **[Figure 10-10-1]**.

Raise the blade fully and install jack stands under the blade and track frame (Item 1) **[Figure 10-10-1]**. Raise the boom until all machine weight is on the jack stands.

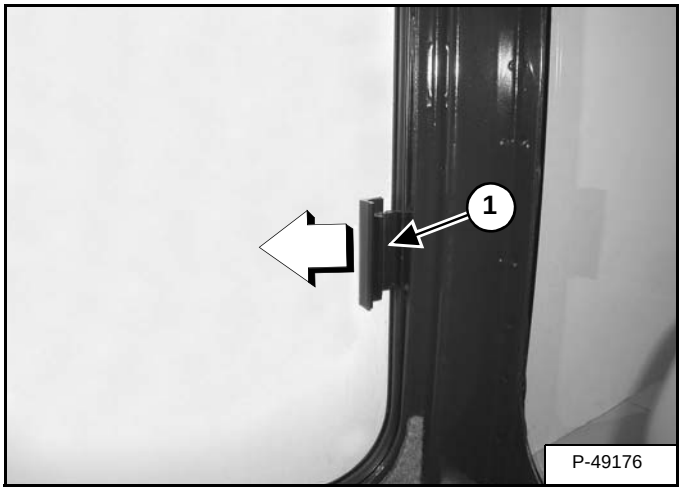
Repeat the procedure for the other side.

Stop the engine.

Right Side Windows

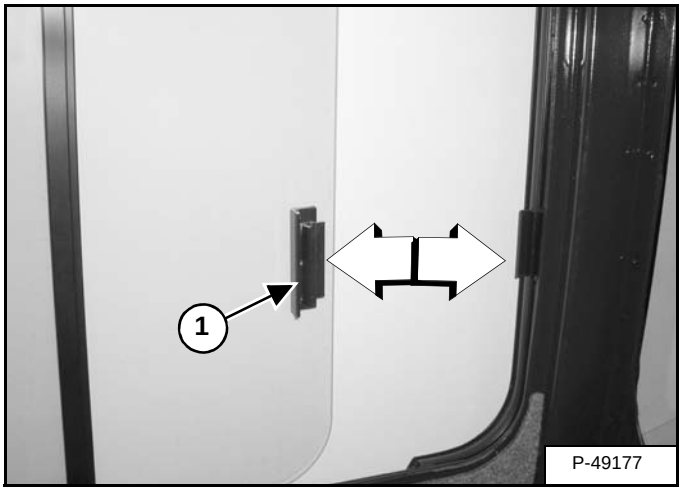
Opening the right rear window

Figure 10-20-12



Pull out on the latch (Item 1) **[Figure 10-20-12]**.

Figure 10-20-13

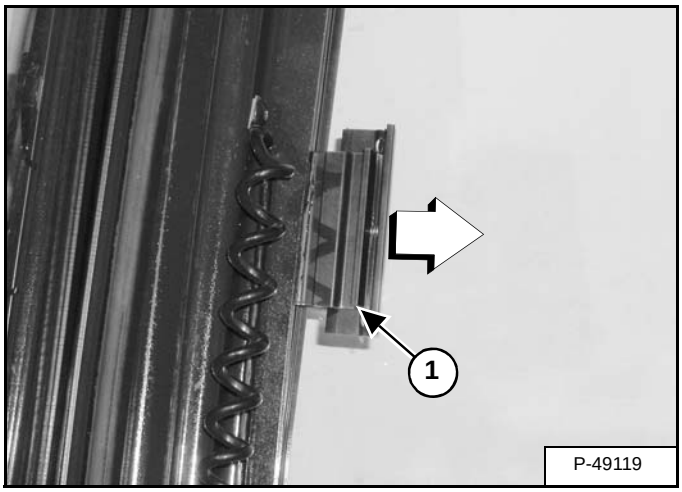


Pull the latch/handle (Item 1) **[Figure 10-20-13]** forward to open the window.

Push the handle back to close the window.

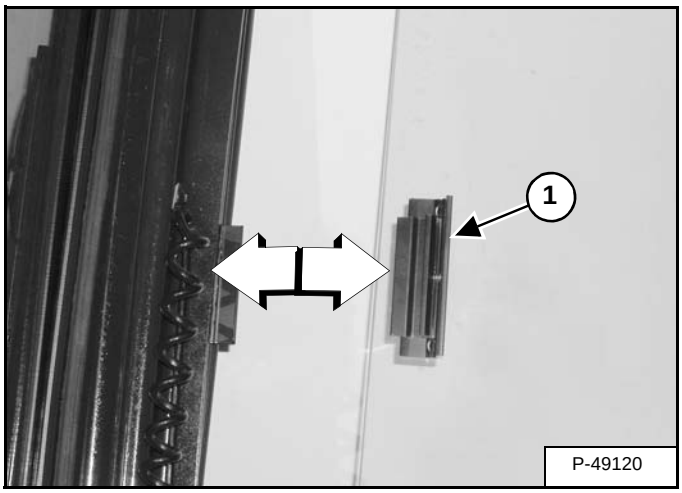
Opening the right front window

Figure 10-20-14



Pull back on the latch (Item 1) **[Figure 10-20-14]**.

Figure 10-20-15



Pull the latch/handle (Item 1) **[Figure 10-20-15]** back to open the window.

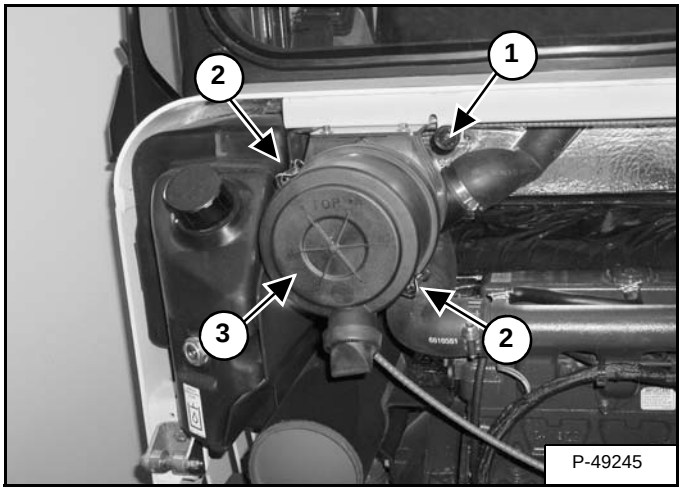
Push the handle forward to close the window.

AIR CLEANER SERVICE

See the SERVICE SCHEDULE for the correct service interval. (See SERVICE SCHEDULE on Page 10-50-1.)

Daily Check

Figure 10-60-1



Check the condition indicator (Item 1) **[Figure 10-60-1]**. If the red ring shows in the condition indicator, the filter needs to be replaced.

Replace the inner filter every third time the outer filter is replaced or as indicated.

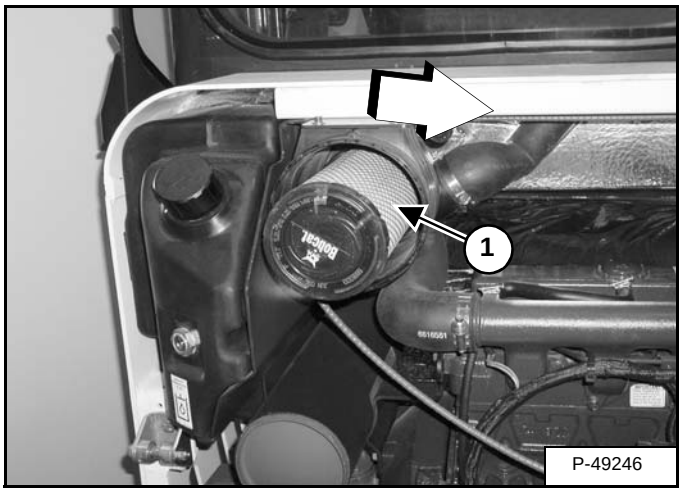
Replacing The Filters

Outer Filter

Release the two fasteners (Item 2) **[Figure 10-60-1]**.

Remove and clean the dust cup (Item 3) **[Figure 10-60-1]**.

Figure 10-60-2



Pull the outer filter (Item 1) **[Figure 10-60-2]** from the air cleaner housing.

Check the housing for damage.

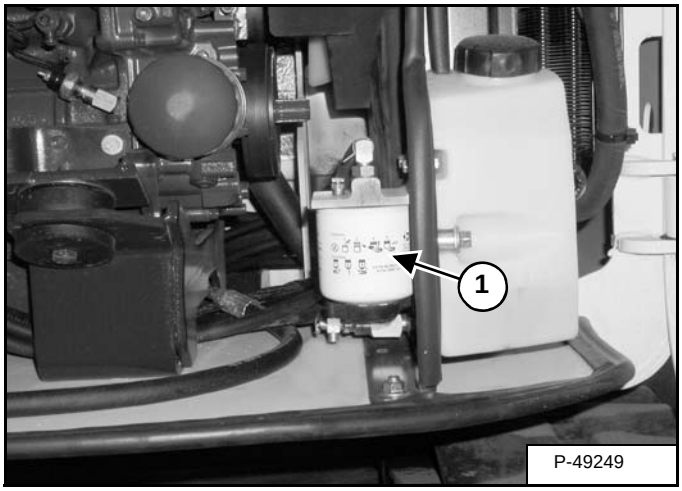
Clean the housing and the seal surface. DO NOT use compressed air.

Install a new filter.

Fuel Filter

See the SERVICE SCHEDULE for the service interval when to replace the fuel filter. (See SERVICE SCHEDULE on Page 10-50-1.)

Figure 10-80-4



Remove the filter (Item 1) **[Figure 10-80-4]**.

Clean the area around the filter housing.

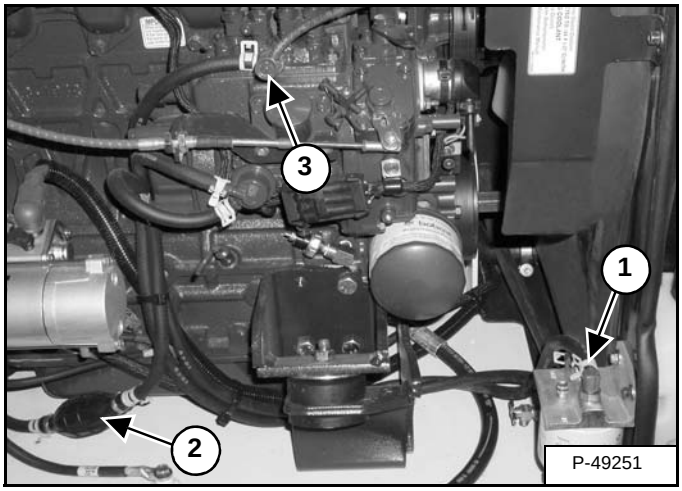
Put oil on the seal of the new filter.

Install the fuel filter, and hand tighten.

Removing Air From The Fuel System

After replacing the fuel filter or when the fuel tank has run out of fuel, air must be removed from the fuel system before starting the engine.

Figure 10-80-5



Open the fuel filter vent (Item 1) and operate the hand pump (priming bulb) (Item 2) **[Figure 10-80-5]** until the fuel flows from the vent with no air bubbles.

Close the vent (Item 1) **[Figure 10-80-5]**.

Start the engine. It may be necessary to open the vent (Item 3) **[Figure 10-80-5]** (at the fuel injection pump) briefly until the engine runs smoothly.

⚠ WARNING

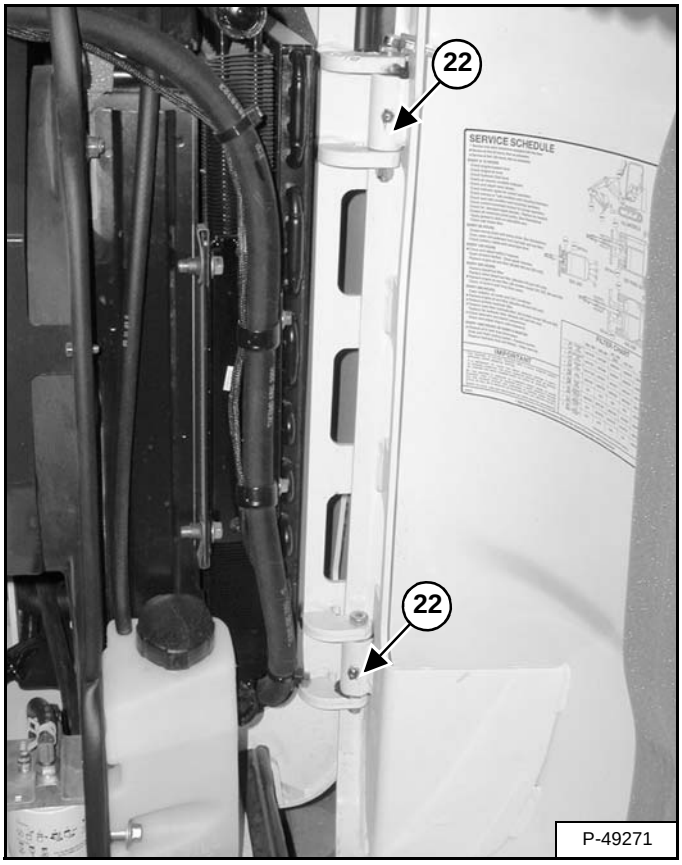
AVOID INJURY OR DEATH

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W-2072-0807

Procedure (Cont'd)

Figure 10-110-8



22. Tailgate Hinge (2) **[Figure 10-110-8]**.

HYDRAULIC SYSTEM

Continued On Next Page

Glossary Of Hydraulic/Hydrostatic Symbols For Excavators

GLOSSARY OF HYDRAULIC/HYDROSTATIC SYMBOLS FOR EXCAVATORS

SYMBOL DESCRIPTION

FLOW LINES and CONNECTIONS

WORKING CIRCUITS – Continuous, Solid Line – Working (Main) Line, Return Line (line conducting fluid from working devices to the reservoir) and Feed Line (main line conductor)

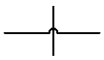
PILOT PRESSURE – Dashed Line – Pilot Line (line which conducts control fluid)

DRAIN CIRCUITS – Dotted Line – Drain Line (drain or bleed line – line conducting fluid from a component housing to the reservoir)

COMPONENTS – Long Chain Line – Enclosure outline for several components assembled in one unit

MECHANICAL CONNECTIONS – Double Line (Shaft, Lever, Piston Rod)

CONNECTED JUNCTION OF OIL LINES (Flow Line Connection)



OIL LINES CROSSING (NOT Connected)

COUPLER – Quick–Acting Coupling (uncoupled, closed by non–return valve)

SYMBOL DESCRIPTION

BASIC and MISCELLANEOUS SYMBOLS

RESTRICTION – Line with Fixed Restriction – Affected by Viscosity (property of resistance to flowing fluid)

VARIABLE ADJUSTMENT RESTRICTION – Regulated or Variable Restriction

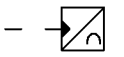
TEMPERATURE CONTROL – (indication of temperature)

TEMPERATURE INDICATOR – (temperature measurement – thermometer)

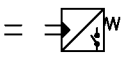
FILTER (strainer or screen) – For fluid conditioning

VENTED AND FILTERED RESERVOIR (reservoir open to atmosphere)

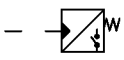
OIL COOLER (heat exchanger) – The arrows in the diamond indicate the extraction of heat (heat dissipation)



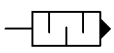
PRESSURE SENSOR – Varies electric signal with pressure



DIFFERENTIAL PRESSURE SWITCH – Switch activates when pressure difference reaches specified level



PRESSURE SWITCH – Switch activates when pressure reaches specified level

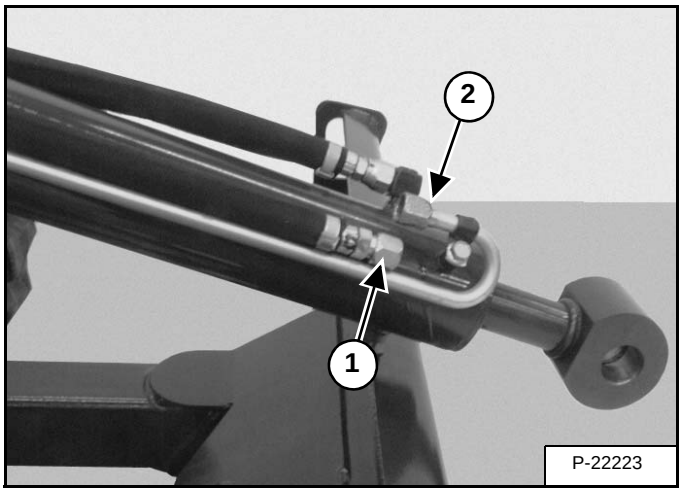


MUFFLER (silencer) – Reduces noise

MS-1892-1

Testing (Cont'd)

Figure 20-20-9



Remove the hose from the base end of the cylinder. Cap the hose (Item 1) **[Figure 20-20-9]**.

Start the engine and retract the boom cylinder.

If there is any oil leakage from the base end fitting (Item 2) **[Figure 20-20-9]**, remove the cylinder for repair or replacement.

ARM CYLINDER

Testing

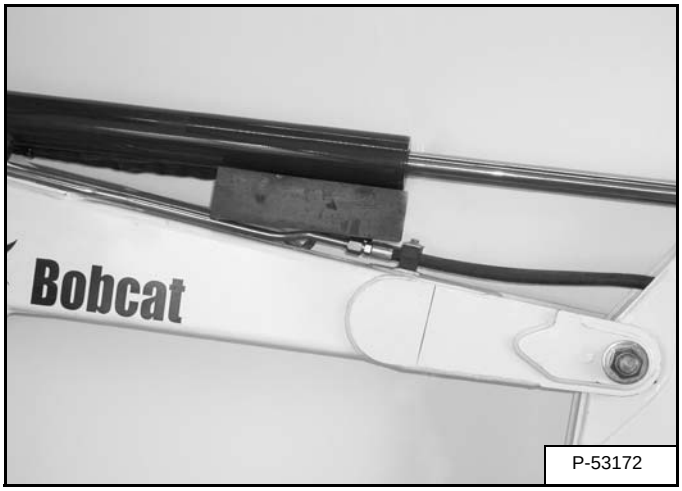
Lower the boom/bucket and blade to the ground.

With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-21-1

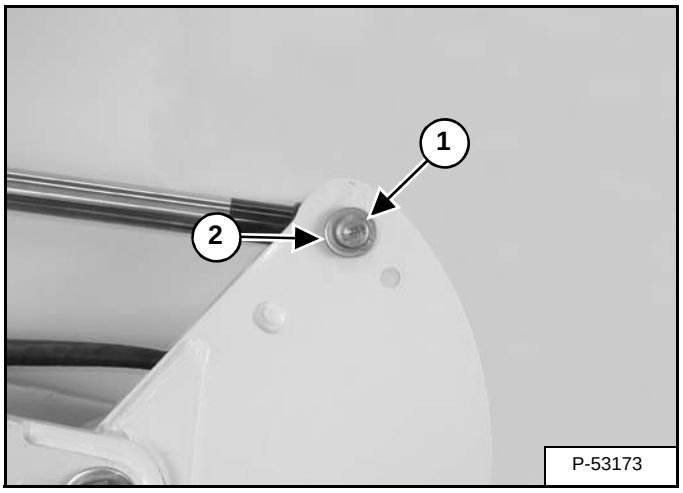
Support the boom with a chain hoist **[Figure 20-21-1]**.

Figure 20-21-2



Support the arm cylinder **[Figure 20-21-2]**.

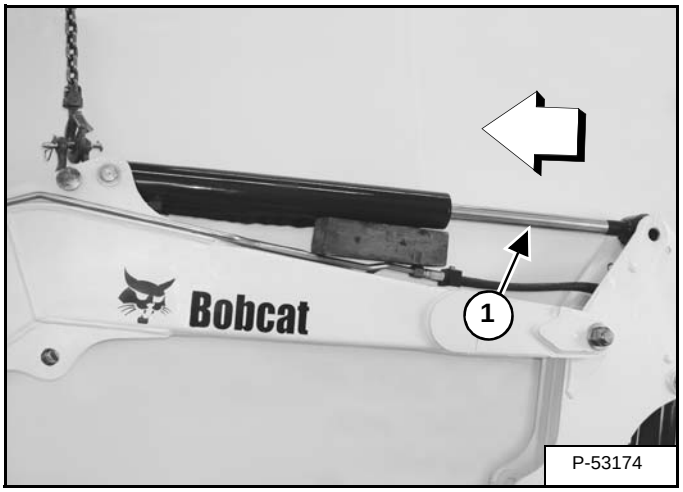
Figure 20-21-3



Remove the snap ring (Item 1) **[Figure 20-21-3]** and washer.

Remove the rod end pin (Item 2) **[Figure 20-21-3]**.

Figure 20-21-4



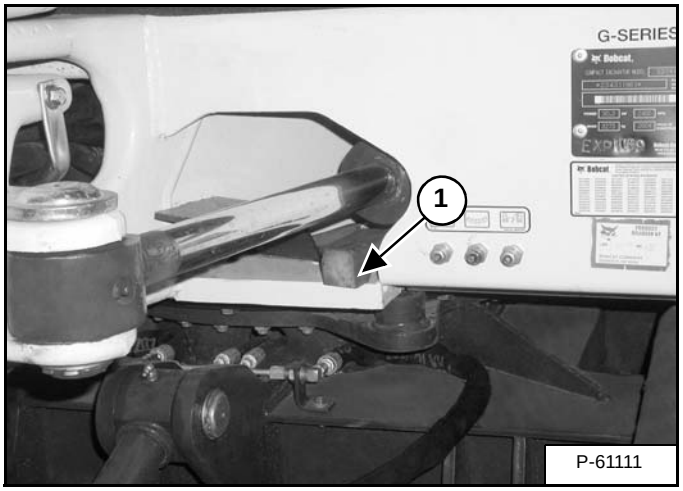
Start the engine and fully retract the cylinder rod (Item 1) **[Figure 20-21-4]**.

BOOM SWING CYLINDER

Testing

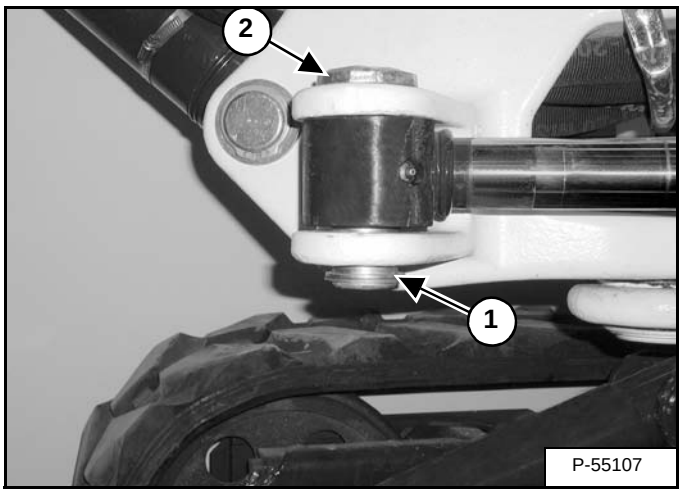
Lower the boom/bucket and blade to the ground.

Figure 20-22-1



Place a block (Item 1) **[Figure 20-22-1]** under the rod end of the boom swing cylinder.

Figure 20-22-2



Remove the snap ring and washer (Item 1) **[Figure 20-22-2]** from the rod end pin of the cylinder.

Remove the pin (Item 2) **[Figure 20-22-2]**.

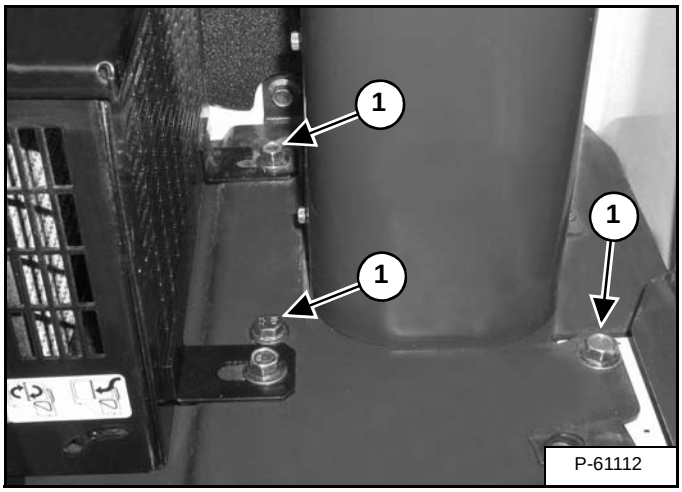
Start the engine and fully retract the cylinder rod.

Stop the engine.

Remove the floormat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

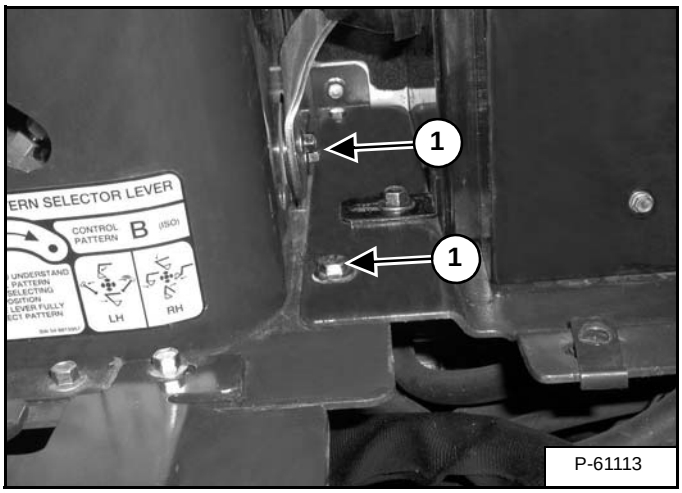
Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Figure 20-22-3



Remove the bolts (Item 1) **[Figure 20-22-3]** from the left side of the rear floor plate.

Figure 20-22-4



Remove the bolts (Item 1) **[Figure 20-22-4]** from the right side of the rear floor panel.

BUCKET CYLINDER

Testing

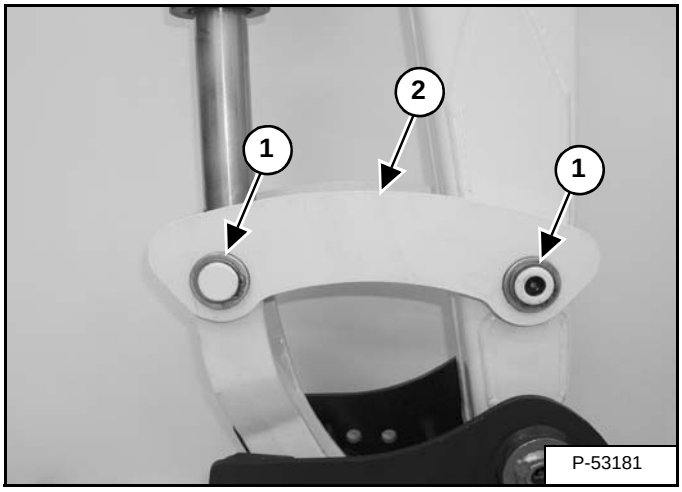
Lower the boom/bucket and blade to the ground.

With the engine off, turn the key to the ON position and move both hydraulic control levers to relieve hydraulic pressure.

Figure 20-23-1

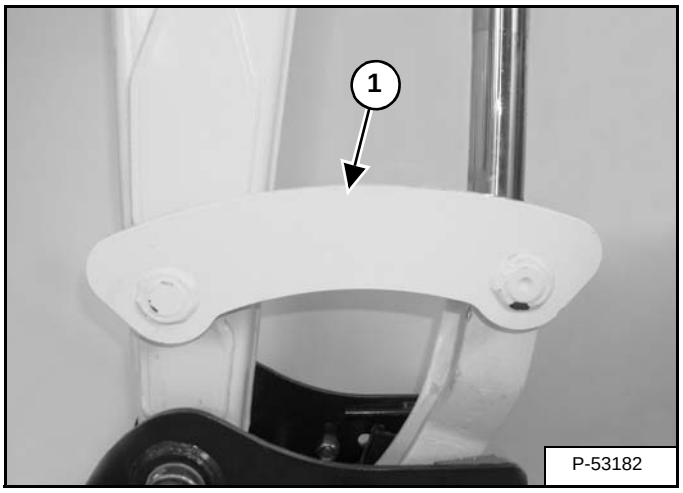
Support the boom using a chain hoist **[Figure 20-23-1]**.

Figure 20-23-2



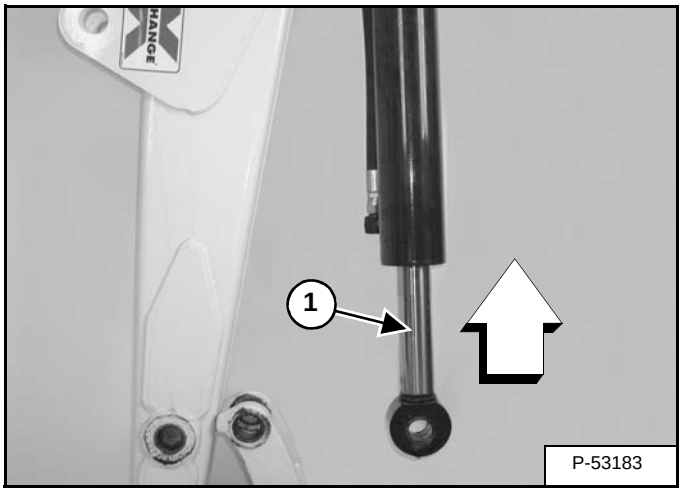
Remove the snap rings (Item 1), washers and plate (Item 2) **[Figure 20-23-2]**.

Figure 20-23-3



Remove the link (Item 1) **[Figure 20-23-3]**.

Figure 20-23-4



Start the engine and fully retract the cylinder rod (Item 1) **[Figure 20-23-4]**.

Assembly

Clean all parts in solvent and dry with compressed air.

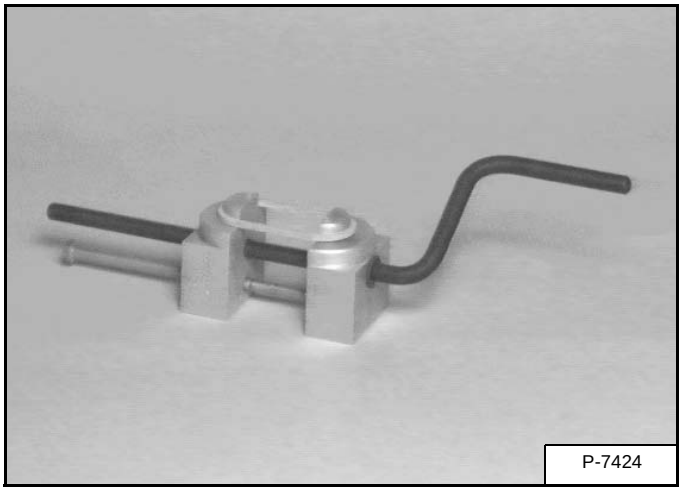
Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

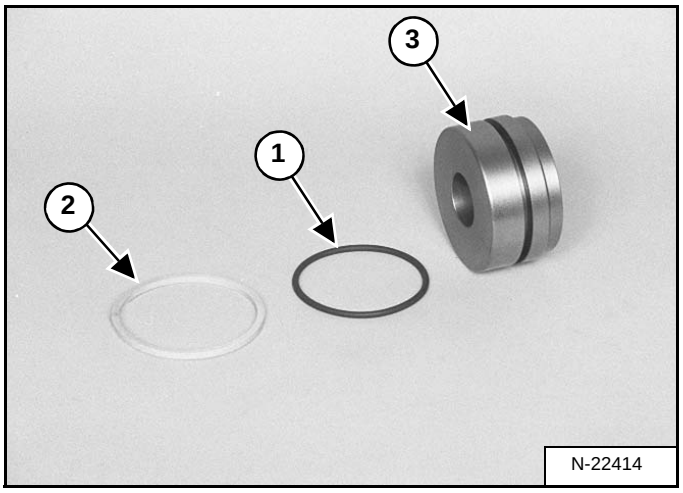
Figure 20-23-28



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-28]**.

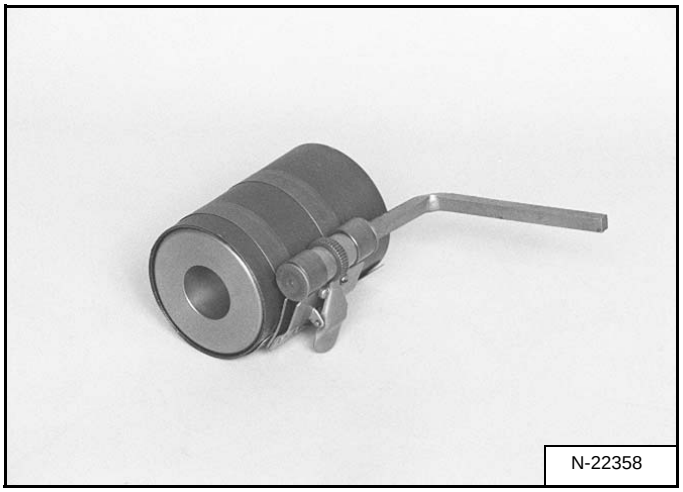
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-29



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-23-29]**.

Figure 20-23-30



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-23-30]**.

Assembly

Clean all parts in solvent and dry with compressed air.

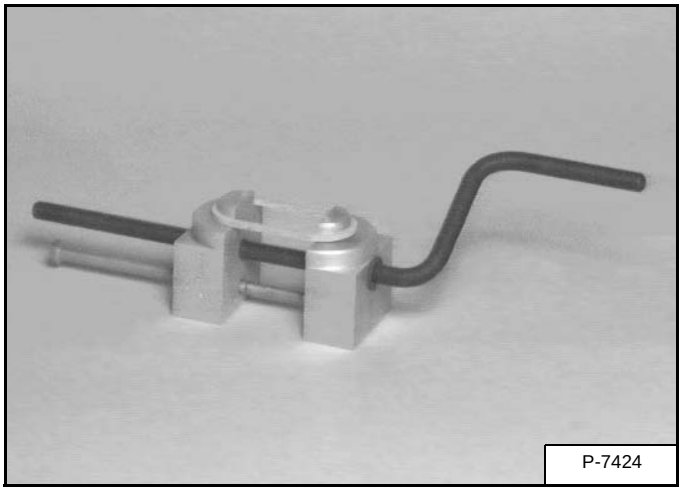
Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Use the following tools to assemble the cylinder:

MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

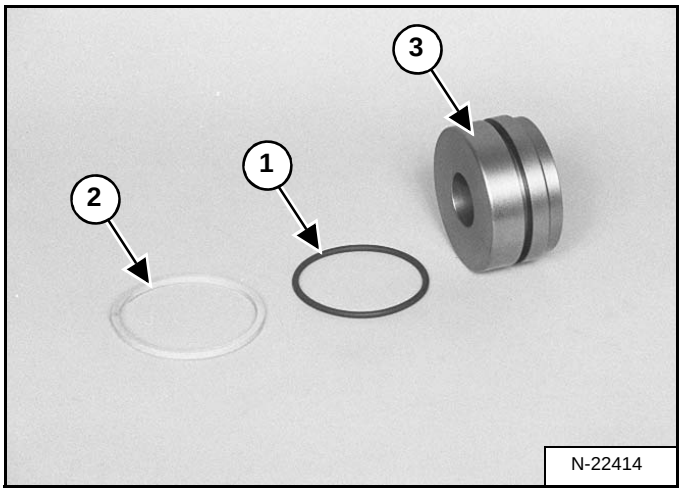
Figure 20-24-17



Install the new seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-17]**.

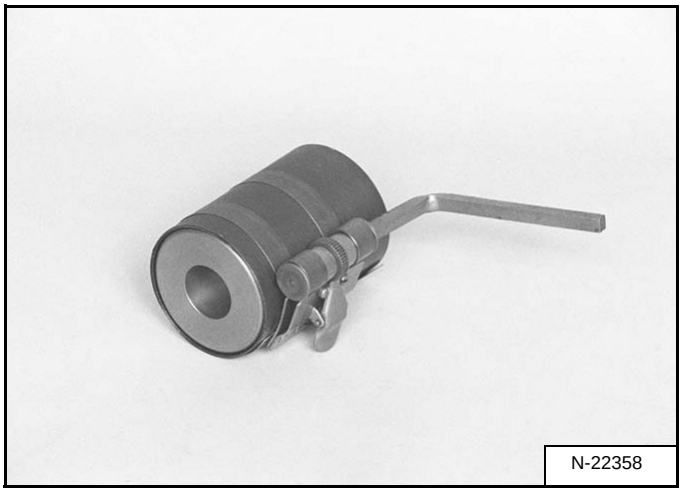
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-18



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-24-18]**.

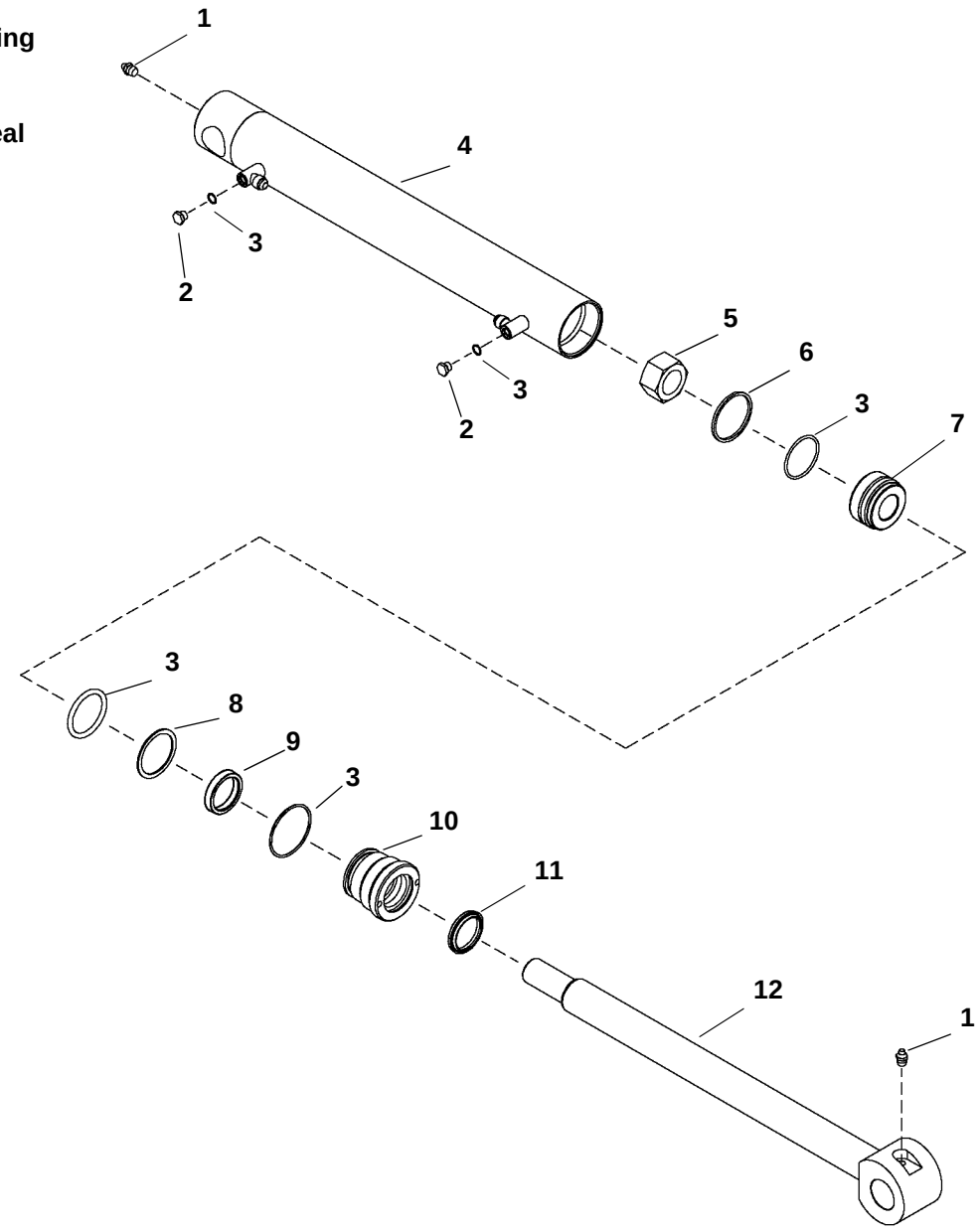
Figure 20-24-19



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-24-19]**.

Parts Identification

1. Grease fitting
2. Plug
3. O-Ring
4. Housing
5. Nut
6. Seal
7. Piston
8. Backup ring
9. Seal
10. Head
11. Wiper Seal
12. Rod



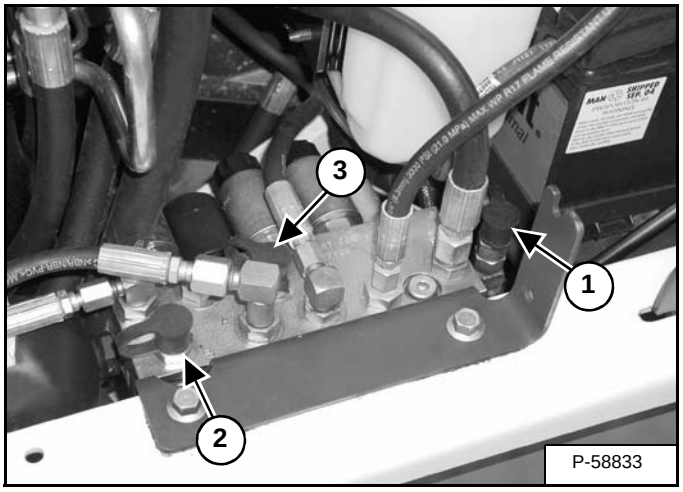
PE2447S

MAIN RELIEF VALVE

Testing And Adjusting The Main Relief Valve

All testing is done with the hydraulic oil at operating temperature and the at high idle speed. (See Engine on Page SPEC-10-6.).

Figure 20-30-1



There is one diagnostic coupler (Item 1) that is used to check the main relief. The second coupler (Item 2) is used in assembly of the excavator. The third coupler (Item 3) **[Figure 20-30-1]** is used to check the pressure reducing valve.

The following tools will be needed for the testing at the diagnostic coupler:

MEL1355 - Test Kit includes the following:
MEL1355-3 - 5000 PSI Gauge
MEL1355-12 - Coupler
MEL1355-9 - Thermometer

System Pressures At Gauge Port Specifications

TEST CONDITIONS

1. Engine High Idle Speed

2. Warm oil over relief function to minimum 150° F (66° C). Cycle all functions during warm up procedure. Warm oil until the pressure build-up valve stabilizes near its target pressure.

3. Activate function until cylinder movement stops. Hold over relief for 5-10 seconds.
   Record pressure.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	G	428	406 - 450
SYSTEM BACK PRESSURE	NONE - CONSOLE DOWN	THROUGH NEUTRAL	P1		280-420
MAIN RELIEF	ANY EXCEPT SLEW	P1	P1	3480	3380-3580
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P1	P1	3050	2900-3200
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P1	P1	3050	2900-3200

PRESSURE REDUCING VALVE

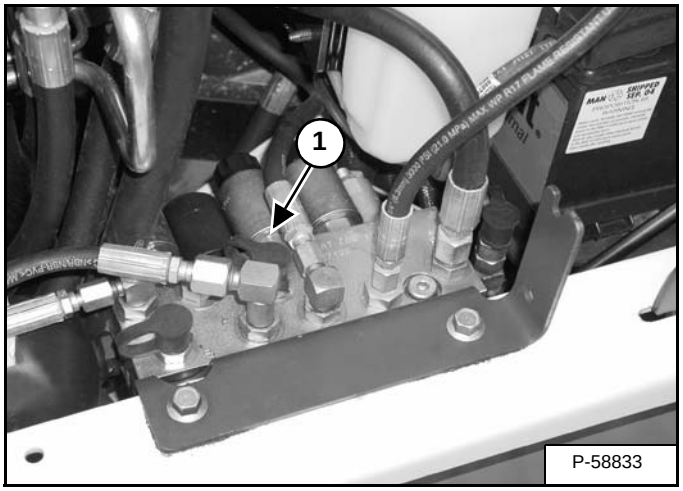
Testing And Adjusting The Pressure Reducing Valve

The pressure reducing valve supplies lower hydraulic pressure to joysticks.

The following tools will be needed for testing the pressure reducing valve:

MEL 1355 - Test Kit includes the following
MEL 1355-2 - 1000 PSI Gauge
MEL 1355-9 - Thermometer

Figure 20-33-1

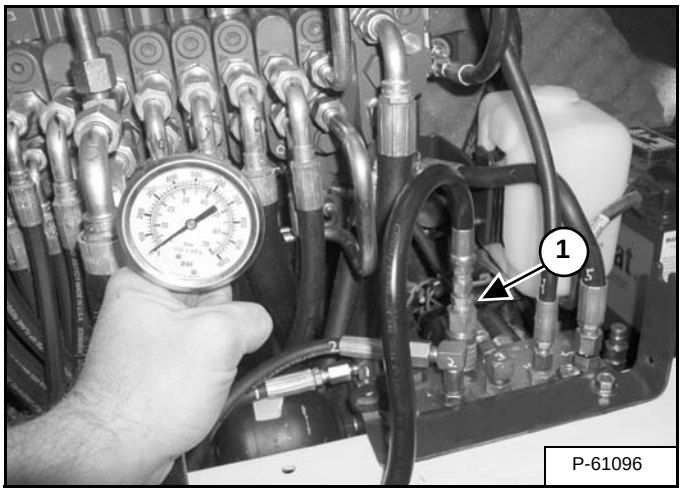


The diagnostic port (Item 1) **[Figure 20-33-1]** will be used to check the pressure reducing valve.

With the engine off, and the key in the run position, lower the left console and move both joysticks to relieve hydraulic pressure.

Open the right side cover.

Figure 20-33-2



Install a 1000 PSI (69 bar) gauge on the diagnostic port (Item 1) **[Figure 20-33-2]**.

Lower the control console and fasten the seat belt.

Start the engine and warm the hydraulic fluid to a minimum operating temperature of 150° F (66° C).

With the hydraulic fluid at operating temperature, run the engine at full RPM.

Engage the bucket curl circuit and fully curl the bucket.

The pressure reducing valve pressure should be as follows:

A target pressure of 428 PSI (26 bar) with an acceptable range of 406-450 PSI (28-31 bar).

Move the engine speed control to low idle speed.

Stop the engine.

With the engine off, and the key in the run position, lower the left console and move both joysticks to relieve hydraulic pressure.

Disassembly

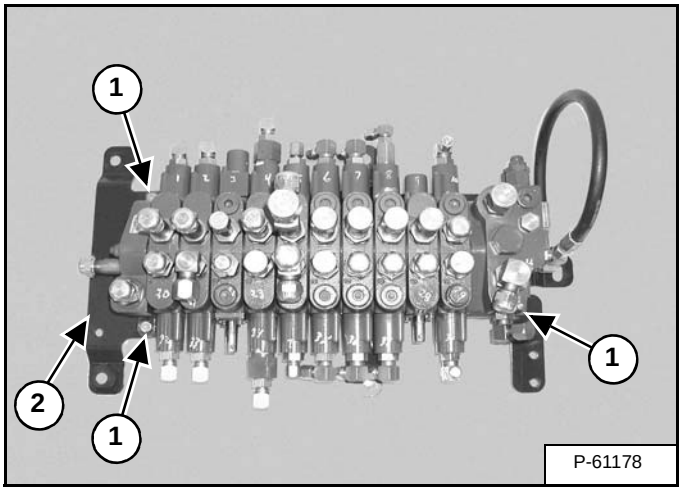
Clean the outside of the control valve before disassembly.

IMPORTANT

When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Figure 20-40-29

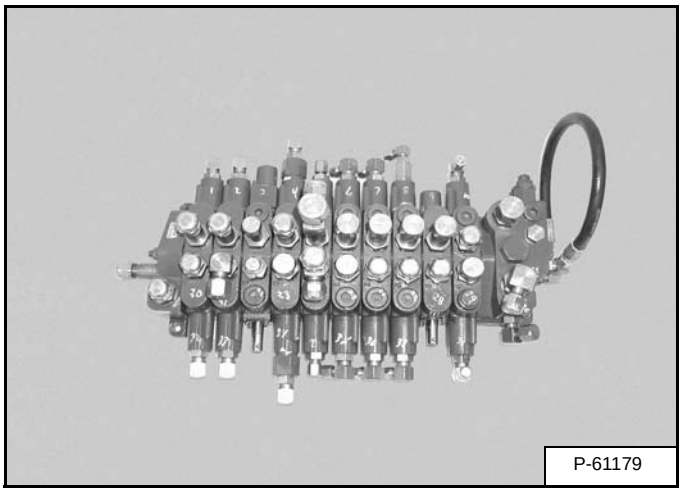


Remove the three bolts (Item 1) from the mount plate (Item 2) **[Figure 20-40-29]**.

Remove the mount plate from the control valve.

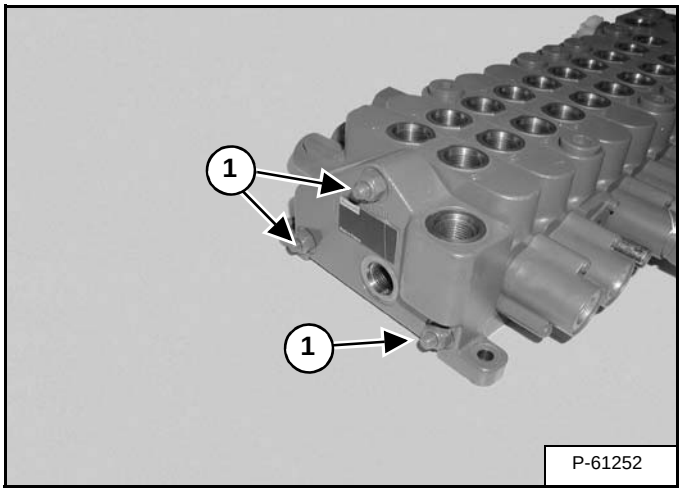
Mark all of the sections of the control valve for proper installation.

Figure 20-40-30



Remove the fittings and hose **[Figure 20-40-30]**.

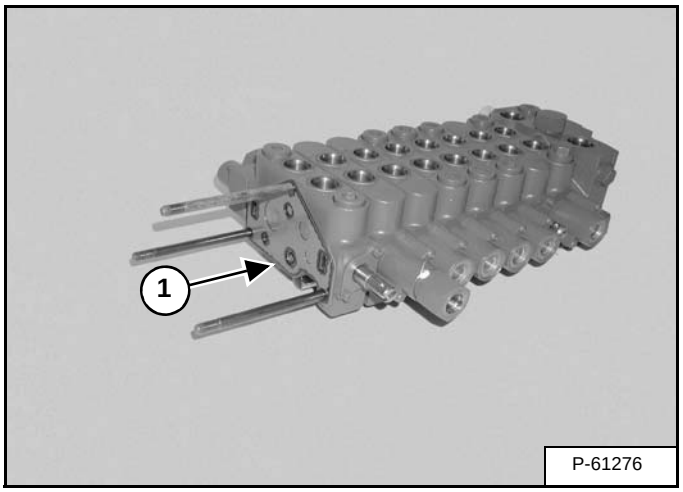
Figure 20-40-31



Remove the nuts (Item 1) **[Figure 20-40-31]**.

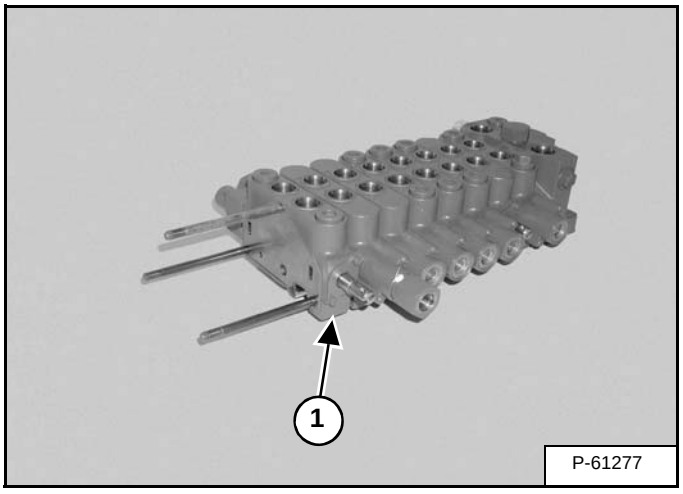
Blade Valve Section Disassembly And Assembly

Figure 20-40-63



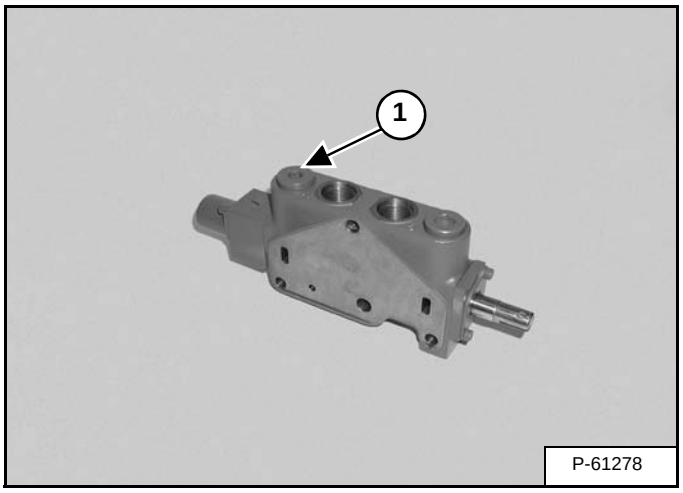
Remove the gasket (Item 1) **[Figure 20-40-63]** from the valve section.

Figure 20-40-64



Remove blade valve section (Item 1) **[Figure 20-40-64]** from the control valve.

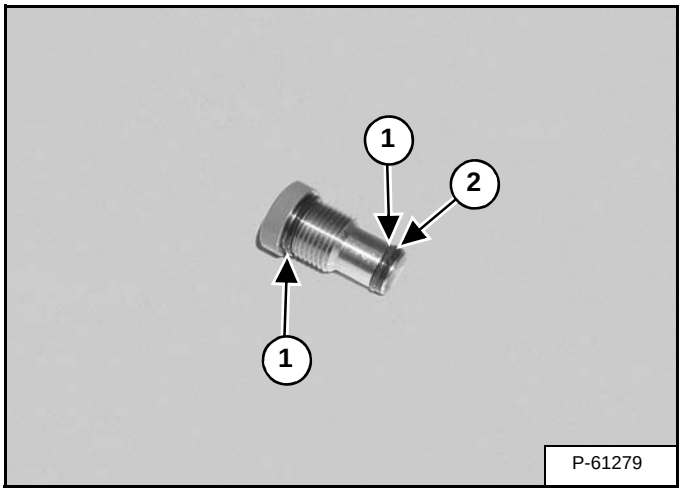
Figure 20-40-65



Remove the plug (Item 1) **[Figure 20-40-65]**.

Installation: Tighten the plug to 22 - 26 ft.-lb. (30 - 35 N•m)

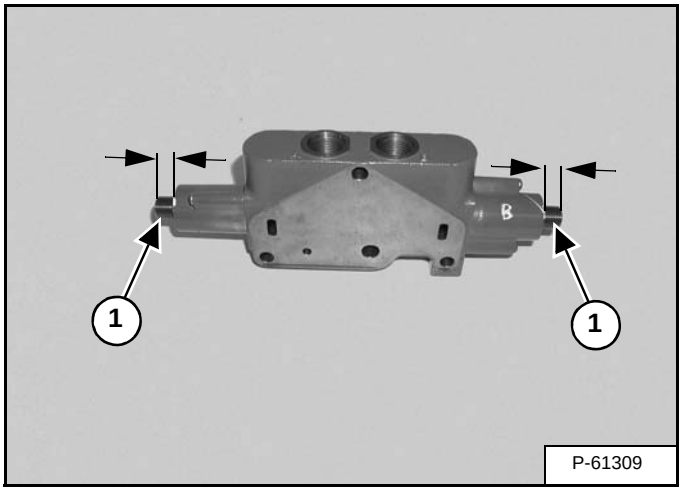
Figure 20-40-66



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-40-66]** from the plug.

Slew Valve Section Disassembly And Assembly (Cont'd)

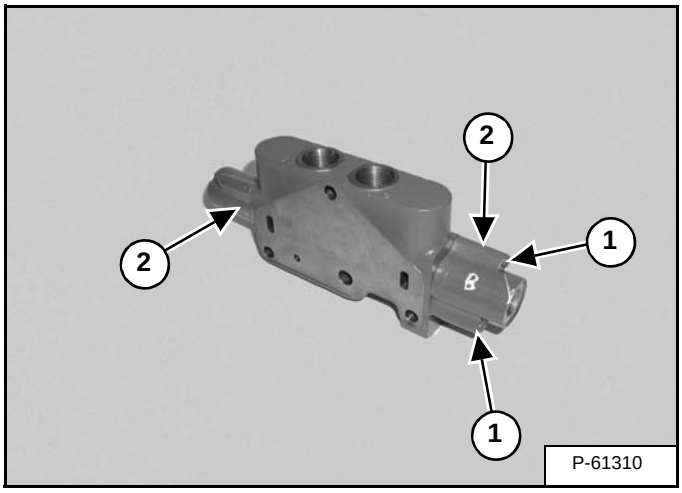
Figure 20-40-100



Measure and record the length of the spool limiter (Item 1) **[Figure 20-40-100]** on both ends of the valve section.

Remove the spool limiters.

Figure 20-40-101

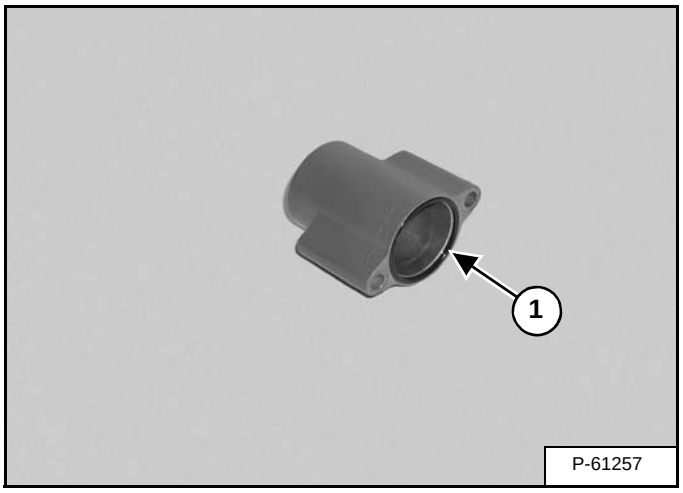


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-40-101]**.

Assembly: Tighten the screws to 27 in.-lb. (3 N•m) torque.

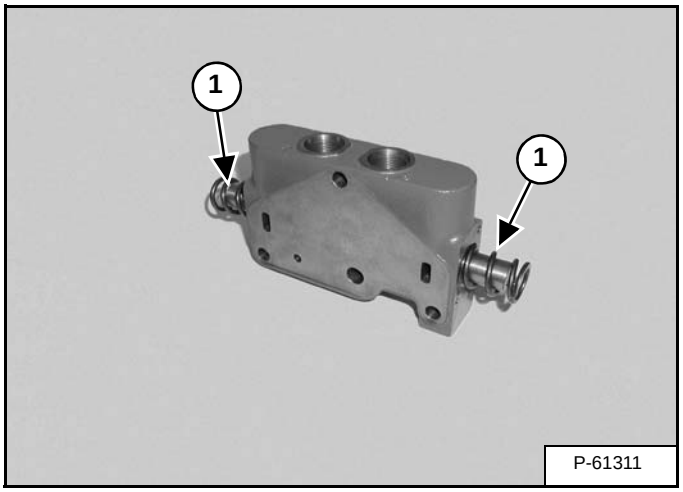
Remove the end caps from the valve section.

Figure 20-40-102



Remove the O-ring (Item 1) **[Figure 20-40-102]** from the end caps.

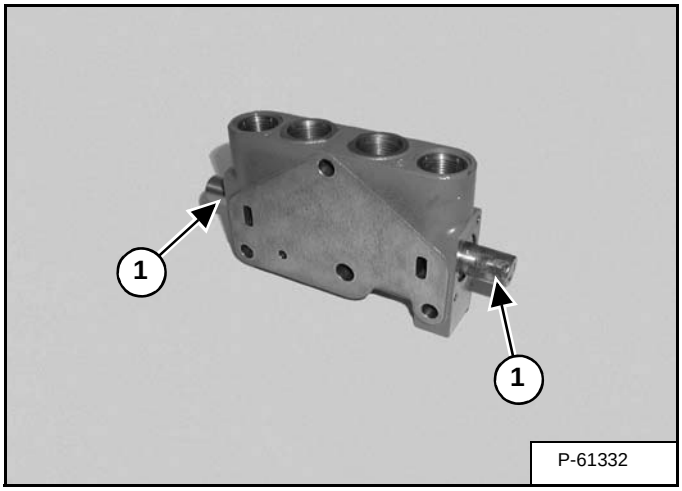
Figure 20-40-103



Remove the centering springs (Item 1) **[Figure 20-40-103]** from the spring guides.

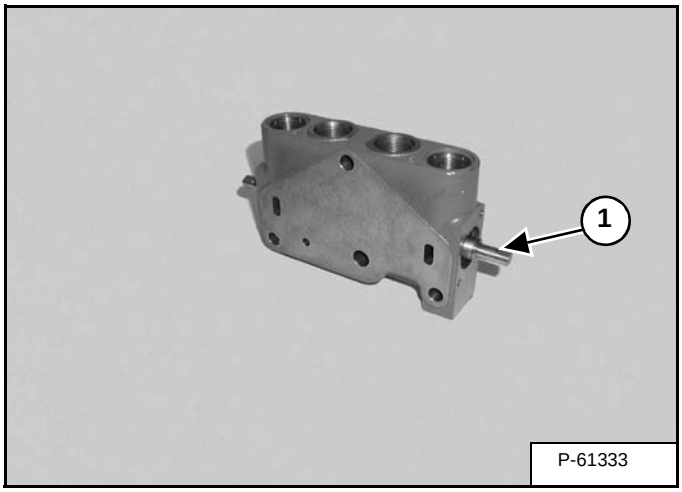
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-137



Remove the spring guides (Item 1) **[Figure 20-40-137]** from both ends of the valve spool.

Figure 20-40-138

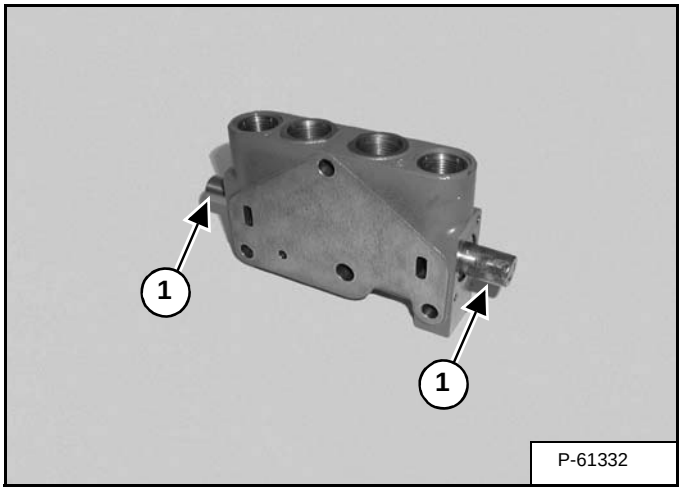


Record the orientation of the spool (Item 1) **[Figure 20-40-138]**. Remove the spool from the valve section.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

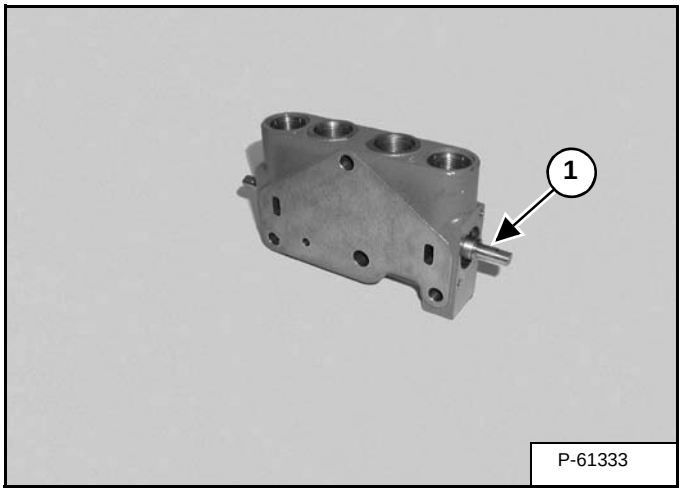
Boom Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-173



Remove the spring guides (Item 1) **[Figure 20-40-173]** from both ends of the valve spool.

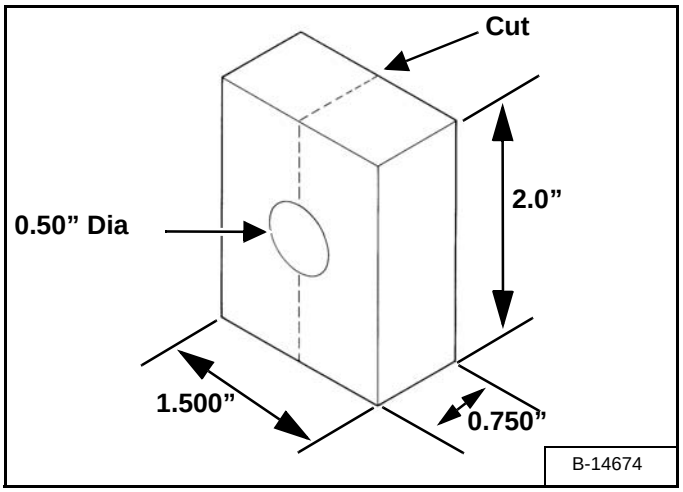
Figure 20-40-174



Record the orientation of the spool (Item 1) **[Figure 20-40-174]**. Remove the spool from the valve section.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

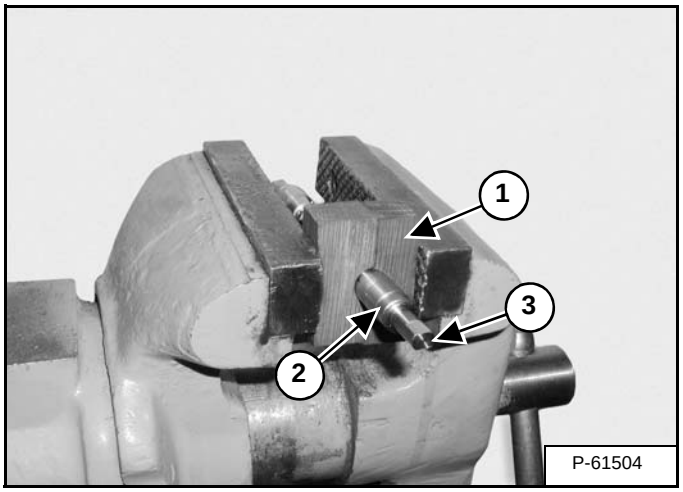
Figure 20-40-175



To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-175]**.

NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

Figure 20-40-176

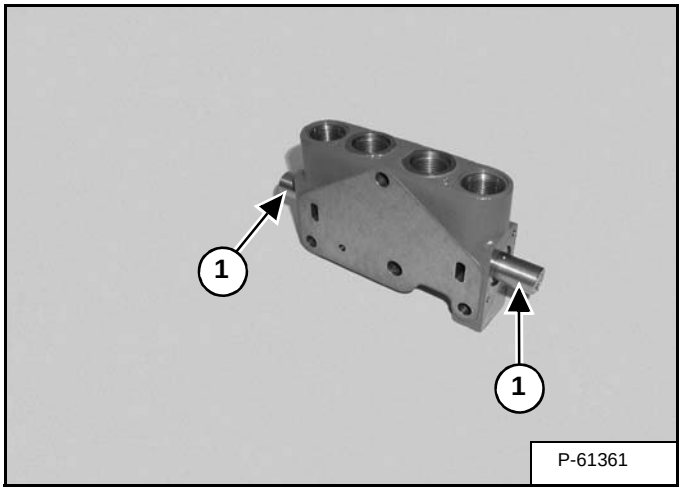


Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the plugs (Item 3) **[Figure 20-40-176]**. (Both ends)

Installation: Apply thread lock adhesive (Loctite® 262) or equivalent to the threads. Tighten the plugs to 44 in.-lb. (5 N•m) torque.

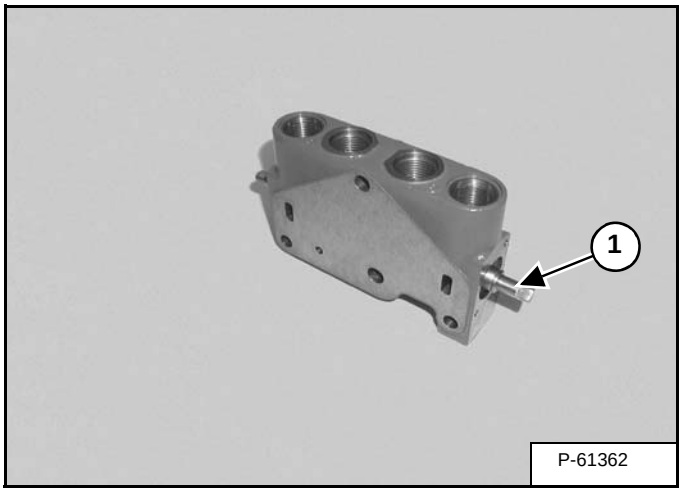
First Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-211



Remove the spring guides (Item 1) **[Figure 20-40-211]** from both ends of the valve spool.

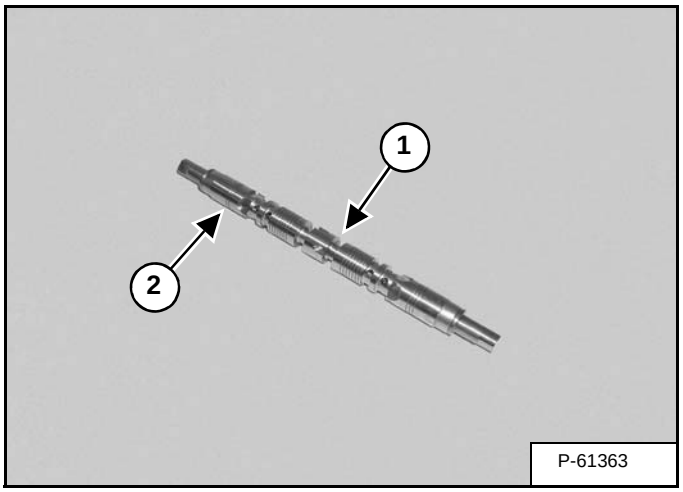
Figure 20-40-212



Record the orientation of the spool (Item 1) **[Figure 20-40-212]**. Remove the spool from the valve section.

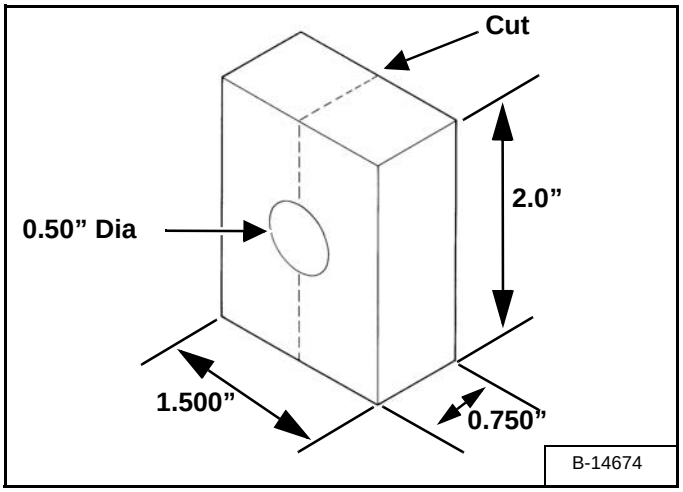
NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

Figure 20-40-213



Assembly: The spool (Item 1) is symmetrical, and can be installed in the valve section with the two spool grooves (Item 2) **[Figure 20-40-213]** either toward the top, or the bottom of the valve section.

Figure 20-40-214

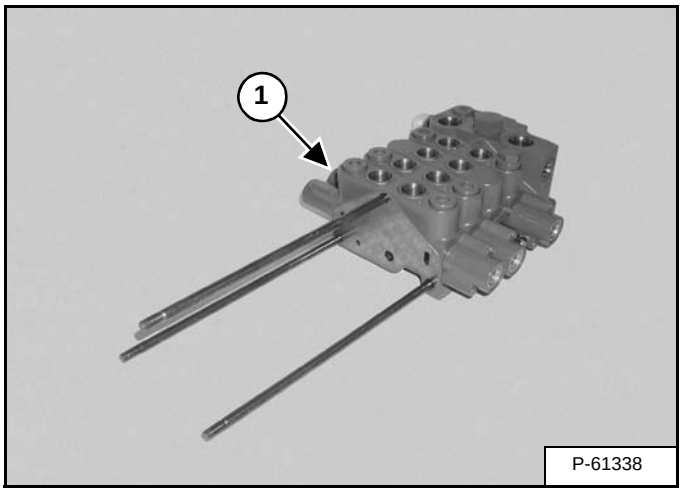


To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-40-214]**.

NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

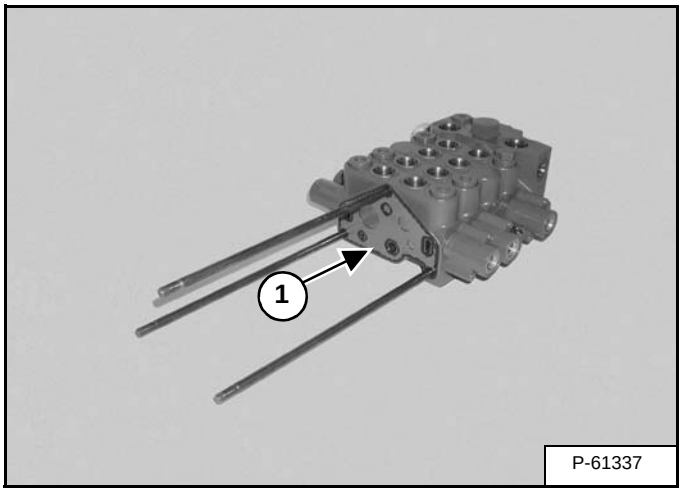
Assembly (Cont'd)

Figure 20-40-248



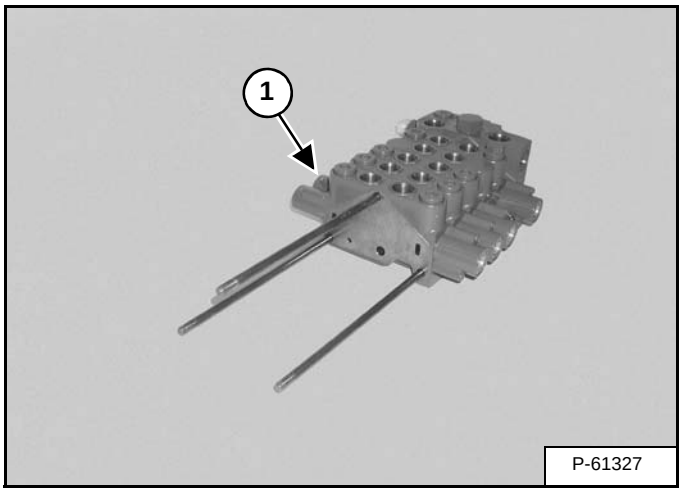
Install the arm valve section (Item 1) **[Figure 20-40-248]** on the tie rods.

Figure 20-40-249



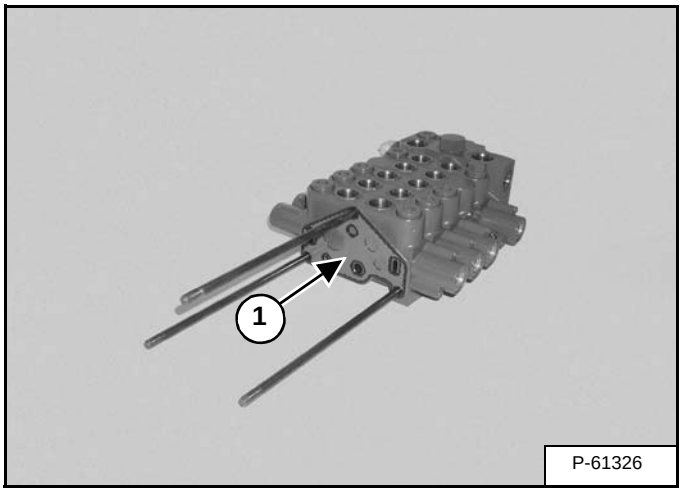
Install the gasket (Item 1) **[Figure 20-40-249]** on the arm valve section.

Figure 20-40-250



Install the bucket valve section (Item 1) **[Figure 20-40-250]** on the tie rods.

Figure 20-40-251

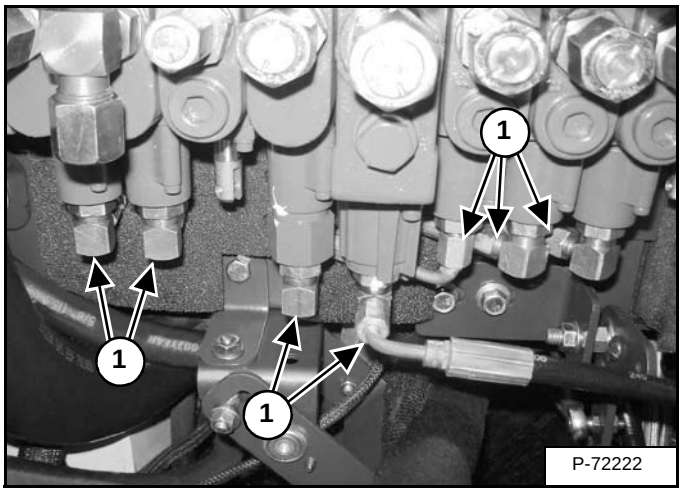


Install the gasket (Item 1) **[Figure 20-40-251]** on the bucket valve section.

HYDRAULIC CONTROL VALVE (S/N 234316877 & ABOVE, S/N 234413319 & ABOVE, S/N 234515533 & ABOVE) (CONT'D)

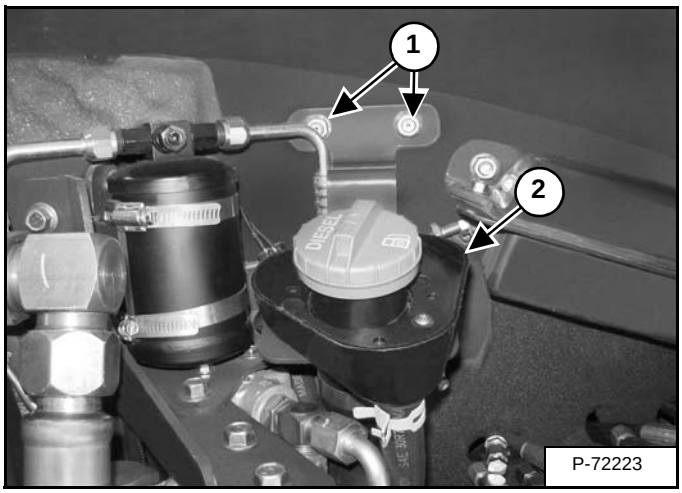
Removal And Installation (Cont'd)

Figure 20-41-12



Remove the hoses (Item 1) **[Figure 20-41-12]**.

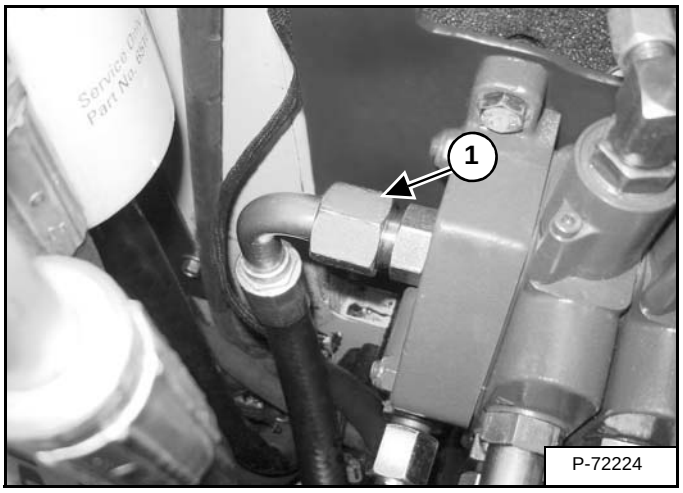
Figure 20-41-13



Remove the two bolts (Item 1) from the fuel fill (Item 2) **[Figure 20-41-13]**.

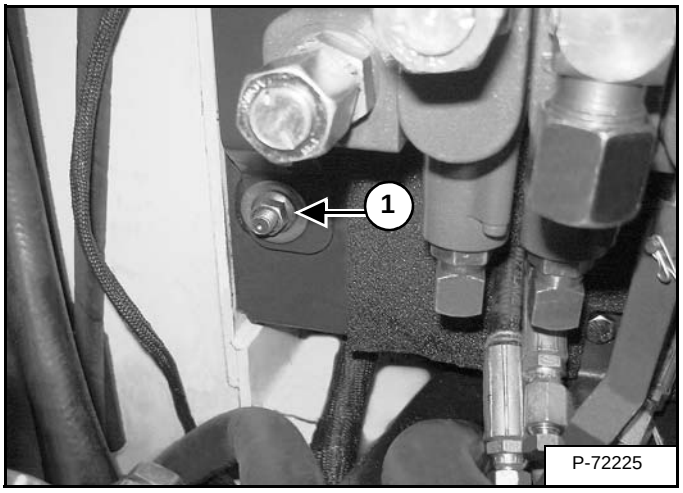
Relocate the fuel fill.

Figure 20-41-14



Remove the hose (Item 1) **[Figure 20-41-14]**.

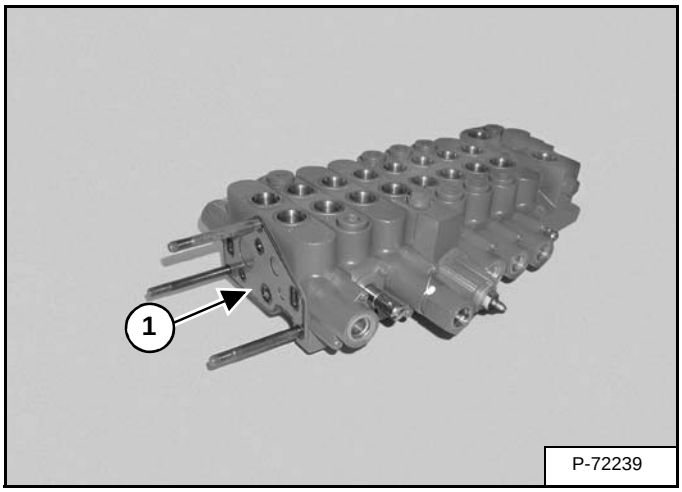
Figure 20-41-15



Remove the nut (Item 1) **[Figure 20-41-15]**, flat washer and rubber washer from the control valve.

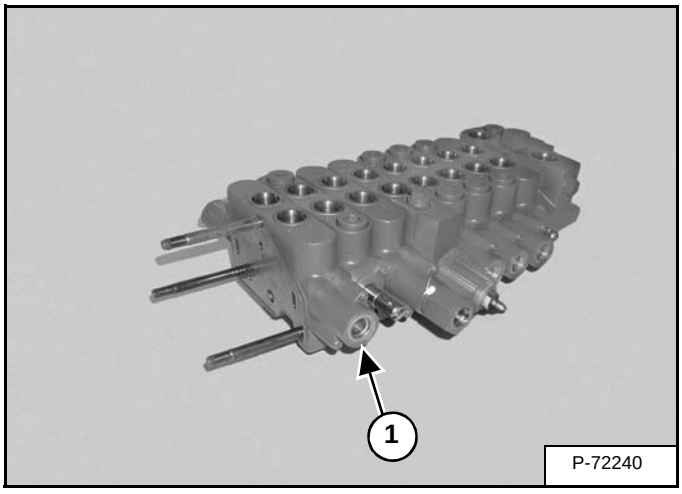
Left Travel Valve Section Disassembly And Assembly

Figure 20-41-42



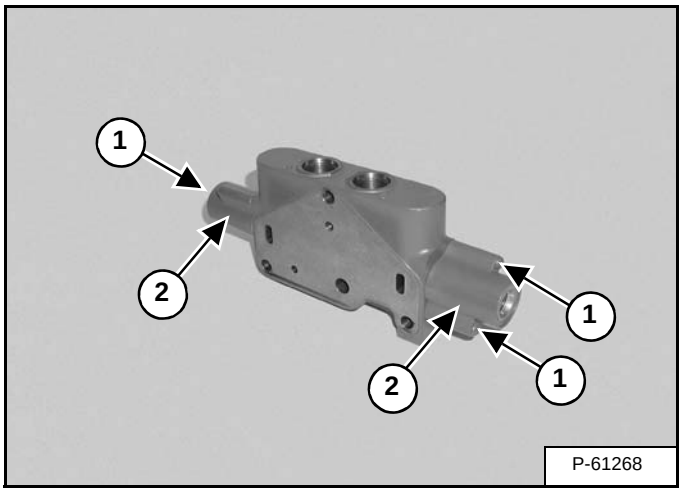
Remove the gasket (Item 1) **[Figure 20-41-42]** from the valve section.

Figure 20-41-43



Remove the left travel valve section (Item 1) **[Figure 20-41-43]** from the control valve.

Figure 20-41-44

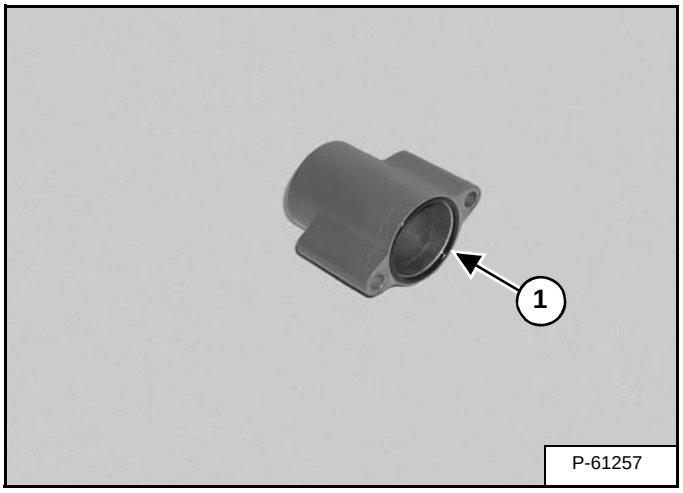


Remove the screws (Item 1) from both end caps (Item 2) **[Figure 20-41-44]**.

Installation: Tighten the screws to 27 in.-lb. (3 N•m) torque.

Remove the end caps from the valve section.

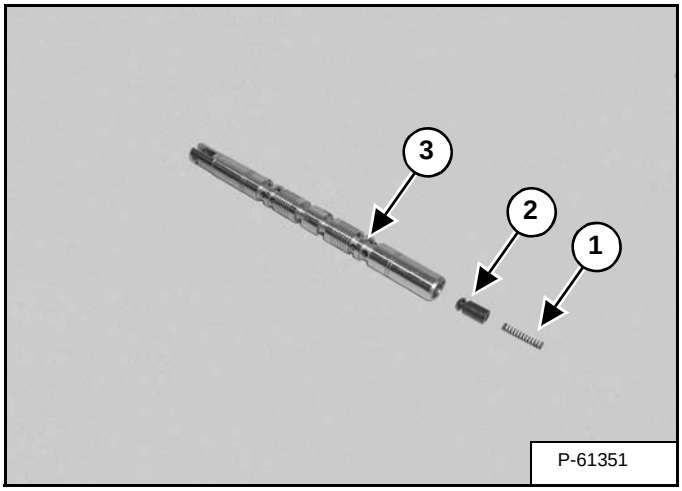
Figure 20-41-45



Remove the O-ring (Item 1) **[Figure 20-41-45]** from the end caps.

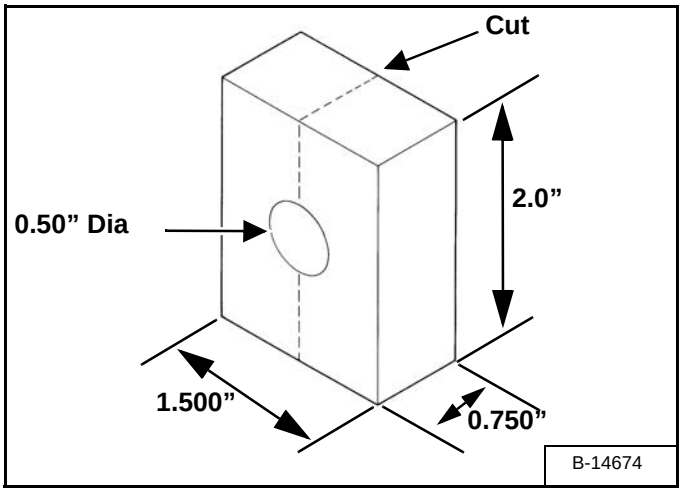
Blade Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-81



Remove the spring (Item 1) and poppet (Item 2) **[Figure 20-41-81]** from the spool.

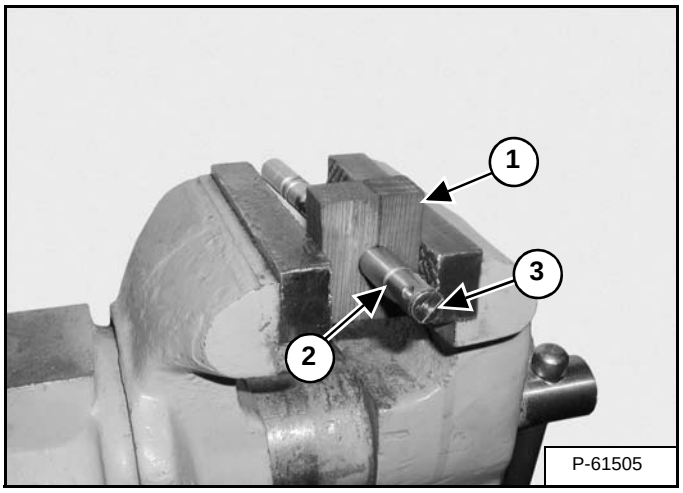
Figure 20-41-82



To remove the linkage end from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.50 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-82]**.

NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

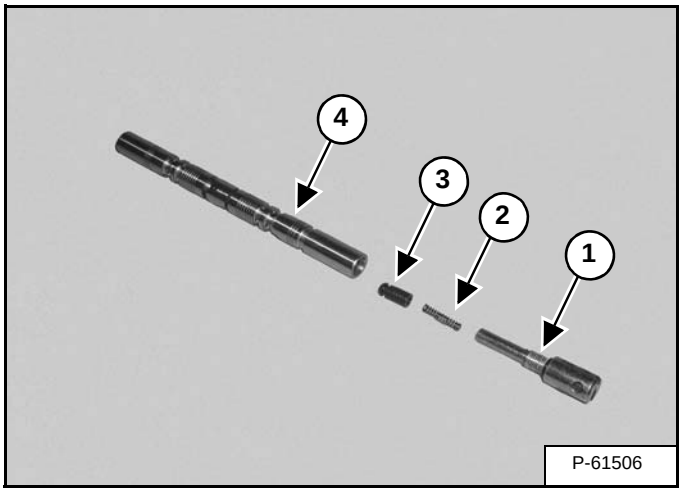
Figure 20-41-83



Using the wood blocks (Item 1) clamp the spool assembly (Item 2) in a vise and loosen the linkage end (Item 3) **[Figure 20-41-83]**.

Installation: Apply thread lock adhesive (Loctite® 242) or equivalent to the threads. Tighten the linkage end to 44 in.-lb. (5 N•m) torque.

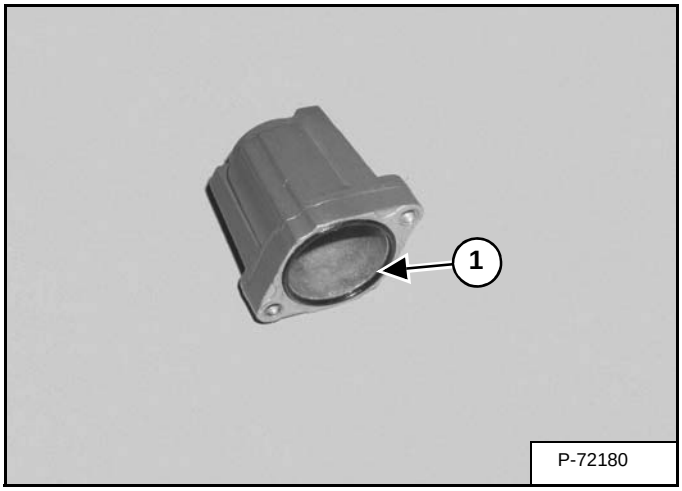
Figure 20-41-84



Remove the linkage end (Item 1), spring (Item 2), and poppet (Item 3) from the spool (Item 4) **[Figure 20-41-84]**.

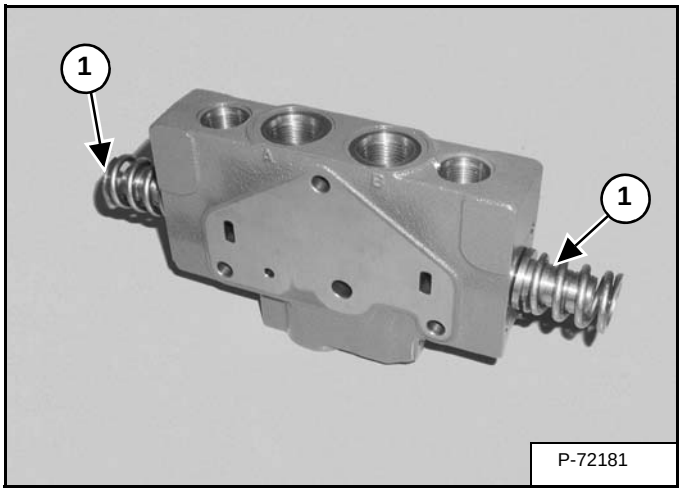
Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-116



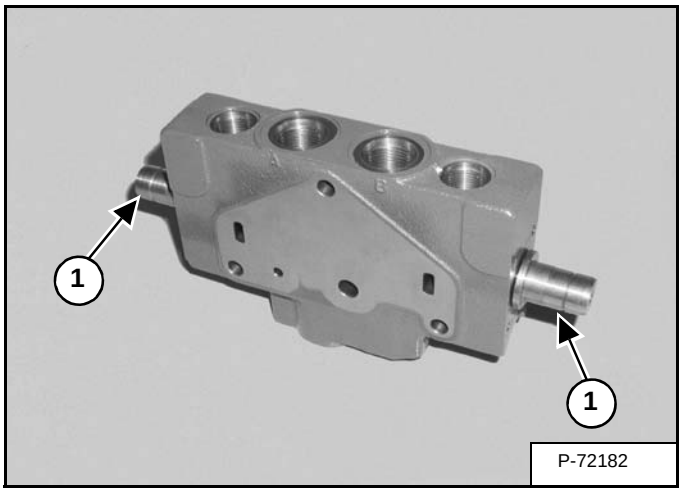
Remove the O-ring (Item 1) **[Figure 20-41-116]** from both end caps.

Figure 20-41-117



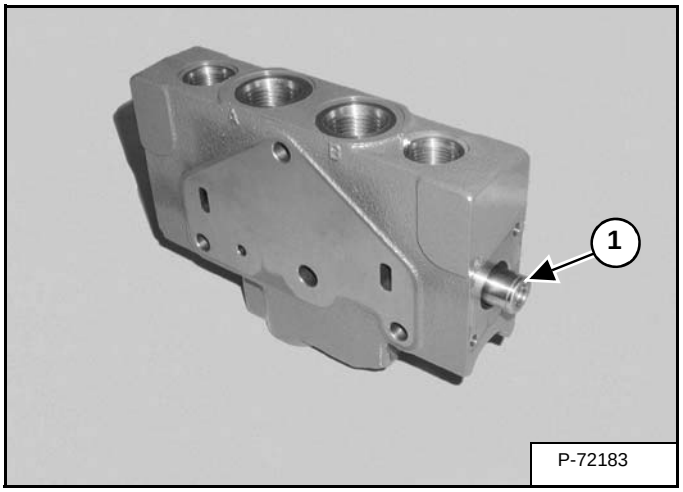
Remove the centering springs (Item 1) **[Figure 20-41-117]** from both ends of the valve spool.

Figure 20-41-118



Remove the spring guides (Item 1) **[Figure 20-41-118]** from both ends of the valve spool.

Figure 20-41-119

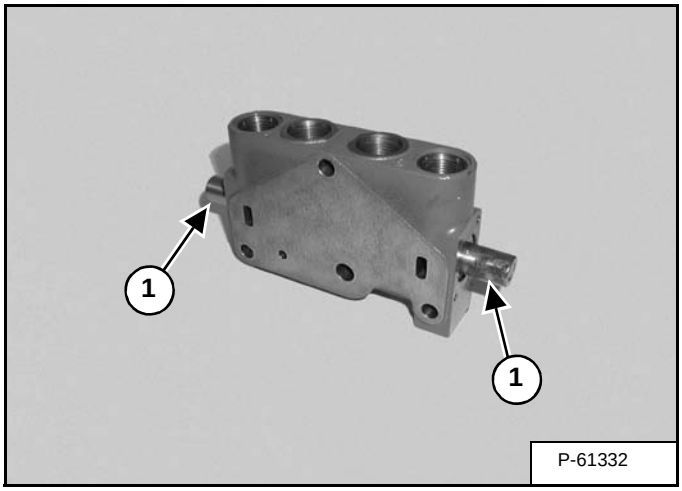


Record the orientation of the spool (Item 1) **[Figure 20-41-119]**. Remove the spool from the valve section.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

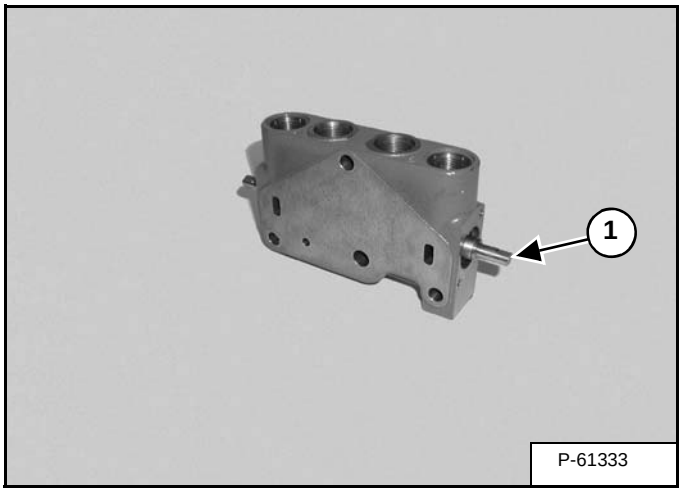
Arm Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-152



Remove the spring guides (Item 1) **[Figure 20-41-152]** from both ends of the valve spool.

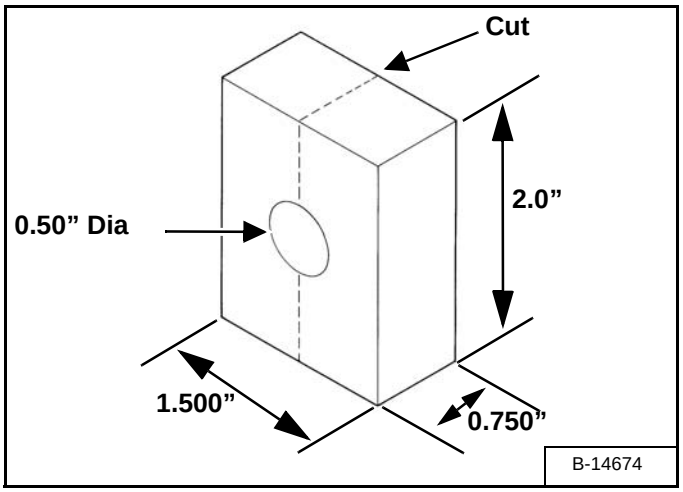
Figure 20-41-153



Record the orientation of the spool (Item 1) **[Figure 20-41-153]**. Remove the spool from the valve section.

NOTE: The spool is not symmetrical. Incorrect spool installation will cause poor hydraulic valve performance.

Figure 20-41-154

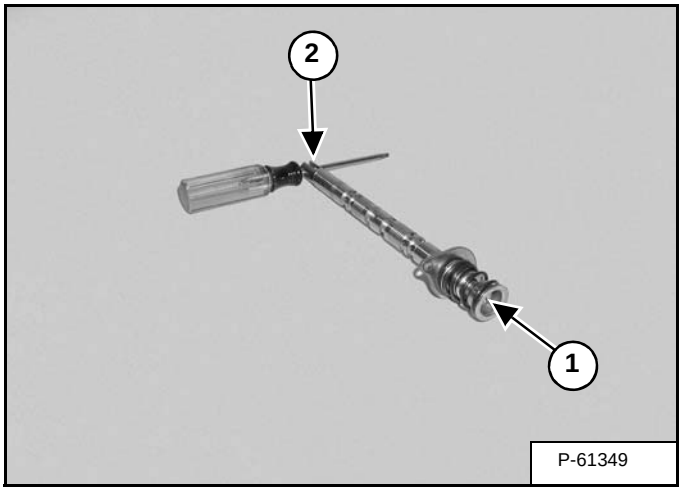


To remove the plugs from the spool, a holding fixture will have to be made from a 0.750 inch thick x 1.500 inches wide x 2.0 inches long (19 mm thick x 38 mm wide x 50 mm long) piece of hardwood. Drill a 0.50 inch (13 mm) hole in the center of the hardwood block. Cut the block lengthwise **[Figure 20-41-154]**.

NOTE: Do not use anything other than hardwood blocks to grip the spool, or the spool will be damaged.

Boom Swing Valve Section Disassembly And Assembly (Cont'd)

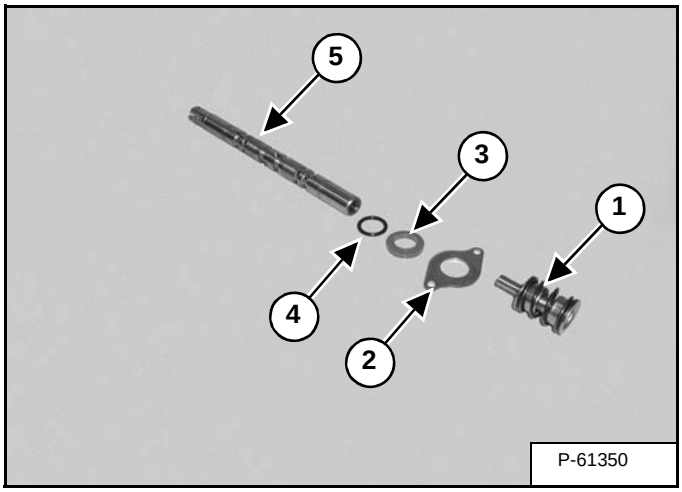
Figure 20-41-188



Loosen the bolt (Item 1) **[Figure 20-41-188]**.

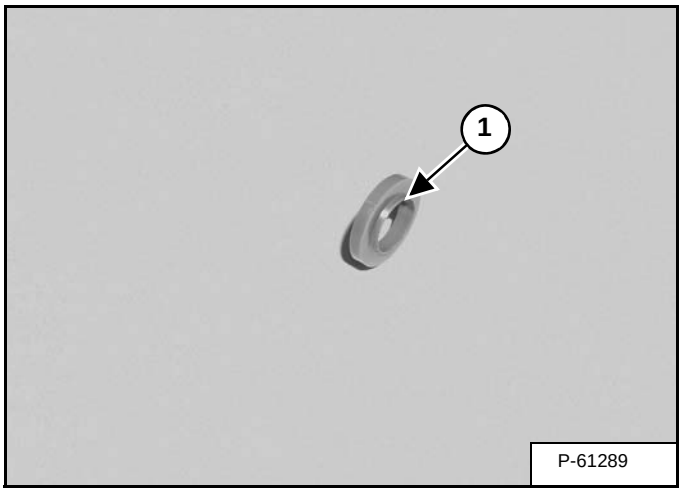
NOTE: To remove the bolt, the spool must be held on the linkage end (Item 2) [Figure 20-41-188], to keep the spool from rotating.

Figure 20-41-189



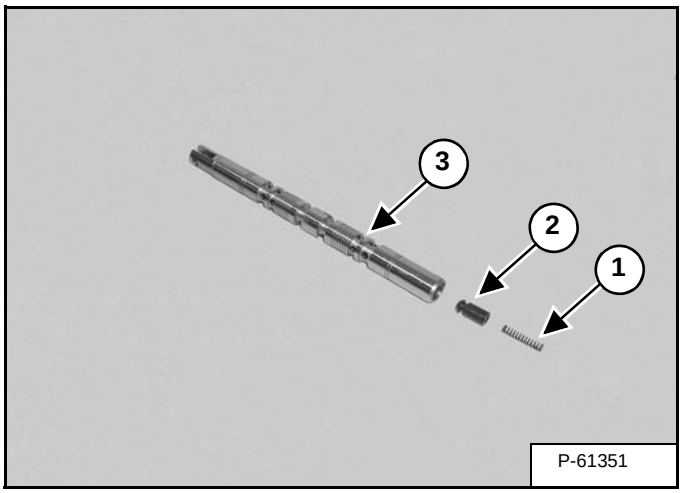
Remove the spring assembly (Item 1), retainer (Item 2), seal (Item 3) and O-ring (Item 4) from the spool (Item 5) **[Figure 20-41-189]**.

Figure 20-41-190



Assembly: Install the seal on the spool with the flange (Item 1) **[Figure 20-41-190]** toward the outside of the valve section.

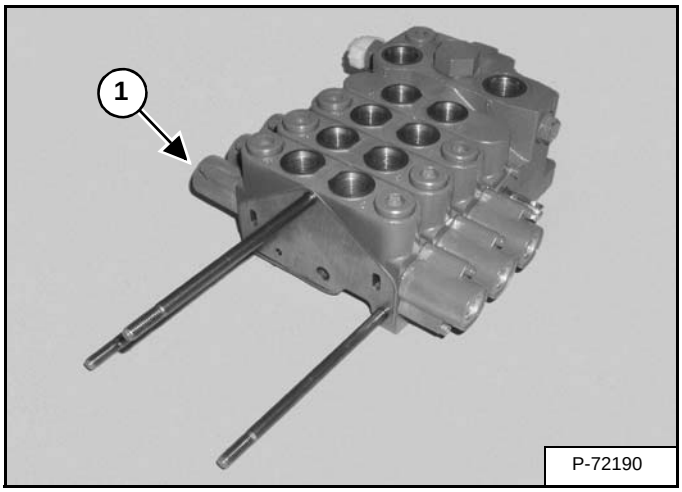
Figure 20-41-191



Remove the spring (Item 1) and poppet (Item 2) from the spool (Item 3) **[Figure 20-41-191]**.

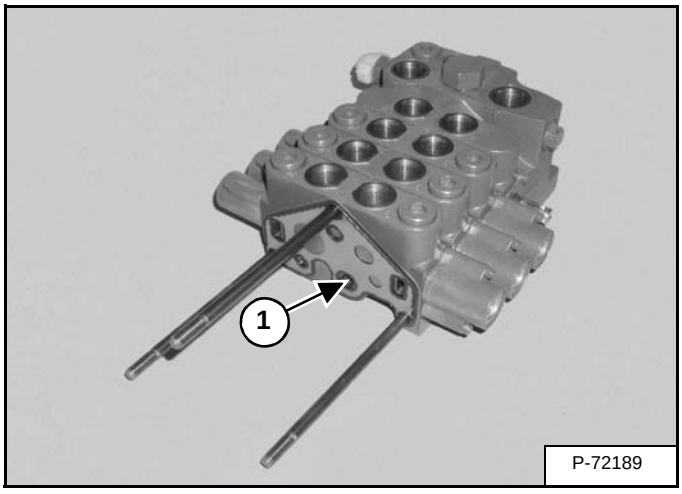
Assembly (Cont'd)

Figure 20-41-226



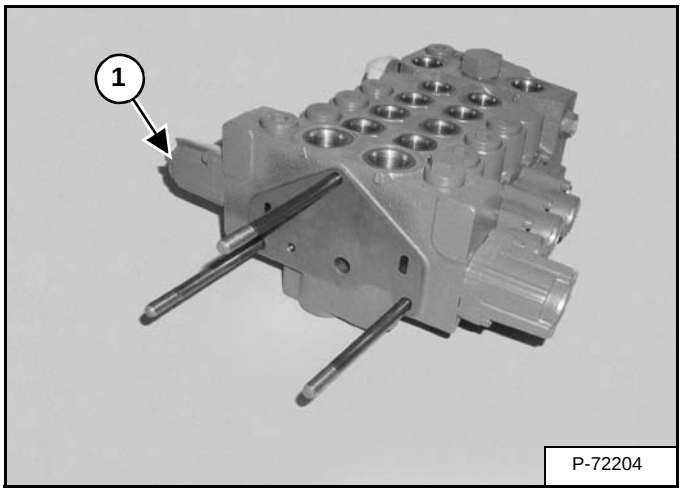
Install the bucket valve section (Item 1) **[Figure 20-41-226]** on the tie rods.

Figure 20-41-227



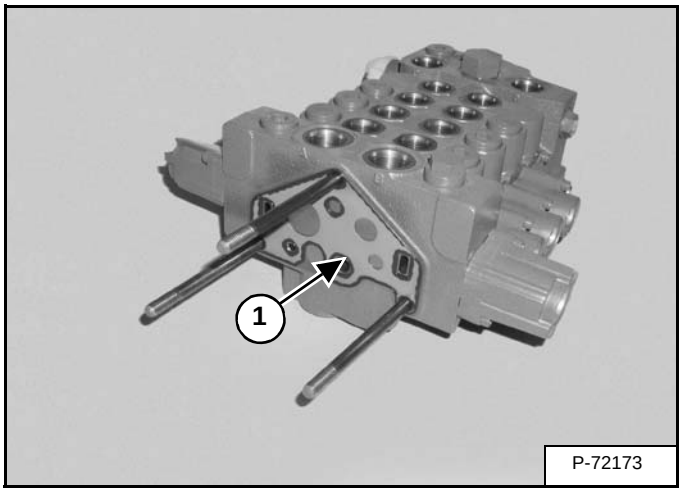
Install the gasket (Item 1) **[Figure 20-41-227]** on the bucket valve section.

Figure 20-41-228



Install the auxiliary valve section (Item 1) **[Figure 20-41-228]** on the tie rods.

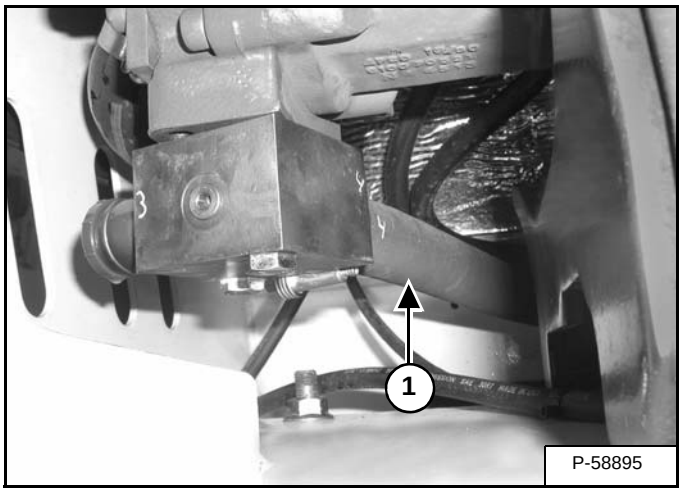
Figure 20-41-229



Install the gasket (Item 1) **[Figure 20-41-229]** on the auxiliary valve section.

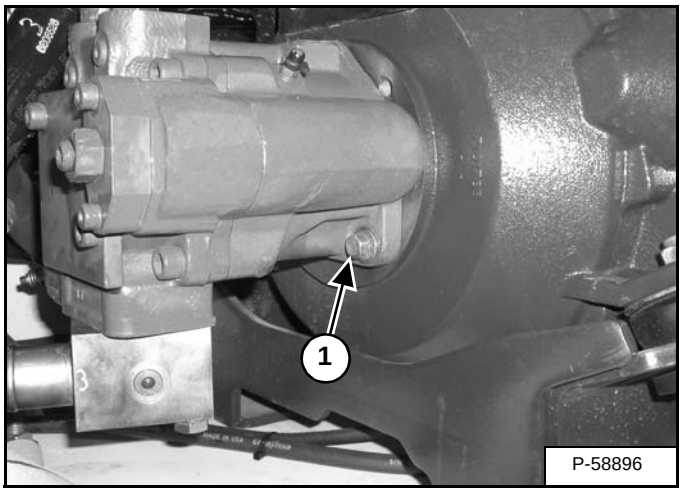
Removal And Installation (Cont'd)

Figure 20-50-13



Remove the hydraulic filter to pump hose (Item 1) **[Figure 20-50-13]**.

Figure 20-50-14

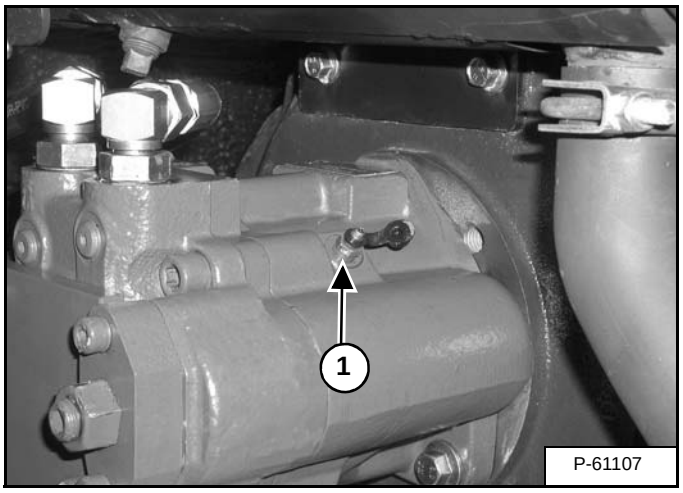


Remove the two bolts (Item 1) **[Figure 20-50-14]**.

Installation: Tighten the bolts to 55 - 60 ft.-lb. (75 - 85 N•m) torque.

Pump Installation: Whenever the hydraulic system has been drained and refilled, the hydraulic pump must be purged of air.

Figure 20-50-15

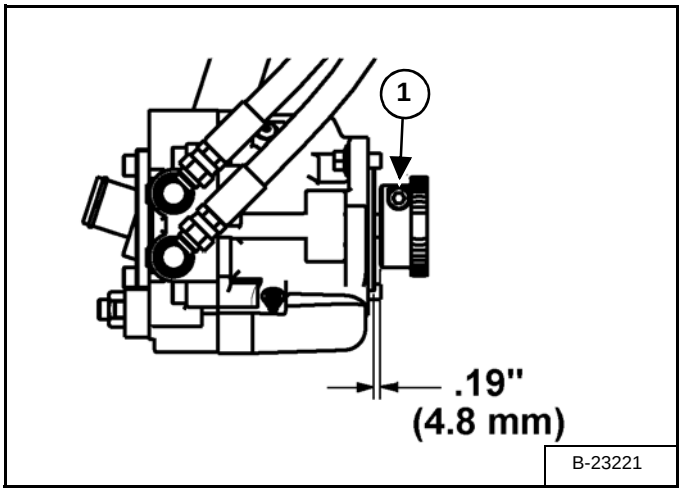


Open the bleed valve (Item 1) **[Figure 20-50-15]** on the hydraulic pump. Close the valve after a steady stream of hydraulic fluid free of any air drains from the valve.

Tighten the bleed valve.

Coupler Removal And Installation

Figure 20-50-16



Remove the bolt (Item 1) **[Figure 20-50-16]** from the coupler.

Slide the coupler off of the pump shaft.

When installing the coupler, maintain 0.19 inch (4,8 mm) gap from the pump mount flange to the coupler.

Tighten the bolt (Item 1) **[Figure 20-50-16]** to 36 - 40 ft.-lb. (49 - 54 N•m) torque.

Assembly

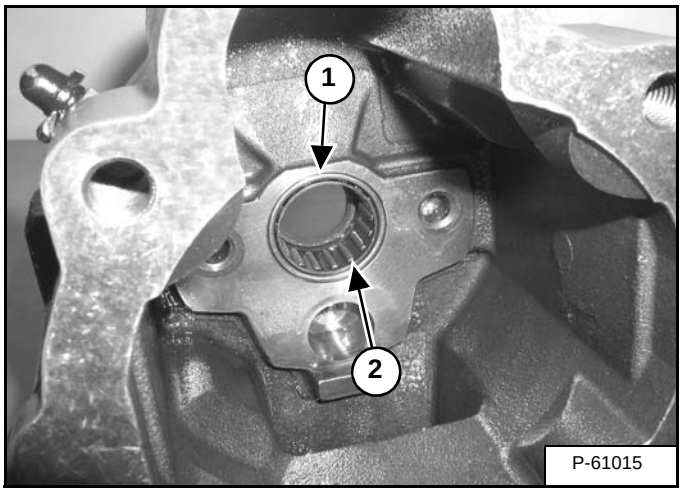
Clean all parts in solvent and dry with compressed air. Do not use compressed air to dry the bearings.

Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

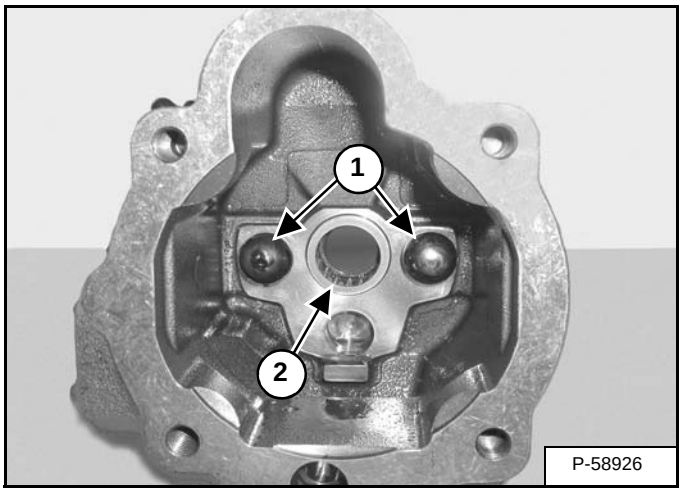
Apply a thin coat of hydraulic fluid to all components before assembly.

Figure 20-50-47



Install the bearing (Item 1) and seal (Item 2) **[Figure 20-50-47]** in the pump housing.

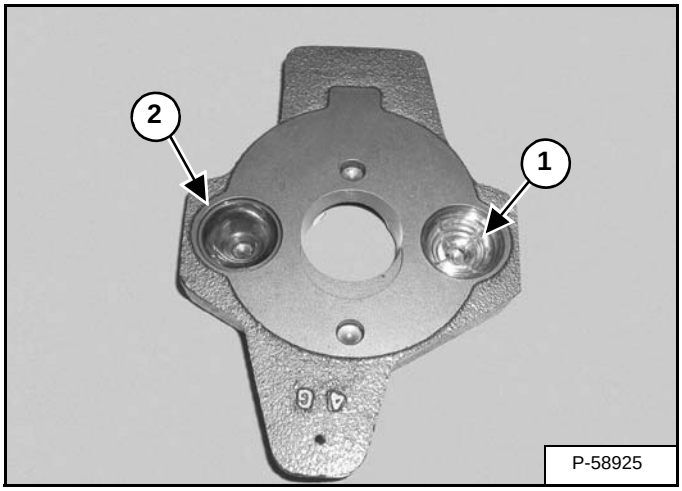
Figure 20-50-48



Install the guides (Item 1) and shim (Item 2) **[Figure 20-50-48]**.

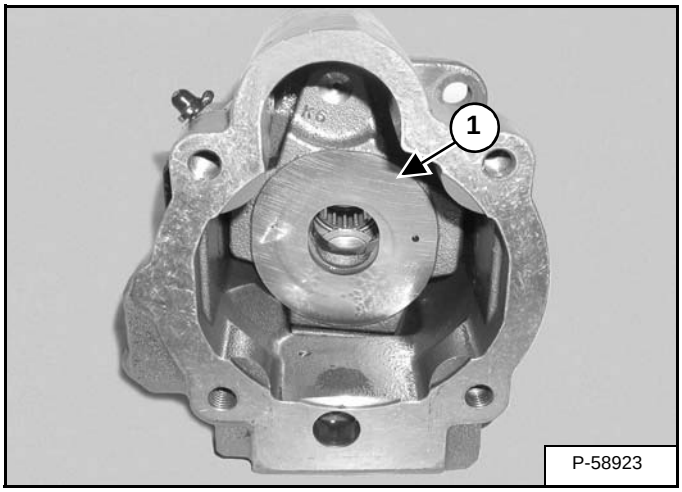
NOTE: Apply assembly lube to the shim for ease of assembly.

Figure 20-50-49



Install the brass guide seat (Item 1) and steel guide seat (Item 2) **[Figure 20-50-49]** in the pump housing.

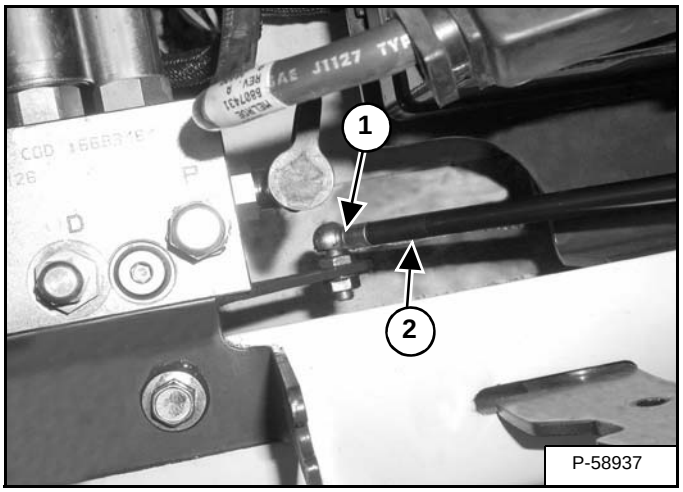
Figure 20-50-50



Install the swash plate (Item 1) **[Figure 20-50-50]** in the pump housing.

Removal And Installation (Cont'd)

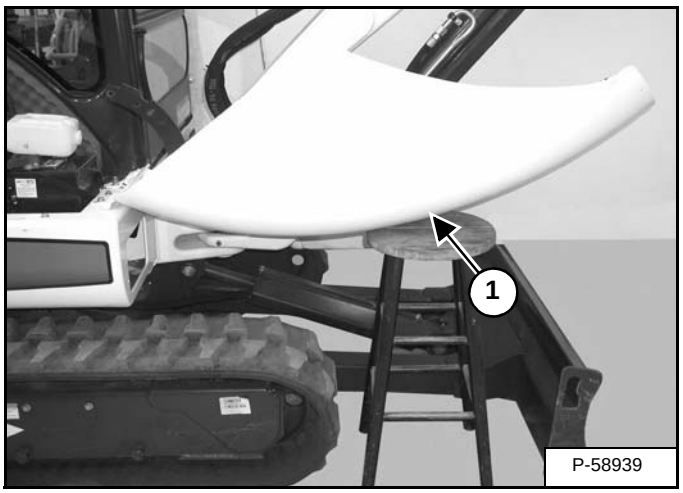
Figure 20-60-7



Remove the retaining clip (Item 1) and gas spring (Item 2) **[Figure 20-60-7]**.

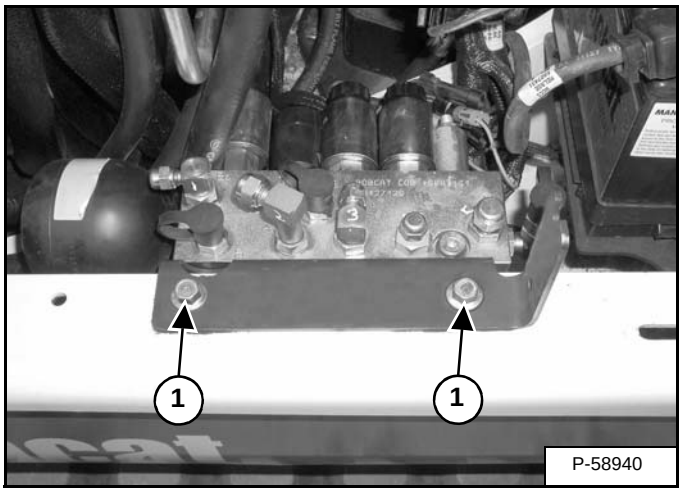
Rotate the gas spring toward the front of the excavator.

Figure 20-60-8



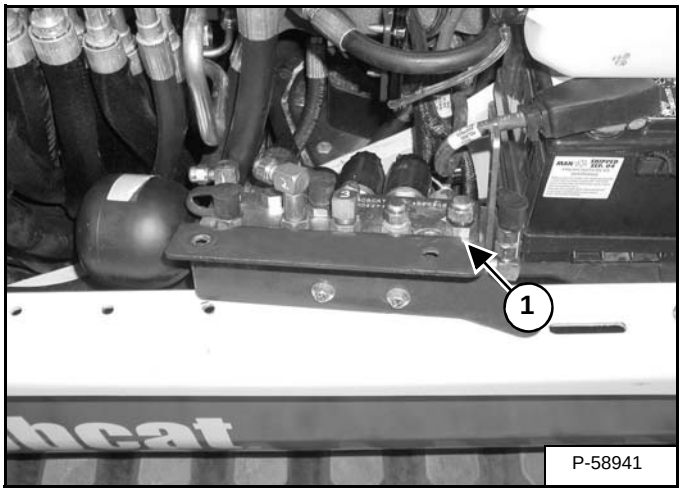
Fully open and support the cover (Item 1) **[Figure 20-60-8]**.

Figure 20-60-9



Remove the bolts (Item 1) **[Figure 20-60-9]**.

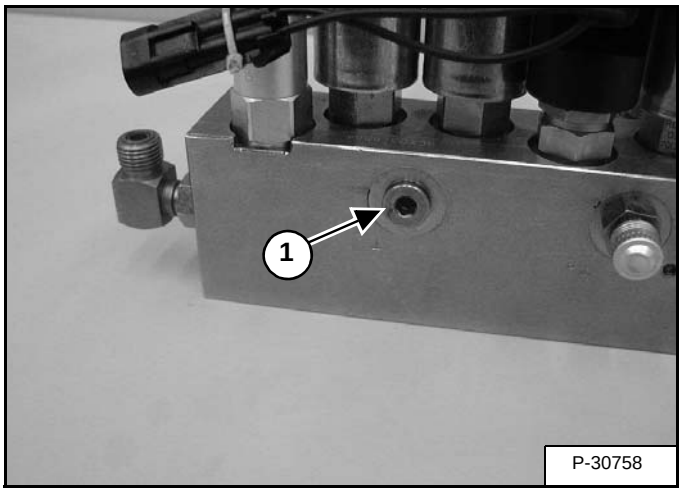
Figure 20-60-10



Remove the manifold assembly (Item 1) **[Figure 20-60-10]**.

Disassembly And Assembly (Cont'd)

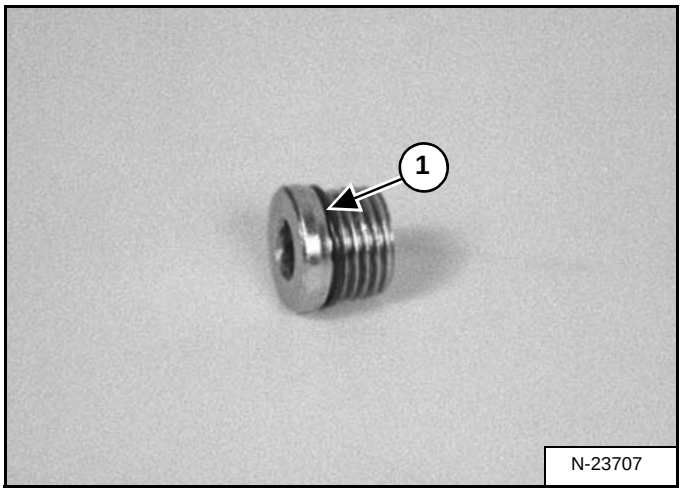
Figure 20-60-43



Remove the plug (Item 1) **[Figure 20-60-43]** from the manifold assembly.

Installation: Tighten the plug to 29 ft.-lb. (40 N•m) torque.

Figure 20-60-44



Remove the O-ring (Item 1) **[Figure 20-60-44]** from the plug.

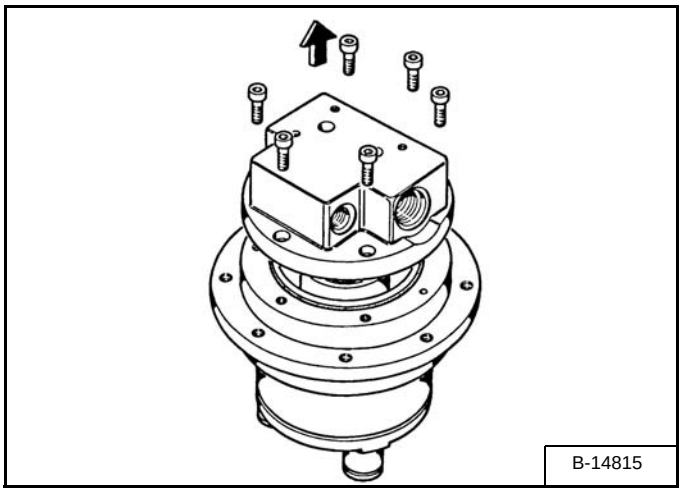
Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

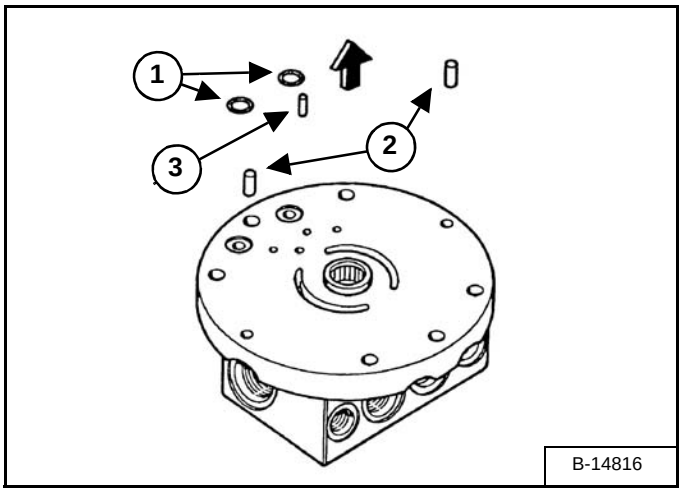
Disassembly (Cont'd)

Figure 20-70-27



Remove the bolts and motor cover **[Figure 20-70-27]**.

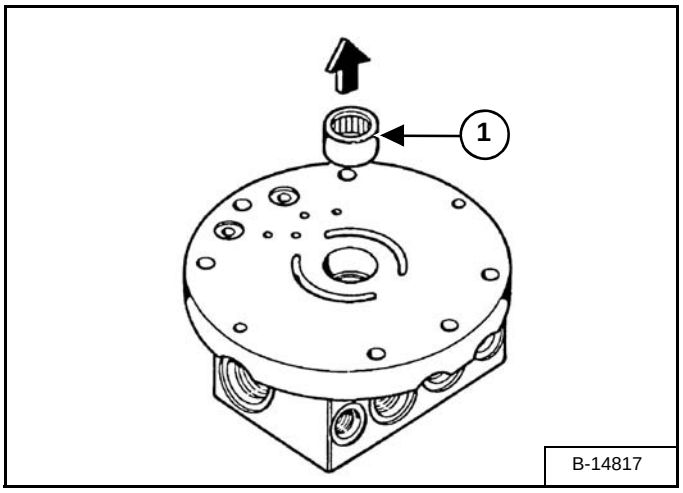
Figure 20-70-28



Remove the O-rings (Item 1) and the dowel pins (Item 2) **[Figure 20-70-28]**.

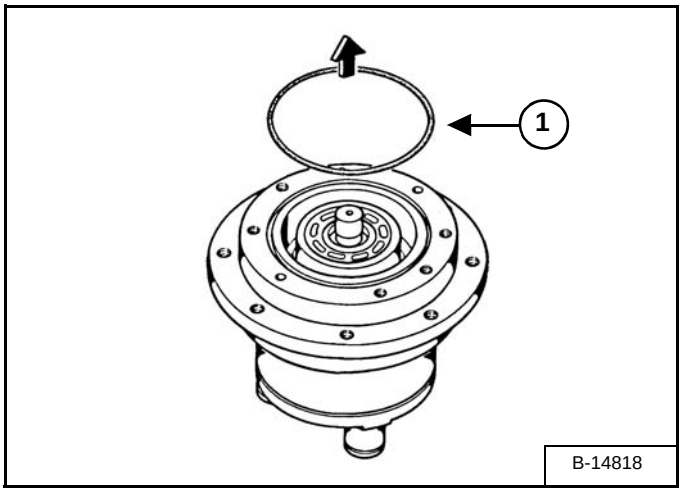
Remove the alignment pin (Item 3) **[Figure 20-70-28]**.

Figure 20-70-29



Remove the bearing (Item 1) **[Figure 20-70-29]** with a bearing puller.

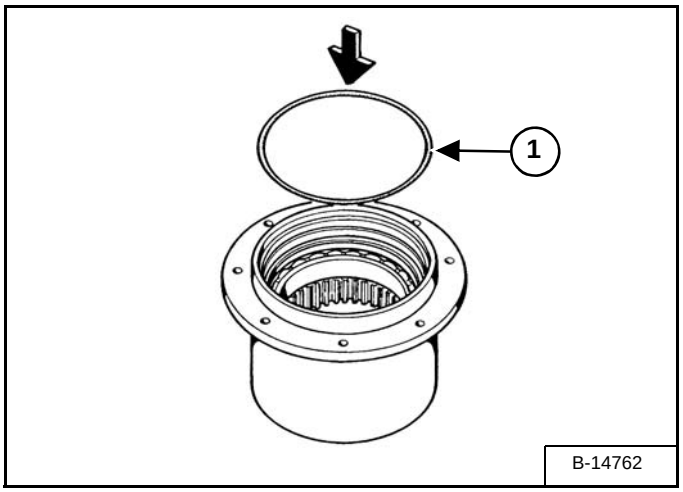
Figure 20-70-30



Remove the O-ring (Item 1) **[Figure 20-70-30]**.

Assembly (Cont'd)

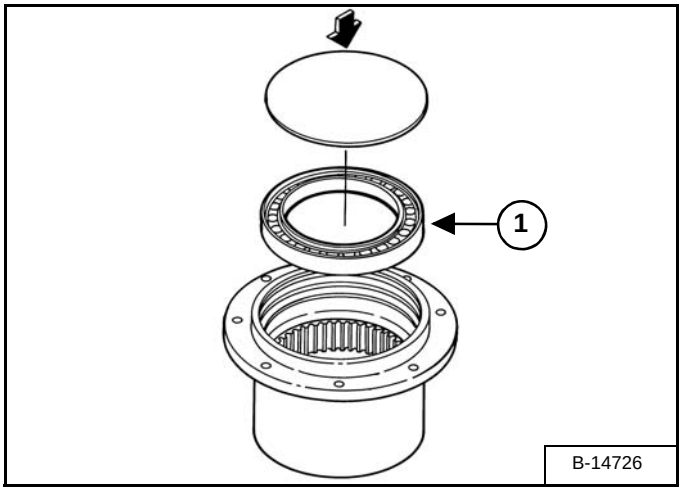
Figure 20-70-63



Apply oil to and install the O-ring (Item 1) **[Figure 20-70-63]**.

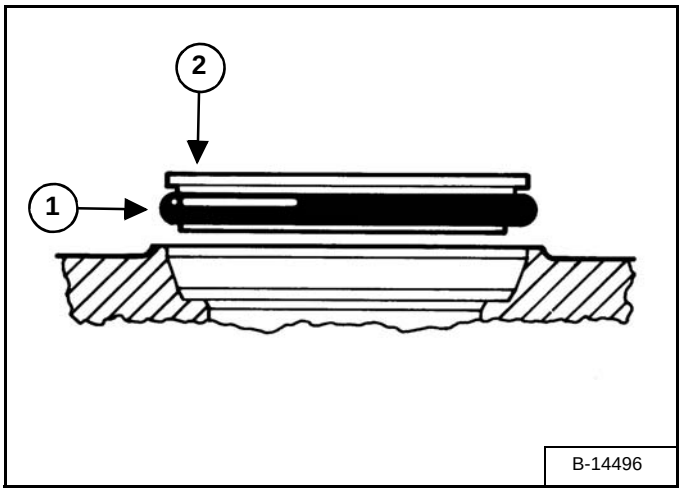
NOTE: Make sure the O-ring (Item 1) [Figure 20-70-63] is correctly installed in the housing groove so it is not damaged when the second bearing is installed.

Figure 20-70-64



Lubricate the outer edge of the second bearing and press the bearing in the housing **[Figure 20-70-64]**.

Figure 20-70-65

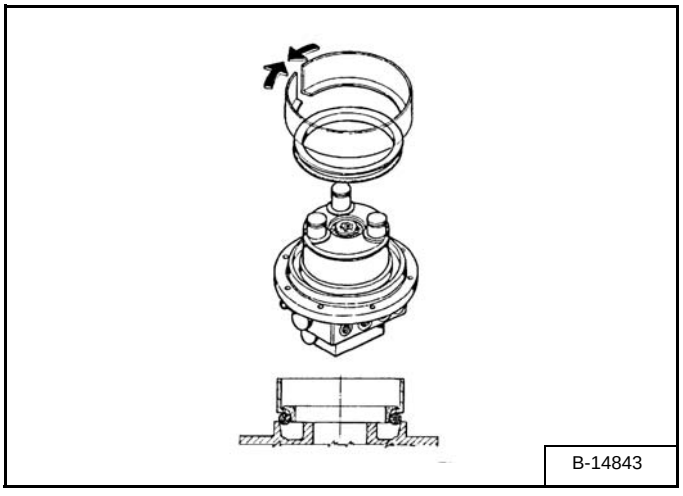


Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-65]**.

NOTE: Inspect the seal ring for burrs before installing the O-ring. Install the O-ring making sure it is not twisted. To remove any twists, gently pull a section of the O-ring and let it snap back.

The O-ring, seal ring and motor assembly must be clean and free of any dust, oil film or foreign matter.

Figure 20-70-66



Install the seal seating tool (MEL1519) on the seal ring and O-ring assembly **[Figure 20-70-66]**.

The O-ring and seal ring assembly has to be lubricated with alcohol so the O-ring will slip past the housing retaining ring and seal uniformly in the motor housing radius **[Figure 20-70-66]**. Do not use oil to lubricate the O-ring.

Dip the O-ring and seal ring assembly in a pan of alcohol.

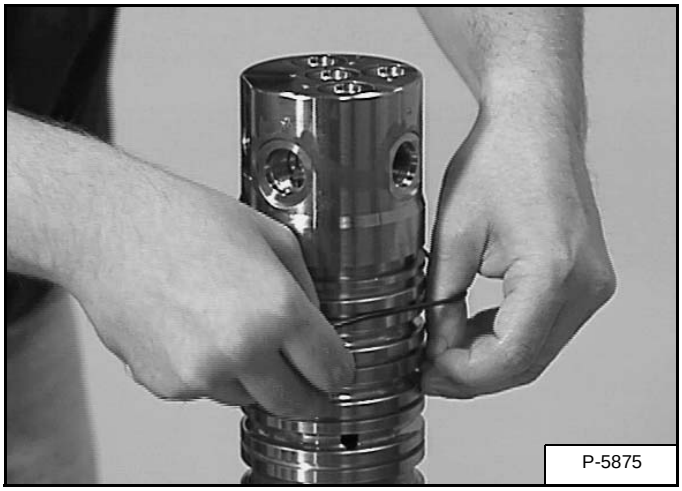
Assembly

Clean all parts in solvent and dry with compressed air.

Inspect all parts for wear or damage. Replace any worn or damaged parts.

Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

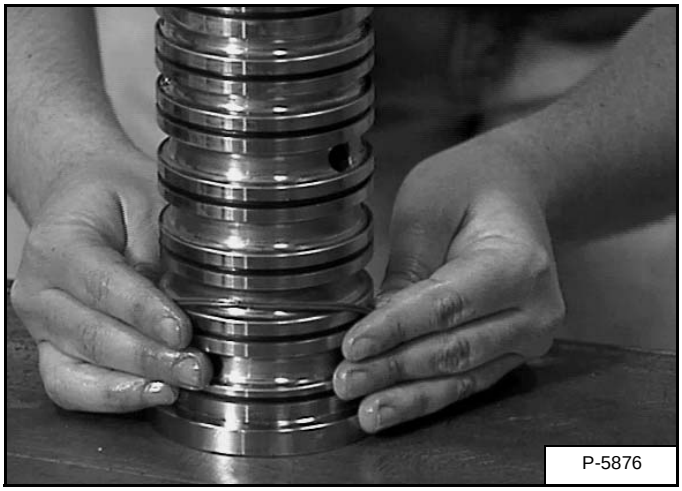
Figure 20-80-9



Install the O-rings on the rotor **[Figure 20-80-9]**.

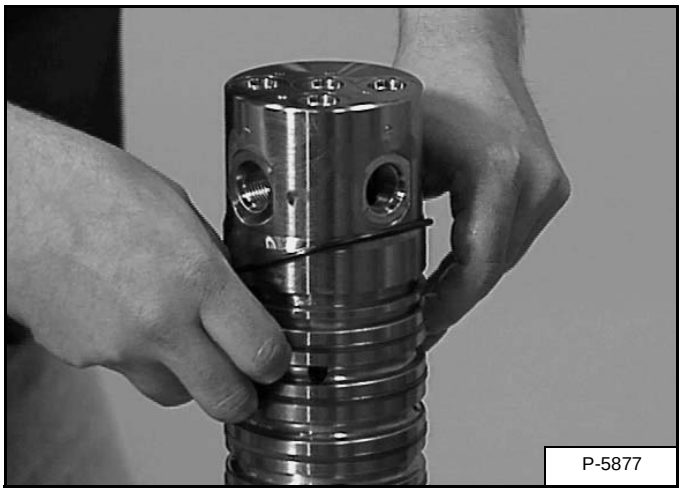
Heat the glid rings and crown seal in hydraulic oil for three minutes at 130° F (54° C).

Figure 20-80-10



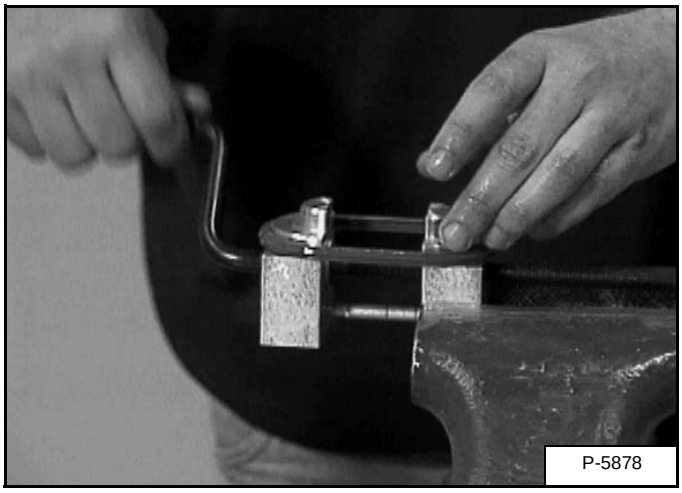
Stretch the heated glid rings to 4.0 inch (101,6 mm) and install on the rotor **[Figure 20-80-10]**.

Figure 20-80-11



Install the crown seal O-ring **[Figure 20-80-11]**.

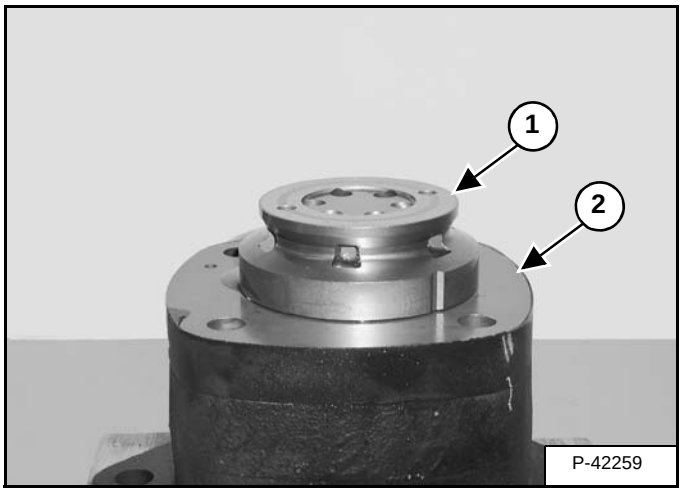
Figure 20-80-12



Stretch the heated crown seal to 4.500 inches (114,3 mm) **[Figure 20-80-12]**.

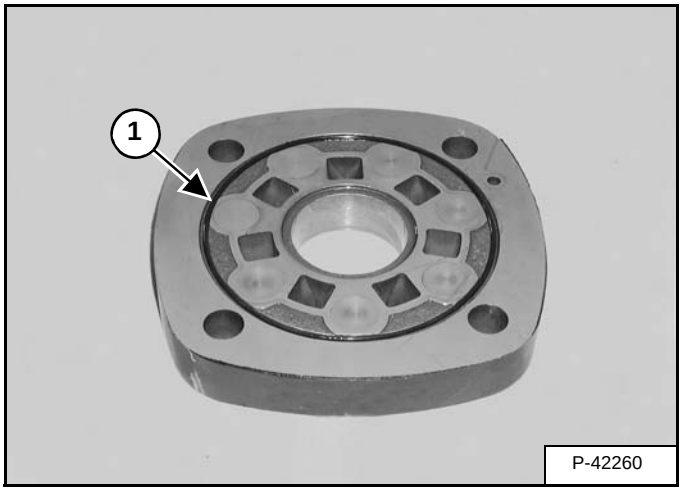
Disassembly (Cont'd)

Figure 20-90-19



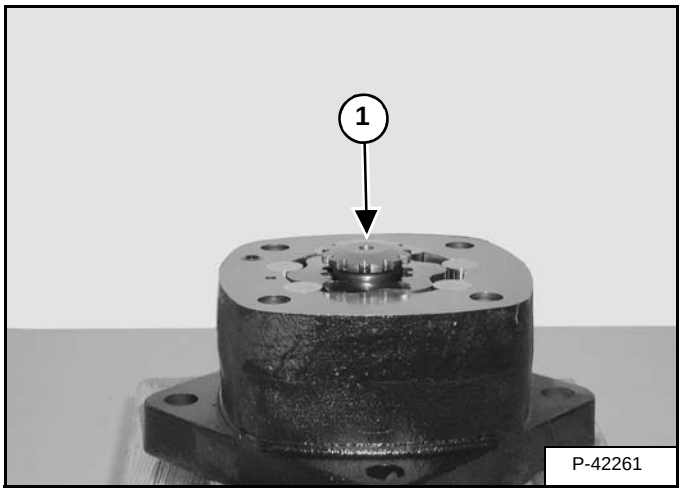
Remove the valve (Item 1) and valve plate (Item 2) **[Figure 20-90-19]**.

Figure 20-90-20



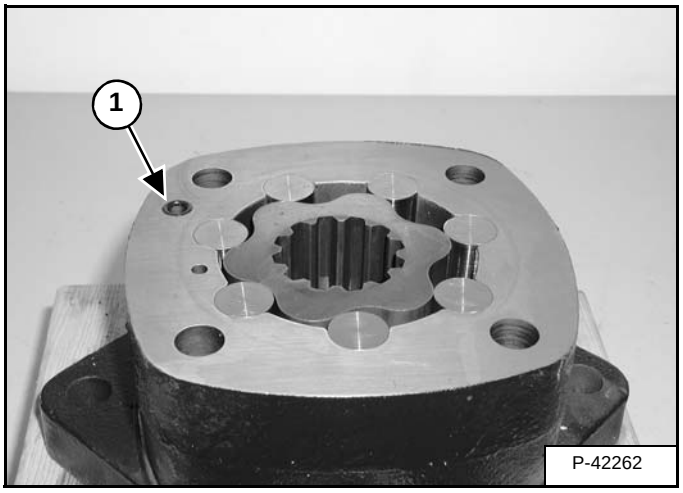
Turn the valve plate over and remove the O-ring (Item 1) **[Figure 20-90-20]**.

Figure 20-90-21



Remove the valve drive (Item 1) **[Figure 20-90-21]**.

Figure 20-90-22



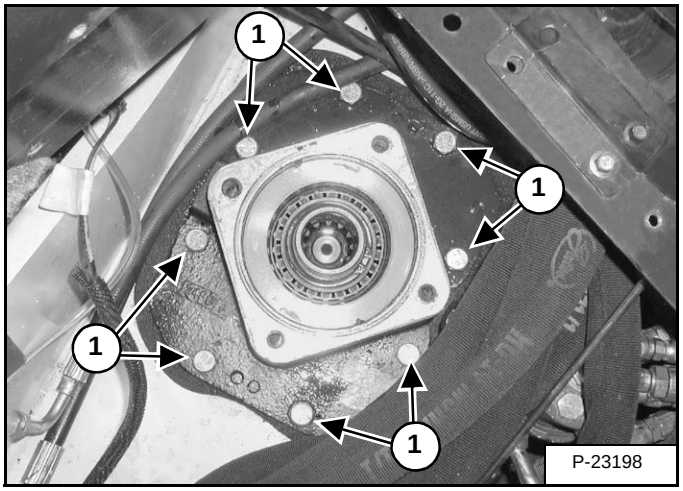
Remove the O-ring (Item 1) **[Figure 20-90-22]** from the Geroler®.

SWING MOTOR DRIVE CARRIER

Removal And Installation

Remove the swing motor. (See Removal And Installation on Page 20-90-1.)

Figure 20-91-1

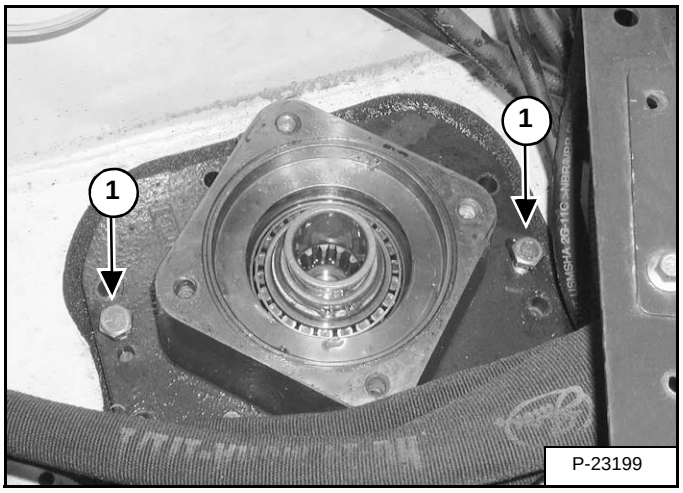


Mark and remove the eight bolts (Item 1) **[Figure 20-91-1]**.

NOTE: It is necessary to mark the bolts as the bolts are two different lengths. The bolts must be installed in the original positions.

Installation: Apply Loctite® 242 to the bolt threads and tighten the bolts to 78 - 85 ft.-lb. (105 - 115 N•m) torque.

Figure 20-91-2



Install two of the short mount bolts (Item 1) **[Figure 20-91-2]** in the threaded holes in the carrier. Tighten the bolts to push the carrier off of the two alignment pins. The pins may stay in either the carrier or the upperstructure.

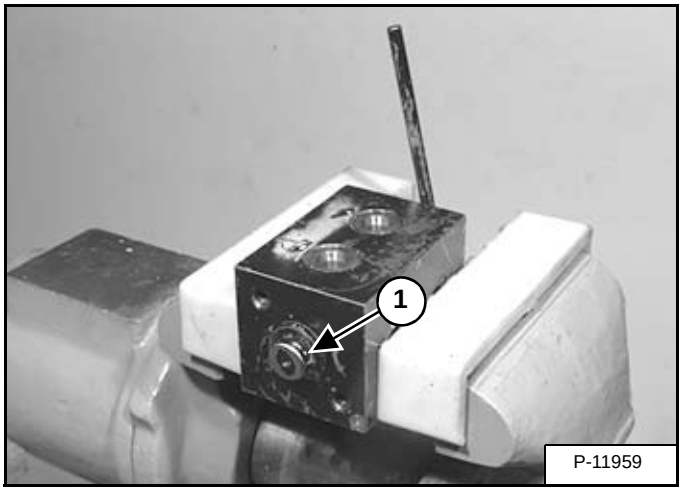
CONTROL PATTERN SELECTOR VALVE (CONT'D)

Disassembly

Clean the outside of the valve before disassembly.

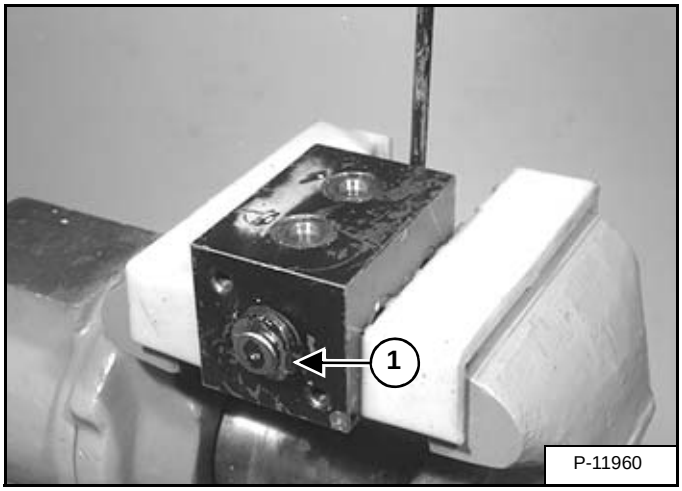
Clamp the valve in a vise equipped with padded jaws.

Figure 20-100-3



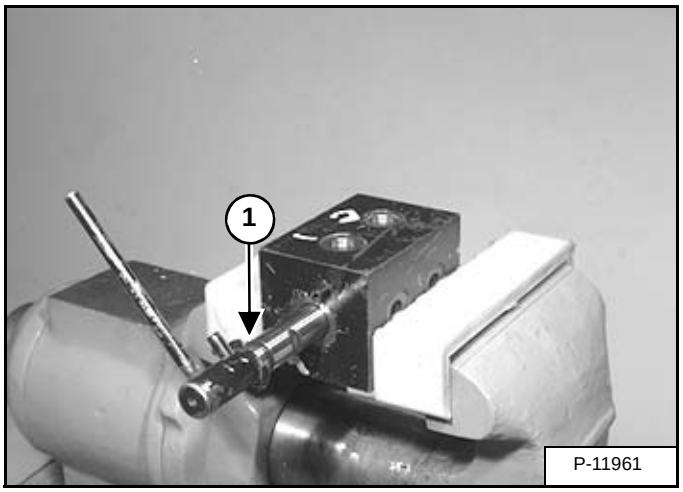
Remove the snap ring (Item 1) **[Figure 20-100-3]**.

Figure 20-100-4



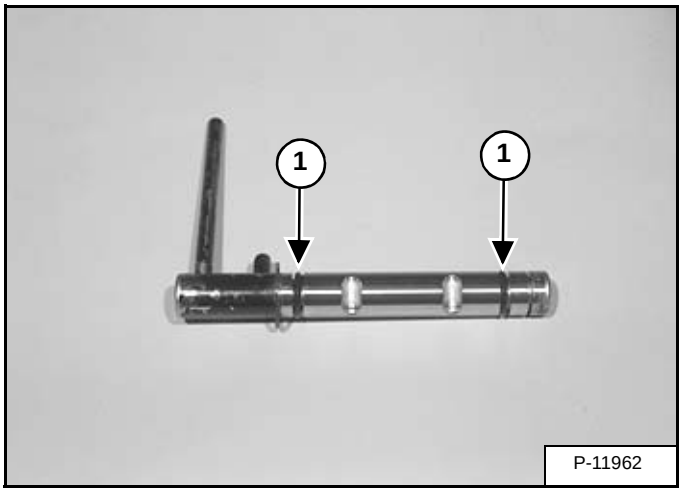
Remove the wave washer (Item 1) **[Figure 20-100-4]**.

Figure 20-100-5



Pull the spool (Item 1) **[Figure 20-100-5]** out of the valve.

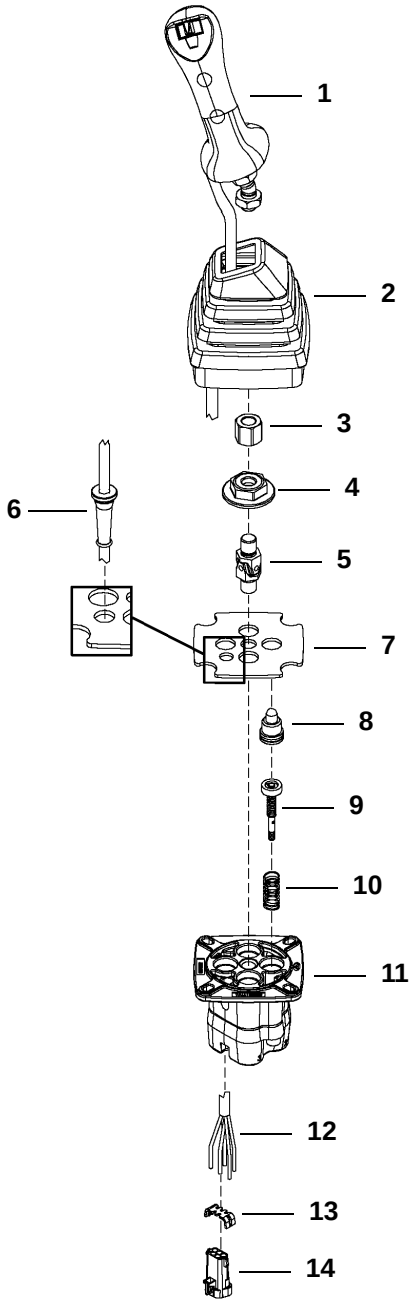
Figure 20-100-6



Remove the O-rings (Item 1) **[Figure 20-100-6]** from the spool.

Parts Identification

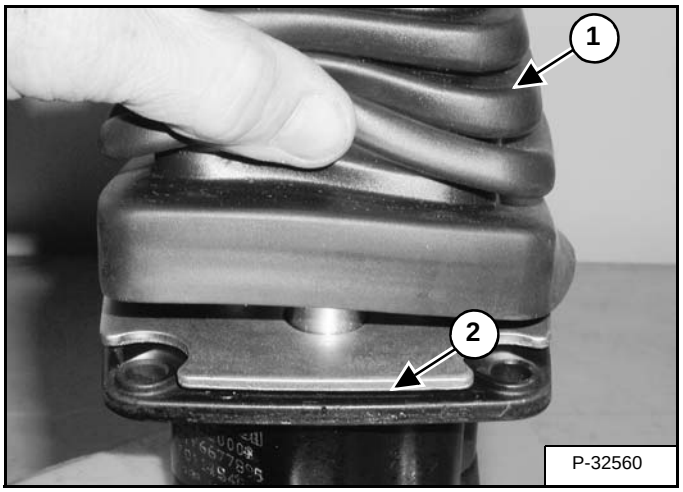
1. Handle
2. Dust Boot
3. Coupler
4. Control Plate
5. U-Joint
6. Grommet
7. Plate
8. Plunger
9. Spool
10. Spring
11. Housing
12. Wire Harness
13. Lock
14. Connector



MS-1352

Assembly (Cont'd)

Figure 20-110-73

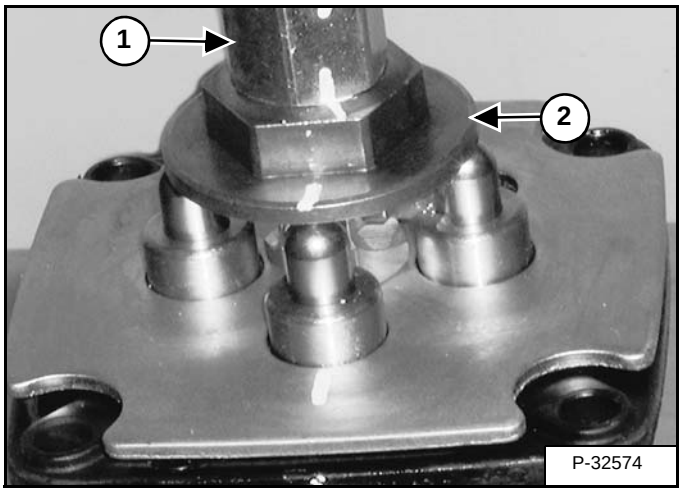


Install the tabs of the boot in between the joystick flange and mounting plate (Item 1) **[Figure 20-110-73]**.

Install the handle. (See Handle Removal And Installation on Page 20-110-2.)

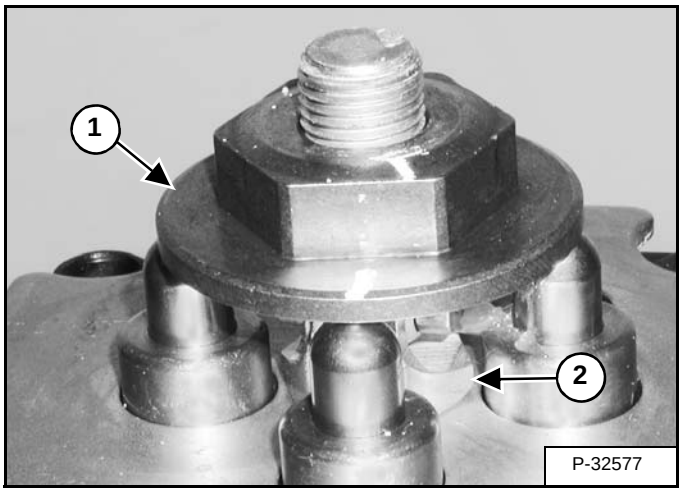
Disassembly (Cont'd)

Figure 20-111-27



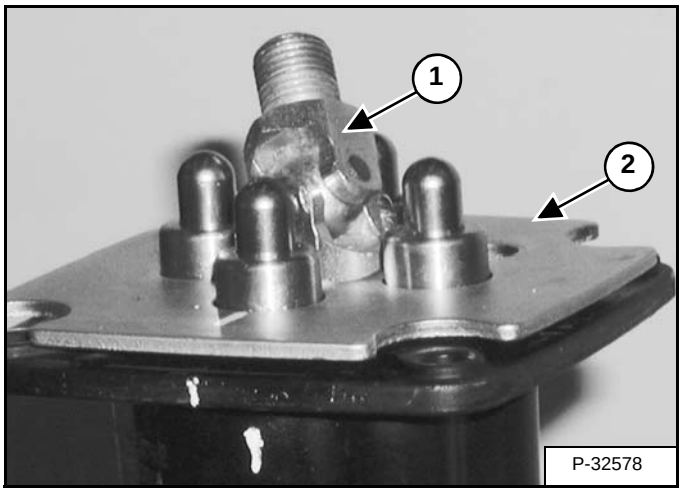
Remove the coupler (Item 1) from the control plate (Item 2) **[Figure 20-111-27]**.

Figure 20-111-28



Remove the control plate (Item 1) from the U-joint (Item 2) **[Figure 20-111-28]**.

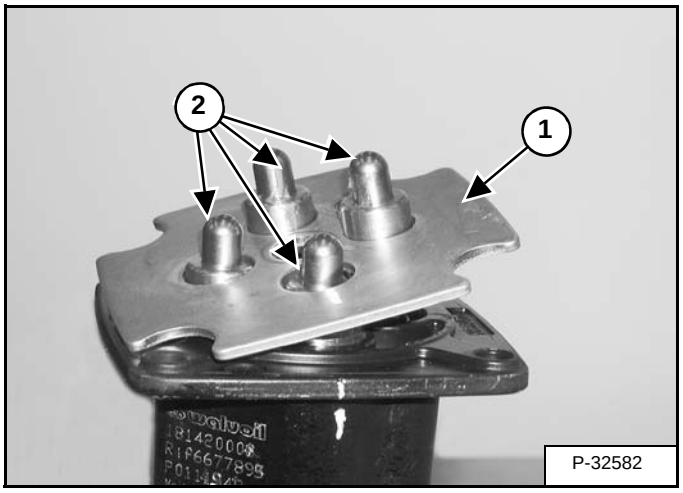
Figure 20-111-29



Mark the plate and housing for correct installation. Remove the U-joint (Item 1) **[Figure 20-111-29]**.

NOTE: The plate (Item 2) [Figure 20-111-29] is spring loaded and will come up as the U-joint is removed.

Figure 20-111-30



Remove the plate (Item 1) **[Figure 20-111-30]**.

NOTE: Use care while removing the plate. The plungers (Item 2) [Figure 20-111-30] are spring loaded.

HYDRAULIC FILTER MOUNT

Removal And Installation

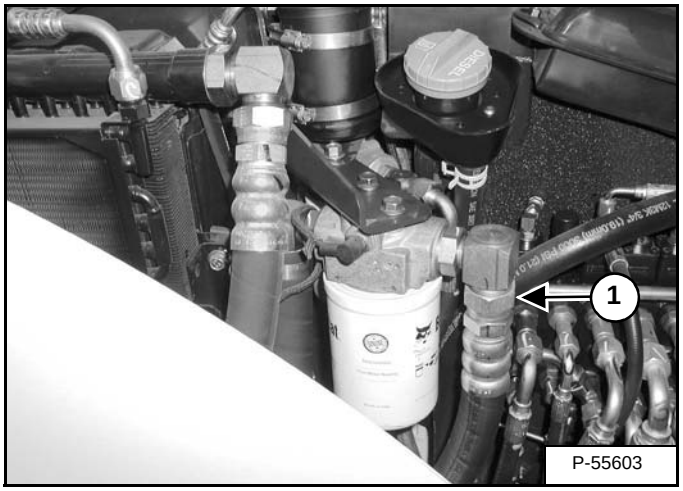
IMPORTANT

When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

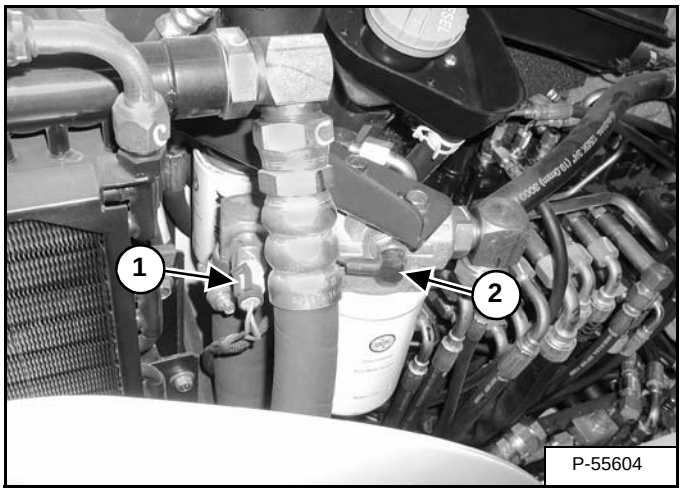
Open the right side cover.

Figure 20-120-1



Remove the hose (Item 1) **[Figure 20-120-1]**.

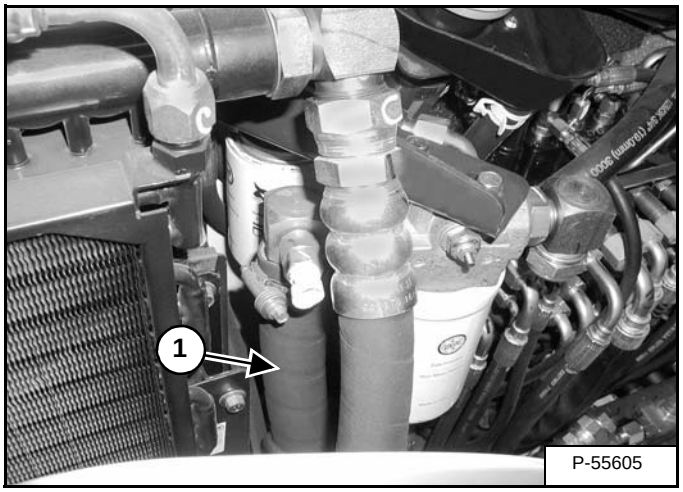
Figure 20-120-2



Disconnect the wire harness (Item 1) **[Figure 20-120-2]**.

Remove the wire harness (Item 2) **[Figure 20-120-2]** from the sending unit.

Figure 20-120-3



Loosen the hose clamp and remove the hose (Item 1) **[Figure 20-120-3]**.

CASE DRAIN FILTER

Removal And Installation

IMPORTANT

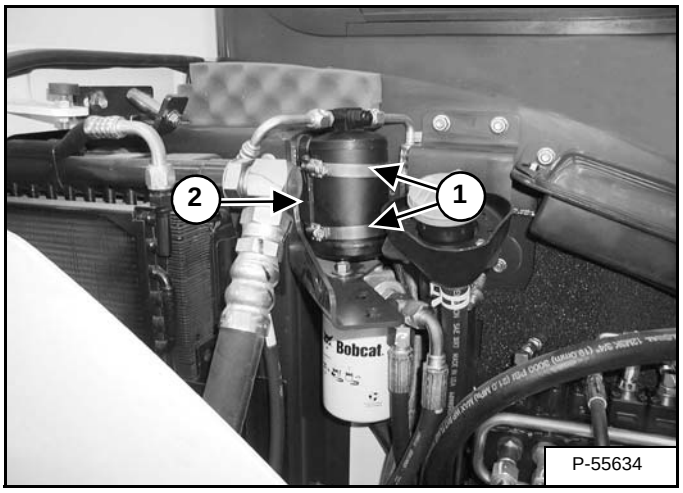
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Open the right side cover.

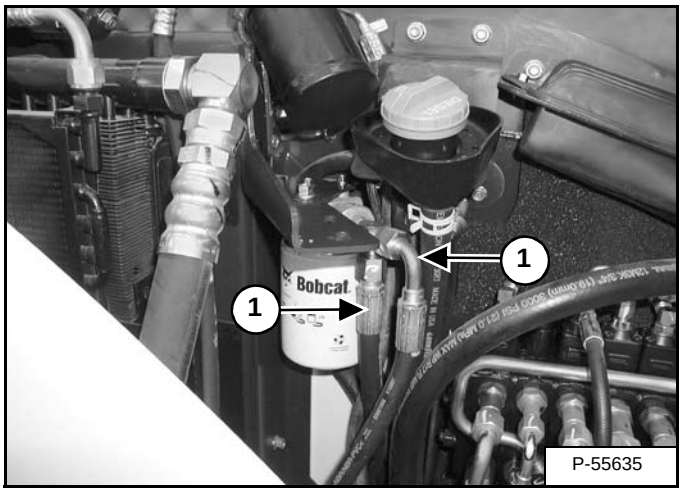
Remove the hydraulic filter mount. (See Removal And Installation on Page 20-120-1.)

Figure 20-160-9



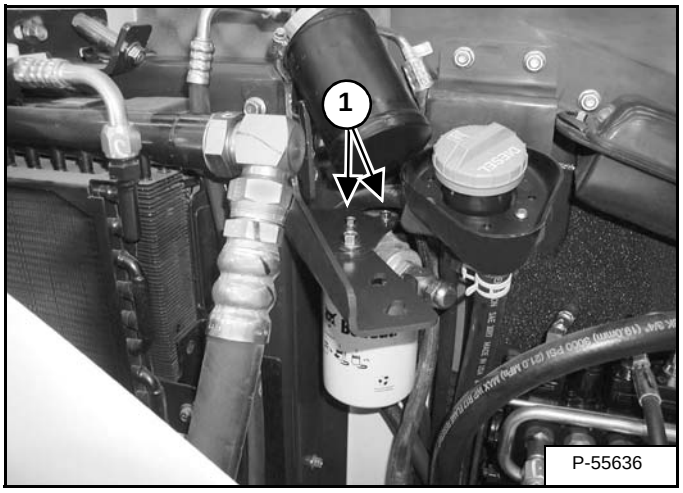
Loosen the clamps (Item 1). Reposition the receiver/dryer (Item 2) **[Figure 20-160-9]**.

Figure 20-160-10



Remove the hoses (Item 1) **[Figure 20-160-10]**.

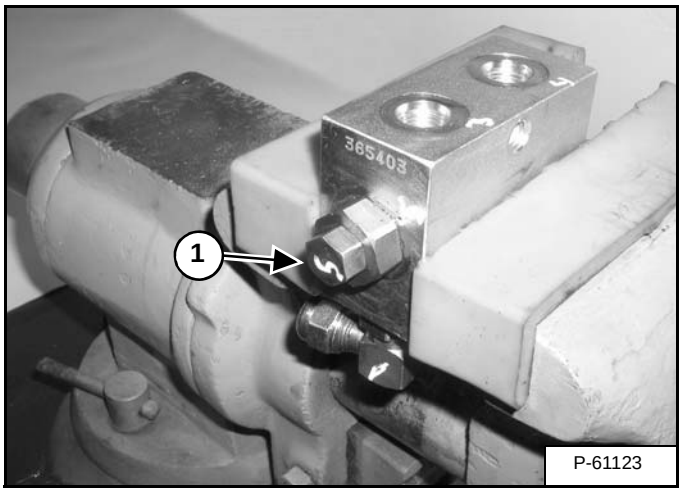
Figure 20-160-11



Remove the bolts (Item 1) **[Figure 20-160-11]**.

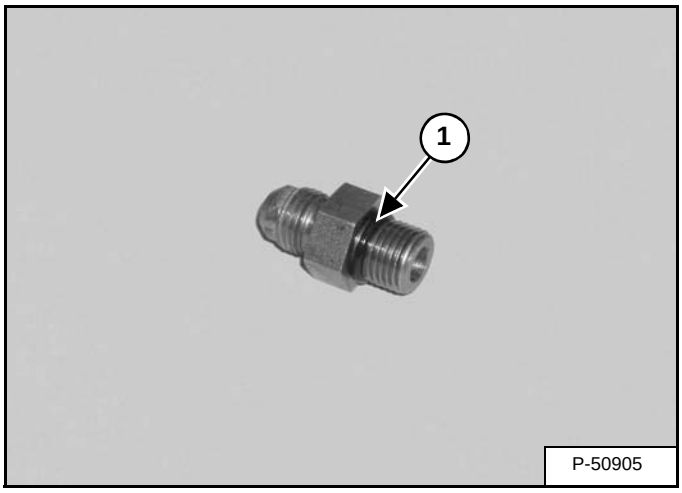
Assembly (Cont'd)

Figure 20-170-26



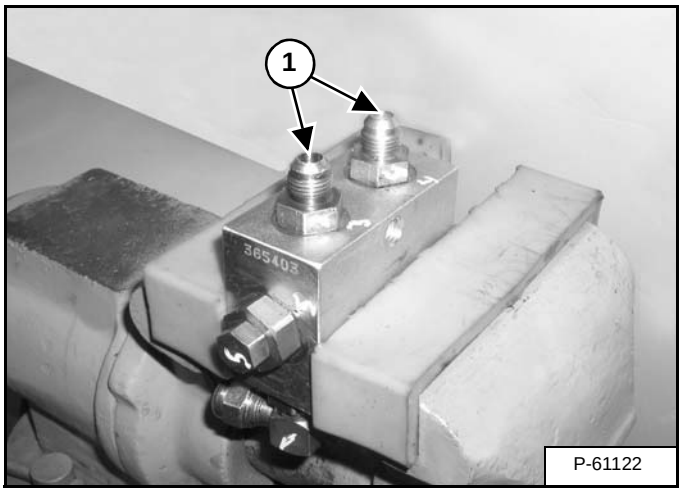
Install the plug (Item 1) **[Figure 20-170-26]**. Tighten to 7 - 8 in.-lb. (9,6 - 11,3 N•m) torque.

Figure 20-170-27



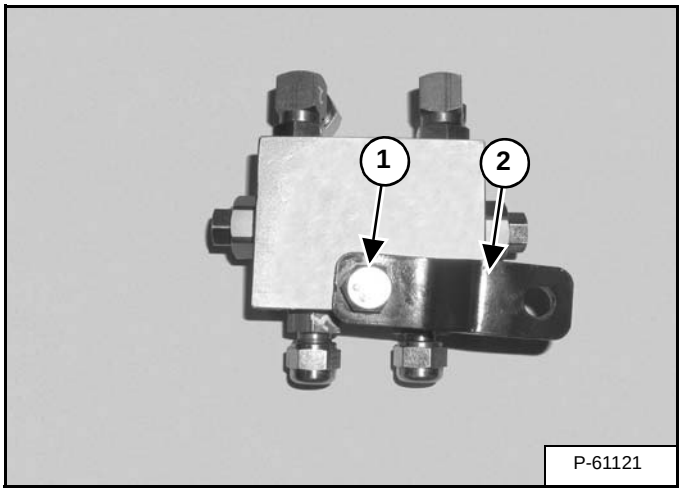
Install the O-ring (Item 1) **[Figure 20-170-27]** on the fittings.

Figure 20-170-28



Install the four fittings (Item 1) **[Figure 20-170-28]** (two per side) on the valve.

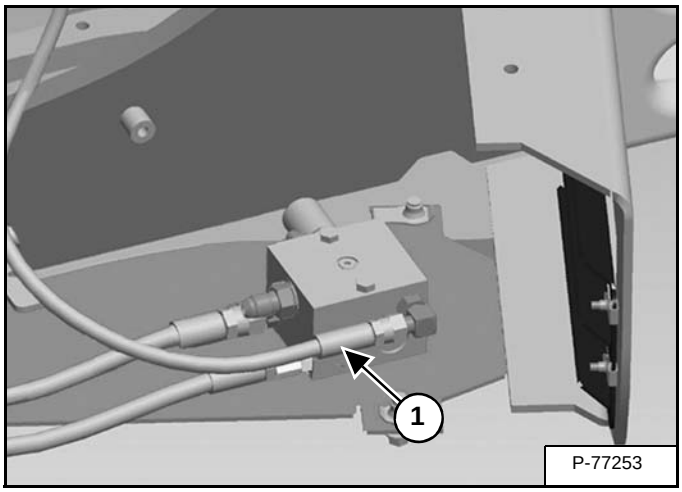
Figure 20-170-29



Install the bracket (Item 1) and bolt (Item 2) **[Figure 20-170-29]**.

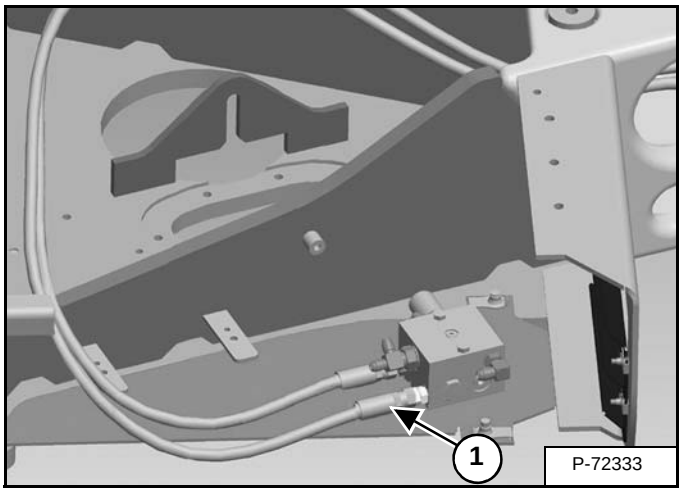
Removal And Installation (Cont'd)

Figure 20-190-8



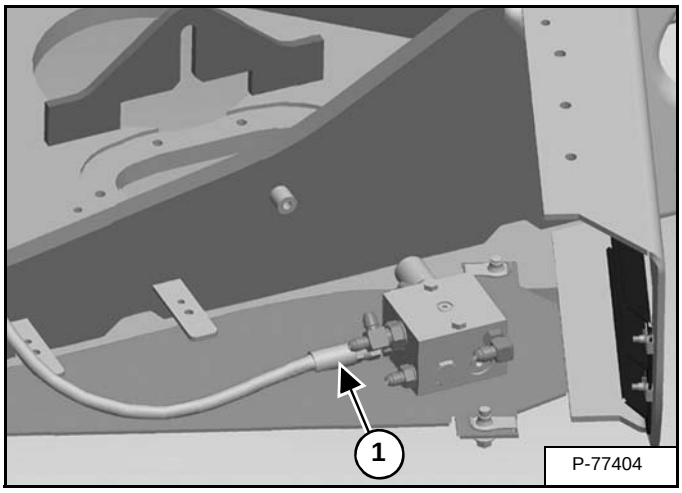
Remove the hose (Item 1) **[Figure 20-190-8]** from the LS port on the X-change valve.

Figure 20-190-9



Remove the hose (Item 1) **[Figure 20-190-9]** from the A port on the X-change valve.

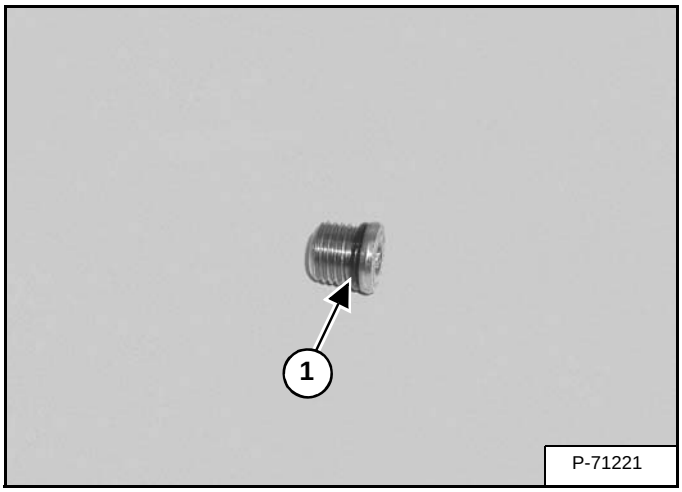
Figure 20-190-10



Remove the hose (Item 1) **[Figure 20-190-10]** from the B port on the X-change valve.

Disassembly (Cont'd)

Figure 20-190-41



Remove the O-ring (Item 1) **[Figure 20-190-41]** from the plug.

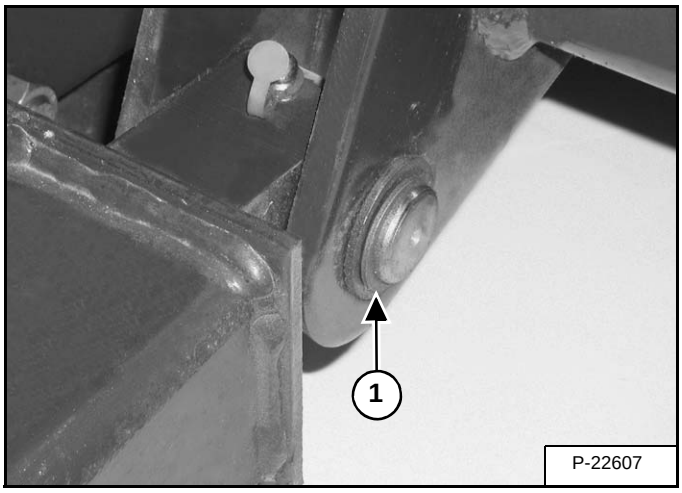
BLADE

Removal And Installation

Lower the blade and bucket to the ground.

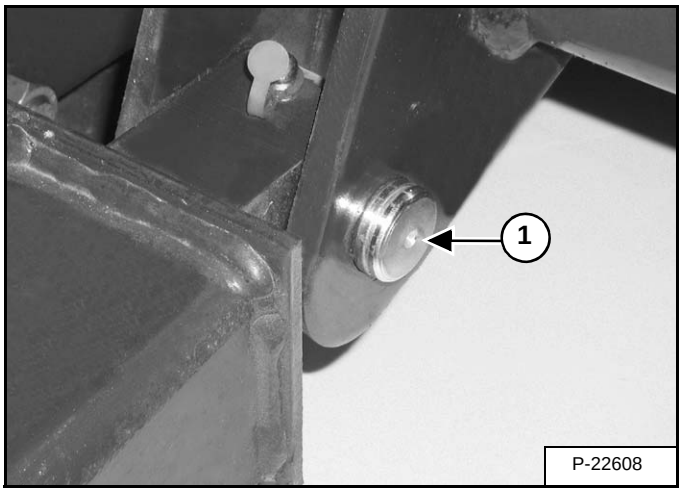
Remove the blade cylinder. (See Removal And Installation on Page 20-24-3.)

Figure 30-10-1



Remove the snap ring (Item 1) **[Figure 30-10-1]** and washer from the blade arm pivot pin (both sides).

Figure 30-10-2



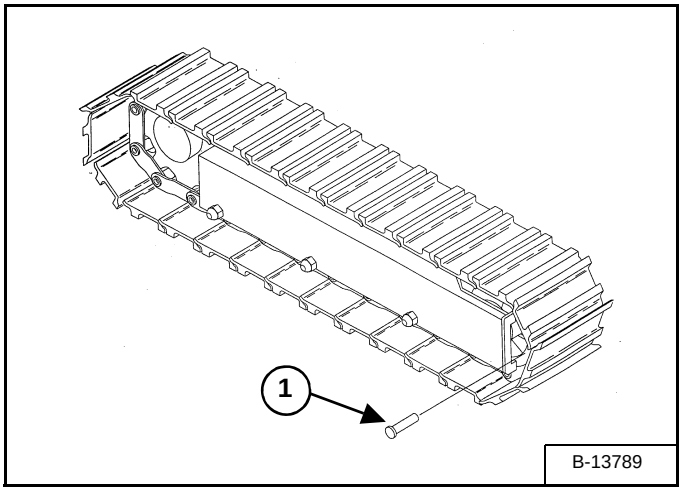
Remove the blade arm pivot pin (Item 1) **[Figure 30-10-2]** (both sides).

Remove the blade.

Steel Track Removal And Installation (Cont'd)

Position the two ends of the track together and use a drift pin to hold the links together.

Figure 30-20-22



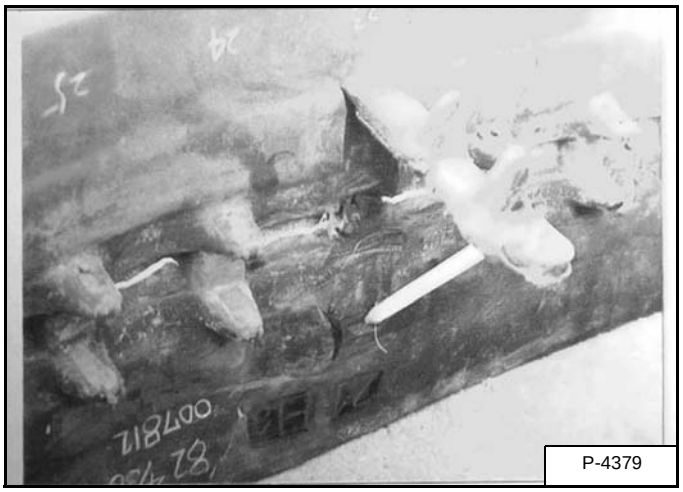
Insert the connecting link pin (Item 1) **[Figure 30-20-22]** into the track link hole. Tap the end of the pin until the press fit diameter contacts the connecting link hole.

Hold a heavy steel block on the back side of the track connecting link and use a hammer to drive the connecting link pin into the track link until the head of the pin is flush with the track link.

See Adjustment for adding grease to the grease spring and for checking track clearance. (See Adjustment on Page 30-20-1.)

Separation Of Embedded Metals

Figure 30-40-6



Damage:

Extraordinary outer forces applied to embedded metals cause their separation from the rubber track's body **[Figure 30-40-6]**.

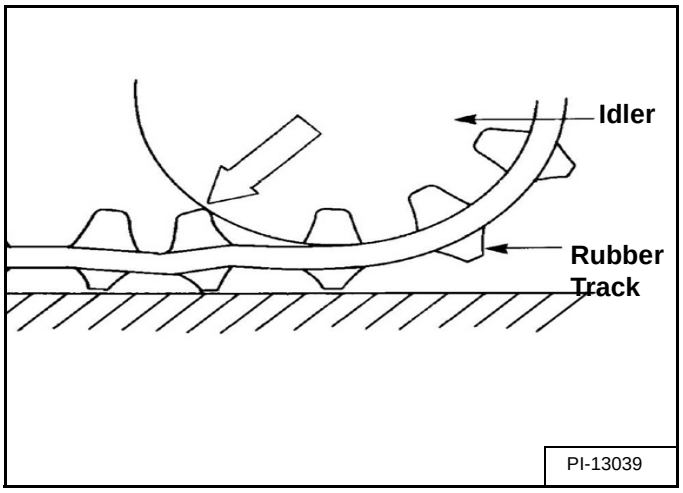
Replacement:

Even a partial separation of embedded metals requires replacement of the track.

Causes of the damage:

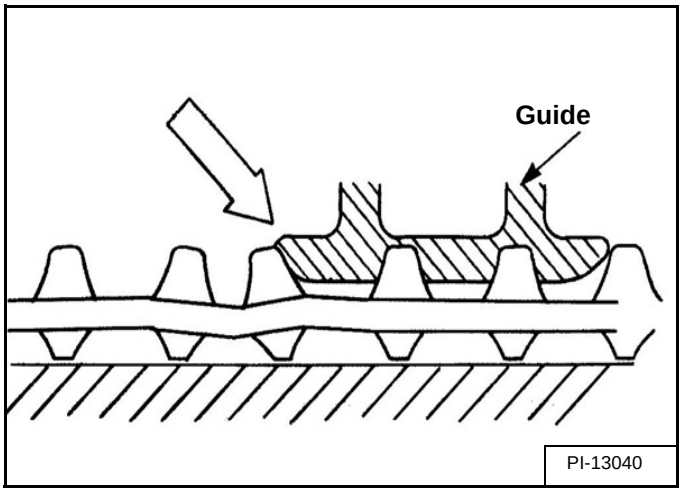
Embedded metals are adhered between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-40-7



When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-40-7]**.

Figure 30-40-8

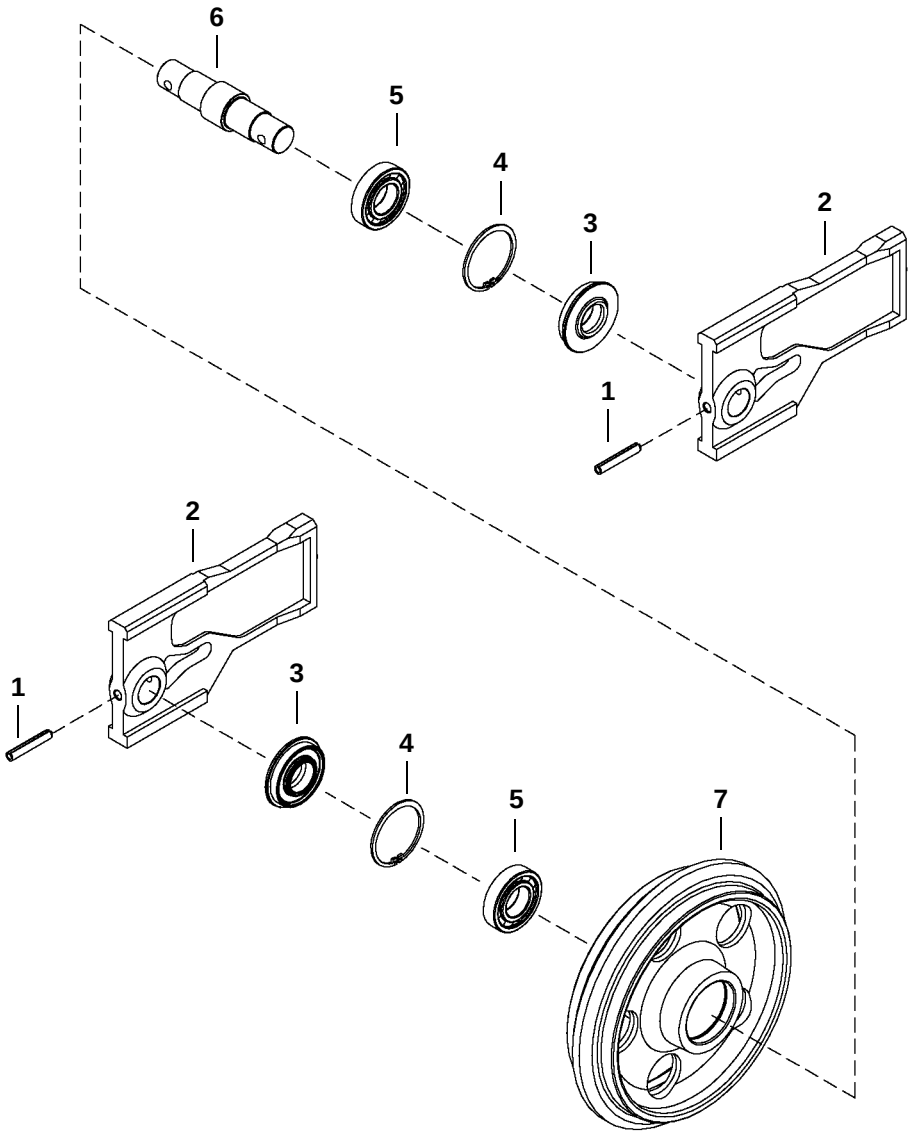


When a rubber track is detracted, it becomes stuck between the guide or the undercarriage frame, causing the separation of embedded metals **[Figure 30-40-8]**.

TRACK IDLER

Parts Identification

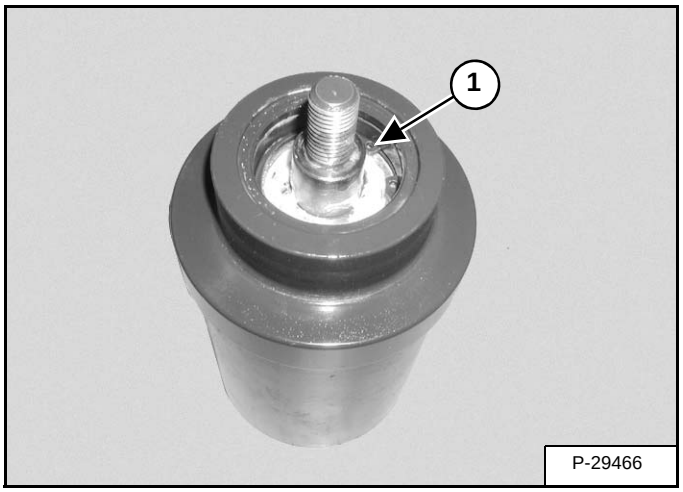
1. Roll Pin
2. Block
3. Seal
4. Snapring
5. Bearing
6. Shaft
7. Idler



PE1801S

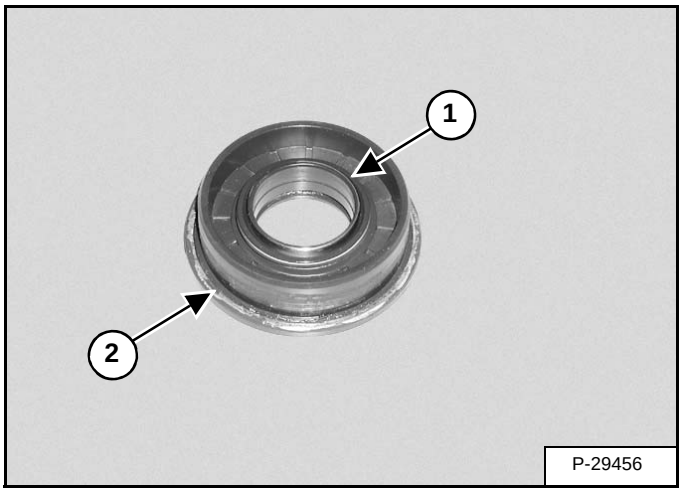
Assembly (Cont'd)

Figure 30-60-10



Install the snap ring (Item 1) **[Figure 30-60-10]** on both sides of the roller.

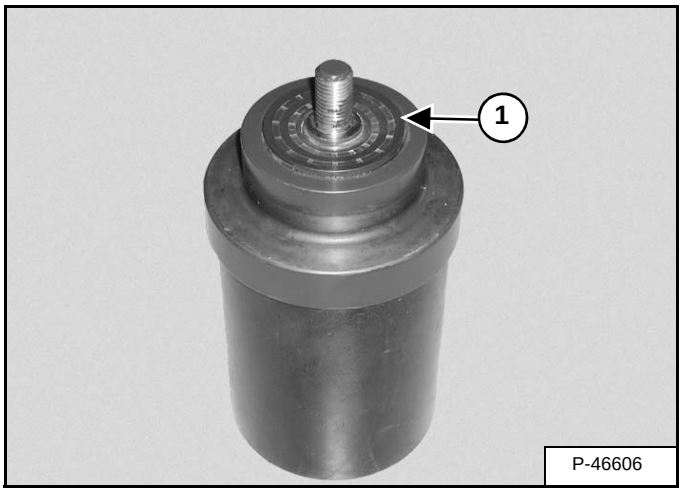
Figure 30-60-11



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-60-11]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-60-11]** of the seal.

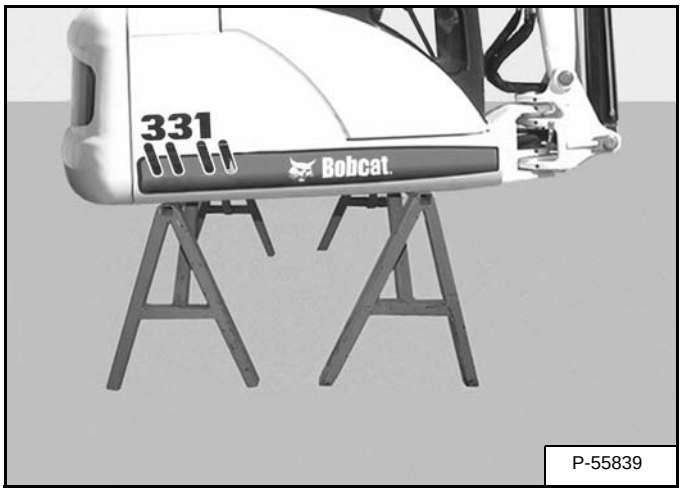
Figure 30-60-12



Using the driving tool, install the seal (Item 1) **[Figure 30-60-12]** on both sides of the roller.

Removal (Cont'd)

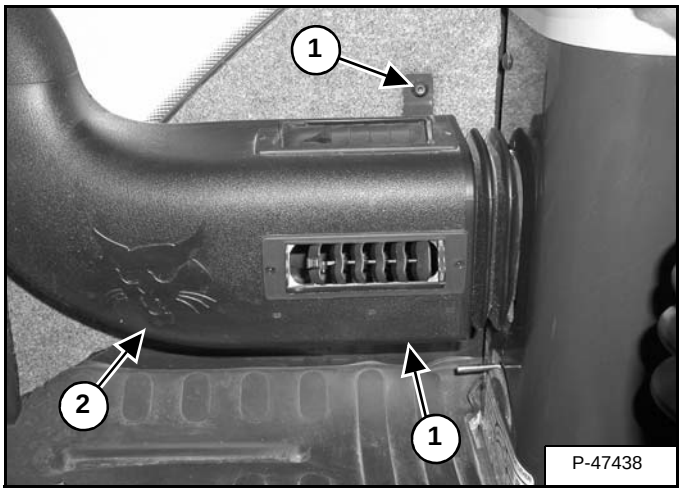
Figure 40-10-14



Lift the upperstructure off of the swing bearing. Put the upperstructure on suitable supporting stands or blocks **[Figure 40-10-14]**.

Removal And Installation (Cont'd)

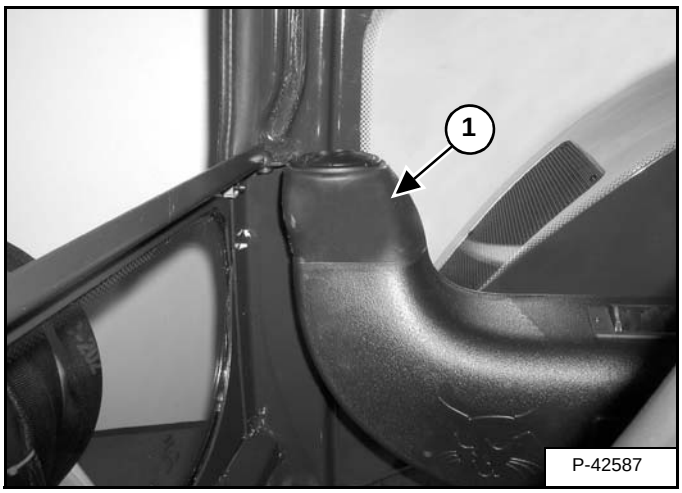
Figure 40-30-5



Remove the screws (Item 1). Remove the air manifold (Item 2) **[Figure 40-30-5]**.

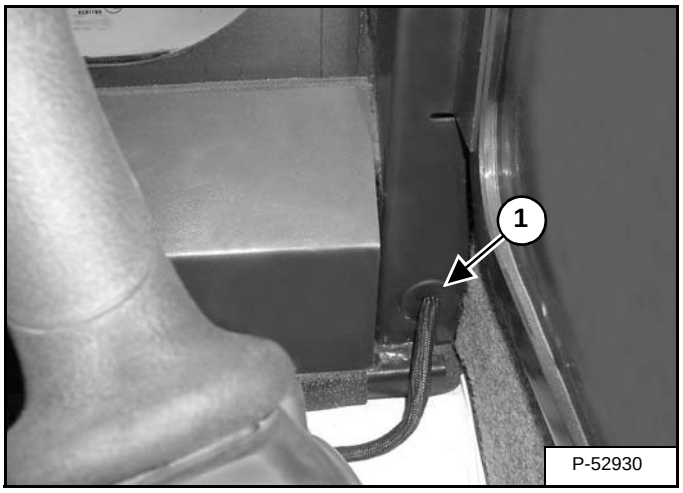
Heater Duct

Figure 40-30-6



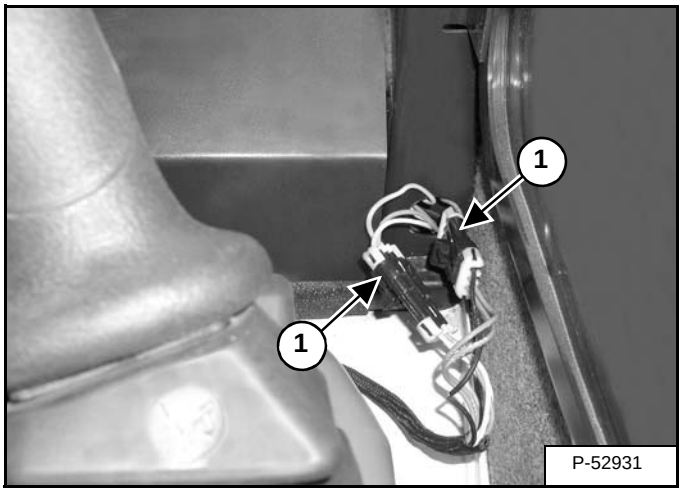
Remove the screws and pull straight up to remove the heater duct (Item 1) **[Figure 40-30-6]**.

Figure 40-30-7



Remove the grommet (Item 1) **[Figure 40-30-7]** from the left rear corner of the cab.

Figure 40-30-8



Remove the wire harness from the cab frame. Disconnect the wire harness (Item 1) **[Figure 40-30-8]**.

CAB (CONT'D)

Glass Installation

Rear and front lower glass

NOTE: See your Bobcat dealer for the correct urethane adhesive, combo primer, glass cleaner and bumpers for correctly installing the new glass.

Remove the majority of the old urethane adhesive from the perimeter of the cab.

NOTE: Leave a thin film (0.03 in. (0,79 mm) thick) of the old urethane on the cab frame, fresh urethane will bond to the remaining film.

Prime and paint any bare metal or scratches.

Clean the metal surfaces with general purposes adhesive cleaner. Clean the glass surface with glass cleaner.

Figure 40-30-36

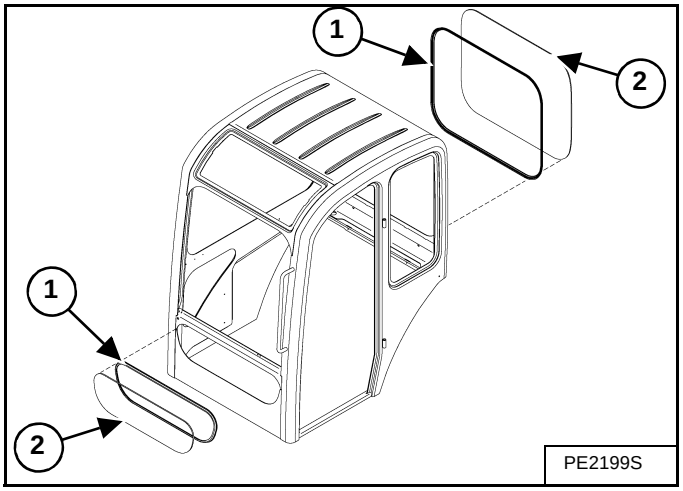
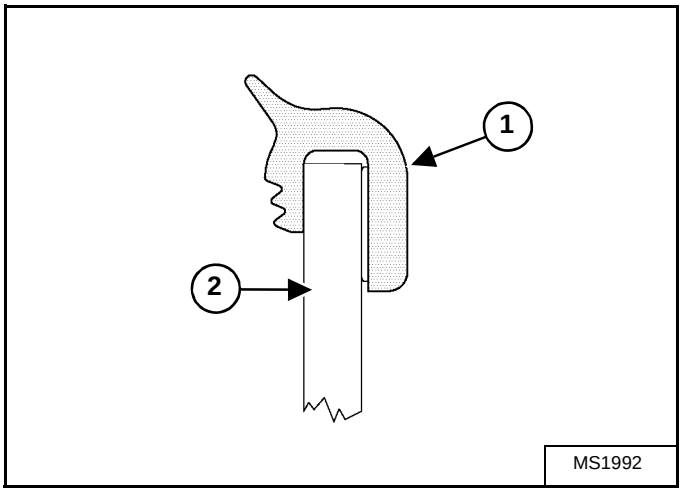


Figure 40-30-37



Install the seal (Item 1) on the glass (Item 2) **[Figure 40-30-36]** & **[Figure 40-30-37]**.

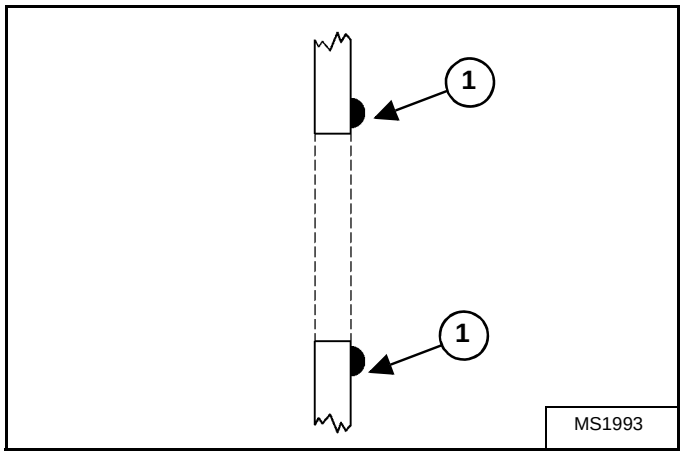
Shake the combo primer for one minute.

Apply one coat of the combo primer to the perimeter of the cab and glass (Item 2) **[Figure 40-30-37]**.

Allow the combo primer to dry for at least 15 minutes. Excess primer can be removed from the glass using a razor blade.

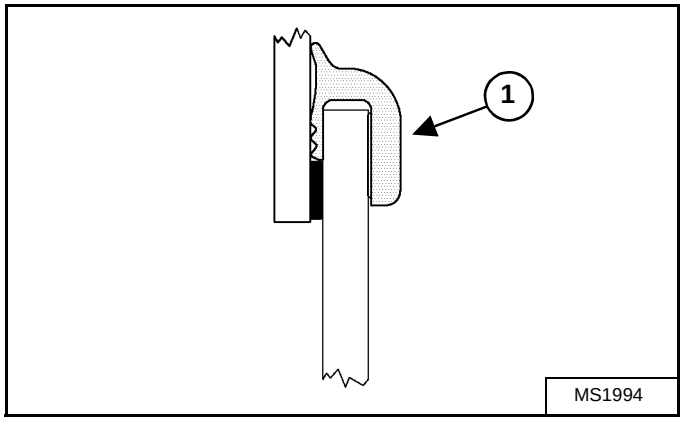
Cut the tip of the adhesive tube to the desired shape and size to provide a bead height sufficient to give good contact with the glass around the entire perimeter.

Figure 40-30-38



Apply a 0.25 X 0.375 in (6.4 X 9.5 mm) triangle shaped bead of urethane adhesive (Item 1) **[Figure 40-30-38]** to the perimeter of the cab.

Figure 40-30-39



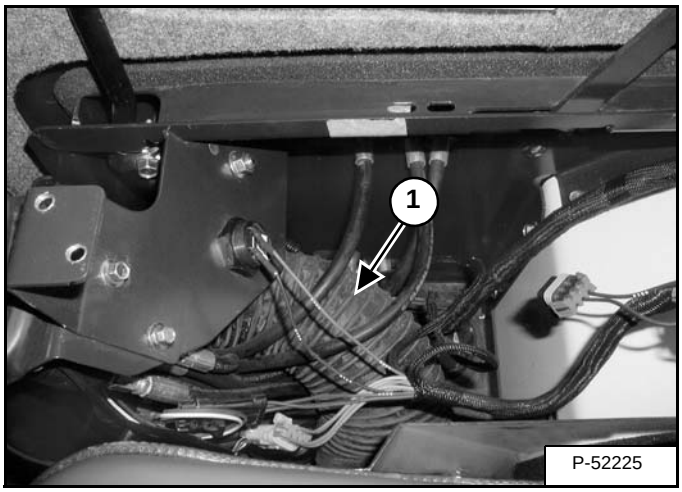
Install the glass and seal assembly (Item 1) **[Figure 40-30-39]**. Press the glass into the cab to make complete contact with the adhesive. Tape the glass in place.

Allow the adhesive to cure for a minimum of twelve hours at 70° F and 20% relative humidity.

Remove the tape after the adhesive is cured.

Console Base Removal And Installation (Cont'd)

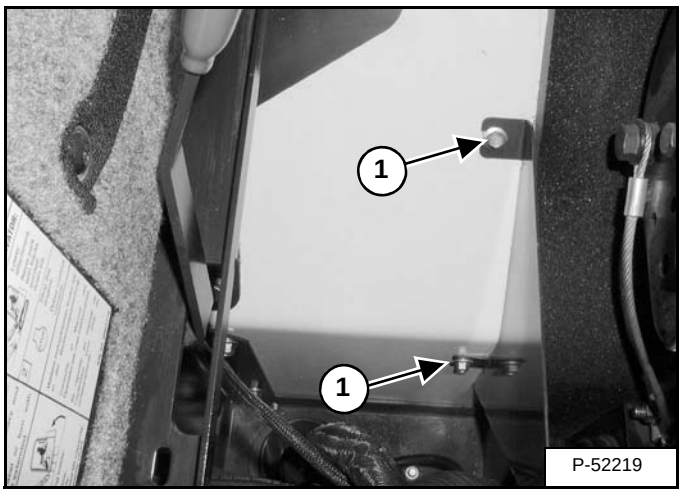
Figure 40-50-9



Remove the hose (Item 1) **[Figure 40-50-9]**.

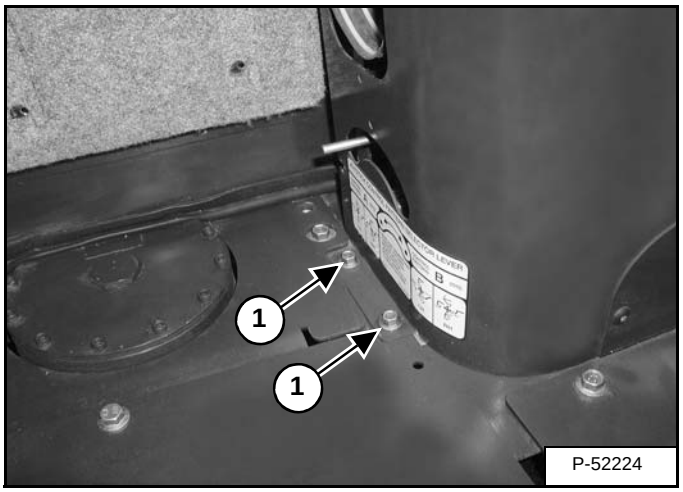
Remove the floor mat. (See Removal And Installation (Cab Equipped Excavators)n Page 40-110-2.)

Figure 40-50-10



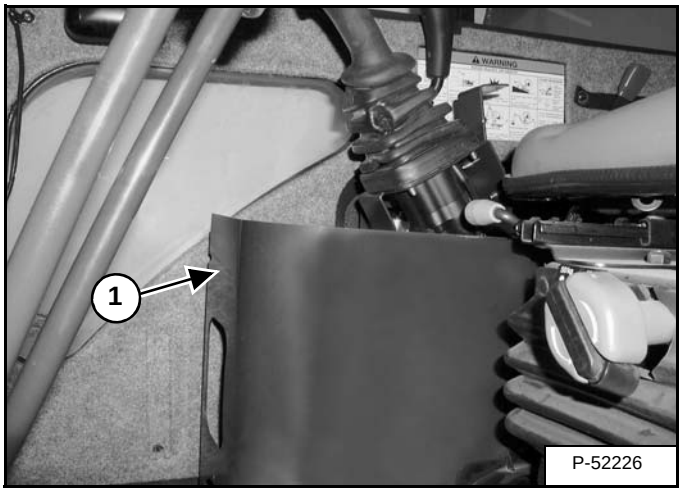
Remove the bolts (Item 1) **[Figure 40-50-10]**.

Figure 40-50-11



Remove the bolts (Item 1) **[Figure 40-50-11]**.

Figure 40-50-12



Slide the console base (Item 1) **[Figure 40-50-12]** forward and remove the base from the excavator.

Console Removal And Installation

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Remove the floormat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Remove the upper console cover. (See Upper Console Cover Removal And Installation on Page 40-60-3.)

Remove the lower console cover. (See Lower Console Cover Removal And Installation on Page 40-60-1.)

IMPORTANT

When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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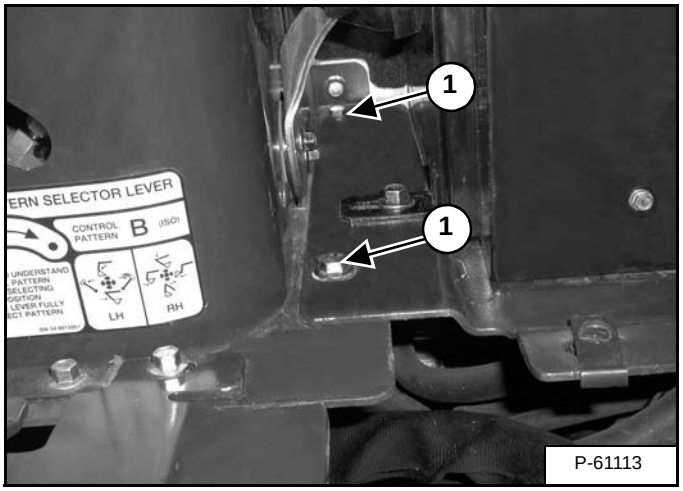
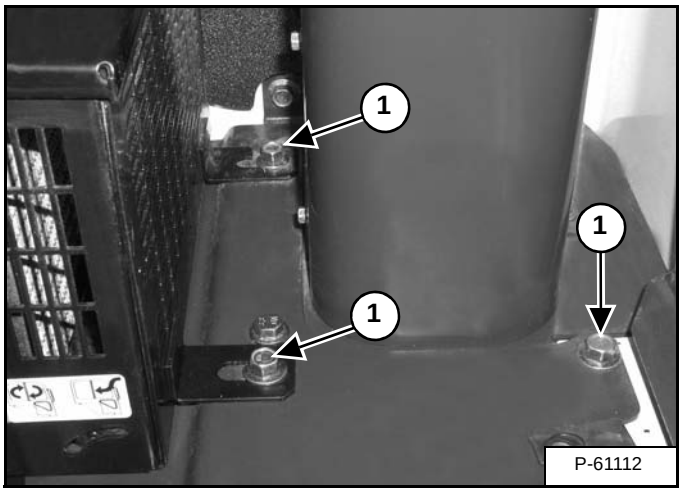
Figure 40-60-19



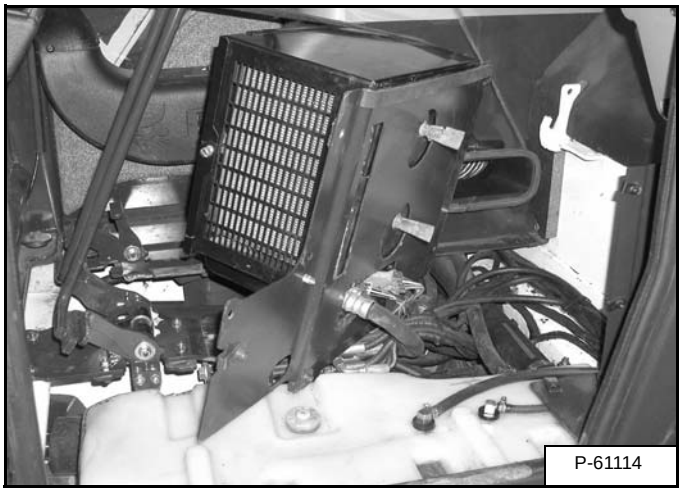
Remove the bolts (Item 1) **[Figure 40-60-19]** from the right side of the evaporator/heater unit.

Figure 40-60-20



Remove the bolts (Item 1) **[Figure 40-60-20]** from the left side of the evaporator/heater unit.

Figure 40-60-21



Relocate the evaporator/heater unit as shown **[Figure 40-60-21]**.

Remove the console base. (See Console Base Removal And Installation on Page 40-60-16.)

IMPORTANT

When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

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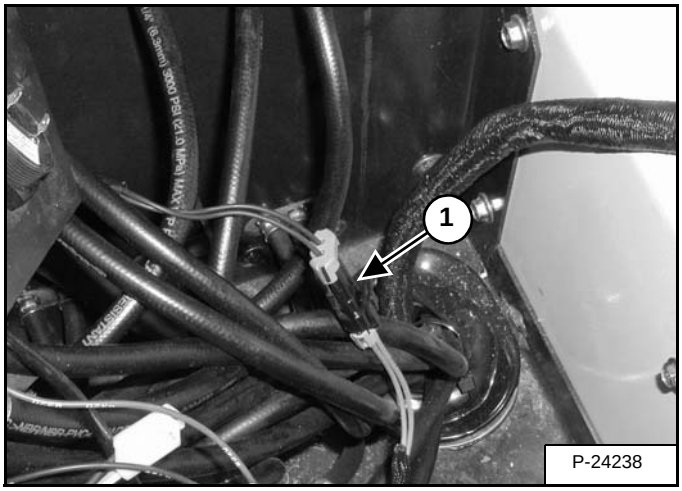
BLADE CONTROL

Lever Removal And Installation

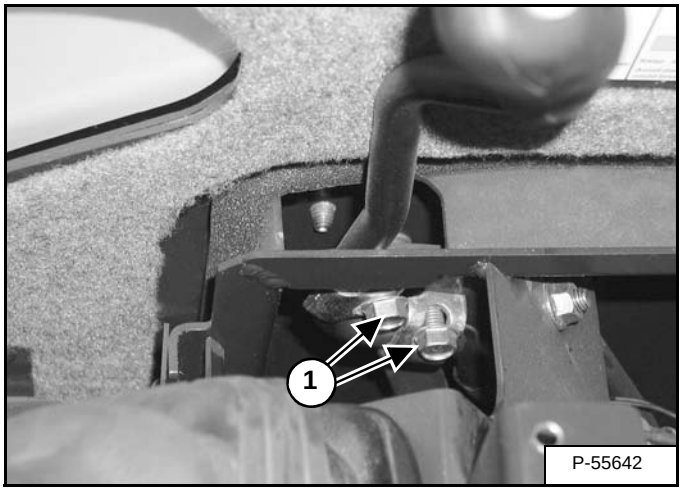
Remove the right console cover. (See Console Cover Removal And Installation on Page 40-50-1.)

Figure 40-80-1



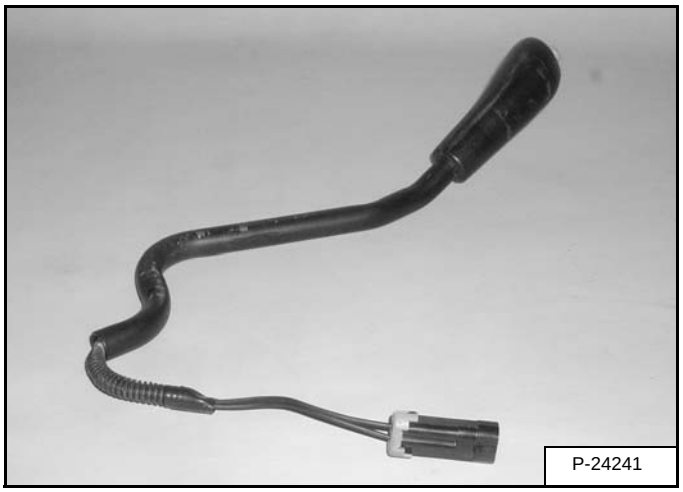
Disconnect the two speed wire harness (Item 1) **[Figure 40-80-1]**.

Figure 40-80-2



Loosen the bolts (Item 1) **[Figure 40-80-2]**.

Figure 40-80-3

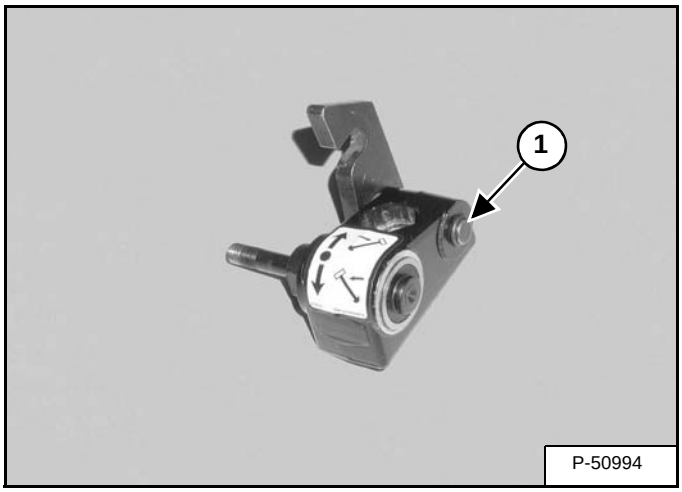


Remove the blade control lever from the excavator **[Figure 40-80-3]**.

NOTE: If the two-speed switch needs to be replaced, the complete blade control lever must be replaced.

Pedal Disassembly And Assembly (Cont'd)

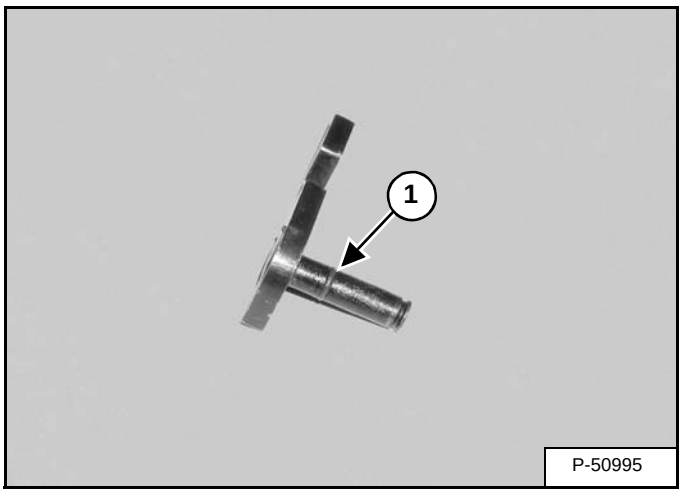
Figure 40-90-7



Remove the O-ring (Item 1) **[Figure 40-90-7]** from the pedal lock.

Remove the pedal lock from the pedal mount.

Figure 40-90-8



Remove the O-ring (Item 1) **[Figure 40-90-8]** from the pedal lock.

NOTE: Do not lubricate the O-rings (Item 1) [Figure 40-90-7] and [Figure 40-90-8]. The O-rings provide a friction fit to prevent the lock from moving freely.

FUEL TANK

Removal And Installation

Remove the floor mat and floor panel. (See Removal And Installation (Cab Equipped Excavators) on Page 40-110-2.)

Remove the travel controls. (See Removal And Installation on Page 40-100-1.)

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Remove the heater unit (If equipped) (See Removal And Installation on Page 70-20-1.)

Remove the left console upper and lower console covers. (See Contents Page 40-01.)

Remove the boom swing cylinder. (See Removal And Installation on Page 20-22-3.)

Drain the fuel tank. (See Removal And Installation on Page 40-120-1.)

⚠ WARNING

AVOID INJURY OR DEATH

Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.

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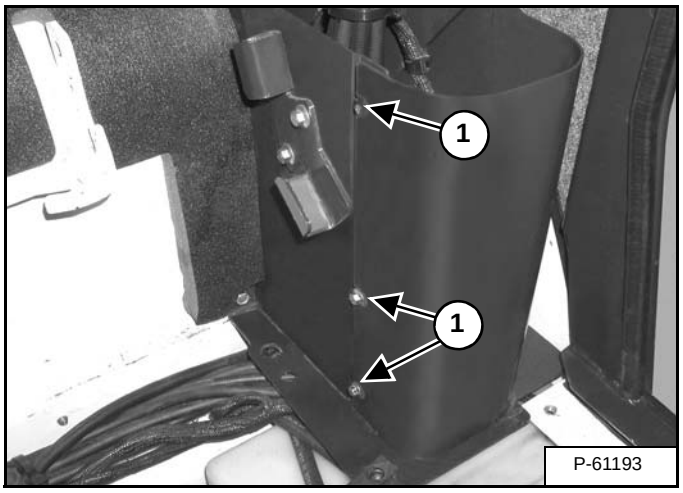
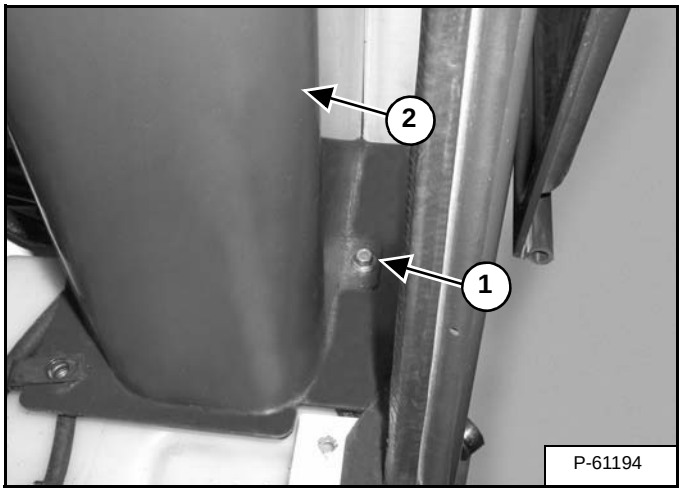
Figure 40-120-1



Remove the bolts (Item 1) **[Figure 40-120-1]**.

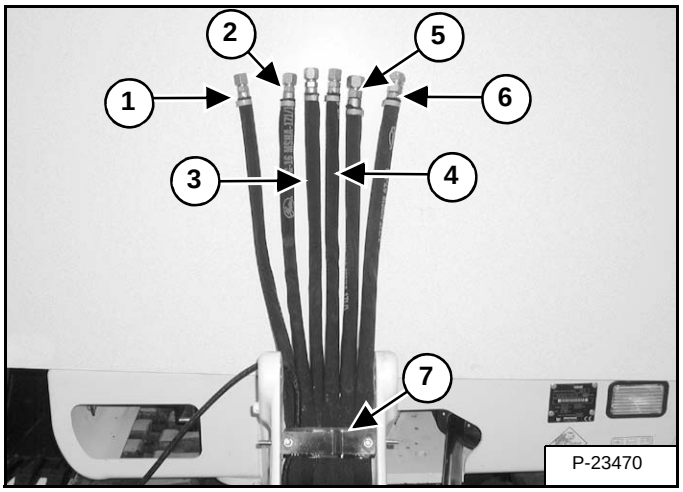
Figure 40-120-2



Remove the bolt (Item 1) and cover (Item 2) **[Figure 40-120-2]**.

Boom Swing Frame Hose Routing

Figure 40-140-13



Route the hoses through the swing frame as follows **[Figure 40-140-13]**:

1. Bucket Base End Hose
2. Arm Base End Hose
3. Male Quick Coupler Hose
4. Female Quick Coupler Hose
5. Arm Rod End Hose
6. Bucket Rod End Hose

Install the hoses and hose clamp (Item 7) **[Figure 40-140-13]**. Do not tighten the clamp at this time.

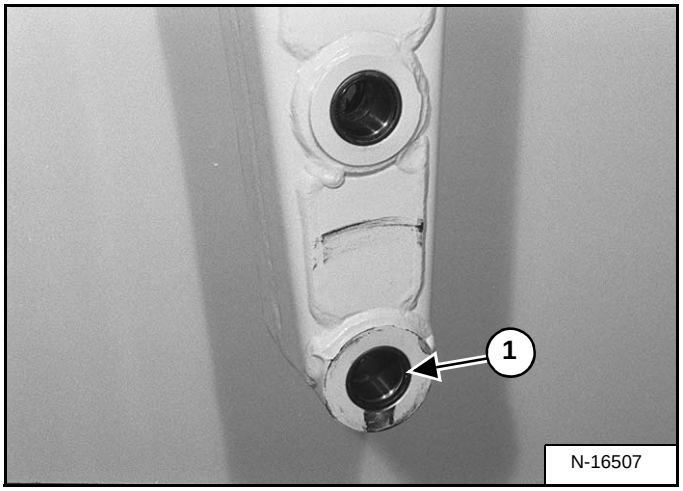
Figure 40-140-14

Measure the length of the hoses from the top of the clamp to the end of each hose **[Figure 40-140-14]**.

Tighten the clamp bolts when the auxiliary hoses are 29 inches (737 mm) and the arm and bucket hoses are 31 inches (787 mm) from the top of the clamp.

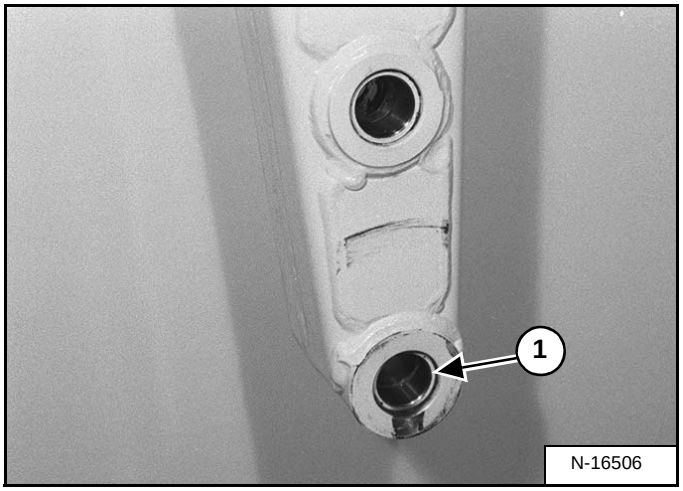
Arm To Bucket And Bucket Link Bushing Removal And Installation (Later Models) (Cont'd)

Figure 40-160-12



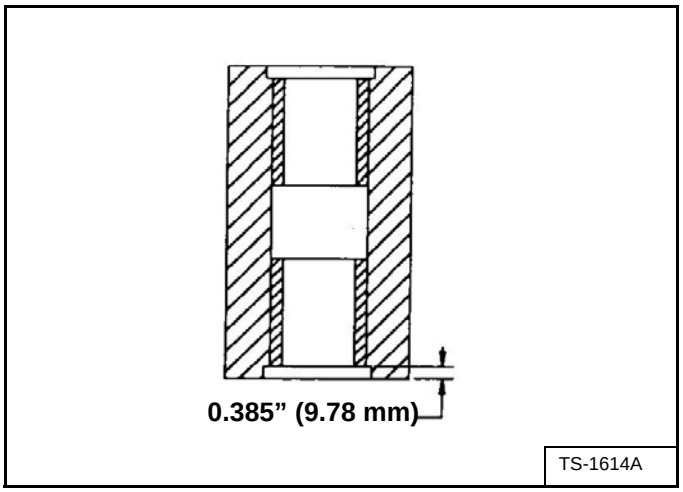
Remove the seals (Item 1) **[Figure 40-160-12]** from both sides of the arm.

Figure 40-160-13



Remove the bushings (Item 1) **[Figure 40-160-13]** from both sides of the arm.

Figure 40-160-14



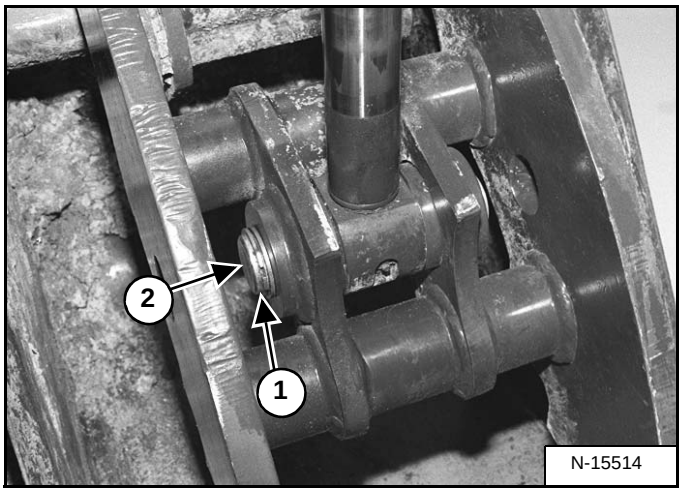
Install the bushings until they are seated 0.385 inches (9.78 mm) in the pin boss **[Figure 40-160-14]** (both sides).

Install new seals on both sides of the arm.

CLAMP

Removal And Installation

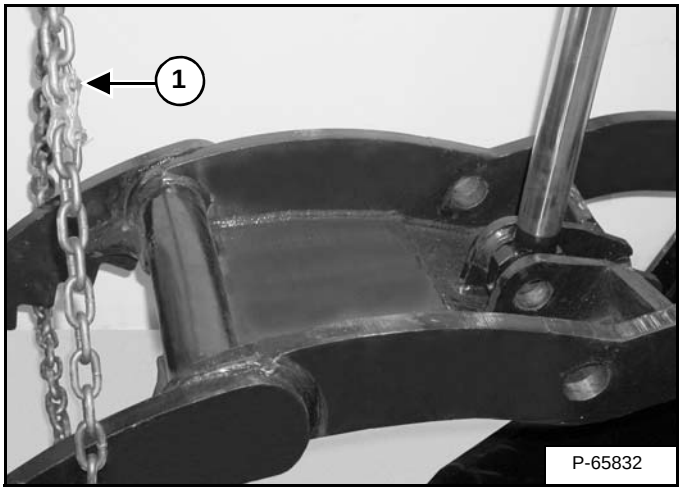
Figure 40-171-1



Remove the snap ring and washer (Item 1) **[Figure 40-171-1]** from the cylinder pin.

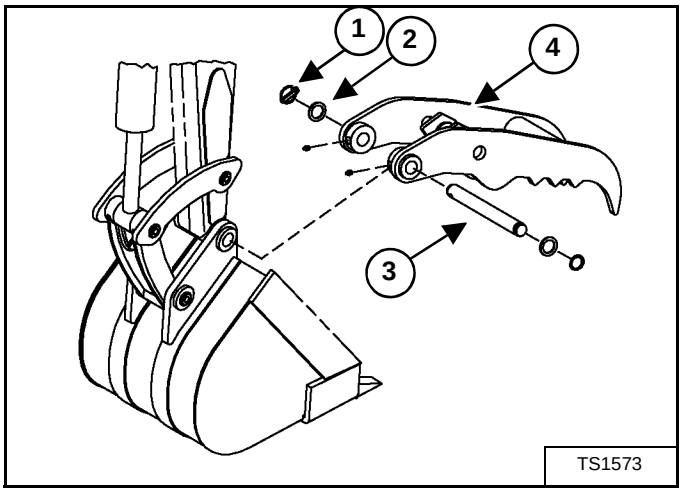
Remove the pin (Item 2) **[Figure 40-171-1]** from the rod end of the cylinder.

Figure 40-171-2



Attach a chain (Item 1) **[Figure 40-171-2]** and lifting device.

Figure 40-171-3

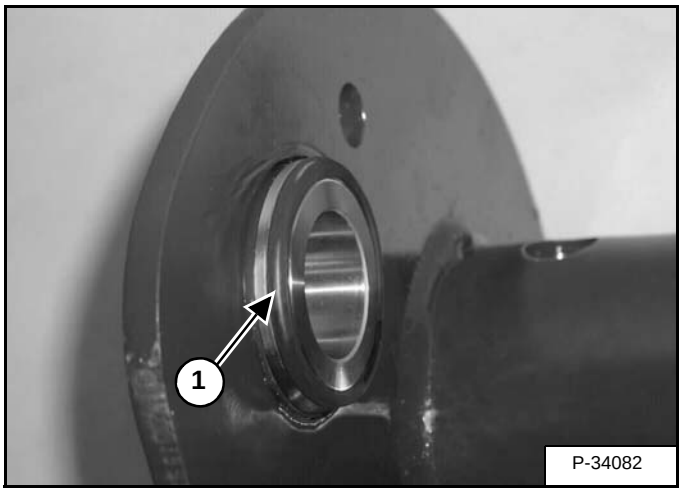


Remove the retainer clip (Item 1), washer (Item 2) and pivot pin (Item 3) **[Figure 40-171-3]**.

Remove the clamp (Item 4) **[Figure 40-171-3]**.

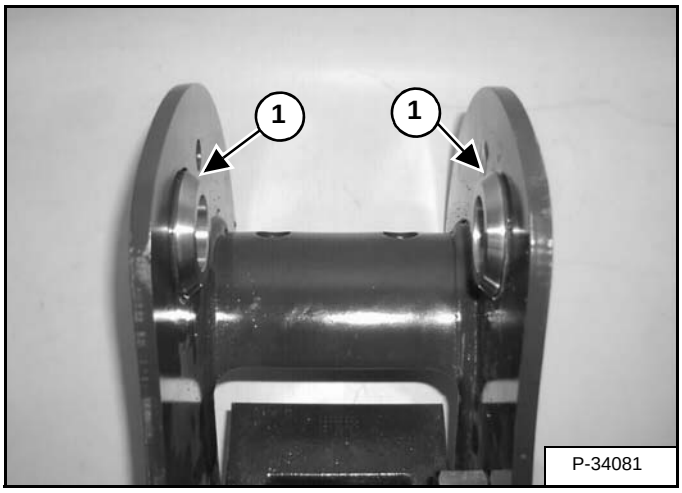
Disassembly (Cont'd)

Figure 40-190-25



Remove the O-ring (Item 1) **[Figure 40-190-25]** (both sides).

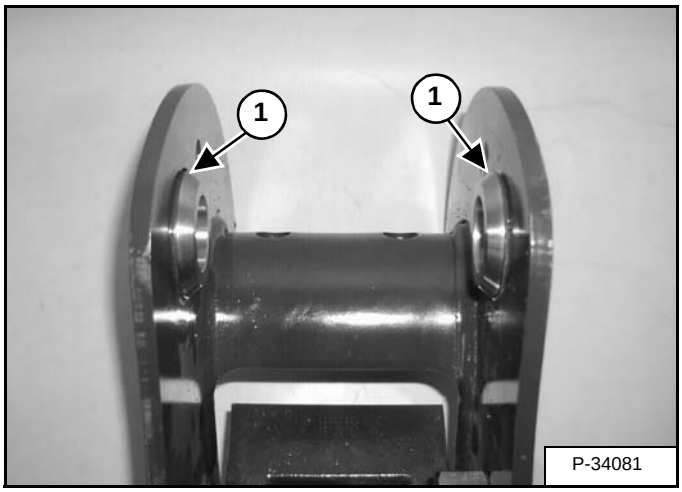
Figure 40-190-26



Remove the bushings (Item 1) **[Figure 40-190-26]**.

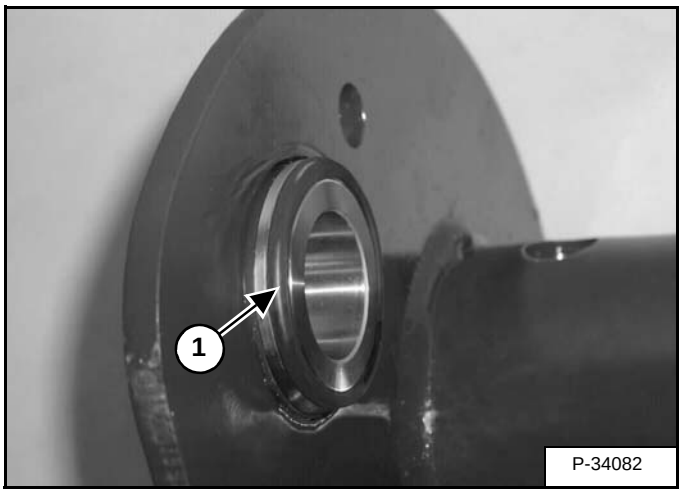
Assembly

Figure 40-190-27



Install the bushings (Item 1) **[Figure 40-190-27]**.

Figure 40-190-28



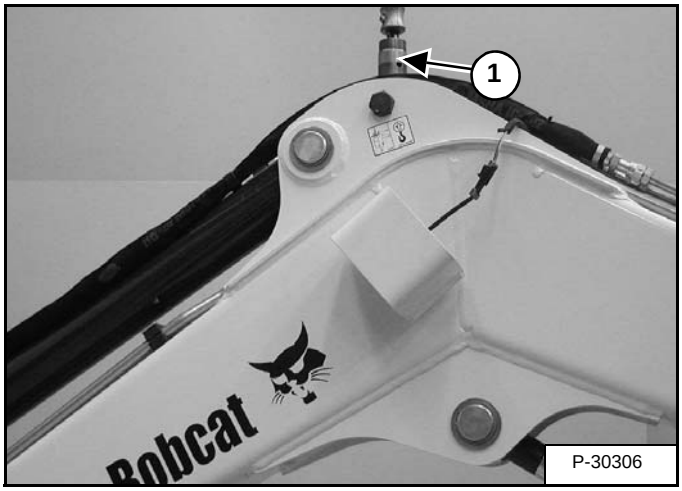
Install the O-ring (Item 1) **[Figure 40-190-28]** (both sides). Use grease to hold the O-rings in place.

X-CHANGE (HYDRAULIC)

Removal And Installation

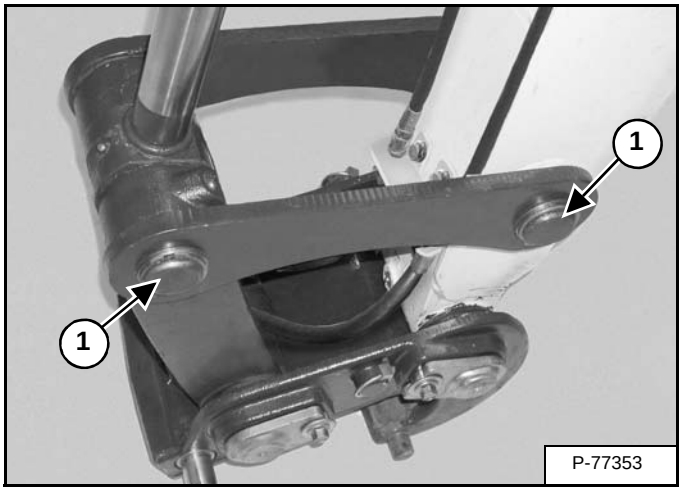
Remove the bucket. (See Operation & Maintenance Manual for the correct removal procedure.)

Figure 40-191-1



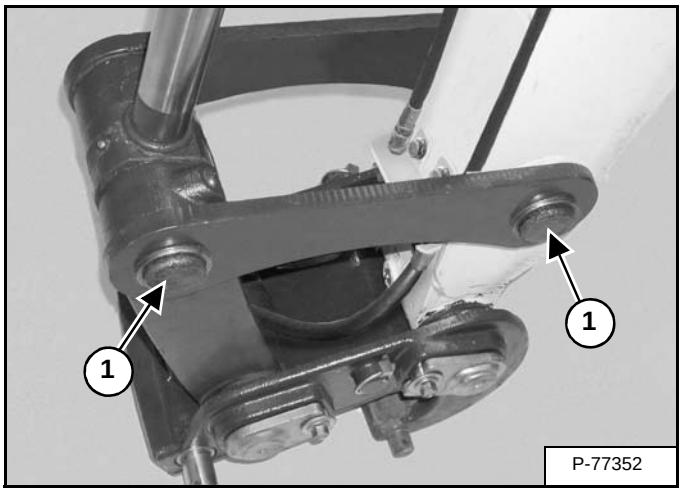
Support the boom with a hoist (Item 1) **[Figure 40-191-1]** and release the pressure on the boom cylinder.

Figure 40-191-2



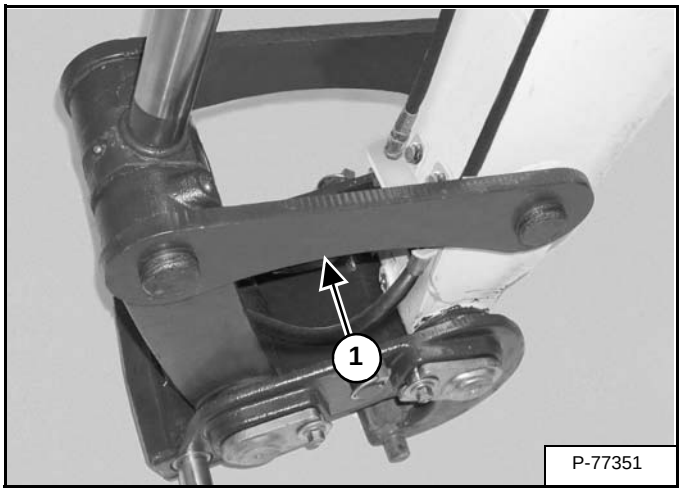
Remove the snap rings (Item 1) **[Figure 40-191-2]**.

Figure 40-191-3



Remove the washers (Item 1) **[Figure 40-191-3]**.

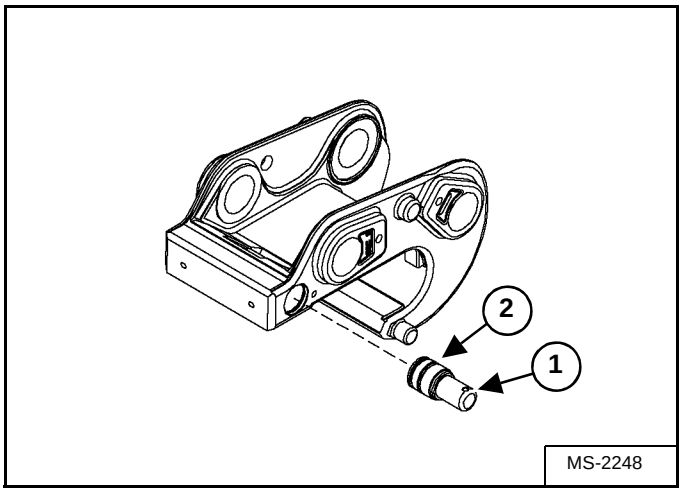
Figure 40-191-4



Remove the plate (Item 1) **[Figure 40-191-4]**.

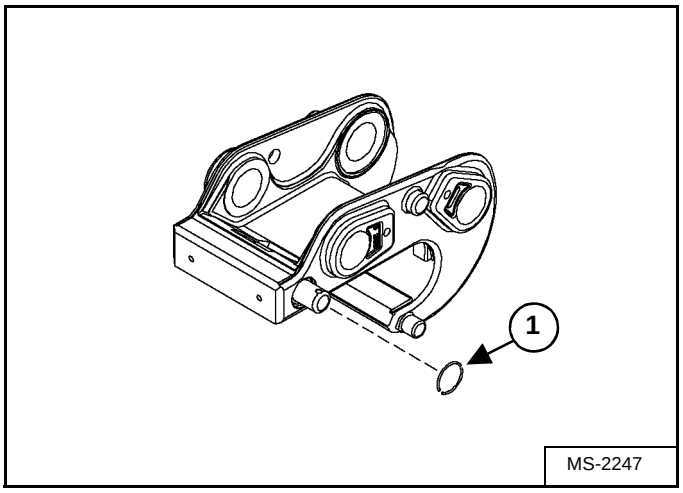
Assembly (Cont'd)

Figure 40-191-34



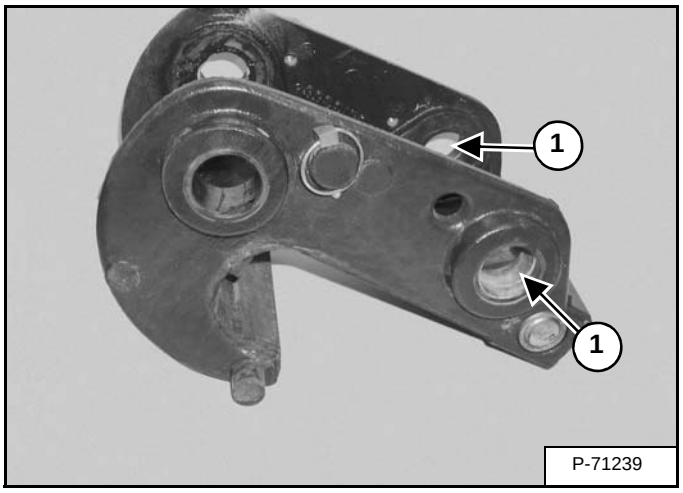
Install the piston (Item 1) and the piston head (Item 2) **[Figure 40-191-34]**.

Figure 40-191-35



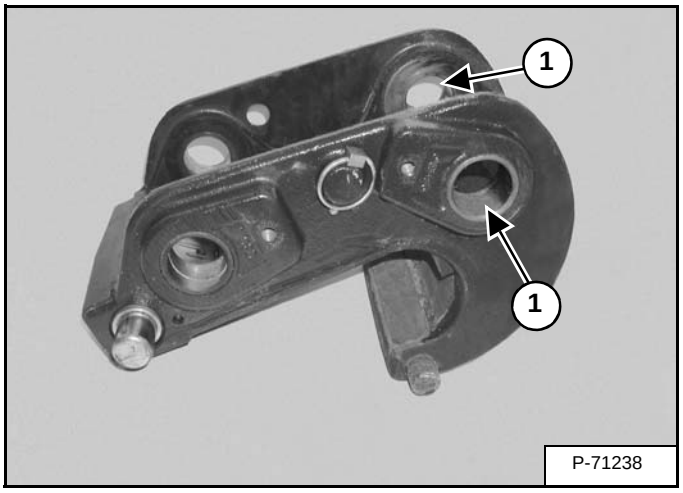
Apply inward pressure on the piston and install the retaining ring (Item 1) **[Figure 40-191-35]**.

Figure 40-191-36



Install the bushings (Item 1) **[Figure 40-191-36]**.

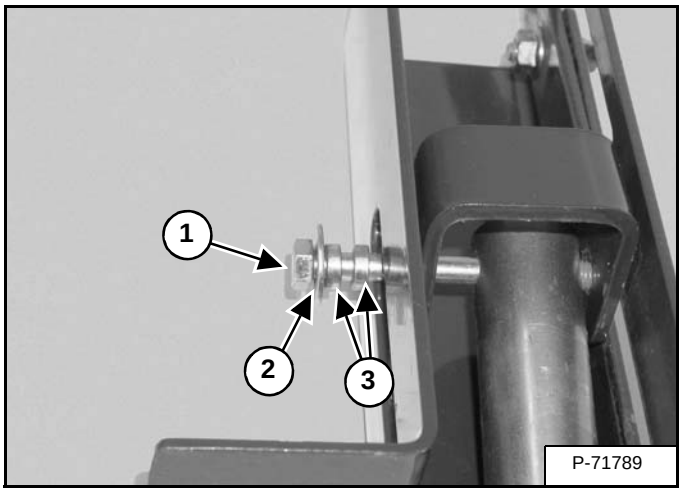
Figure 40-191-37



Install the bushings (Item 1) **[Figure 40-191-37]**.

Disassembly And Assembly (Later Models) (Cont'd)

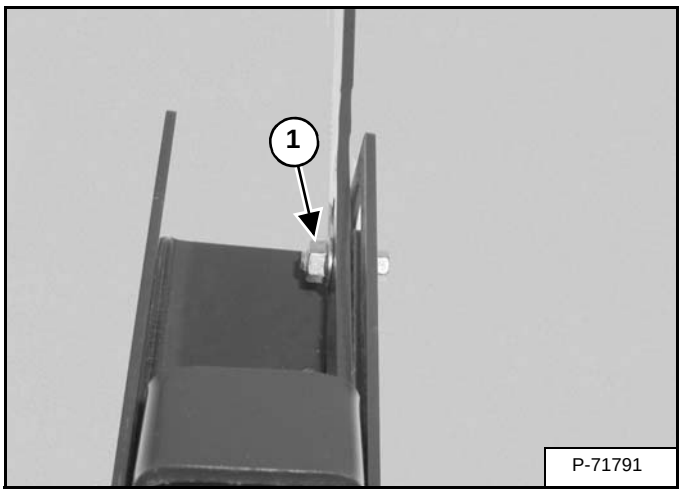
Figure 40-200-8



Remove the bolt (Item 1), washer (Item 2) and spacers (Item 3) **[Figure 40-200-8]**.

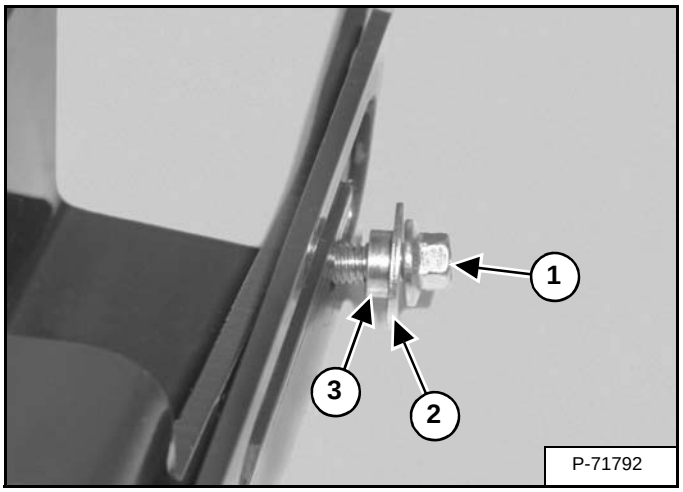
Remove the pin.

Figure 40-200-9



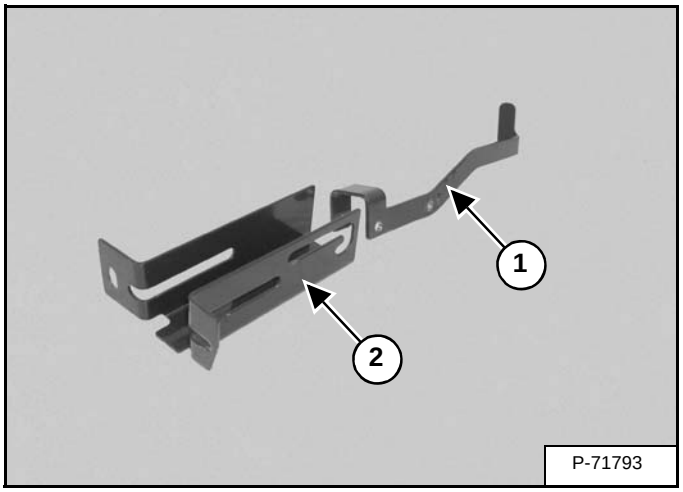
Remove the nut (Item 1) **[Figure 40-200-9]**.

Figure 40-200-10



Remove the bolt (Item 1), washer (Item 2) and spacer (Item 3) **[Figure 40-200-10]**.

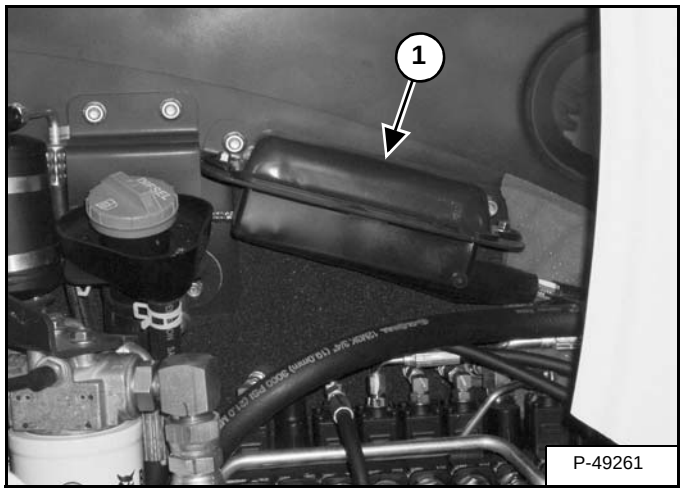
Figure 40-200-11



Separate the slide (Item 1) from the housing (Item 2) **[Figure 40-200-11]**.

Description

Figure 50-10-6



The excavator has a 12 volt, negative ground electrical system. The electrical system is protected by fuses located under the right side cover of the excavator (Item 1) **[Figure 50-10-6]**. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

The battery cables must be clean and tight. Check the electrolyte level in the battery. Add distilled water as needed. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution.

Put Battery Saver P/N 6664458 or grease on the battery terminals and cable ends to prevent corrosion.

⚠ WARNING

AVOID INJURY OR DEATH

Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.

If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.

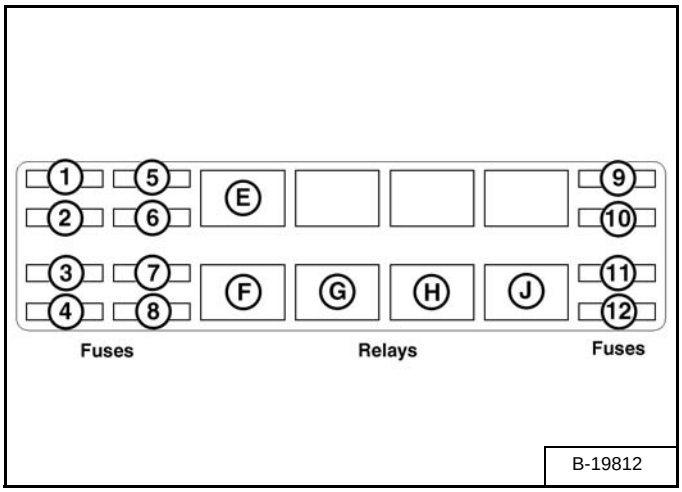
W-2065-0807

Fuse And Relay Location

A decal is inside the cover to show location and amp ratings.

Remove the cover to check or replace the fuses and relays.

Figure 50-10-7



The location and sizes are shown below and **[Figure 50-10-7]**.

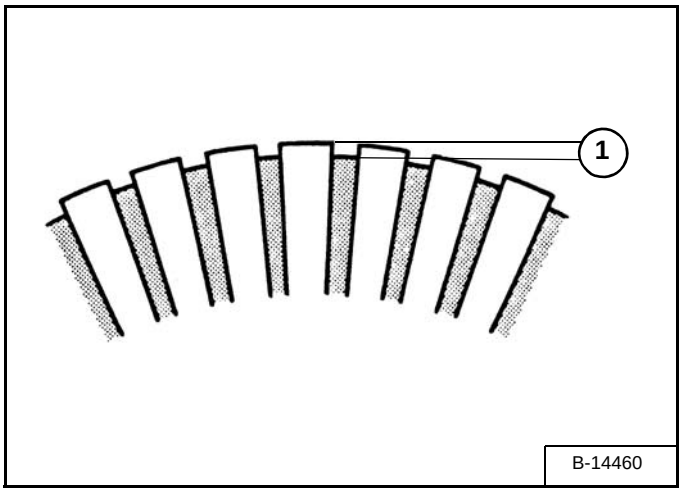
REF	DESCRIPTION	AMP	REF	DESCRIPTION	AMP
1	***Not Used***	- -	11	Lights	20
2	Heater	25	12	ACC Plug	15
3	Ignition	5			
4	Fuel Solenoid	25			
5	Wiper	5			
6	Switch Power	20			
7	Alternator/ Heater	25			
8	ACD	25			
9	Controller	25			
10	ACD	25			

Always replace fuses using the same type and capacity.

REF	DESCRIPTION
E	Switch Power
F	Fuel Solenoid
G	Lights
H	Glow Plug
J	Starter

Inspection And Repair (Cont'd)

Figure 50-40-30



Measure the segment mica depth (Item 1) **[Figure 50-40-30]**.

Service Limit - 0.008 inch (0,2 mm)

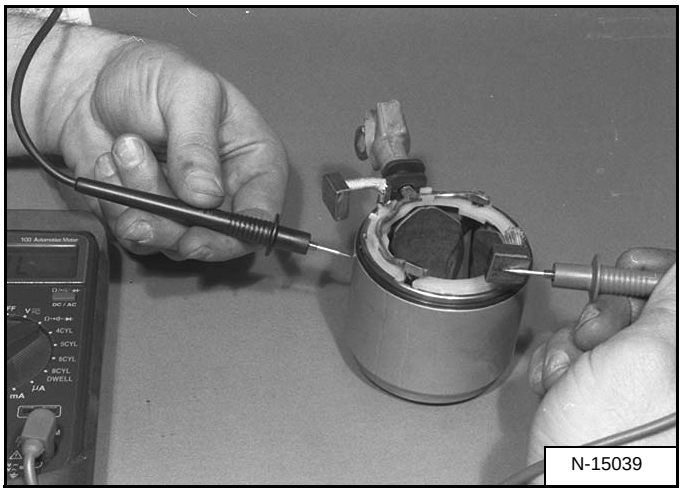
If it is worn, replace the armature.

Check the commutator surface for burned spots which usually indicates an open-circuit, and correct it using #400 sand paper.

Check the field windings for wear and damage.

Check all the connections for clean and tight solder joints.

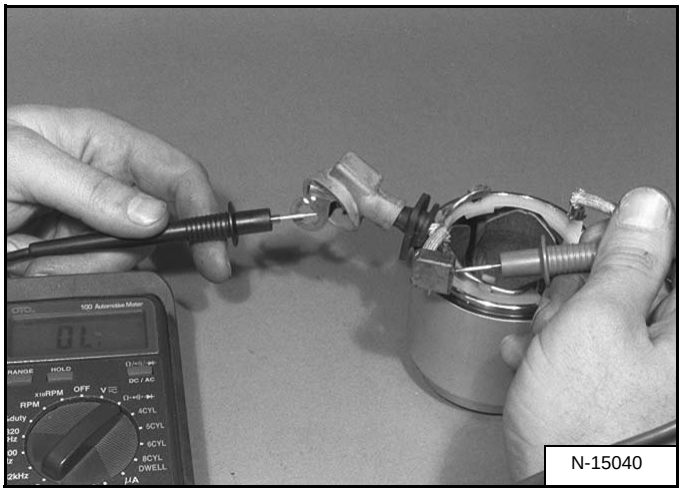
Figure 50-40-31



Field Winding Ground Test: Use a circuit tester, touch one probe to the field winding end of the brush and the other probe to the surface of the frame **[Figure 50-40-31]**. There should be no continuity. If there is continuity, the field windings are grounded.

Replace the field windings.

Figure 50-40-32



Field Windings Continuity Test: Use a circuit tester, touch one probe to the wire and the other probe to the brush **[Figure 50-40-32]**. There must be continuity. If there is no continuity, the field windings are open-circuited. Replace the yoke if the field windings have an open circuit.

Inspect the brushes for wear and damage.

Replace the brush holder or yoke assembly if the brushes are worn or damaged.

Check brush springs, for damage or rust. Replace as needed.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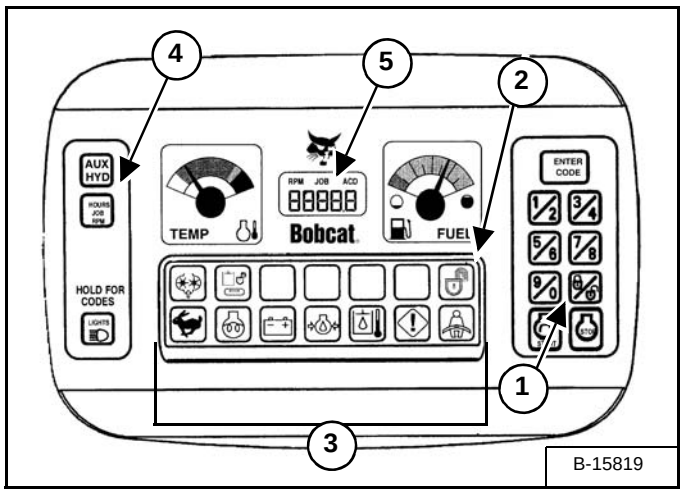
Password Lockout Feature

This allows the operator to Unlock the password feature so that a password does not need to be used every time you start the engine.

Perform Password Entry (See Password Entry (For Starting and Operating the Machine) (the engine can be started or stopped.)

Figure 50-100-2



Press the Lock/Unlock button (Item 1) **[Figure 50-100-2]**. The LCD will continuously alternate from **UnLoc** to **CodE** for 1 second periods.

Perform Password Entry again.

UnLoc will appear in the LCD (Item 5), the Unlocked Icon (Item 2) will appear in the Icon Display Area (Item 3) **[Figure 50-100-2]** and there will be two short beeps.

To start an Unlocked system, press the ENTER CODE button and press the START button.

When you stop the engine with the system unlocked, you will hear one long beep every 3 seconds for 15 seconds.

To lock the system again, press the Lock/Unlock button (Item 1) **[Figure 50-100-2]** and enter the password during the 15 second period.

Job Clock

The JOB CLOCK can be set to record accumulated hours for a particular job.

Press and release the HOURS/JOB/RPM button (Item 4) until JOB light is ON at the top, center of the LCD (Item 5) **[Figure 50-100-2]**.

While the JOB light is ON, press and hold the HOURS/JOB/RPM button (Item 4) **[Figure 50-100-2]** until the LCD returns to zero.

This process will clear the accumulated hours and will begin recording JOB CLOCK time again. (This does not affect the HOURMETER which continues to record the total operating hours of the excavator.)

Pressing the HOURS/JOB/RPM button again or pressing the START button will return the LCD to HOURMETER function.

RPM

The LCD (Item 5) **[Figure 50-100-2]** can be set to display engine RPM.

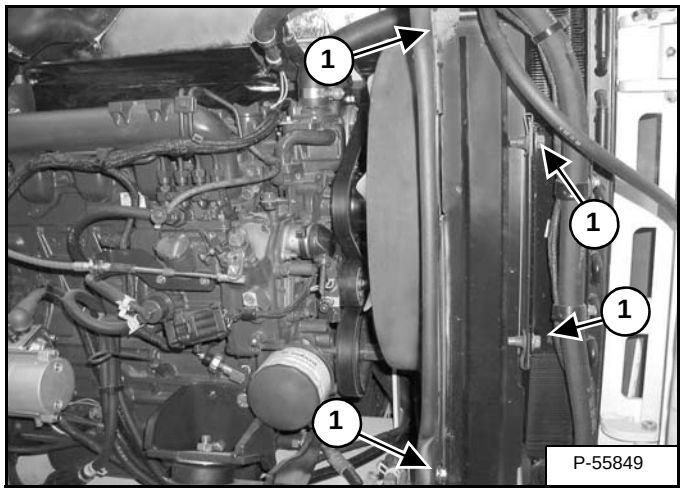
With the engine running, press and release the HOURS/JOB/RPM button (Item 4) until RPM light is ON at the top, center of the LCD (Item 5) **[Figure 50-100-2]**.

Engine RPM is now displayed in the LCD.

Press the HOURS/JOB/RPM button (Item 4) **[Figure 50-100-2]** again the return to HOURMETER function.

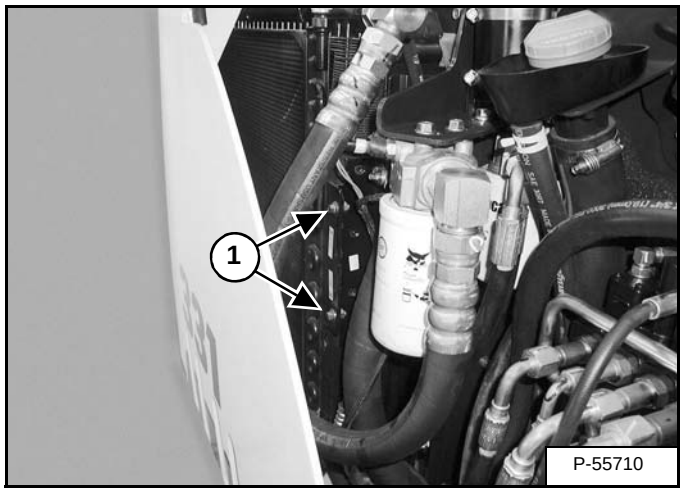
Removal And Installation (Cont'd)

Figure 60-40-5



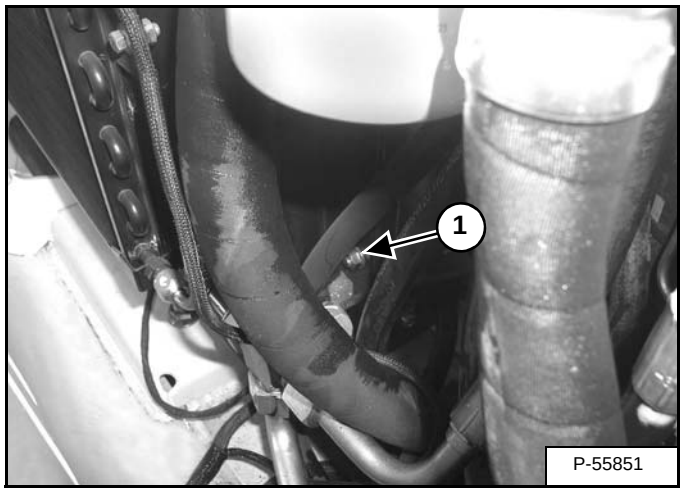
Remove the bolts (Item 1) **[Figure 60-40-5]** from the rear of the radiator.

Figure 60-40-6



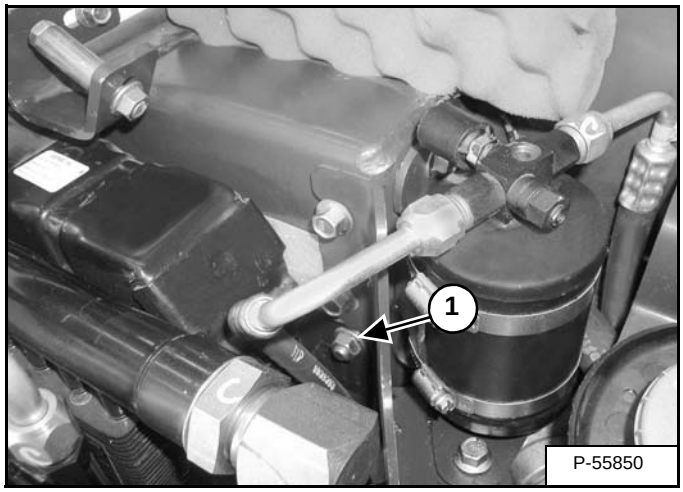
Remove the bolts (Item 1) **[Figure 60-40-6]**.

Figure 60-40-7



Remove the lower front radiator bolt (Item 1) **[Figure 60-40-7]**.

Figure 60-40-8

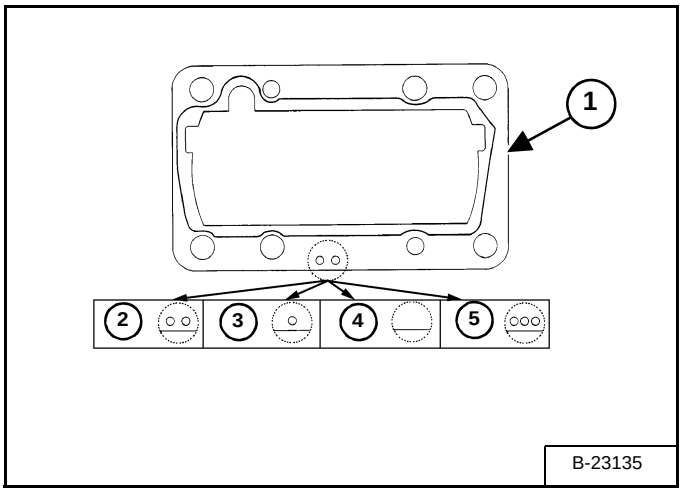


Remove the upper front radiator bolt (Item 1) **[Figure 60-40-8]**.

Remove the radiator from the excavator.

Fuel Injection Pump Timing (Cont'd)

Figure 60-50-20



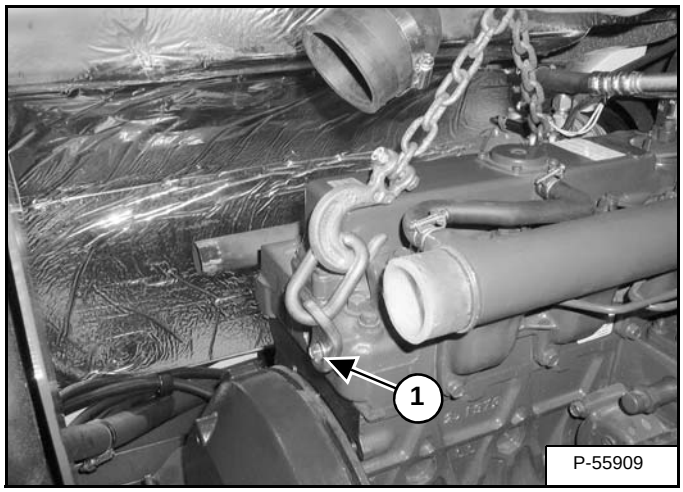
The correct engine timing is 4.5-6.5 B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-50-20]** to time the engine to 4.5-6.5 B.T.D.C. The engine is correctly timed when the correct mark on the flywheel is aligned with the notch in the timing hole.

NOTE: Shims (Item 1) are available in four thicknesses, shims with the two holes (Item 2) are 0,20 mm thick, shims with one hole (Item 3) are 0,25 mm thick, shims with no holes (Item 4) are 0,30 thick and shims with three holes (Item 5) [Figure 60-50-20] are 0,35 mm thick.

NOTE: Increasing the thickness of the shim pack by 0.050 mm retards the injection timing by 0.500°. Decreasing the shim pack by 0,050 mm advances the timing by 0,500°.

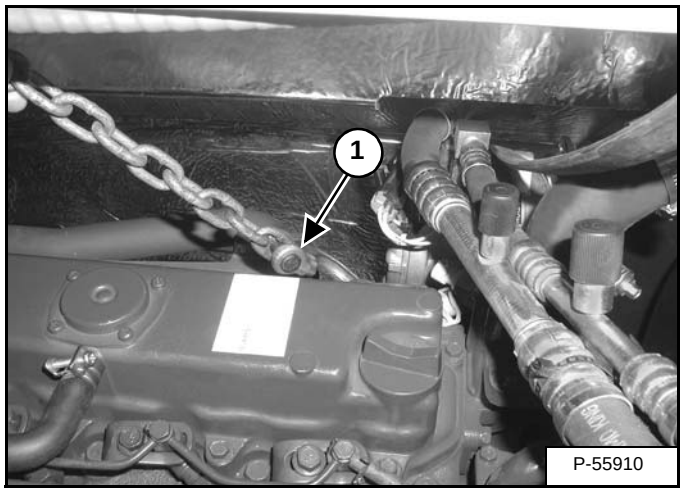
Removal And Installation (Cont'd)

Figure 60-60-20



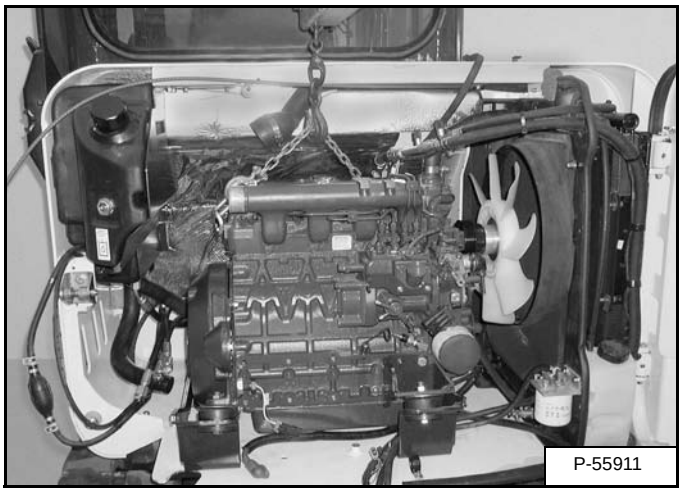
Attach a lifting bracket (Item 1) **[Figure 60-60-20]** and chain to the pump end of the engine.

Figure 60-60-21



Attach a chain (Item 1) **[Figure 60-60-21]** to the lifting bracket on the front of the engine.

Figure 60-60-22



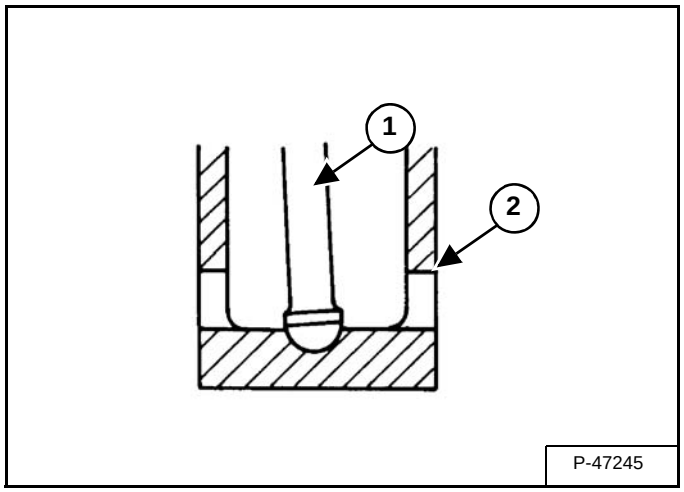
Attach a hoist to the chain, slightly raise and support the engine. Rotate the pump end of the engine toward the back of the excavator **[Figure 60-60-22]**.

Relocate all wires and hoses away from the engine.

Raise the hoist and remove the engine.

Cylinder Head Removal And Installation (Cont'd)

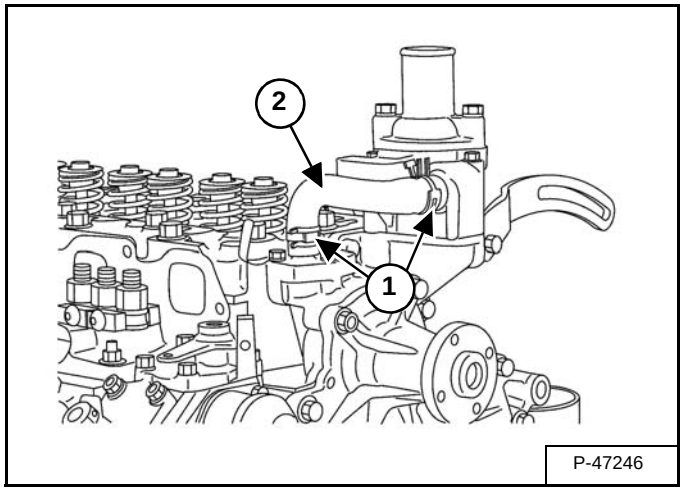
Figure 60-80-5



Installation: The push rod (Item 1) must be seated in the tappet (Item 2) **[Figure 60-80-5]** correctly or the push rods will be damaged.

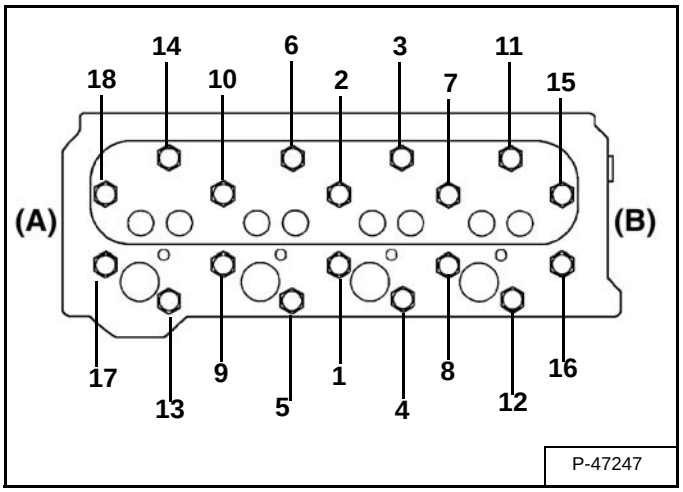
After installing the rocker arm assembly and push rods, the valve lash must be adjusted. (See Valve Clearance Adjustment on Page 60-50-14.)

Figure 60-80-6



Remove the clamps (Item 1) and remove the hose (Item 2) **[Figure 60-80-6]**.

Figure 60-80-7



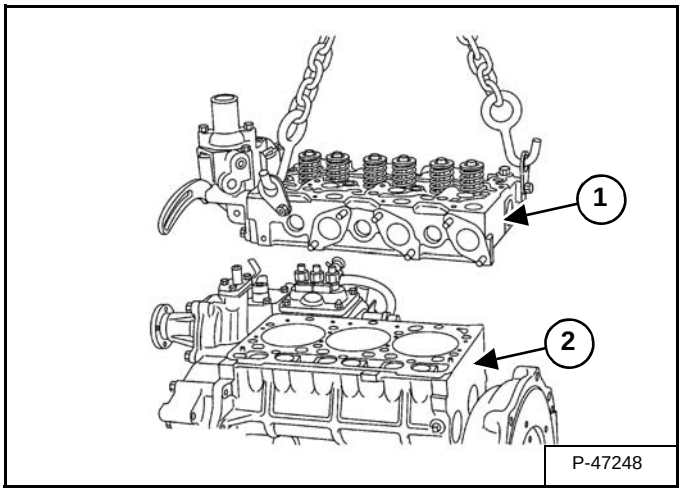
Remove the cylinder head bolts in order of #18 to #1 **[Figure 60-80-7]**.

NOTE: (A) is the gearcase side, (B) is the flywheel side.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence in order of #1-#18 to 69 - 72 ft.-lb. (93 - 98 N•m) torque.

NOTE: Re-tighten the cylinder head bolts in the correct sequence after the engine has been run for 30 minutes.

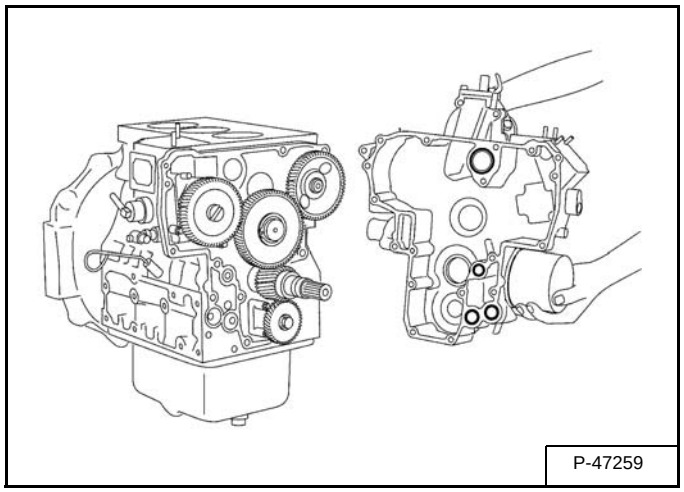
Figure 60-80-8



Remove the cylinder head (Item 1) and gasket (Item 2) **[Figure 60-80-8]**.

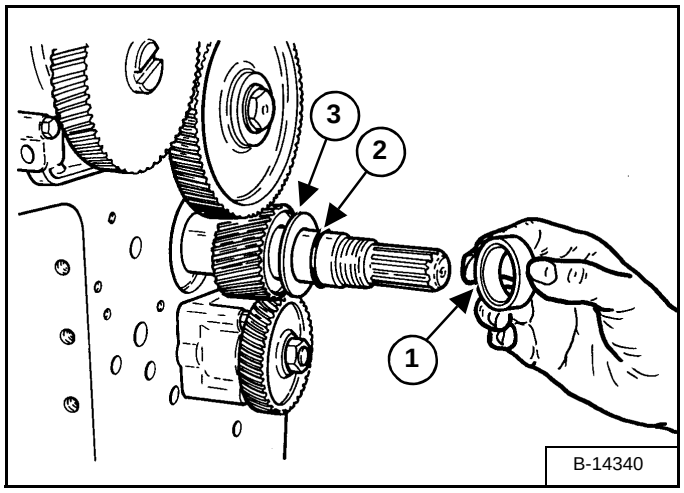
Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-80-35



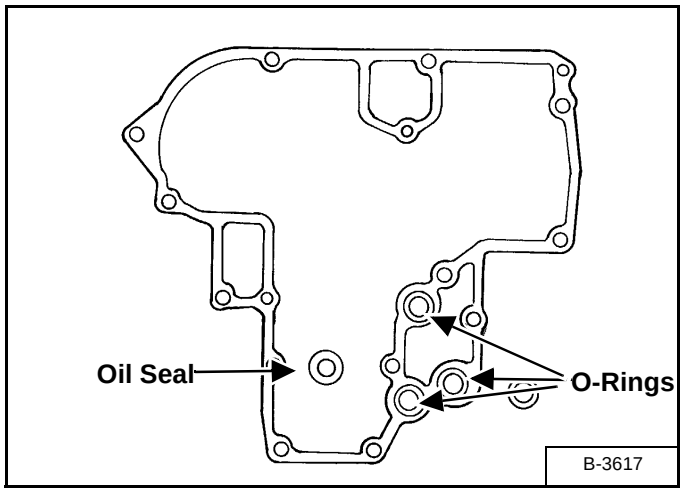
Remove the timing gearcase cover **[Figure 60-80-35]**.

Figure 60-80-36



Remove the crankshaft collar (Item 1), O-ring (Item 2) and oil slinger (Item 3) **[Figure 60-80-36]**.

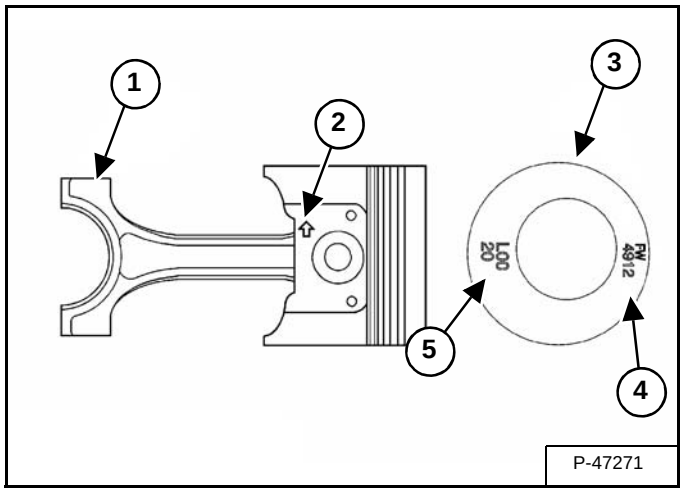
Figure 60-80-37



Installation: Install new O-rings and oil seal into the timing gearcase cover **[Figure 60-80-37]**.

Piston And Connecting Rod Removal And Installation (Cont'd)

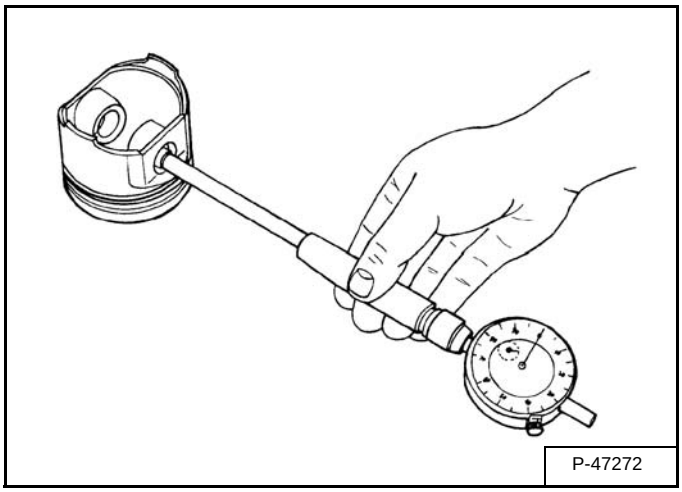
Figure 60-80-66



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in clean engine oil to 176° F. (80° C.) and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 & 5) **[Figure 60-80-66]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod Servicing

Figure 60-80-67

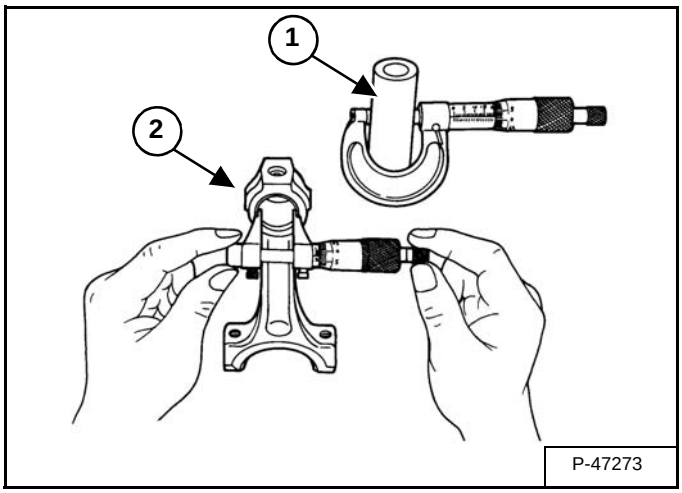


Measure the I.D. of the piston pin bore in both horizontal and vertical directions **[Figure 60-80-67]**.

If the measurement exceeds the allowable limit, replace the piston.

Piston Bore I.D.	0.984 - 0.985 in. (25,0 - 25,013 mm)
Allowable Limit	0.986 in. (25,05 mm)

Figure 60-80-68

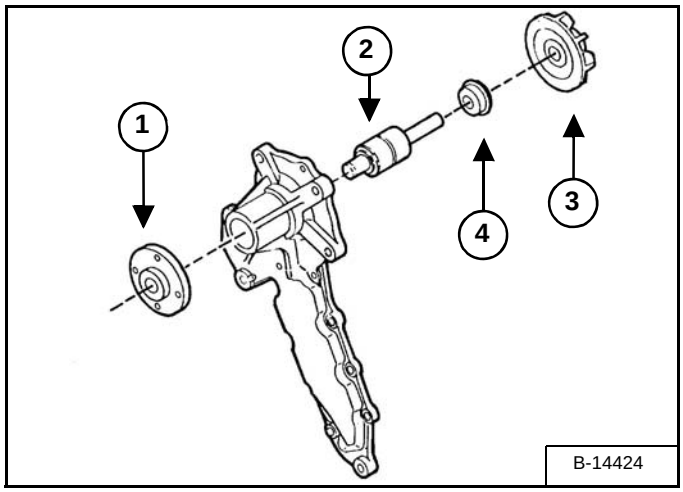


Measure the O.D. of the piston pin (Item 1) **[Figure 60-80-68]**.

Measure the I.D. of the connecting rod small end (Item 2) **[Figure 60-80-68]**.

Water Pump Disassembly And Assembly

Figure 60-80-97



Remove the flange (Item 1) **[Figure 60-80-97]**.

Press the shaft (Item 2) and impeller (Item 3) **[Figure 60-80-97]** out the impeller side of the water pump.

Remove the impeller (Item 3) **[Figure 60-80-97]** from the shaft.

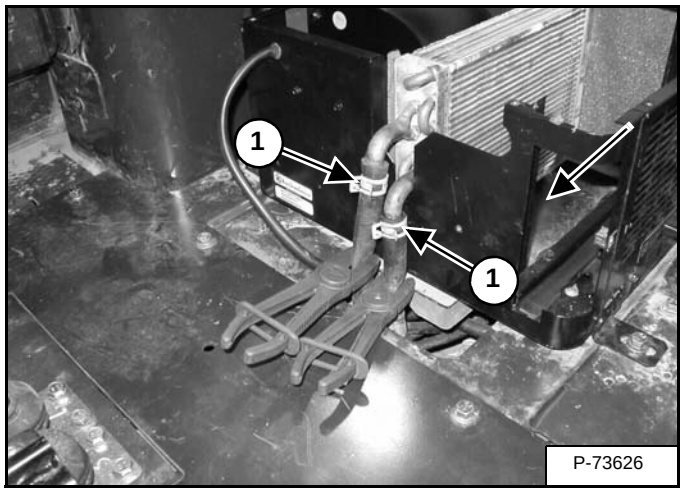
Remove the seal (Item 4) **[Figure 60-80-97]**.

Install a new seal (Item 4) **[Figure 60-80-97]** when assembling the water pump.

HEATER COIL (LATER MODELS) (CONT'D)

Removal And Installation Without A/C (Cont'd)

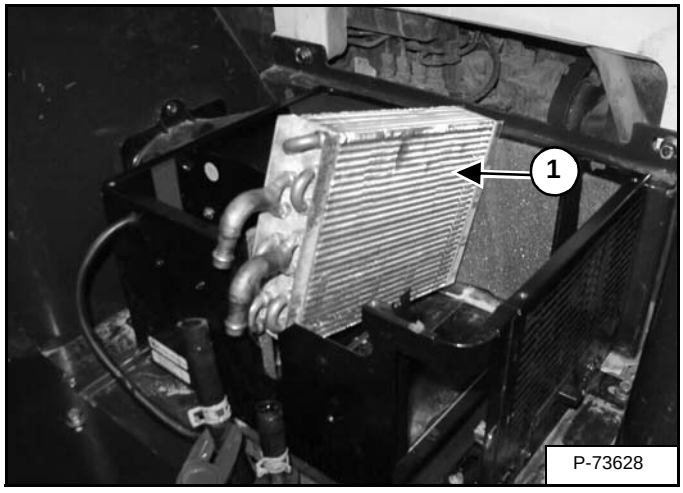
Figure 70-11-5



Clamp the heater hoses using clamping pliers and remove the hose clamps (Item 1) **[Figure 70-11-5]** from the hoses.

Remove the heater hoses from the heater coil.

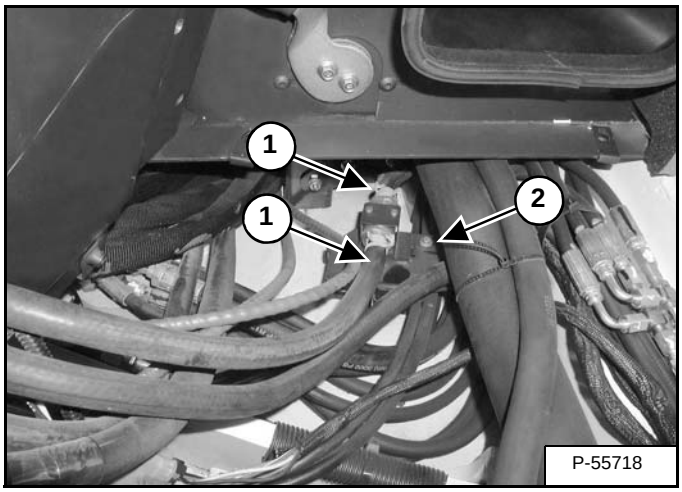
Figure 70-11-6



Lift the heater coil (Item 1) **[Figure 70-11-6]** straight up and remove it from the heater unit.

Removal And Installation (Cont'd)

Figure 70-30-5



Mark and remove the hoses (Item 1). Remove the two bolts (Item 2) **[Figure 70-30-5]** from the heater valve.

Remove the heater valve from the excavator.

The heater valve is not serviceable and must be replaced as an assembly.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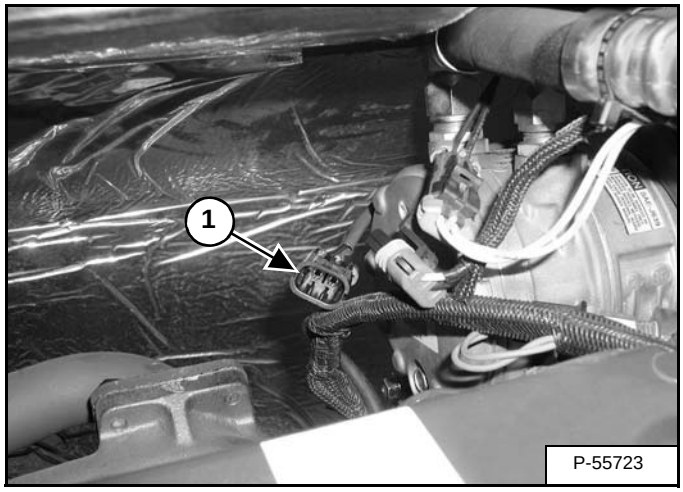
Checking The Electrical System (Cont'd)

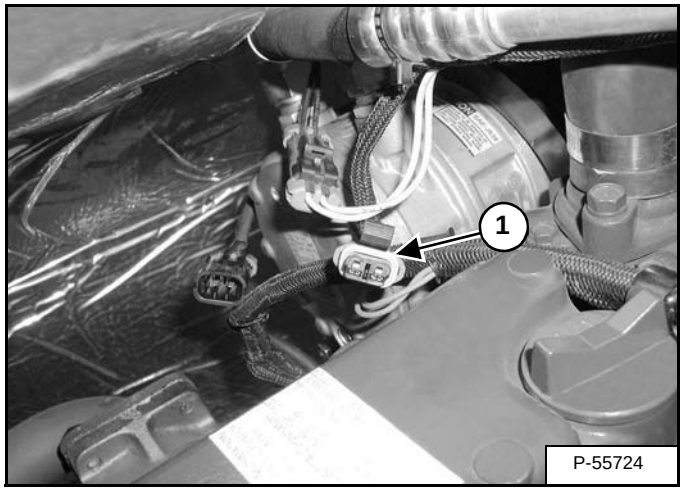
Figure 70-80-16



With a multimeter, check the resistance to the compressor clutch (Item 1) **[Figure 70-80-16]**.

If there is no resistance value, replace the compressor clutch. (See Removal And Installation on Page 70-140-1.)

Figure 70-80-17

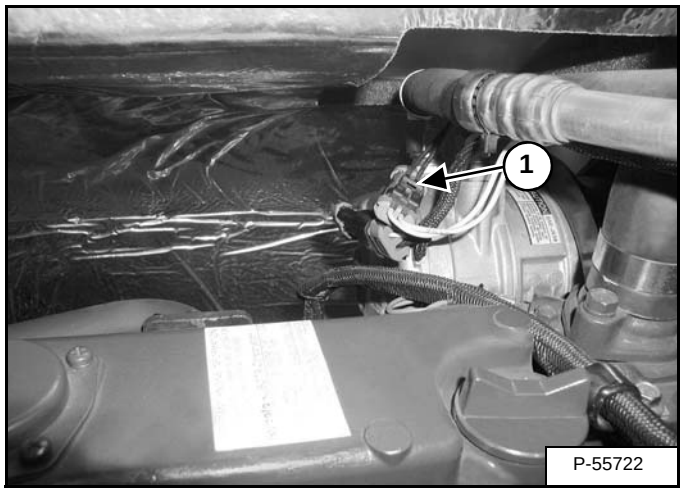


With a multimeter, check the voltage to the compressor clutch at the wire harness (Item 1) **[Figure 70-80-17]**.

If the voltage reading is approximately 12 volts, the system is operating correctly.

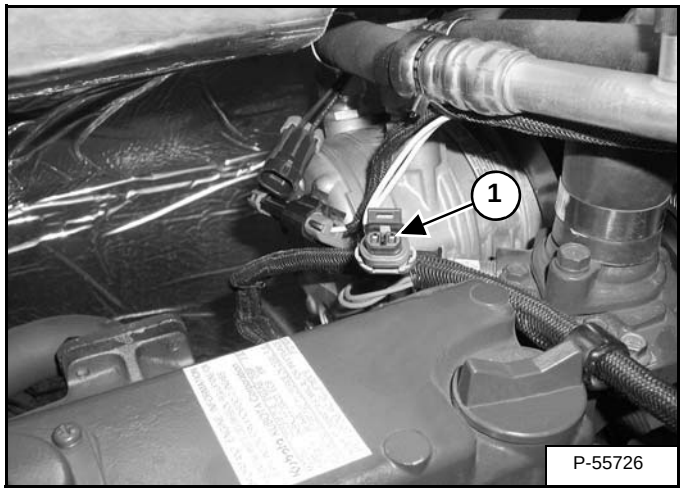
If there is no power at the clutch, reconnect the wiring harness to the compressor clutch.

Figure 70-80-18



Disconnect the wire harness (Item 1) from the pressure switch (Item 2) **[Figure 70-80-18]**.

Figure 70-80-19



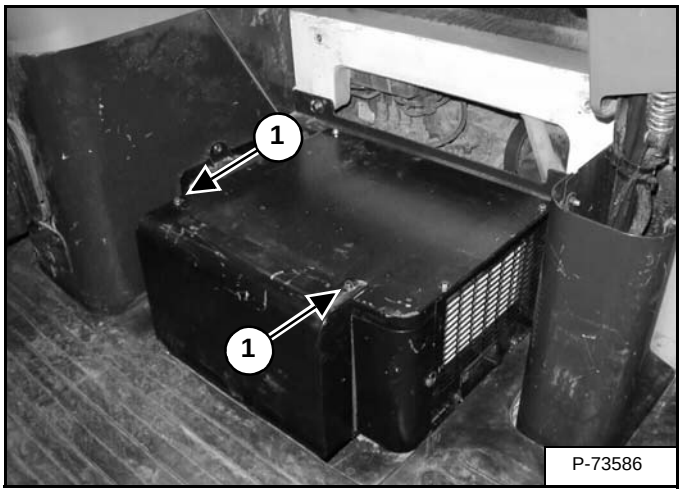
Using a multimeter check the wiring harness (Item 1) **[Figure 70-80-19]** for voltage.

The voltage should be approximately 12 volts.

Cleaning The A/C Evaporator Coil & Heater Coil

Remove the seat and seat mount. (See Removal And Installation on Page 40-40-1.)

Figure 70-81-3



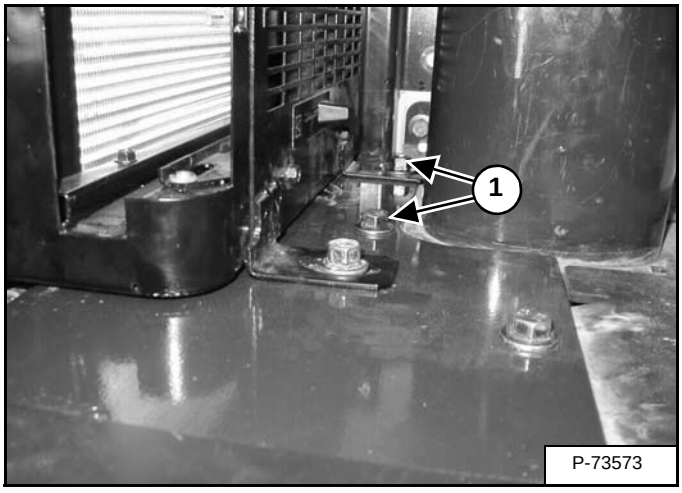
Remove the bolts (Item 1) **[Figure 70-81-3]**.

Remove the front cover.

Remove the fresh air filter from the unit. (See HEATER AIR FILTER (WITH CAB OPTION ONLY) on Page 10-61-1.)

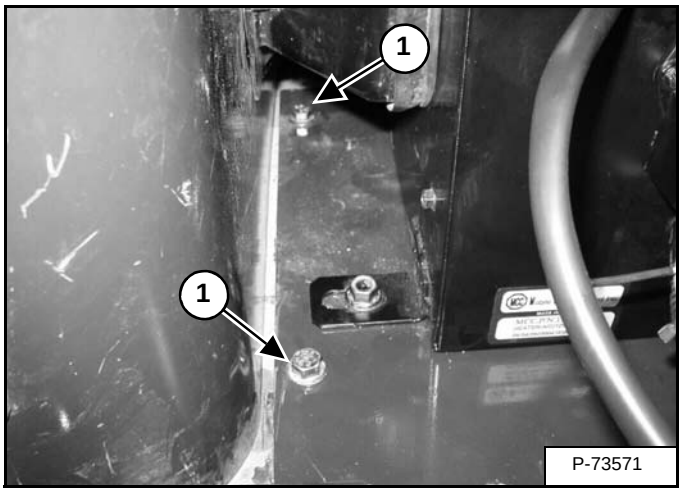
Remove the floormat and floor plate. (See Removal And Installation on Page 40-120-1.)

Figure 70-81-4



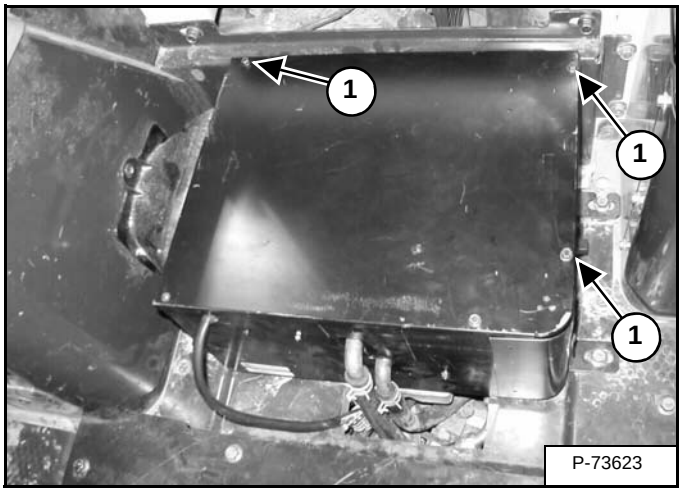
Remove the bolts (Item 1) **[Figure 70-81-4]** from the left side of the cab.

Figure 70-81-5



Remove the bolts (Item 1) **[Figure 70-81-5]** from the right side of the cab.

Figure 70-81-6

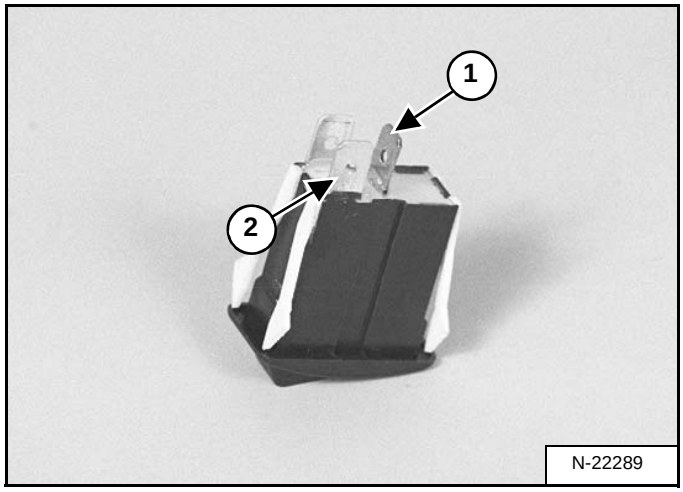


Move the unit forward. Remove the bolts (Item 1) **[Figure 70-81-6]** from the access cover.

Remove the access cover.

Checking The Electrical System (Cont'd)

Figure 70-81-33



If there is voltage at the wiring harness, check the A/C switch **[Figure 70-81-33]** for resistance.

With the switch in the OFF position there should be no resistance between any of the three terminals on the A/C switch.

With the switch in the ON position there should be resistance between terminal (Item 1) and terminal (Item 2) **[Figure 70-81-33]**.

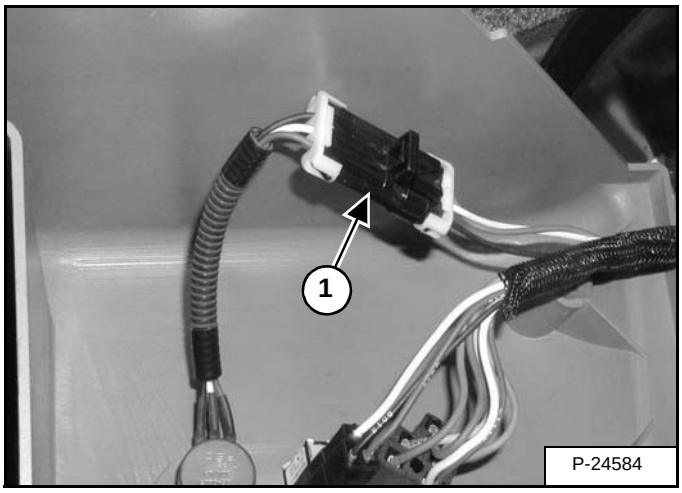
If no resistance value is found, replace the A/C switch.

If a resistance value is found, check the potentiometer.

The potentiometer will effect the A/C system and also effect the operation of the heater.

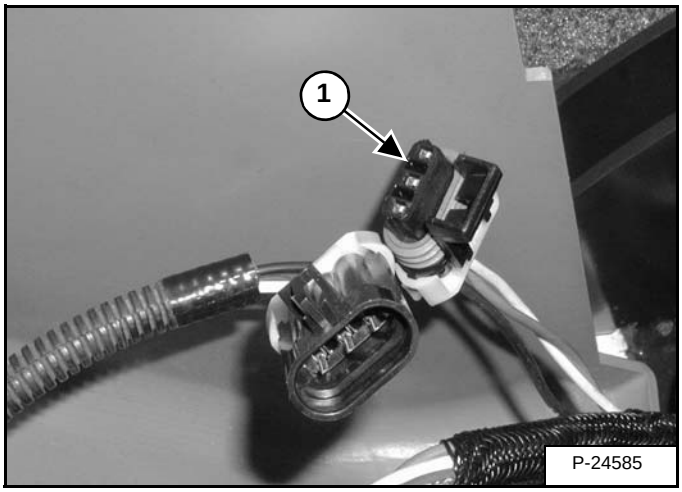
If the heater valve does not open, or close, or the A/C does not work, check the potentiometer.

Figure 70-81-34



Disconnect the wire harness (Item 1) **[Figure 70-81-34]** from the potentiometer.

Figure 70-81-35



Check the wire harness (Item 1) **[Figure 70-81-35]** for voltage. Between pins **A** and **C** the voltage should be approximately 12 volts.

If there is no voltage at the wiring harness, check the harness for broken wires.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Track

Width	12.6 in. (320 mm)
Number of Shoes (steel track)	41
Number of Rollers	4 (on bottom)
331 Ground Pressure Rubber Track Steel Track	 4.22 PSI (0,291 bar) 4.31 PSI (0,297 bar)
331E w/Long Arm Ground Pressure Rubber Track Steel Track	 4.54 PSI (0,313 bar) 4.63 PSI (0,319 bar)
334 Ground Pressure Rubber Track Steel Track	 4.43 PSI (0,306 bar) 4.52 PSI (0,312 bar)

Electrical

Alternator	12 volts, 90 amp open frame w/ internal regulator
Battery	12 volt negative ground 12 volt, 530 CCA @ 0° F (-18° C), 75 minute reserve capacity
Starter	12 volt gear reduction 2.7 HP (2.0 kW)
Lights (2)	37.5 watts each

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

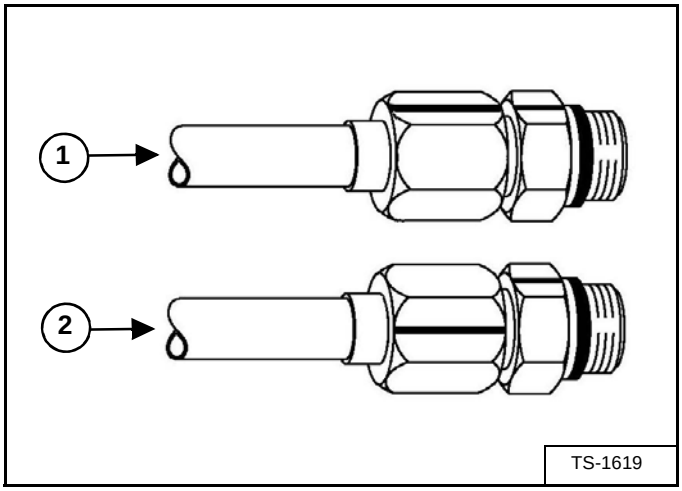
Replace hoses which show signs of wear, damage or weather cracked rubber.

Always use two wrenches when loosening and tightening hose or tubeline fittings.

Flare Fitting

Use the following procedure to tighten the flare fitting:

Figure SPEC-40- 3



Tighten the nut until it makes contact with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[Figure SPEC-40- 3]**.

Use the chart below to find the correct tightness needed (Item 2) **[Figure SPEC-40- 3]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.

FLARE FITTING TIGHTENING TORQUE

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE ft.-lb. (N•m)	NEW Rotate No. of Hex Flats	RE-ASSEMBLY Rotate No. of Hex Flats
5/8”	5/16”	1/2”-20	17 (23)	2-1/2	1
11/16”	3/8”	9/16”-18	22 (30)	2	1
7/8”	1/2”	3/4”-16	40 (54)	2	1
1”	5/8”	7/8”-14	60 (81)	1-1/2	1
1-1/4”	3/4”	1-1/16”-12	84 (114)	1	3/4
1-3/8”	1”	1-5/16”-12	118 (160)	3/4	3/4

CONVERSIONS (CONT'D)

U.S. To Metric Conversion

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9