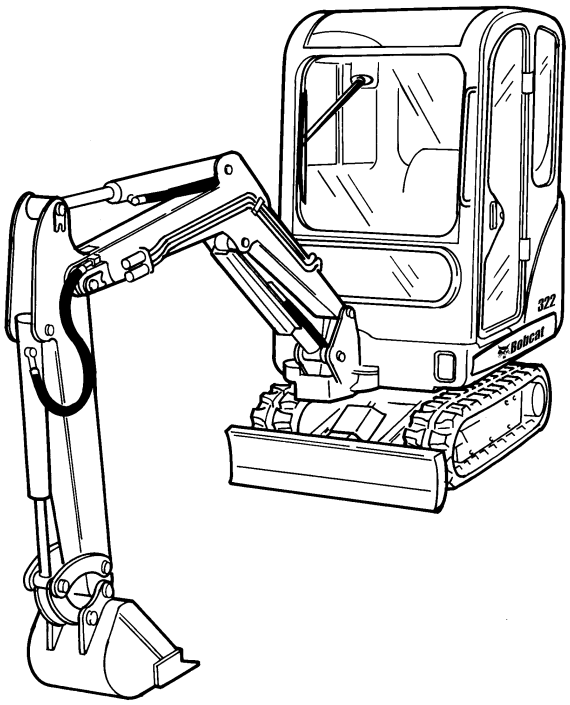
320
322

Bobcat®

Service Manual

320 - S/N 223911001 & Above
322 - S/N 224011001 & Above
(G Series)



Ingersoll Rand
Compact Vehicle Technologies

6902668 (7-06)
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

WARNING

Warnings on the machine and in the manuals are for your safety. Failure to obey warnings can cause injury or death.

W-2044-1285

IMPORTANT

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

I-2019-0284

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.

Figure 10-10-1

Raise one side of the machine (approximately 4 inches) using the boom and arm as shown in **[Figure 10-10-1]**.

Raise the blade fully and install jackstands under the blade and the track frame. Lower the machine until all machine weight is on the jackstands.

Stop the engine.

⚠ WARNING

Put jackstands under the blade and rear corners of the undercarriage before working under the machine. Failure to block up the machine may allow it to move or fall and result in injury or death

W-2218-1195

⚠ WARNING

AVOID INJURY OR DEATH

Keep fingers and hands out of pinch points when checking the track tension.

W-2142-0189

TRANSPORTING THE EXCAVATOR

When transporting the machine, observe the rules, motor vehicle laws and vehicle limit ordinances. Use a transport and towing vehicle of adequate length and capacity.

Secure the parking brakes and block the wheels of the transport vehicle.

Remove the blade extensions (If equipped). See Blade Extension Removal And Installation. (See Extension Removal And Installation on Page 30-10-1)

Retract the track frame if required. See the correct Operation And Maintenance Manual for the proper procedure.

Align the ramps with the center of the transport vehicle. Secure the ramps to the truck bed and be sure ramp angle does not exceed 15 degrees.

Use metal loading ramps with a slip resistant surface that are the correct length and width, and can support the weight of the machine.

The rear of the trailer must be blocked or supported when loading or unloading the Excavator to prevent the front of the transport vehicle from raising.

Determine the direction of the track movement before moving the machine (blade forward). Engage the slew lock . (See SWING LOCK on Page 10-11-1.)

Figure 10-30-18

Move the machine forward onto the transport vehicle **[Figure 10-30-18]**.

Do not change direction of the machine while it is on the ramps. Lower the boom, arm, and bucket to the transport vehicle.

Stop the engine and remove the key. Put blocks under the front and rear of the tracks.

Figure 10-30-19

Figure 10-30-20

Fasten chains to the front corners of the blade and to the tie down loop at the rear **[Figure 10-30-19]** & **[Figure 10-30-20]** to prevent it from moving when going up or down slopes, or during sudden stops.

Use chain binders to tighten the chains and then safely tie the chain binder levers to prevent loosening.

⚠ WARNING

Adequately designed ramps of sufficient strength are needed to support the weight of the machine when loading onto a transport vehicle. Wood ramps can break and cause personal injury.

W-2058-0494

ENGINE COOLING SYSTEM

Check the cooling system every day to prevent overheating, loss of performance or engine damage.

Cleaning The Cooling System

Open the tailgate.

Use air pressure or water pressure to clean the radiator and oil cooler.

Checking Coolant Level

WARNING

AVOID BURNS

Do not remove radiator cap when the engine is hot. You can be seriously burned.

W-2070-1003

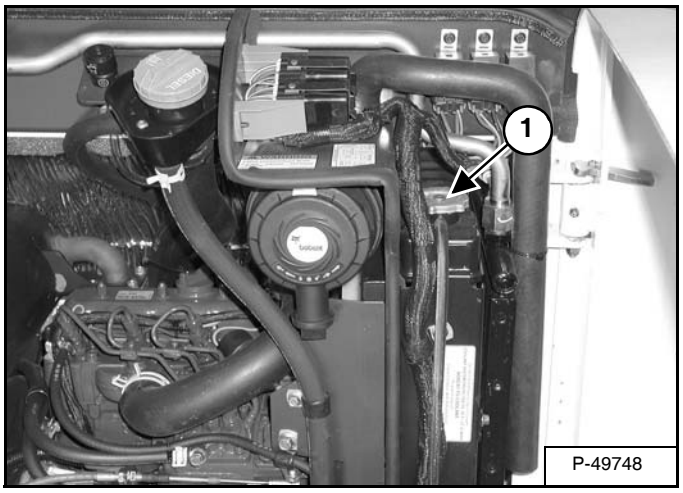
WARNING

Wear safety glasses to prevent eye injury when any of the following conditions exist:

- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W-2019-1285

Figure 10-70-9



When the engine is cool, remove the radiator cap (Item 1) **[Figure 10-70-9]**.

The coolant level must be 0.750 to 1.0 inch (20 - 25 mm) below the filler neck.

If the coolant level is low, add premixed coolant to the radiator.

IMPORTANT

AVOID ENGINE DAMAGE

Always use the correct ratio of water to antifreeze.

Too much antifreeze reduces cooling system efficiency and may cause serious premature engine damage.

Too little antifreeze reduces the additives which protect the internal engine components; reduces the boiling point and freeze protection of the system.

Always add a premixed solution. Adding full strength concentrated coolant can cause serious premature engine damage.

I-2124-0497

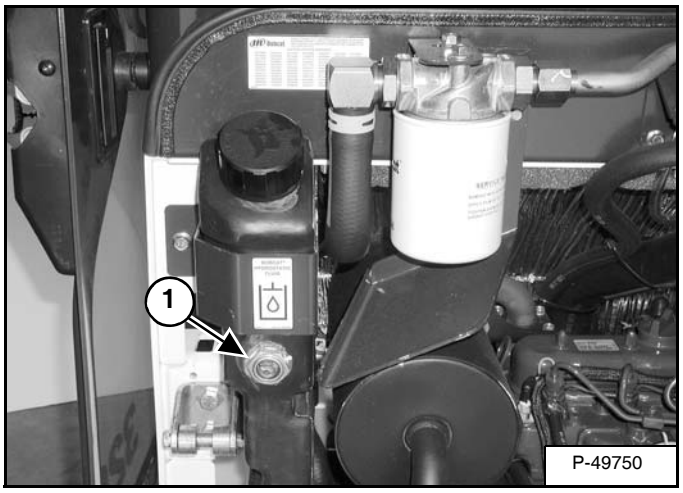
HYDRAULIC SYSTEM

Checking And Adding Hydraulic Oil

Put the machine on a level surface.

Retract the arm and bucket cylinders, put the bucket on the ground and raise the blade. Stop the engine.

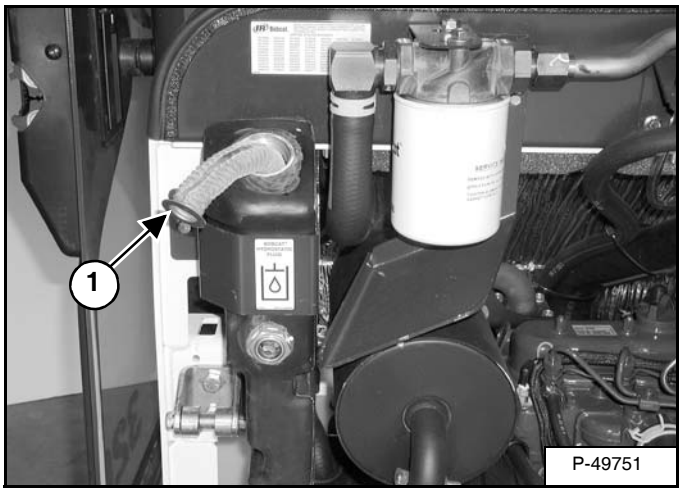
Figure 10-100-8



Open the tailgate. The fluid must be at the center of the sight gauge (Item 1) **[Figure 10-100-8]**.

Remove oil fill cap (Item 2) **[Figure 10-100-8]**.

Figure 10-100-9



Check the condition of the screen (Item 1) **[Figure 10-100-9]** in the fill neck of the reservoir. The screen must be installed in fill neck when adding oil.

Add the correct fluid to the reservoir until it is at the center of the sight gauge (Item 1) **[Figure 10-100-8]**. (See FUEL, COOLANT AND LUBRICANTS on Page SPEC-60-1.)

Install the cap. Close the tailgate.

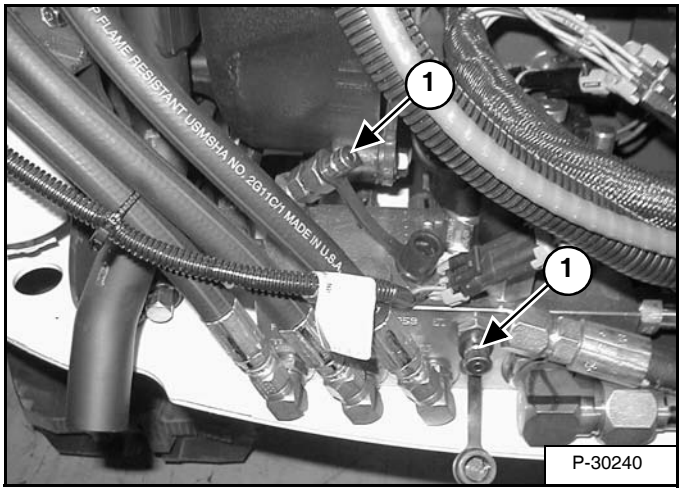
⚠ WARNING

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 which can result in injury or death.

W-2103-1285

Diagnostic Couplers

Figure 10-100-10



The diagnostic couplers (Item 1) **[Figure 10-100-10]** are located on the hydraulic block.

The couplers can be used by your Bobcat dealer to check circuit pressures.

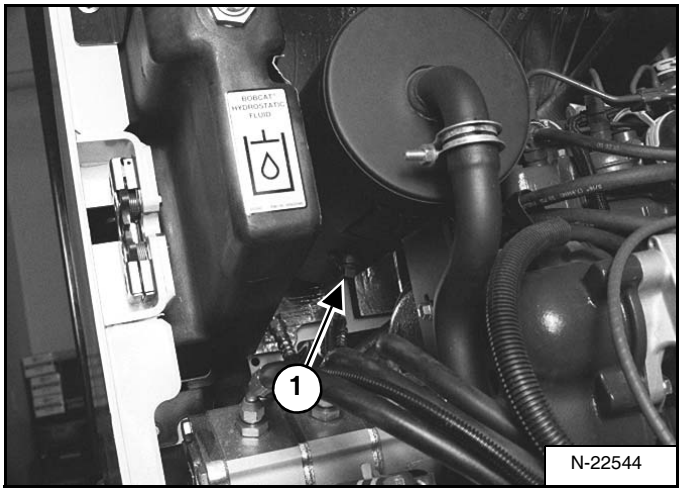
SPARK ARRESTOR MUFFLER

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

Do not operate the Excavator with a defective exhaust system.

Stop the engine. Open the rear door.

Figure 10-130-1



Remove the plug (Item 1) **[Figure 10-130-1]** from the bottom of the muffler.

Start the engine and run for about ten seconds while a second person, wearing safety glasses, holds a piece of wood over the outlet of the muffler. (The carbon deposits will be forced out of the muffler cleanout hole.)

Stop the engine. Install and tighten the plug.

Close the rear door.

WARNING

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-1285

WARNING

Stop engine and allow the muffler to cool before cleaning the spark chamber. Wear safety goggles. Failure to obey can cause serious injury.

W-2011-1285

WARNING

Never use machine in atmosphere with explosive dust or gases or where exhaust can contact flammable material. Failure to obey warnings can cause injury or death.

W-2068-1285

WARNING

When the engine is running during service, the steering levers must be in neutral.

Failure to do so can cause injury or death.

W-2203-0595

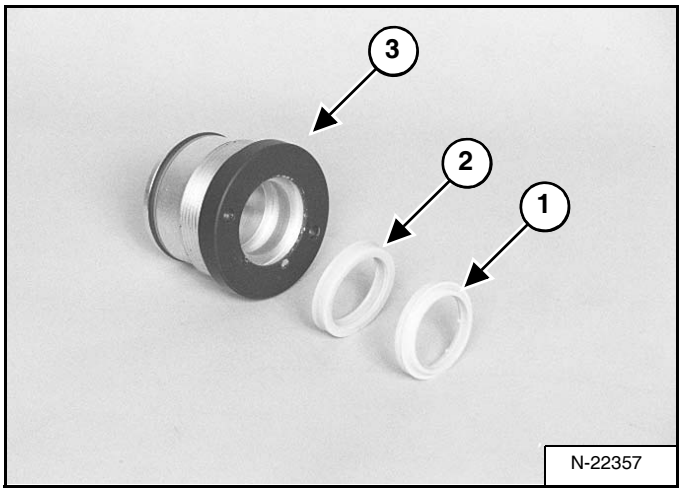
Continued On Next Page

Troubleshooting The Cylinder Circuit

TROUBLESHOOTING THE CYLINDER CIRCUIT		
PROBLEM	**CAUSE**	**CORRECTION**
Cylinder inoperable.	Control console(s) raised.	Lower control console.
	Loose fittings or broken hoses.	Repair or replace.
	Lever linkage misadjusted.	Readjust.
	Control console lockout switch.	Readjust or replace.
	Cylinder internal leakage excessive.	Repair or replace.
	Control lever (joystick) manifold solenoid coil defective.	Test, repair or replace.
	Control lever (joystick) manifold solenoid valve defective.	Test, repair or replace.
	Control lever (joystick) manifold pressure reducing valve defective.	Test, repair or replace.
	Control lever (joystick) internal leakage excessive.	Repair or replace.
Cylinder force insufficient.	Main relief valve pressure too low.	Readjust or replace.
	Work port relief pressure too low.	Readjust or replace.
Cylinder speed too slow.	Lever linkage misadjusted.	Readjust.
	Cylinder internal leakage excessive.	Repair or replace.
	Control lever (joystick) manifold solenoid valve defective.	Repair or replace.
	Control lever (joystick) manifold pressure reducing valve defective.	Repair or replace.
	Control valve internal leakage excessive.	Repair or replace.
	Control lever (joystick) internal leakage excessive.	Repair or replace.
Cylinder drift excessive.	Cylinder internal leakage excessive.	Repair or replace.
	Work port relief valve seals leaking.	Test, repair or replace.
	Control valve internal leakage excessive.	Repair or replace.

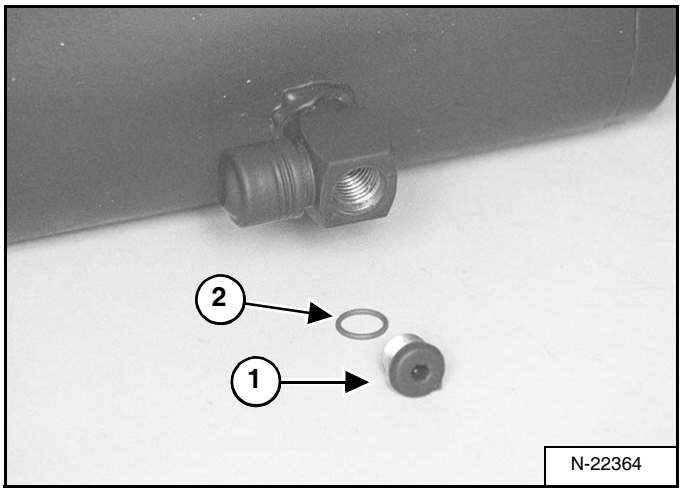
Disassembly (Cont'd)

Figure 20-20-15



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-20-15]**.

Figure 20-20-16



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-20-16]**.

Assembly

Use the following tools to assemble the cylinder:

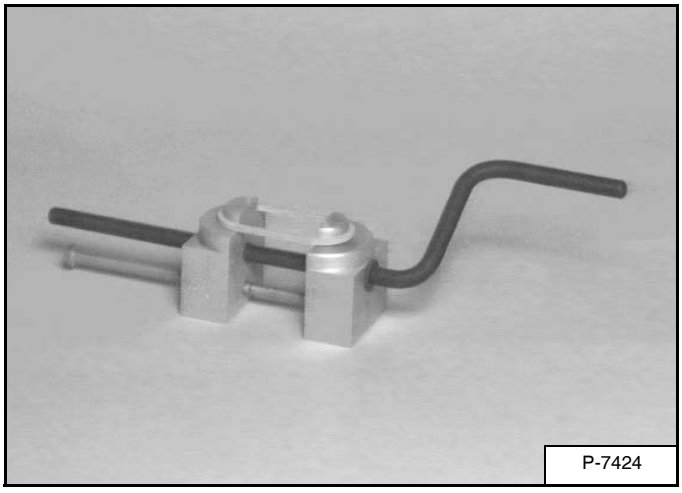
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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 20-20-17



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

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

Assembly

Use the following tools to assemble the cylinder:

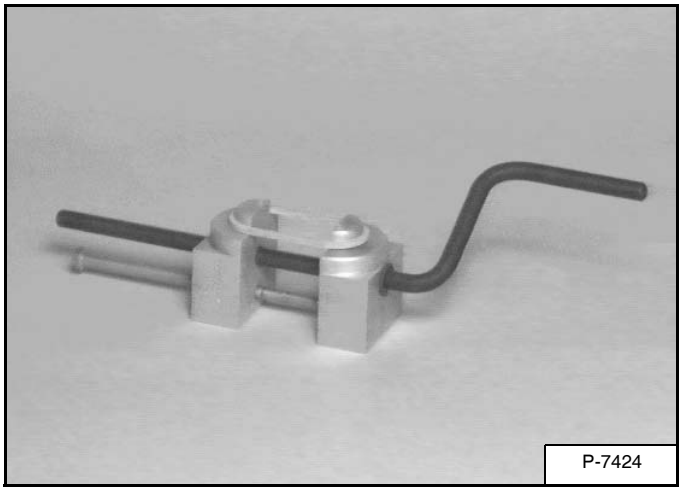
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

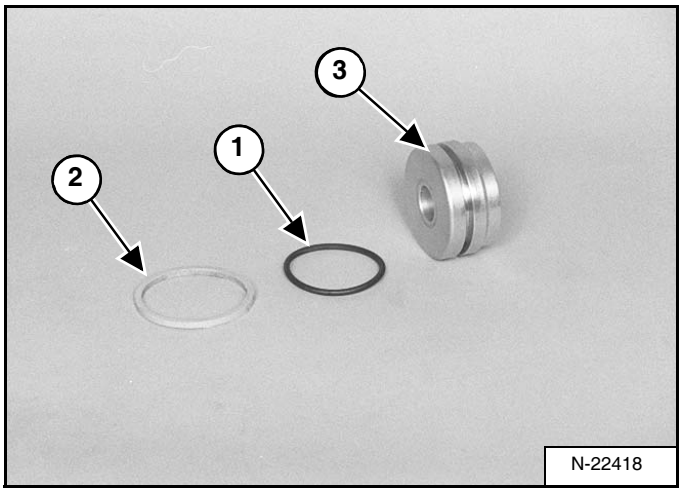
Figure 20-21-14



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-21-14]**.

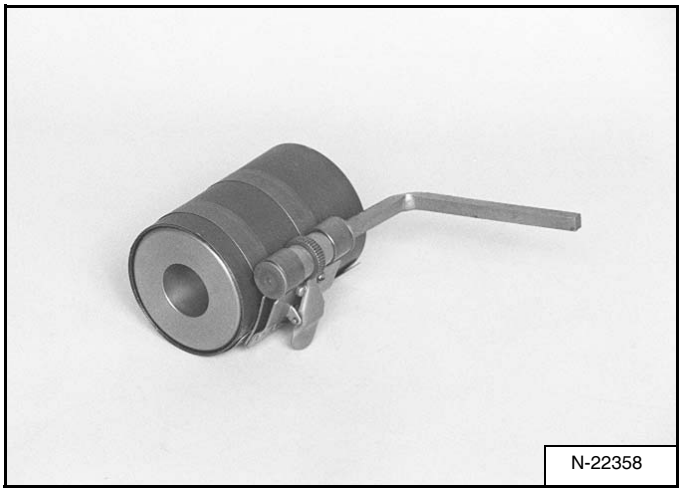
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-21-15



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-21-15]**.

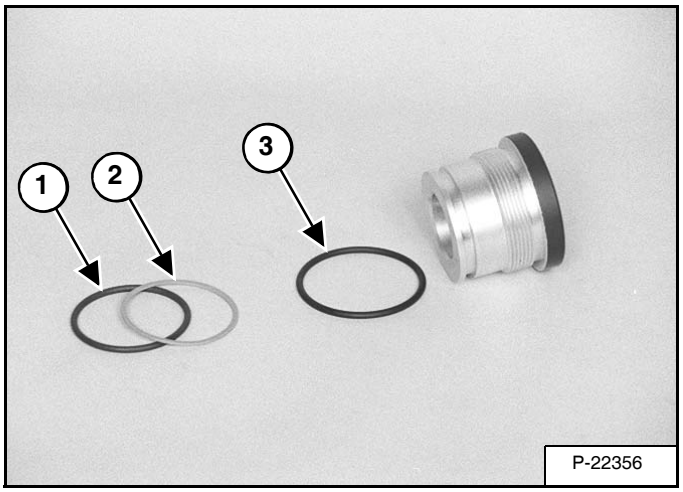
Figure 20-21-16



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-21-16]**.

Disassembly (Cont'd)

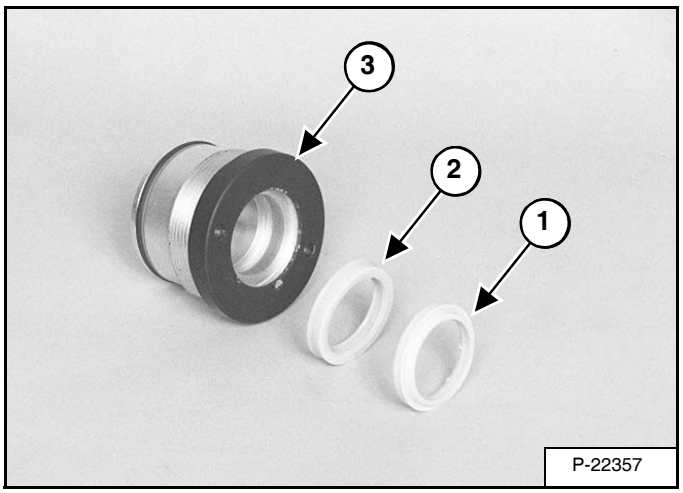
Figure 20-22-17



Remove the O-ring (Item 1) and the back-up ring (Item 2) **[Figure 20-22-17]**.

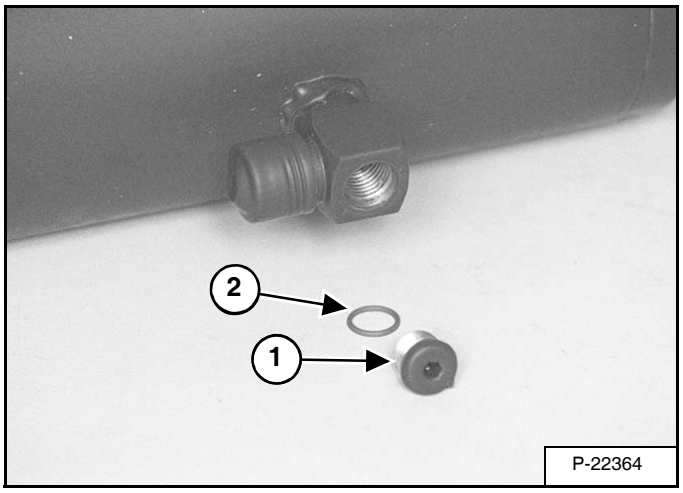
Remove the O-ring (Item 3) **[Figure 20-22-17]**.

Figure 20-22-18



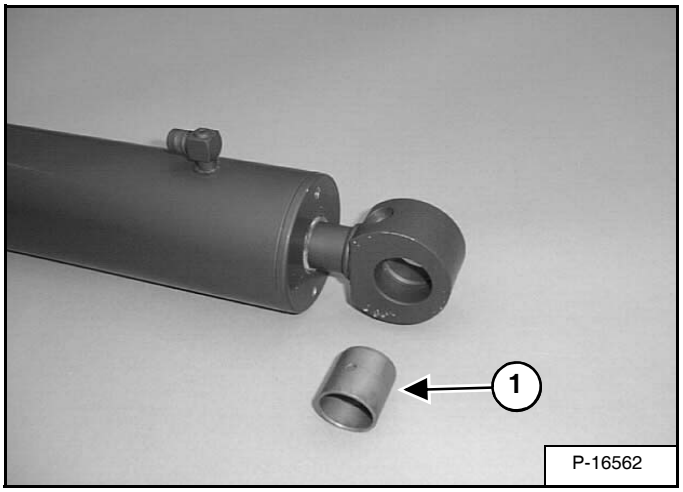
Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-22-18]**.

Figure 20-22-19



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-22-19]**.

Figure 20-22-20



Remove the bushing (Item 1) **[Figure 20-22-20]**.

Assembly

Use the following tools to assemble the cylinder:

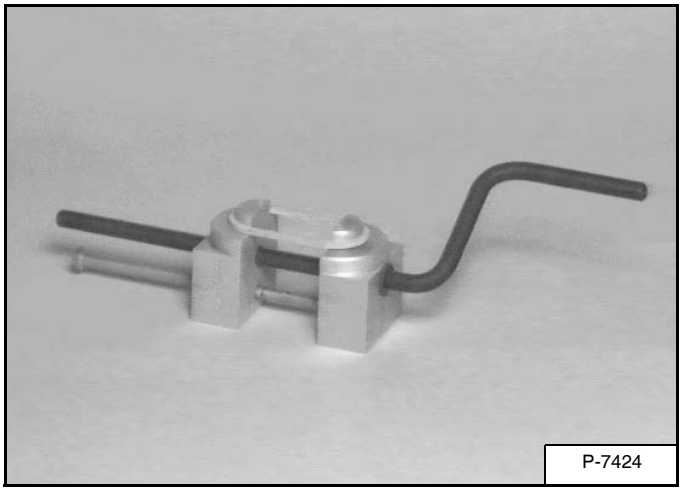
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

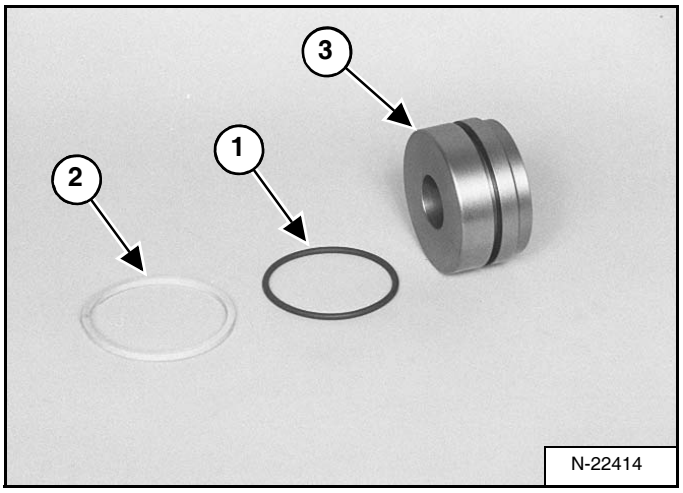
Figure 20-23-15



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-15]**.

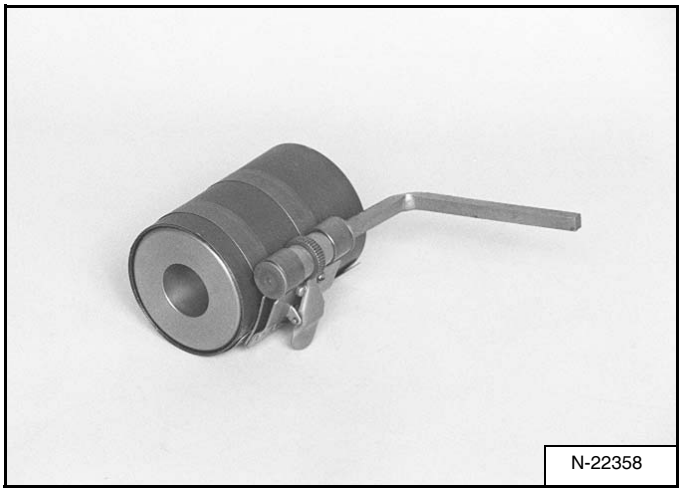
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-16



Standard Piston: Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-23-16]**.

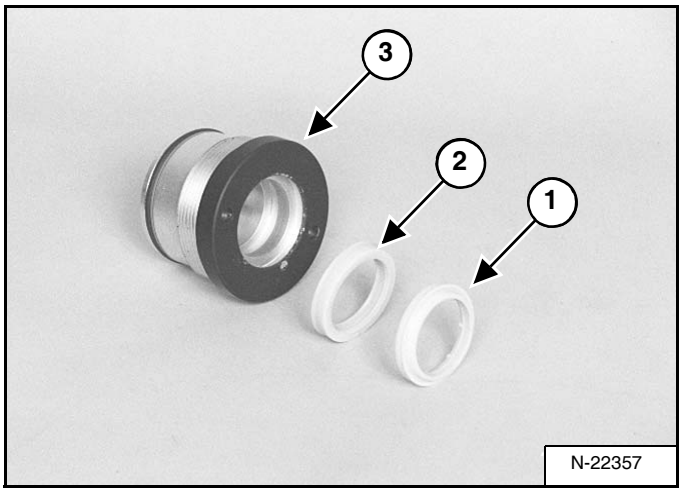
Figure 20-23-17



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes **[Figure 20-23-17]**.

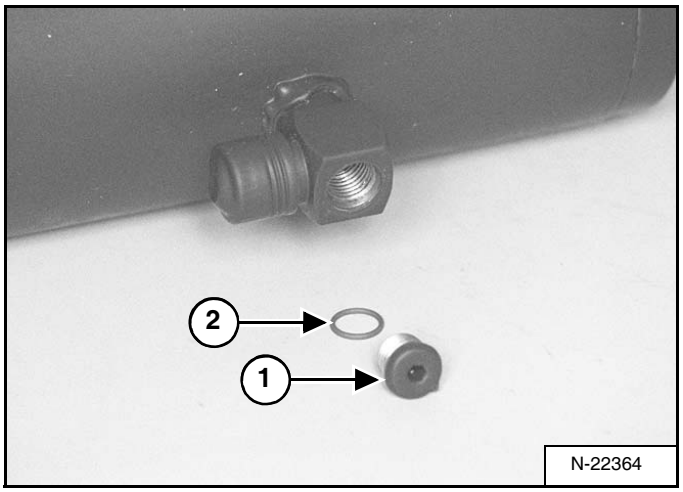
Disassembly (Cont'd)

Figure 20-24-15



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head (Item 3) **[Figure 20-24-15]**.

Figure 20-24-16



Remove plug (Item 1) and O-ring (Item 2) **[Figure 20-24-16]**.

TRACK FRAME EXANSION CYLINDER (CONT'D)

Disassembly

Clean the outside of the expansion cylinder before disassembly.

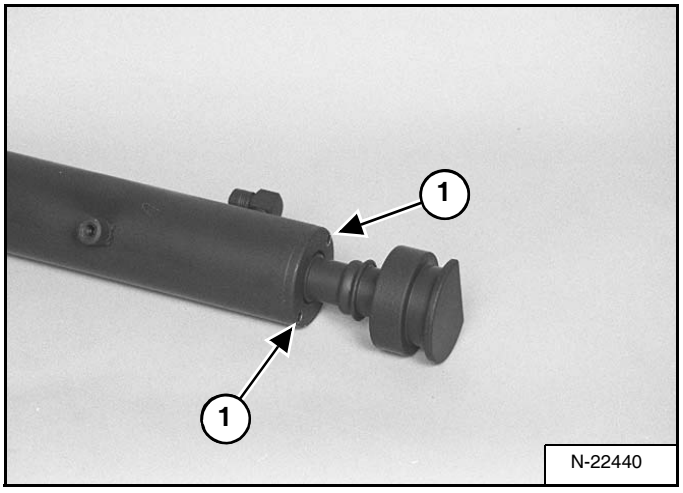
Use the following tools to disassemble the cylinder:

MEL1074 - O-ring Seal Hook
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

Hold the hydraulic cylinder over a drain pan and move the rod in and out slowly to remove the fluid from the cylinder.

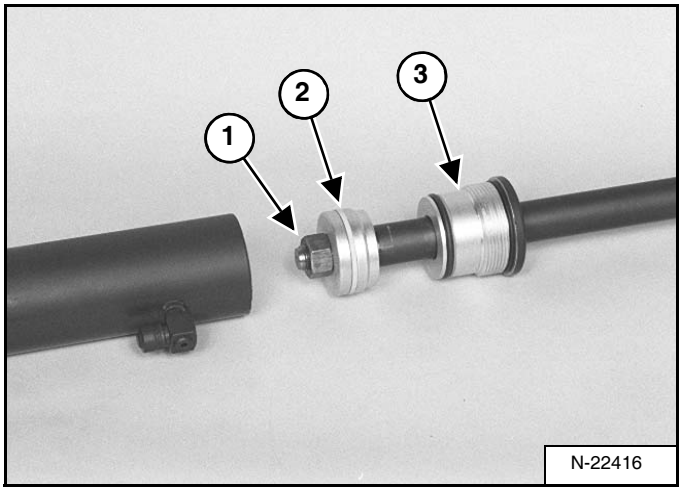
Put the base end of the cylinder in a vise.

Figure 20-25-20



Insert the adjustable gland nut wrench into the two holes (Item 1) **[Figure 20-25-20]** to loosen the head.

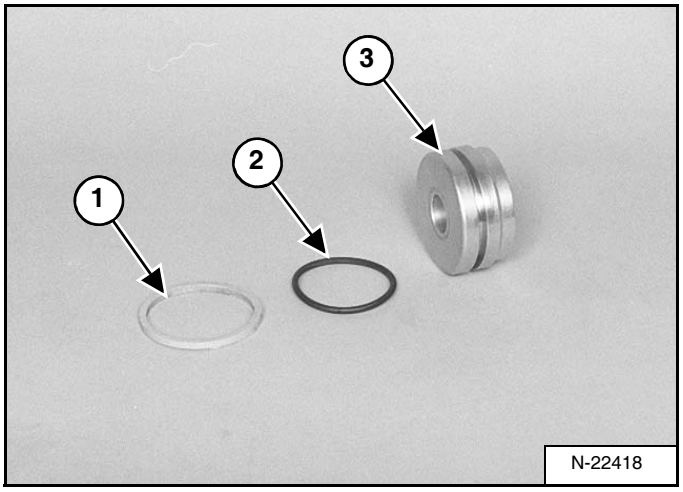
Figure 20-25-21



Remove the head and the rod assembly from the cylinder **[Figure 20-25-21]**. Put the rod end in a vise.

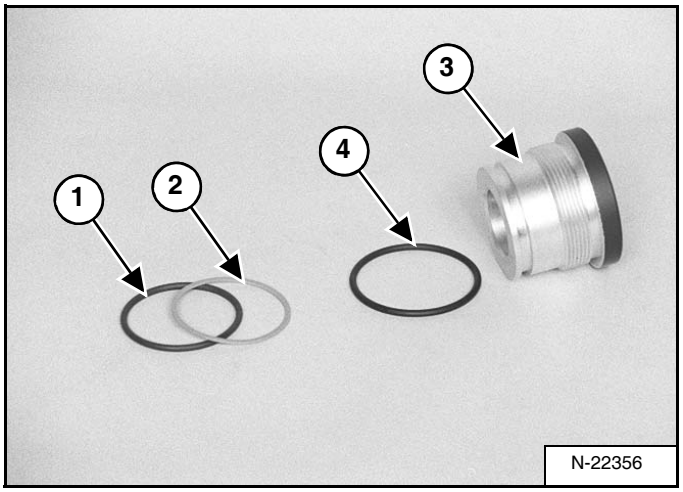
Remove the nut (Item 1), piston (Item 2) and head (Item 3) **[Figure 20-25-21]**.

Figure 20-25-22



Standard Piston: Remove the seal (Item 1) and O-ring (Item 2) from the piston (Item 3) **[Figure 20-25-22]**.

Figure 20-25-23



Remove the O-ring (Item 1) and the back-up ring (Item 2) from the groove in the head (Item 3) **[Figure 20-25-23]**.

Remove the thin O-ring (Item 4) **[Figure 20-25-23]**.

CROSSPORT RELIEF VALVES

Testing And Adjusting The Crossport Relief Valve

The hydraulic system has two crossport relief valves that protect the swing motor from high pressure.

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.

Open the tailgate.

Figure 20-32-1

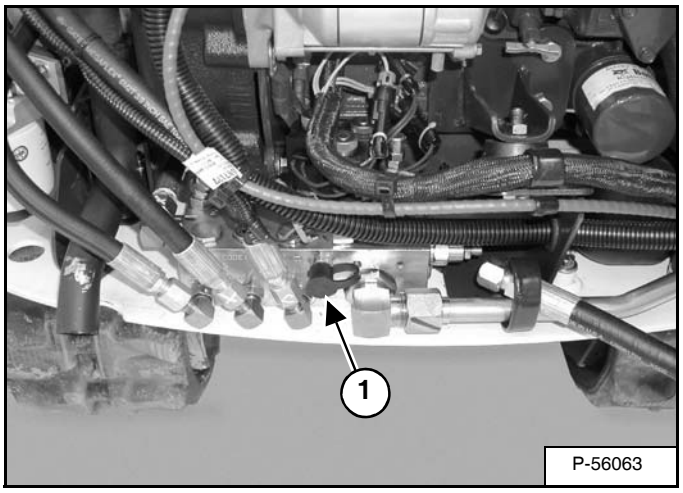
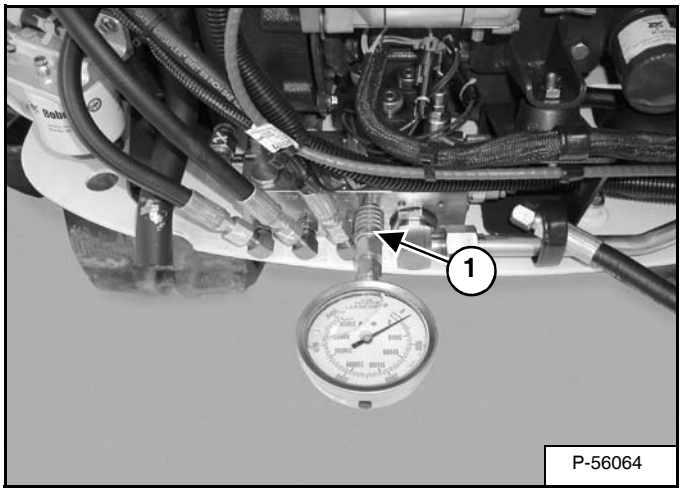


Figure 20-32-2



Connect the test gauge coupler from the test kit to the “G” diagnostic port (Item 1) **[Figure 20-32-1]** & **[Figure 20-32-2]**.

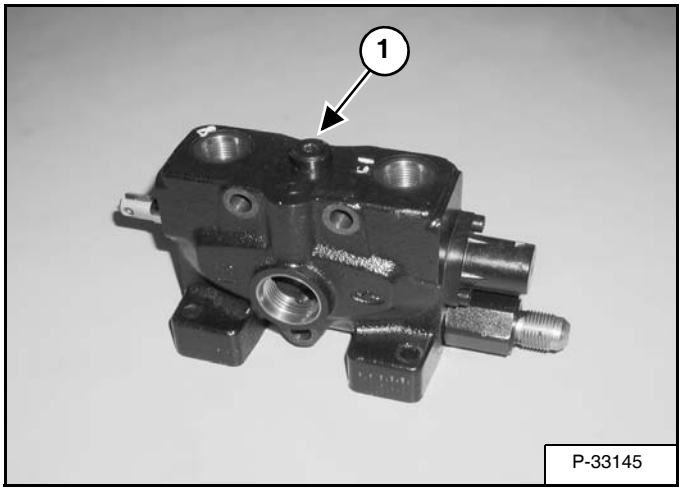
Lower the control console and fasten the seat belt.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURIZED	TEST PORT	TARGET (PSI)	ACCEPTABLE RANGE (PSI)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	*	435	406 - 450
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P2 & P3	G	415	345-485
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	115	MAX ALLOWABLE 155
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P3	G	2475	2375-2525
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1	G	2515	2415-2565
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P2 & P3	G	2515	2415-2565
SWING MOTOR - CROSS PORT RELIEF	SWING RIGHT	P1	G	1475	1400-1550
SWING MOTOR - CROSS PORT RELIEF	SWING LEFT	P1	G	1475	1400-1550

**Under seat at bulkhead*

Auxiliary Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-19

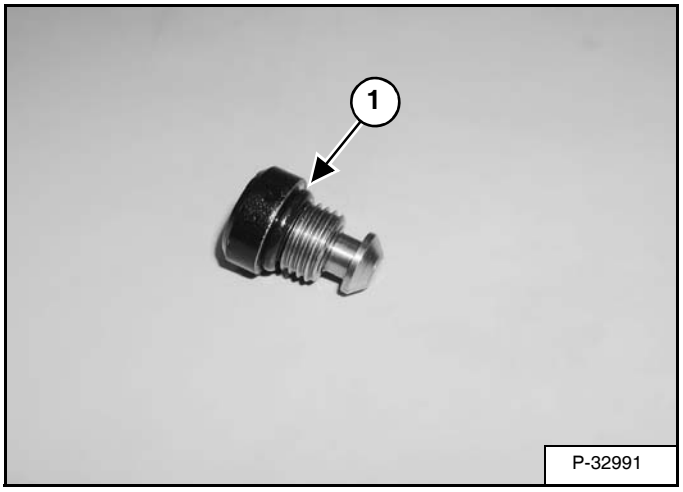


Remove the load check valve assembly (Item 1) **[Figure 20-40-19]**.

NOTE: The load check valve assembly is serviced only as a unit.

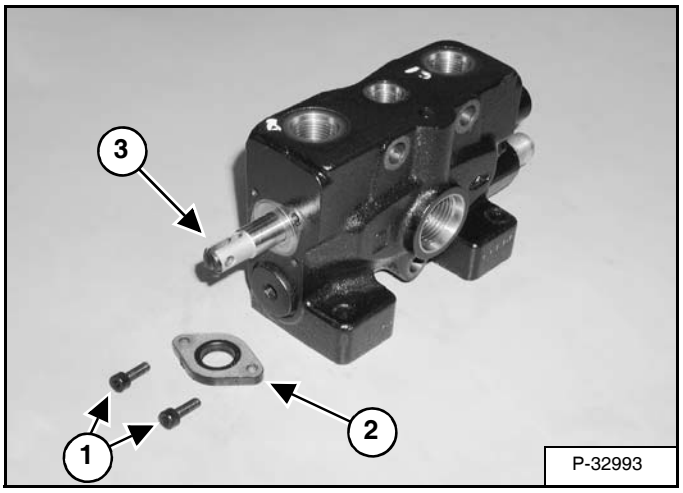
Installation: Tighten the load check valve to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-20



Remove the O-ring (Item 1) **[Figure 20-40-20]** from the load check valve.

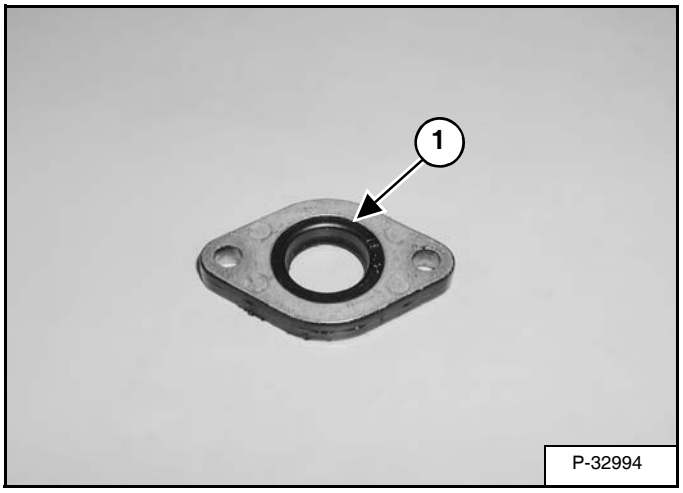
Figure 20-40-21



Remove the bolts (Item 1) and retaining plate (Item 2) from the actuating end of the spool (Item 3) **[Figure 20-40-21]**.

Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-40-22



Remove the seal (Item 1) **[Figure 20-40-22]** from the retaining plate.

Left Travel Valve Section Disassembly and Assembly

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.

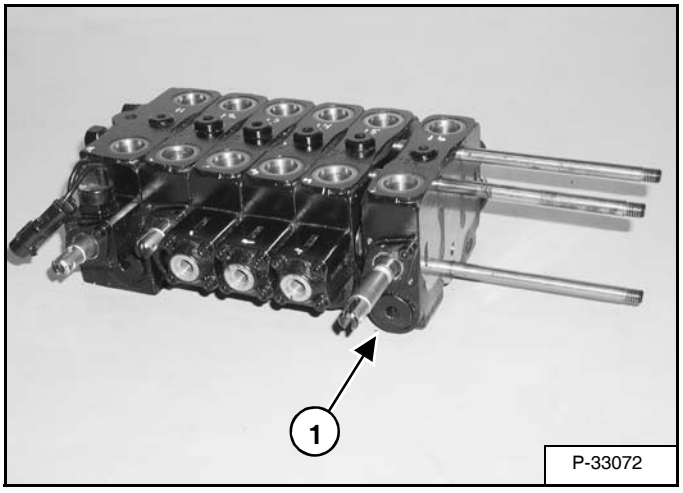
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

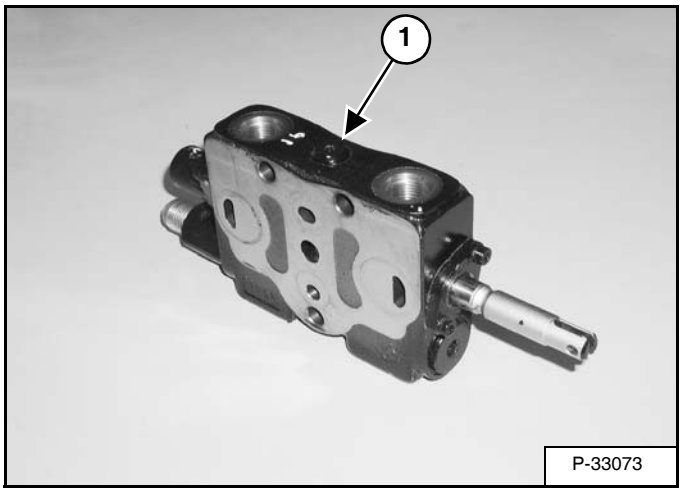
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-51



Remove the left travel valve section (Item 1) **[Figure 20-40-51]** from the valve assembly.

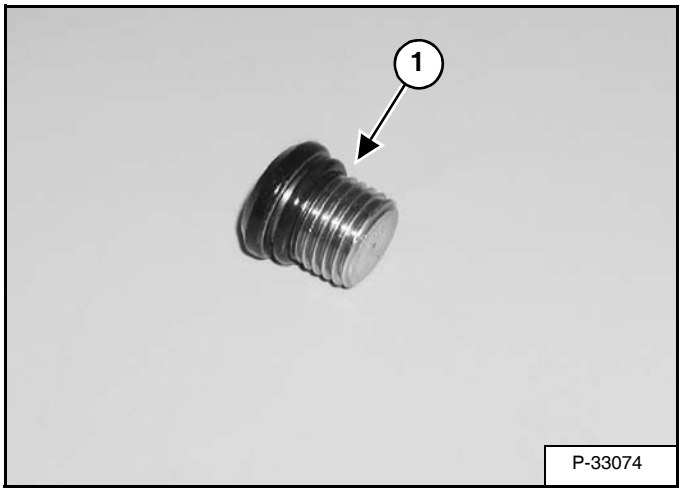
Figure 20-40-52



Remove the plug (Item 1) **[Figure 20-40-52]** from the left travel valve block.

Installation: Tighten the plug to 18 ft.-lb. (24 N•m) torque.

Figure 20-40-53



Remove the O-ring (Item 1) **[Figure 20-40-53]** from the plug.

Arm Valve Section Disassembly and Assembly

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.

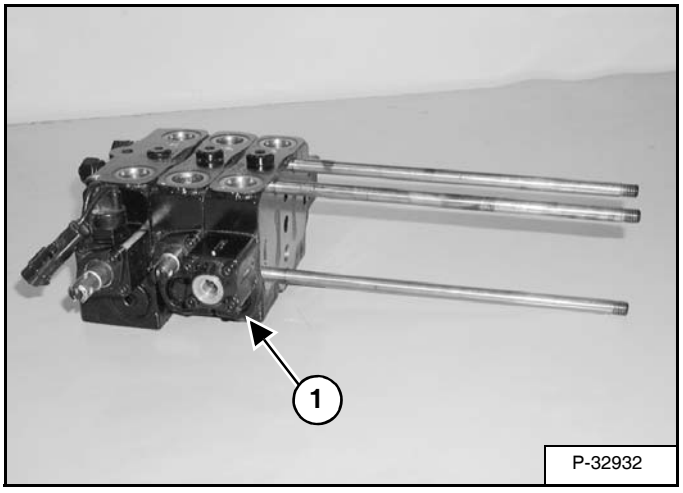
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

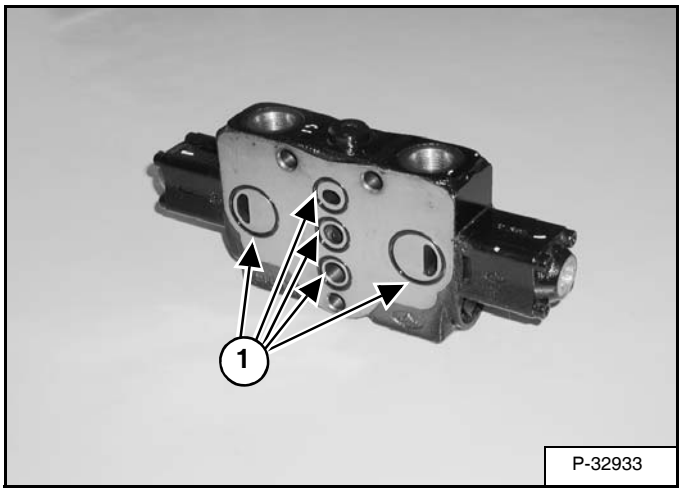
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-84



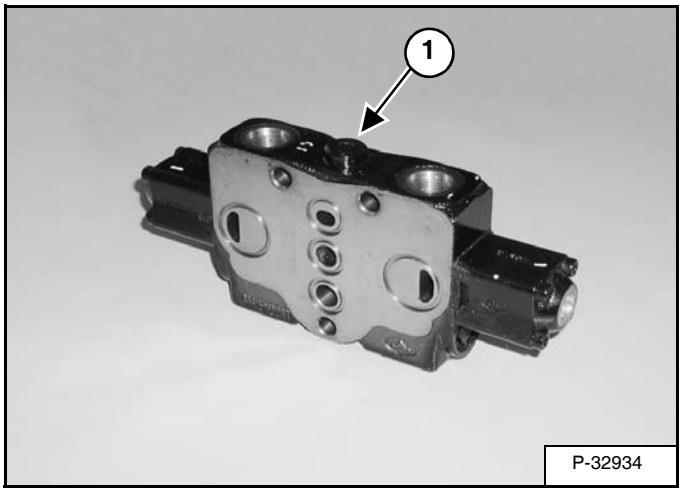
Remove the arm valve section (Item 1) **[Figure 20-40-84]** from the valve assembly.

Figure 20-40-85



Remove the O-rings (Item 1) **[Figure 20-40-85]** from the arm valve block.

Figure 20-40-86



Remove the load check valve (Item 1) **[Figure 20-40-86]**.

Installation: Tighten the load check valve to 18 ft.-lb. (24 N•m) torque.

Assembly

Clean all parts in solvent and dry with compressed air.

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

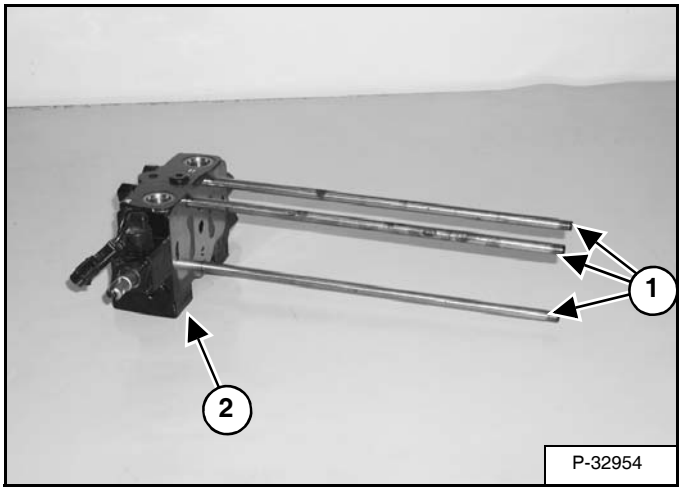
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

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.

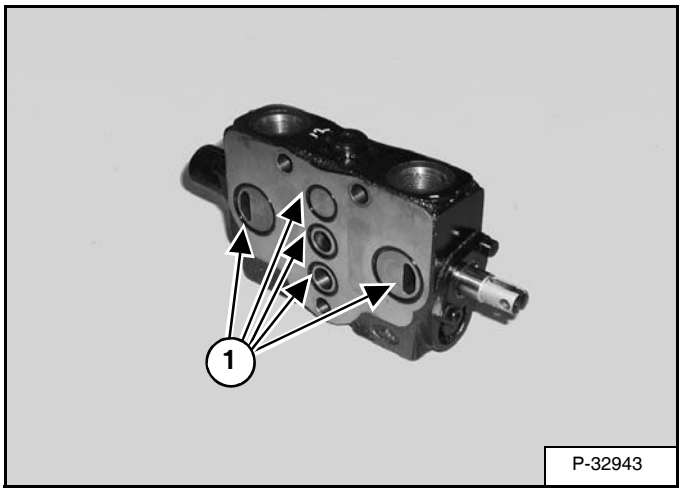
I-2003-0888

Figure 20-40-118



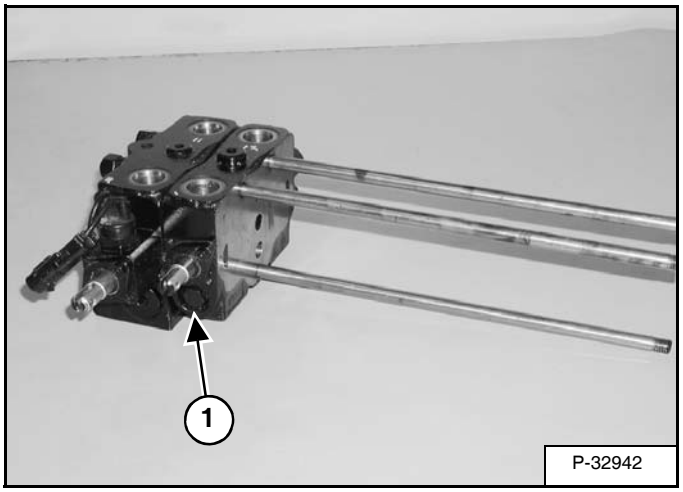
Install the tie rods (Item 1) on the right travel valve section (Item 2) **[Figure 20-40-118]**.

Figure 20-40-119



Install the O-rings (Item 1) **[Figure 20-40-119]** on the boom swing valve section.

Figure 20-40-120



Install the boom swing valve section (Item 1) **[Figure 20-40-120]** on the tie rods.

Disassembly

Clean the outside of the hydraulic control valve before disassembly.

IMPORTANT

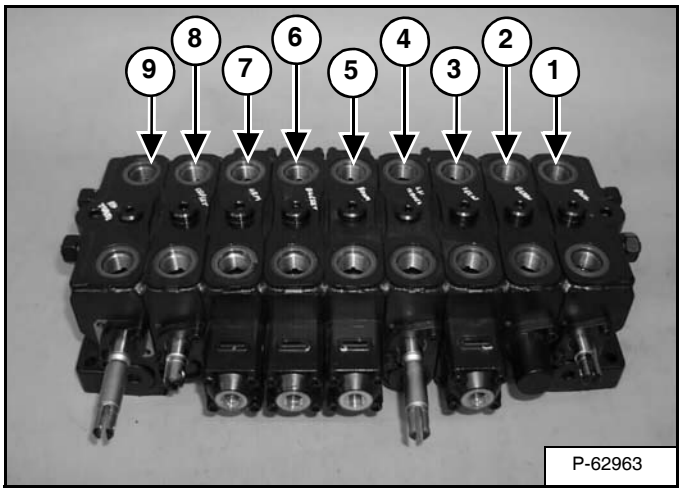
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I-2003-0888

Figure 20-41-11

Remove the hoses and fittings **[Figure 20-41-11]**.

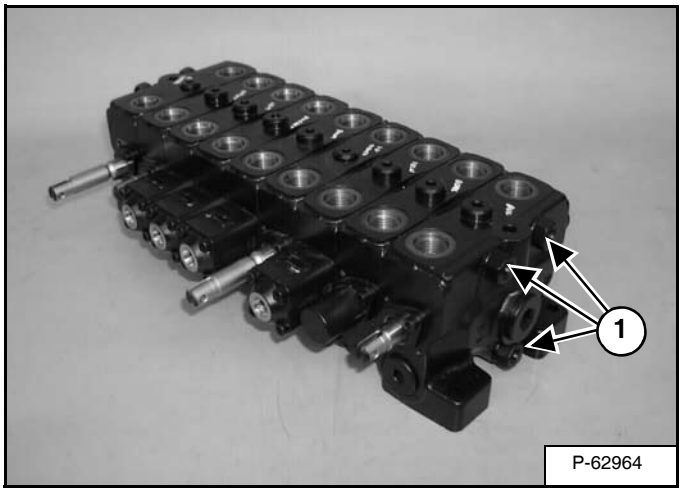
Figure 20-41-12



Mark the valve sections for ease of assembly **[Figure 20-41-12]**.

1. Auxiliary Valve
2. Blade Valve
3. Slew Valve
4. Left Travel Valve
5. Boom Valve
6. Bucket Valve
7. Arm Valve
8. Boom Swing Valve
9. Right Travel Valve

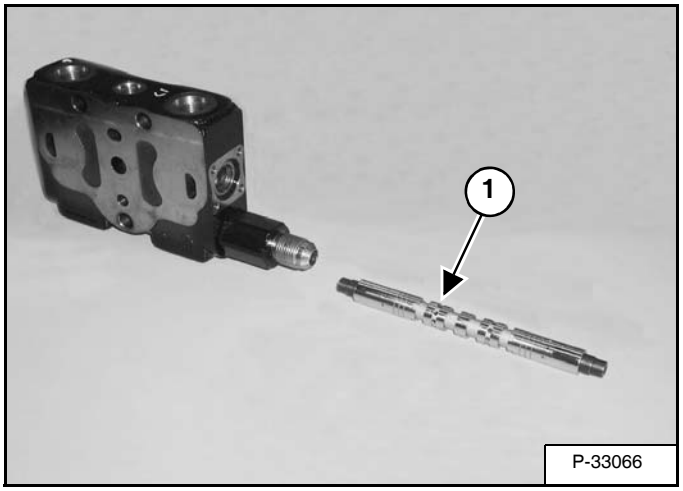
Figure 20-41-13



Remove the tie rod nuts (Item 1) **[Figure 20-41-13]** and washers.

Slew Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-45

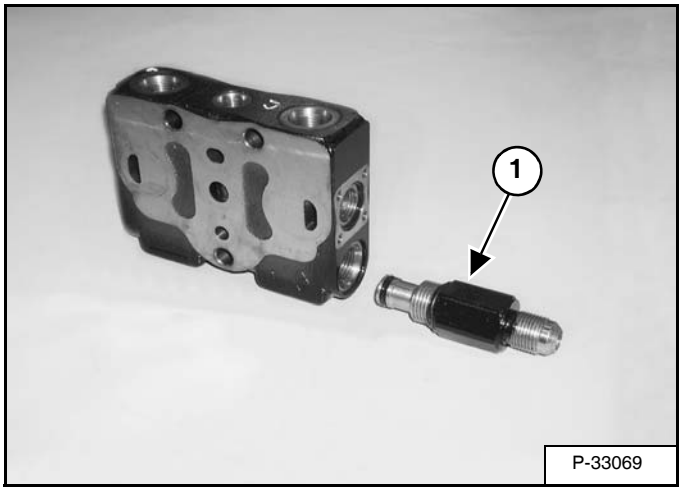


Remove the spool (Item 1) **[Figure 20-41-45]**.

The spool and valve block are not serviced separately.

NOTE: When the spool is removed, use care not to scratch the spool surface and do not interchange spools and valve blocks.

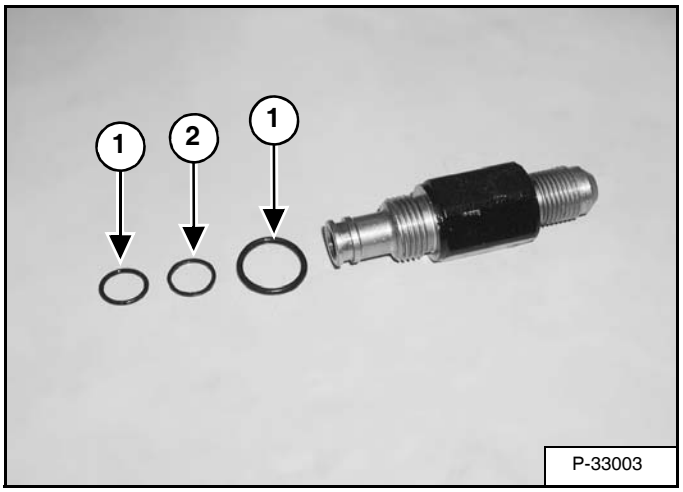
Figure 20-41-46



Remove the fitting (Item 1) **[Figure 20-41-46]**.

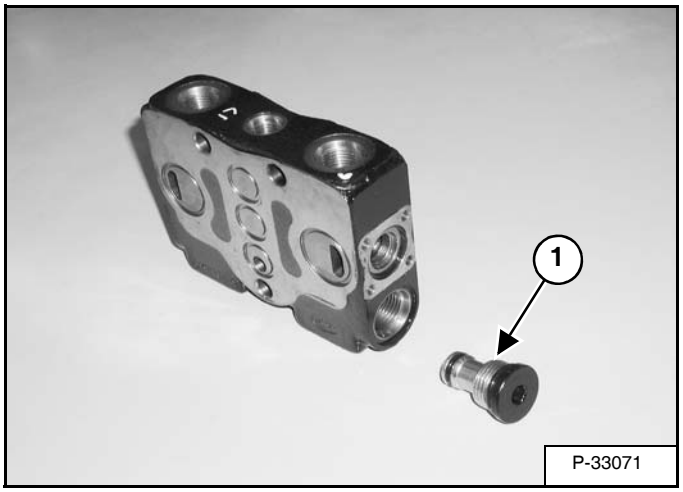
Installation: Tighten the fitting to 31 ft.-lb. (42 N•m) torque.

Figure 20-41-47



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-41-47]** from the fitting.

Figure 20-41-48

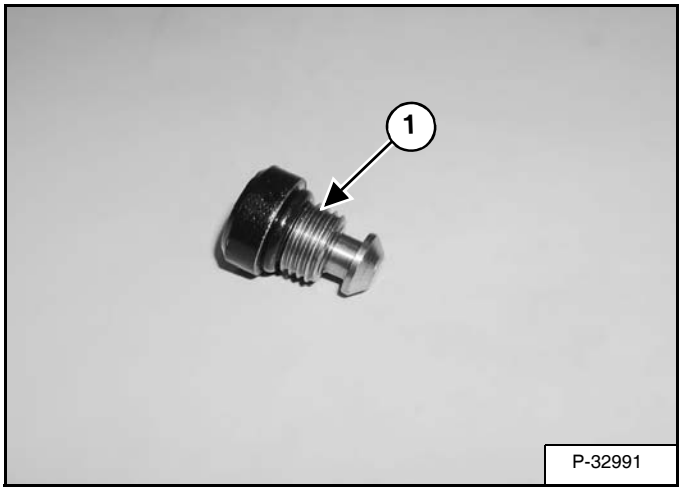


Remove the plug (Item 1) [**[Figure 20-41-48]**

Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

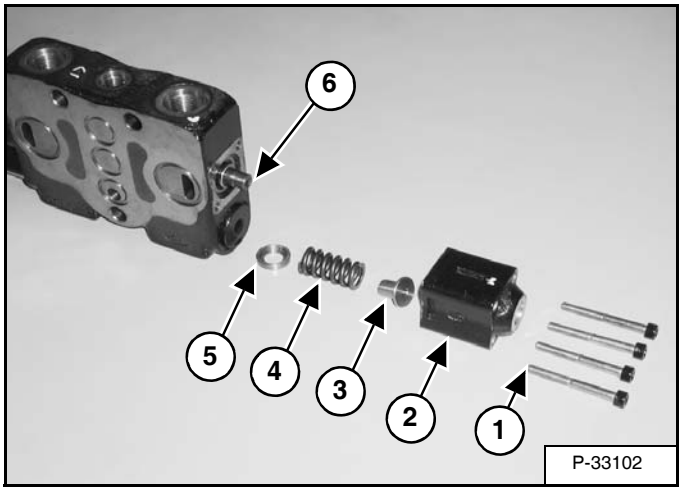
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-77



Remove the O-ring (Item 1) **[Figure 20-41-77]** from the load check valve.

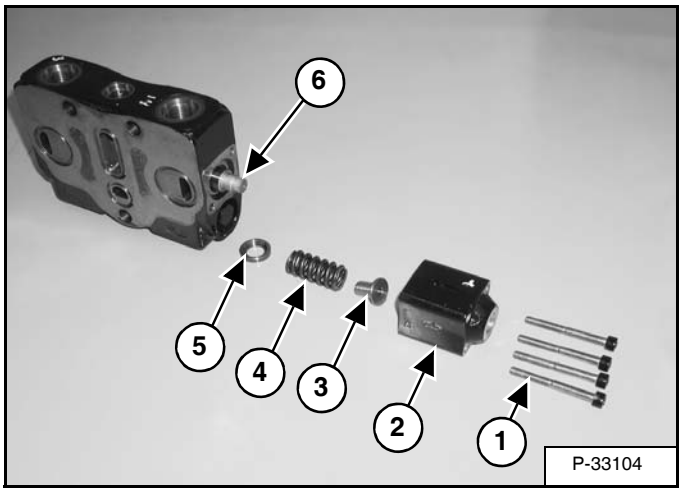
Figure 20-41-78



Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-78]**.

Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-41-79

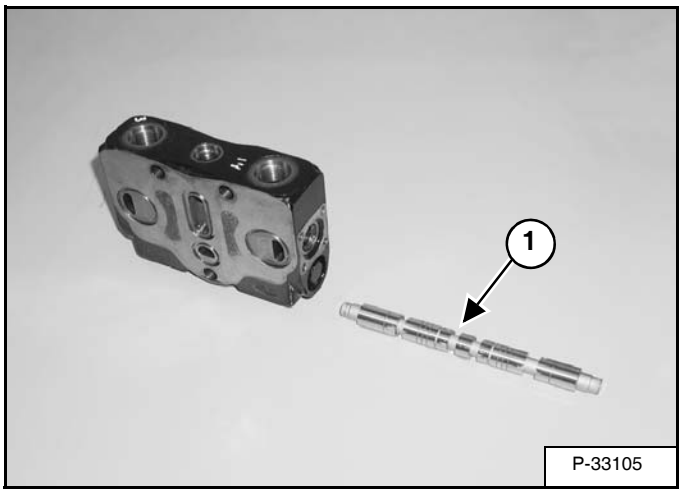


Remove the bolts (Item 1), actuator (Item 2), spring seat (Item 3), spring (Item 4) and spring retainer (Item 5) **[Figure 20-41-79]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 6) **[Figure 20-41-79]**.

Installation: Tighten the bolts to 5 ft.-lb. (6,6 N•m) torque.

Figure 20-41-80



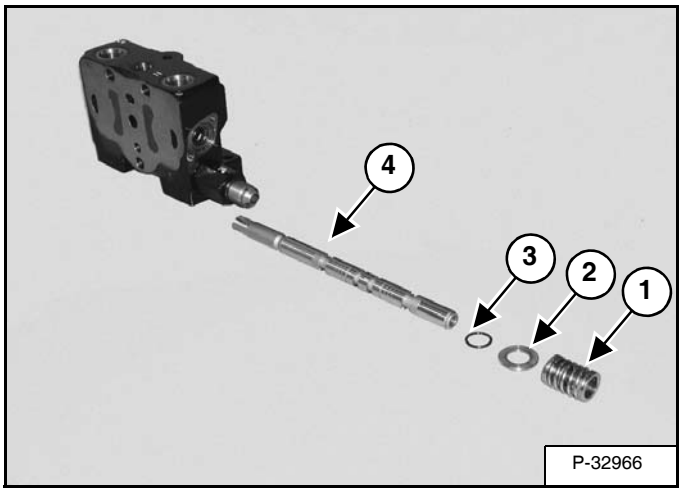
Remove the spool (Item 1) **[Figure 20-41-80]**.

The spool and valve block are not serviced separately.

NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Right Travel Valve Section Disassembly And Assembly (Cont'd)

Figure 20-41-110



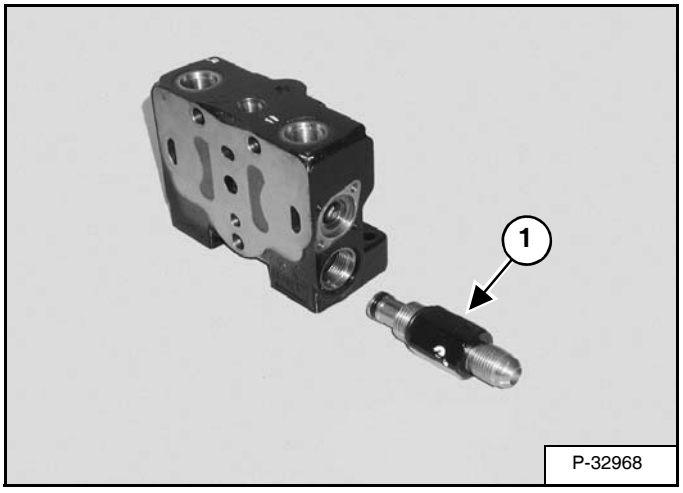
Remove the spring assembly (Item 1), washer (Item 2), O-ring (Item 3) and spool (Item 4) **[Figure 20-41-110]**.

The spool and valve block are not serviced separately.

NOTE: When the spool is removed, use care not to scratch the spool surface. Do not interchange spools and valve blocks.

Installation: Tighten the spring retaining screw to 18 ft.-lb. (24 N•m) torque.

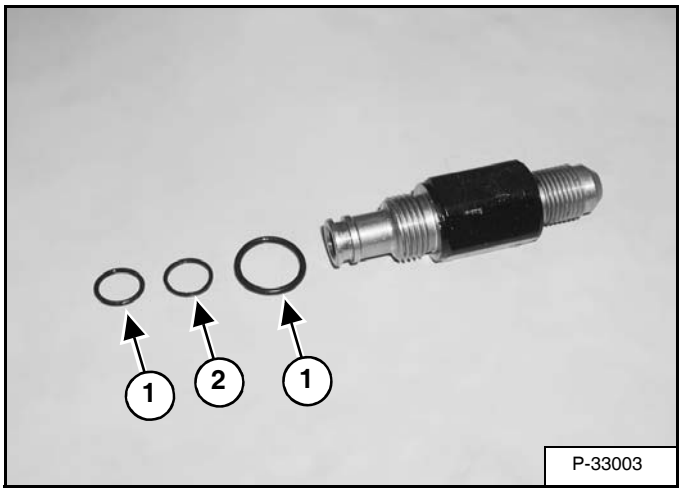
Figure 20-41-111



Remove the fitting (Item 1) **[Figure 20-41-111]**.

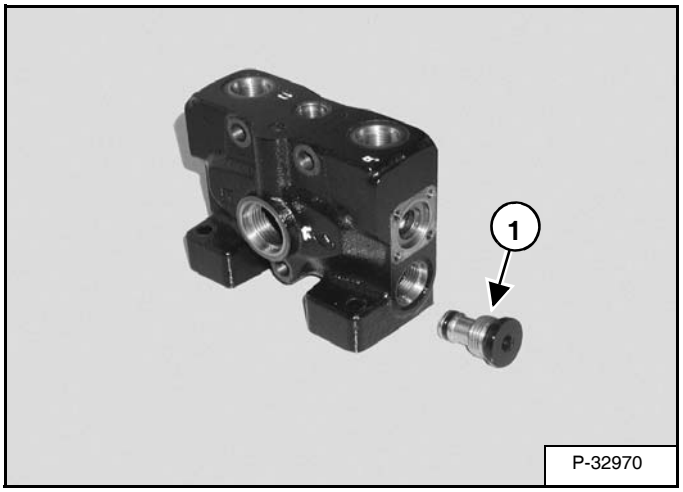
Installation: Tighten the fitting to 31 ft.-lb. (42 N•m) torque.

Figure 20-41-112



Remove the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-41-112]** from the fitting.

Figure 20-41-113



Remove the plug (Item 1) **[Figure 20-41-113]**.

Installation: Tighten the plug to 31 ft.-lb. (42 N•m) torque.

Removal And Installation

Lower the boom/bucket and blade to the ground.

Relieve hydraulic pressure.

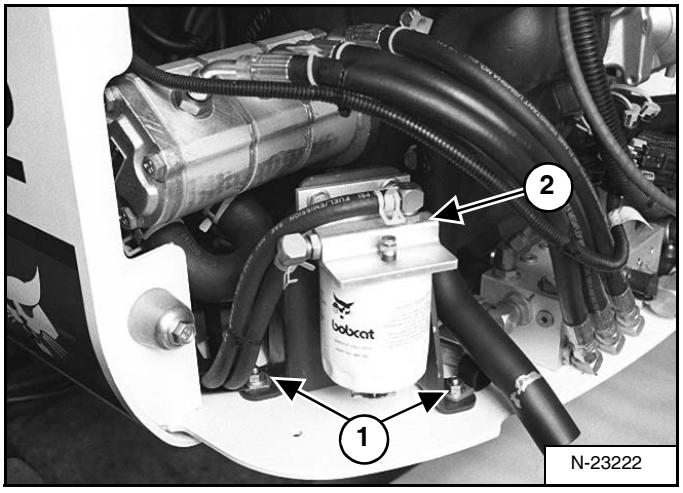
Drain the hydraulic reservoir. (See Replacing Hydraulic Oil on Page 10-100-2.)

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 20-50-142



Remove the bolts and nuts (Item 1) **[Figure 20-50-142]** from the fuel filter bracket.

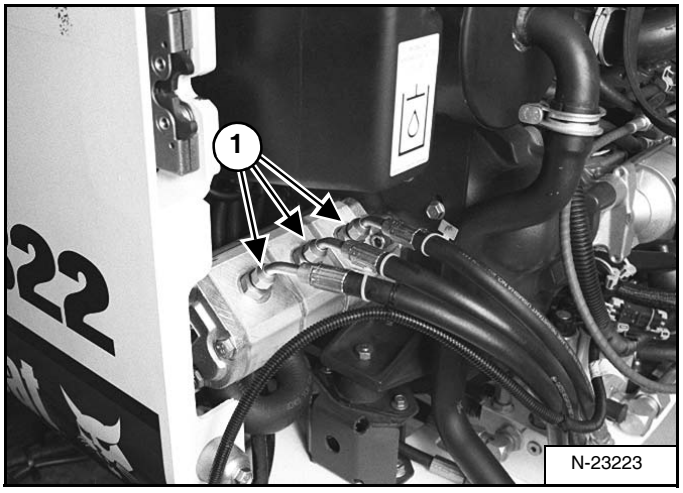
Move the fuel filter and bracket assembly (Item 2) **[Figure 20-50-142]** away from the front of the hydraulic pump.

WARNING

Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

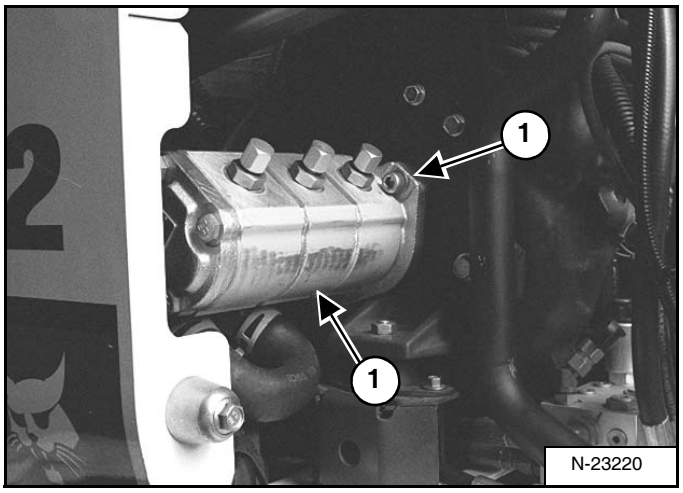
Figure 20-50-143



Remove the three pressure hoses (Item 1) **[Figure 20-50-143]**.

Cap and plug the hoses and fittings.

Figure 20-50-144



Remove the bolts (Item 1) **[Figure 20-50-144]** from the pump flange.

Installation: Tighten the bolts to 29-37 ft.-lb. (40-50 N•m) torque.

MANIFOLD ASSEMBLY/ACCUMULATOR

Description

NOTE: The 320L manifold is not equipped with a two speed solenoid. The photos may appear different, the procedure is the same.

The manifold body contains a two speed solenoid valve, a system bypass valve, a pressure reducing valve and a safety relief valve.

The body is connected to the accumulator.

The manifold supplies 435 PSI (30 Bar) to the joysticks to activate the control valve spools.

The accumulator provides short term reserve pressure for joystick function with the engine off and the key in the ON position.

Removal And Installation

Lower the boom/bucket and blade to the ground.

⚠ WARNING

Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

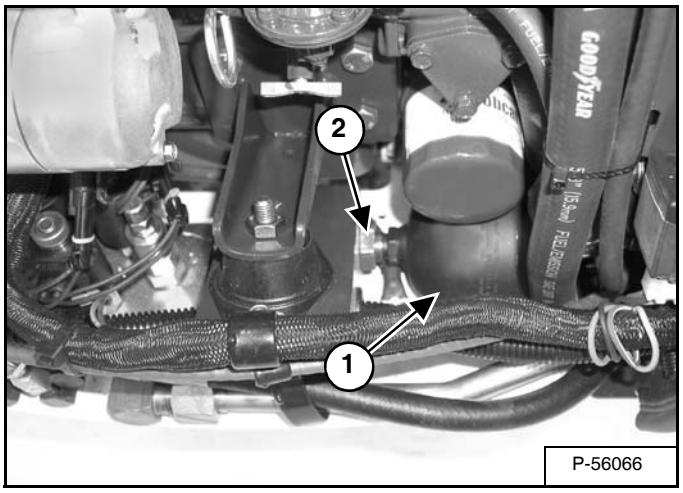
IMPORTANT

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

From the operator's seat, drain the residual pressure from the accumulator by stroking a function with the engine off and the key in the run position.

Figure 20-60-1



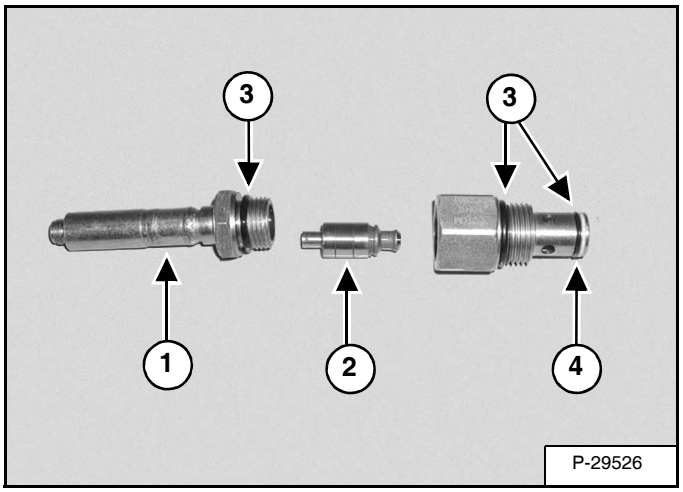
Open the tailgate. Remove the accumulator (Item 1) **[Figure 20-60-1]** from the manifold.

Installation: Tighten the accumulator and O-ring to 22-24 ft.-lb. (29-33 N•m) torque.

Remove the nut (Item 2) **[Figure 20-60-1]**.

Disassembly (S/N 223911001 - 223911247 & S/N 224011001 - 224012293) (Cont'd)

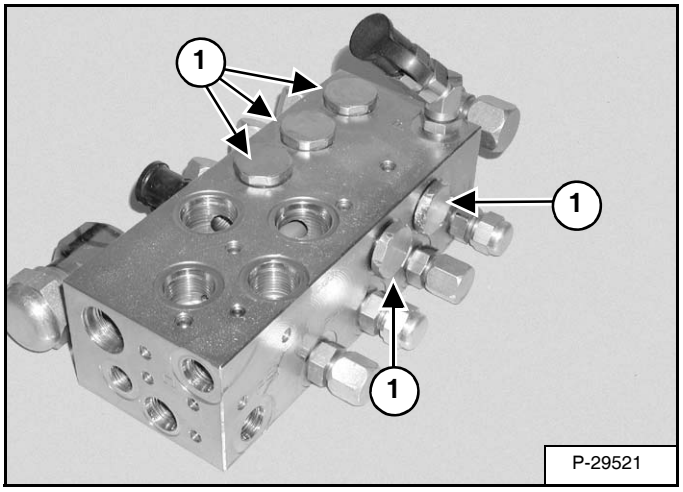
Figure 20-60-34



Remove the top of the solenoid (Item 1) and the spool (Item 2) **[Figure 20-60-34]** from the bottom of the solenoid.

Remove the O-rings (Item 3) and back-up ring (Item 4) **[Figure 20-60-34]**.

Figure 20-60-35



Remove the plugs (Item 1) **[Figure 20-60-35]** from the top and side of the manifold.

Figure 20-60-36

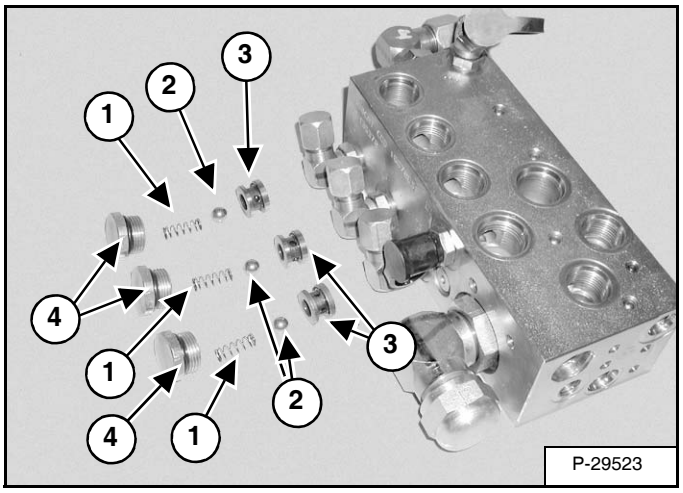
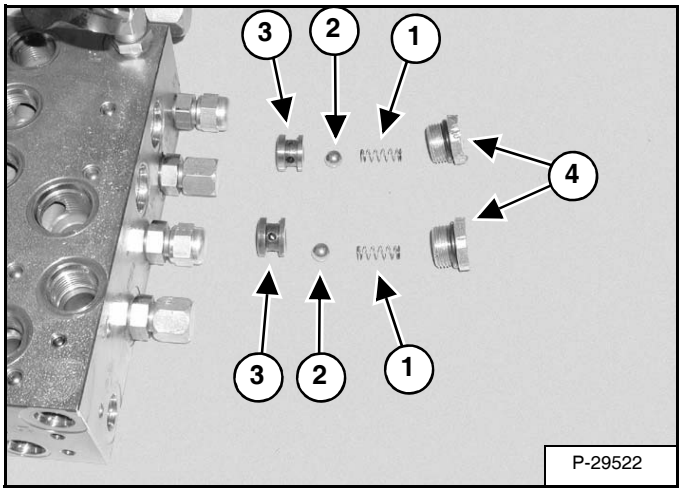


Figure 20-60-37

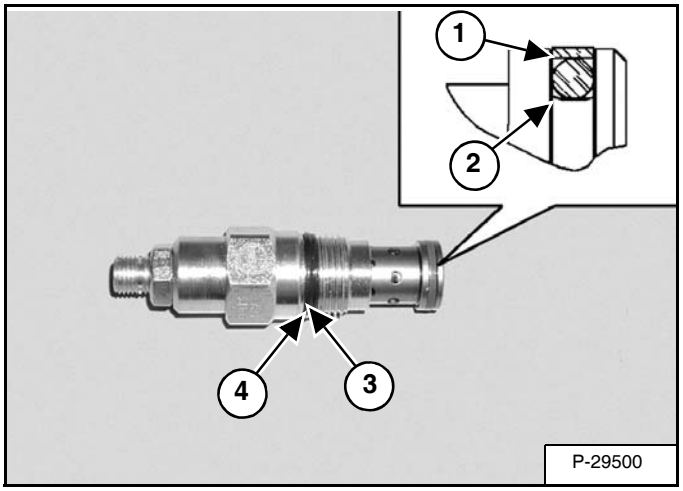


Remove the springs (Item 1), check balls (Item 2) and seats (Item 3) **[Figure 20-60-36]** & **[Figure 20-60-37]**.

Remove the O-rings (Item 4) **[Figure 20-60-36]** & **[Figure 20-60-37]** from the plugs.

Assembly (S/N 223911001 - 223911247 & S/N 224011001 - 224012293) (Cont'd)

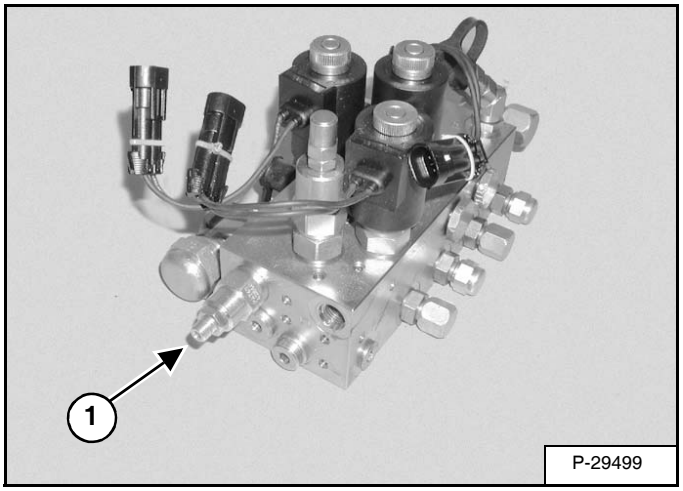
Figure 20-60-73



Install the O-ring (Item 1) and seal (Item 2) **[Figure 20-60-73]** on the relief valve.

Install the O-ring (Item 3) and back-up ring (Item 4) **[Figure 20-60-73]** on the relief valve.

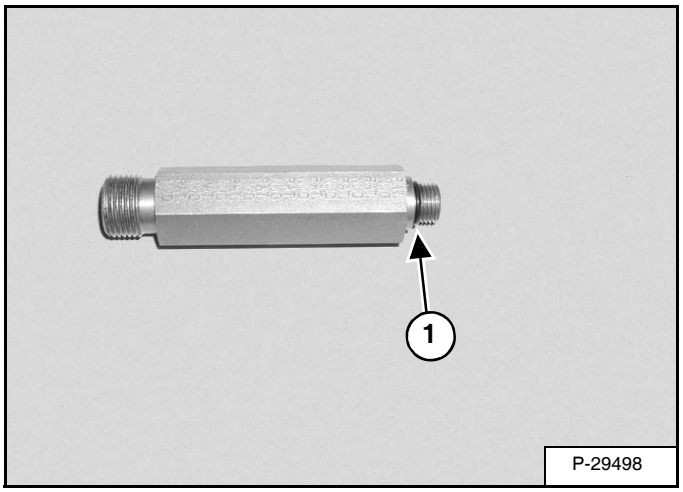
Figure 20-60-74



Install the relief valve (Item 1) **[Figure 20-60-74]** in the manifold.

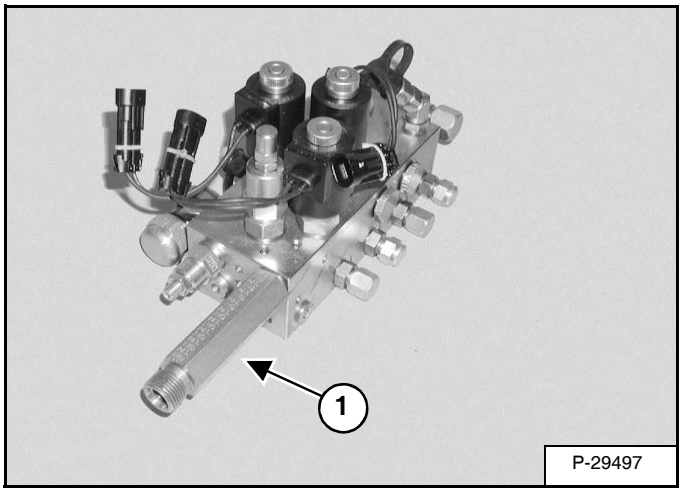
Tighten the valve to 18-22 ft.-lb. (25-30 N•m) torque.

Figure 20-60-75



Install the O-ring (Item 1) **[Figure 20-60-75]** on the accumulator extension.

Figure 20-60-76

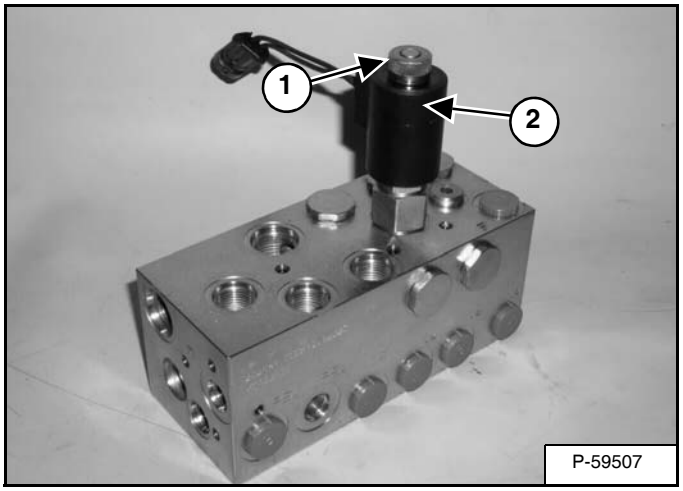


Install the accumulator extension (Item 1) **[Figure 20-60-76]** on the manifold.

Tighten the extension to 22-24 ft.-lb. (29-33 N•m) torque.

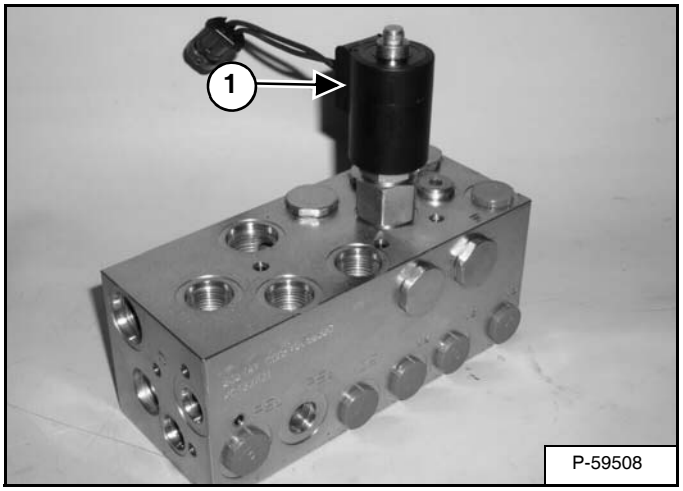
Disassembly (S/N 223911248 & Above & S/N 224012294 & Above) (Cont'd)

Figure 20-60-109



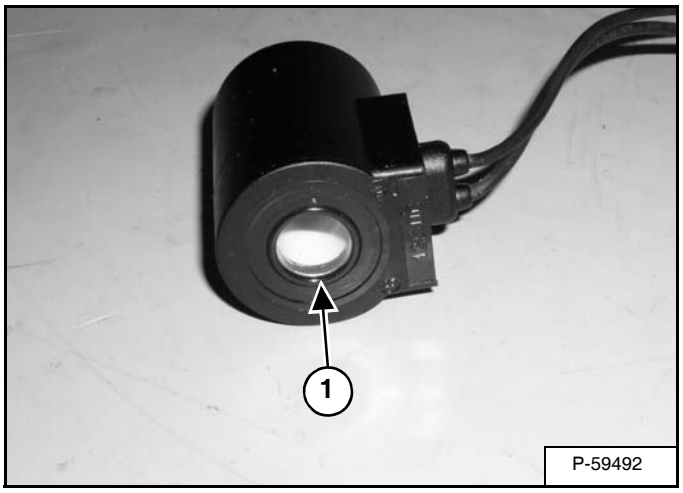
Remove the nut (Item 1) from the two speed solenoid (Item 2) **[Figure 20-60-109]**.

Figure 20-60-110



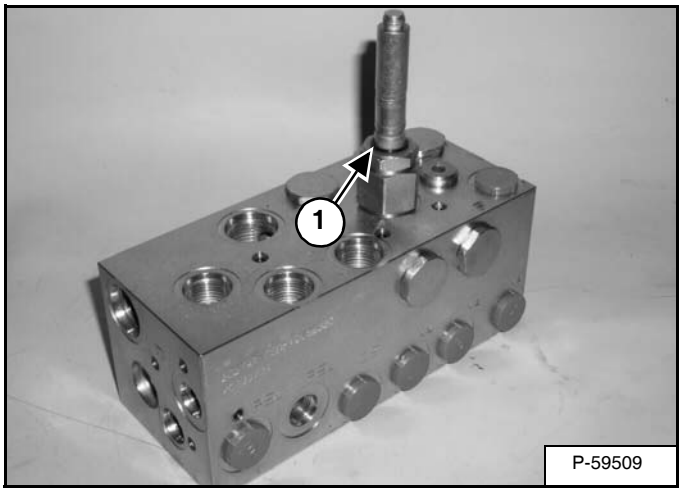
Remove the coil with no strap (Item 1) **[Figure 20-60-110]** from the solenoid stem.

Figure 20-60-111



Remove the O-ring (Item 1) **[Figure 20-60-111]** from the coil.

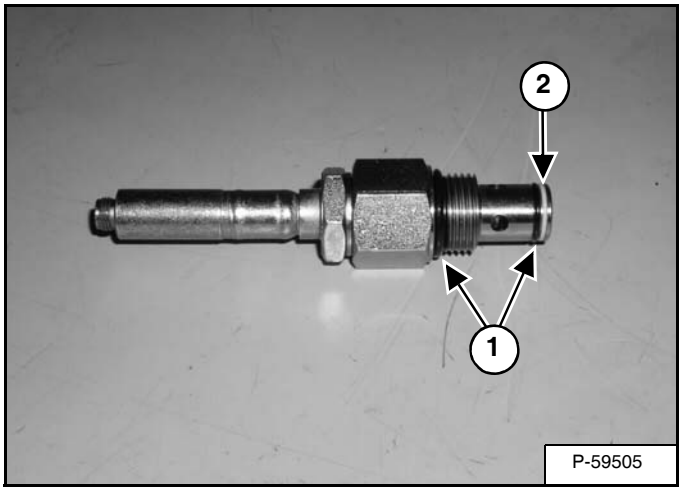
Figure 20-60-112



Remove the O-ring (Item 1) **[Figure 20-60-112]** from the solenoid stem.

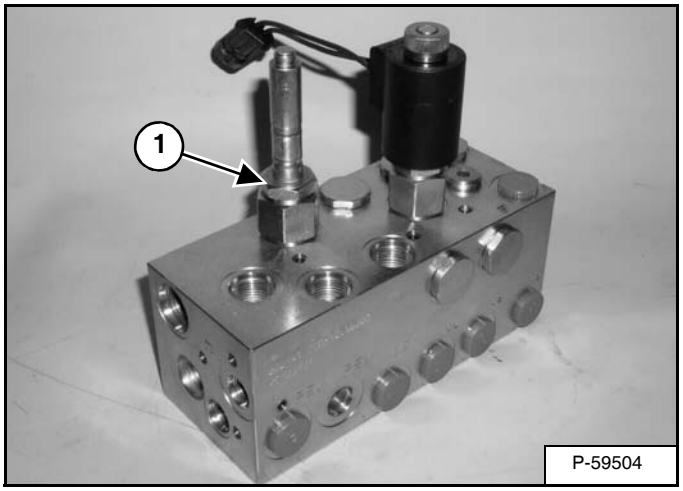
Assembly (S/N 223911248 & Above & S/N 224012294 & Above) (Cont'd)

Figure 20-60-149



Install the O-rings (Item 1) and backup ring (Item 2) **[Figure 20-60-149]**.

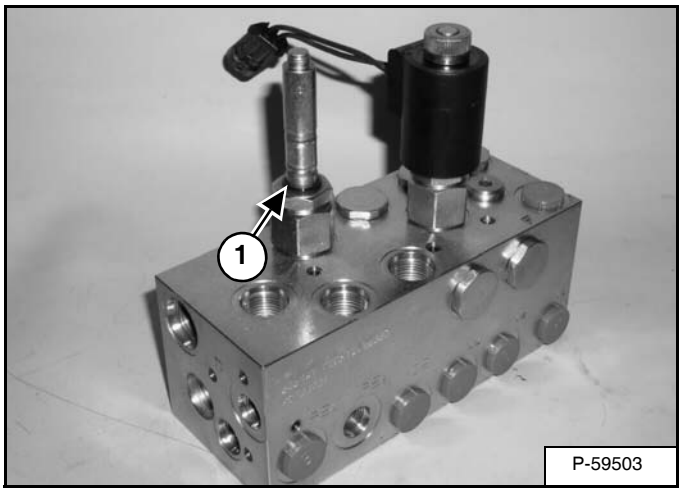
Figure 20-60-150



Install the solenoid stem (Item 1) **[Figure 20-60-150]**.

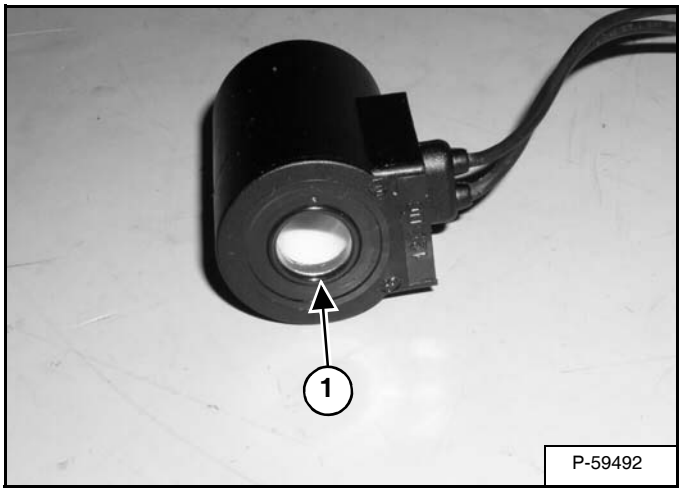
Tighten the solenoid stem to 37 ft.-lb. (50 N•m) torque.

Figure 20-60-151



Install the O-ring (Item 1) **[Figure 20-60-151]** on the solenoid stem.

Figure 20-60-152



Install the O-ring (Item 1) **[Figure 20-60-152]** on the coil.

Disassembly

IMPORTANT

hen 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.

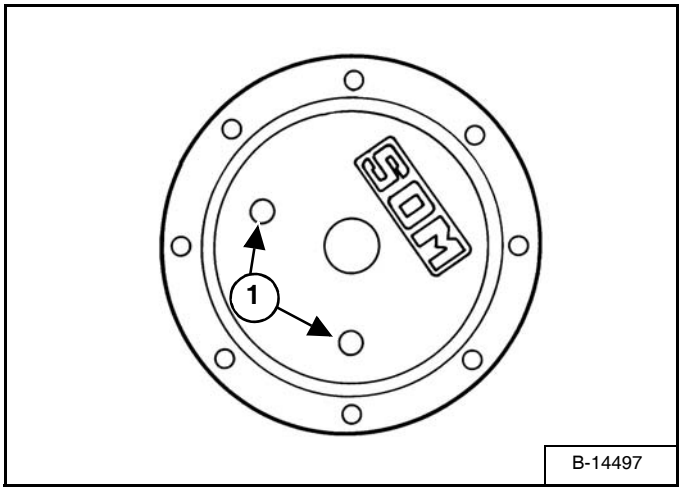
I-2003-0888

Clean the outside of the travel motor before disassembly.

The following tool will need to be ordered from OTC tool to reassemble the travel motor:

MEL1468 for torque ring and seal ring assembly.

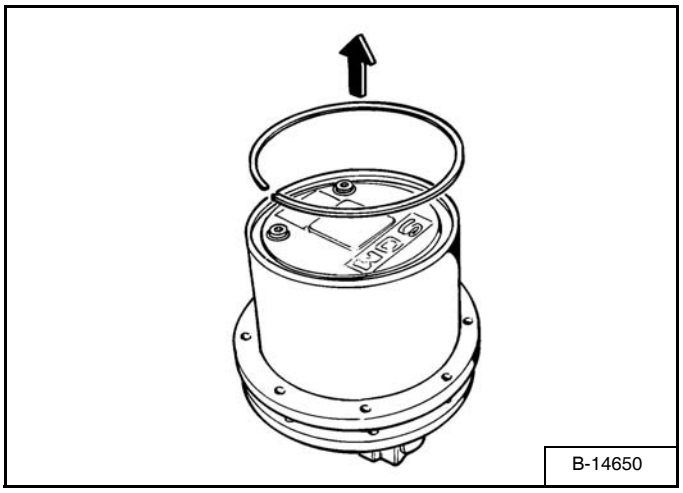
Figure 20-70-4



Remove the drain plugs (Item 1) **[Figure 20-70-4]** from the end cover.

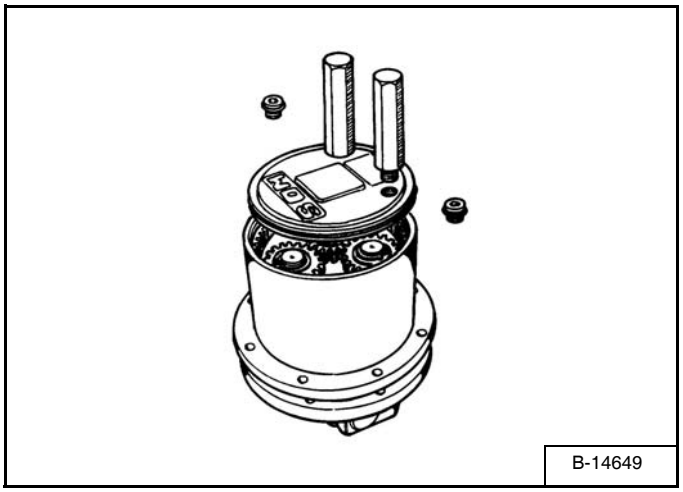
Drain the oil into a container.

Figure 20-70-5



Remove the internal snap ring from the travel motor case **[Figure 20-70-5]**.

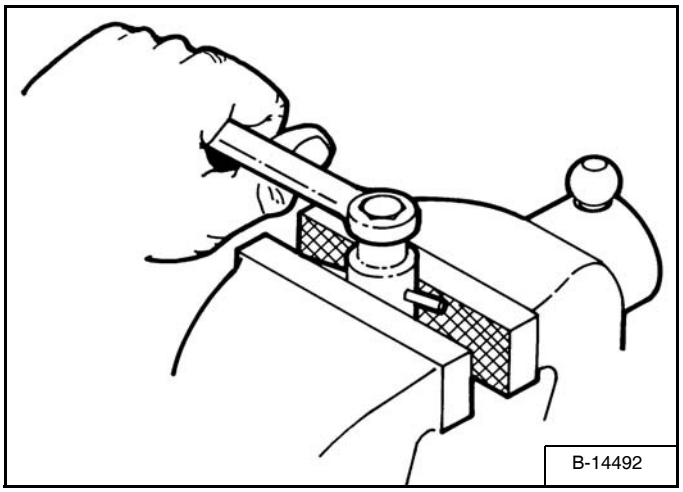
Figure 20-70-6



To remove the cover, install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

Assembly (Cont'd)

Figure 20-70-43



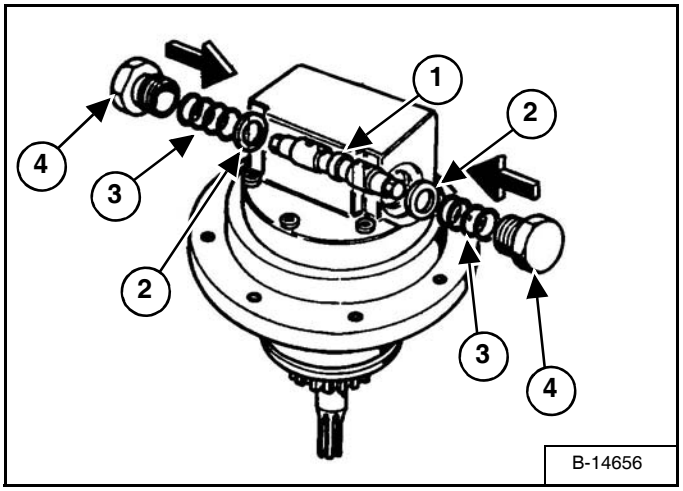
To assemble the spool, insert a hardened pin through the hole in the spool and use a vise with protective jaws to hold the spool **[Figure 20-70-43]**.

NOTE: Do not use any type of tool to grip the spool or damage to the spool will result.

Install the two plugs in both ends of the spool **[Figure 20-70-43]**.

Tighten the plugs to 18-22 ft. lbs. (25-30 Nm) torque.

Figure 20-70-44



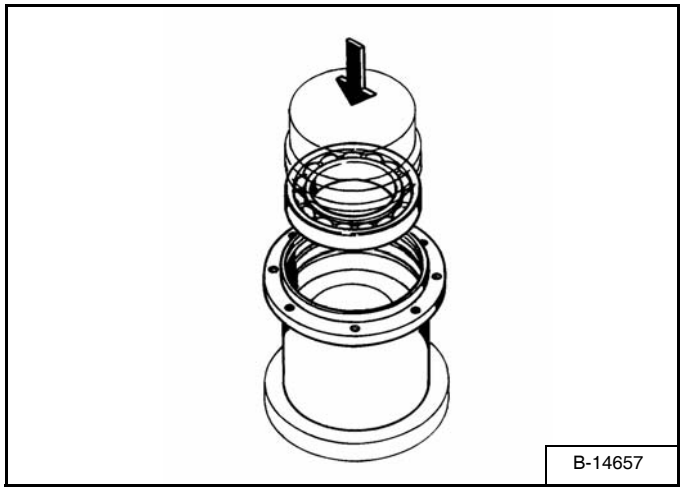
Apply oil to the spool and install the spool (Item 1) **[Figure 20-70-44]** in the motor cover.

Install the washer (Item 2) and spring (Item 3) **[Figure 20-70-44]** in the motor cover.

Apply oil to the O-rings and install the new O-rings on the plugs (Item 4) **[Figure 20-70-44]**.

Install the plugs (Item 4) **[Figure 20-70-44]** in the motor cover.

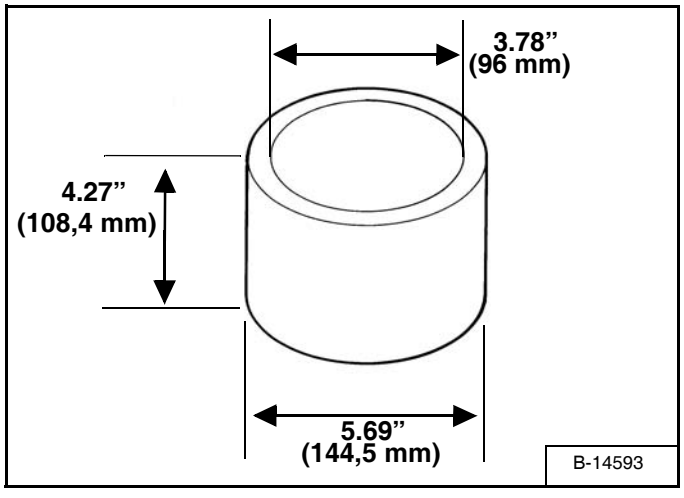
Figure 20-70-45



Apply oil to the outer edge of the bearing and press the bearing in the housing, using the bearing installation tool **[Figure 20-70-45]**.

Obtain the bearing installation tool locally.

Figure 20-70-46

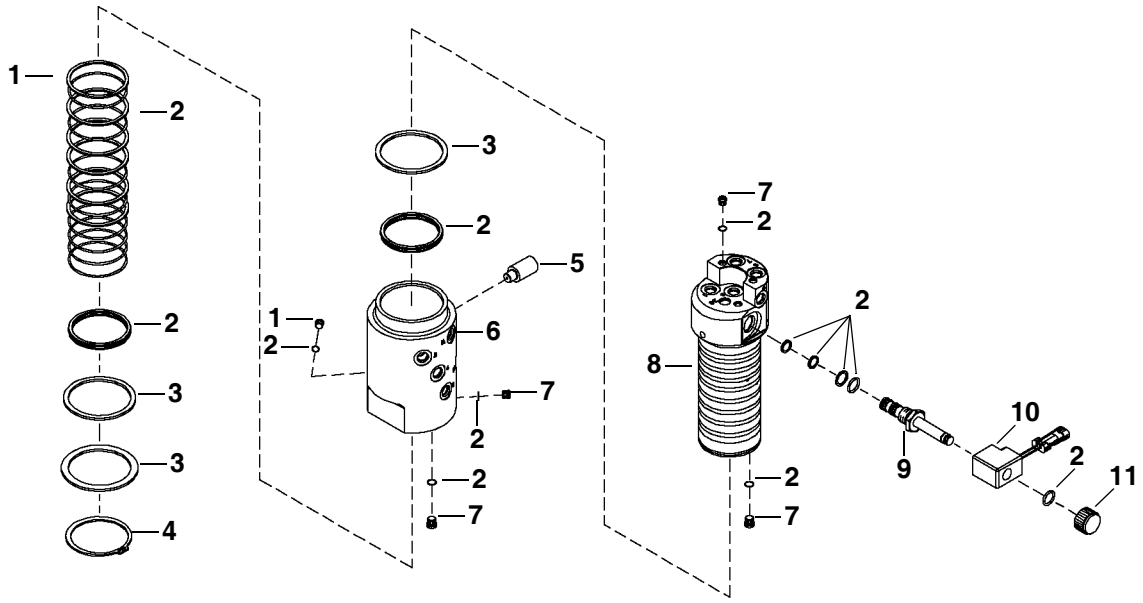


The dimensions of the bearing installation tool **[Figure 20-70-46]** are as follows:

Height	4.27 inch (108, 4 mm)
I.D.	3.78 inch (96 mm)
O.D.	5.69 inch (144,5 mm)

Parts Identification 322

1. Seal
2. O-Ring
3. Washer
4. Snap Ring
5. Stud
6. Housing
7. Plug
8. Rotor
9. Spool
10. Coil
11. Nut



PE-1578

SWING MOTOR

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.

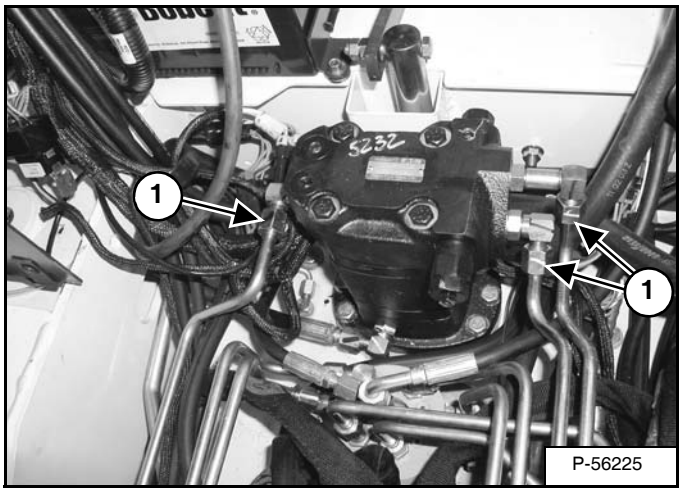
I-2003-0888

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

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

Remove blade extension tray. (See Removal And Installation on Page 40-210-1.)

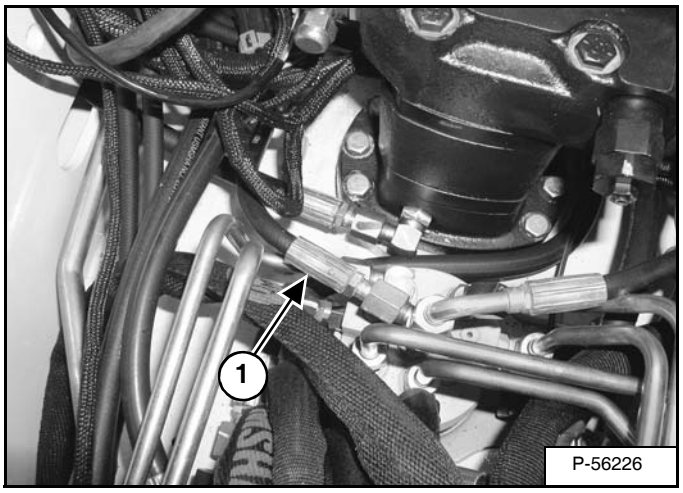
Figure 20-90-1



Mark the hose and tubelines for ease of assembly **[Figure 20-90-1]**.

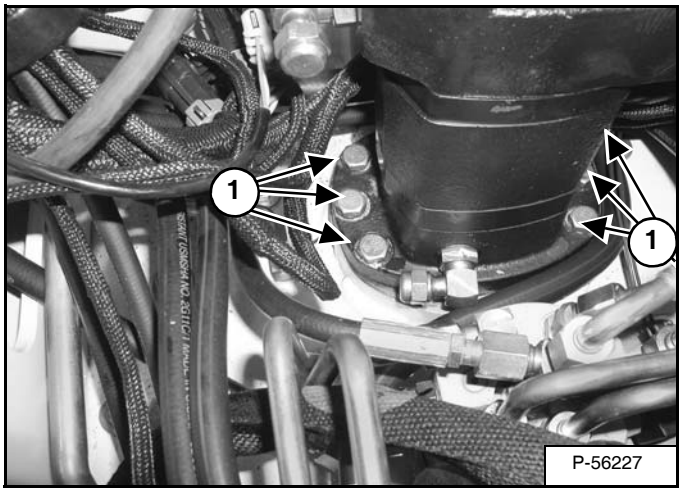
Remove the tubelines (Item 1) **[Figure 20-90-1]**.

Figure 20-90-2



Remove hose (Item 1) **[Figure 20-90-2]**.

Figure 20-90-3



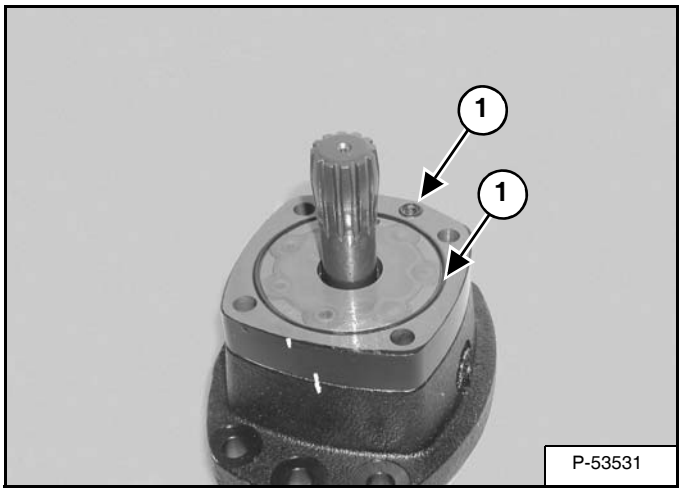
Remove the six bolts (Item 1) **[Figure 20-90-3]** from the swing motor.

Installation: Tighten the bolts to 29-37 ft.-lbs. (40-50 Nm) torque.

Remove the swing motor from the Excavator.

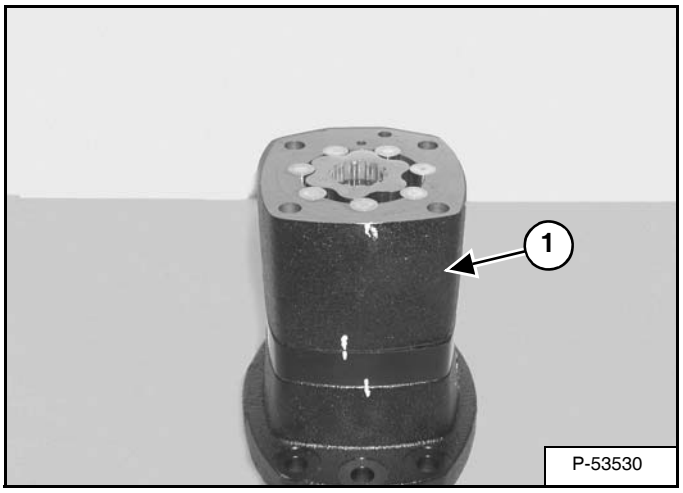
Assembly (Cont'd)

Figure 20-90-36



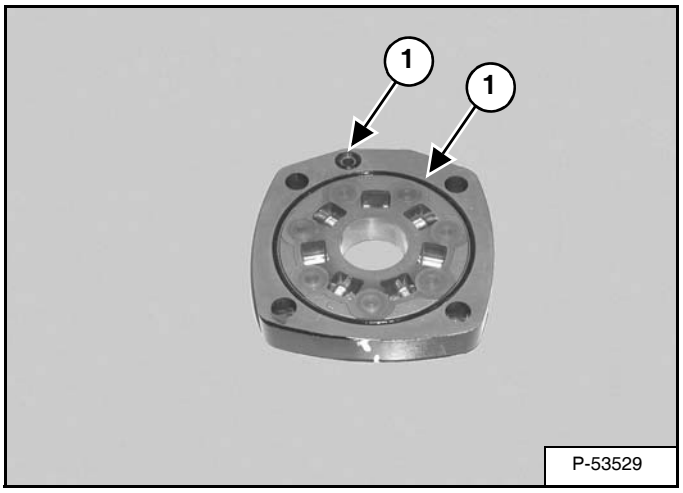
Install the O-rings (Item 1) **[Figure 20-90-36]**.

Figure 20-90-37



Install the geroler (Item 1) **[Figure 20-90-37]**.

Figure 20-90-38

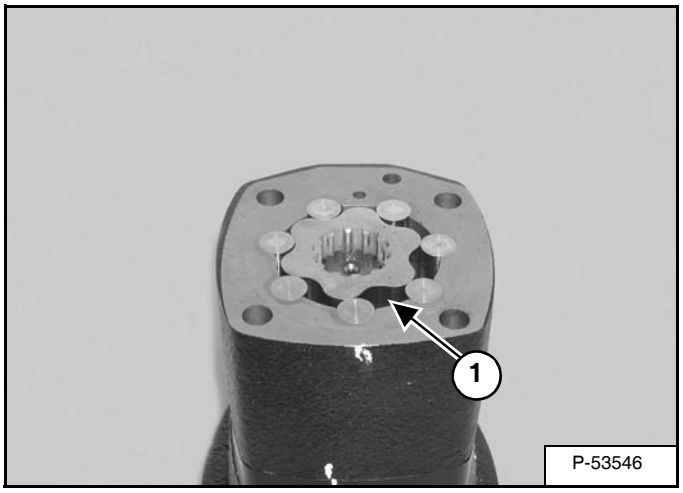


Install the O-rings (Item 1) **[Figure 20-90-38]** on the valve plate.

Motor Timing

The direction that the output shaft rotates is determined by timing. Time the motor as follows:

Figure 20-90-39



Locate the largest open pocket in the geroler (Item 1) **[Figure 20-90-39]**.

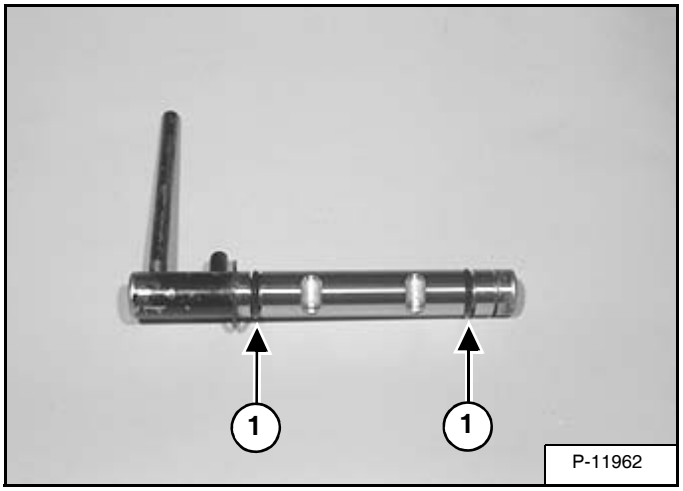
Assembly

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 O-rings. Lubricate all O-rings with clean hydraulic fluid before installation.

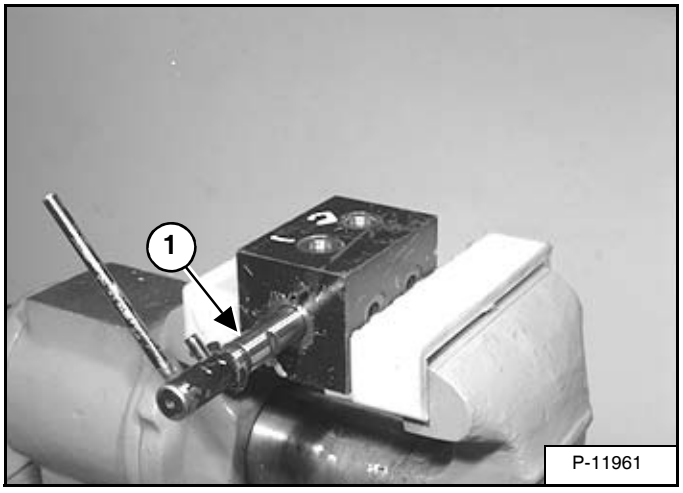
Figure 20-100-11



Clean all parts in solvent and dry with compressed air.

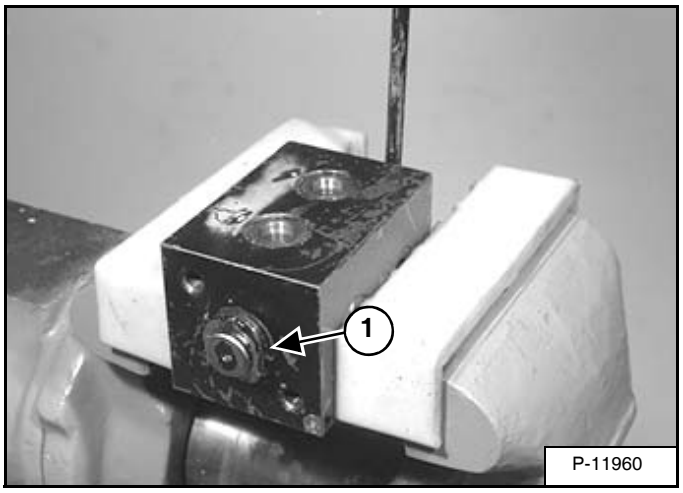
Apply oil to and install new O-rings (Item 1) **[Figure 20-100-11]** on the spool.

Figure 20-100-12



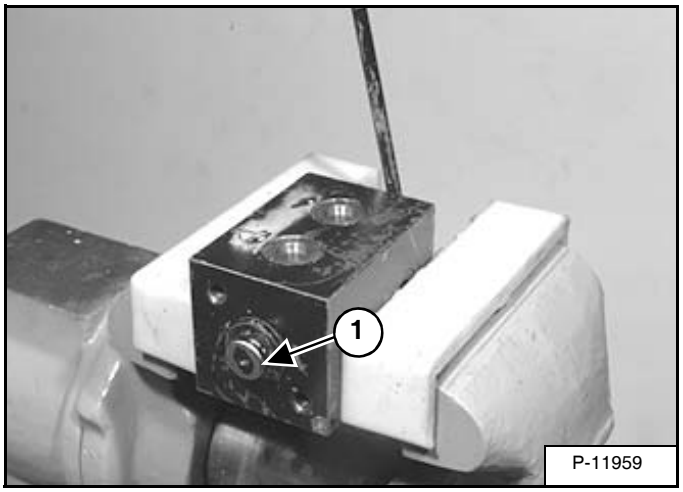
Apply oil to and install the spool (Item 1) **[Figure 20-100-12]** in the housing.

Figure 20-100-13



Install the wave washer (Item 1) **[Figure 20-100-13]** on the end of the spool.

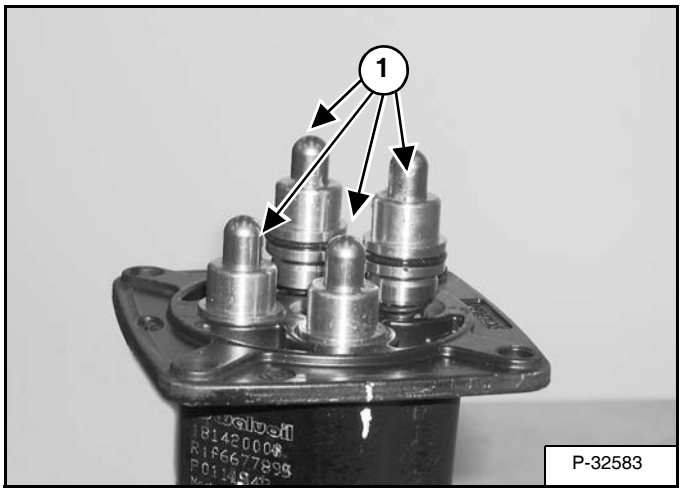
Figure 20-100-14



Install the snap ring (Item 1) **[Figure 20-100-14]** on the spool.

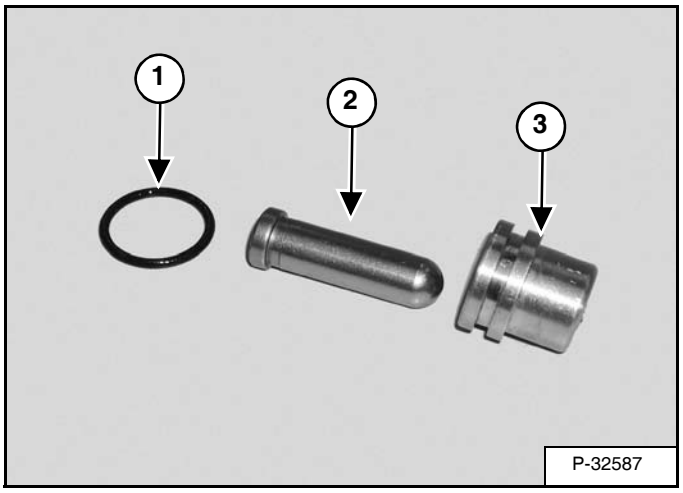
Disassembly (Cont'd)

Figure 20-110-19



Remove the plunger assemblies (Item 1) **[Figure 20-110-19]**.

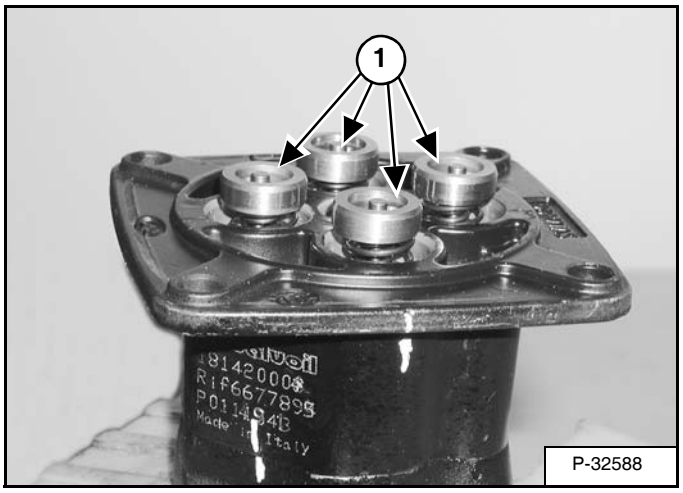
Figure 20-110-20



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-110-20]**.

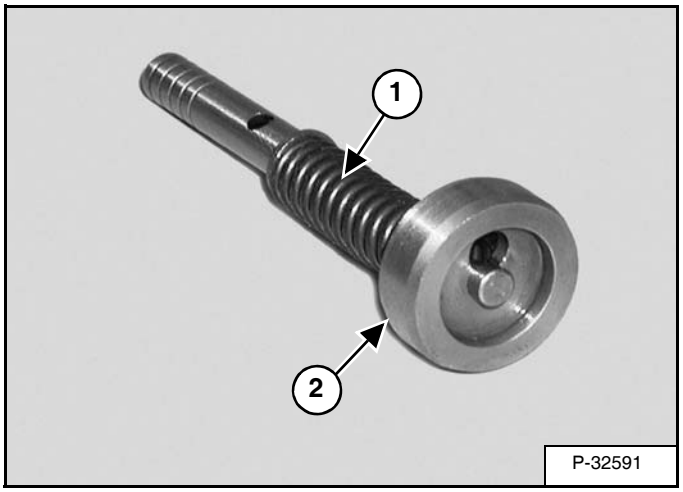
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-110-21



Remove the spool assemblies (Item 1) **[Figure 20-110-21]**.

Figure 20-110-22



Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-110-22]**.

LEFT CONTROL LEVER (JOYSTICK)

Testing

Check the pressure reducing valve for the correct pressure. (See Testing And Adjusting The Pressure Reducing Valve on Page 20-33-1.)

The following tools will be needed to do the procedure:

MEL1355 - Hydraulic Test Kit

Lower the boom/bucket and blade to the ground.

Stop the engine.

Relieve hydraulic pressure.

⚠ WARNING

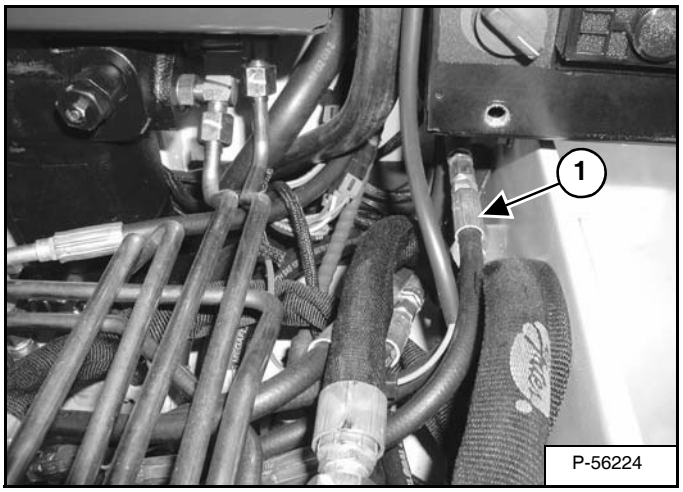
Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possible death if proper medical treatment by a physician familiar with this injury is not received immediately.

W-2145-0290

Open the tailgate.

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

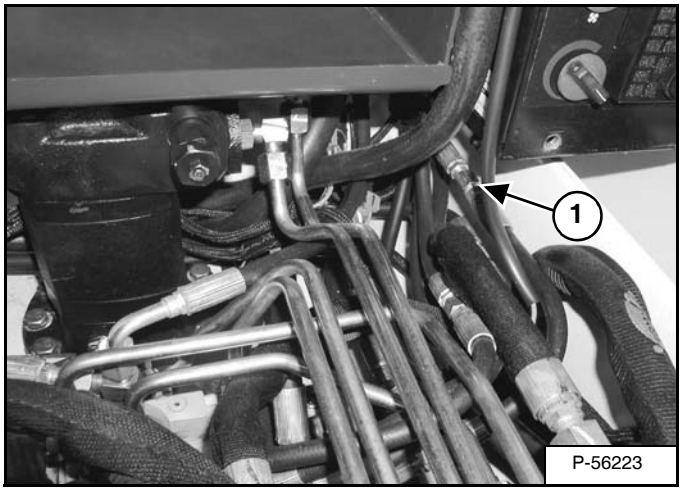
Figure 20-113-1



At the control valve assembly, find the pilot line (Item 1) **[Figure 20-113-1]** of the control lever (joystick) that is to be checked. Arm, Bucket, Boom, and Swing (slew).

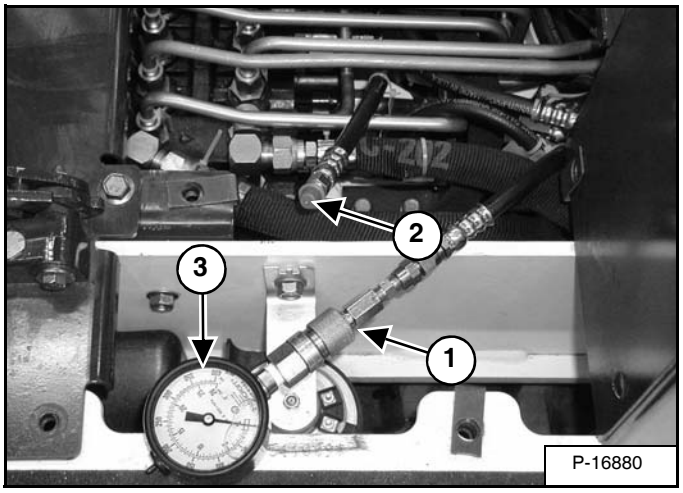
NOTE: These four valves (Arm, Bucket, Boom & Swing (Slew) have short extension hoses with connectors for fast valve removal and testing.

Figure 20-113-2



Disconnect the hydraulic hose (Item 1) **[Figure 20-113-2]** from the short control valve extension hose.

Figure 20-113-3



From the test kit, install a hydraulic fitting and test port (Item 1) **[Figure 20-113-3]** to the control lever (joystick) hydraulic hose.

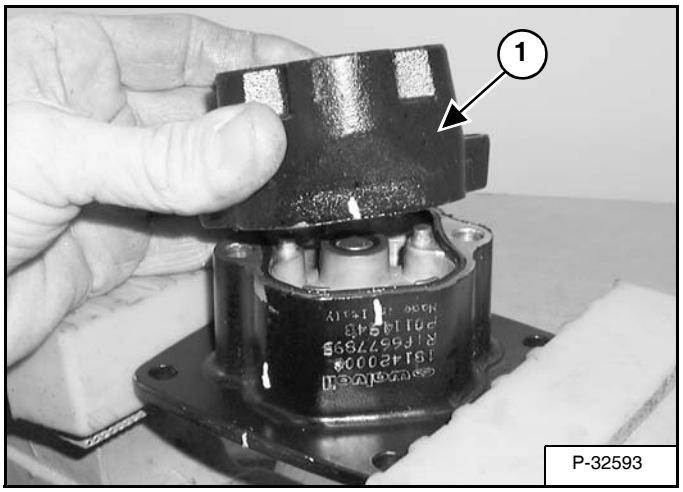
Cap the short control valve extension hose (Item 2) **[Figure 20-113-3]**.

Install a 1000 PSI (69 Bar) gauge and female coupler (Item 3) **[Figure 20-113-3]** on the test port.

Start the engine and warm the hydraulic oil to operating temperature 150°F (66°C).

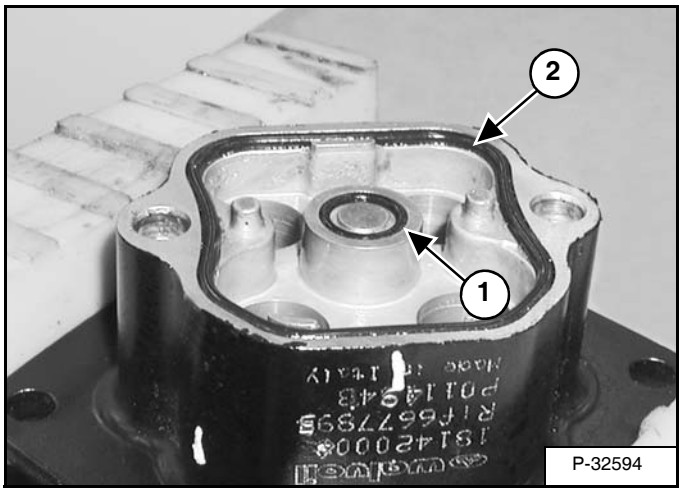
Disassembly (Cont'd)

Figure 20-111-30



Remove the end cap (Item 1) **[Figure 20-111-30]**

Figure 20-113-31



Remove the O-ring (Item 1) and seal (Item 2) **[Figure 20-113-31]**.

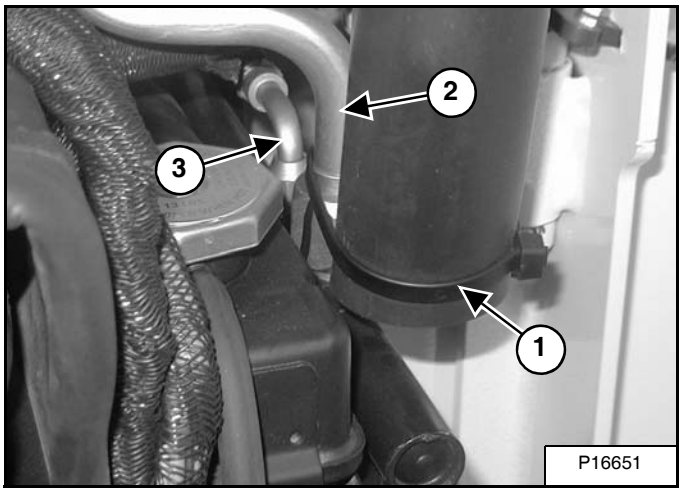
OIL COOLER

Removal And Installation

Open tailgate.

Drain hydraulic reservoir. (See Replacing Hydraulic Oil on Page 10-100-2)

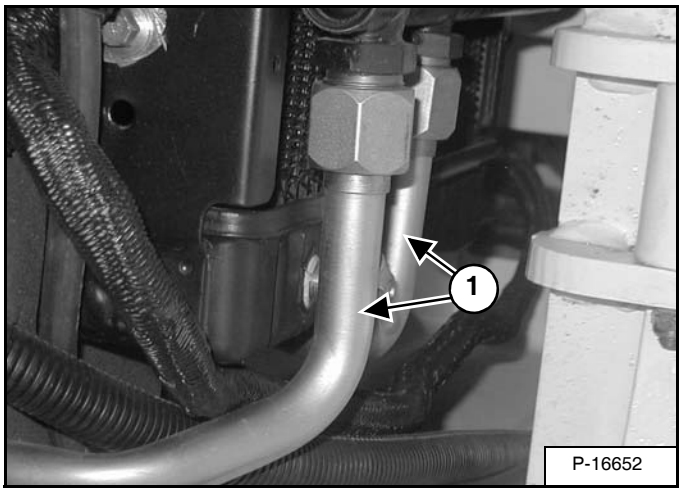
Figure 20-140-1



Remove tie strap (Item 1) **[Figure 20-140-1]**.

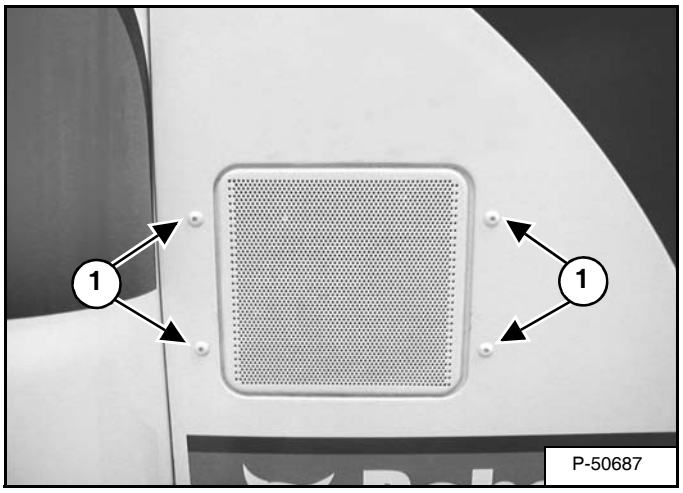
Remove the tubeline (Item 2) and plug hose (Item 3) **[Figure 20-140-1]** from the top of the oil cooler.

Figure 20-140-2



Remove the tubelines (Item 1) **[Figure 20-140-2]** from the bottom of the oil cooler.

Figure 20-140-3



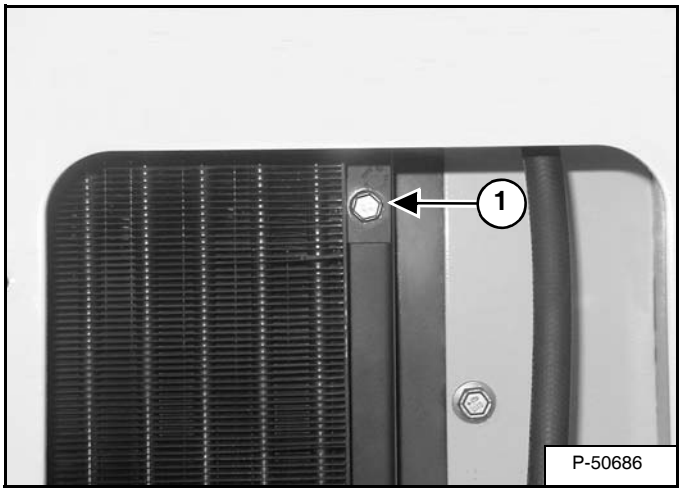
Remove the four bolts (Item 1) **[Figure 20-140-3]** holding the grill to the side frame.

Push the grill in and slide the grill out the back of the Excavator.

NOTE: Use a magnet or hook pick to prevent the grill from dropping and being scratched or damaged.

NOTE: Support the oil cooler before removing the mounting bolts.

Figure 20-140-4



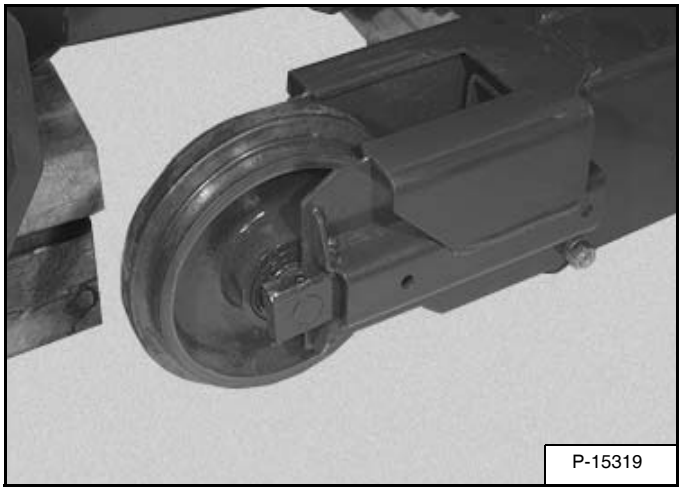
Remove the bolt (Item 1) **[Figure 20-140-4]** mounting the oil cooler to the radiator.

TRACK FRAME

Disassembly And Assembly

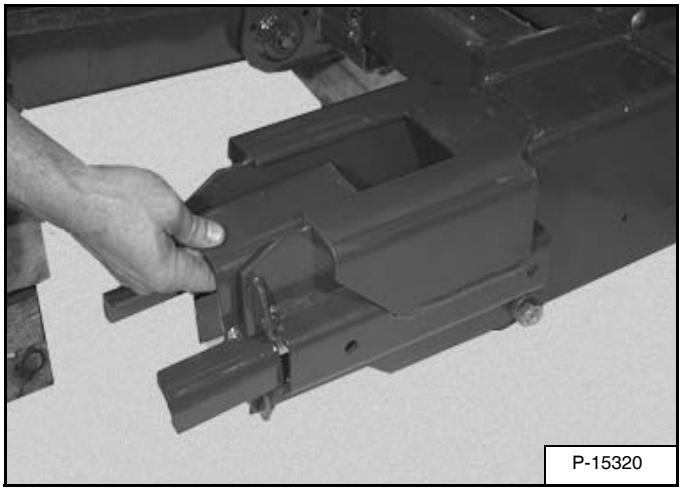
Remove the track. (See Removal And Installation on Page 30-20-4.)

Figure 30-30-11



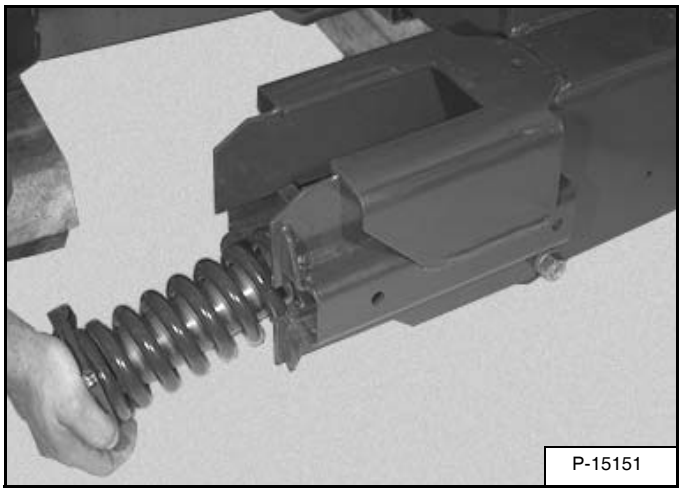
Slide the front track idler out of the track frame to remove it **[Figure 30-30-11]**.

Figure 30-30-12



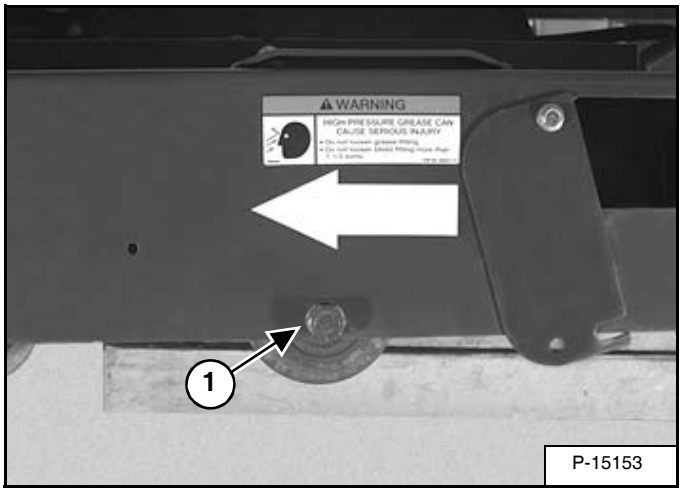
Remove the sliding plate **[Figure 30-30-12]**.

Figure 30-30-13



Slide the recoil spring cylinder forward and remove it from the track frame **[Figure 30-30-13]**.

Figure 30-30-14



Loosen the nuts from the track roller on both sides of the track frame **[Figure 30-30-14]**.

Installation: Tighten the nuts to 125 - 140 ft.-lb. (170-190 N•m) torque.

Remove the track roller (Item 1) **[Figure 30-30-14]**.

Lug Abrasion

Damage:

Figure 30-40-37

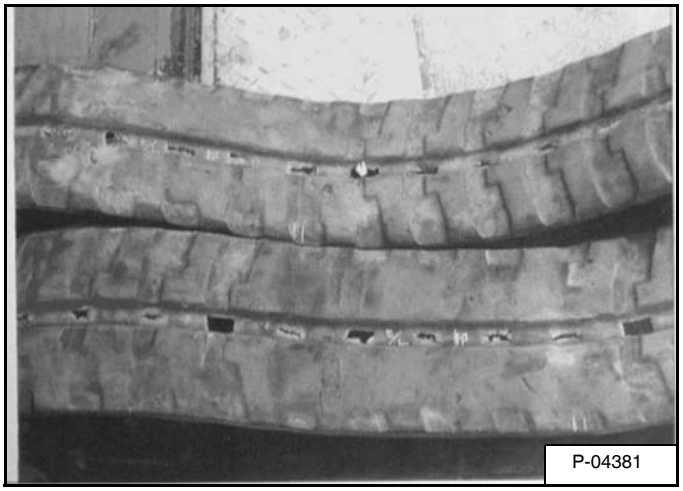
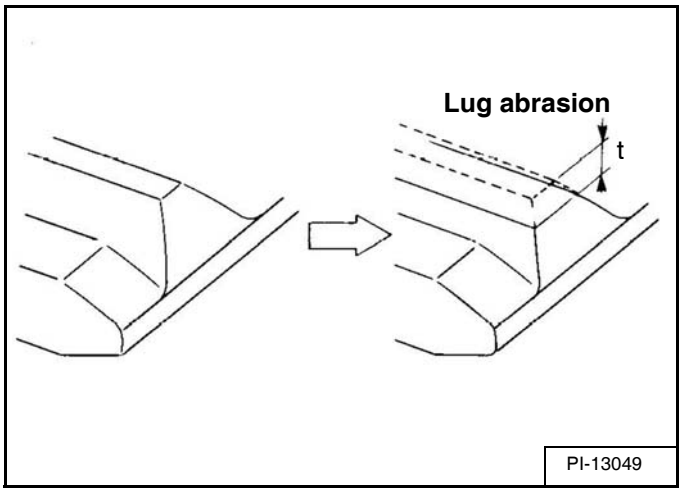


Figure 30-40-38



As operation time increases, the lug side undergoes abrasion **[Figure 30-40-37]** & **[Figure 30-40-38]**.

Replacement:

No replacement is required.

Causes Of The Damage:

Lug abrasion will occur as operation time increases. Even as lug abrasion increases, the rubber track can be used. However, as the traction performance deteriorates, it is highly recommended to replace the abraded tracks with new ones when the lug height becomes less than 5 mm.

Prevention:

In order to prevent the rubber track from abnormal or premature abrasion, the following operating conditions should be avoided:

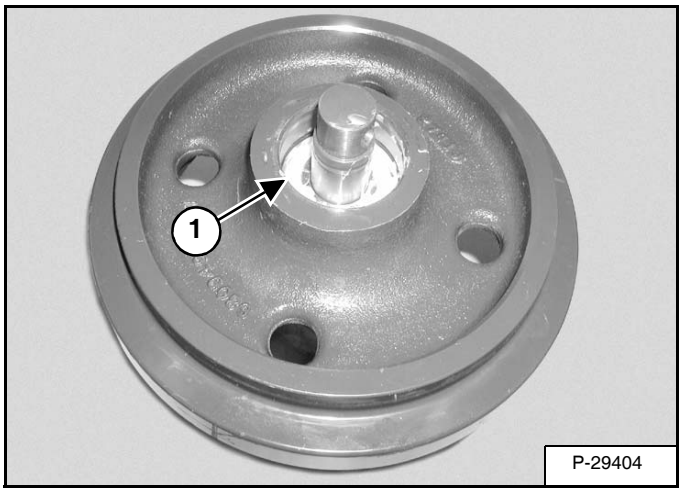
Making quick and repeated turns on concrete and asphalt roads.

Driving up and down hilly paths with slippage.

Making frequent turns on paths covered with rocks and wood.

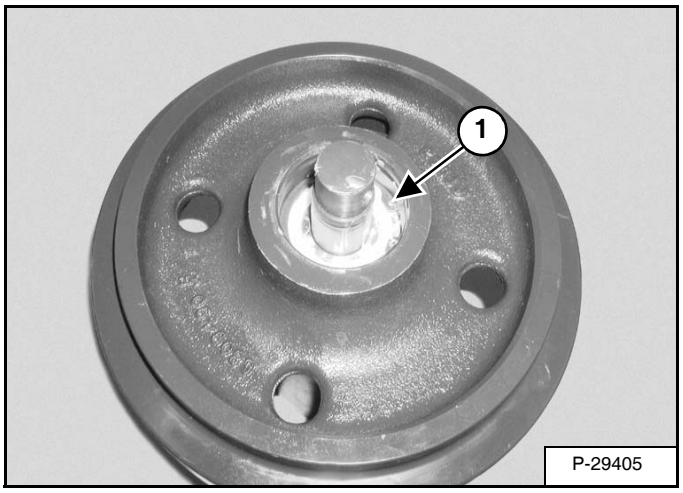
Assembly (Cont'd)

Figure 30-50-57



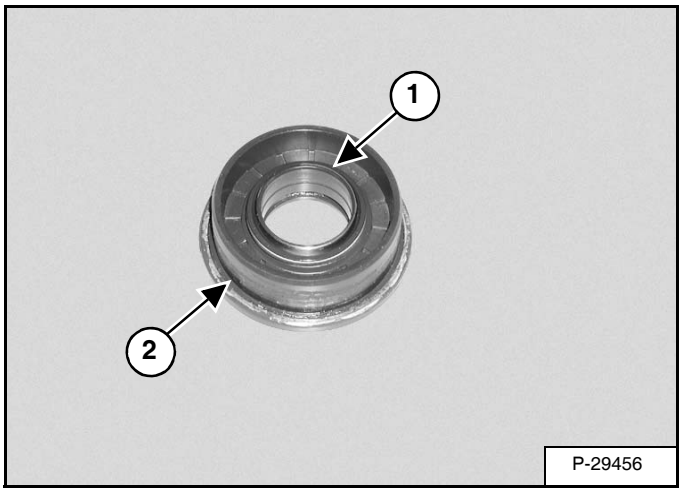
Install the bearing (Item 1) **[Figure 30-50-57]**. Use a brass drift to seat the bearing.

Figure 30-50-58



Install the snap ring (Item 1) **[Figure 30-50-58]**.

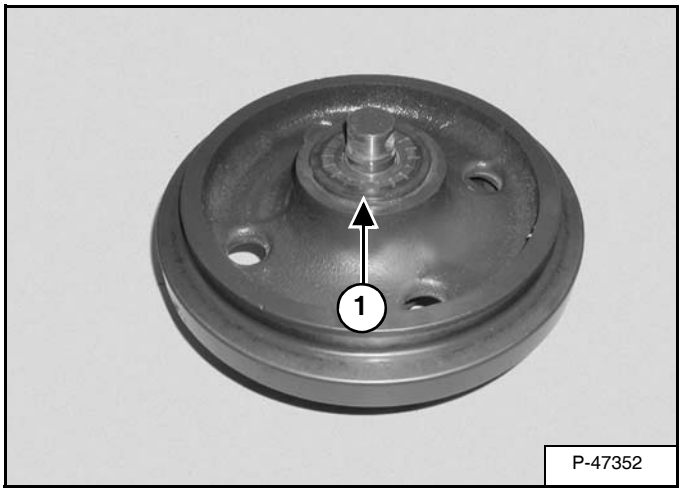
Figure 30-50-59



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-50-59]** of the seal.

Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-50-59]** of the seal.

Figure 30-50-60



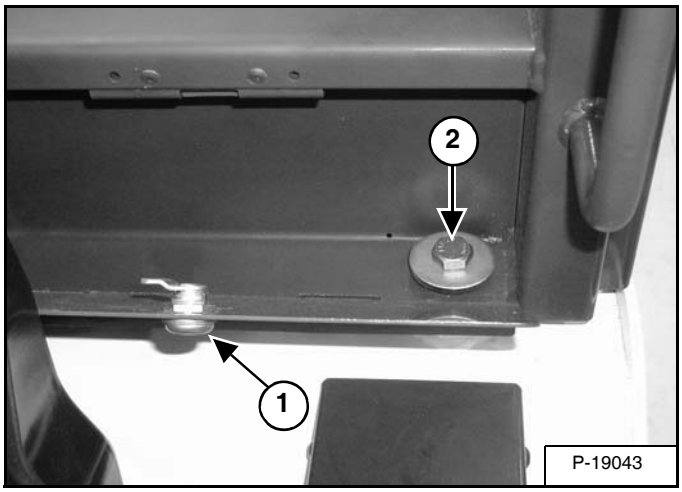
Using the driving tool, install the seal (Item 1) **[Figure 30-50-60]** on both sides of the idler.

UPPERSTRUCTURE & SWING SECTION

Continued On Next Page

Removal And Installation (Cont'd)

Figure 40-20-14



Open and remove the Operation & Maintenance Manual storage door (Item 1) **[Figure 40-20-14]** with the start key.

NOTE: Later models are not equipped with the storage door.

Remove the bolt and washer (Item 2) **[Figure 40-20-14]** from the left rear of the canopy.

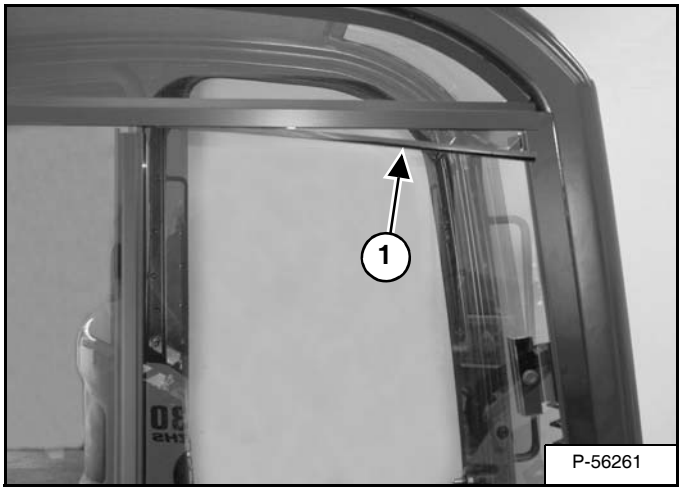
Installation: Tighten the bolt to 118-133 ft.-lbs. (160-180 Nm) torque.

Remove the canopy from the upperstructure.

Right Side Rear Sliding Window Removal And Installation

Close and latch the front and rear sliding windows.

Figure 40-30-39



Use a pick to pull the felt (Item 1) **[Figure 40-30-39]** from the top window channel.

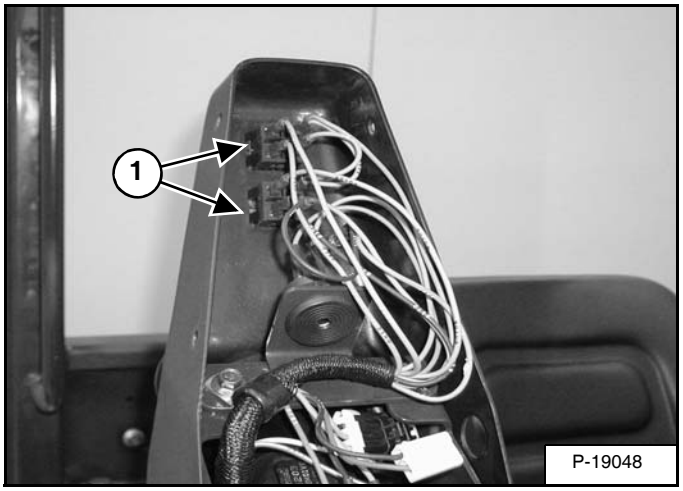
Unlatch the rear sliding window and slide the window open until it stops.

Figure 40-30-40

Lift the window up into the top channel and tilt the bottom edge out **[Figure 40-30-40]**. Remove the window from the cab.

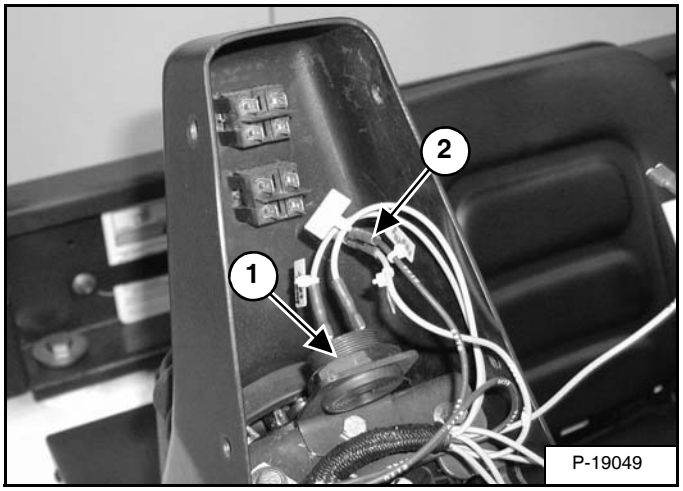
Console Cover Removal And Installation (ROPS Canopy Models 320 & 322) (Cont'd)

Figure 40-50-14



Mark and remove the wires from the indicator lamps (Item 1) **[Figure 40-50-14]**.

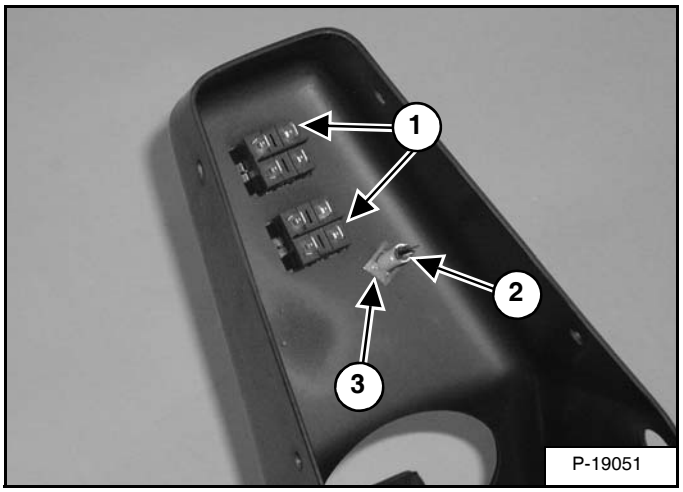
Figure 40-50-15



Mark and remove the wires from the horn (Item 1) and two speed indicator (Item 2) **[Figure 40-50-15]**.

Lift the console cover over the control lever (joystick) handle.

Figure 40-50-16

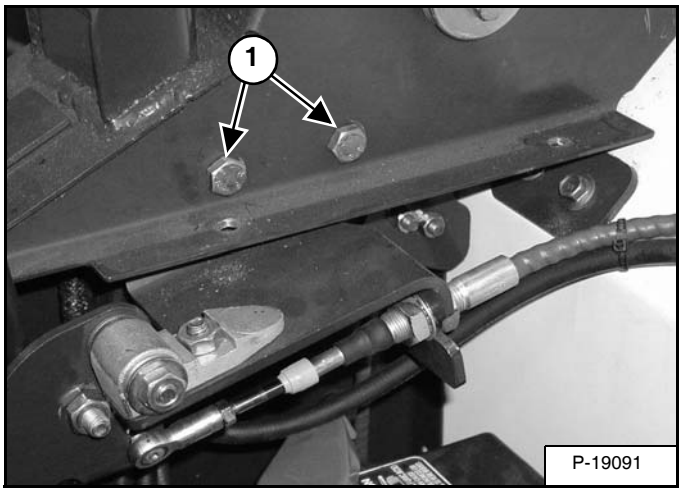


Remove the indicator lights (Item 1) **[Figure 40-50-16]** by squeezing together the mounting tabs on the indicator light and pushing the indicator out of the top of the console cover.

Remove the two speed indicator (Item 2) by removing the retaining clip (Item 3) **[Figure 40-50-16]** and pushing the indicator out of the top of the console cover.

Console Base Removal And Installation (Cont'd)

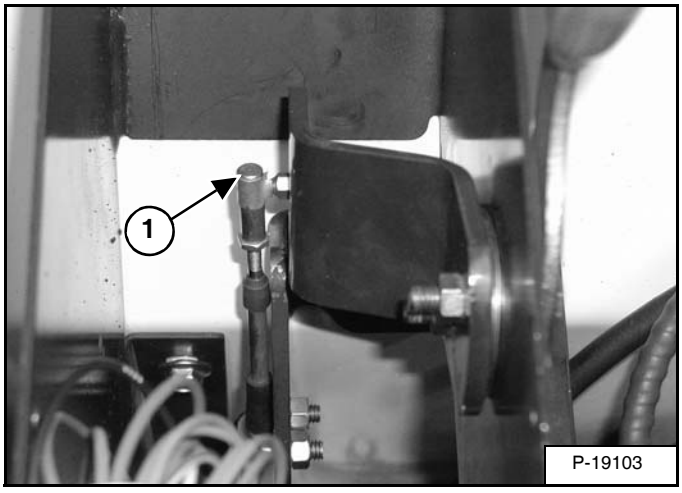
Figure 40-50-44



Remove the bolts and nuts (Item 1) **[Figure 40-50-44]** fastening the blade linkage assembly to the console base.

Remove the blade linkage assembly from the right console.

Figure 40-50-45



Disconnect the speed control cable (Item 1) **[Figure 40-50-45]**.

Figure 40-50-46

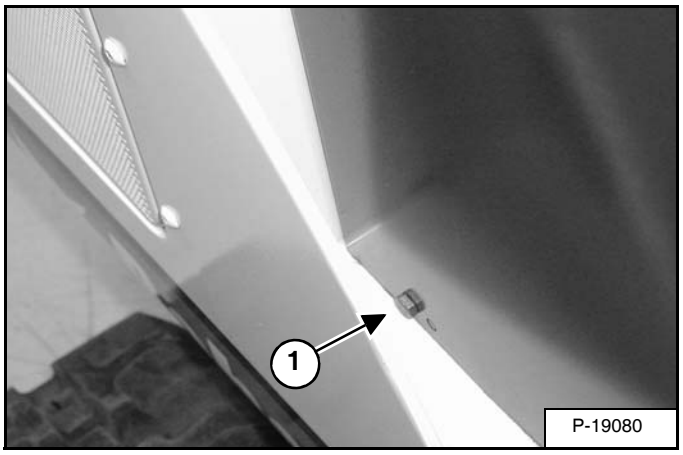
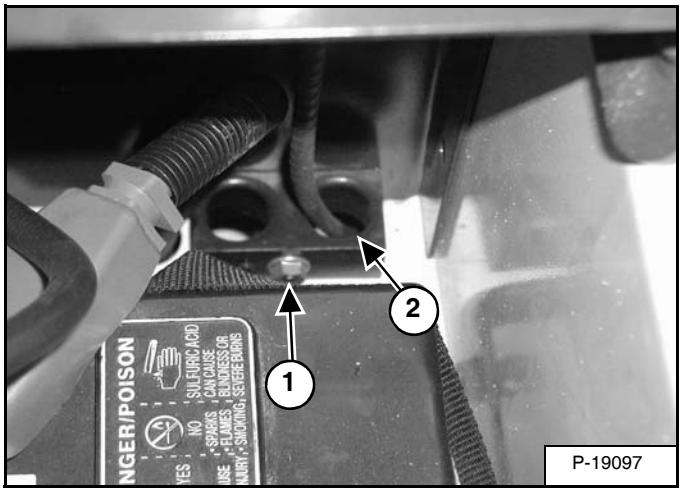


Figure 40-50-47



Remove the bolt and nut (Item 1) **[Figure 40-50-46]** & **[Figure 40-50-47]** holding the plastic block (Item 2) **[Figure 40-50-47]** to the inside console base.

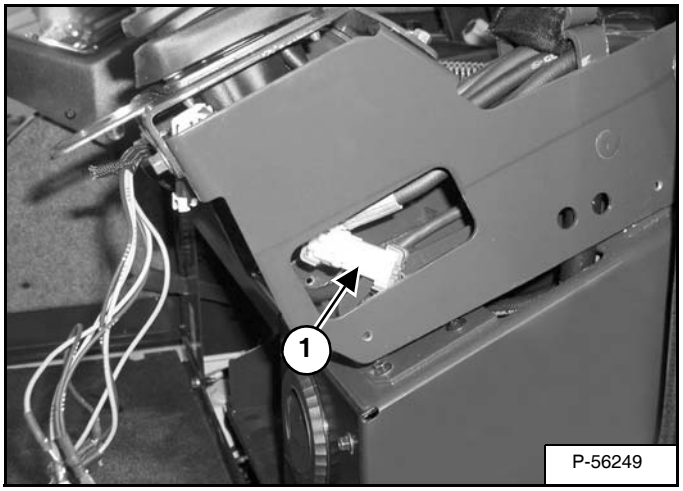
Upper Console Removal And Installation

Lower the boom/bucket and blade to the ground.

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

Remove the gas spring. (See Gas Spring Removal And Installation on Page 40-60-3.)

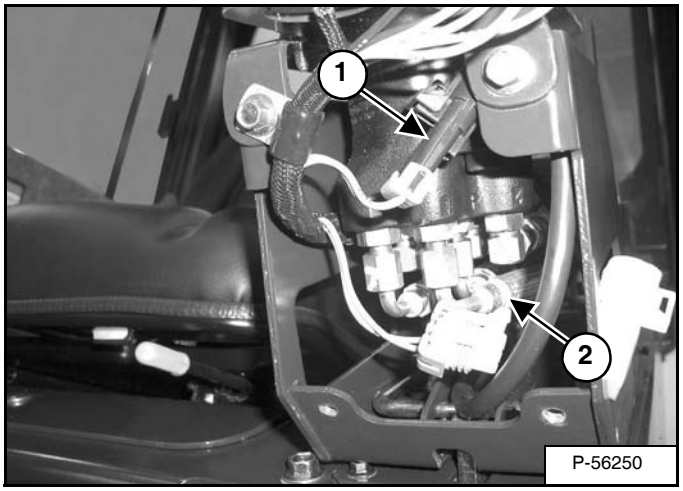
Figure 40-60-24



Disconnect the wire harness (Item 1) **[Figure 40-60-24]**.

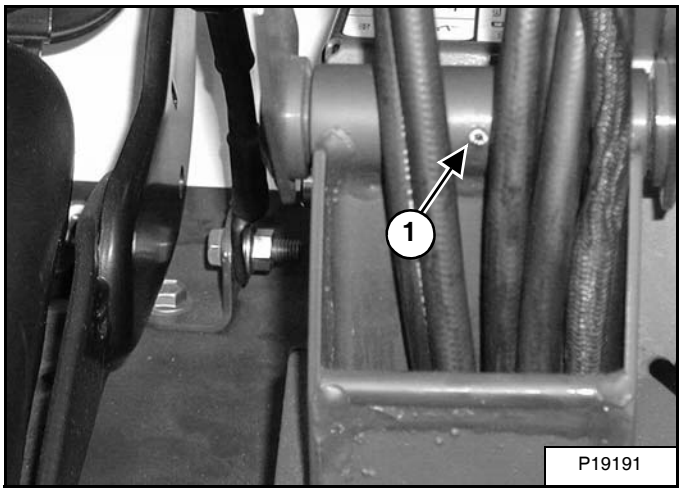
Raise and support the console.

Figure 40-60-25



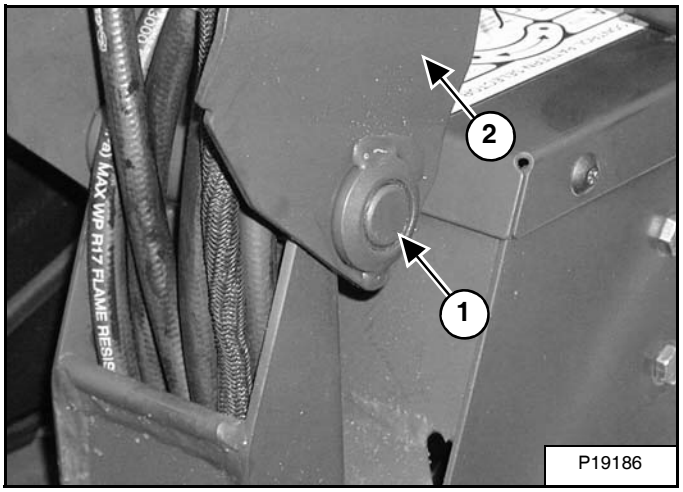
Disconnect the wire harness (Item 1) and remove the hoses (Item 2) **[Figure 40-60-25]** from the control lever (joystick).

Figure 40-60-26



Drive the roll pin (Item 1) **[Figure 40-60-26]** through the pivot shaft towards the back of the console base.

Figure 40-60-27

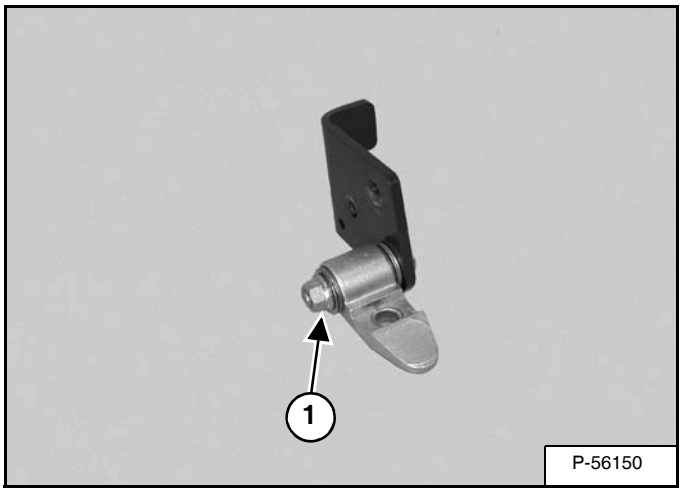


Drive the pivot shaft (Item 1) through and remove the upper console (Item 2) **[Figure 40-60-27]**.

NOTE: Feed the hoses and wire harness through the upper console during removal to avoid hose and harness damage.

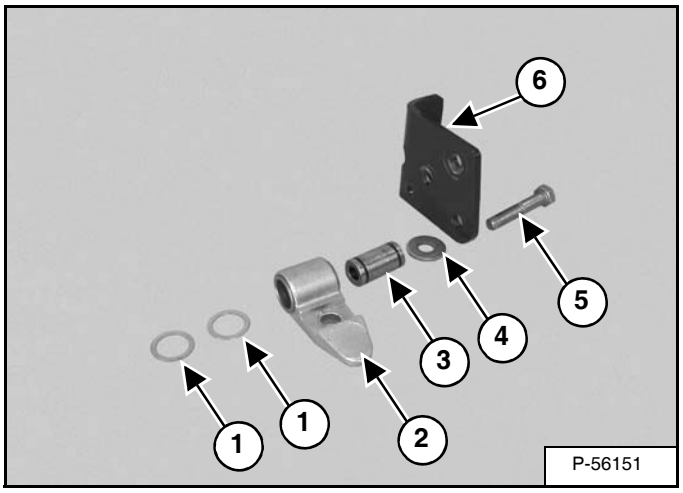
Disassembly And Assembly (Cont'd)

Figure 40-80-8



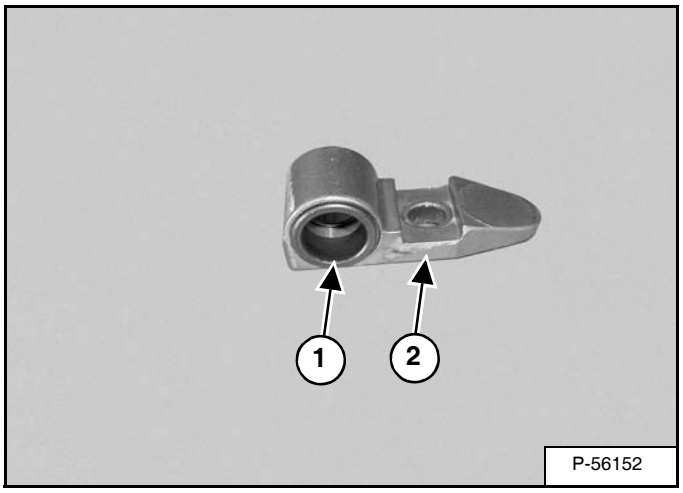
Remove the nut (Item 1) **[Figure 40-80-8]**.

Figure 40-80-9



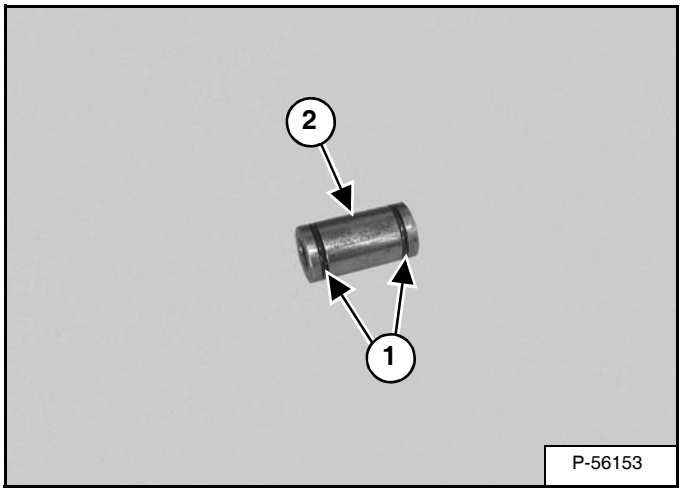
Remove the washers (Item 1), bellcrank (Item 2), sleeve (Item 3), washer (Item 4) and bolt (Item 5) from the pivot mount (Item 6) **[Figure 40-80-9]**.

Figure 40-80-10



Remove the bushing (Item 1) from the bellcrank (Item 2) **[Figure 40-80-10]**. (Both Sides)

Figure 40-80-11



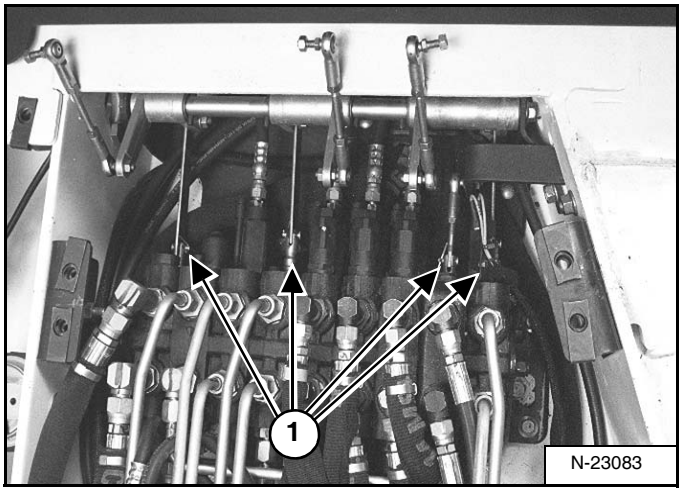
Remove the O-rings (Item 1) from the sleeve (Item 2) **[Figure 40-80-11]**.

CONTROL LINKAGE ASSEMBLY

Removal And Installation

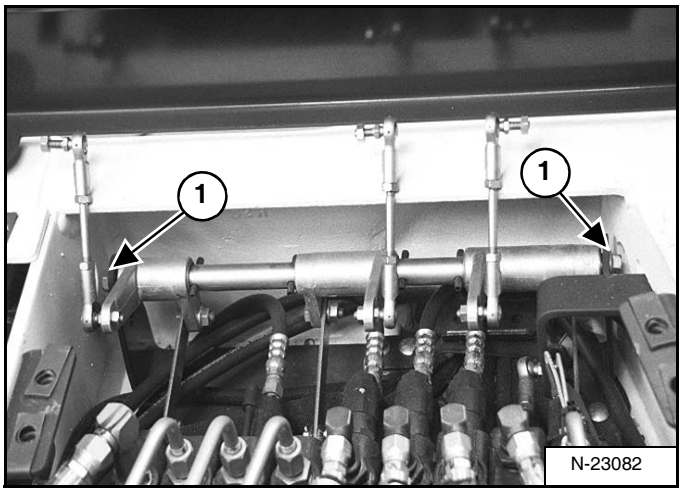
Remove the floormat and floorplates. (See Removal and Installation on Page 40-120-1.)

Figure 40-110-1



Remove the cotter pins and clevis pins (Item 1) **[Figure 40-110-1]** from the clevis at the control valve.

Figure 40-110-2



Remove the bolts (Item 1) **[Figure 40-110-2]** from the control linkage assembly mounting brackets by accessing the bolt heads through the clearance holes in the side frame.

Remove the control linkage assembly from the Excavator.

FUEL TANK

Removal and Installation

Open the tailgate.

Remove the muffler. (See Removal And Installation on Page 60-20-1.)

Remove the hydraulic reservoir. (See Removal and Installation on Page 20-130-1.)

Remove the hydraulic filter bracket assembly. (See Removal and Installation on Page 20-120-1.)

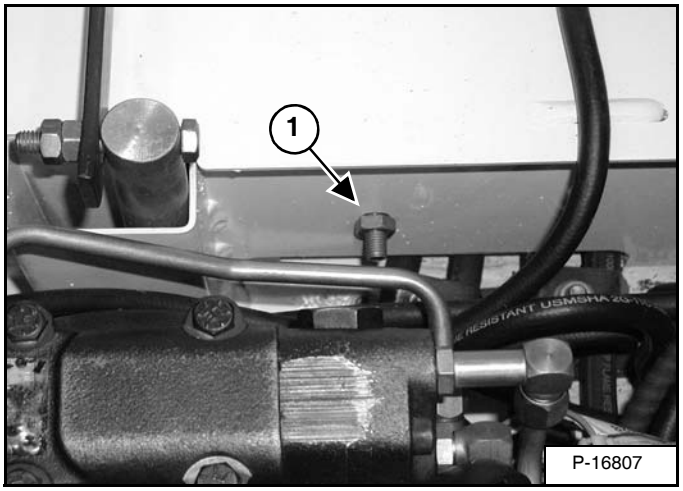
Remove the engine. (See Removal and Installation on Page 60-60-1.)

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

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

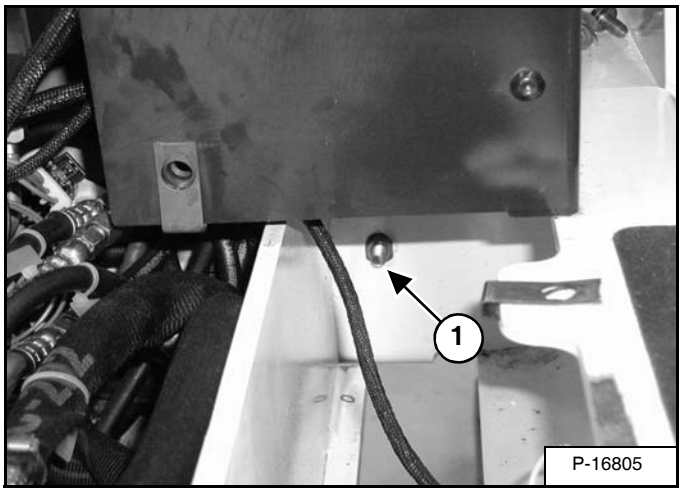
Remove the blade extension tray. (See Removal And Installation on Page 40-210-1.)

Figure 40-130-1



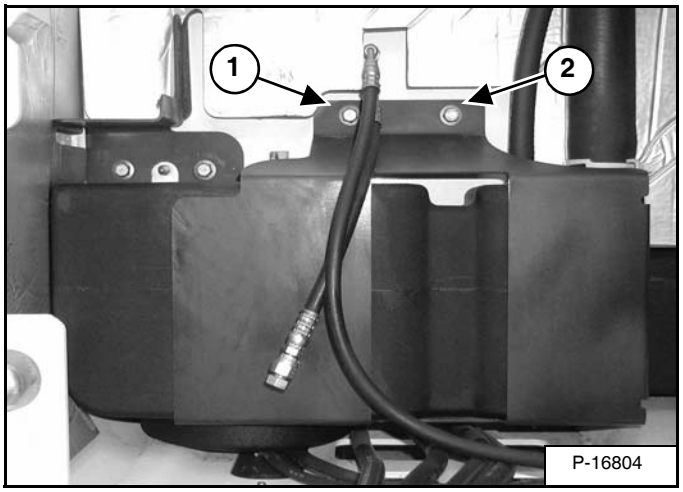
Remove the nut (Item 1) **[Figure 40-130-1]** from the fuel tank mounting bolt behind the swing motor.

Figure 40-130-2



Remove the nut (Item 1) **[Figure 40-130-2]** from the fuel tank mounting bolt under the left console.

Figure 40-130-3



Remove the short bolt (Item 1) and the long bolt (Item 2) **[Figure 40-130-3]** from the fuel tank mounting bracket.

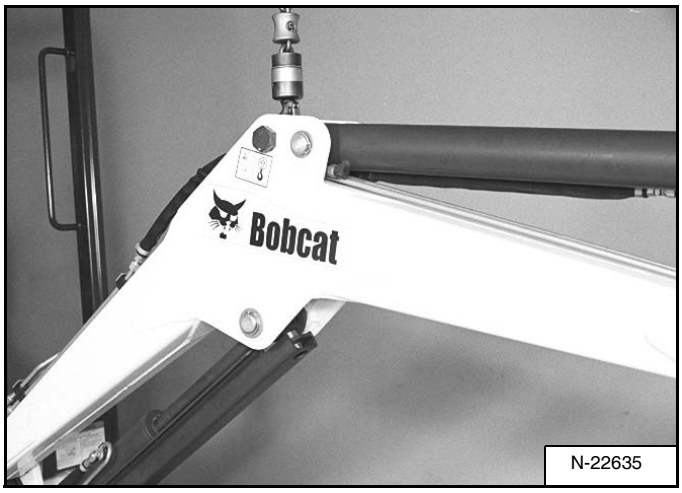
BOOM

Removal And Installation

Remove the bucket. (See Removal And Installation on Page 40-180-1.)

Remove the arm. (See Removal And Installation on Page 40-170-1.)

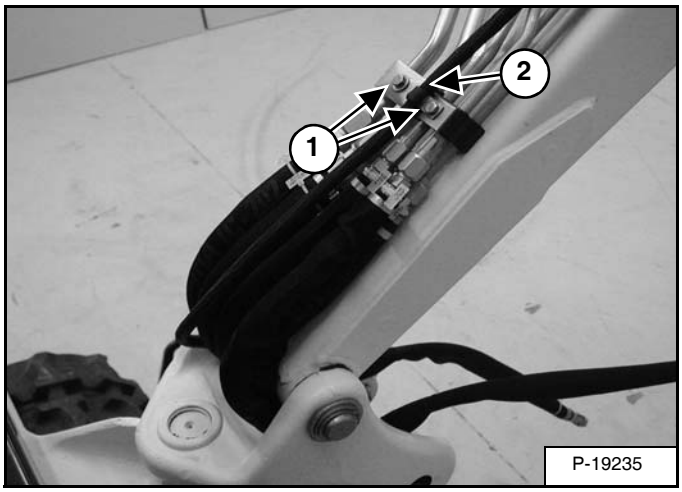
Figure 40-160-1



Install a chain hoist on the boom **[Figure 40-160-1]**.

Remove the boom cylinder. (See Removal and Installation on Page 20-20-3.)

Figure 40-160-2

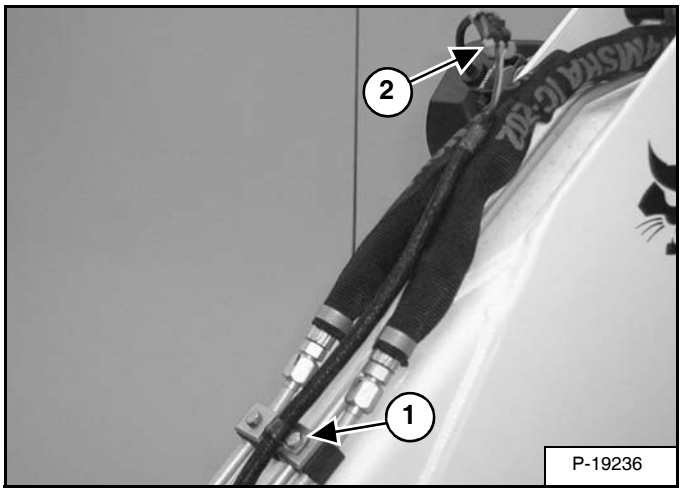


Remove the bolts (Item 1) and the retainer plates. Remove the wire harness (Item 2) **[Figure 40-160-2]** from the retainer.

Mark the hoses for ease of assembly.

Remove the six hoses from the tubes **[Figure 40-160-2]**.

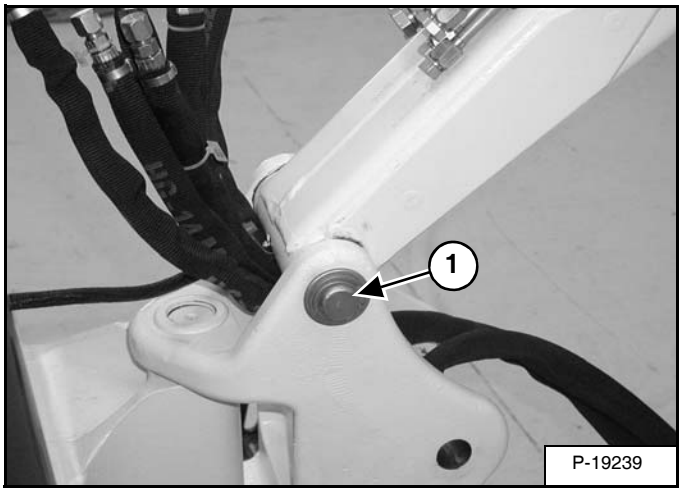
Figure 40-160-3



Remove the bolt (Item 1) **[Figure 40-160-3]** and wire harness clamp.

Disconnect the wire connector (Item 2) **[Figure 40-160-3]**.

Figure 40-160-4



Remove the snap ring and washer (Item 1) **[Figure 40-160-4]** from the boom pivot pin.

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.

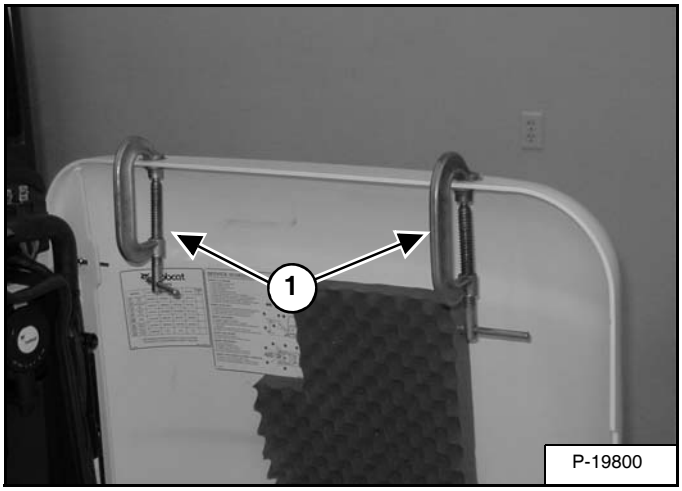
I-2003-0888

TAILGATE

Removal And Installation

Open the tailgate.

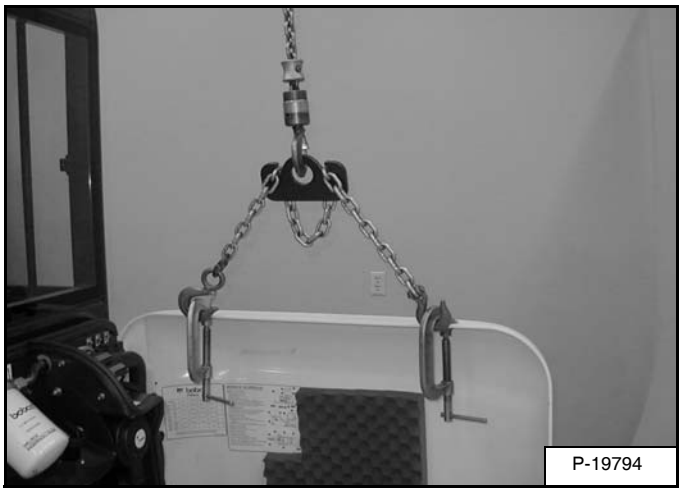
Figure 40-190-1



Install and tighten two c-clamps (Item 1) **[Figure 40-190-1]** equally spaced from the sides on the top of the tailgate.

NOTE: To prevent paint damage use rubber pads on the c-clamps.

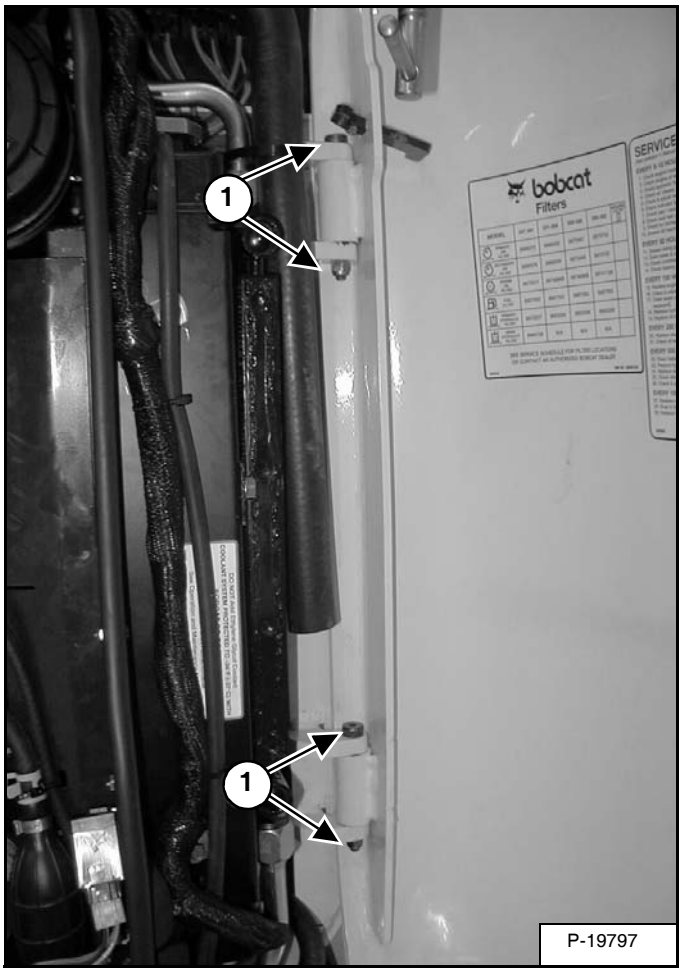
Figure 40-190-2



Install chains to the c-clamps and chain hoist **[Figure 40-190-2]**.

NOTE: Use a lifting device of sufficient capacity. Approximate weight of the tailgate is 160 lbs. (352 kg).

Figure 40-190-3

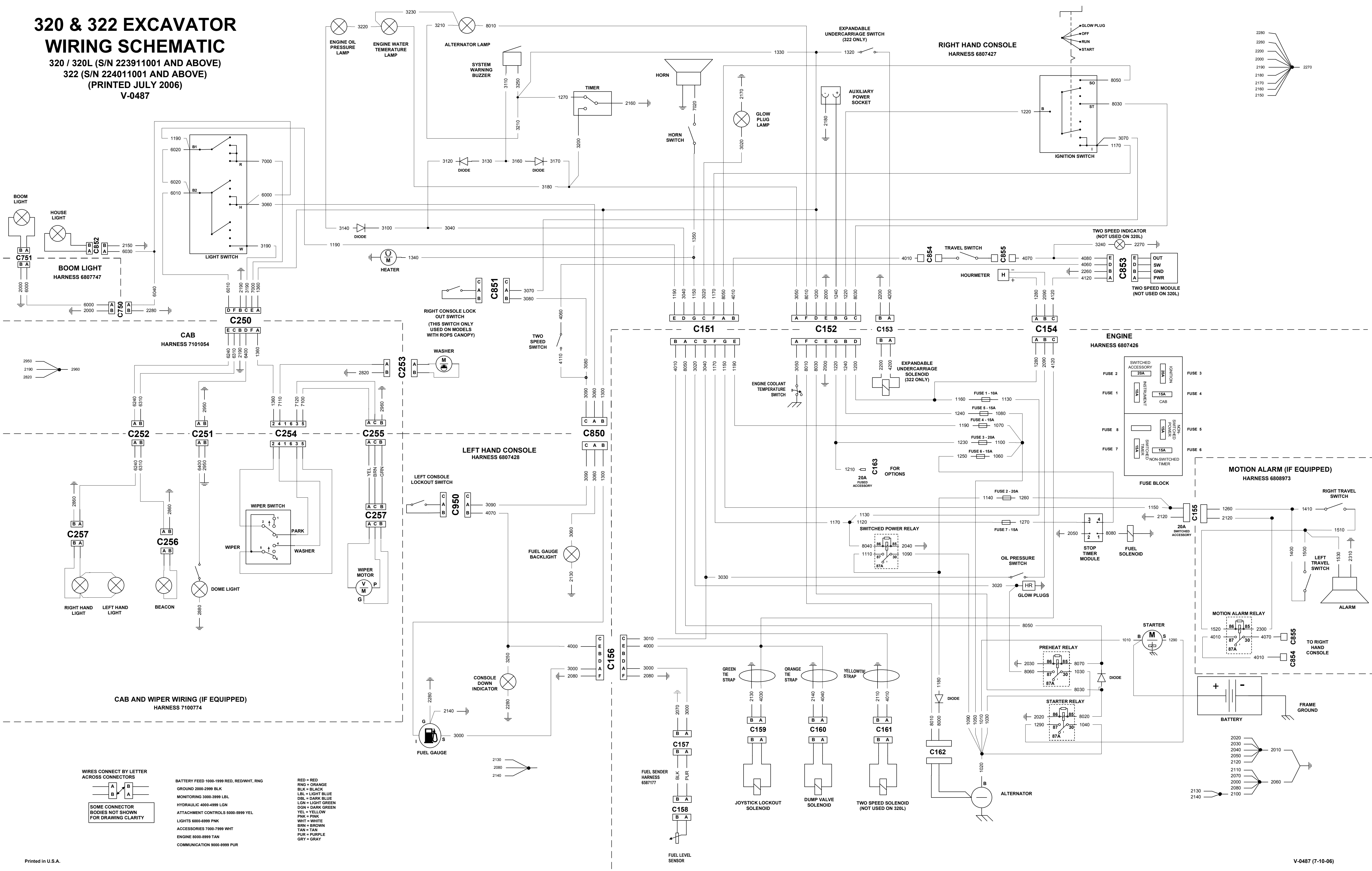


Remove the nuts and bolts (Item 1) **[Figure 40-190-3]** from the hinges.

Remove the tailgate from the Excavator.

320 & 322 EXCAVATOR WIRING SCHEMATIC

320 / 320L (S/N 223911001 AND ABOVE)
322 (S/N 224011001 AND ABOVE)
(PRINTED JULY 2006)
V-0487



ENGINE OIL PRESSURE LAMP
ENGINE WATER TEMERATURE LAMP
ALTERNATOR LAMP
SYSTEM WARNING BUZZER
TIMER
HORN
HORN SWITCH
GLOW PLUG LAMP
AUXILIARY POWER SOCKET
EXPANDABLE UNDERCARRIAGE SWITCH (322 ONLY)
RIGHT HAND CONSOLE
HARNESS 6807427
GLOW PLUG
OFF
RUN
START
IGNITION SWITCH
LIGHT SWITCH
BOOM LIGHT
HOUSE LIGHT
BOOM LIGHT
HARNESS 6807747
DIODE
HEATER
TRAVEL SWITCH
TWO SPEED INDICATOR (NOT USED ON 320L)
HOURMETER
TWO SPEED MODULE (NOT USED ON 320L)
RIGHT CONSOLE LOCK OUT SWITCH (THIS SWITCH ONLY USED ON MODELS WITH ROPS CANOPY)
TWO SPEED SWITCH
CAB
HARNESS 7101054
WASHER
C250
C751
C750
C852
C851
C253
C151
C152
C153
C154
C853
C854
C855
ENGINE
HARNESS 6807426
EXPANDABLE UNDERCARRIAGE SOLENOID (322 ONLY)
ENGINE COOLANT TEMPERATURE SWITCH
FUSE BLOCK
C252
C251
C254
C255
C850
LEFT HAND CONSOLE
HARNESS 6807428
FOR OPTIONS
C163
MOTION ALARM (IF EQUIPPED)
HARNESS 6808973
LEFT CONSOLE LOCKOUT SWITCH
C950
WIPER SWITCH
PARK
WASHER
WIPER
C257
C256
WIPER MOTOR
RIGHT HAND LIGHT
LEFT HAND LIGHT
BEACON
DOME LIGHT
FUEL GAUGE BACKLIGHT
SWITCHED POWER RELAY
STOP TIMER MODULE
FUEL SOLENOID
OIL PRESSURE SWITCH
GLOW PLUGS
C155
RIGHT TRAVEL SWITCH
LEFT TRAVEL SWITCH
ALARM
MOTION ALARM RELAY
TO RIGHT HAND CONSOLE
STARTER
PREHEAT RELAY
STARTER RELAY
BATTERY
FRAME GROUND
C156
CONSOLE DOWN INDICATOR
CAB AND WIPER WIRING (IF EQUIPPED)
HARNESS 7100774
FUEL GAUGE
GREEN TIE STRAP
ORANGE TIE STRAP
YELLOWTIE STRAP
C159
C160
C161
C157
C158
C162
JOYSTICK LOCKOUT SOLENOID
DUMP VALVE SOLENOID
TWO SPEED SOLENOID (NOT USED ON 320L)
FUEL SENDER HARNESS 6587177
FUEL LEVEL SENSOR
ALTERNATOR

WIRES CONNECT BY LETTER ACROSS CONNECTORS

SOME CONNECTOR BODIES NOT SHOWN FOR DRAWING CLARITY

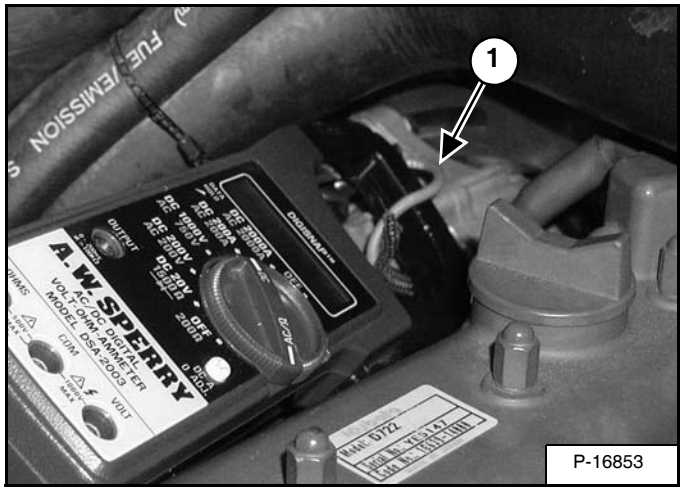
BATTERY FEED 1000-1999 RED, RED/WHT, RNG
GROUND 2000-2999 BLK
MONITORING 3000-3999 LBL
HYDRAULIC 4000-4999 LGN
ATTACHMENT CONTROLS 5000-5999 YEL
LIGHTS 6000-6999 PNK
ACCESSORIES 7000-7999 WHT
ENGINE 8000-8999 TAN
COMMUNICATION 9000-9999 PUR

RED = RED
RNG = ORANGE
BLK = BLACK
LBL = LIGHT BLUE
DBL = DARK BLUE
LGN = LIGHT GREEN
DGN = DARK GREEN
YEL = YELLOW
PNK = PINK
WHT = WHITE
BRN = BROWN
TAN = TAN
PUR = PURPLE
GRY = GRAY

Alternator Output Test

Check the battery and battery connections. (See BATTERY on Page 50-20-1.)

Figure 50-30-13



Use an induction meter and loop around the positive (+) wire (Item 1) **[Figure 50-30-13]** at the alternator.

Start the engine and run at full RPM.

The ammeter reading should be between 35 and 40 amps.

If the ammeter reading is less than 35 amps do the full field test.

⚠ WARNING

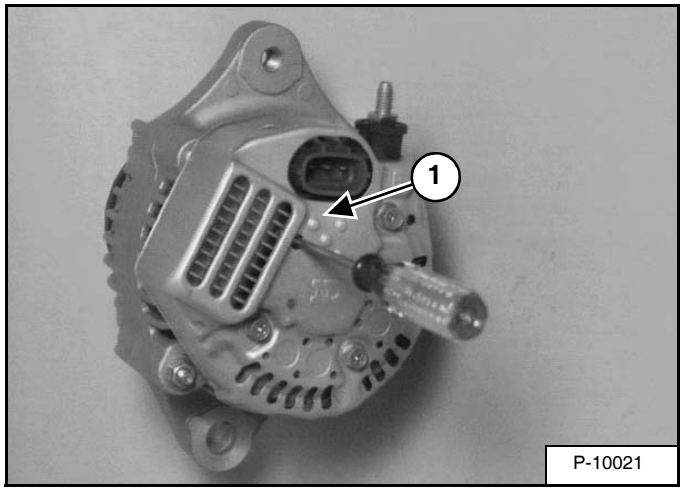
When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-1285

Full Field Test

Start the engine and run at full RPM.

Figure 50-30-14



Place a small screw driver in the test port (Item 1) **[Figure 50-30-14]** to provide a ground to the alternator case. This will give maximum amperage output from the alternator.

NOTE: The Full Field Test should only last long enough to get ammeter reading to prevent damage to the alternator.

The ammeter reading should be above 35 amps.

If the ammeter reading is low, repair or replace the alternator.

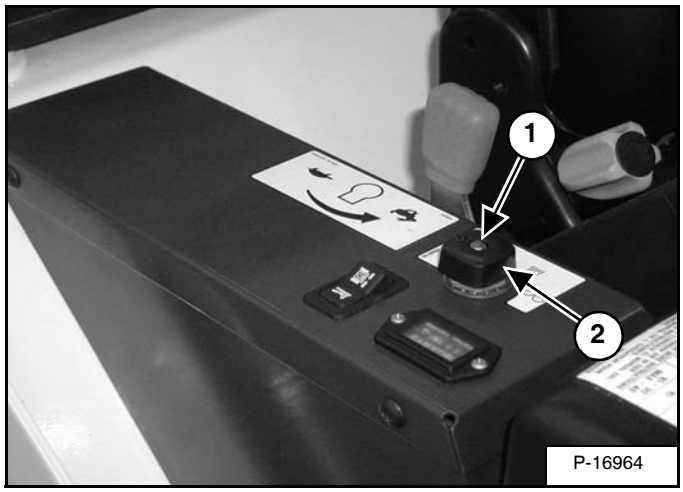
⚠ WARNING

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-1285

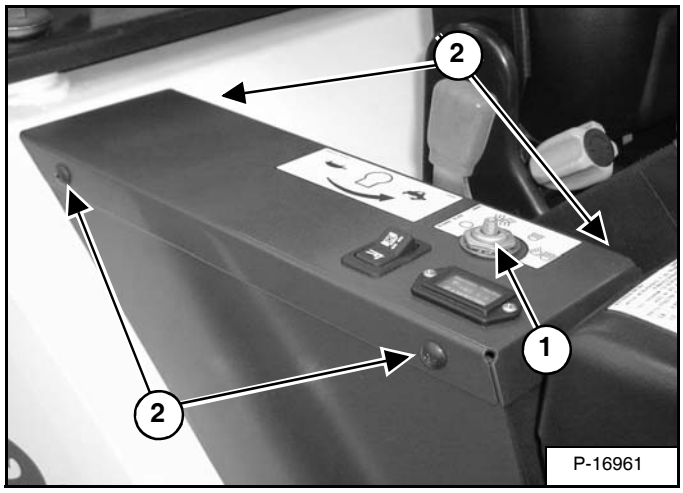
Light Switch Removal And Installation

Figure 50-50-13



Remove the screw (Item 1) and knob (Item 2) **[Figure 50-50-13]** from the switch.

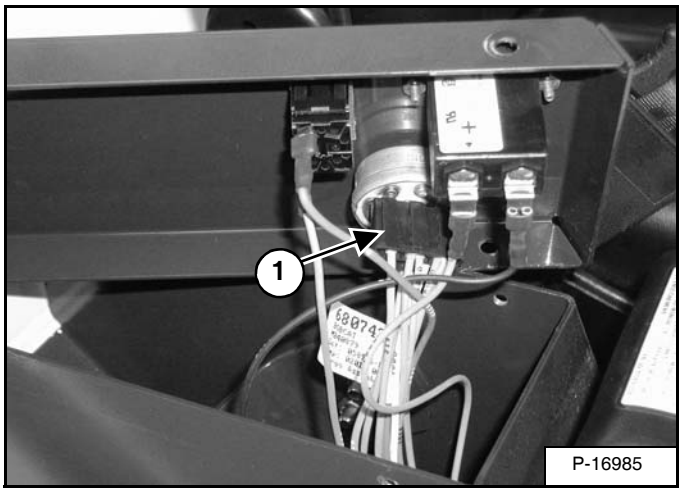
Figure 50-50-14



Remove the nut and lock washer (Item 1) **[Figure 50-50-14]** from the switch.

Remove the four screws (Item 2) **[Figure 50-50-14]** from the cover panel.

Figure 50-50-15



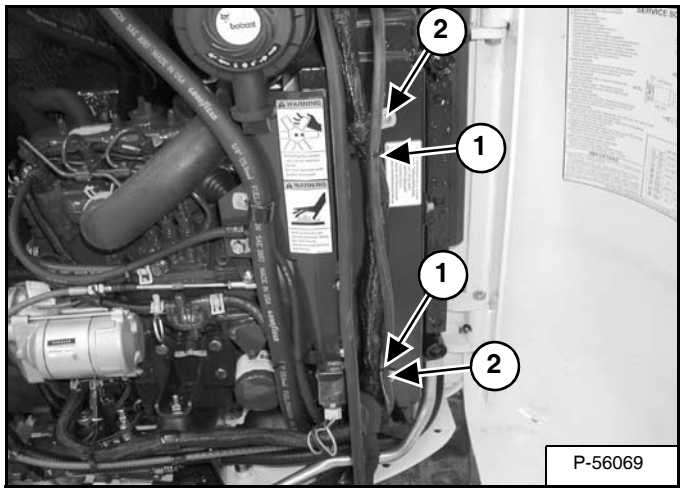
Disconnect the wire harness (Item 1) **[Figure 50-50-15]** from the switch.

Remove the switch from the bottom of the panel.

Continued On Next Page

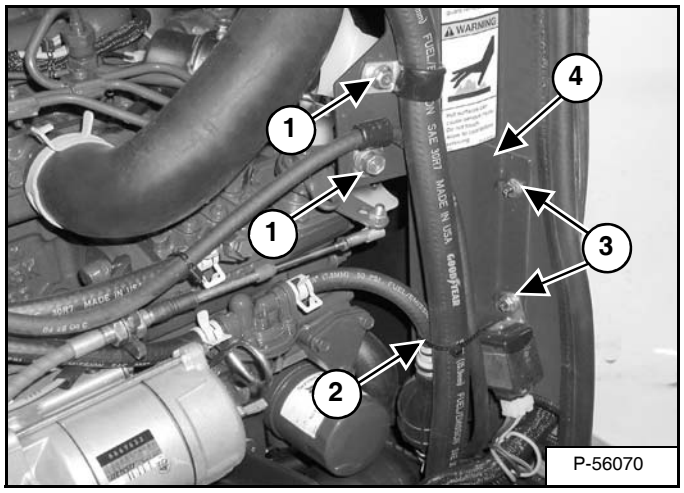
Removal And Installation (Cont'd)

Figure 60-40-4



Remove the tie straps (Item 1) and bolts (Item 2) **[Figure 60-40-4]** fastening the wire harness to the radiator.

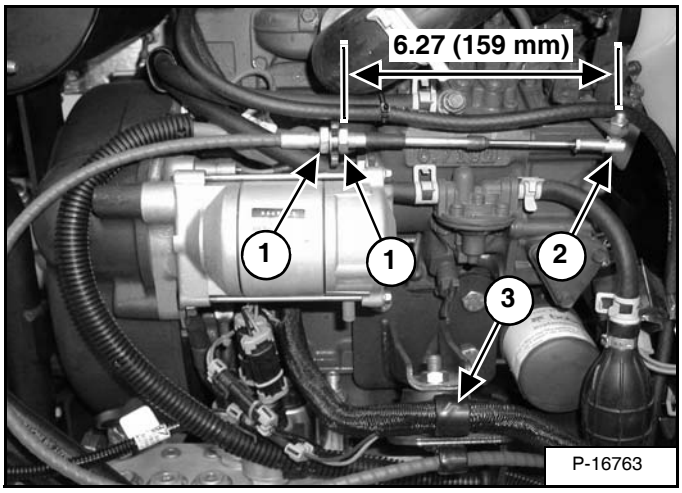
Figure 60-40-5



Remove the bolts (Item 1) and tie strap (Item 2) **[Figure 60-40-5]** on the fan guard.

Remove the nuts (Item 3) and remove the fan guard (Item 4) **[Figure 60-40-5]**.

Figure 60-40-6



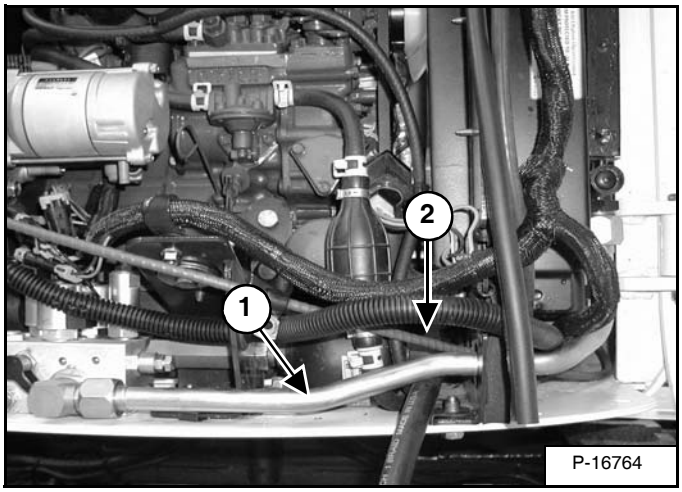
Loosen the nuts (Item 1) **[Figure 60-40-6]** fastening the cable to the bracket.

Disconnect the linkage (Item 2) **[Figure 60-40-6]** from the bracket.

Remove the nut and cable clamp (Item 3) **[Figure 60-40-6]** from the engine mount.

Installation: The linkage measurement from bracket to the center of the ball joint is 6.27 inches (159 mm).

Figure 60-40-7

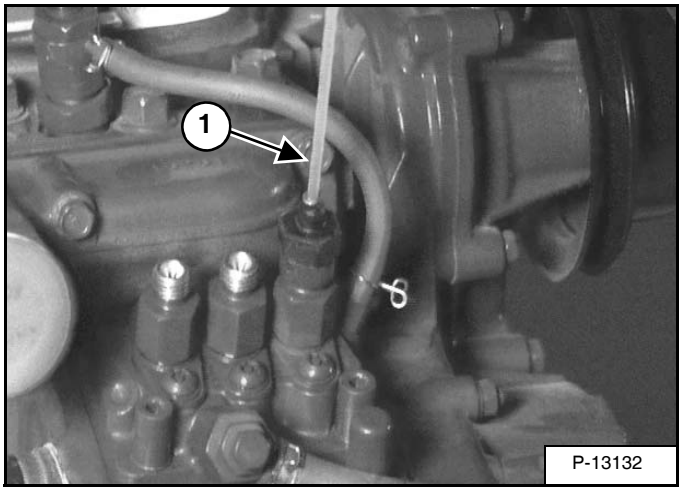


Remove the tubeline (Item 1) **[Figure 60-40-7]** from the manifold assembly to the oil cooler. Remove the tubeline by pulling the tubeline through the radiator bracket from the engine side of the radiator.

Push the engine speed control cable (Item 2) **[Figure 60-40-7]** through the radiator bracket towards the tailgate. Move the cable to the side.

Fuel Injection Pump Timing (Cont'd)

Figure 60-50-13



Install a short plastic tube (Item 1) **[Figure 60-50-13]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

NOTE: The fuel must be in the tube before attempting timing.

Move the fuel lever on the injection pump to full fuel position (or full throttle).

Turn the flywheel clockwise slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-50-13]**.

At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-50-13]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 20-22° B.T.D.C.

Figure 60-50-14

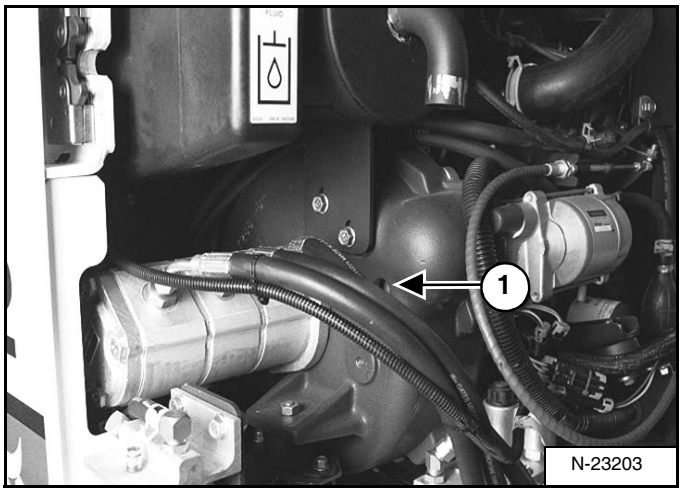
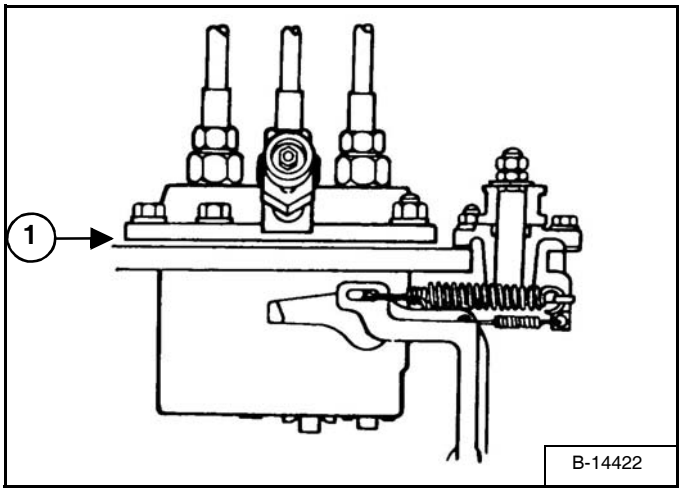


Figure 60-50-15



The correct engine timing for all Kubota D722-B(E) engines is 20-22° B.T.D.C. Add or subtract shims (Item 1) **[Figure 60-50-14]** to time the engine to 20-22° B.T.D.C. The engine is correctly timed when the 20-22° B.T.D.C. mark on the flywheel is aligned with the notch in the timing hole **[Figure 60-50-15]**.

NOTE: Adding or reducing the shim thickness by 0.05 mm retards or advances the injection timing by approximately 0.5°.

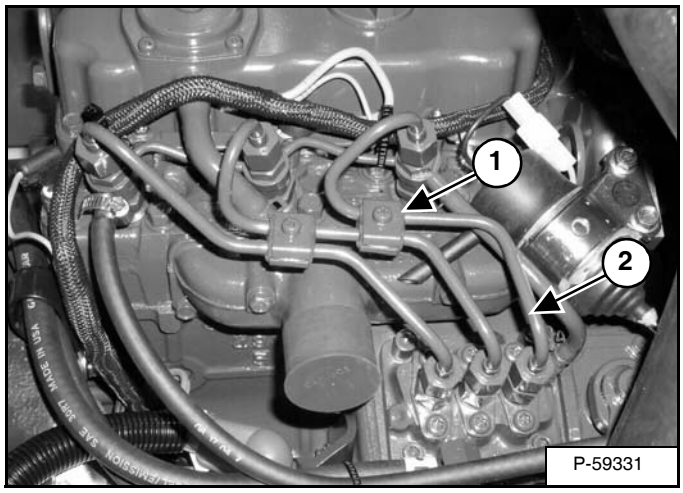
Some problems caused by faulty injector nozzles:

- The engine is hard to start or will not start.
- Rough engine operation at idle.
- The engine will not have full power.
- The engine exhaust smoke is black, white or blue.

Fuel Injection Pump Timing

Timing the injection pump is done by changing the number of shims between the injection pump and the injection pump mounting surface.

Figure 60-51-13



Remove the fuel line clamp (Item 1) **[Figure 60-51-13]**.

Remove the number one cylinder high pressure line (Item 2) **[Figure 60-51-13]** from the injection pump.

Remove the exhaust extension tube. (See Removal And Installation on Page 60-20-1.)

IMPORTANT

Do not bend the high pressure fuel injection tubes when removing or installing them.

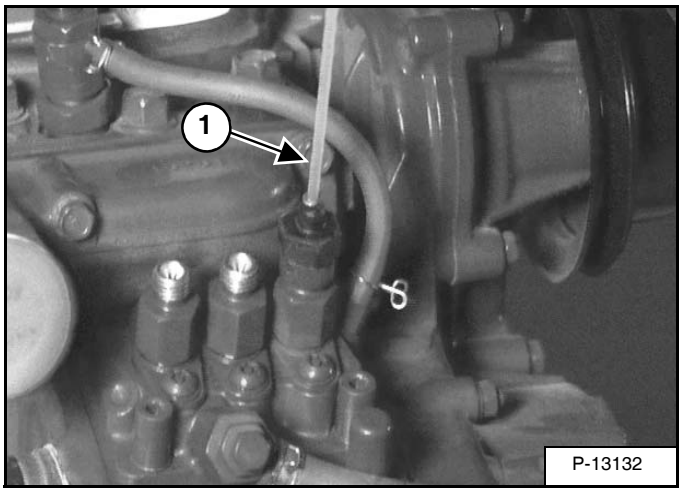
I-2029-0289

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I-2028-0289

Figure 60-51-14



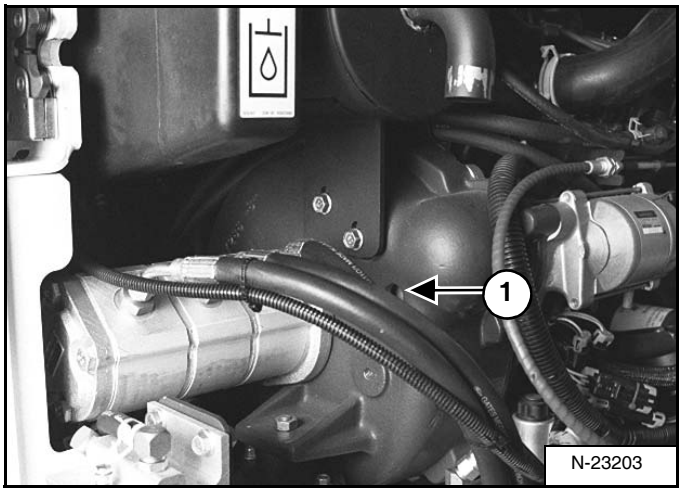
Install a short plastic tube (Item 1) **[Figure 60-51-14]** in the number one cylinder port of the injection pump. The tube should fit tight in the port and point upward.

NOTE: The fuel must be in the tube before attempting timing.

Move the fuel lever on the injection pump to full fuel position (or full throttle).

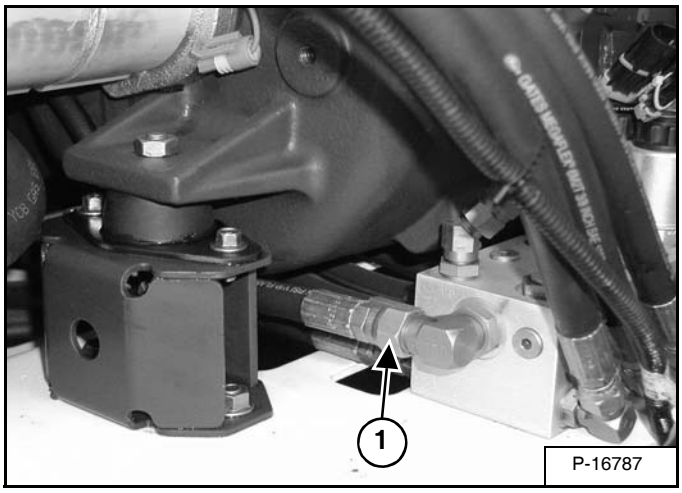
Turn the flywheel counterclockwise (facing the flywheel) slowly until the start of fuel rise in the plastic tube (Item 1) **[Figure 60-51-14]**.

Figure 60-51-15



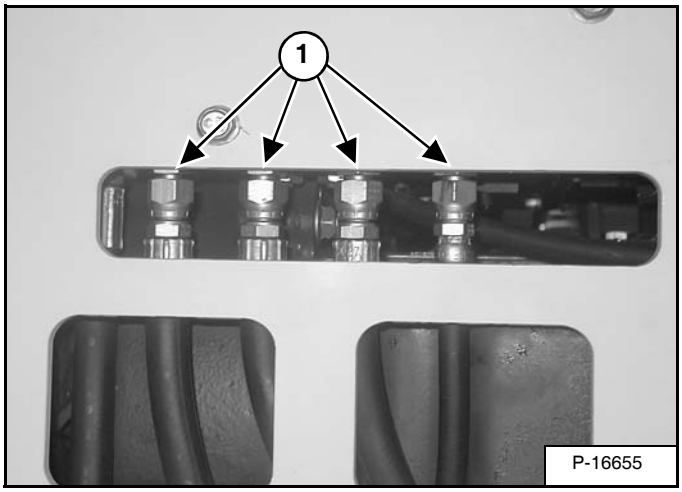
At this point look at the timing mark (located on the flywheel) for proper alignment (Item 1) **[Figure 60-51-15]**. When the timing mark is aligned as shown the timing is correct for the injection pump, which is 19-21° B.T.D.C.

Figure 60-60-18



Disconnect and cap the hose (Item 1) **[Figure 60-60-18]** on the side of the manifold assembly.

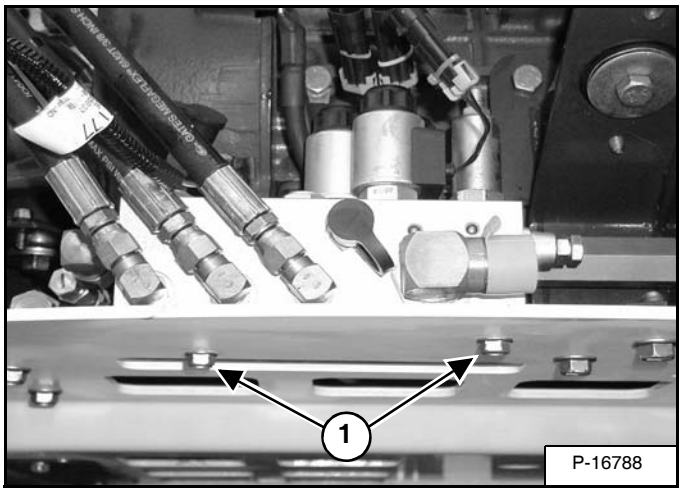
Figure 60-60-19



Mark and disconnect the four hoses (Item 1) **[Figure 60-60-19]** on the backside of the manifold assembly. Disconnect the four hoses from the underside of upperstructure.

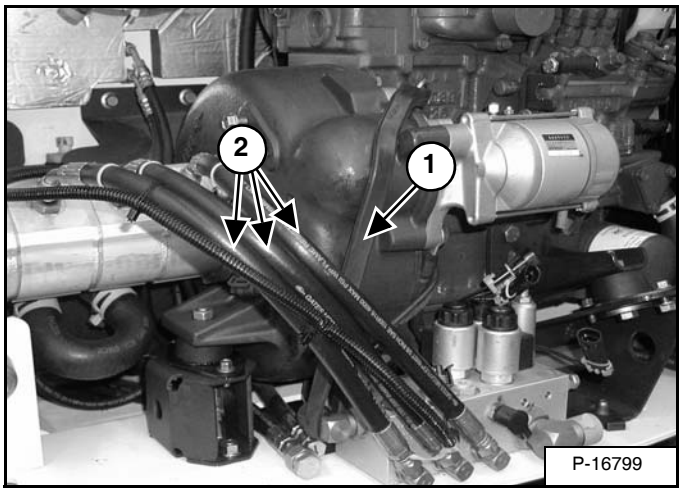
Removal and Installation (Cont'd)

Figure 60-60-20



Remove the two bolts (Item 1) **[Figure 60-60-20]** fastening the manifold assembly to the upperstructure.

Figure 60-60-21

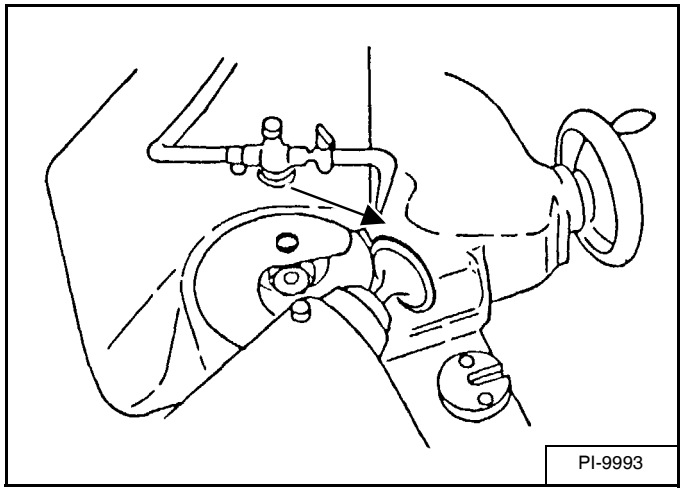


Support the end of the manifold assembly with a strap (Item 1) to the engine **[Figure 60-60-21]**.

NOTE: Manifold assembly and pump hoses (Item 2) [Figure 60-60-21] can be left assembled during engine removal.

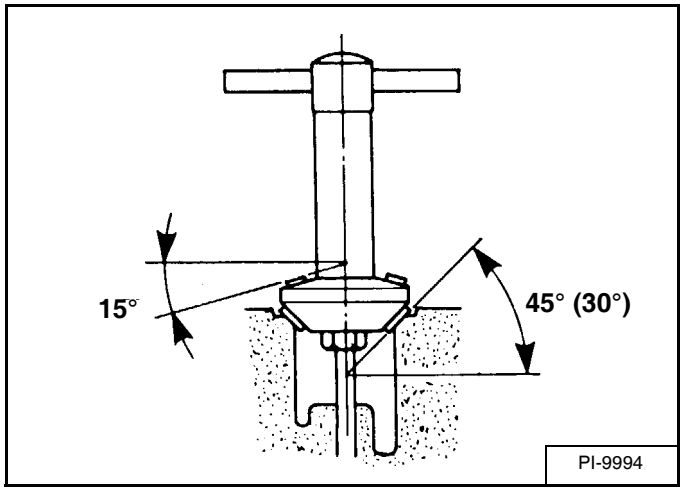
Valve And Valve Seat Reconditioning

Figure 60-80-17



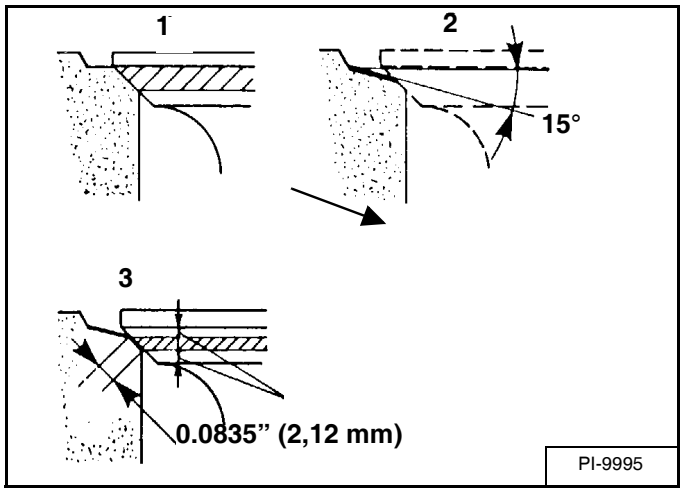
Grind the valve face to the correct angle using a valve refacer **[Figure 60-80-17]** & **[Figure 60-80-19]**.

Figure 60-80-18



Grind the valve surface in the cylinder head to the correct angle **[Figure 60-80-18]**.

Figure 60-80-19



Check the seat surface and valve face (Item 1) **[Figure 60-80-19]**.

If the seat surface is too wide, use a 15 degree cutter (Item 2) to get the correct width (Item 3) **[Figure 60-80-19]**.

Valve Seat Width

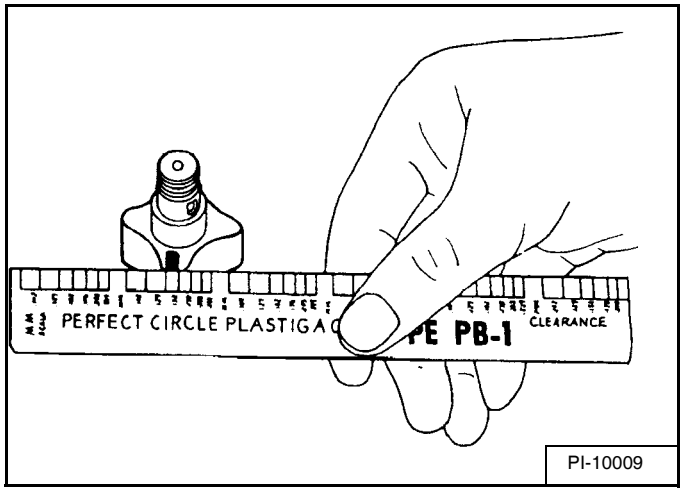
Intake	0.0835 in. (2,12 mm)
Exhaust	0.0835 in. (2,12 mm)

Valve Seat & Face Angle

Intake	45°
Exhaust	45°

Oil Pump, Service, (Cont'd)

Figure 60-80-48



Put a piece of press gauge on the rotor face **[Figure 60-80-48]**.

Install the cover and tighten the bolts.

Remove the cover carefully. Measure the width of the press gauge **[Figure 60-80-48]**.

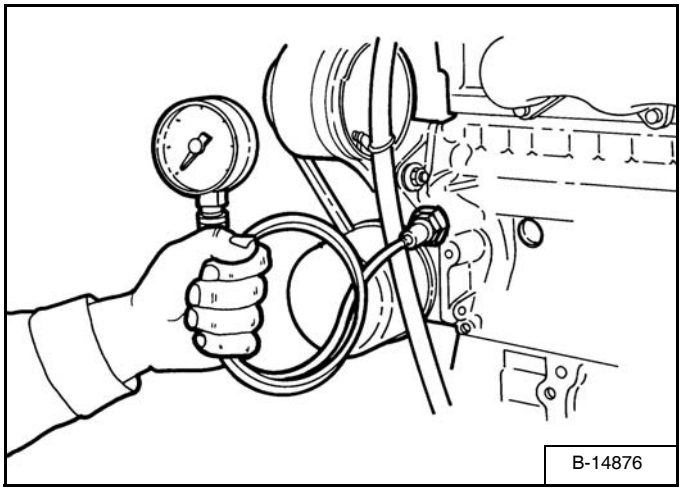
If the clearance exceeds the factory limit replace the oil pump rotor assembly.

End Clearance	0.003-0.005 in. (0,08-0,14 mm)

Engine Oil Pressure, Checking

Remove the oil pressure sensor.

Figure 60-80-49



Install a pressure gauge **[Figure 60-80-49]**.

Start the engine and run until it is at operating temperature.

Measure oil pressure at both idling and rated speeds.

If the oil pressure is less than the allowable limit, check the following item:

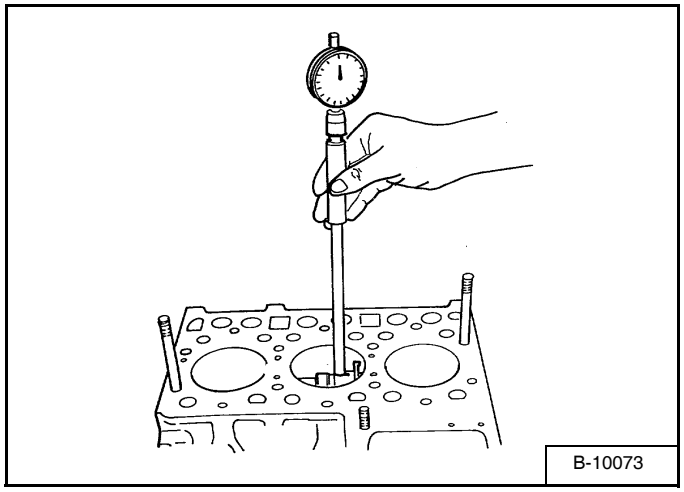
- Engine Oil Insufficient
- Oil Pump Defective
- Oil Galley Plugged
- Oil Strainer Plugged
- Excessive Oil Clearance
- Foreign Matter in Relief Valve
- Oil Filer Cartridge plugged

At Idle Speed Allowable Limit	14 PSI (1 Bar)
At Rated Speed	28-64 PSI (2-4 Bar)
Allowable Limit	14 PSI (1 Bar)

Installation: After checking engine oil pressure, tighten oil pressure sensor to 11-15 ft.-lb. (14,7-19,6 N•m).

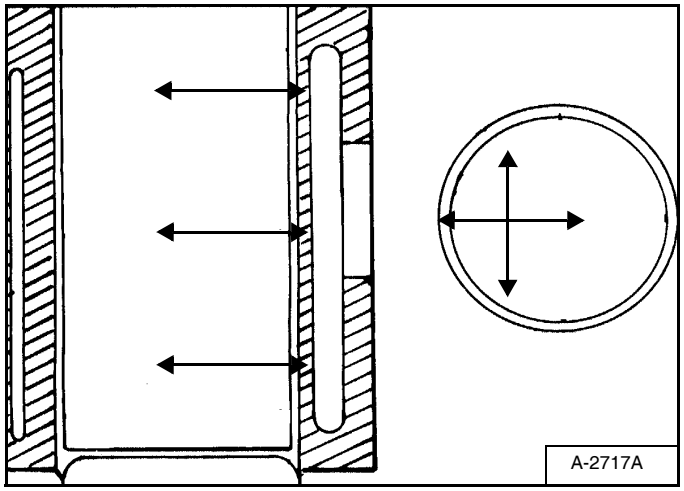
Cylinder Bore, Checking

Figure 60-80-77



Check the inside diameter of the cylinder line **[Figure 60-80-77]**.

Figure 60-80-78



To find the maximum wear check the inside diameter in six different locations **[Figure 60-80-78]**.

When the cylinder bore is not within specifications, bore and hone the cylinder for an oversize piston.

Cylinder Bore I.D.	2.638-2.639 in. (67,0-67,02 mm)
Allowable Limit	0.006 in. (0,15 mm)

NOTE: Make sure you use the correct oversize pistons and rings.

Water Pump Removal And Installation

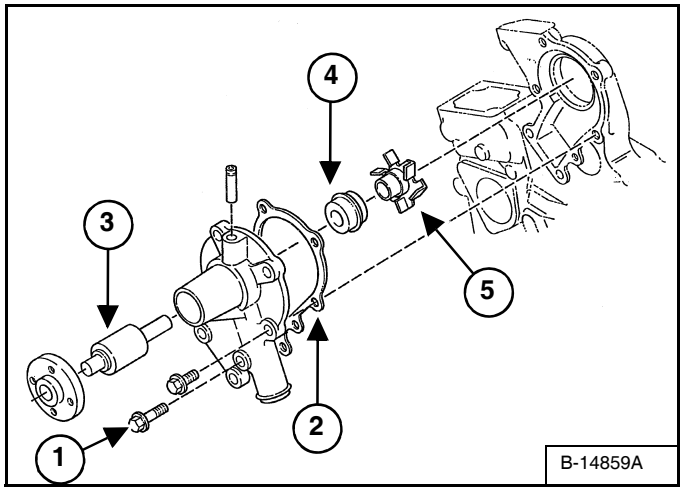
Drain the cooling system.

Remove the radiator. (See Removal And Installation on Page 60-40-1.)

Remove the alternator belt.

Remove the fan.

Figure 60-80-79



Remove the water pump bolts (Item 1) **[Figure 60-80-79]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-80-79]** when installing the water pump and apply Liquid-Type Gasket (Three Bond 1215 or equivalent) to both sides of new gasket.

Water Pump Disassembly And Assembly

Put the water pump in a vise.

Remove the pulley.

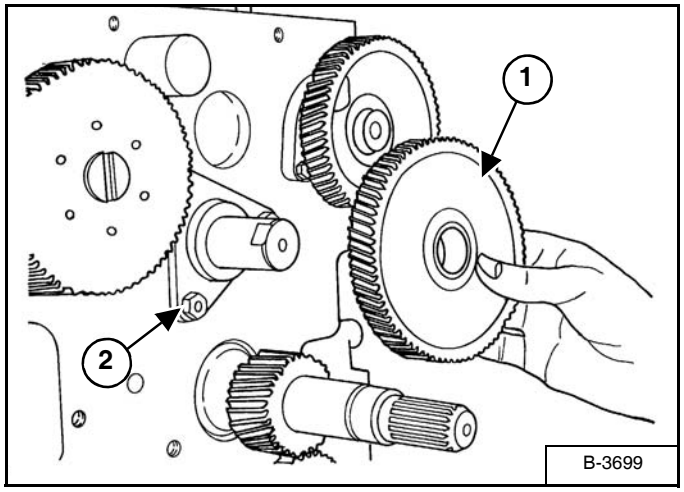
Press the shaft (Item 3) **[Figure 60-80-79]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-80-79]**.

Install a new seal when assembling the water pump.

Idler Gear And Camshaft Removal And Installation (Cont'd)

Figure 60-81-31

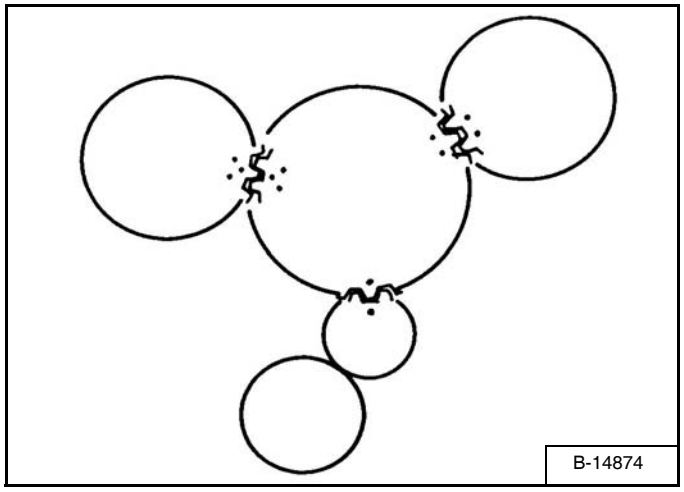


Remove the idler gear (Item 1) **[Figure 60-81-31]**.

Remove idler gear mounting screws (Item 2) **[Figure 60-81-31]**.

Installation: Tighten screws to 7-8 ft.-lb. (10-11 N•m) torque.

Figure 60-81-32

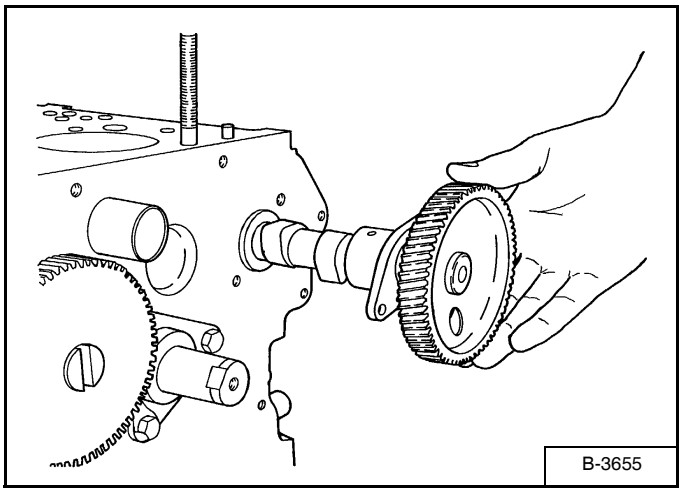


Installation: Make sure the timing marks are in correct alignment when installing the timing gears **[Figure 60-81-32]**.

Align the holes on the camshaft gear with the camshaft retainer plate bolts.

Remove the bolts.

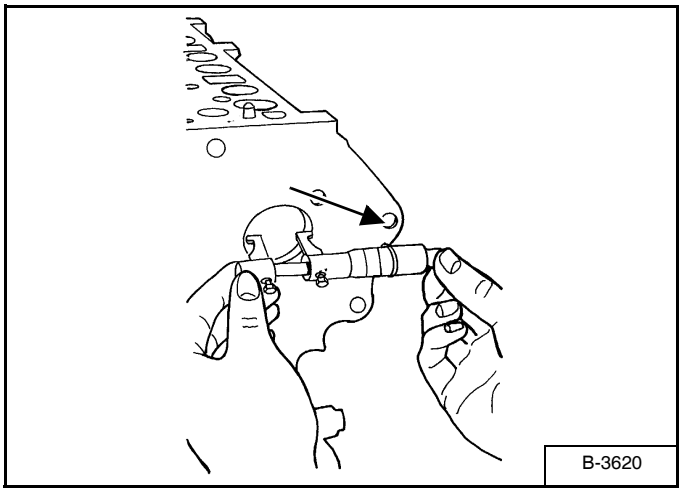
Figure 60-81-33



Remove the camshaft from the engine block **[Figure 60-81-33]**.

Installation: Tighten the camshaft retainer bolts to 14-15 ft.-lb. (18-21 N•m) torque.

Figure 60-81-34



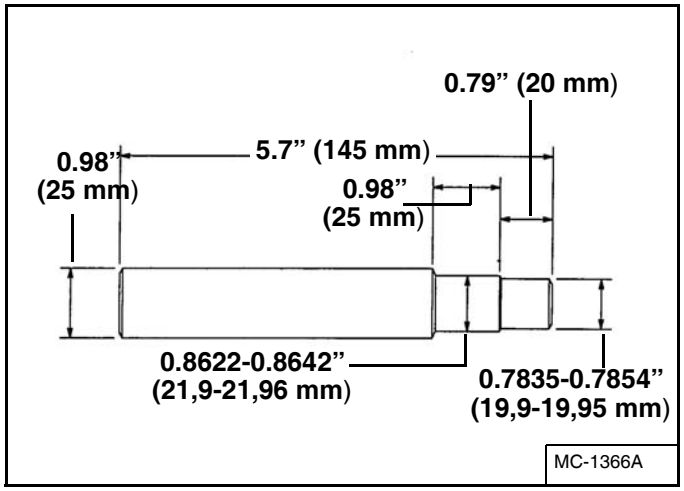
Measure the camshaft bearing in the engine block **[Figure 60-81-34]**.

Piston And Connecting Rod, Servicing (Cont'd)

Calculate the oil clearance. If the clearance exceeds the allowable limit, replace the bushing. If it still exceeds the specifications, replace the piston pin.

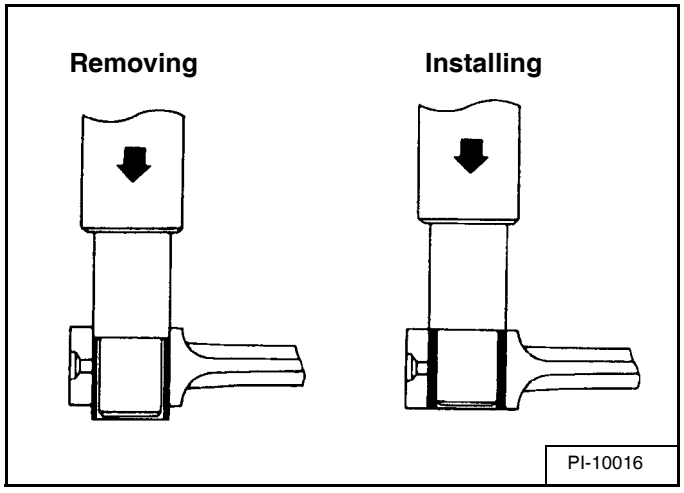
Piston Pin O.D.	0.7875-0.7878 in. (20,002-20,011 mm)
Bushing I.D.	0.7884-0.7890 in. (20,025-20,04 mm)
Oil Clearance between Piston Pin & Bushing	0.0006-0.0015 in. (0,014-0,038 mm)
Allowable Limit	0.004 in. (0,10 mm)

Figure 60-81-60



To replace the connecting rod small end bushing, make a driver tool as shown in figure **[Figure 60-81-60]**.

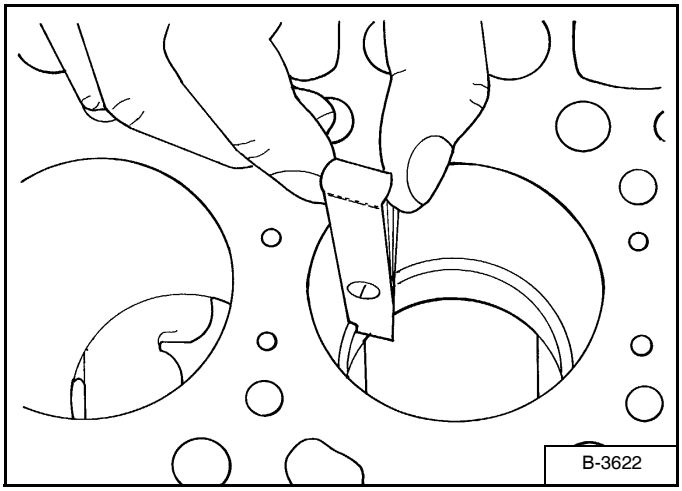
Figure 60-81-61



Use a press and special driver tool to remove the small end bushing **[Figure 60-81-61]**.

Installation: Clean the small end bushing and bore. Put oil on the bushing and press into the connecting rod until it is flush **[Figure 60-81-61]**.

Figure 60-81-62



Install a new piston ring into the lower part of the cylinder bore. Measure the ring gap with a feeler gauge **[Figure 60-81-62]**.

If the gap exceeds the allowable limit, replace the piston ring.

Top Compression Ring & Oil Ring	0.006-0.012 in. (0,15-0,30 mm)
Second Compression Ring	0.012-0.018 in. (0,30-0,45 mm)
Allowable Limit	0.047 in. (1,2 mm)


Bobcat®

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Valve Springs

Free Length	1.244 (31,6)
Allowable Limit	1.118 (28,4)
Fitted Length	1.063 (27)
Compress to Fitted Length	14.6 lb. (65 N)
Allowable Limit	12.3 lb. (55 N)
Inclination Allowable Limit	0.047 (1,2)

Rocker Arms

O.D. of Rocker Arm Shaft	0.4123 - 0.4128 (10,47 - 10,48)
I.D. of Rocker Arm	0.4134 - 0.4141 (10,5 - 10,52)
Clearance Between Rocker Arm & Shaft	0.0006 - 0.0018 (0,016 - 0,045)
Allowable Limit	0.006 (0,15)

Camshaft

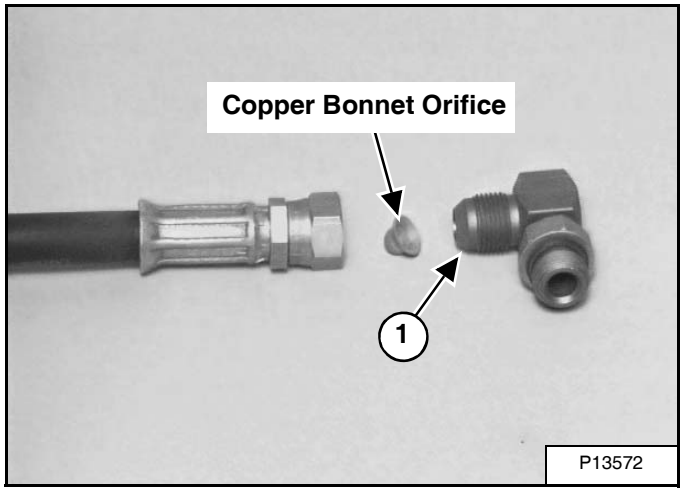
Journal O.D.	1.2966 - 1.2972 (32,93 - 32,95)
Bearing I.D.	1.2992 - 1.3002 (32,99 - 33,025)
Oil Clearance	0.002 - 0.004 (0,05 - 0,91)
Allowable Limit	0.006 (0,15)
Alignment Allowable Limit	0.0004 (0,01)
Cam Lobe Height	1.0583 (26,88)
Allowable Limit	1.056 (26,83)
End Clearance	0.002 - 0.005 (0,047 - 0,123)
Allowable Limit	0.006 (0,15)

O-ring Flare Fitting (Cont'd)

NOTE: O-ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

Do not use a O-ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

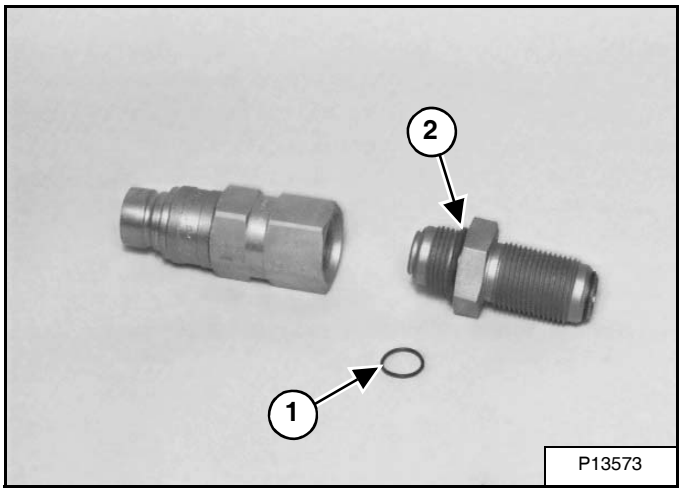
Figure SPEC-40-6



Use a standard flare fitting (Item 1) **[Figure SPEC-40-6]** as shown.

When a O-ring flare fitting is used as a straight thread port adapter the O-ring flare face is not used to seal. The O-ring may come off the fitting and enter the system.

Figure SPEC-40-7



Always remove the O-ring (Item 1) **[Figure SPEC-40-7]** from the flare face as shown.

An O-ring (Item 2) **[Figure SPEC-40-7]** is added to the flat boss of the fitting to seal the connection in this application.