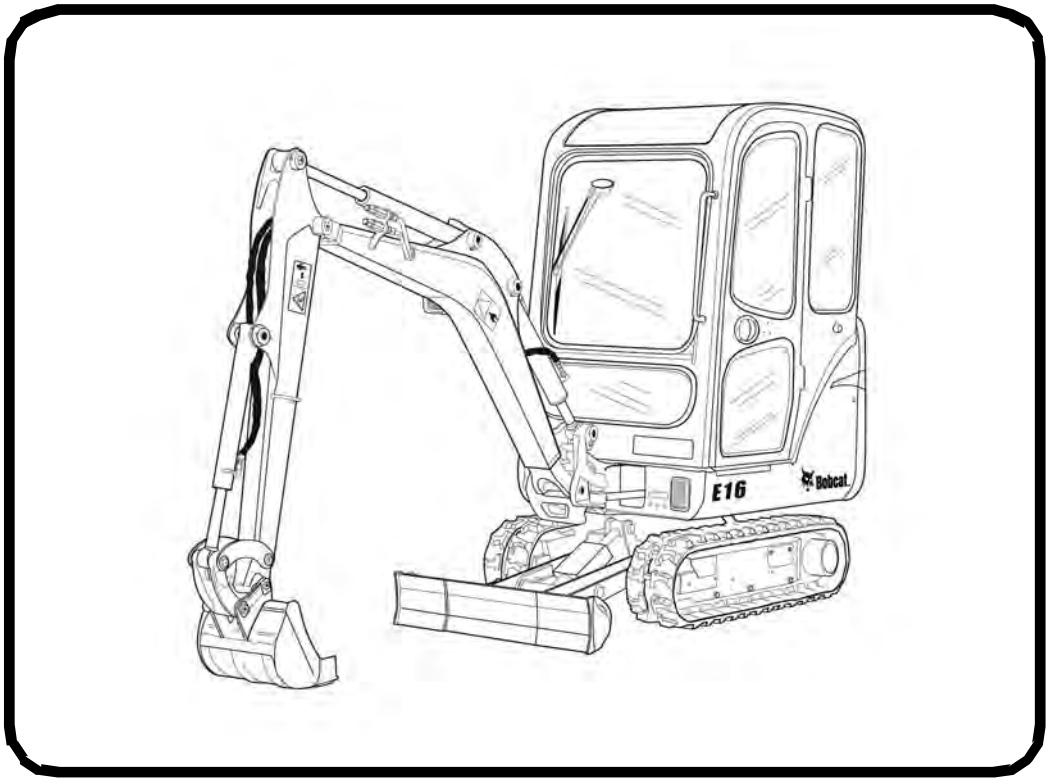
Bobcat

Service Manual
E16 Compact Excavator

S/N AHLL11001 & Above



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Printed in Belgium

Safety Alert Symbol

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

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

IMPORTANT

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

I-2019-0284

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

D-1002-1107

WARNING

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

W-2044-1107

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

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

SI EXC EMEA-0409 SM

OPERATOR CAB (ROPS / TOPS)

Description

The Bobcat excavator has an optional operator cab (ROPS / TOPS) as standard equipment to protect the operator if the excavator is tipped over. The seat belt must be worn for ROPS / TOPS protection.

Check the ROPS / TOPS cab, mounting, and hardware for damage. Never modify the ROPS / TOPS cab. Replace the cab and hardware if damaged.

ROPS / TOPS - Roll-Over Protective Structure per ISO 12117-2, and Tip-Over Protective Structure per ISO 12117.

⚠ WARNING

Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Bobcat Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

W-2069-0200

TAILGATE

Opening And Closing

⚠ WARNING

AVOID INJURY OR DEATH

Never service or adjust the machine when the engine is running unless instructed to do so in the manual.

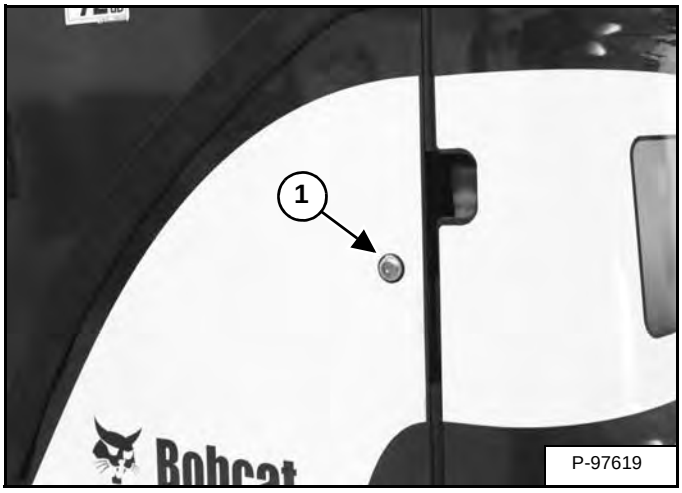
W-2012-0497

⚠ WARNING

Keep the rear door closed when operating the machine. Failure to do so could seriously injure a bystander.

W-2020-1285

Figure 10-40-1



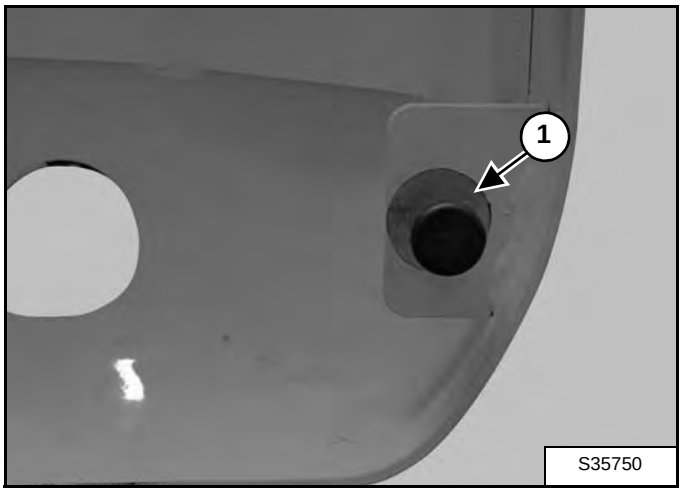
Pull the latch (Item 1) **[Figure 10-40-1]** to open the tailgate.

Push firmly to close the tailgate.

NOTE: The tailgate can be locked using the start key.

Adjusting The Bumper

Figure 10-60-1

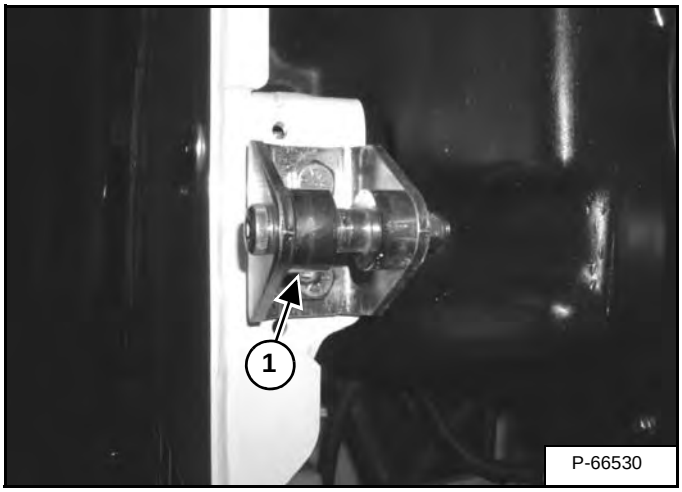


The door bumper (Item 1) **[Figure 10-60-1]** can be adjusted for alignment with the tailgate.

Close the tailgate before operating the excavator.

Adjusting The Latch

Figure 10-60-2



The tailgate latch (Item 1) **[Figure 10-60-2]** can be adjusted by loosening the two bolts, moving the latch, and tightening the two bolts.

Close the tailgate before operating the excavator.

Removing And Replacing Coolant (Cont'd)

Mix the coolant in a separate container. (See ENGINE COOLING SYSTEM on Page 10-100-1.)and (See Capacities on Page SPEC-10-9.)

NOTE: The cooling system is factory filled with propylene glycol (purple color). DO NOT mix propylene glycol with ethylene glycol.

The correct mixture of coolant to provide a -37°C (-34°F) freeze protection is 5 L propylene glycol mixed with 4,4 L of water **OR** 1 U.S. gal propylene glycol mixed with 3.5 qt of water.

Add premixed coolant; 47% water and 53% propylene glycol to the recovery tank if the coolant level is low.

Use a refractometer to check the condition of propylene glycol in your cooling system.

Add premixed coolant until the level is correct.

Run the engine until it is at operating temperature. Stop the engine. Check the coolant level and add as needed. Be sure the radiator cap is tight.

Add coolant to the recovery tank as needed.

Close the tailgate.

Removing And Replacing The Hydraulic Fluid

See the service schedule for the correct service interval. (See SERVICE SCHEDULE on Page 10-70-1.)

⚠ WARNING

AVOID INJURY OR DEATH

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

W-2072-EN-0909

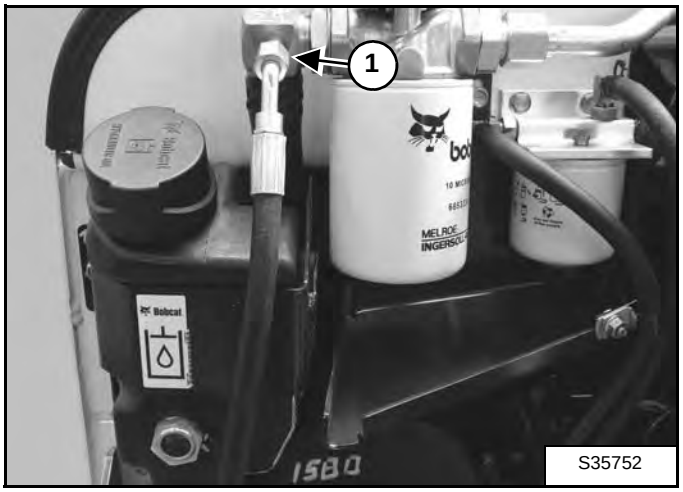
Retract the tracks fully.

Retract the arm and bucket cylinders, lower the bucket to the ground. Stop the engine.

Open the tailgate. (See TAILGATE on Page 10-60-1.)

Remove and replace the hydraulic filter.

Figure 10-130-6



Loosen the hose (Item 1) **[Figure 10-130-6]** at the top and lead it into a container to drain the hydraulic fluid.

IMPORTANT

Fluid such as engine oil, hydraulic fluid, coolants, grease, etc. must be disposed of in an environmentally safe manner. Some regulations require that certain spills and leaks on the ground must be cleaned in a specific manner. See local regulations for the correct disposal.

I-2067-EN-0711

IMPORTANT

If the fluid is being drained because of a system failure, remove and clean all hydraulic lines.

I-2045-0788

Reinstall the hose.

Add fluid to the reservoir until it is at the center of the sight gauge (Item 2) **[Figure 10-130-5]**.

Run the excavator through the hydraulic functions. Stop the engine. Check the fluid level and add as needed.

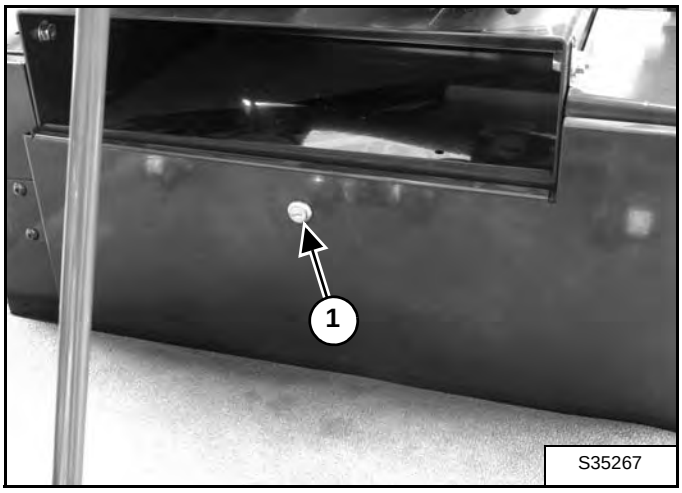
ALTERNATOR BELT

Belt Adjustment (S/N AHLL11001 - AHLL13119)

Replace the belt if it is stretched or has cracks. Replace the pulley if the belt makes contact with the bottom of the groove in the pulley.

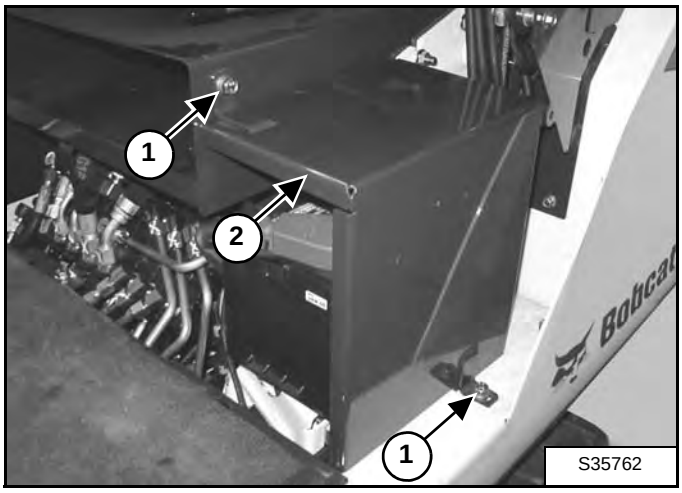
Stop the engine.

Figure 10-170-1



Use the start key to remove the access cover (Item 1) **[Figure 10-170-1]**.

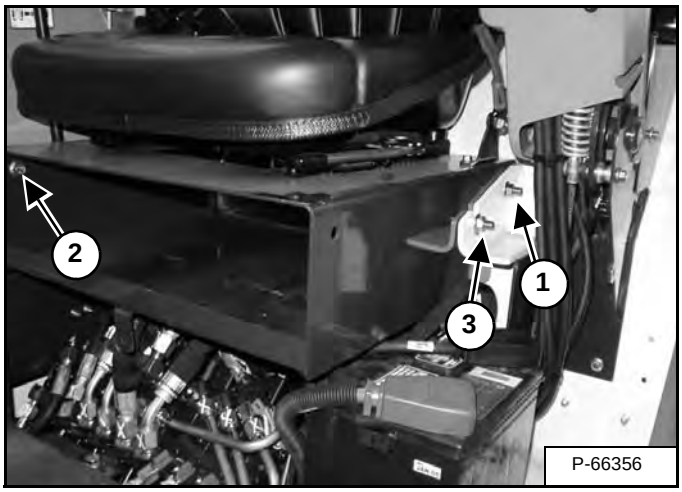
Figure 10-170-2



Remove the two bolts (Item 1) **[Figure 10-170-2]** and brackets from the battery cover.

Remove the cover (Item 2) **[Figure 10-170-2]**.

Figure 10-170-3



Remove the two bolts (Item 1) **[Figure 10-170-3]** and nuts from both sides of the seat mount.

Remove the bolt (Item 2) **[Figure 10-170-3]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 10-170-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

EXCAVATOR STORAGE AND RETURN TO SERVICE

Storage

Sometimes it can be necessary to store your Bobcat excavator for an extend period of time. Below is a list of items to perform before storage.

- Thoroughly clean the excavator including the engine compartment.
- Lubricate the excavator.
- Replace worn or damaged parts.
- Drive the excavator onto planks in a dry protected shelter.
- Lower the boom fully with the bucket flat on the ground.
- Put grease on any exposed cylinder rods.
- Put fuel stabilizer in the fuel tank and run the engine a few minutes to circulate the stabilizer to the pump and fuel injectors.
- Drain and flush the cooling system. Refill with premixed coolant.
- Replace all fluids and filters (engine, hydraulic).
- Replace all filters (i.e.: air cleaner, heater, etc.).
- Put all controls in neutral position.
- Remove the battery. Be sure the electrolyte level is correct, then charge the battery. Store it in a cool dry place above freezing temperatures and charge it periodically during storage.
- Cover the exhaust pipe opening.
- Tag the machine to indicate that it is in storage condition.

Return to Service

After the Bobcat excavator has been in storage, it is necessary to follow a list of items to return the excavator to service.

- Check the engine and hydraulic fluid levels; check coolant level.
- Install a fully charged battery.
- Remove grease from exposed cylinder rods.
- Check all belt tensions.
- Be sure all shields and guards are in place.
- Lubricate the excavator.
- Remove cover from exhaust pipe opening.
- Start the engine and let it run for a few minutes while observing the instrument panels and systems for correct operation.
- Drive the excavator off of the planks.
- Operate machine, check for correct function.
- Stop the engine and check for leaks. Repair as needed.

MOTION ALARM SYSTEM

Description

This excavator can be equipped with a motion alarm system. The motion alarm will sound when the operator moves the travel control levers in either the forward or reverse direction. Slight movement of the steering levers in either the forward or reverse direction is required with hydraulic components before the back-up alarm will sound.

Inspecting

Figure 10-250-1

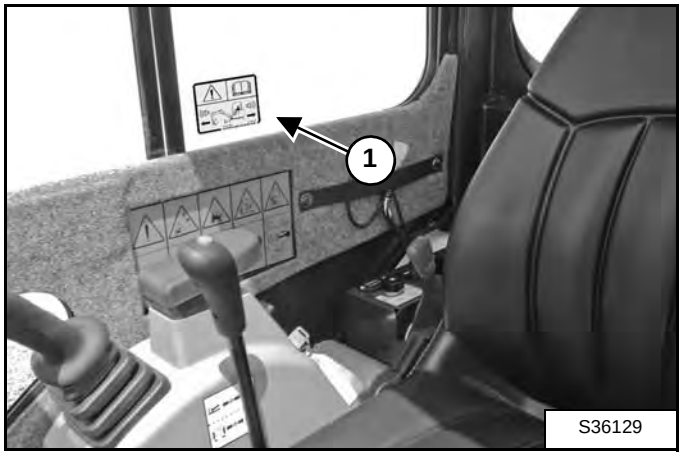
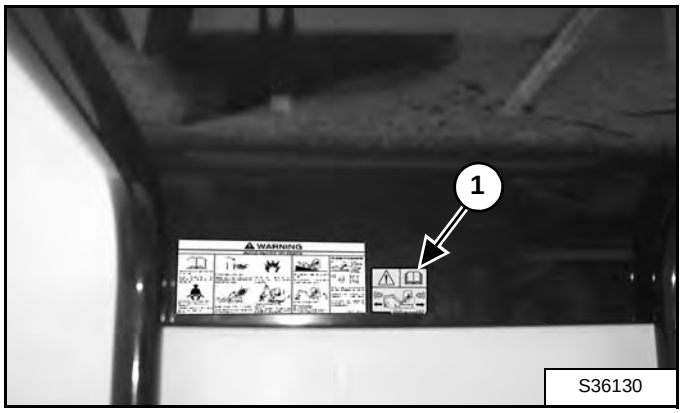


Figure 10-250-2



Inspect for damaged or missing motion alarm decal (Item 1) **[Figure 10-250-1]** (cab machine) or (Item 1) **[Figure 10-250-2]** (canopy machine). Replace if required.

NOTE: The excavator will need to be moved slightly in both the forward and reverse direction to test the motion alarm. Keep all bystanders away from machine during test.

⚠ WARNING

AVOID INJURY OR DEATH

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-2050-0807

Sit in the operator's seat and fasten the seat belt. Start the engine.

Move the travel control levers (one lever at a time) in the forward direction. The motion alarm must sound. Move the travel control levers (one lever at a time) in the reverse direction. The motion alarm must sound.

Return both levers to neutral and turn excavator key to OFF position. Exit the excavator.

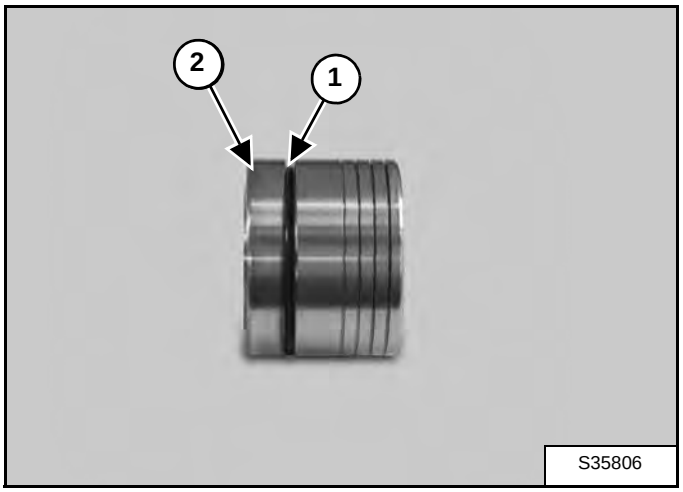
HYDRAULIC SYSTEM

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.

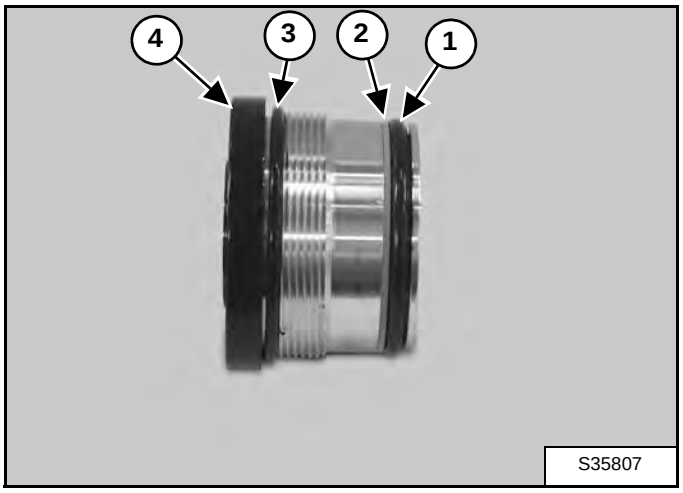
Disassembly (Cont'd)

Figure 20-20-14



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-20-14]**.

Figure 20-20-15

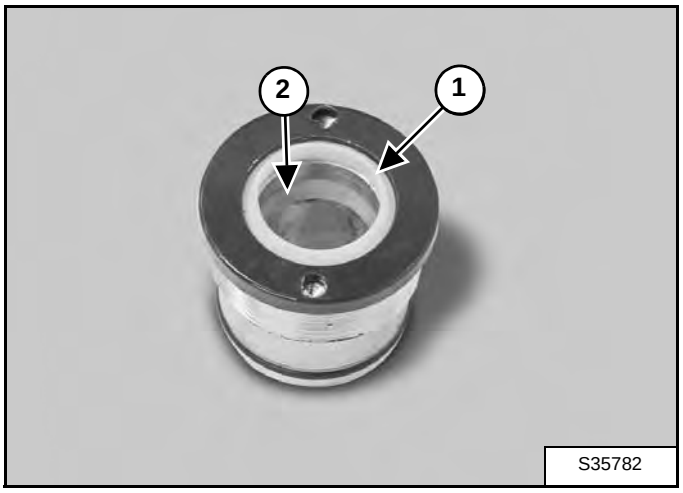


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-20-15]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-20-15] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-20-15]**.

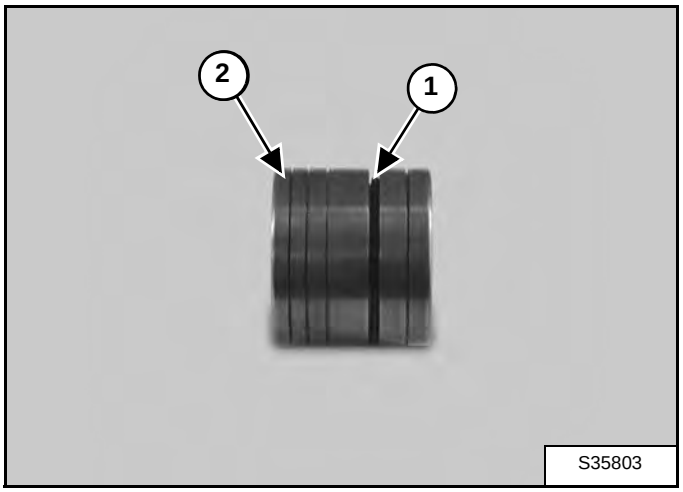
Figure 20-20-16



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-20-16]**.

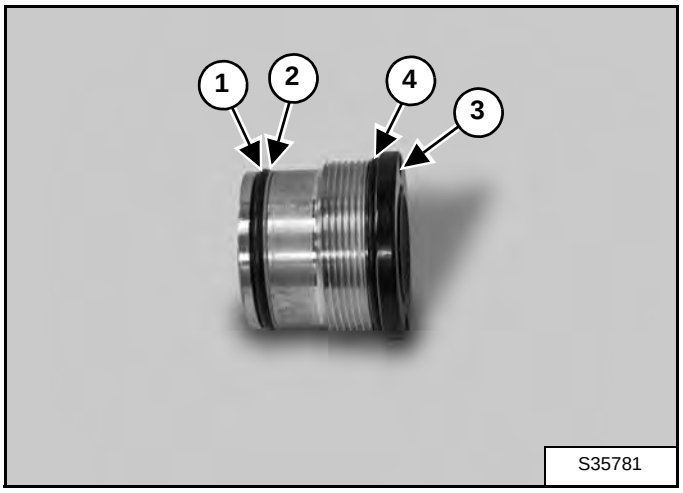
Disassembly (Cont'd)

Figure 20-21-12



Remove the O-ring (Item 1) from the piston (Item 2) **[Figure 20-21-12]**.

Figure 20-21-13

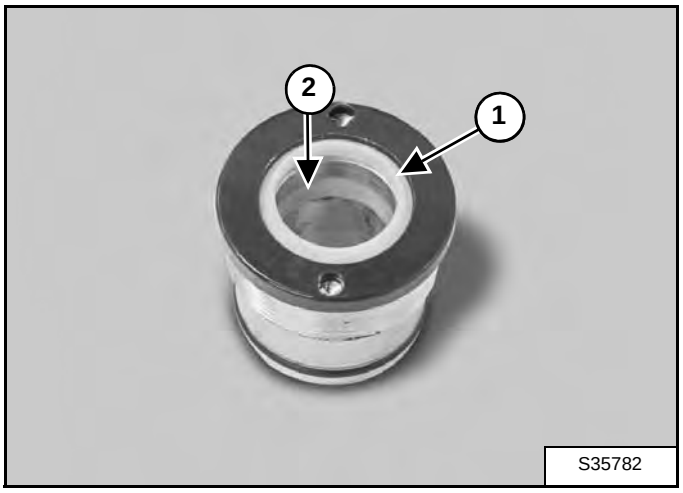


Remove the O-ring (Item 1) and the back-up ring (Item 2) from the head (Item 3) **[Figure 20-21-13]**.

NOTE: O-ring (Item 1) and back-up ring (Item 2) [Figure 20-21-13] were replaced, for a limited time, with a one piece seal. Service replacements may use either seal, as available.

Remove the O-ring (Item 4) **[Figure 20-21-13]**.

Figure 20-21-14



Remove the wiper seal (Item 1) and rod seal (Item 2) from the inside of the head **[Figure 20-21-14]**.

Assembly

Use the following tools to assemble the cylinder:

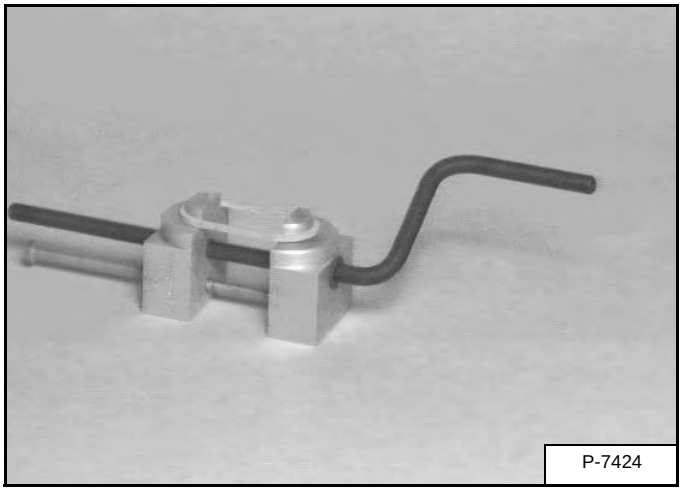
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

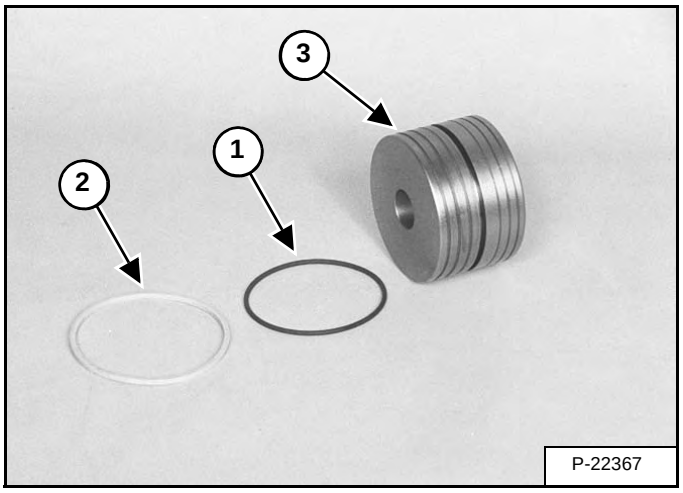
Figure 20-22-15



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-22-15]**.

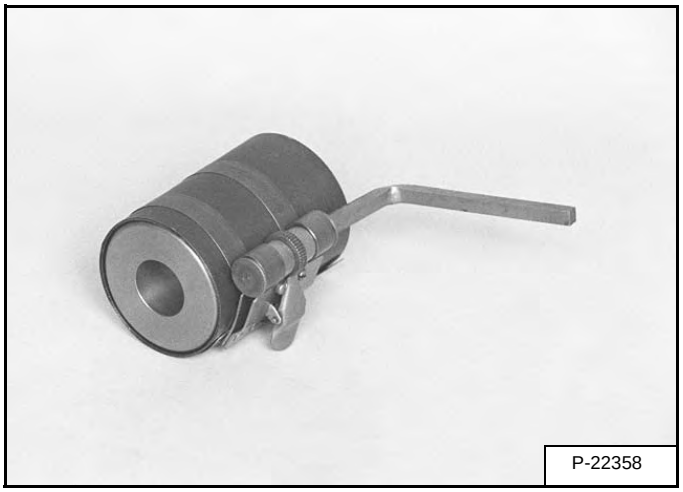
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-22-16



Install the O-ring (Item 1) and seal (Item 2) on the piston (Item 3) **[Figure 20-22-16]**.

Figure 20-22-17



Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about 3 minutes **[Figure 20-22-17]**.

Assembly

Use the following tools to assemble the cylinder:

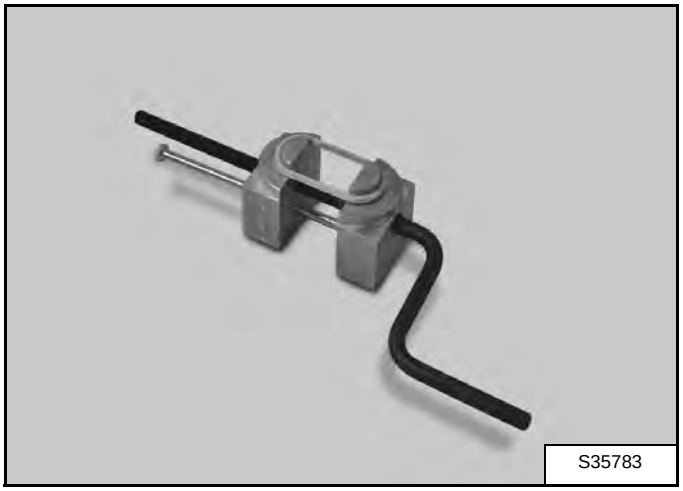
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-2 - Special Offset Pins

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.

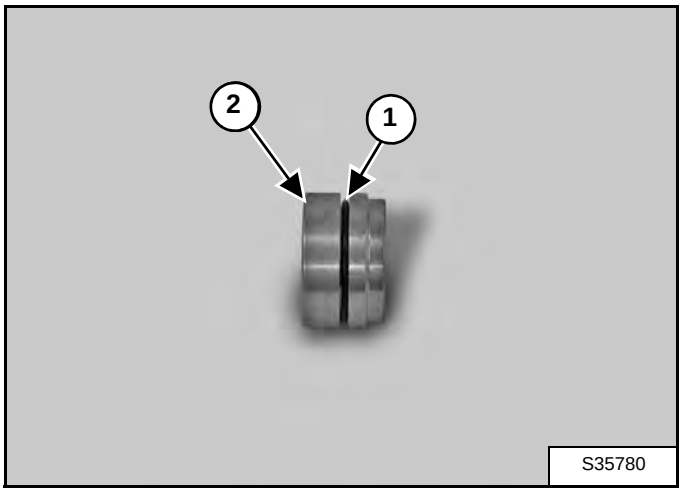
Figure 20-23-13



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-23-13]**.

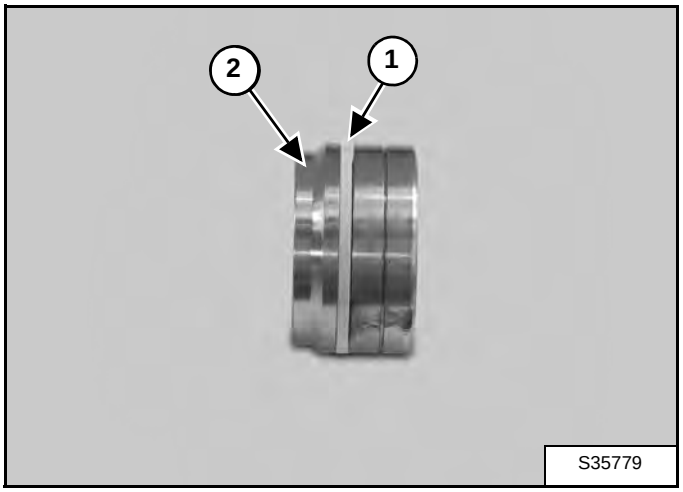
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-23-14



Standard piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-23-14]**.

Figure 20-23-15



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-23-15]**.

Assembly

Use the following tools to assemble the cylinder:

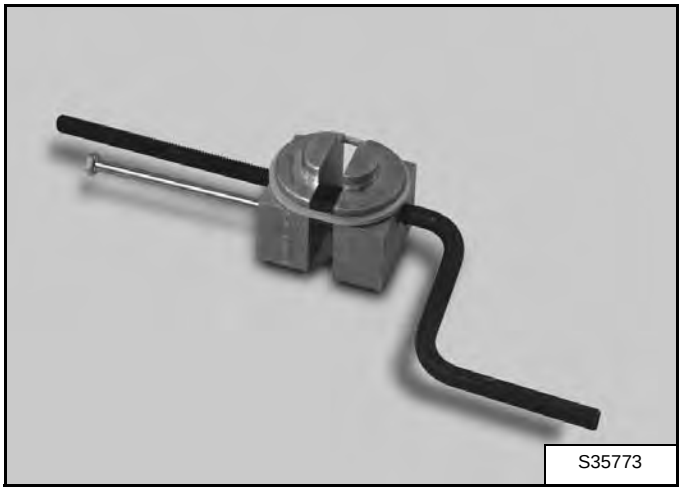
MEL1396 - Universal Seal Expander
MEL1033 - Rod Seal Installation Tool
Piston Ring Compressor
MEL1075 - Adjustable Gland Nut Wrench
MEL1075-1 - Standard Pins

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.

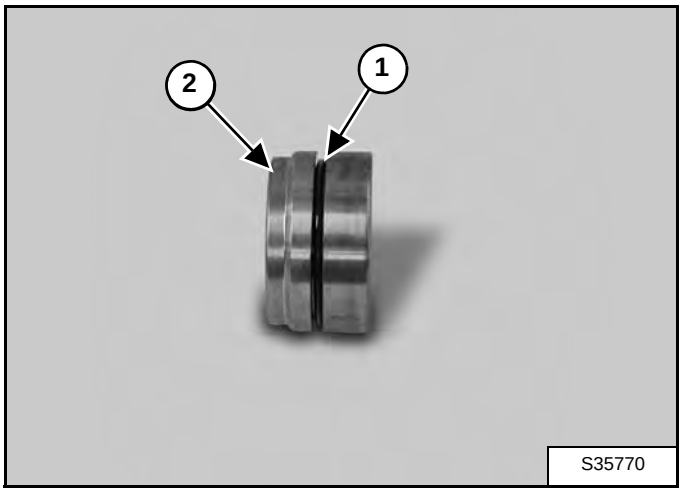
Figure 20-24-14



Install the seal on the tool and slowly stretch it until it fits the piston **[Figure 20-24-14]**.

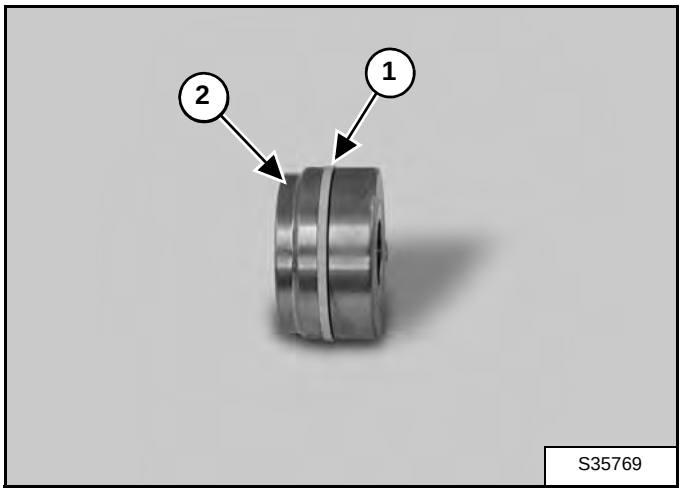
Allow the seal to stretch for 30 seconds before installing it on the piston.

Figure 20-24-15



Standard piston: Install the O-ring (Item 1) on the piston (Item 2) **[Figure 20-24-15]**.

Figure 20-24-16



Install the seal (Item 1) on the piston (Item 2) **[Figure 20-24-16]**.

Disassembly

Clean the outside of the expansion cylinder before disassembly.

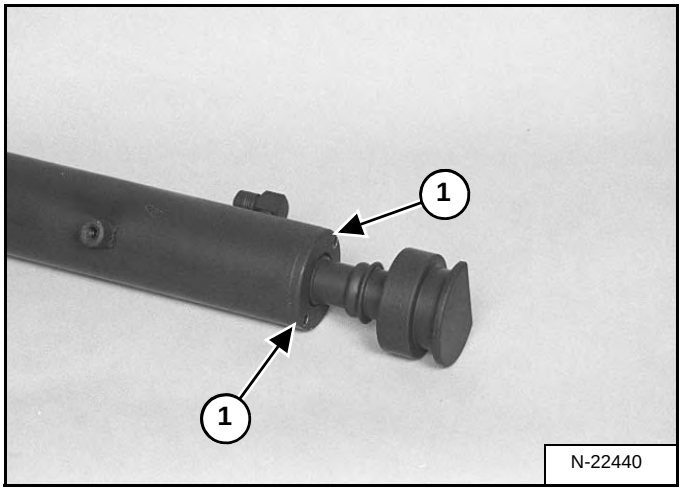
Use the following tools to disassemble the cylinder:

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

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

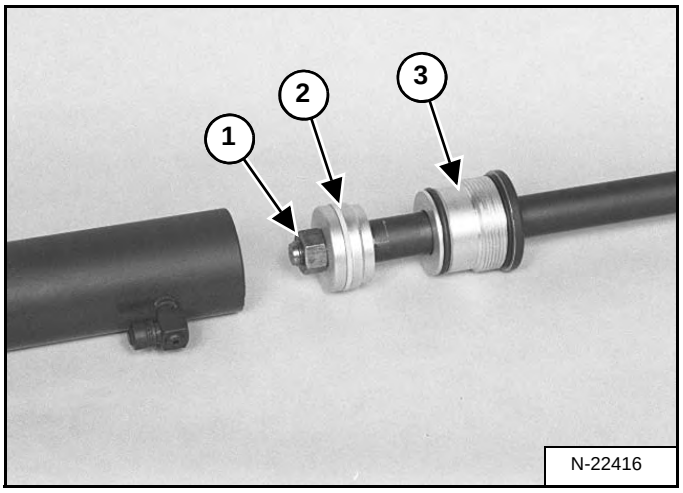
Put the base end of the cylinder in a vise.

Figure 20-25-20



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

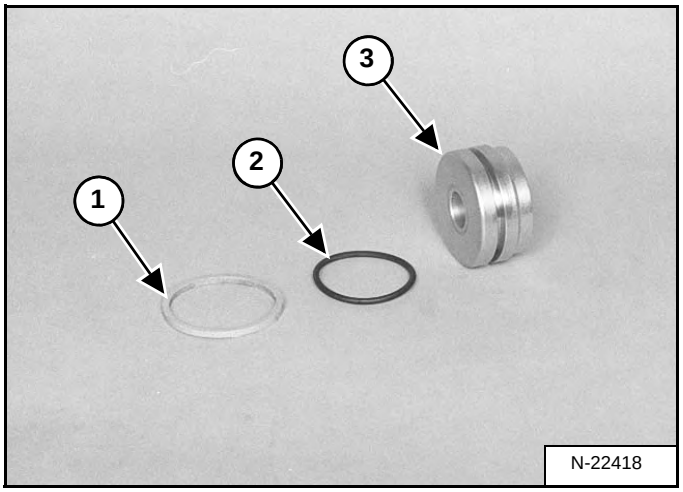
Figure 20-25-21



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]**.

VALVE (CROSSPORT RELIEF)

Testing And Adjusting

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 - 34,5 MPa (345 bar) (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 66°C (150°F). 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. (See TAILGATE on Page 10-60-1.)

Figure 20-32-1

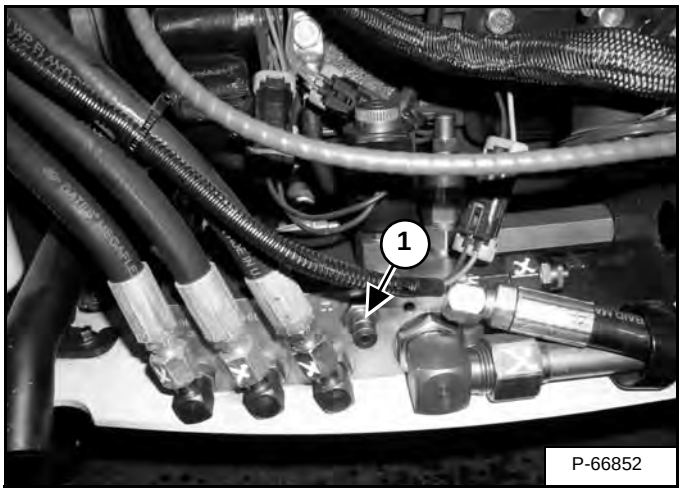
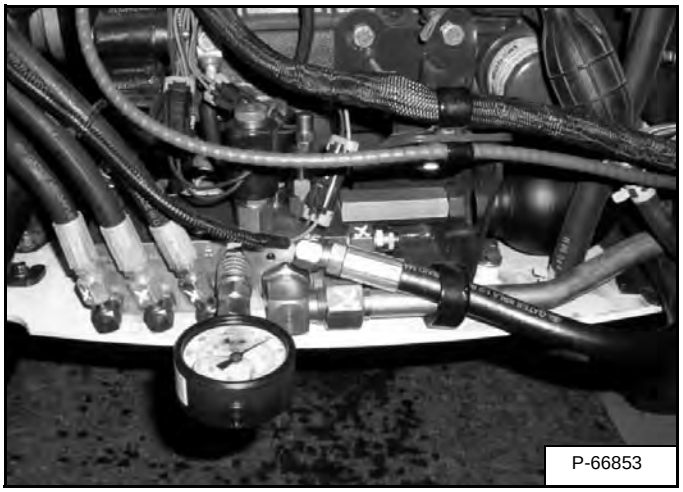


Figure 20-32-2



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

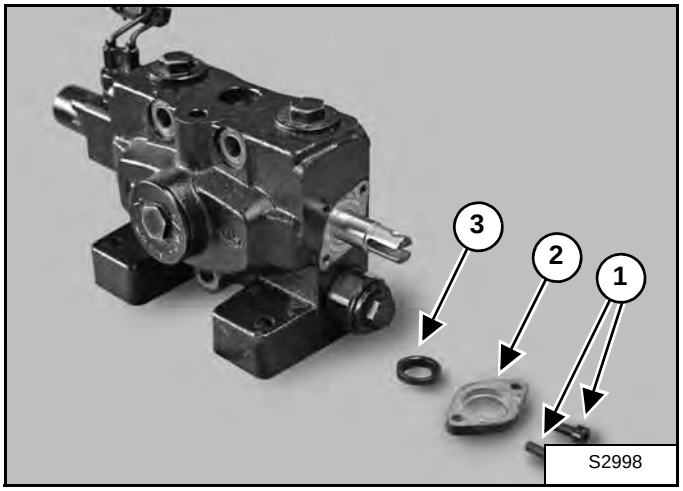
Lower the control console and fasten the seat belt.

SYSTEM CHECK	FUNCTION TO ENGAGE	CIRCUIT PRESSURISED	GAUGE LOCATION	TARGET MPa (bar) (psi)	ACCEPTABLE RANGE MPa (bar) (psi)
JOYSTICK PILOT PRESSURE	ANY JOYSTICK FUNCTION	JOYSTICK PILOT	PSI	3 (30) (435)	2,8 - 3,1 (28 - 31) (406 - 450)
PRESSURE BUILD - UP VALVE	NONE - CONSOLE DOWN	P1 & P2	G	2.861 (28,61) (415)	2,38 - 3,34 (23,8 - 33,4) (345 - 485)
SYSTEM BY - PASS	NONE - CONSOLE UP	DUMP TO TANK	G	0,79 (7,9) (115)	MAX ALLOWABLE 1,07 (10,7) (155)
MAIN RELIEF ON MANIFOLD BLOCK	BOOM	P2	G	22,89 (229) (3320)	22,2 - 23,58 (222 - 236) (3220 - 3420)
MAIN RELIEF ON MANIFOLD BLOCK	AUXILIARY	P1 & P2	G	18,96 (190) (2750)	18,27 - 19,65 (182,7 - 196,5) (2650 - 2850)
MAIN RELIEF ON MANIFOLD BLOCK	ARM	P1 & P2	G	22,89 (229) (3320)	22,2 - 23,58 (222 - 236) (3220 - 3420)
SWING MOTOR - CROSS PORT RELIEF	SLEW RIGHT	P3	G	16,55 (165) (2400)	16,2 - 16,89 (162 - 169) (2350 - 2450)
SWING MOTOR - CROSS PORT RELIEF	SLEW LEFT	P3	G	16,55 (165) (2400)	16,2 - 16,89 (162 - 169) (2350 - 2450)

* Under seat at Bulkhead

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

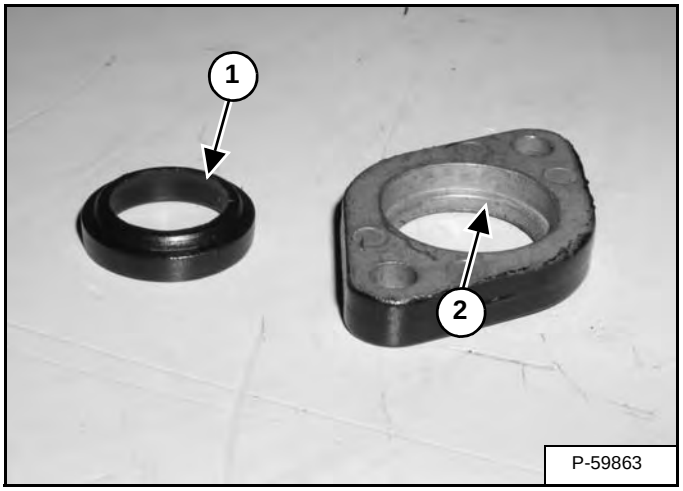
Figure 20-40-13



Remove the bolts (Item 1), retaining plate (Item 2) and seal (Item 3) **[Figure 20-40-13]**.

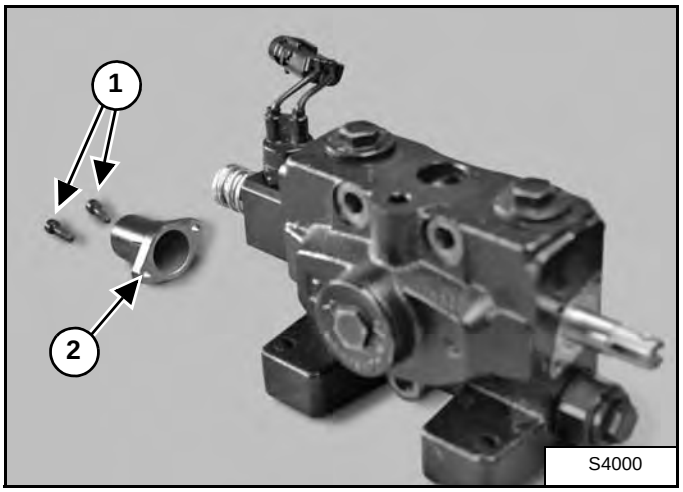
Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-14



Installation: Make sure the lip (Item 1) of the seal fits inside the retaining plate (Item 2) **[Figure 20-40-14]**.

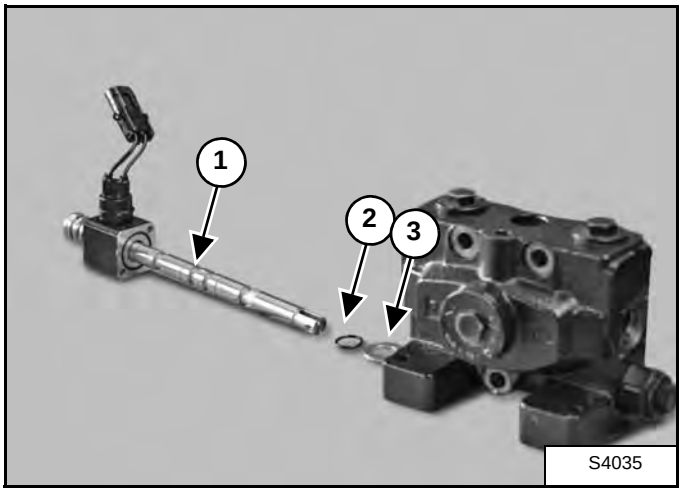
Figure 20-40-15



Remove the bolts (Item 1) and cap (Item 2) **[Figure 20-40-15]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

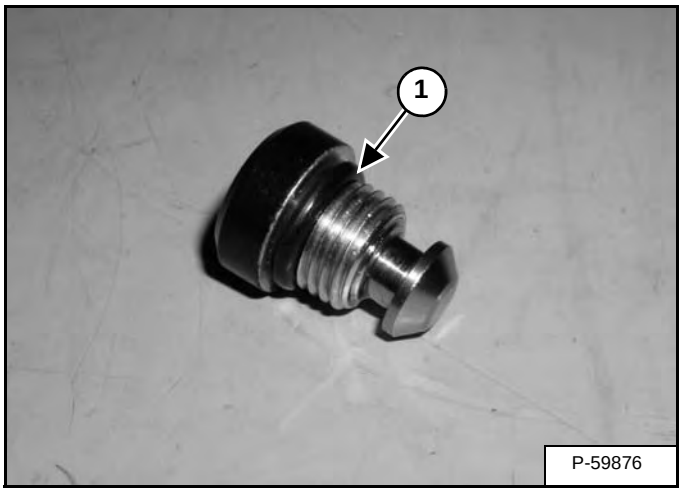
Figure 20-40-16



Remove the spool and spool cover assembly (Item 1), O-ring (Item 2) and washer (Item 3) **[Figure 20-40-16]** from the valve.

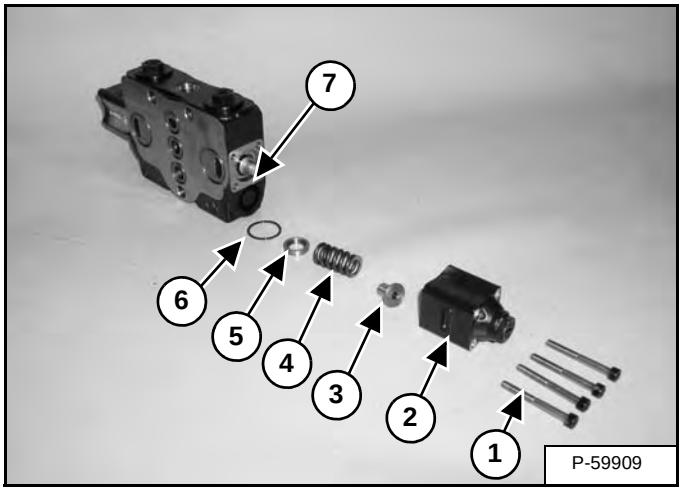
Bucket Valve Section Disassembly And Assembly (Cont'd)

Figure 20-40-47



Remove the O-ring (Item 1) **[Figure 20-40-47]** from the load check valve.

Figure 20-40-48

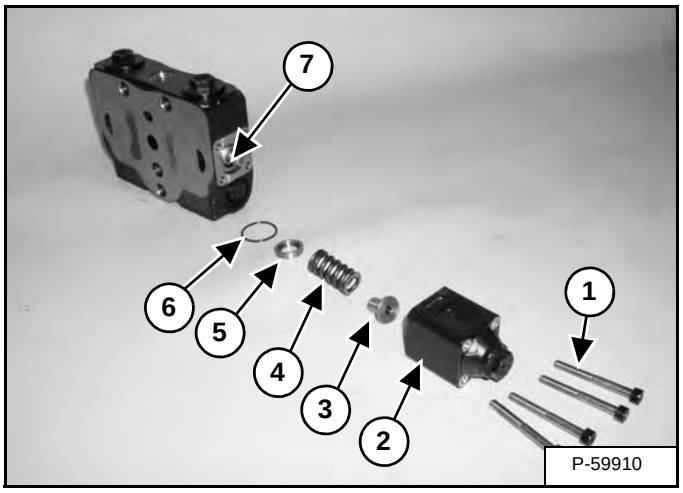


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-48]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-48]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-49

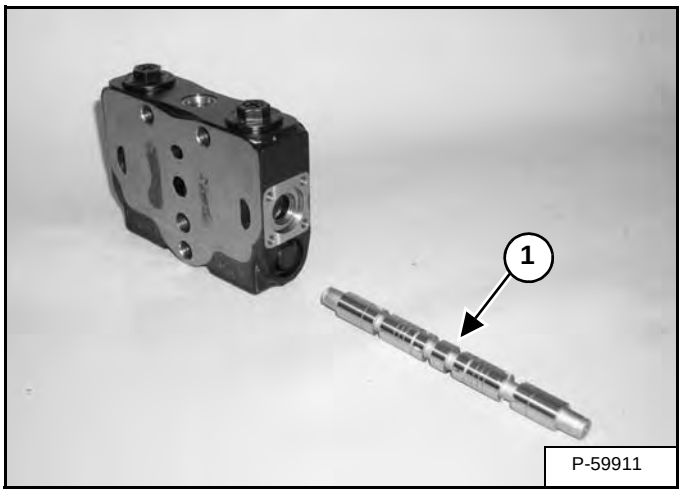


Remove the bolts (Item 1), spool cover (Item 2), spring seat (Item 3), spring (Item 4), spring retainer (Item 5) and O-ring (Item 6) **[Figure 20-40-49]**.

Installation: Install the lip of the spring retainer (Item 5) over the spool (Item 7) **[Figure 20-40-49]**.

Installation: Tighten the bolts to 6,6 N•m (58.4 in-lb) torque.

Figure 20-40-50



Remove the spool (Item 1) **[Figure 20-40-50]**.

The spool and valve section are not serviced separately.

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

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.

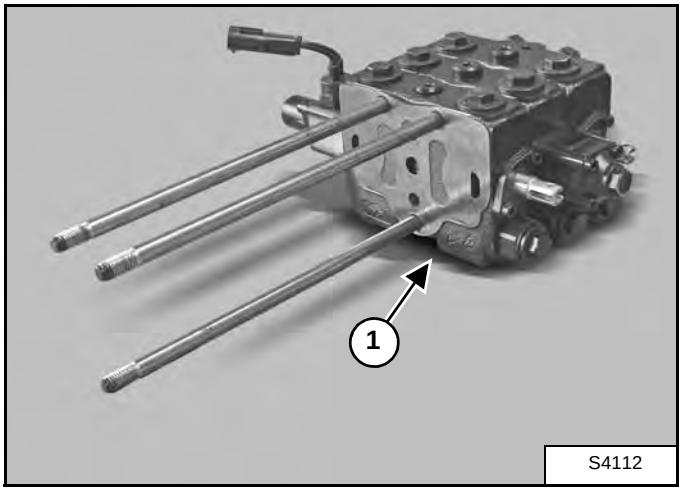
I-2003-0888

Clean all parts in solvent and dry with compressed air.

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

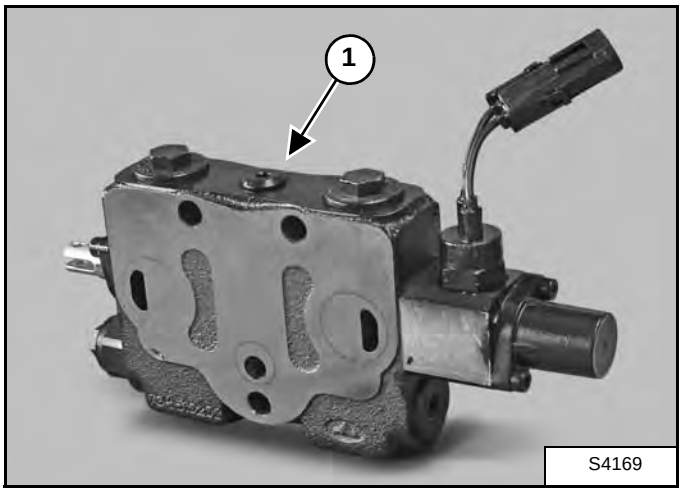
Always install new seals and O-rings. Lubricate all seals and O-rings with clean hydraulic fluid before installation.

Figure 20-40-79



Remove the left travel valve section (Item 1) **[Figure 20-40-79]** from the valve assembly.

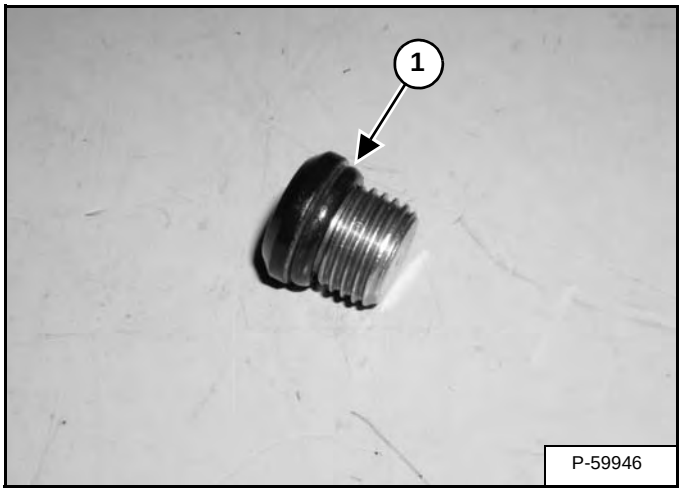
Figure 20-40-80



Remove the plug (Item 1) **[Figure 20-40-80]** from the left travel valve section.

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

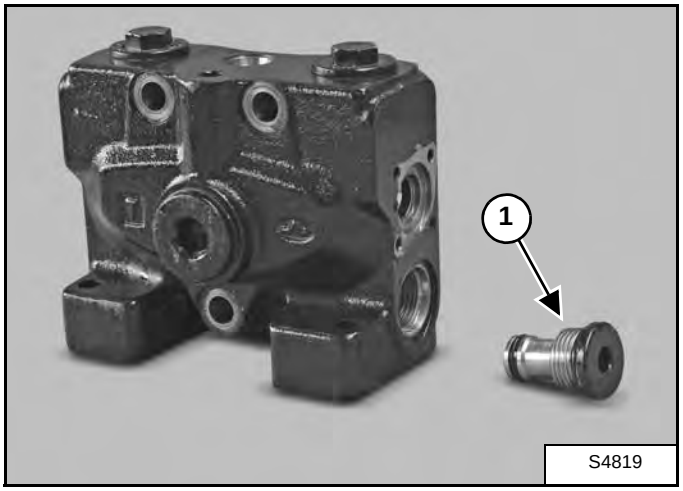
Figure 20-40-81



Remove the O-ring (Item 1) **[Figure 20-40-81]** from the plug.

Blade Valve Section Disassembly And Assembly (Cont'd)

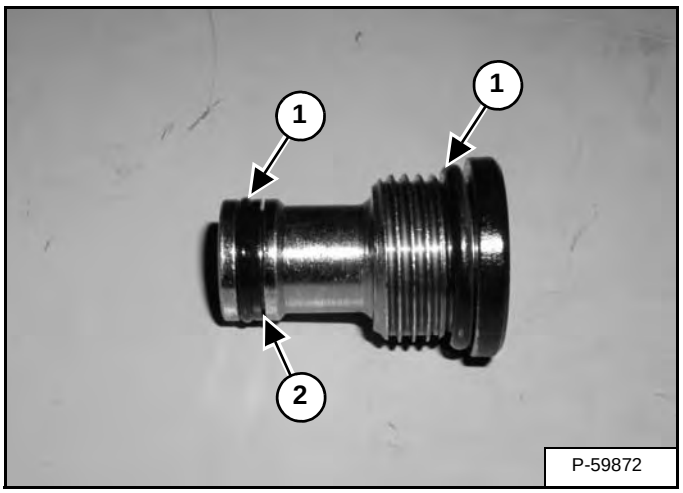
Figure 20-40-115



Remove the plug (Item 1) **[Figure 20-40-115]**.

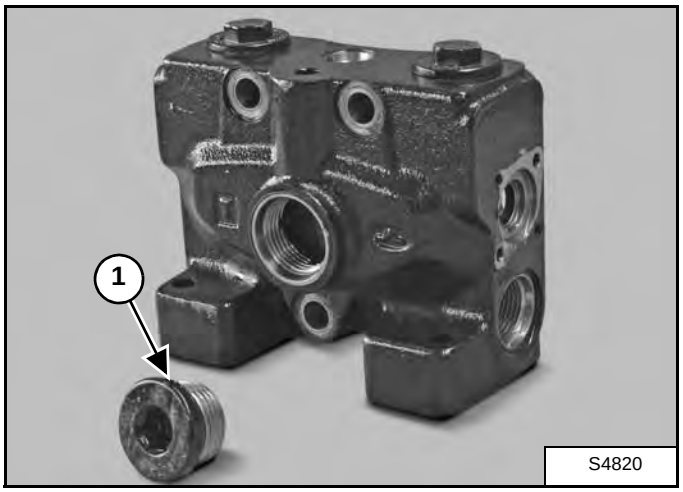
Installation: Tighten the plug to 42 N•m (31 ft-lb) torque.

Figure 20-40-116



Remove the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-40-116]** from the plug.

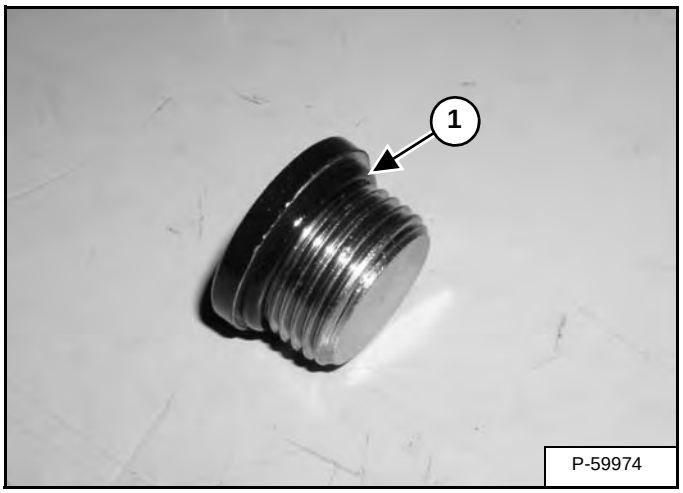
Figure 20-40-117



Remove the plug (Item 1) **[Figure 20-40-117]**.

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

Figure 20-40-118



Remove the O-ring (Item 1) **[Figure 20-40-118]** from the plug.

Testing The Gear Pump

All pump testing is done with the hydraulic fluid at operating temperature and with the engine high speed setting.

Figure 20-50-9

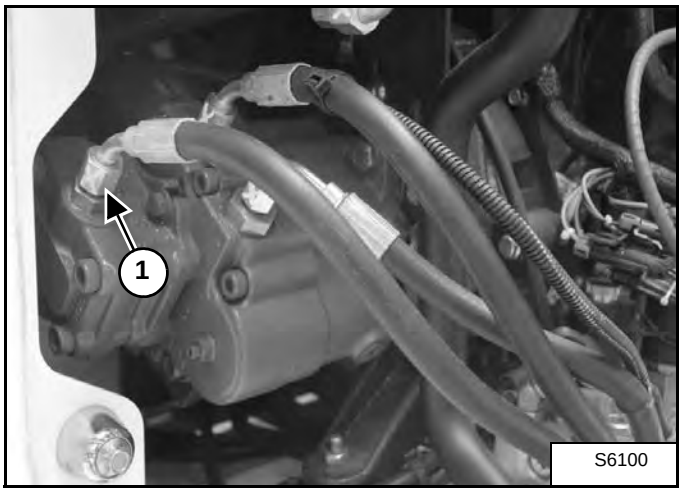
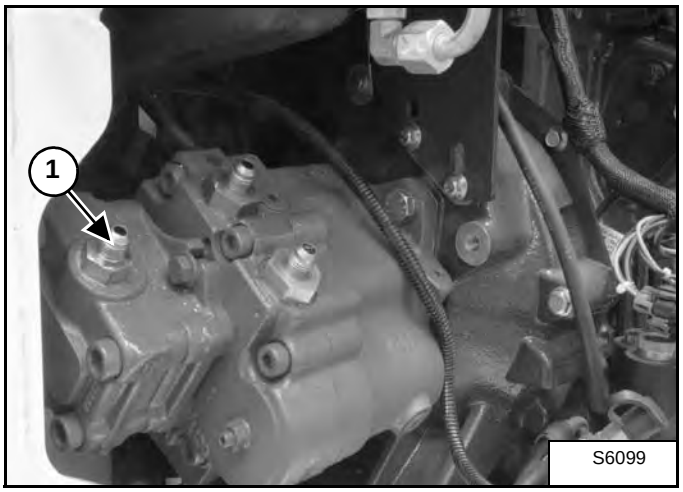
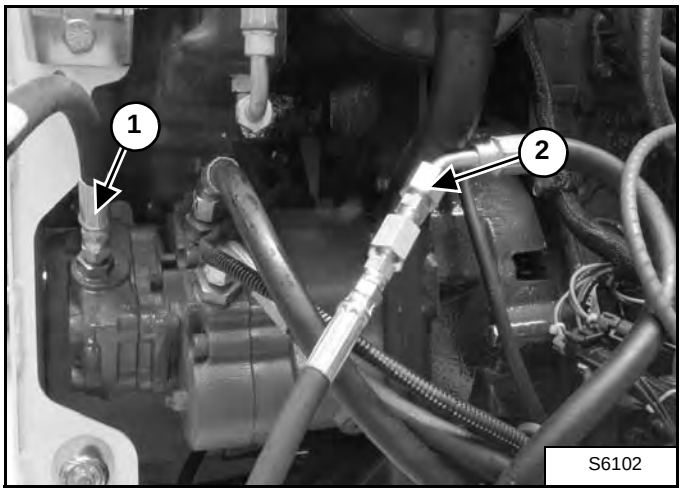


Figure 20-50-10



Remove the outlet hose (Item 1) **[Figure 20-50-9]** and **[Figure 20-50-10]** from the hydraulic pump section being tested.

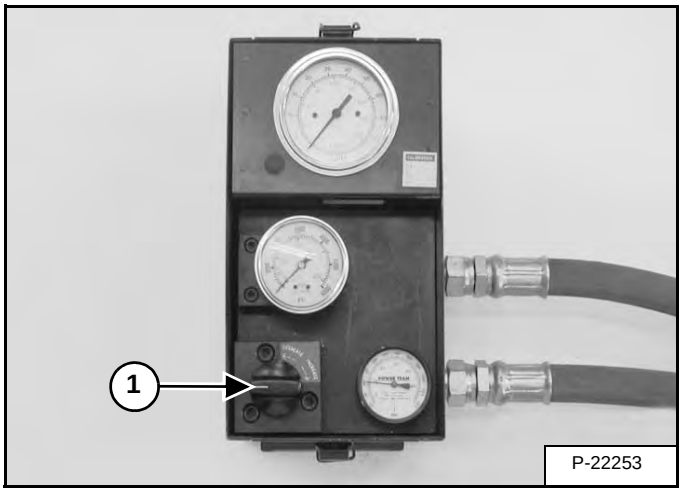
Figure 20-50-11



Connect the inlet (Item 1) **[Figure 20-50-11]** of the tester to the pump.

Connect the outlet of the tester to the hose (Item 2) **[Figure 20-50-11]** that was removed from the pump.

Figure 20-50-12



NOTE: Open the flow control knob (Item 1) [Figure 20-50-12] fully to prevent pump damage. This is a direct pump test. There is no relief valve in the system.

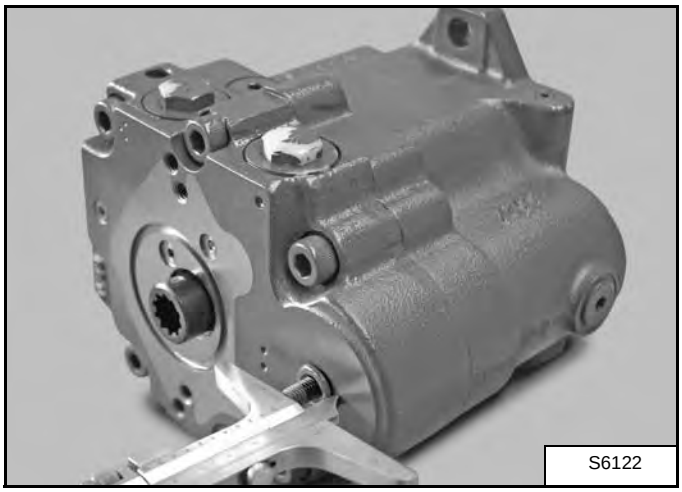
Start the engine and run at low rpm. Make sure the tester is connected correctly. If no flow is indicated at the tester, the hoses are connected wrong.

Increase the engine speed to full rpm. Warm the hydraulic fluid to 66°C (150°F) by turning the restrictor valve until the gauge reads about 6,9 MPa (69 bar) (1000 psi). Do not exceed system pressure.

After the temperature is correct, open the restrictor valve fully.

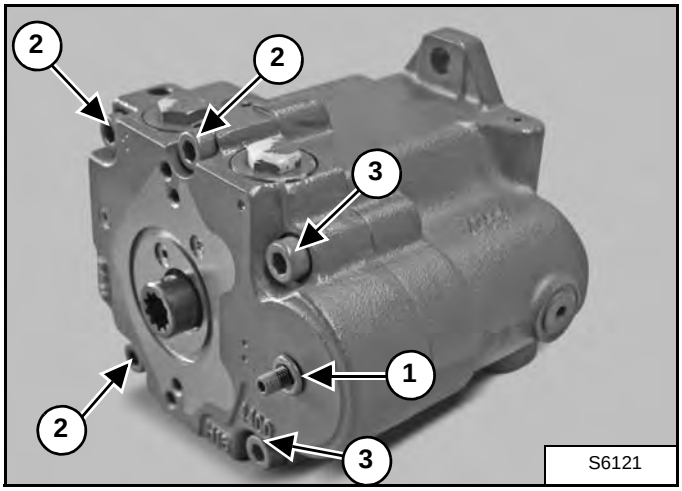
Piston Pump Disassembly (Cont'd)

Figure 20-50-39



Measure the outside length of the pressure adjustment screw **[Figure 20-50-39]** for aid in adjustment after re-assembly

Figure 20-50-40

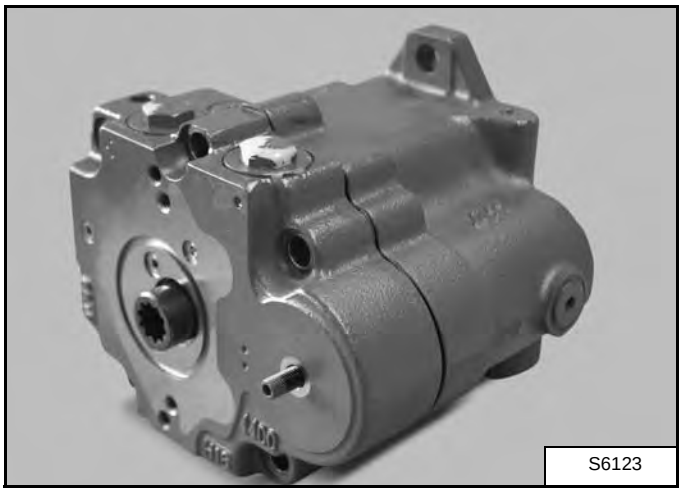


Remove the seal washer (Item 1) **[Figure 20-50-40]** from the pump housing.

Remove the three bolts (Item 2) **[Figure 20-50-40]** from the pump housing.

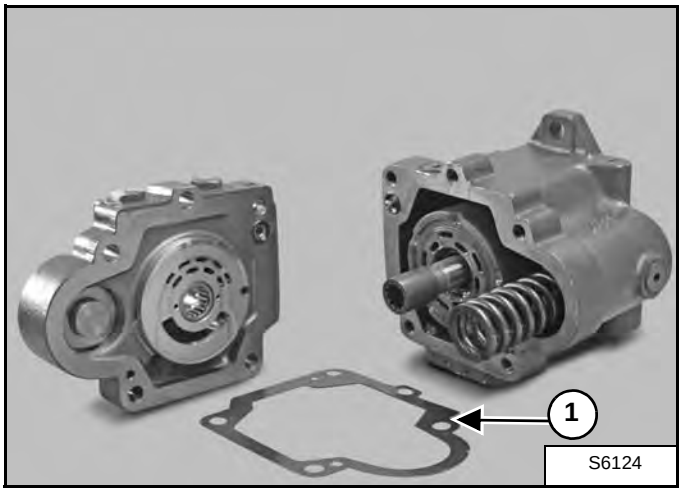
Remove the two bolts (Item 3) **[Figure 20-50-40]** from either side of the pressure adjusting spring in the pump housing.

Figure 20-50-41



Separate the two halves of pump housings **[Figure 20-50-41]**.

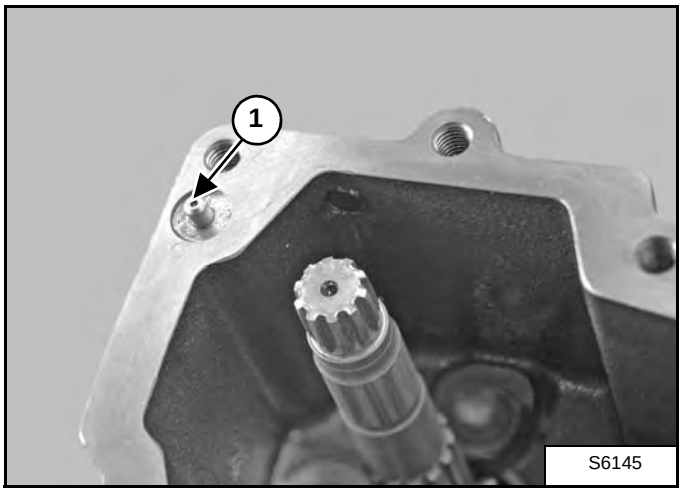
Figure 20-50-42



Remove the packing (Item 1) **[Figure 20-50-42]** from between the pump housings.

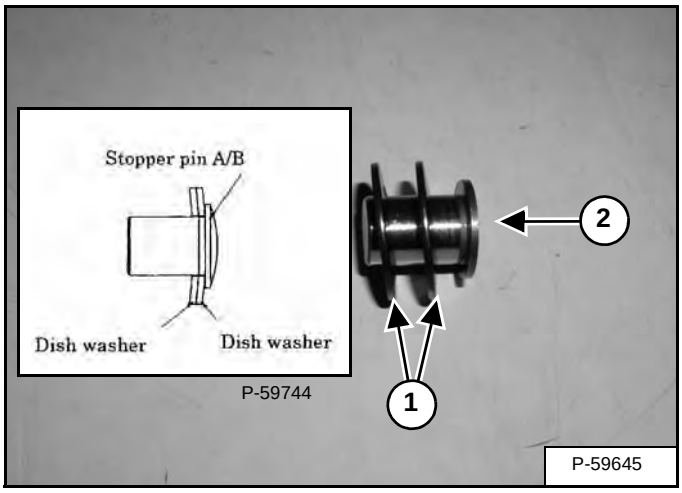
Piston Pump Assembly (Cont'd)

Figure 20-50-79



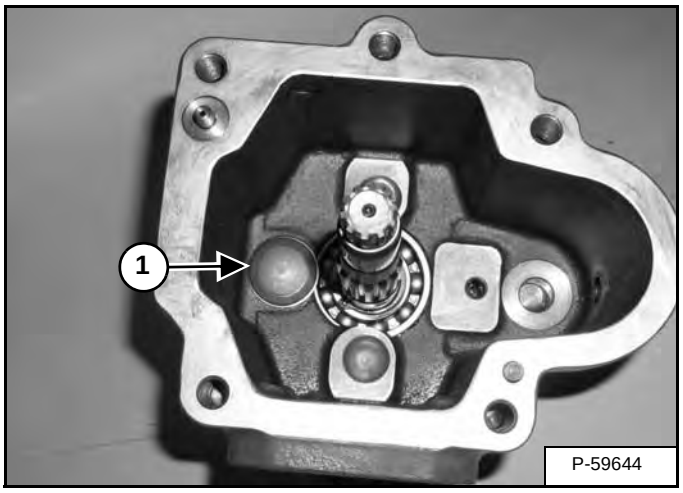
Install the pin (Item 1) **[Figure 20-50-79]** in the pump housing.

Figure 20-50-80



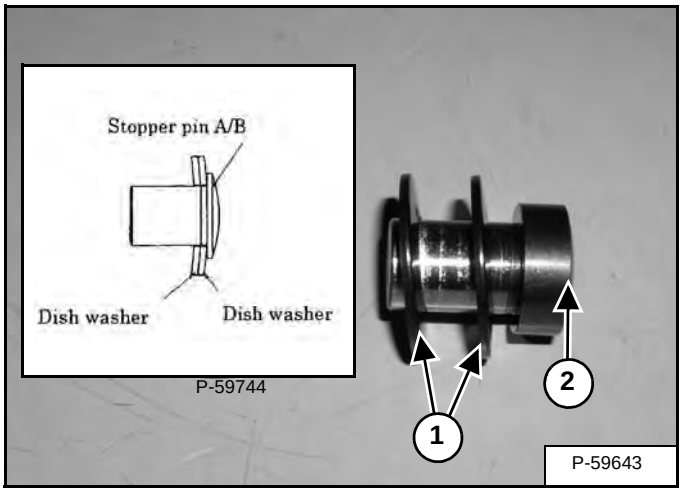
Install the two dish washers (Item 1) on the stopper pin B (Item 2) **[Figure 20-50-80]**.

Figure 20-50-81



Install stopper pin B and washers (Item 1) **[Figure 20-50-81]** into pump housing.

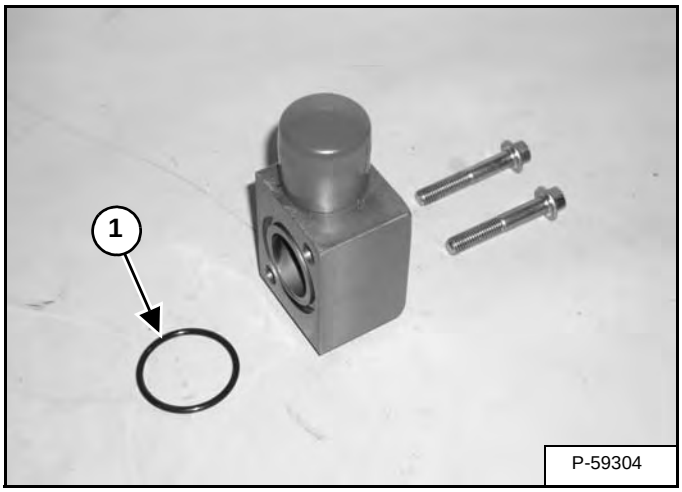
Figure 20-50-82



Install the two dish washers (Item 1) on the stopper pin A (Item 2) **[Figure 20-50-82]**.

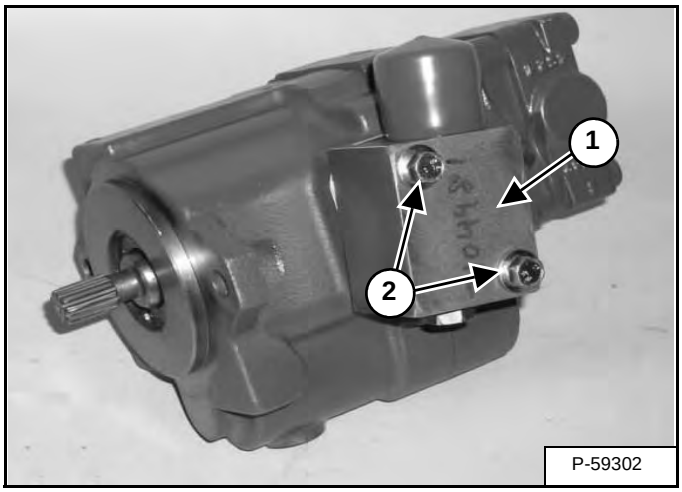
Assembly (Cont'd)

Figure 20-50-118



Install the O-ring (Item 1) **[Figure 20-50-118]** on the pump block.

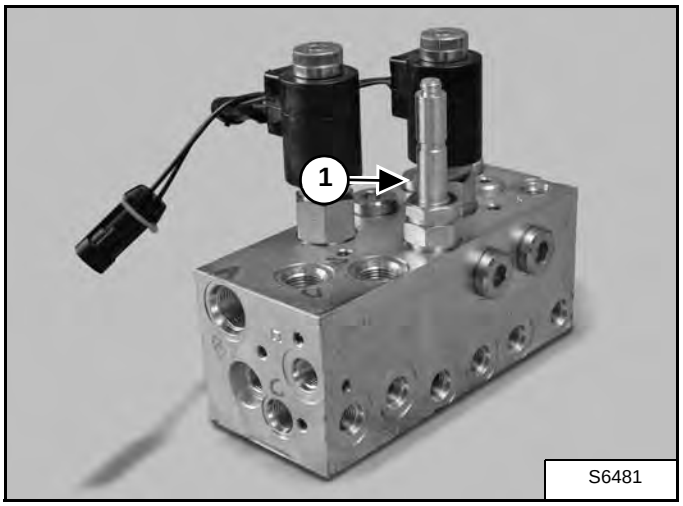
Figure 20-50-119



Install pump block (Item 1) and the two bolts (Item 2) **[Figure 20-50-119]**.

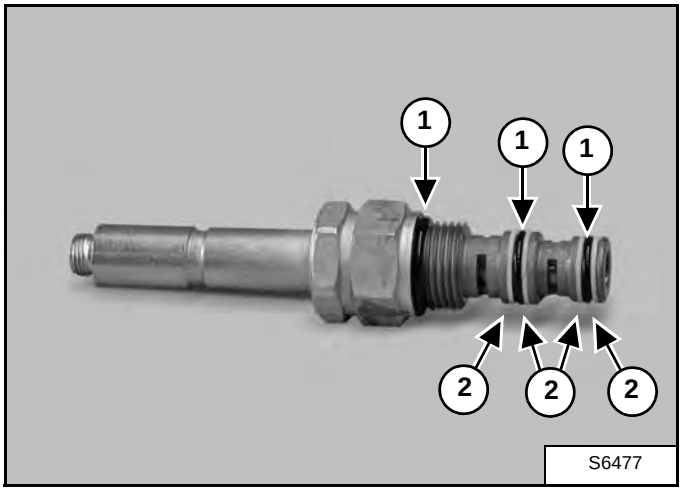
Disassembly (Cont'd)

Figure 20-60-27



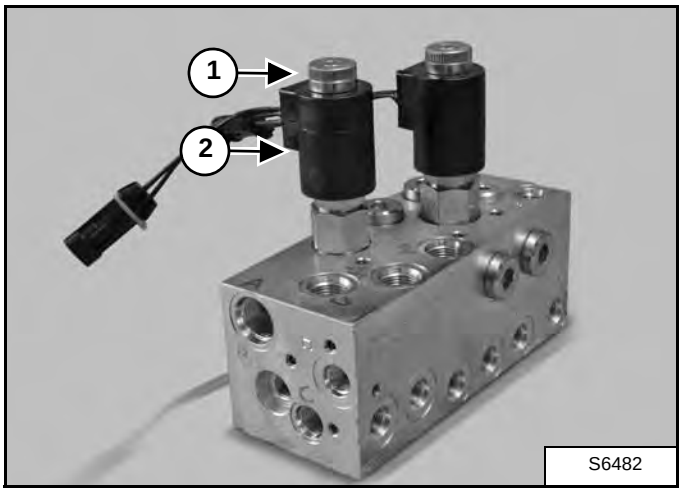
Remove the solenoid stem (Item 1) **[Figure 20-60-27]**.

Figure 20-60-28



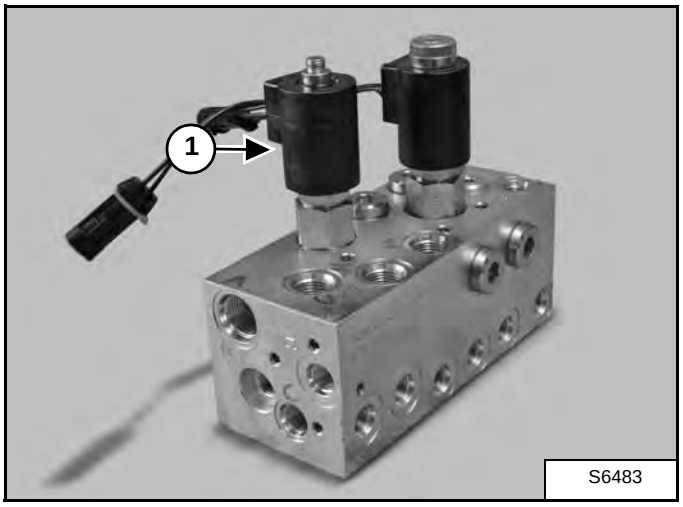
Remove the three O-rings (Item 1) and the four back-up rings (Item 2) **[Figure 20-60-28]** from the solenoid stem.

Figure 20-60-29



Remove the nut (Item 1) from the system bypass solenoid (Item 2) **[Figure 20-60-29]**.

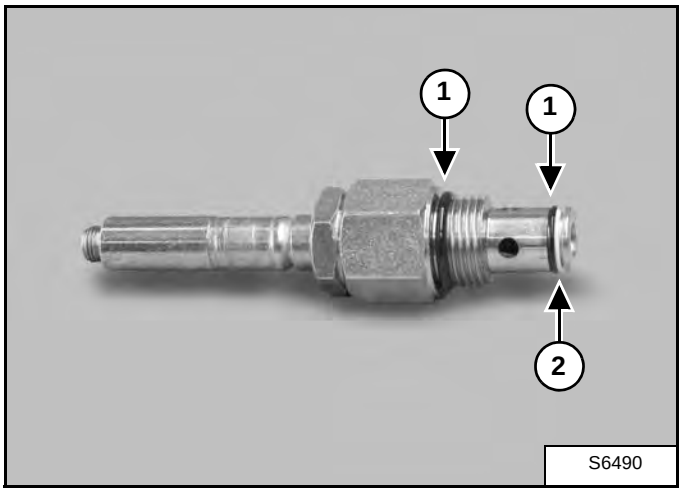
Figure 20-60-30



Remove the coil with orange strap (Item 1) **[Figure 20-60-30]** from the solenoid stem.

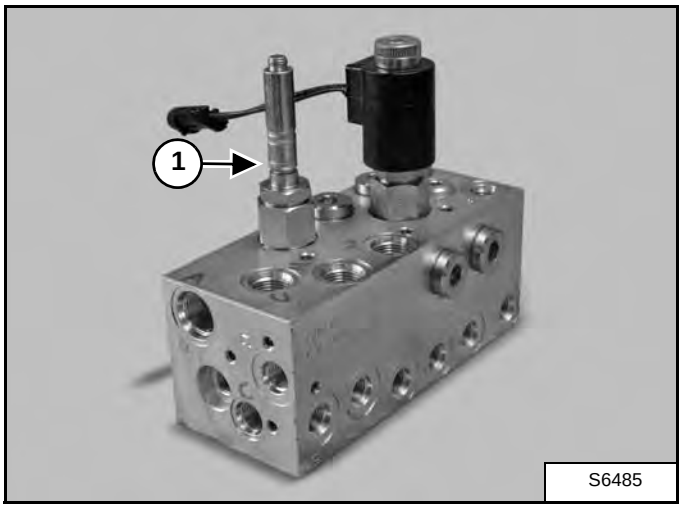
Assembly (Cont'd)

Figure 20-60-67



Install the O-rings (Item 1) and back-up ring (Item 2) **[Figure 20-60-67]**.

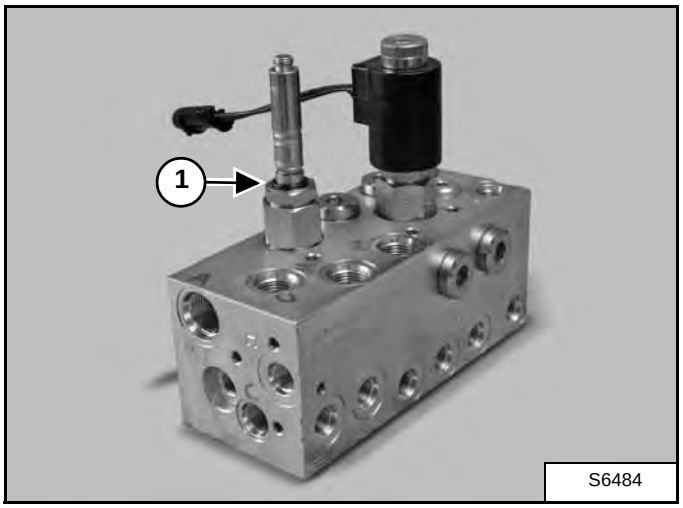
Figure 20-60-68



Install the solenoid stem (Item 1) **[Figure 20-60-68]**.

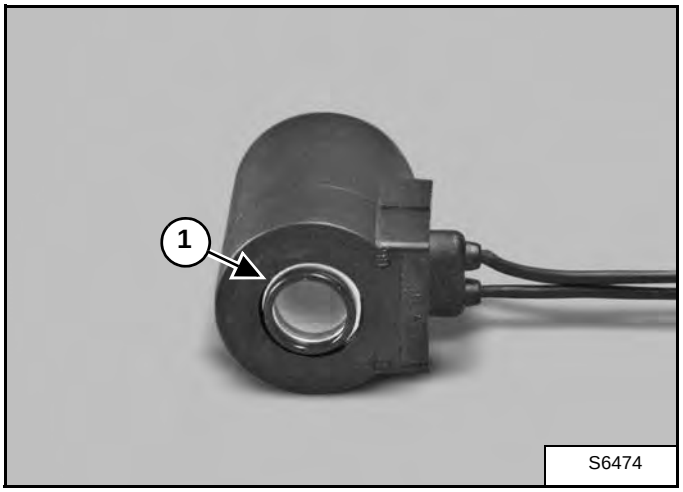
Tighten the solenoid stem to 50 N•m (37 ft-lb) torque.

Figure 20-60-69



Install the O-ring (Item 1) **[Figure 20-60-69]** on the solenoid stem.

Figure 20-60-70



Install the O-ring (Item 1) **[Figure 20-60-70]** on the coil.

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.

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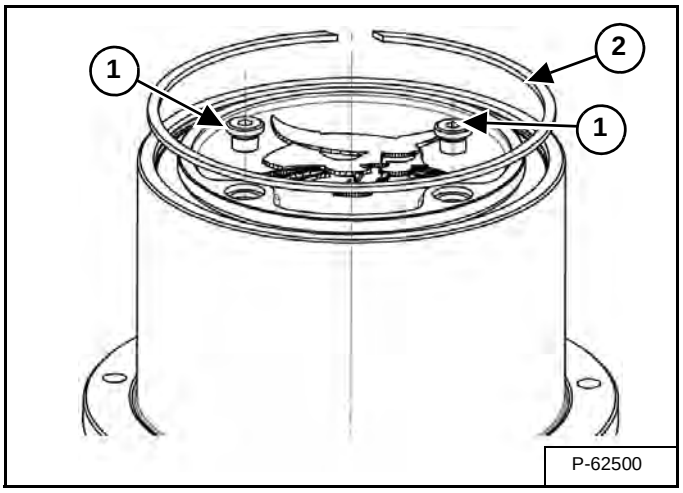
Clean the outside of the travel motor before disassembly.

Drain the lubricant from the travel motor.

Figure 20-70-4



Remove the drain plugs (Item 1) and snap ring (Item 2) **[Figure 20-70-4]** securing the reduction gear cover.

Drain the excess oil into a container.

Figure 20-70-5

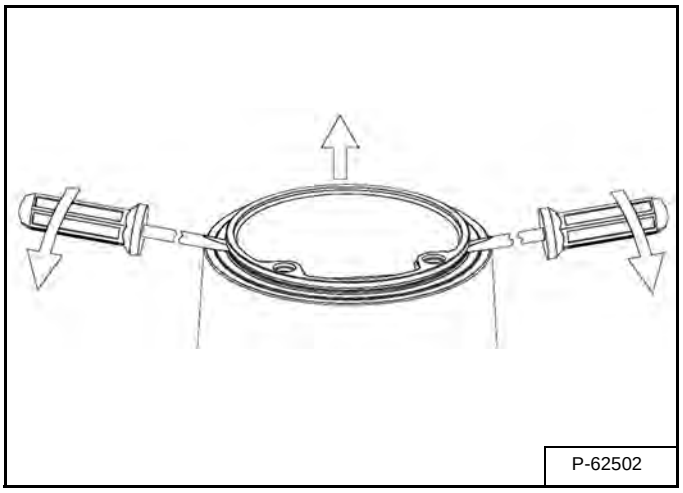
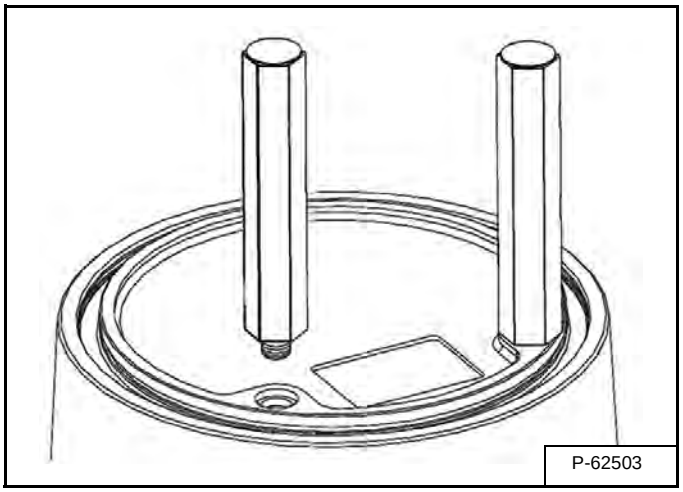


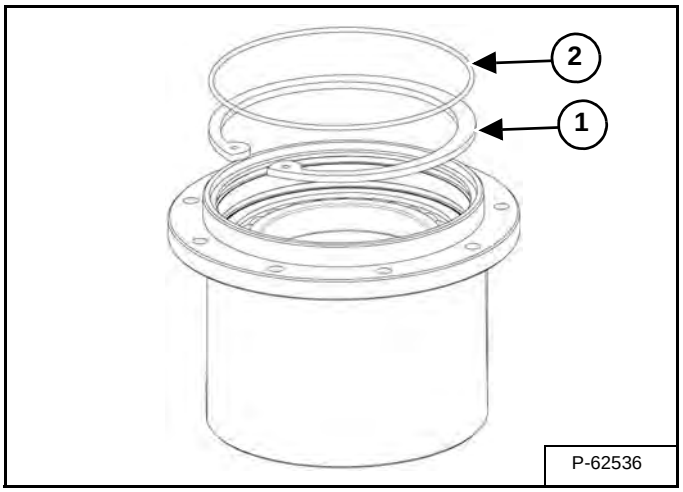
Figure 20-70-6



To remove the cover, lift the cover up using screwdrivers in the upper groove **[Figure 20-70-5]**, or install two threaded pins in the drain holes and lift the cover off **[Figure 20-70-6]**.

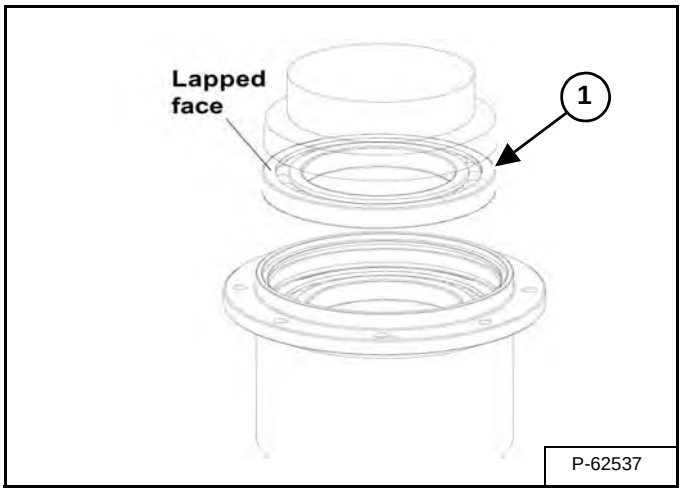
Assembly (Cont'd)

Figure 20-70-40



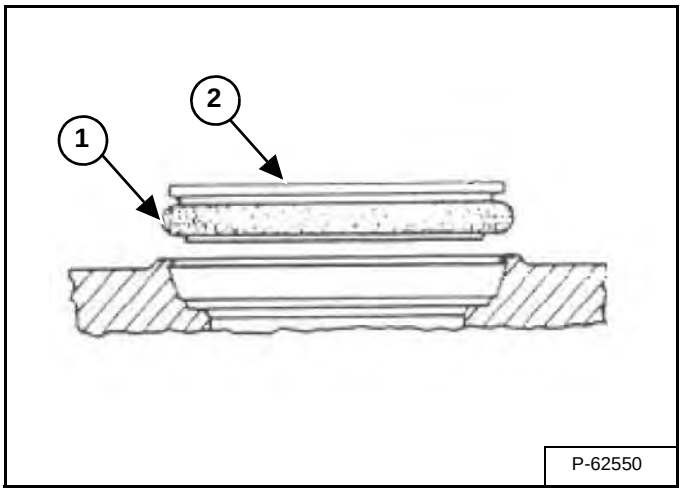
Install the retaining ring (Item 1) and O-ring (Item 2) **[Figure 20-70-40]**.

Figure 20-70-41



Using the bearing installation tool **[Figure 20-70-38]**, install the second bearing (Item 1) **[Figure 20-70-41]** keeping the lapped face up. Use extreme care not to damage the lapped face of the bearing.

Figure 20-70-42

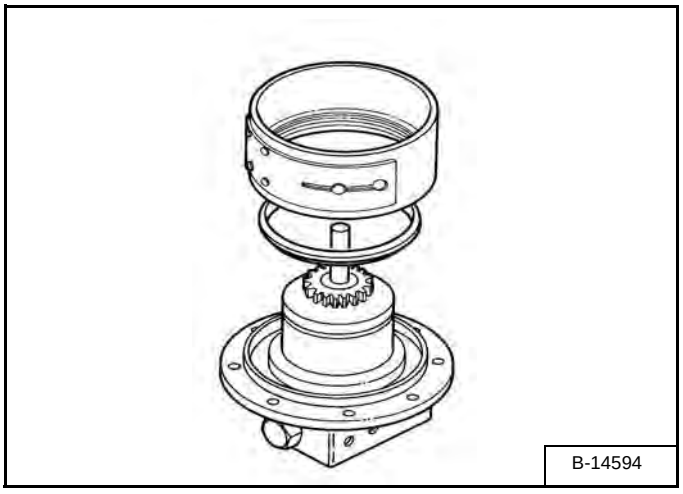


Install the O-ring (Item 1) on the seal ring (Item 2) **[Figure 20-70-42]**.

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

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

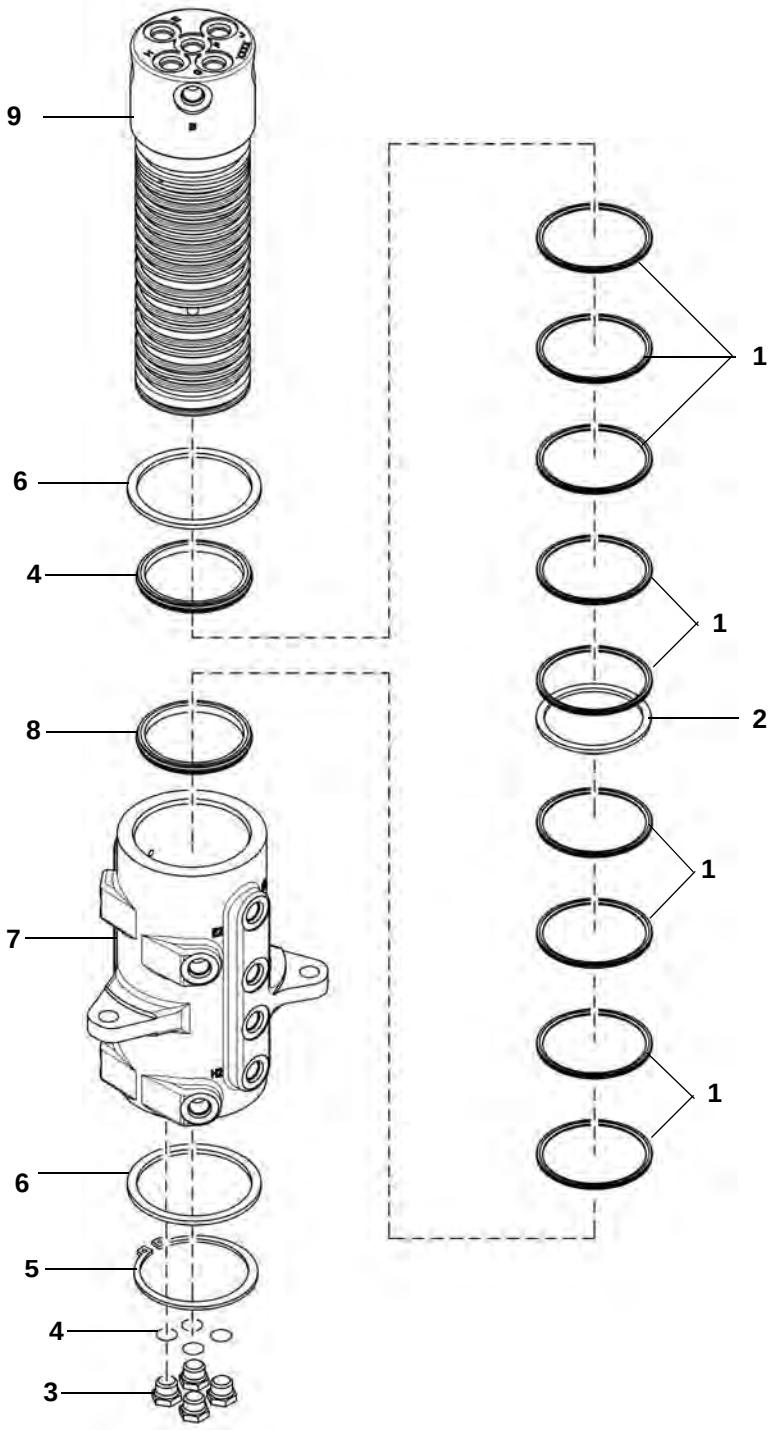
Figure 20-70-43



Install the seal seating tool (MEL1468) on the seal ring **[Figure 20-70-43]**.

Parts Identification (AHLL22003 & Above)

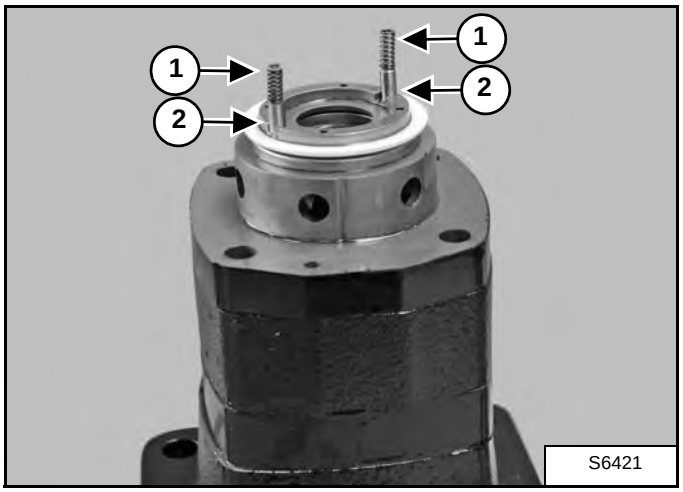
1. Seal
2. Backup Ring
3. Plug
4. O-ring
5. Snap Ring
6. Washer
7. Housing
8. Backup Ring
9. Rotor



NA9140S

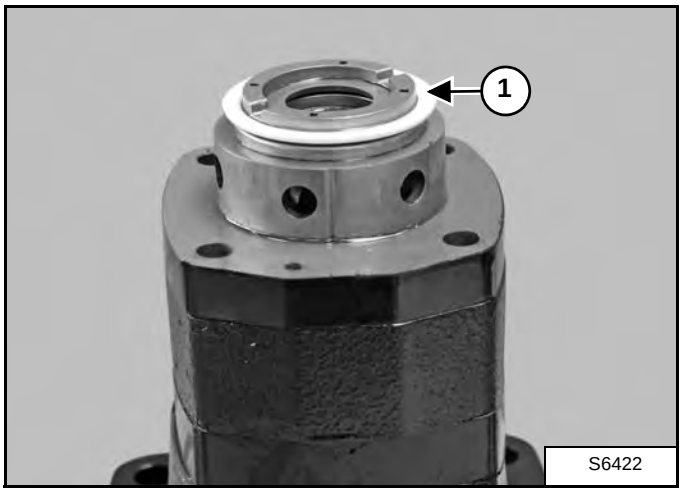
Disassembly (Cont'd)

Figure 20-90-11



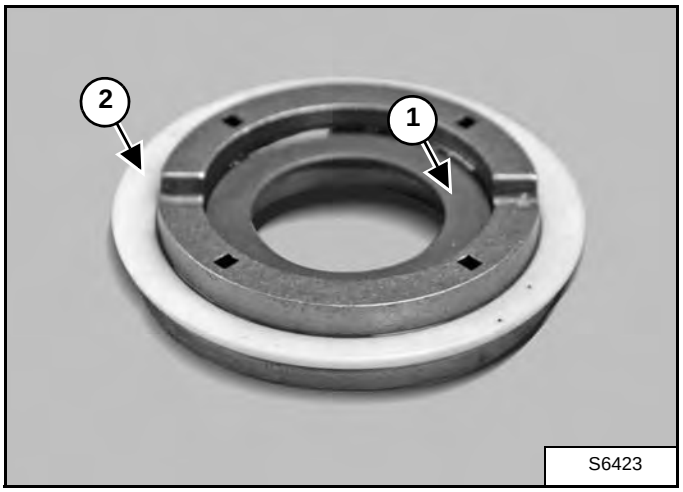
Remove the springs (Item 1) and pins (Item 2) **[Figure 20-90-11]**.

Figure 20-90-12



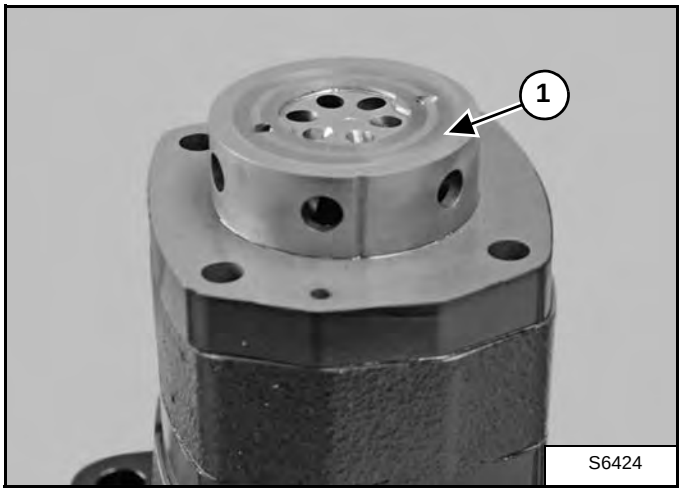
Remove the balance ring (Item 1) **[Figure 20-90-12]**.

Figure 20-90-13



Remove the inner seal (Item 1) and outer seal (Item 2) **[Figure 20-90-13]**.

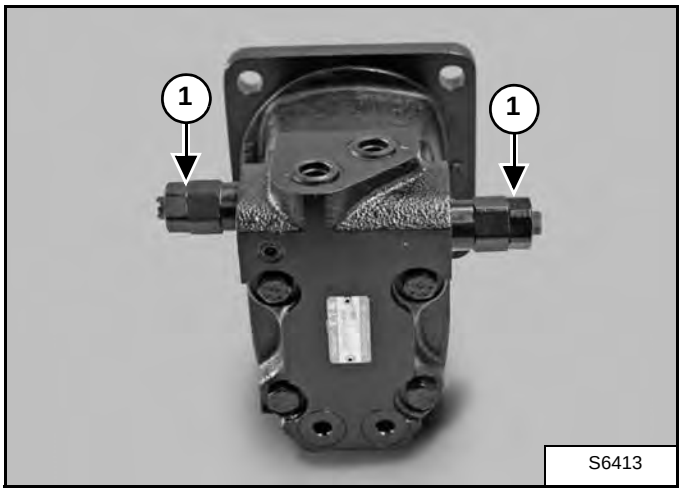
Figure 20-90-14



Remove the valve (Item 1) **[Figure 20-90-14]**.

Assembly (Cont'd)

Figure 20-90-50

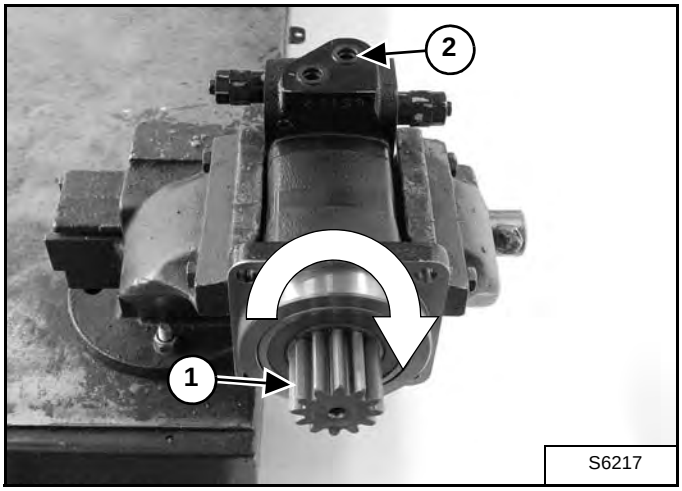


Install the crossport relief valves (Item 1) **[Figure 20-90-50]**.

Installation: Tighten the bolts to 98 N•m (72 ft-lb) torque.

Clamp the motor in a vise.

Figure 20-90-51



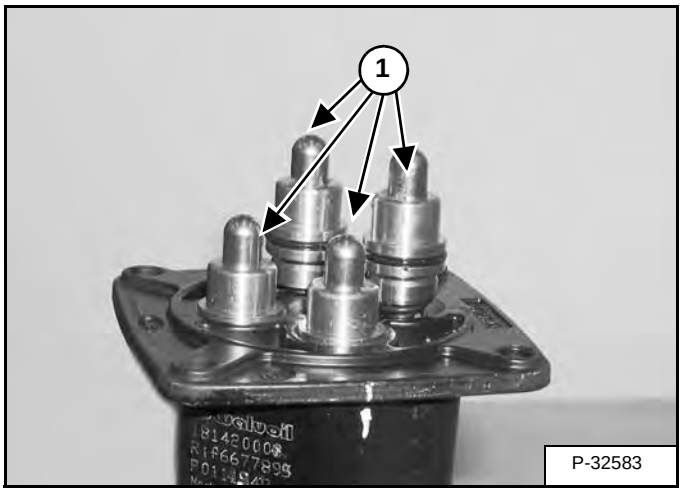
Turn the shaft (Item 1) **[Figure 20-90-51]** in a clockwise direction.

If the motor is correctly timed, there will be suction at the top port (Item 2) **[Figure 20-90-51]**.

CONTROL LEVER (JOYSTICK) (RIGHT) (CONT'D)

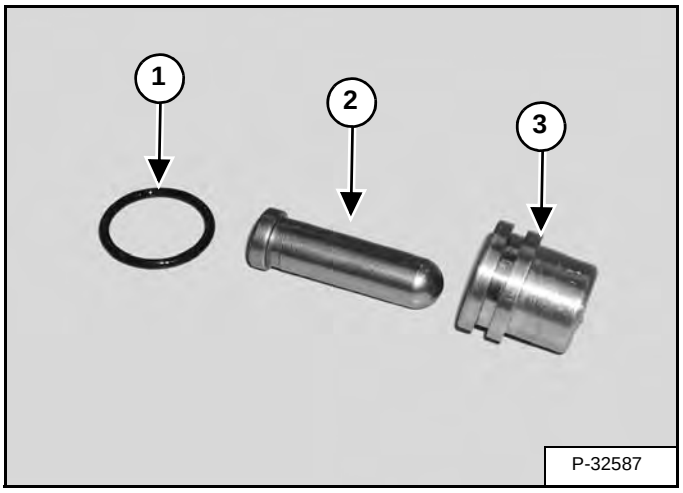
Disassembly (Cont'd)

Figure 20-100-18



Remove the plunger assemblies (Item 1) **[Figure 20-100-18]**.

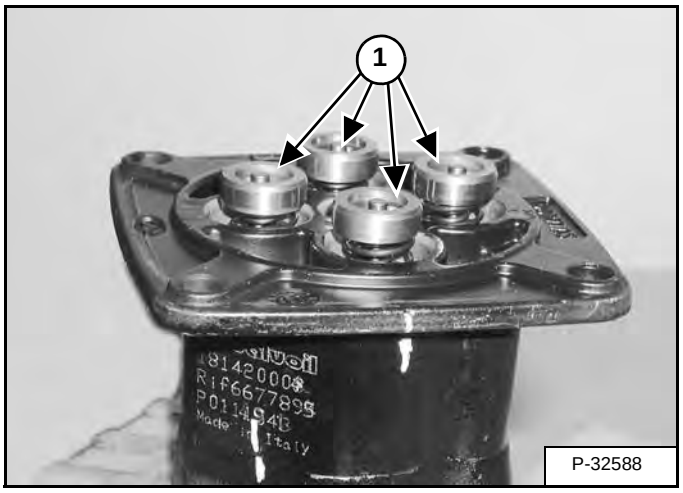
Figure 20-100-19



Remove the O-ring (Item 1) and plunger (Item 2) from the bushing (Item 3) **[Figure 20-100-19]**.

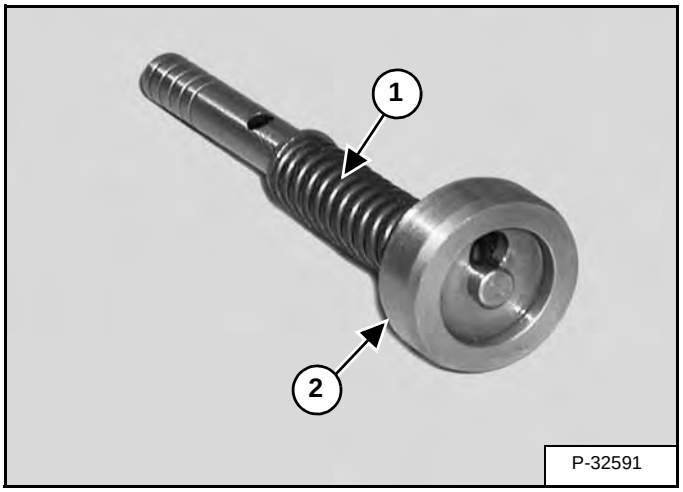
NOTE: Mark the spool assemblies for installation in their original location.

Figure 20-100-20



Remove the spool assemblies (Item 1) **[Figure 20-100-20]**.

Figure 20-100-21



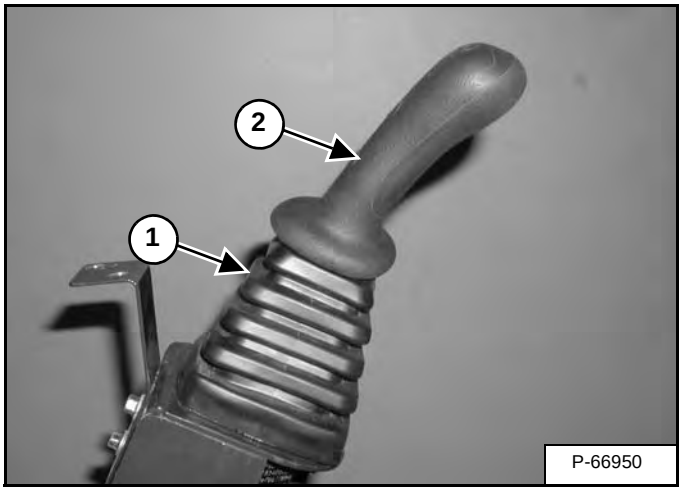
Compress the spring (Item 1) and remove the seat (Item 2) **[Figure 20-100-21]**.

CONTROL LEVER (JOYSTICK) (LEFT) (CONT'D)

Handle Removal And Installation

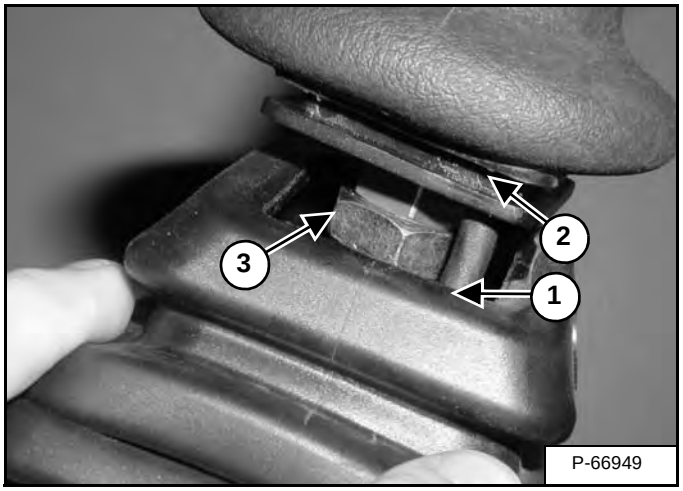
Remove the console cover. (See Left Rear Console Cover Removal And Installation on Page 40-60-8.)

Figure 20-101-3



Remove the dust boot (Item 1) from the handle (Item 2) **[Figure 20-101-3]**.

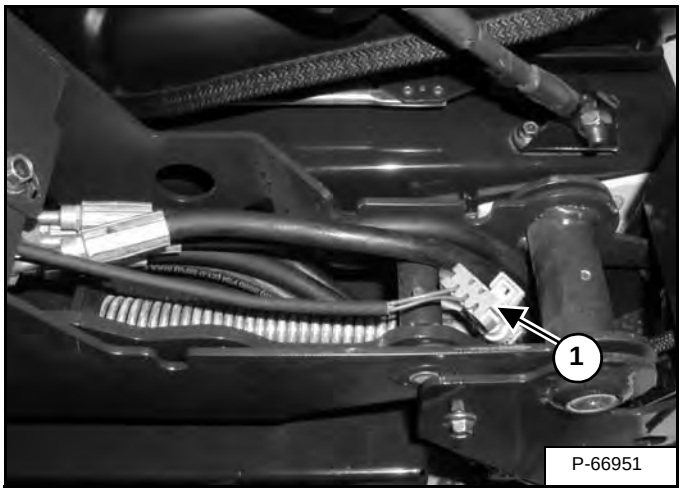
Figure 20-101-4



Installation: Align the top of the dust boot (Item 1) with the groove (Item 2) **[Figure 20-101-4]**.

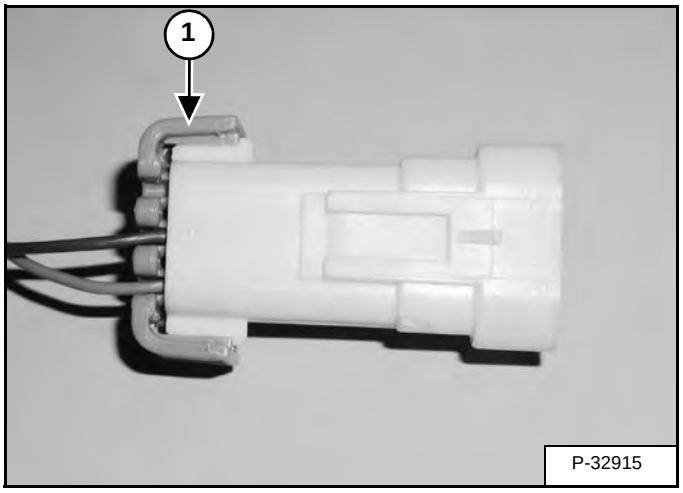
Hold the dust boot (Item 1) down and loosen the nut (Item 3) **[Figure 20-101-4]**.

Figure 20-101-5



Disconnect the wire harness (Item 1) **[Figure 20-101-5]**.

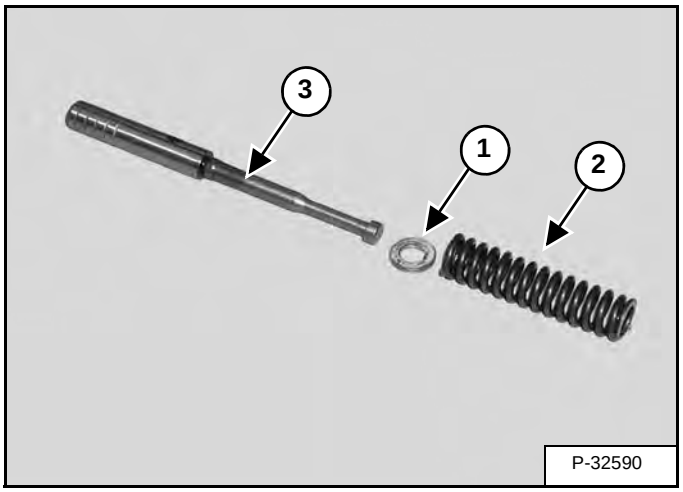
Figure 20-101-6



Remove the lock (Item 1) **[Figure 20-101-6]** from the electrical connector.

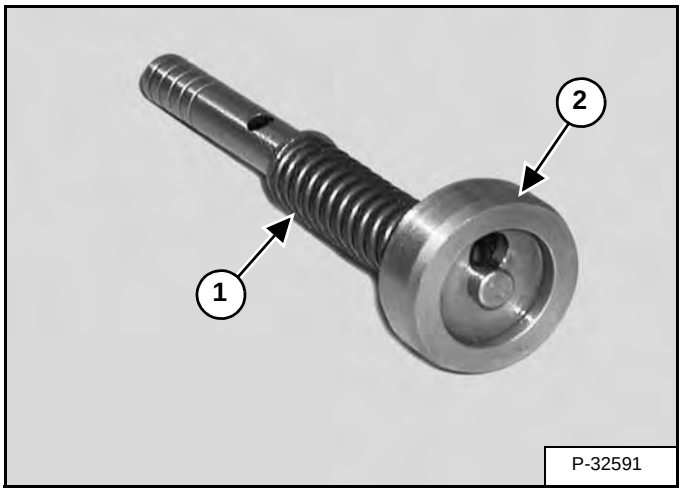
Assembly (Cont'd)

Figure 20-101-35



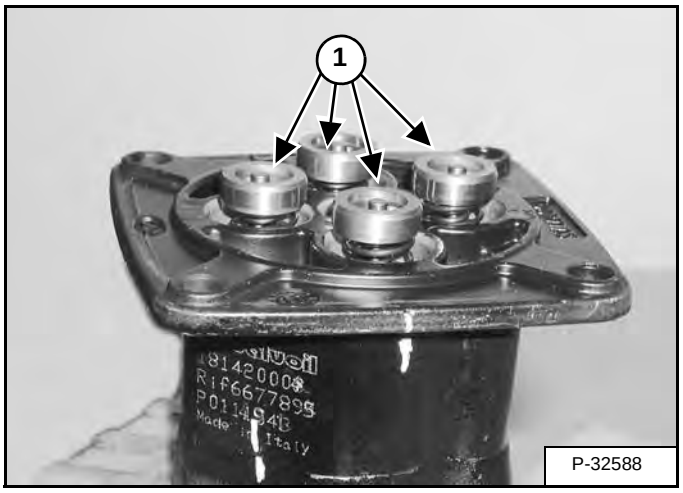
Install the shim (Item 1) and spring (Item 2) on the spool (Item 3) **[Figure 20-101-35]**.

Figure 20-101-36



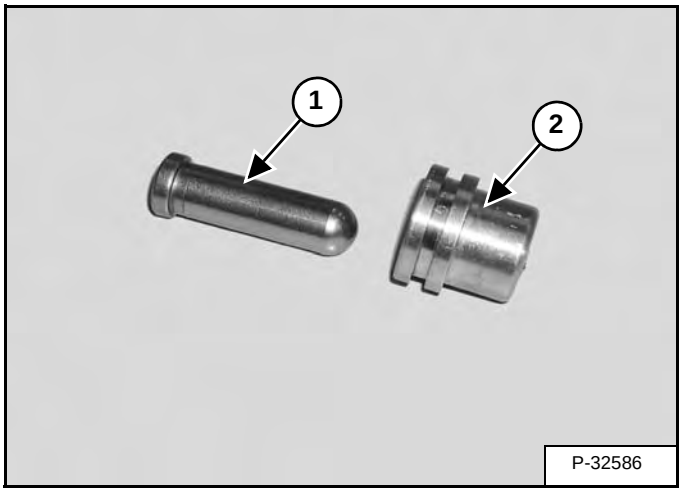
Compress the spring (Item 1) and install the spring seat (Item 2) **[Figure 20-101-36]**.

Figure 20-101-37



Install the spool assemblies (Item 1) **[Figure 20-101-37]** into the housing.

Figure 20-101-38



Install the plunger (Item 1) into the bushing (Item 2) **[Figure 20-101-38]**.

BLADE / TRACK EXPANSION SOLENOID BLOCK (FOR MODEL E16 S/N AHLL11001 - 13119)

Description

The blade / track expansion solenoid block diverts hydraulic fluid to either the blade or track expansion function with the switch on the right hand console.

The blade / track expansion solenoid block is located under the floor mat and floor panels on the right side of the excavator.

The blade / track expansion solenoid block has a 29 MPa (290 bar) (4205 psi) relief valve to protect the blade function from overpressure.

Block Removal And Installation

Lower the boom / bucket and blade to the ground.

With the engine off, turn the start key to the ON position and move the blade lever to relieve hydraulic pressure.

IMPORTANT

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

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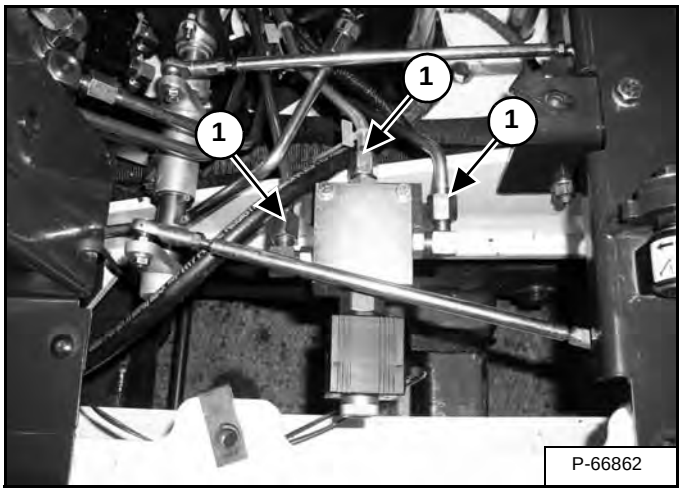
Remove the floor mat and floor panel. (See Removal And Installation on Page 40-140-1.)

⚠ 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 doctor familiar with this injury is not received immediately.

W-2145-EN-0210

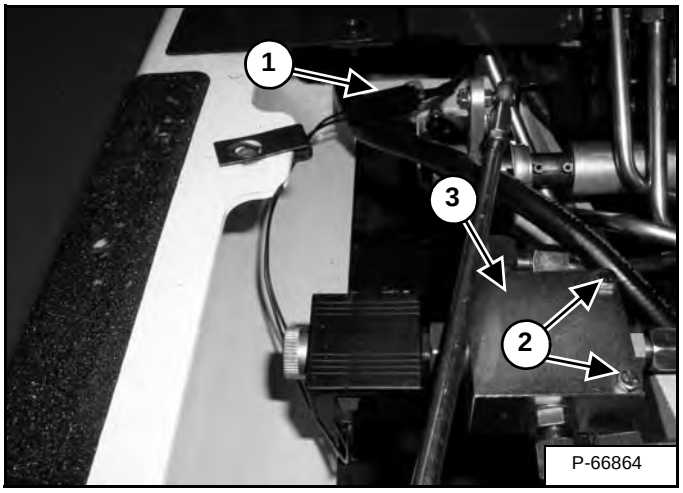
Figure 20-140-1



Mark all tubelines (Item 1) **[Figure 20-140-1]** for ease of assembly.

Disconnect the tubelines (Item 1) **[Figure 20-140-1]** from the block.

Figure 20-140-2



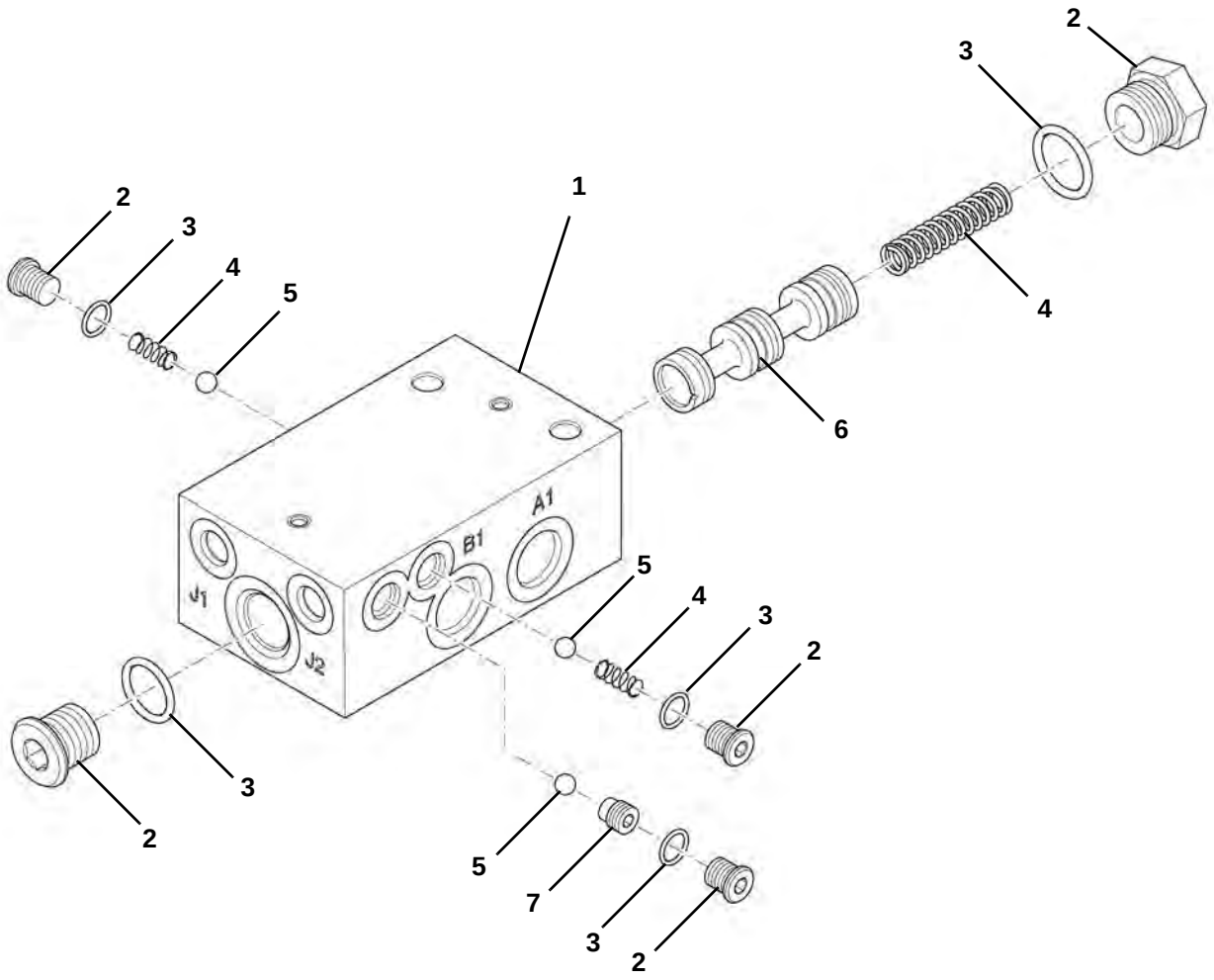
Disconnect the wire harness (Item 1) **[Figure 20-140-2]** from the excavator harness.

Remove the bolts (Item 2) **[Figure 20-140-2]**.

Remove the blade / track expansion solenoid block (Item 3) **[Figure 20-140-2]** from the excavator.

Parts Identification

1. Valve
2. Plug
3. O-ring
4. Spring
5. Ball
6. Spool
7. Shuttle seat



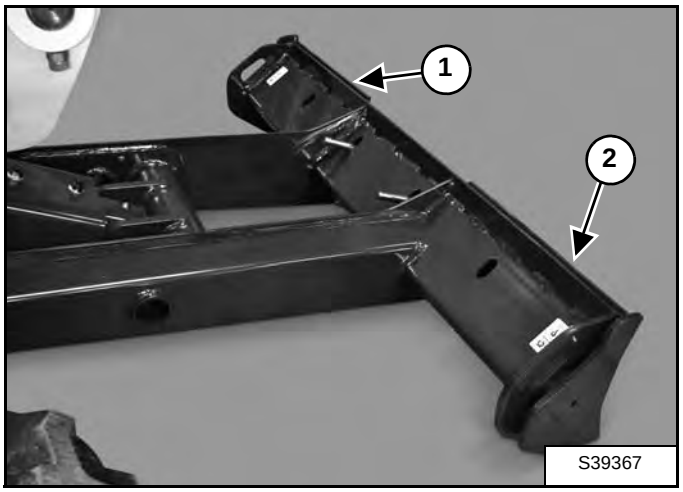
EM1112

BLADE

Description

The blade extensions are used to match the blade width to the track width. Secure the blade extensions in the retracted position when transporting the excavator or when narrow operating width is needed. Under normal operating conditions, the blade width should match the track width.

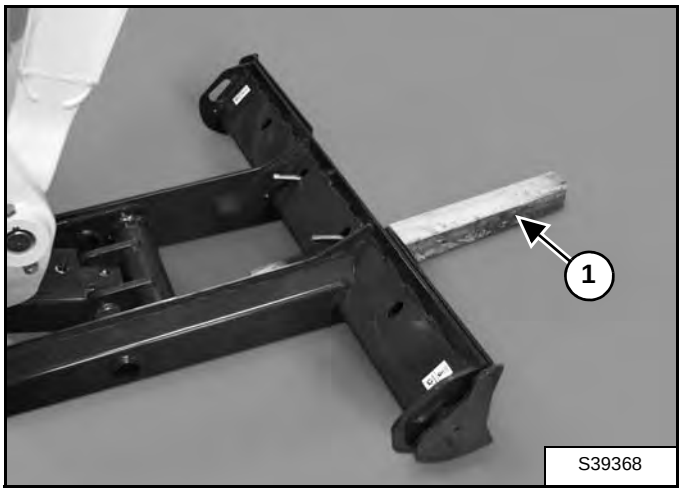
Figure 30-10-1



The blade extensions (Items 1 and 2) **[Figure 30-10-1]** are located on the blade.

Extension Removal And Installation

Figure 30-10-2

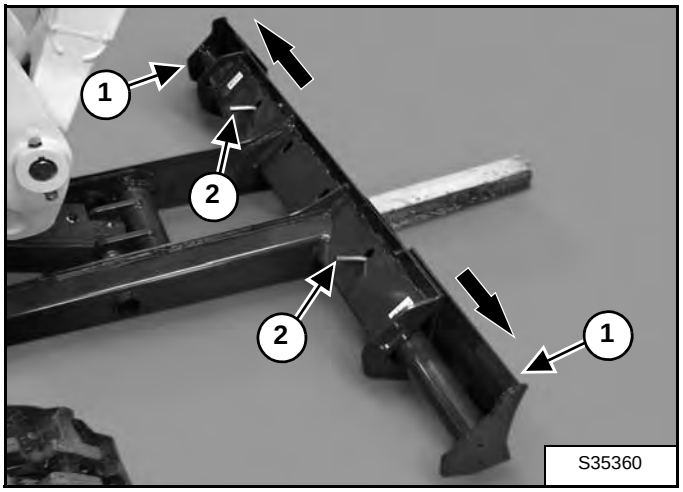


Put a block (Item 1) **[Figure 30-10-2]** under the blade.

Fully lower the blade on the block.

Stop the engine.

Figure 30-10-3

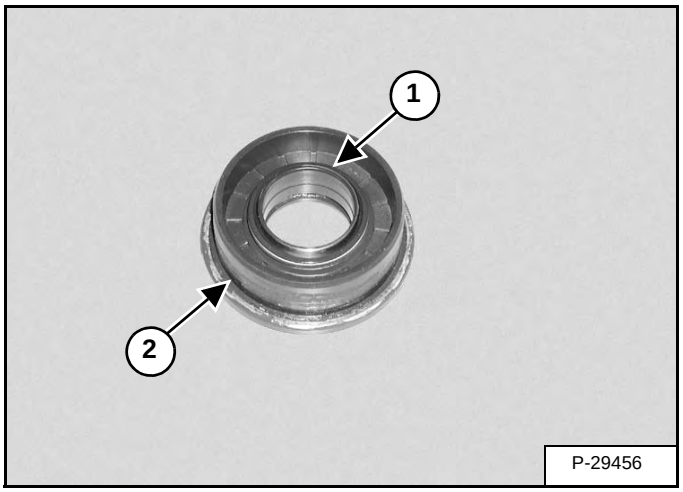


Remove the two pins (Item 1) **[Figure 30-10-3]** from the blade extensions.

Remove the blade extensions (Item 1) **[Figure 30-10-3]** from the blade.

Idler Assembly (Cont'd)

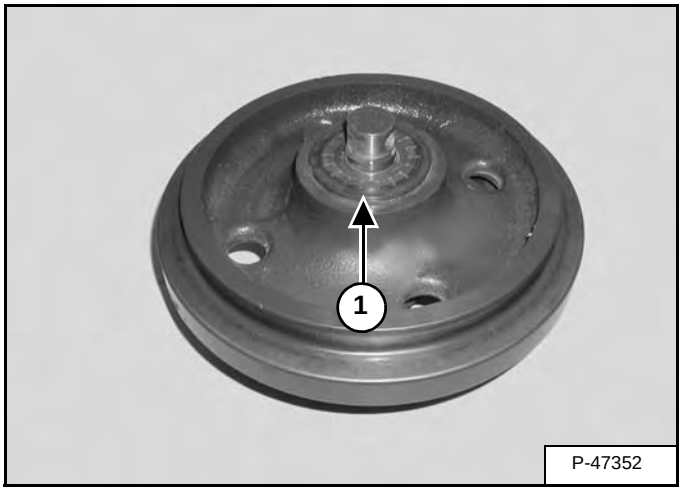
Figure 30-20-25



Apply assembly lube to the inside diameter (Item 1) **[Figure 30-20-25]** of the seal.

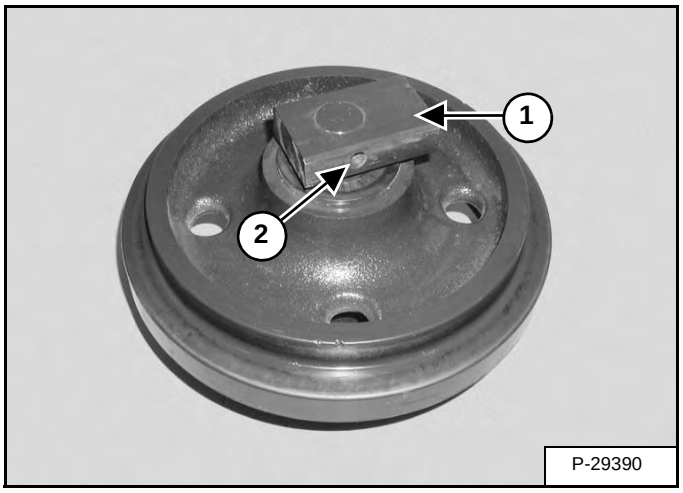
Apply a small bead of high temperature silicone sealant around the flange surface (Item 2) **[Figure 30-20-25]** of the seal.

Figure 30-20-26



Using the driving tool, install the seal (Item 1) **[Figure 30-20-26]** on both sides of the idler.

Figure 30-20-27



Install the block (Item 1) and roll pin (Item 2) **[Figure 30-20-27]** on both sides of the shaft.

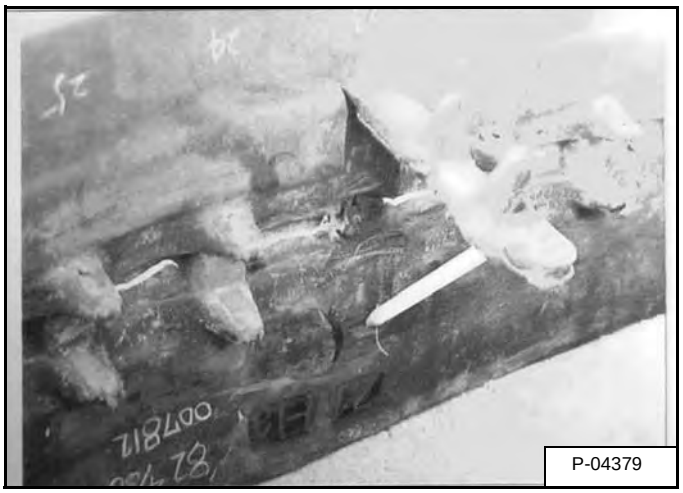
TRACK MAINTENANCE (CONT'D)

Track Damage Identification (Cont'd)

Separation Of Embedded Metals

Damage:

Figure 30-30-6



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

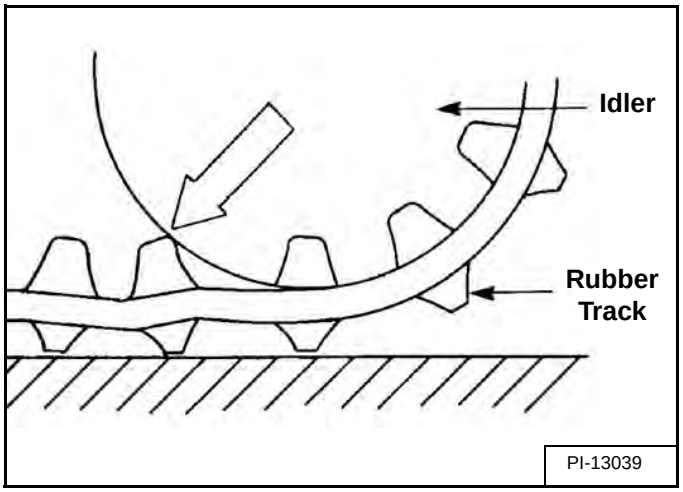
Replacement:

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

Causes Of The Damage:

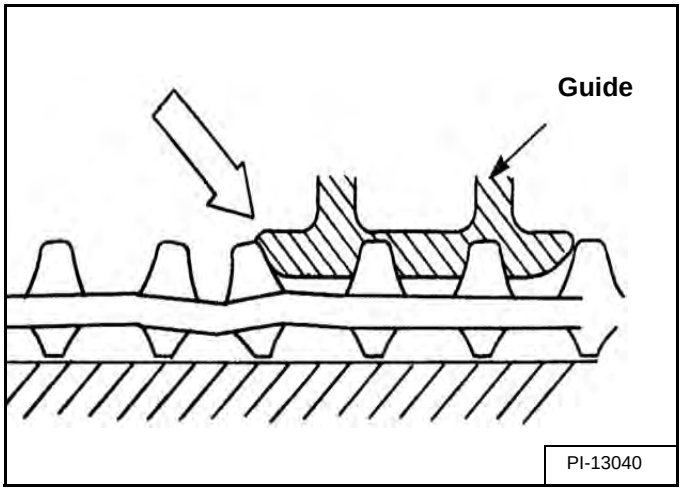
Embedded metals adhere between the steel cords and the rubber body. The following cases generate external forces greater than the adhesion strength, causing separation of the embedded metals:

Figure 30-30-7



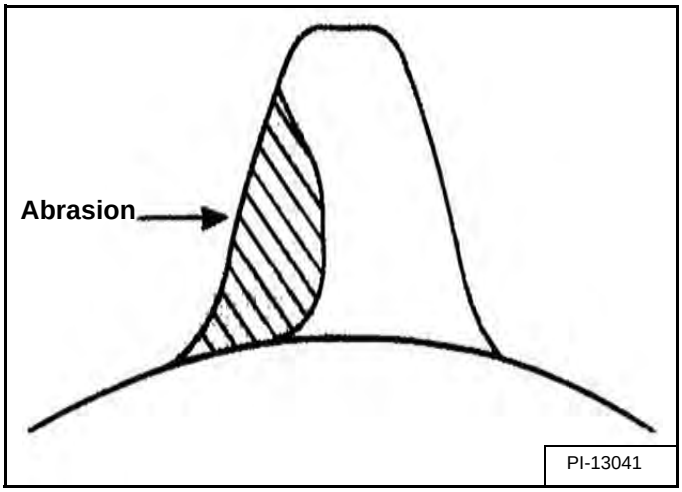
When the idler continually rides on the projections of embedded metals, the embedded metals will eventually peel off **[Figure 30-30-7]**.

Figure 30-30-8



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

Figure 30-30-9



Abnormally worn sprockets as shown will pull embedded metals out **[Figure 30-30-9]**.

Prevention:

Similar to the prevention against the cutting of the steel cords:

Periodically check on site, recommended track tension. (See Checking Tension on Page 30-20-1.)

SWING CIRCLE GEAR

Removal And Installation

Remove the upperstructure from the swing circle gear. (See Removal on Page 40-10-1.)

Figure 30-40-1

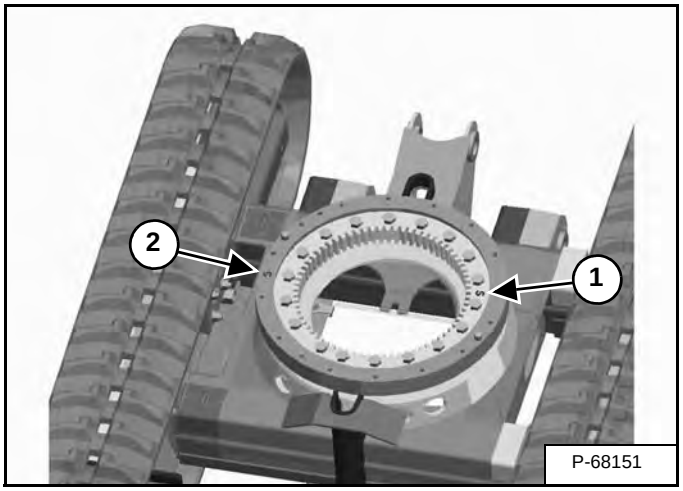
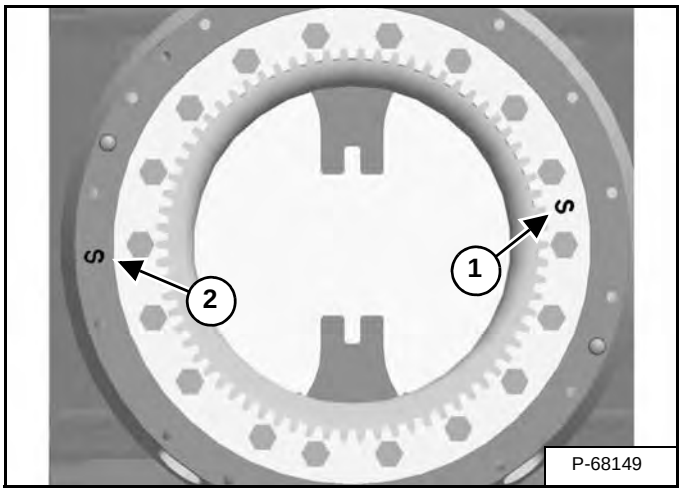


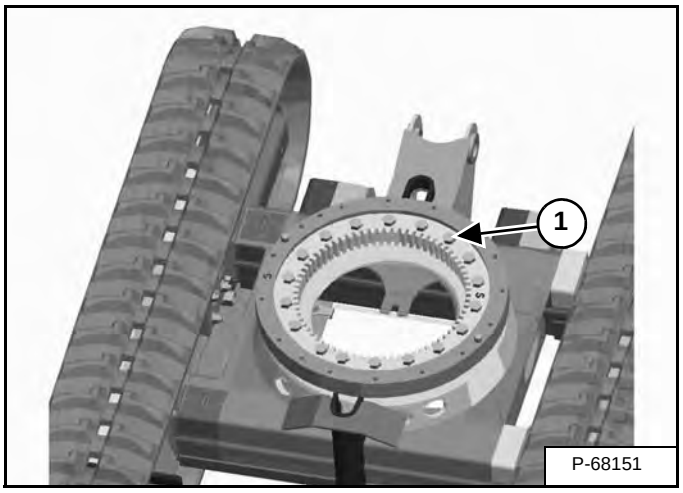
Figure 30-40-2



The swing gear and outer ring both have a soft zone. The swing gear soft zone is identified with an S (Item 1) stamped in the swing gear. The outer ring soft zone is identified with an S (Item 2) **[Figure 30-40-1]** and **[Figure 30-40-2]** stamped in the outer ring.

The soft zones of both the swing gear and outer ring must be positioned 180° of each other.

Figure 30-40-3



Remove the bolts (Item 1) **[Figure 30-40-3]** and nuts from the swing circle gear.

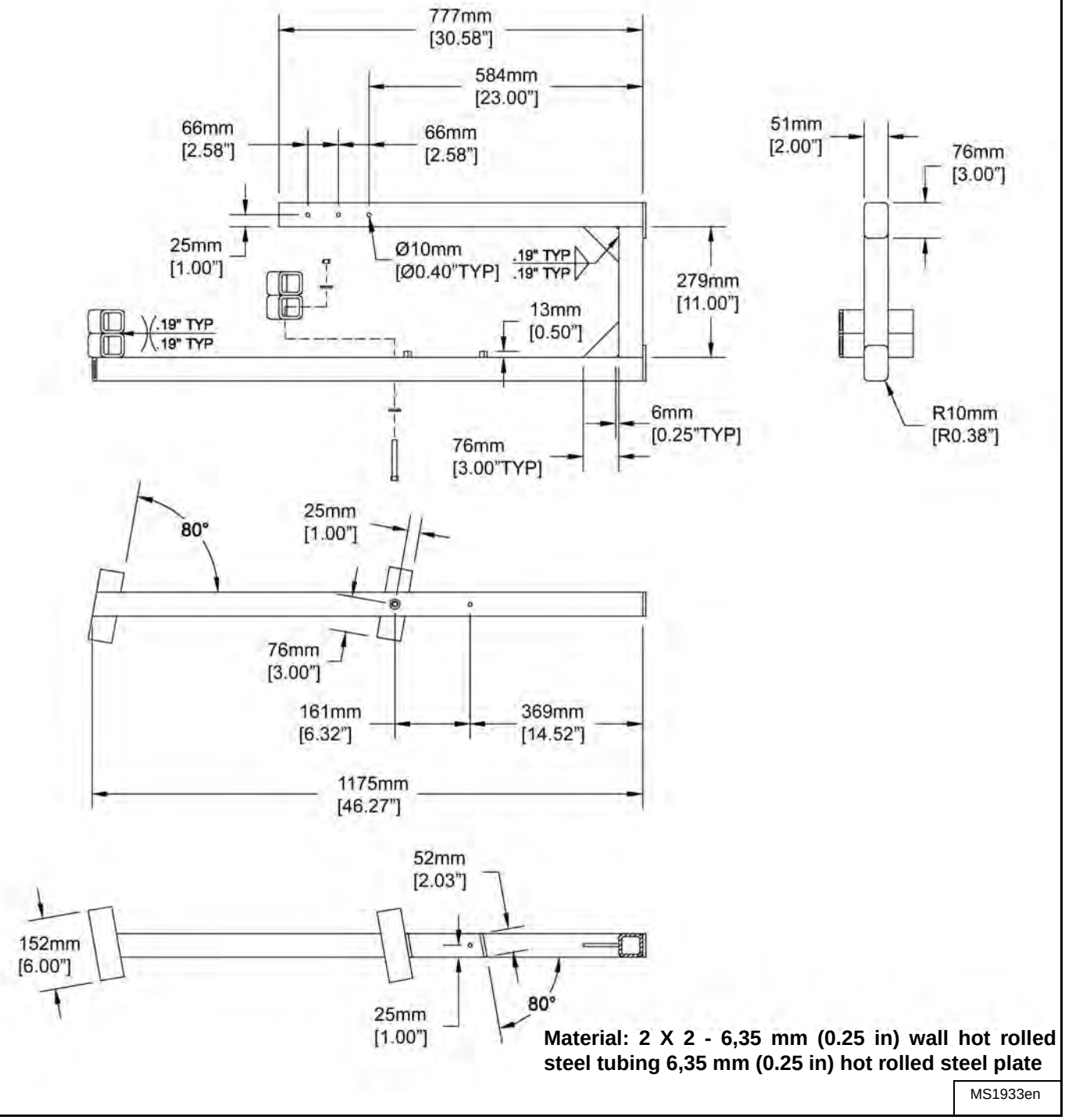
Installation: Tighten the bolts (Item 1) **[Figure 30-40-3]** and nuts to 105 - 115 N•m (78 - 85 ft-lb) torque.

ROPS CANOPY

Removal And Installation

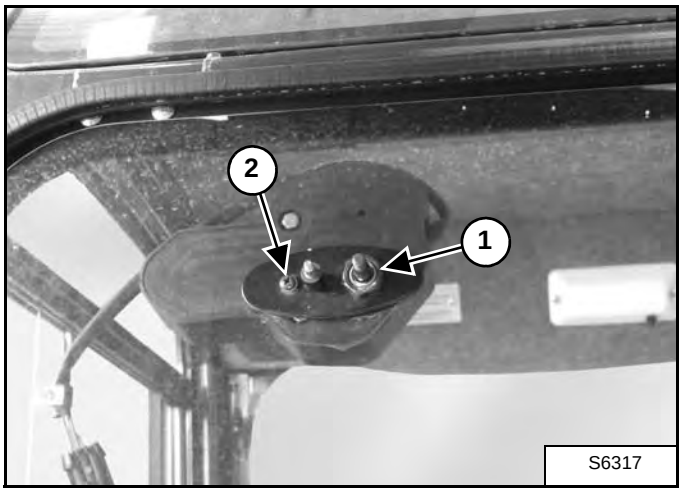
Build the service lifting bracket used to remove and install the ROPS canopy. Use the dimensions shown in **[Figure 40-20-1]** to build the service lifting bracket.

Figure 40-20-1



Front Window Removal And Installation (Cont'd)

Figure 40-30-18

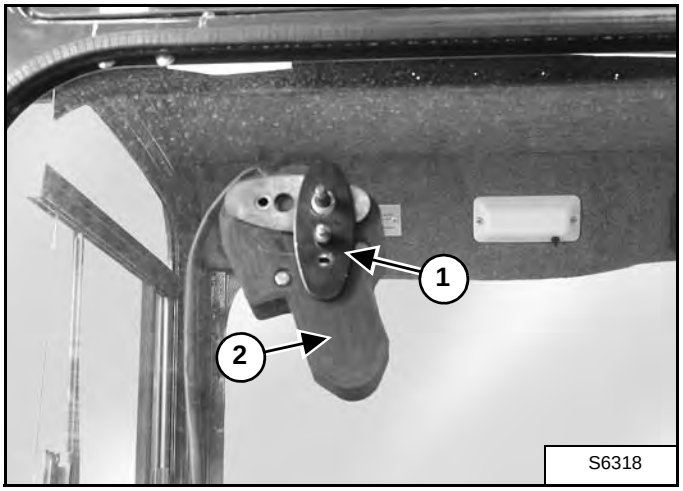


Remove the nut and washer (Item 1) **[Figure 40-30-18]**.

Remove the bolt (Item 2) **[Figure 40-30-18]**.

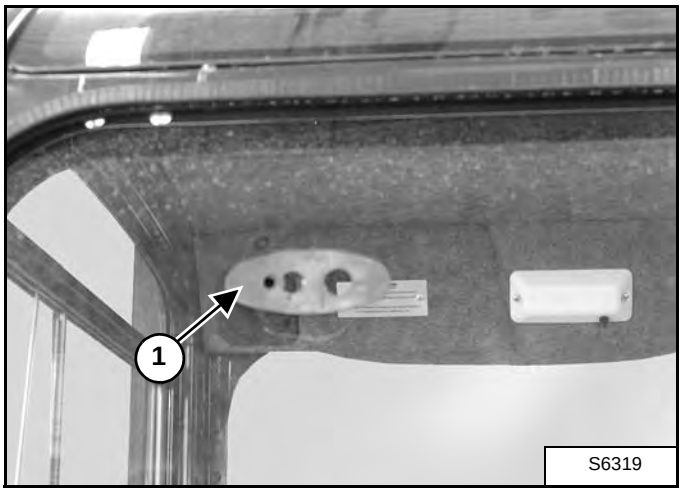
NOTE: Support the wiper motor before removing the bolts.

Figure 40-30-19



Remove the plate (Item 1) and wiper motor (Item 2) **[Figure 40-30-19]**.

Figure 40-30-20

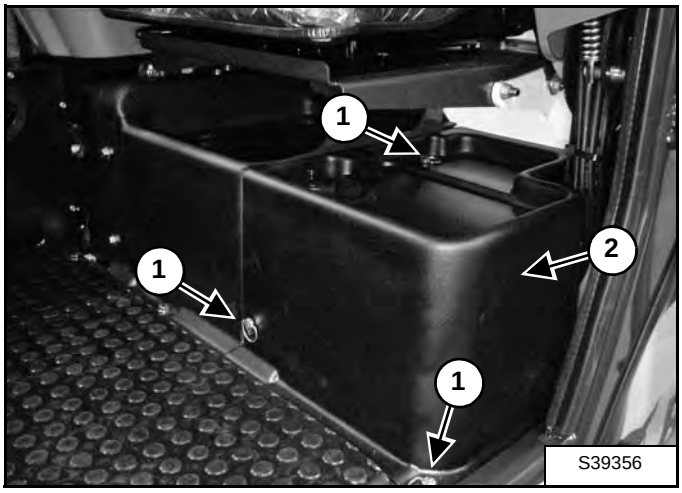


Remove the seal (Item 1) **[Figure 40-30-20]**.

SEAT AND SEAT MOUNT (FOR MODEL E16 S/N AHLL13120 & ABOVE)

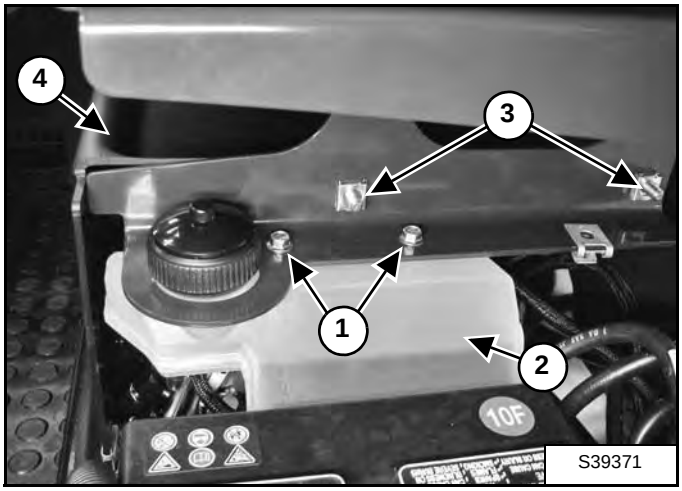
Seat Mount Removal And Installation

Figure 40-41-1



Loosen the three screws (Item 1) and remove the battery cover (Item 2) **[Figure 40-41-1]**.

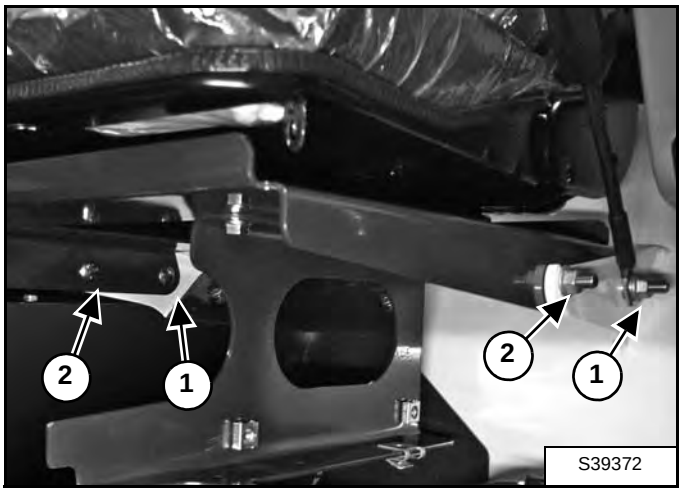
Figure 40-41-2



Remove the two bolts (Item 1) and lower the windscreen washer bottle (Item 2) **[Figure 40-41-2]**.

Remove the two bolts (Item 3) from the access cover (Item 4) **[Figure 40-41-2]**.

Figure 40-41-3

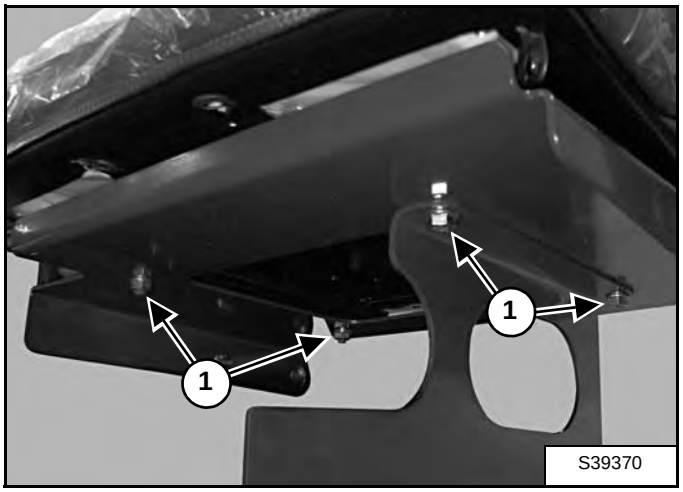


Remove the two bolts (Item 1) **[Figure 40-41-3]** and nuts from both sides of the seat mount.

Loosen the two bolts (Item 2) **[Figure 40-41-3]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 40-41-4

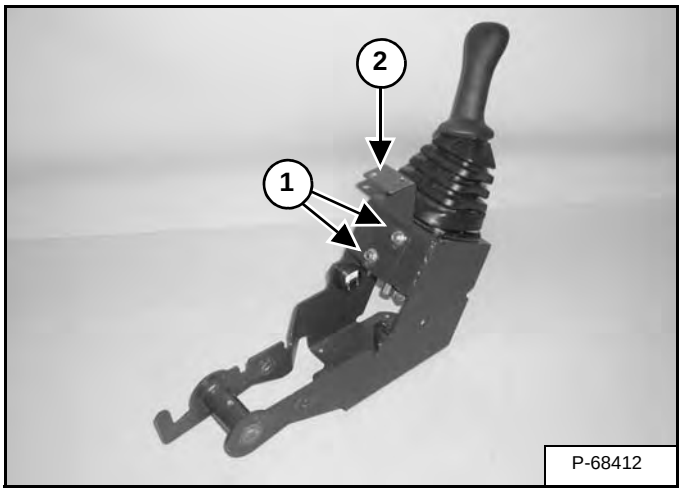


Remove the four nuts and washers (Item 1) **[Figure 40-41-4]** from the seat bolts and remove seat and rail assembly.

NOTE: The lower seat rails do not separate from the seat rails and are attached to the bottom of the seat as an assembly.

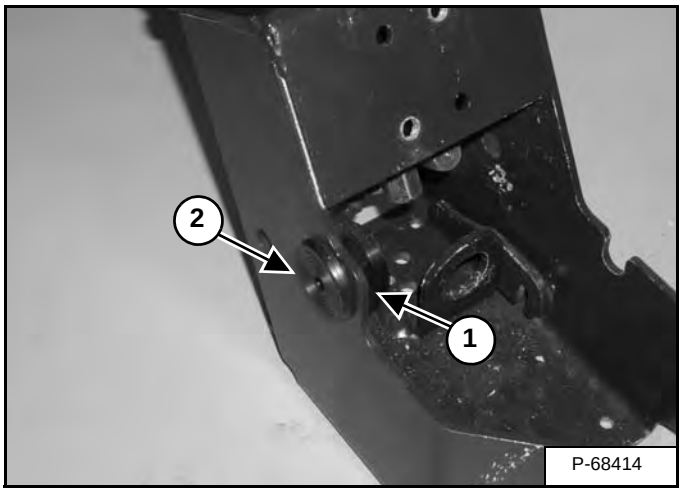
Joystick Console Frame Disassembly And Assembly

Figure 40-50-25



Remove the screws (Item 1) and bracket (Item 2) **[Figure 40-50-25]**.

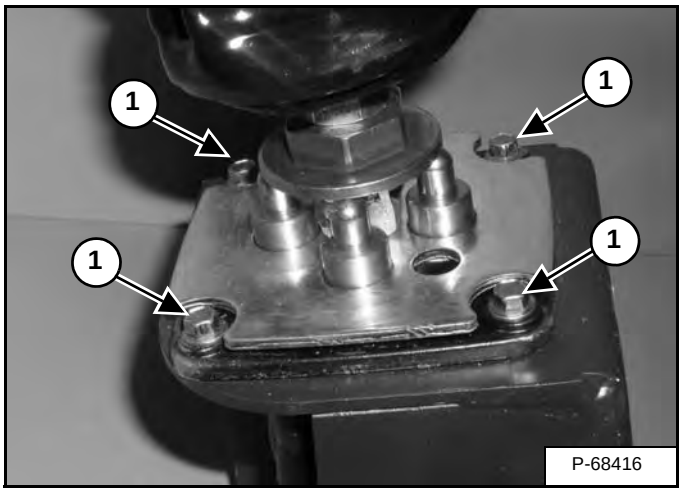
Figure 40-50-26



Remove the nut (Item 1) from the buzzer (Item 2) **[Figure 40-50-26]**.

Remove the buzzer (Item 2) **[Figure 40-50-26]**.

Figure 40-50-27



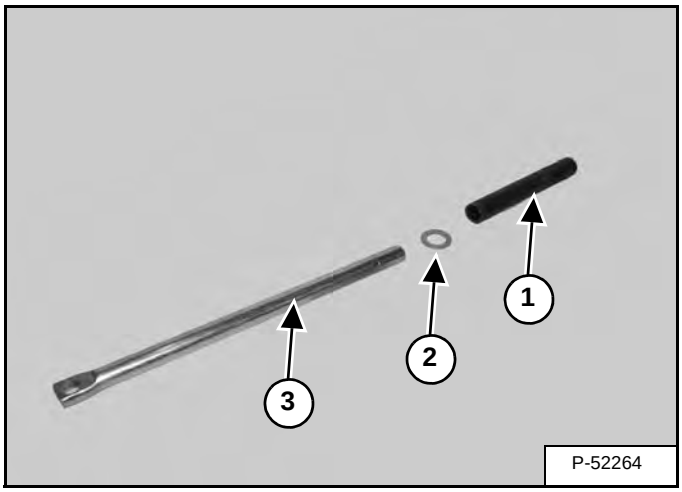
Lift the joystick boot.

Remove the screws (Item 1) **[Figure 40-50-27]** from the joystick bracket.

Remove the joystick from the console frame.

Compression Spring Disassembly And Assembly (Cont'd)

Figure 40-60-13

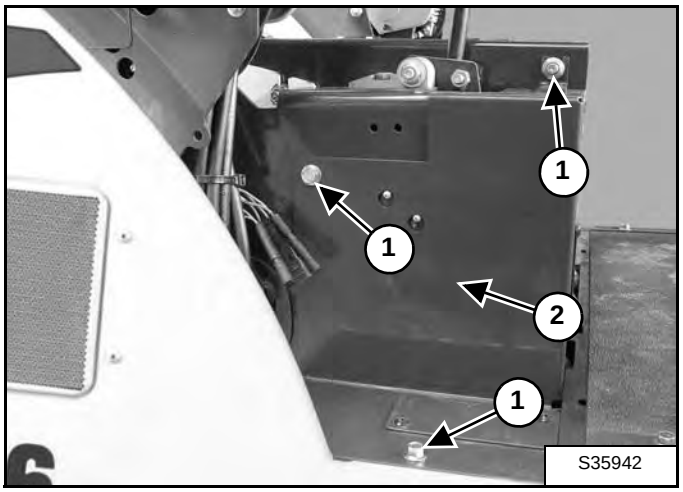


Remove the sleeve (Item 1) and washer (Item 2) from the shaft (Item 3) **[Figure 40-60-13]**.

BLADE CONTROL

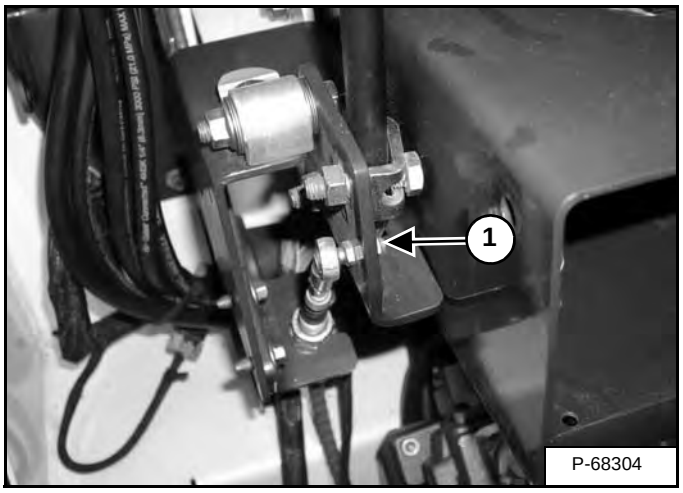
Removal And Installation

Figure 40-80-1



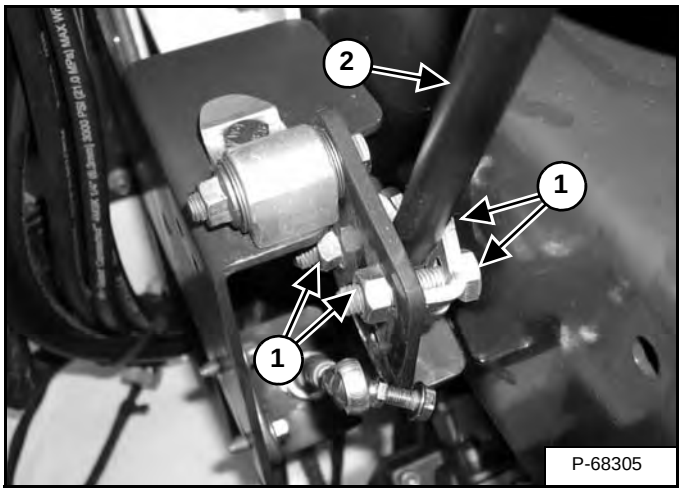
Remove the three bolts (Item 1) and remove the right side cover (Item 2) **[Figure 40-80-1]**.

Figure 40-80-2



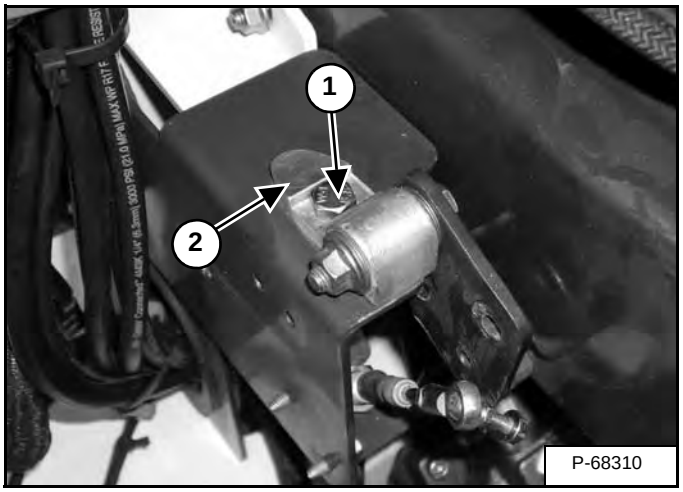
Remove the nut holding the ball joint of the blade / track expansion cable (Item 1) **[Figure 40-80-2]**.

Figure 40-80-3



Remove the bolts and nuts (Item 1). Remove the blade / track expansion lever (Item 2) **[Figure 40-80-3]**.

Figure 40-80-4



Remove the nut and bolt (Item 1) **[Figure 40-80-4]**.

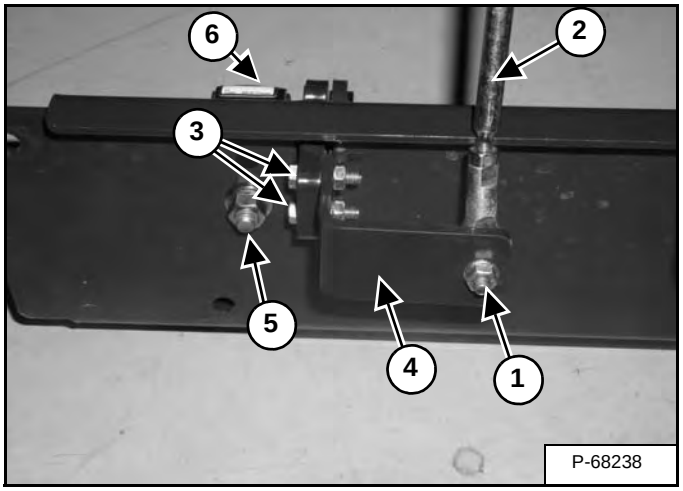
Remove the bellcrank and pivot mount (Item 2) **[Figure 40-80-4]**.

LEFT PEDAL

Removal And Installation

Remove the floor mat and floor panels. (See Removal And Installation on Page 40-140-1.)

Figure 40-120-1



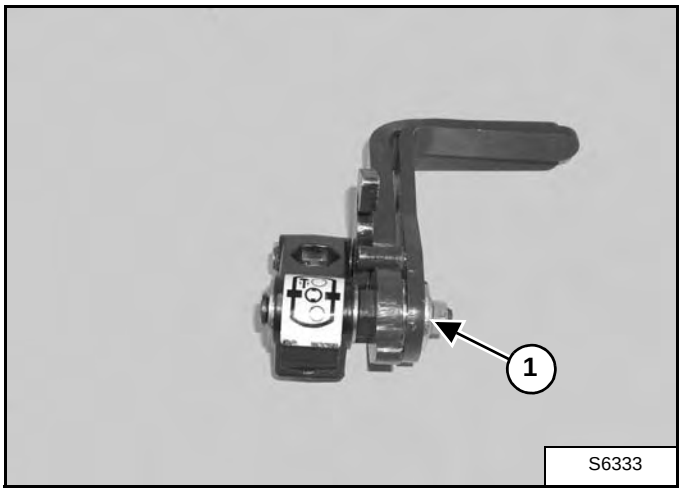
Remove the nut (Item 1) and linkage rod (Item 2) **[Figure 40-120-1]**.

Remove the two bolts and nuts (Item 3) and remove the bracket (Item 4) **[Figure 40-120-1]**.

Remove the nut and bolt (Item 5) and remove the boom swing pedal assembly (Item 6) **[Figure 40-120-1]**.

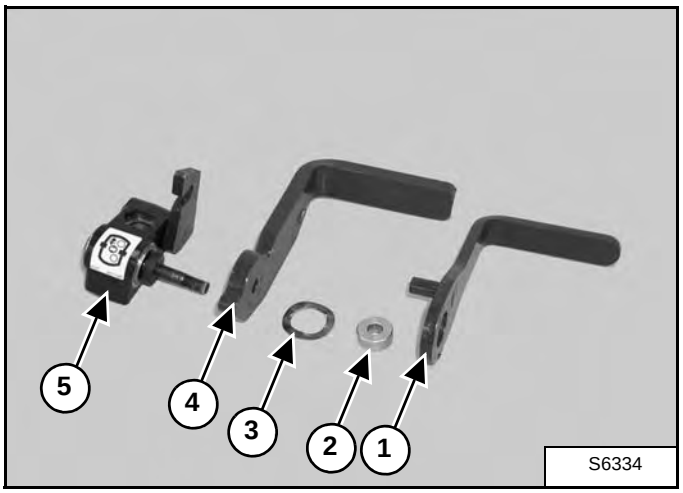
Disassembly And Assembly

Figure 40-120-2



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

Figure 40-120-3



Remove the rear pedal (Item 1), bushing (Item 2), wave washer (Item 3), and front pedal (Item 4) from the mount (Item 5) **[Figure 40-120-3]**.

FLOOR MAT AND FLOOR PANELS

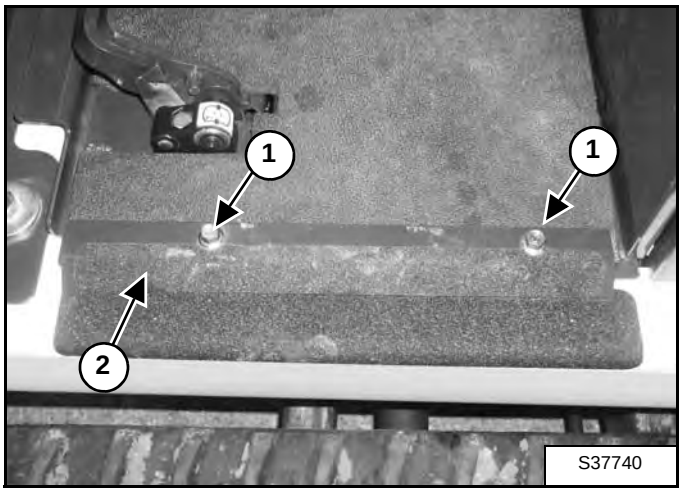
Description

The floor of the excavator (cab or canopy) is divided into two floor panels covered by a mat. The rear floor panel provides accessibility to the hydraulic components and the front panel consists of the travel levers and foot pedals.

The rear floor panel is the only floor panel that needs to be removed when servicing the hydraulic components. The front floor panel only needs to be removed when the travel levers, pedals and upperstructure slew lock need servicing.

Removal And Installation

Figure 40-140-1

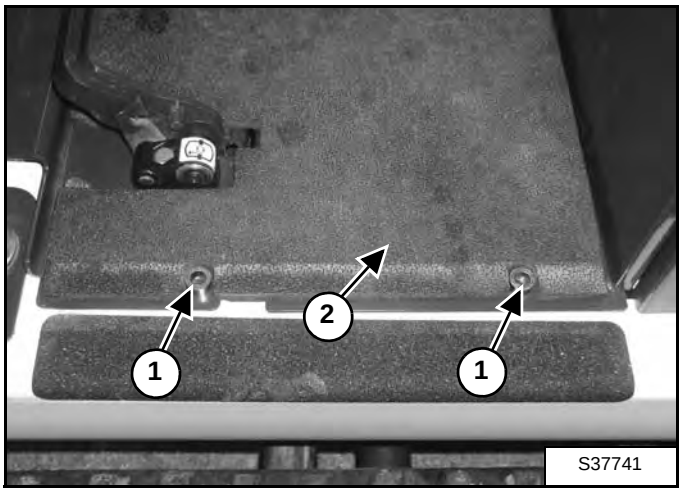


Remove the bolts (Item 1) **[Figure 40-140-1]** in both floor mat retaining plates.

Remove the floor mat retaining plate (Item 2) **[Figure 40-140-1]** from both sides.

NOTE: Excavators that are equipped with a cab only have a floor mat retainer plate on the door side.

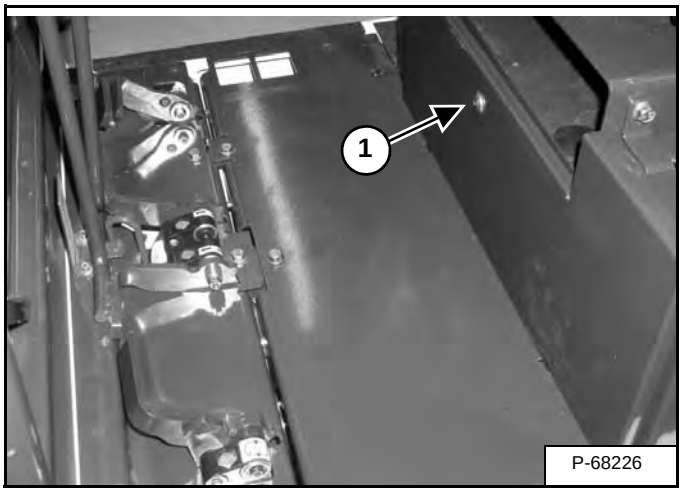
Figure 40-140-2



Remove the spacers (Item 1) from both sides of the floor mat (Item 2) **[Figure 40-140-2]**.

Remove the floor mat (Item 2) **[Figure 40-140-2]**.

Figure 40-140-3



Use the key to remove the access panel (Item 1) **[Figure 40-140-3]**.

Boom Pivot Bushing Removal

The following parts will be needed for removal and installation of the boom pivot bushings.

Bolt - 15,88 x 114,3 mm long (0.625 x 4.5 in long)

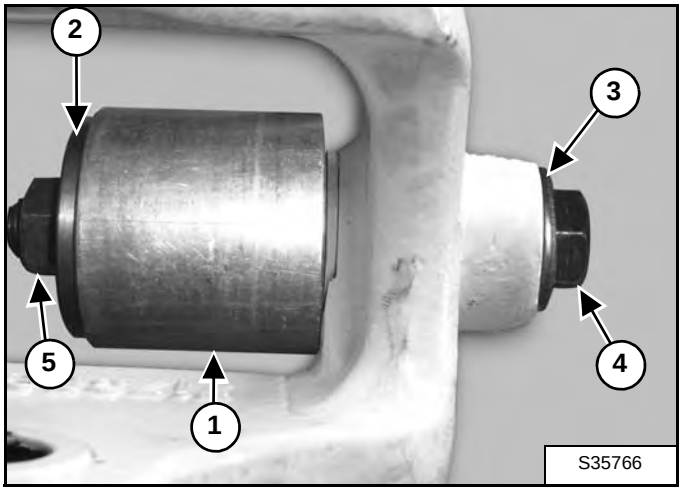
Nut - 15,875 mm (0.625 in)

Washer -
(15,875 mm I.D. x 34,9 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 1.375 in O.D. x 0.25 in thick)

Washer -
(15,875 mm I.D. x 66,7 mm O.D. x 6,35 mm thick)
(0.625 in I.D. x 2.625 in O.D. x 0.25 in thick)

Spacer -
(57,15 mm I.D. x 66,7 mm O.D. x 38,1 mm thick)
(2.250 in I.D. x 2.625 in O.D. x 1.5 in thick)

Figure 40-170-11



Install the spacer (Item 1) and washer (Item 2) **[Figure 40-170-11]** over the flanged end of the bushing.

The spacer (Item 1) **[Figure 40-170-11]** must be centered over the bushing to avoid contact between the bushing and the spacer during removal.

Install the washer (Item 3) **[Figure 40-170-11]** on the opposite end of the bushing. This washer must be centered on the bushing and must not contact the casting.

Install the bolt (Item 4) and the nut (Item 5) **[Figure 40-170-11]** through the washers and spacer.

Boom Pivot Bushing Installation

Tighten the bolt and nut to remove the bushing from the casting.

Apply a film of grease to the outer diameter of the bushing and the inner diameter of the casting.

Centre the bushing in the casting hole.

NOTE: Make sure the bushing is centered into the casting hole and is started in the hole evenly and square.

Put the washer (Item 3) over the flanged end of the bushing. Put the washer (Item 2) **[Figure 40-170-11]** over the bushing hole casting, center the washer over the bushing hole.

Install the bolt (Item 4) through the washers and the bushing and install the nut (Item 5) **[Figure 40-170-11]**.

Tighten the bolt and nut until the bushing is seated in the casting.

BUCKET

Removal And Installation

WARNING

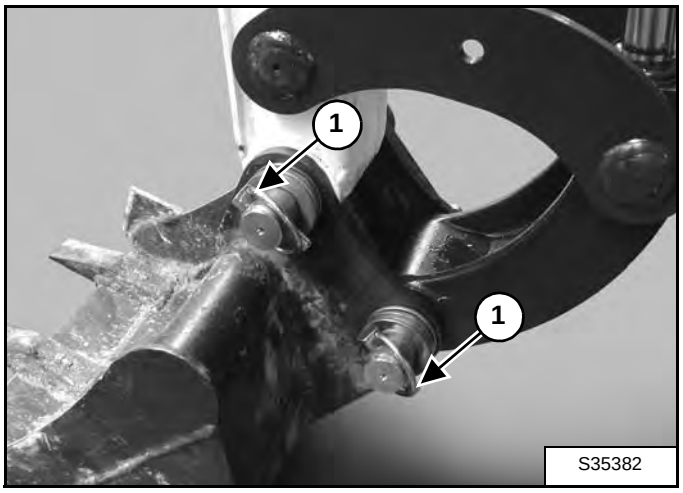
AVOID INJURY OR DEATH

Stop the machine on a firm flat surface. When removing or installing attachments (such as a bucket), always have a second person in the operator's seat, give clear signals and work carefully.

W-2140-0189

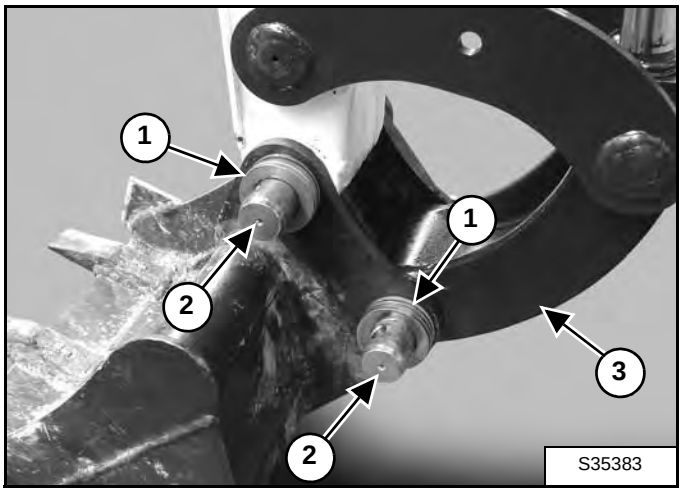
Park the excavator on a flat surface and put the bucket on the ground.

Figure 40-200-1



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

Figure 40-200-2



Remove the washers (Item 1) and the pivot pins (Item 2) **[Figure 40-200-2]**.

Keep the pins clean. Do not damage the dust seals in the arm when removing the bucket.

Install the arm into the bucket, align the hole, install the pivot pin (Item 2) and washer (Item 1) **[Figure 40-200-2]**.

Install the link (Item 3) into the bucket, align the hole, install the pivot pin and washer (Item 2) **[Figure 40-200-2]**.

Install the fasteners (Item 1) **[Figure 40-200-1]**. Add grease to the pivot.

WARNING

AVOID INJURY OR DEATH

Never use attachments or buckets which are not approved by Bobcat Company. Buckets and attachments for safe loads of specified densities are approved for each model. Unapproved attachments can cause injury or death.

W-2052-0907

Troubleshooting

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service personnel only.

WARNING

AVOID INJURY OR DEATH

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

W-2003-0807

PROBLEM	CAUSE
Battery will not take charge.	1, 2, 3, 4, 5
Alternator will not charge.	1, 2, 5
Starter will not turn engine.	2, 3, 4, 6, 7, 8, 9

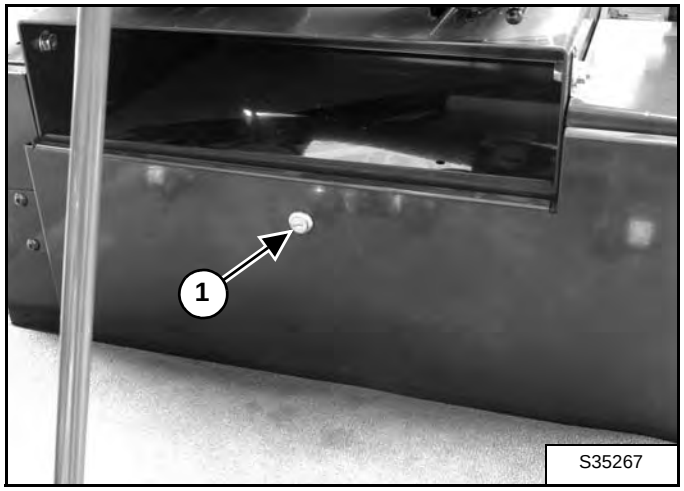
KEY TO CORRECT THE CAUSE
1. Engine accessory drive belt is loose or damaged.
2. Battery connections are dirty or loose.
3. Battery is damaged.
4. The earth connection is not making a good contact.
5. The alternator is damaged.
6. The engine is locked.
7. The starter is damaged.
8. The wiring or the solenoid is damaged.
9. Check the fuses.

ALTERNATOR (CONT'D)

Removal And Installation

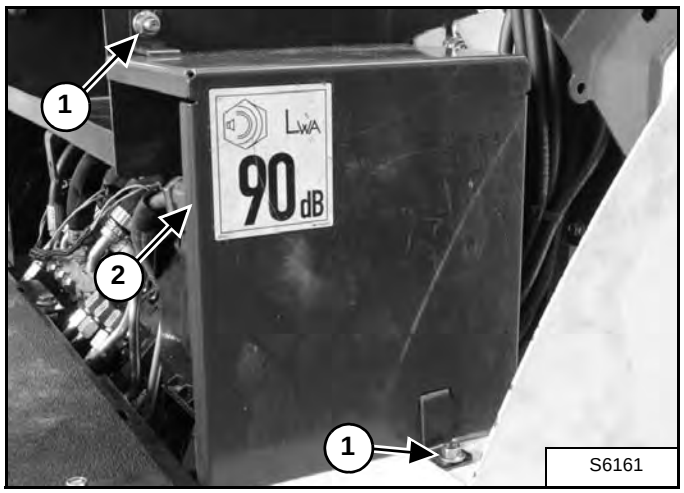
For Model E16 S/N AHLL11001 - 13119:

Figure 50-30-6



Use the start key to remove the access cover (Item 1) **[Figure 50-30-6]**.

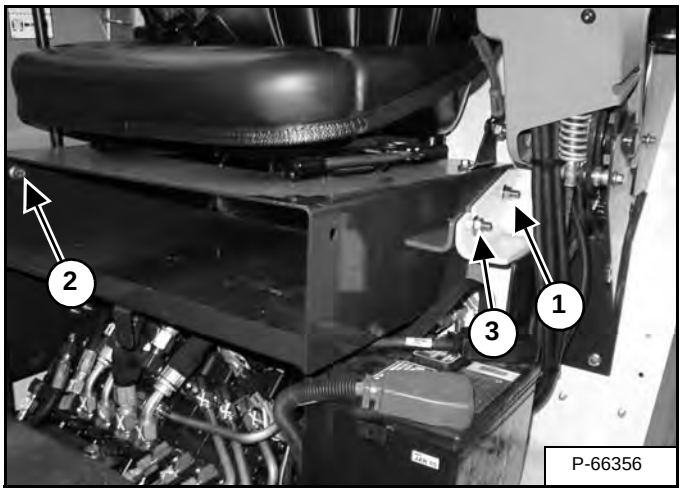
Figure 50-30-7



Remove the two bolts (Item 1) and brackets from the battery cover (Item 2) **[Figure 50-30-7]**.

Remove the cover (Item 2) **[Figure 50-30-7]**.

Figure 50-30-8



Remove the two bolts (Item 1) **[Figure 50-30-8]** and nuts from both sides of the seat mount.

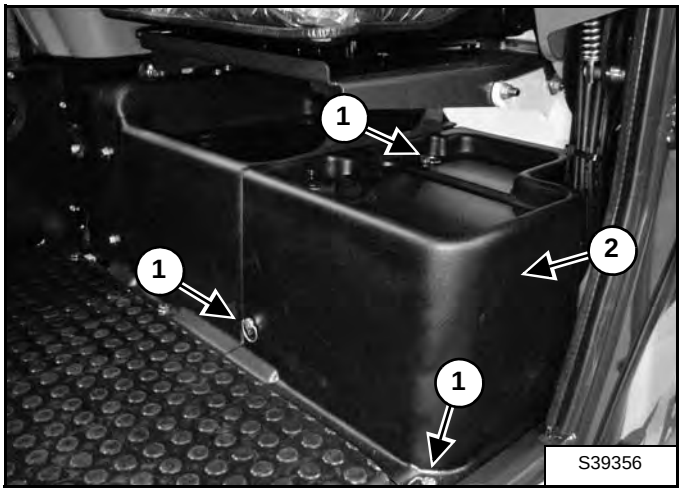
Remove the bolt (Item 2) **[Figure 50-30-8]**, nut and bracket from the right side of the seat mount.

Loosen the two bolts (Item 3) **[Figure 50-30-8]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

For Model E16 S/N AHLL13120 & Above:

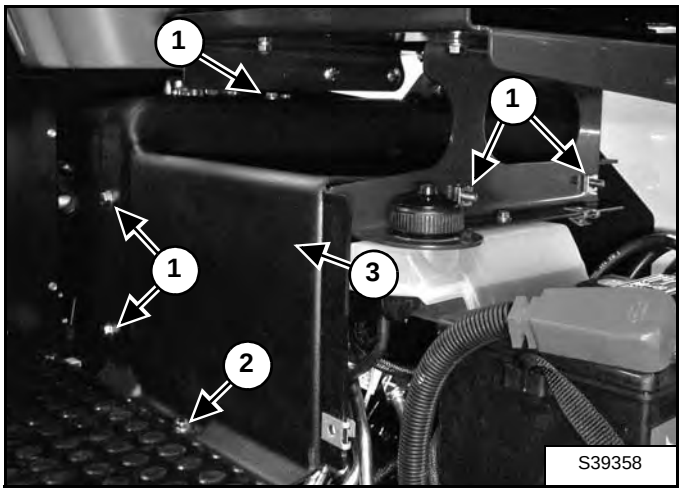
Figure 50-30-9



Loosen the three screws (Item 1) and remove the battery cover (Item 2) **[Figure 50-30-9]**.

Removal And Installation (Cont'd)

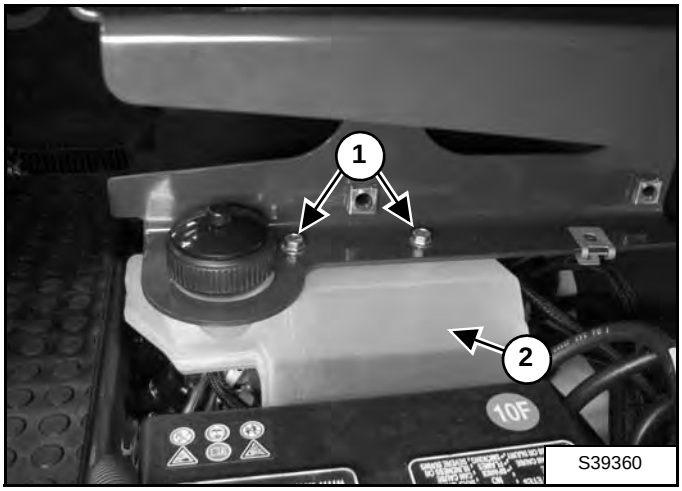
Figure 50-40-5



Remove the six bolts (Item 1 and 2) and remove the access cover (Item 3) **[Figure 50-40-5]**.

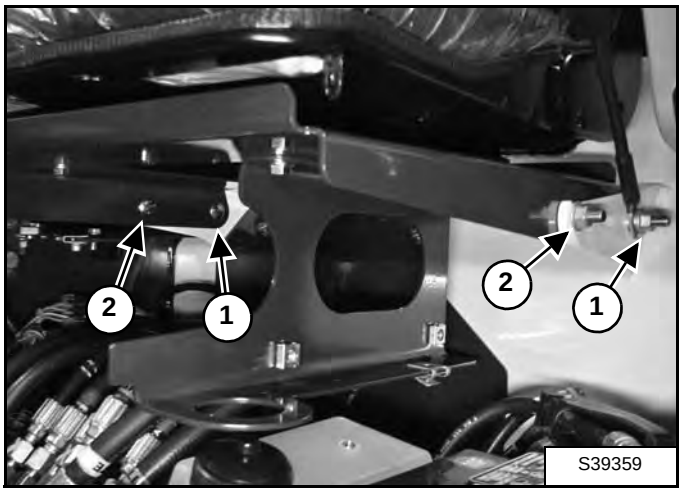
Installation: Tighten bolt (Item 2) **[Figure 50-40-5]** to 8 - 10 N•m (70.8 - 88.5 in-lb) torque.

Figure 50-40-6



Remove the two bolts (Item 1) and lower the windscreen washer bottle (Item 2) **[Figure 50-40-6]**.

Figure 50-40-7

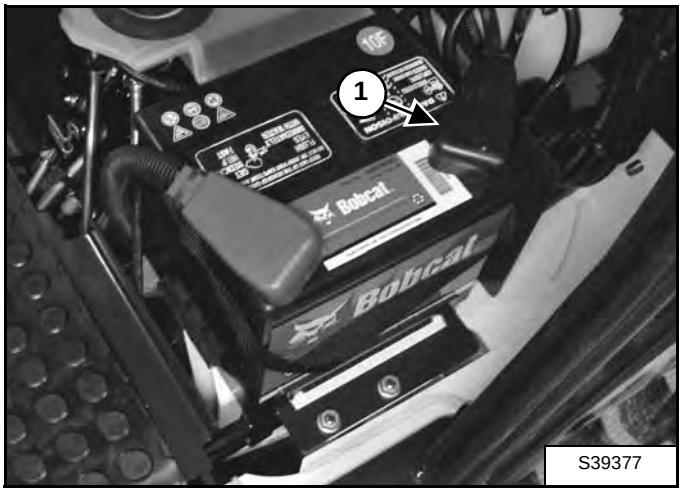


Remove the two bolts (Item 1) **[Figure 50-40-7]** and nuts from both sides of the seat mount.

Loosen the two bolts (Item 2) **[Figure 50-40-7]** and nuts from both sides of the seat mount.

Remove the seat and seat mount.

Figure 50-40-8



Disconnect the negative (-) cable (Item 1) **[Figure 50-40-8]** from the battery.

MICROSWITCH (CONT'D)

Right Console Microswitch Removal And Installation

Figure 50-60-11

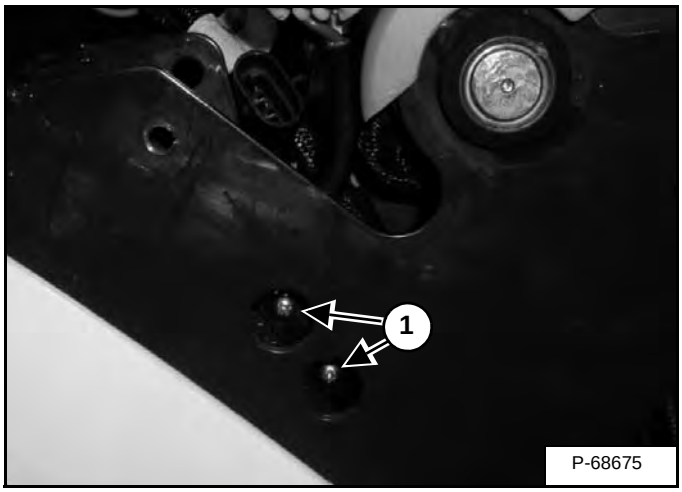
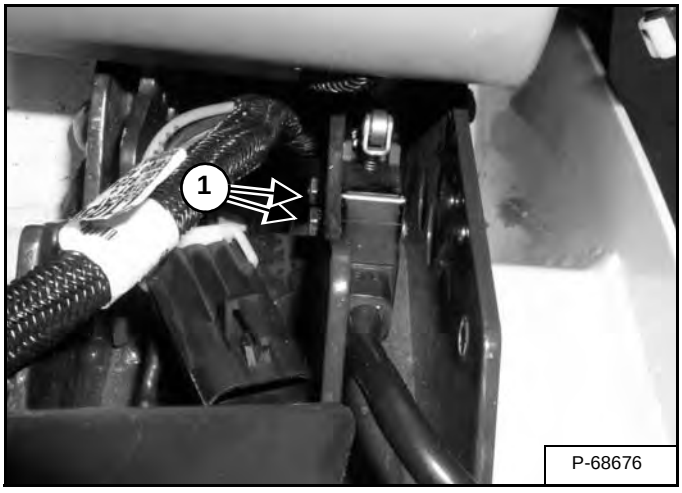


Figure 50-60-12



Remove the nuts, lockwashers and bolts (Item 1) **[Figure 50-60-11]** and **[Figure 50-60-12]** fastening the microswitch.

Remove the microswitch.

NOTE: The microswitch does not have an adjustment procedure. The microswitch is mounted to the frame in a fixed location.

Torque Values (Cont'd)

Tightening Torques For General Use Screws, Bolts And Nuts

Grade / Nominal Unit Diameter	**Standard Screw and Bolt** (4)		**Special Screw and Bolt** (7)	
	N•m	**ft-lb**	**N•m**	**ft-lb**
M6	7,9 - 9,3	5.8 - 6.9	9,8 - 11,3	7.23 - 8.32
M8	17,7 - 20,6	13.0 - 15.2	23,5 - 27,5	17.4 - 20.3
M10	39,2 - 45,1	28.9 - 33.3	49,0 - 55,9	36.2 - 41.2
M12	62,8 - 72,6	46.3 - 53.5	77,5 - 90,2	57.1 - 66.5

Screw and bolt material grades are shown by numbers punched on the screw and bolt heads. Prior to tightening, be sure to check out the numbers as shown below.

Punched number	Screw and bolt material grade
None or 4	Standard screw and bolt SS400, S20C
7	Special screw and bolt S43C, S48C (Refined)

Compression - Checking

The tool listed will be needed to do the following procedure:

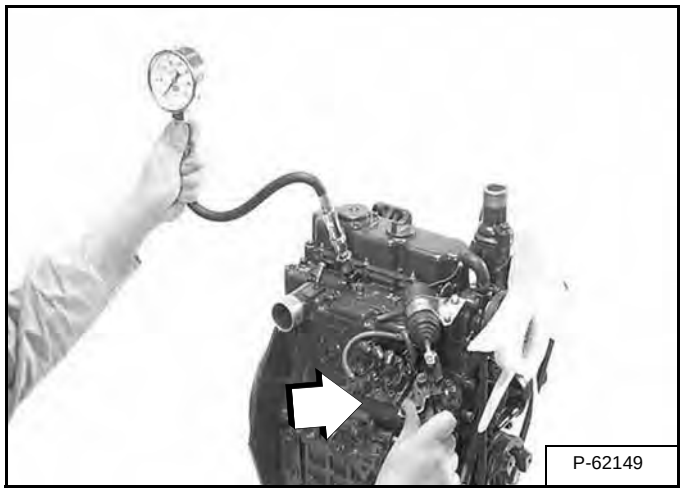
MEL10630 - Engine Compression Test Kit
Warm the engine.

Remove the glow plugs, muffler and air cleaner from the engine. (If testing through glow plug hole.)

Remove the air cleaner, muffler and all injector nozzles. (If testing through injector nozzle hole.)

Install the compression adapter in the cylinder head.

Figure 60-10-29



Connect the compression gauge to the adapter **[Figure 60-10-29]**.

Ensure the speed control lever is set at the low idle setting.

Hold fuel shut off lever to no fuel (shutoff). See arrow, **[Figure 60-10-29]**. Shut off solenoid does not need to be removed.

Turn the engine with the starter at 200 to 300 rpm. Run the test for each cylinder more than twice for 5 to 10 seconds each time and take the average reading. Make sure you are using a fully charged battery.

The correct compression for the engine is 2,8 to 3,2 MPa (28 - 32 bar) (412 - 469 psi) with no more than 10% difference between the cylinders.

If the pressures are not within 10% of each other, apply a small amount of oil in the cylinders and retest.

If the pressures increase after applying oil, check cylinder walls and piston rings.

If the pressures do not increase after applying oil, check top clearance, valve clearance and cylinder head.

Water Pump Removal And Installation

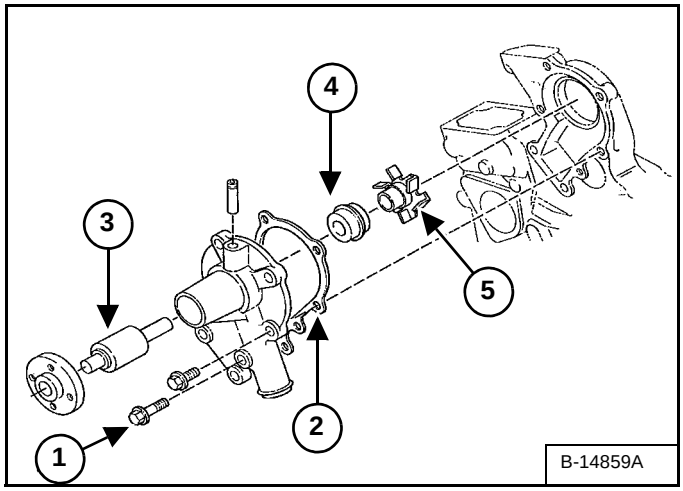
Drain the cooling system.

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

Remove the alternator belt.

Remove the fan.

Figure 60-40-19



Remove the water pump bolts (Item 1) **[Figure 60-40-19]**.

Remove the water pump.

Installation: Always use a new gasket (Item 2) **[Figure 60-40-19]** 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.

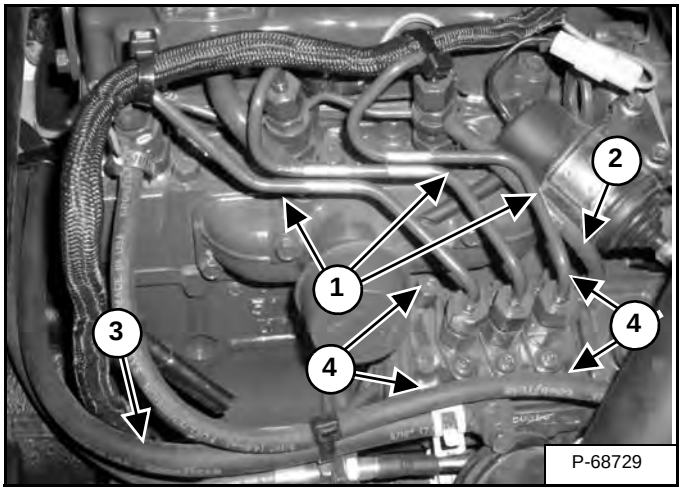
Press the shaft (Item 3) **[Figure 60-40-19]** out of the pulley side of the water pump. Press out the shaft with the impeller on it.

Remove the seal (Item 4) and impeller (Item 5) **[Figure 60-40-19]**.

Install a new seal when assembling the water pump.

Fuel Injection Pump Removal And Installation (Cont'd)

Figure 60-60-8



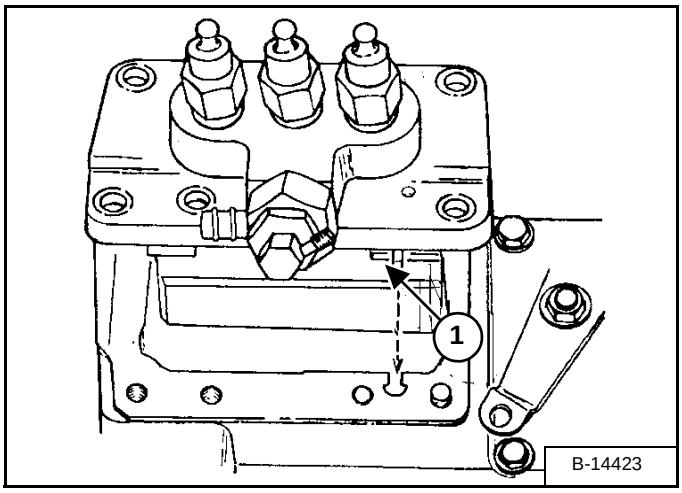
Disconnect the high pressure lines (Item 1) **[Figure 60-60-8]** from the fuel injector and fuel injection pump.

Disconnect the fuel return hose (Item 2) and the fuel feed hose (Item 3) **[Figure 60-60-8]**.

Remove the four injection pump mounting bolts (Item 4) **[Figure 60-60-8]**.

Installation: Tighten the pipe retaining nuts to 25 - 34 N•m (18 - 25 ft-lb) torque.

Figure 60-60-9



Align the pin (Item 1) **[Figure 60-60-9]** in the control rack with the slot in the engine block.

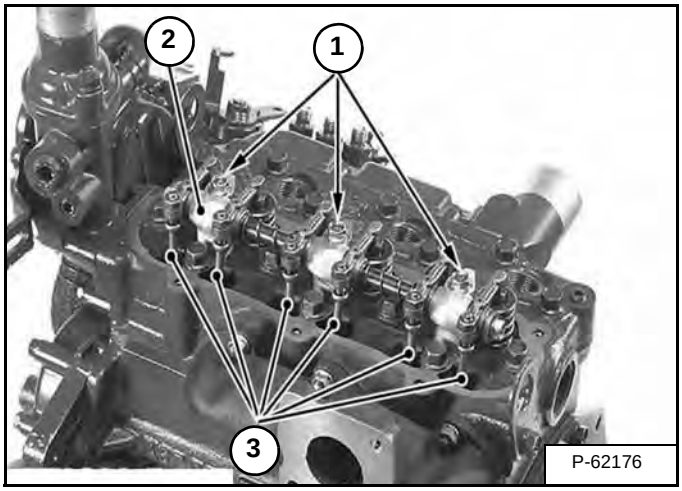
Remove the injection pump.

Installation: When the injection pump is installed, make sure the pin (Item 1) **[Figure 60-60-9]** on the control rack is correctly installed on the fork lever. If the slot is not installed correctly, the engine will run over maximum speed and serious damage can result.

NOTE: Make sure the same number shims are installed under the injection pump. The shims are used for engine timing.

Cylinder Head Removal And Installation (Cont'd)

Figure 60-70-10



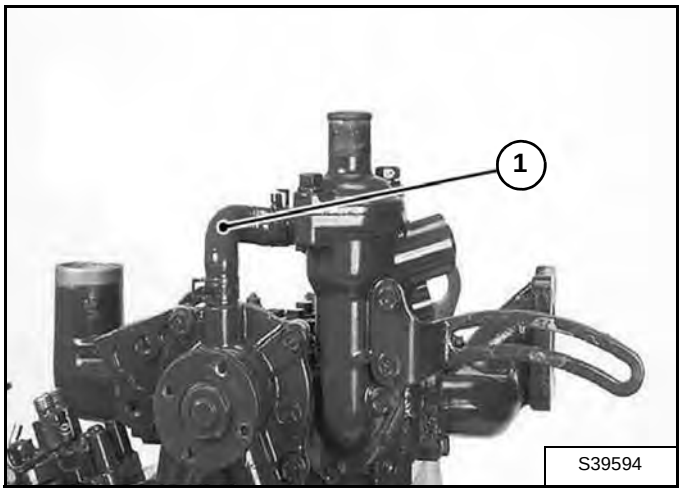
Remove the rocker arm bracket screws (Item 1) and shaft assembly (Item 2) **[Figure 60-70-10]**.

Installation: Tighten the nuts to 9,8 - 11,3 N•m (86.7 - 100 in-lb) torque.

Remove the pushrods (Item 3) **[Figure 60-70-10]**.

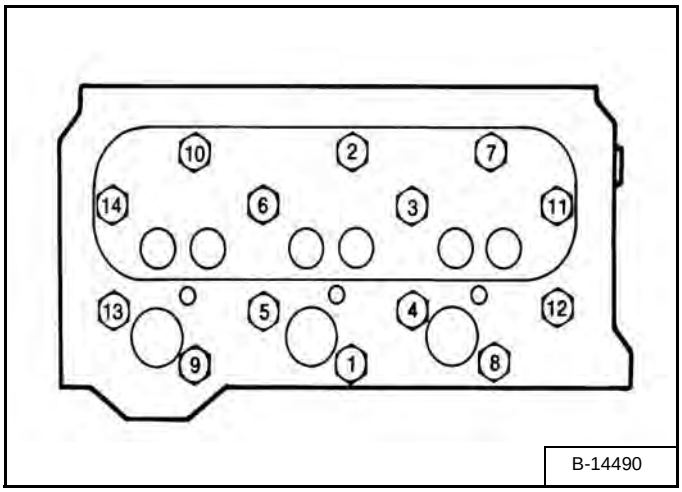
Remove the intake and exhaust manifolds.

Figure 60-70-11



Remove the water return hose (Item 1) **[Figure 60-70-11]**.

Figure 60-70-12



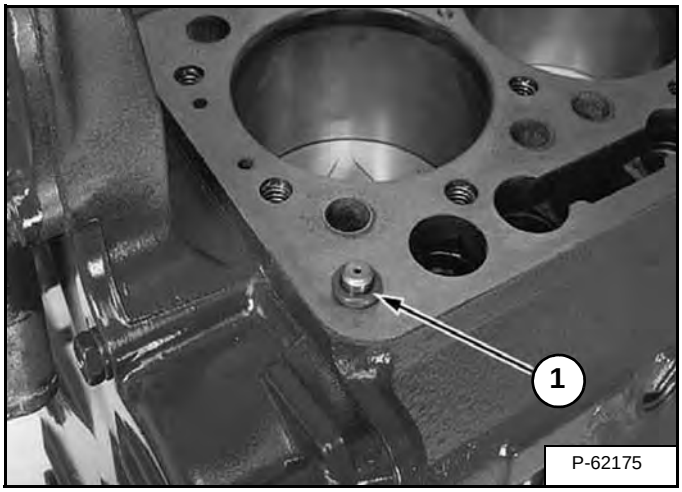
Remove the cylinder head bolts in order of #14 to #1 **[Figure 60-70-12]**.

Installation: Put oil on the bolt threads. Tighten the bolts in the correct sequence of #1 to #14 to 38 - 42 N•m (28 - 31 ft-lb) torque.

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

Remove the cylinder head from the engine block.

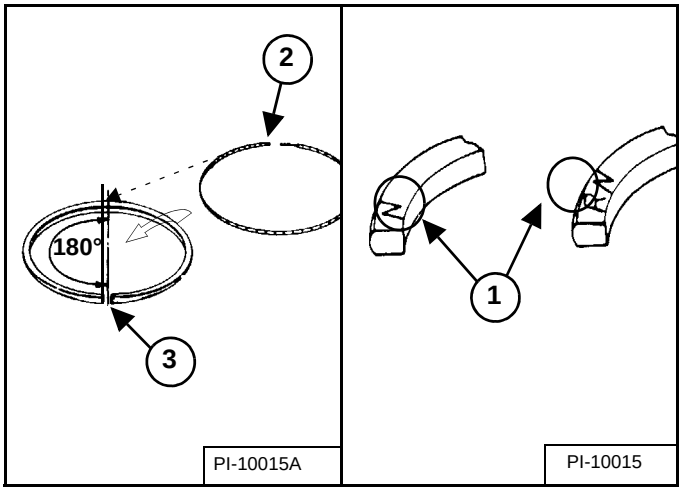
Figure 60-70-13



Installation: Always use a new head gasket and new O-ring. Make sure the O-ring (Item 1) **[Figure 60-70-13]** is seated over the dowel.

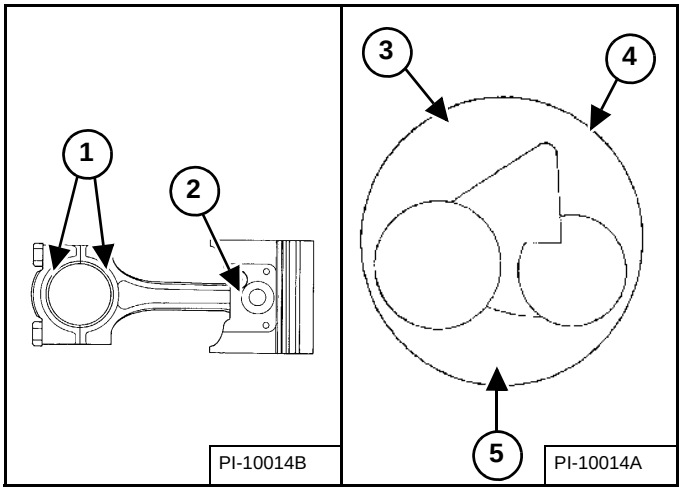
Piston And Connecting Rod Removal And Installation (Cont'd)

Figure 60-80-4



Installation: When installing new rings, assemble the ring so the mark (Item 1) near the gap faces the top of the piston. When installing the oil ring, place the expander joint (Item 2) on the opposite side of the oil ring gap (Item 3) **[Figure 60-80-4]**.

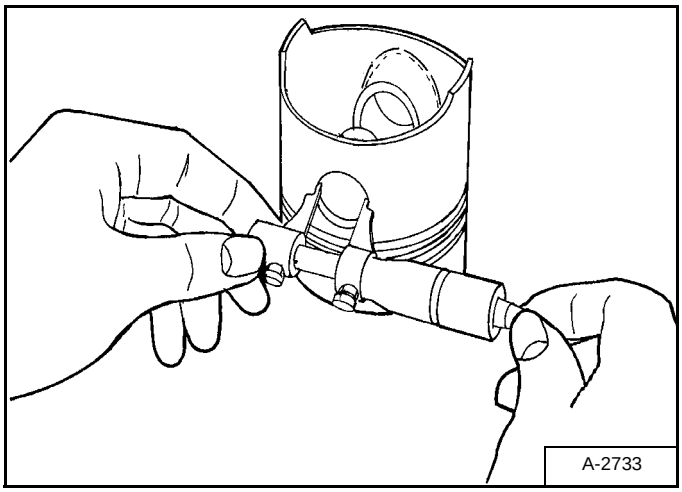
Figure 60-80-5



Installation: When reassembling, align the marks (Item 1) on the connecting rod and piston (Item 2). Heat the piston in oil to 80°C (176°F) for 10 to 15 minutes and tap the piston pin into position. Place the piston rings so that there are gaps every 120° (Items 3, 4 and 5) **[Figure 60-80-5]** with no gap facing the piston pin in the cylinder.

Piston And Connecting Rod - Servicing

Figure 60-80-6



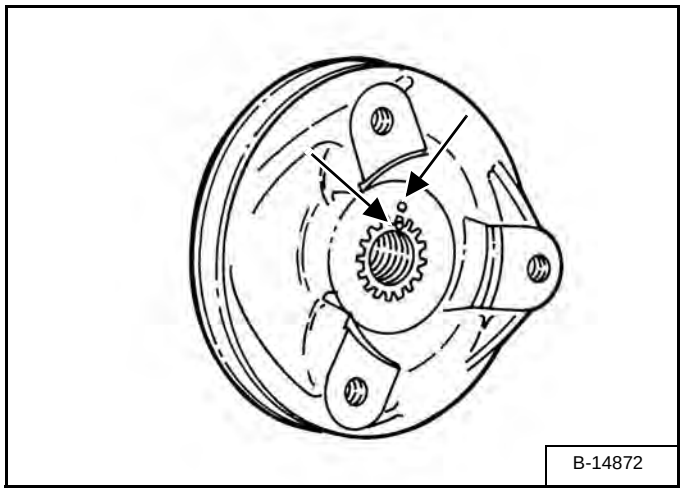
Measure the I.D. of the piston pin bore in both horizontal and vertical direction **[Figure 60-80-6]**.

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

Piston Pin Bore I.D.	20,00 - 20,013 mm (0.7874 - 0.7879 in)
Allowable Limit	20,05 mm (0.789 in)

Timing Gearcase Cover Removal And Installation (Cont'd)

Figure 60-90-5

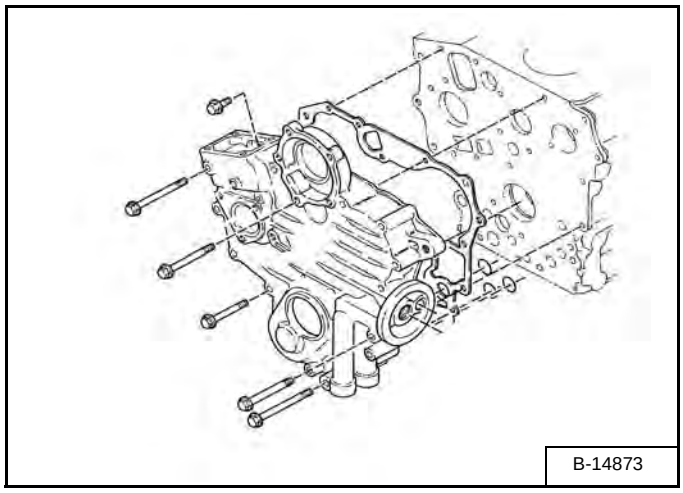


When installing the crank shaft pulley, make sure the alignment marks are aligned **[Figure 60-90-5]**.

Remove the timing gearcase cover bolts.

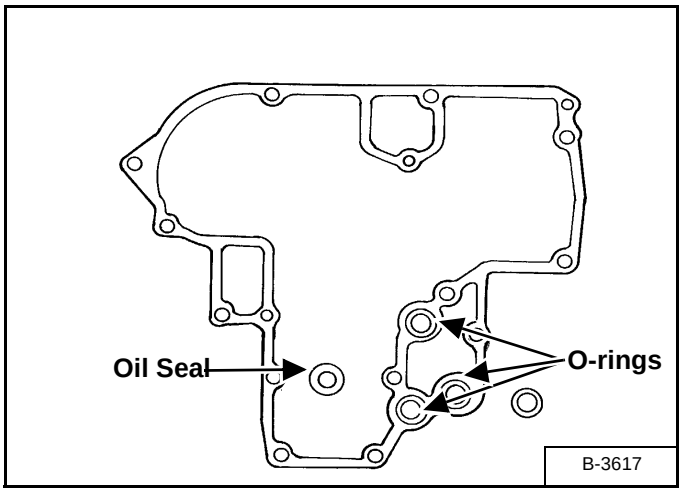
Installation: Tighten the bolts to 10 - 11 N•m (88.5 - 97.4 in-lb) torque.

Figure 60-90-6



Remove the timing gearcase **[Figure 60-90-6]**.

Figure 60-90-7



Installation: Install three new O-rings and the oil seal into the timing gearcase cover **[Figure 60-90-7]**.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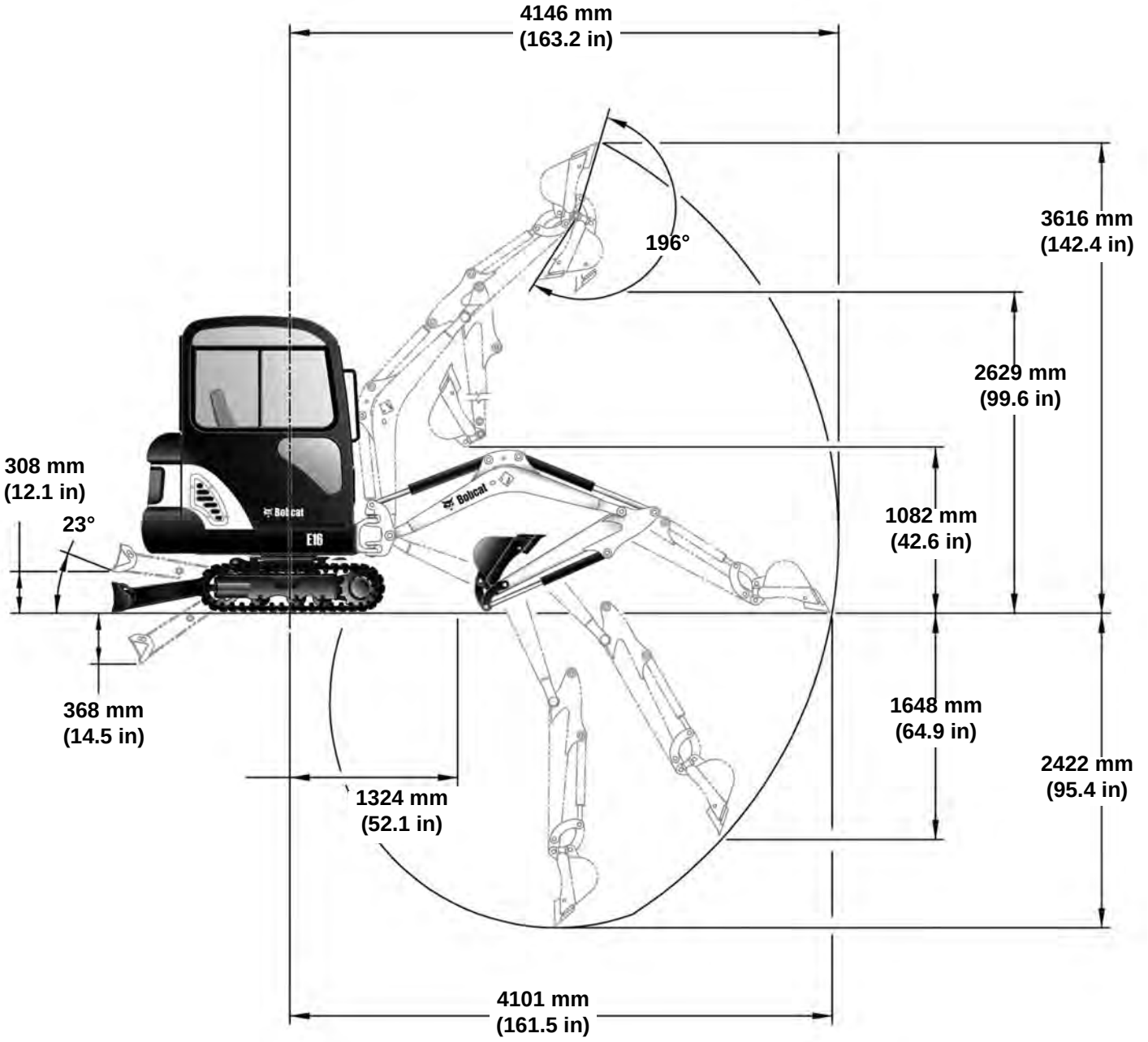
Machine Dimensions - Standard Arm

- All dimensions are shown in metric. Respective imperial dimensions are given in inches enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.



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